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Increasing patient safety by adopting system safety in a healthcare setting

A case study of the perinatal centre at the Skaraborg Hospital Group

Master's thesis in the Master Degree Programs Quality and Operations Management and Supply Chain Management

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ABSTRACT

In Sweden, like the rest of the world, it is dangerous to become hospitalized. According to the Swedish National board of health and welfare, Socialstyrelsen, almost 10 % of patients in healthcare suffer from adverse medical events emanating within the healthcare context. Although patient safety has been often debated in healthcare, the attempts to improve the performance within the field have neither been satisfactory nor acceptable. Therefore, a new approach towards safety is needed. This approach is found to be system safety.

The purpose of the thesis is to build a bridge between theory and practice by identifying how a perinatal centre can increase the level of patient safety by adopting a system view on safety. System safety entails a system approach towards safety, an approach that includes two dimensions: by shaping the working behaviour, and by managing the environmental and operational conditions.

System safety is a beneficial approach in healthcare settings since the healthcare is a complex system, with complex interactions between ingoing components. The approach is of particular use in healthcare settings such as perinatal centres: where there is a high level of variation, low predictability and where adverse events might turn into fatal outcomes.

The findings of how the perinatal centre perceives and works with safety show that healthcare today lacks a system approach to safety. A new way of perceiving safety needs to be based on an understanding of how accidents occur from a system point of view. This will in turn change the way to work with patient safety – by managing and monitoring i) the working behaviour and ii) the environmental and operational conditions.

Keywords: *System safety; Patient safety; Healthcare*

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DEFINITIONS AND ABBREVIATIONS

The following concepts are fundamental for the understanding of this thesis, hence, they are defined below. Additionally, the commonly used abbreviations are listed.

Patient safety **–** According to the Swedish national board of health and welfare (2015), patient safety is related to the absence or the avoidance of care damages. According to the Swedish Parliament (2010) care damage occurs when a patient suffers from physical or psychological distress, or illness and death that could be avoided if adequate actions had been taken in the patient's contact with the healthcare. According to the same understanding, Leveson, et al. (2009, p. 234) defines safety as "freedom from unacceptable losses (accidents)".

Risk **–** Kaplan and Garrick (1981) define risk as "the possibility of loss or injury" and the "degree of probability of such loss" (Kaplan & Garrick, 1981, p. 12). A hazard however, is defined as "a source of danger" (Kaplan & Garrick, 1981, p. 12). Hence, a risk includes the possibilities for that source to be converted into an actual loss, illness or injury.

Component **–** A component is something that operates within a system. For example a component can be a person (also called actor), an IT-system, a machine, a memorandum or a process. In this thesis components are also called elements or actors.

Accident **–** Parker et al. (1995) define accidents as incidents that involve injury to a person or damage to properties or physical products. According to Leveson (2011b), an accident is an event that involves an unplanned or unacceptable loss. Hence, in this thesis an accident is referred to as an event that involves an unacceptable loss (often damage or injury) to a component.

Failure **–** According to Leveson (2011a), a failure occurs when a component does not meet the requirements given or when it cannot operate as intended to. Hence, a failure is a component's inability to operate as requested.

Reliability **–** In this thesis reliability will be defined as the probability that a component will fulfil its given constraints or requirements over the time and conditions given (Leveson, 2011b). Hence, reliability is related to component requirements and the environmental aspects in which a component operates.

HRO **–** High Reliability Organizations refers to organizations aiming at having a high level of safety over long time periods (Van Stralen, 2011). According to Carroll & Rudolph (2006) one single accident in such organizations can cause great harm to many people, i.e. the consequences of an accident can be catastrophic.

System safety: The fundamental reasoning behind the system safety concept is based on the understanding that systems are complex, and thus, need to be modelled, analysed and managed accordingly. Subsequently, the system needs to be modelled not only by identifying and defining each component (task, machine, person etc.) in a generic setting or context, but also with respect to the interactions between components and the dynamic behaviour of systems and actors (Rasmussen, 1997).

SkaS – Skaraborg Hospital Group

For a Swedish-English translation of other key words, see Appendix I.

Table of content

1. Introduction

In this introductory chapter, the background of the thesis is presented. This is followed by a presentation of the observed case, along with the purpose, research questions and delimitations.

1.1. Background

In Sweden, like the rest of the world, it is dangerous to become hospitalized. According to the Swedish National board of health and welfare, Socialstyrelsen (2015), almost 10 % of patients in healthcare suffer from adverse medical events emanating within the healthcare context. Patient safety is often debated in healthcare, and many practitioners seek to identify promising strategies to improve the practices associated with patient safety. However, the performance within the field has neither been satisfactory nor acceptable (Chuang, et al., 2008).

Safety in healthcare has traditionally been viewed upon as a static and linear property, depending on independent, individual components (Trucco, 2010). Additionally, risk management performed in healthcare is rarely integrated with the entire structure of the organization (Kuhn & Youngberg, 2002). Thus, the changes may fail by becoming episodic rather than sustained, implying that the effects of the changes deteriorate over time. Furthermore, the changes tend to become clinic- or incident-focused rather than spread organization-wide, implying that the effects of the change is limited to specific parts of the organization (Kuhn & Youngberg, 2002). However, a healthcare system is not close to being linear and independent and should instead be viewed upon as an integrated and adaptive set of people, processes and products (Tien & Goldschmidt-Clermont, 2009).

In order to increase the level of safety, the healthcare industry have glanced on some of the concepts present in high risk industries, such as civil aviation and nuclear organizations (Reason, 2013). This has led to that some famous safety concepts within these industries, such as the theories on High Reliability Organizations (HRO) has had impact also on the view upon safety in healthcare. While HRO is built upon the assumption that: "if each person and component in the system operates reliably, there will be no accidents" - that is, if each component is reliable, the system is to be considered safe (Leveson, 2011a). However, as Leveson (2011a), Trucco (2010), Rasmussen (1997) and many others claim, safety and reliability are different properties − a system can be reliable and unsafe, or safe and unreliable. In complex systems, accidents can also be the result of the interaction between perfectly functioning (reliable and non-failed) components (Leveson, 2011a). Thus, a new approach is needed to understand and enable a higher level of patient safety. The proposed new approach is system safety.

Several researchers (Reason, 1990; Institute of Medicine, 1999; Institute of Medicine, 2001) have identified that the application of a systems approach is key in order to successfully implement patient safety (a more thorough reasoning to why will be explained in chapter 2). Some key elements of the systems view on safety have had influence on the Swedish healthcare systems. For instance, the structure underlying the law of patient safety (Swedish Parliament, 2010) has moved beyond the "name, blame and shame" approach towards a non-punitive approach to patient safety issues, which entails a more 'system' approach in that it allows for

identification of the actual causes rather than to identify a scapegoat. However, most of the system safety approach has not yet been acknowledged by the Swedish healthcare system.

Though system safety has been an area of research for decades, few attempts aiming at giving a complete set of recommendations for how a single healthcare organization can increase the level of patient safety by adopting a system view on safety. In order to do so, a thorough assessment of how the organization perceives and works with patient safety needs to be performed, including organization-specific challenges and opportunities. This has been achieved by mapping how the clinic works with safety by identifying i) managers' and co-workers' perceptions of safety (reasoning and thoughts), ii) processes related to safety and iii) tools, functions and mechanisms used in their work with safety. Furthermore, such recommendations are assumed to also be applicable for healthcare organizations with similar organizational characteristics, challenges and opportunities.

The organization of focus is the perinatal centre in Skövde, a part of the Skaraborg Hospital Group (further referred to as SkaS). SkaS consists of four healthcare centres in the Skaraborg area: Skövde, Lidköping, Falköping and Mariestad. The perinatal centre is one out of 5 centres in Region Västra Götaland.

The perinatal centre in the Child and Women's business area at SkaS Skövde consists of the obstetric clinic, the maternity ward clinic and the neonatal clinic. The assumption is that SkaS Skövde has a traditional linear way of working with patient safety. The perinatal centre, and especially the obstetrics clinic, is a fast-paced, cross-functional environment, where many critical decisions need to be made in a short amount of time (Scholefield, 2008). As will be discussed in chapter 2, this environment, with a high degree of interaction, implies a complex system. Furthermore, a complex system is depending on a holistic system view on safety (Trucco, 2010). Therefore, the perinatal centre at SkaS Skövde is a suitable organization to study when further investigating how a system view on safety can be adopted within healthcare organizations.

1.2. Purpose

The purpose of the thesis is to build a bridge between theory and practice by identifying how a perinatal centre can increase the level of patient safety by adopting a system view on safety.

1.3. Research questions

In order to achieve the above stated purpose, three research questions have been formulated.

RQ1: How can the level of patient safety be increased according to system safety theory?

This question aims at providing an understanding of the underlying principles and mechanisms of system safety and how these differ from the principles and mechanisms of one of the major dominant views on patient safety, i.e. High Reliability Organizations.

RQ2: What are the opportunities and challenges for a perinatal centre's work with patient safety?

In order to identify how the findings in RQ1 can be tailored to a perinatal centre, the perinatal centre's specific challenges and opportunities for adapting a system view on safety will be identified.

1.4. Delimitations

As mentioned in the introduction, the primary care is not a part of SkaS and will only be considered as a source of information. Furthermore, only recommendations will be developed, and their implementation, along with the result, will not be investigated in this report due to resources and time limitations.

1.5. Report outline

The report will follow the structure presented below.

Chapter 1: An introduction to the thesis and its related research fields are given, including a brief description of the case. Additionally, the purpose is presented, along with the research questions, whose answers aim at achieving this purpose. Further, this chapter includes key definitions and abbreviations, along with the outline of the thesis.

Chapter 2: The relevant available theory within the research fields of interest are further presented, concluded by a theoretical framework and discussion used in the analysis of data.

Chapter 3: The methodology used to conduct the thesis is presented, including the choice on research strategy, research design and methods for collecting and analysing data.

Chapter 4: Empirical data from the case study is presented according to their hierarchical segmentation and their characteristic.

Chapter 5: The data from the case is analysed using data from the theoretical framework. The analysis includes comparison between hierarchical levels (horizontal comparison) and between characteristics (vertical comparison). Furthermore, the analysis aims at describing the result according to the two main safety disciplines within each segment.

Chapter 6-8: A discussion including the authors' interpretations and opinions, the implications of the findings, and suggestions for future research will be presented. This is supplemented with the recommendations for the case organization.

2. Theoretical framework

In the following chapter, a number of basic theoretical concepts and fields will be presented in order to bring understanding to the underlying concepts affecting the research questions. In order to understand how complex systems function, the theories related to complex system dynamics are introduced. Furthermore, one of the most dominant safety theories of modern history is presented. This enables an understanding of the main concept that has formed the current view on patient safety. Last, but not least, the theoretical field of system safety is presented, in order to understand why system safety should be deployed, how it can be implemented, and when it should be implemented. The chapter is concluded by showing how contributions from mainly three of the leading researchers within system safety can be combined into a comprehensive theoretical framework.

2.1. Complex system dynamics

Across all disciplines, healthcare is becoming more complex (Plsek & Greenhalgh, 2001). According to Plsek and Greenhalgh (2001), linear models must be abandoned in order to overcome the increasing complexities in healthcare. Their proposed approach entails the capability to accept unpredictability in order to encourage creativity and flexible responses to opportunities and changing patterns in the care system. Existing theories for complex systems vary and the definitions are many. Therefore, selected definitions will be further elaborated.

Tien and Goldschmidt-Clermont (2009) define healthcare systems as combinations of three essential components; people, processes and products. Each of the components are characterized by several other components, see Figure 1. Thus, a healthcare system is a system of systems, which is an integrated and adaptive set of people, processes and products (Tien & Goldschmidt-Clermont, 2009). In other words, a healthcare system is tightly coupled among people, processes and products. According to Tien and Goldschmidt-Clermont (2009), integration occurs over the physical, temporal organizational and functional dimensions, and adaptation occurs over the monitoring, feedback, and learning dimensions in an organization. Especially, due to the uncertainties connected to the human components of these systems, healthcare systems can be considered complex and the complexities of the systems should be addressed with methods that improve system integration and adaptation (Tien & Goldschmidt-Clermont, 2009).

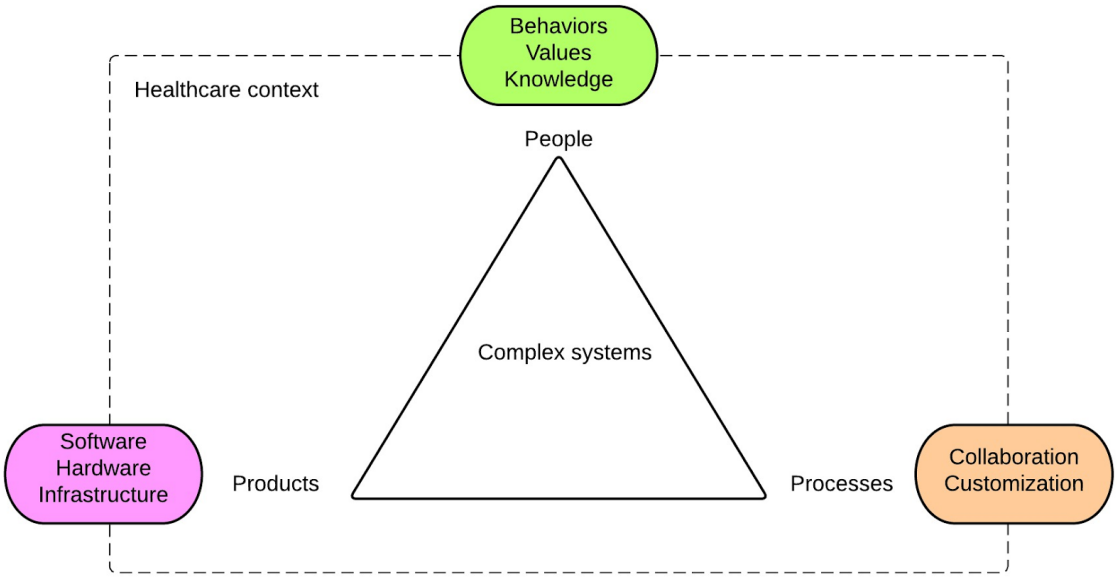


Figure 1. A description of a complex system, based on Tien & Goldschmidt-Clermont (2009)

Complex adaptive systems (CAS) can be seen as a descriptive model of how complex organizations interact. Paley (2007) claim that complex adaptive systems consist of a number of individual elements that interact in a particular way, and that it is the nature of those interactions, and the results from them, that makes a system complex. In order to get an understanding of how the interactions among the elements produce structures and behaviours within the system, both the complex system as well as their ingoing elements needs to be observed (Paley, 2007). Tien & Goldschmidt (2009) argue that a healthcare system is a system of systems. Therefore, sub-systems should initially be identified at the local level, in teams and clinics, since it would become unmanageable to observe the complexities of a whole organization simultaneously (Paley, 2007). Also, Paley (2007) states that complex system theories can be applied to the healthcare sector only if the complexities get addressed with new concepts rather than existing models and theories.

Chuang et al. (2008) argue that a system, as a healthcare system, is a combination of interacting elements that work within an organization. In order to achieve the desired results, the elements function in a specific, coordinated manner. The elements within the system are composed of components, attributes and relationships, and the organization cannot be classified as a system if one of the elements is absent (Chuang, et al., 2008). According to Blanchard and Fabrycky (1998), components are the operating parts of the system e.g. inputs, processes and outputs, and can adopt different values to describe to state of the system. Furthermore, the attributes of the system are described as the properties of the components that characterize the system, and the relationships within the system are the links between the components and attributes (Blanchard & Fabrycky, 1998). Additionally, Chuang et al (2008) claim that the system's components are the sources that cause different behaviours and the behaviours

constitute the outcomes. Hence, only system structures can explicate the underlying causes of behaviour in such a way that patterns of the behaviour can be changed (Chuang, et al., 2008).

In summary, the main arguments for how to address complex systems focus on the interactions among components, and that these interactions need to be identified and observed in order to understand the underlying behaviours of the organization. Also, it is clear that a healthcare system is complex since the components in the system are interrelated and tightly coupled. Furthermore, in order to improve complex systems, they should be addressed with methods adjusted for identification of the complexities within an organization, rather than linear and static organizational development models and tools.

2.2. High Reliability Organization

Organizations aiming at having a high level of safety over long periods of time can be referred to as HROs (Van Stralen, 2011). According to Carroll & Rudolph (2006) one single accident in such organizations can cause great harm to many people, i.e. the consequences of an accident can be catastrophic. Reliability is, by many organizations, achieved by simplifying and standardizing operational tasks and by foreseeing and handling organizational disruptions (Carrol & Rudolph, 2006).

Since there has been much debate in the literature regarding how to identify and describe an HRO, there is no single definition. However, Roberts & Rousseau (1989) argue that there are some characteristics that differentiate HROs from other organizations. For instance, the organization is characterized by a variety of components and systems, which are interdependent and unpredictable. Also, the organization is extremely hierarchical with clear roles and responsibilities. Moreover, an HRO is characterized by redundancy in control and information systems, and has a high level of accountability where it is important to make activities right the first time (Roberts & Rousseau, 1989). HROs also have compressed time factors meaning that activities take place in seconds (Roberts & Rousseau, 1989). Some of the characteristics might be found in several other types of organizations but, according to Roberts & Rousseau (1989), HROs typically have *all* of them. The criteria proposed by Roberts & Rousseau (1989) imply that not all types of organizations can be HROs (Lekka, 2011). However, Hopkins (2007) argue that there has been a shift from identifying criteria to enable classification of whether an organization is an HRO or not, towards focusing on the types of processes and practices that enable certain organizations to reach high reliability. According to Hopkins (2007, p. 7) "*this is a useful change of terminology since it gets away from questions of just how safe does an organisation have to be before it can be considered an HRO, and it highlights instead what an organisation needs to do in order to reach the required end state*". In addition, Weick & Sutcliffe (2007) argue that different types of organizations sometimes need to make complex decisions with high uncertainty and therefore there is much to be learned from HRO principles and practices overall.

When decoupling the characteristics that define an organization from the characteristics that enable organizations to achieve and maintain a high safety culture according to the high

reliability theory, there are several different terms and definitions that more or less describe the same HRO processes and practices (Lekka, 2011). However, Lekka (2011) claims that the different descriptions "*capture HROs' ability to collect, analyse and synthesise information about the 'bigger picture' of current operations in such a way that enables them to effectively contain and prevent potential future failures*" (Lekka, 2011, p. 9). In summary, Table 1 shows the main characteristics identified within the different studies of HROs.

Table 1. A summary of the main characteristics of HRO

Author	(Roberts, 1990), (Roberts & Rousseau, 1989)	(Bierly & Spender, 1995)	(Weick & Sutcliffe, 2007)	(Roberts & Bea, 2001)
Research discipline	Organizational psychology	Organizational culture	Social psychology	Organizational structure
Focus	Characteristics of highly safe organizations. Organizational structure	Characteristics of a highly safe organization and the culture that enable a safety performance	Achieving a high reliability organization through mindfulness.	Hazard recognition and study of HROs
Findings	• Management by exception • Climate of continuous training • Several channels are used • In-built redundancy • Deference to expertise during emergencies	• Centralization in control over operations in combination with decentralized decision-making • A learning culture • An open climate • A culture that encourages good incident reporting	• Preoccupation with failure • Reluctance to simplify • Remain sensitive to operations • Maintain capabilities for resilience • Deference of expertise	• Balance efficiency with reliability • Seek what they don´t know • Communicate the big picture to everyone

For example, it can be argued that Roberts & Bea's (2001) "*HROs aggressively seek to know what they don't know*" and Weick & Sutcliffe´s (2007) "*Preoccupation with failure*" and "*Reluctance to simplify*" are similar. The meaning of this is that the organization should work with tracking potential failures. Small mistakes and incidents are seen as indicators for the organization's health and reliability and therefore reporting of small errors and continuous learning from these incidents are important (Lekka, 2011). Moreover, small errors and incidents are seen as an opportunity to improve operations (Weick & Sutcliffe, 2007). Also, Bierly & Spender (1995) argue that an HRO has "*A culture that encourages good incident reporting"* including analysis of accidents to gain a realistic view of the organization's condition.

Furthermore, Roberts (1990) and Roberts & Rousseau (1989) argue that an HRO has a "*Climate of continuous training*" as well as Bierly & Spender (1995) who claim that an HRO has "*A learning culture*". In order to develop and maintain co-workers´ knowledge of complex operations within the organization and to improve their technical competence continuous training is important. Additionally, training is also important in order to recognize risks, hazards and to

respond quickly and appropriately to unexpected events. This characteristic is also seen as a means for building trust and credibility among personnel (Lekka, 2011; Roberts, 1990; Roberts & Rousseau, 1989). This is in accordance with Weick & Sutcliffe (2007), who also argue that in order to "*Maintain capabilities for resilience*" an HRO have personnel with deep knowledge of the system, the technology and other actors within the system.

Both Roberts (1990), Roberts and Rousseau (1989) and Weick and Sutcliffe (2007) argue that HRO organizations practice "*Deference to expertise*". This idea is based on that when something happens, an accident for example, normal hierarchical structures cease to exist and the decision-making is transferred to individuals with expertise in the specific problem. By taking advantage of shifting locations of expertise the organization can fully adjust to a specific problem in the best possible way (Weick & Sutcliffe, 2007).

Weick & Sutcliffe (2007) suggests that HROs are good at anticipating potential failures since they "*remain sensitive to operations*". This means that HROs are attentive to the front line work and operations, and that the bigger picture of HROs is more situational than strategic. Additionally, Bierly & Spender (1995) argue that in operations, centralized decision-making should be combined with decentralized decision-making and delegation. The centralized decision-making should focus on dealing with the inter-relationships between operational processes and the collective decisions of the organization. Delegation and decentralized decision-making however aim at handling the complexity of each process. Roberts (1990) and Roberts and Rousseau (1989) describes this as "*Management by exception*".

According to Roberts & Bea (2001) HROs have well developed communication channels in order to "*communicate the big picture to everyone*", so that the organization can access relevant information in emergency situations. Also, HROs try to get everyone to communicate with each other about how they fit in the big picture. Further, HROs have well-defined procedures for both normal and emergency situations with well-known decision rules (Lekka, 2011). Good communication channels and an open climate are also characteristics that Bierly & Spender (1995) and Roberts (1990) and Roberts and Rousseau (1989) discuss. Additionally, Roberts (1990) and Roberts and Rousseau (1989) argue that "*Several channels are used"* to ensure availability of expertise and that HROs have "*In-built redundancy"*. The latter means that backup systems are important to make it possible to continuously monitor critical activities and pursue internal crosschecks of critical decisions.

Finally, Roberts & Bea (2001) suggested that *"HROs balance efficiency with reliability*". This means that HROs design their reward and incentive systems to recognize costs of failures as well as benefits of reliability in order to enable the personnel to make decisions that are safe in the short-run and profitable in the long-run (Lekka, 2011).

In summary, there are several opinions on what constitutes an HRO, where the main discussion has been about whether an organization is entitled to call itself an HRO or not due to the characteristics of the organization. Therefore, an alternative approach to HROs focusing on the practices and characteristics that improves the reliability of an organization has been developed. Four different descriptions of HRO characteristics have been elaborated and are

presented in Table 1, and they have been argued to be similar, to some extent, even though the terminology of the characteristics differs. Weick & Sutcliffe (2007) argue that these characteristics are reliability-enhancing which also can be referred to as "…*the five key ideas of a mindful infrastructure*" (Weick & Sutcliffe, 2007, p. 9).

2.3. System safety

One of the earliest recordings of the system safety concepts can be traced back to a technical paper from 1947 entitled "Engineering for Safety". In the paper, the following was stated (Roland & Moriarty, 1990, p. 10):

> *"Safety must be designed and built into airplanes just as are performance, stability and structural integrity. A safety group must be just as important a part of a manufacturer's organization as a stress, aerodynamics, or a weights group."*

The modern, however still evolving, discipline of system safety is an emerging field within the borderland between engineering management and social sciences. It includes theoretical fields on topics such as technology and policy, system engineering, system and decision analysis, management and entrepreneurship, operations research, and much more (Leveson, 2011a). Rasmussen (1997, p. 184) captures the essence of the underlying philosophy of system safety in the quotation below:

> *"A system is more than the sum of its elements."*

The fundamental reasoning behind the system safety concept is based on the understanding that systems are complex, and thus, need to be modelled, analysed and managed accordingly. Subsequently, the system needs to be modelled not only by identifying and defining each component (task, machine, person etc.) in a generic setting or context, but also with respect to the interactions between components and the dynamic behaviour of systems and actors (Rasmussen, 1997). This basic understanding also affects the view on safety.

A traditional way of decomposing a system is to model it by identifying chains of decisions that can be easily isolated and rationalized (Rasmussen, 1997). However, proper decisions have been found to be difficult to isolate. In a familiar work environment, the front-line staff knows by heart the normal flow of activities and action alternatives available for each context, why the analytical and knowledge-based reasoning after time will be replaced by skill- and rule-based choice among familiar action alternatives (this is generally considered as the concepts of practice and know-how). In such contexts operational decisions are rarely rational in the sense that they are made using the full information, but rather based on information distinguished among the perceived alternatives for action (Rasmussen, 1997). Therefore, it is difficult to analyse the decisions made without also having to take into account the context in which the decisions are made, and which identified dynamic work process they are intended to control.

Another way is to model human behaviour in terms of a stream of acts. This includes a view of that when an accident occur, it will be easy to find which ingoing component or actor has violated a formal rule or instruction, and who thereby is responsible for the accident (Rasmussen, 1997). This is unreliable in a dynamic environment, where behaviour is context dependent (Rasmussen, 1997). Consequently, the emphasis should be shifted from explaining the role that humans play in accidents and the errors they make (deviations from normative procedure) to instead focus on the mechanisms and factors that shape human behaviour, that is - the features and context in which human actions take place and decisions are made (Leveson, 2011b). Furthermore, a model is necessary for identifying what affects the organizational setting needed for a failure to turn into an accident (Rasmussen, 1997). Thus, a supplementary explanatory model, including both the perspective of the action and the setting, is needed.

Trucco, et al. (2008) visualizes these two major dimensions of system safety, along with their relationship, as can be seen in Figure 2. Here, an *accident* is explained as being dependent on both the 'unsafe action' and a 'dangerous circumstance' or a 'dangerous setting' (where the latter will be the term used in this thesis). This will be further elaborated on below, but in short the argumentation is based on that an accident will only occur when an unsafe action takes place (due to either a component failure, a component interaction failure or a combination of the two, which will be further described below) while also the system operates in a dangerous setting (when we have crossed the boundary of acceptable performance, which also will be further elaborated on below). As will be seen below, the framework by Trucco, et al. (2008) may be combined with the research performed by two other main contributors to the theoretical field of system safety, namely Leveson and Rasmussen. Their work will be presented below, in relationship to the model presented in Figure 2.

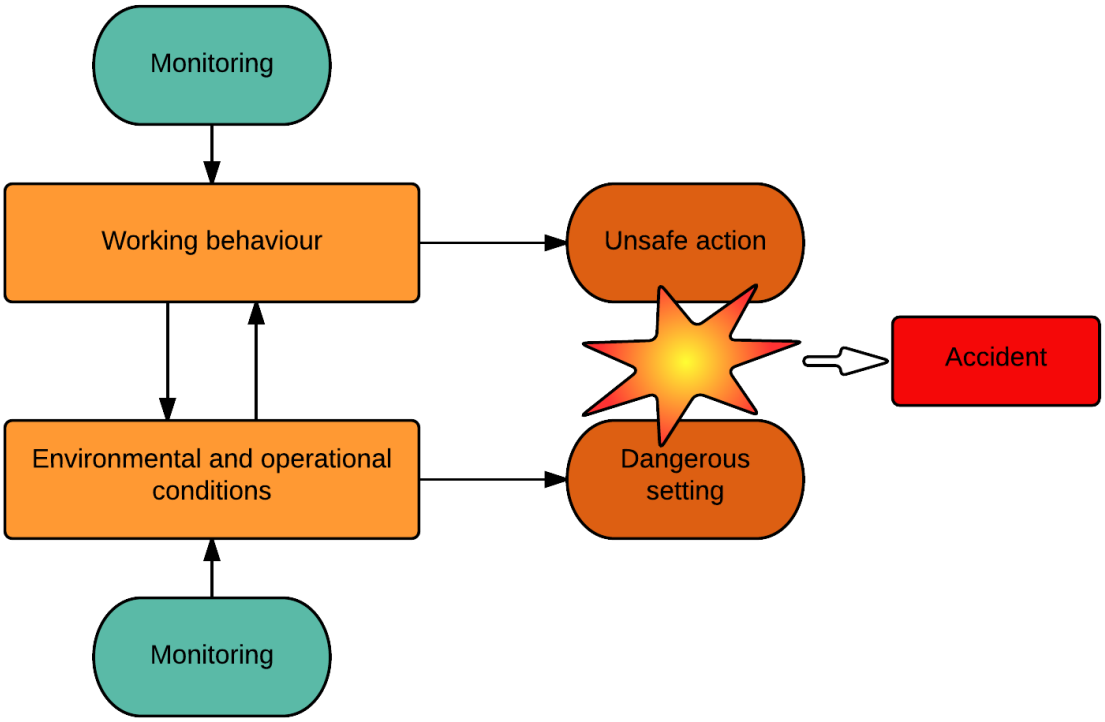


Figure 2. Visualization of how an unsafe action in a dangerous setting results in an accident, adapted from Trucco, et al. (2008)

Working behaviour and unsafe actions

In contrast to the reasoning of HRO, an 'unsafe action' does not need to be an 'unreliable action', but could rather be a reliable action performed in a context where in fact it would have been preferable if the action did not conform to the pre-designed specifications. This since reliability and safety are different properties, that are not necessarily working in the same direction (Leveson, 2011a). A system can be reliable, but unsafe. It can also be safe, but unreliable (Leveson, 2011a; Rasmussen, 1997). This since reliability in engineering is defined as the "probability that a component satisfies its specified behavioural requirements over time and under given conditions" (Leveson, et al., 2009, p. 234). Safety, in turn, is defined as "freedom from unacceptable losses (accidents)" (Leveson, et al., 2009, p. 234). Thus, reliability is a context dependent property, and is strongly correlated to "specified behavioural requirements" and "given conditions". The problem is that when the context changes, these requirements and conditions may change with it, why the "reliable actions" may become unsafe, considering their new context (Leveson, 2011a). Sometimes, when an operator or in the healthcare context a doctor or nurse have violated orders or formal instructions, this has been done since the new, unique context required an exception for the action to be safe – thus, the actions of the actor were unreliable but safe.

Furthermore, failures can occur even though the ingoing components are fully functioning. This since there in complex systems are two types of failures, namely i) the failures where a component have acted in an unsafe manner, which will be called *component failure,* and ii) failures that stem from dysfunctional interactions between non-failed components will be

denoted *component interaction failure* (Leveson, 2011a). The two can also affect each other, where dysfunctional interactions can ample the effect of a failed component.

The occurrence of *component interaction failures* can be explained in terms of inadequate control over component interactions and the rate of component interaction failures increases with the complexity of the system (Leveson, 2011b). In order to entirely prevent such failures to take place requires eliminating all potential dysfunctional interactions, that is, interactions that can lead to hazardous states in the controlled process (Leveson, 2004).

Accidents arise from interactions among system components and do not specify single causal variables or factors (Leplat, 1987). This implies the need of modelling accidents as a control problem - accidents occur when component failures, component interaction failures or external disturbances are not adequately handled by the control system, resulting in loss of control (Leveson, 2004).

The shaping of working behaviour can be done in primarily two ways, either by enforcing constraints on the way of working, or by designing for the 'right' behaviour. That is – to make it *"easy to do things right and hard to do things wrong"* (Carayon, et al., 2006, p. i53). Recommendations of how to design the system in order for preventing unsafe actions can be found within for example the research field of human factors engineering, such as the concepts by Hollnagel (2003) and others on cognitive task design. However, the most important thing to consider is whether the task is "standardizable" or not – that is, if the task should be performed in the same manner time after time. If so, the enforcement of constraints in order to prevent these actions to be performed in any other manner than the intended one is preferable. If the task is context-dependant, and thus not "standardizable", we rather need to design the task so that it is clear and easy to make the right decisions and follow the chosen path of action (Hollnagel, 2003).

Environmental and operational conditions and dangerous setting

A basic understanding that may seem trivial but that needs to be accepted is that systems often have multiple goals, and those goals (including safety) may be in conflict with each other (Rollenhagen, 2013). In order for the system to be able to identify and mitigate unsafe actions, the system must be in a setting where time and money allows the employees to identify these actions. In Figure 3 below, a system including the environmental and operational conditions are modelled – a system being shaped by a number of interacting objectives which have to be respected by the ingoing components in the system in order to have a successful work performance (Rasmussen, 1997). This model can be paralleled to be describing the environmental and operational conditions in the model depicted in Figure 2.

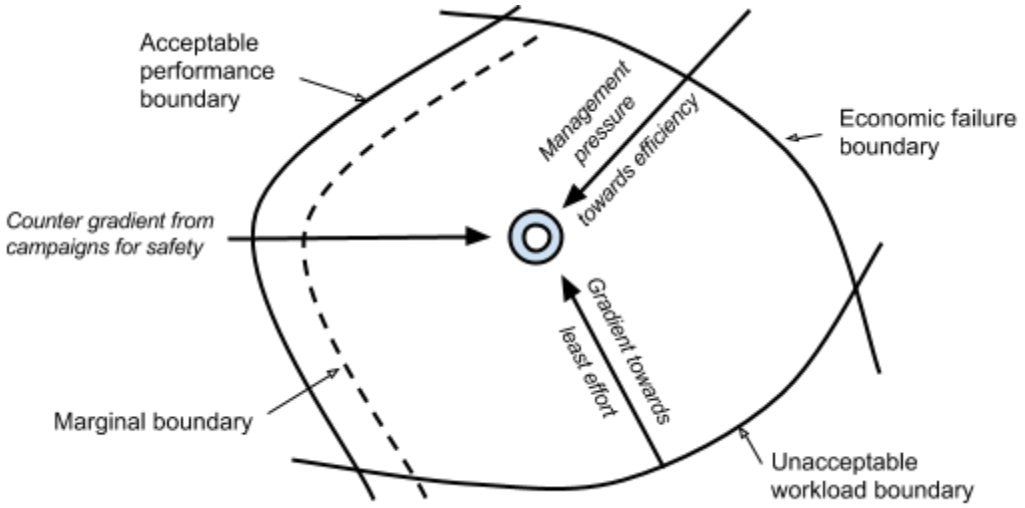


Figure 3. The Rasmussen (1997) model of interactions between boundaries in a work system

When changes occur in the system, which in most systems are normal and common, the system will have to temporarily modify its strategies and activities, often in an unpredictable and varied manner. The actors in the system will have to adapt to these changes, and during the adaptive search the gradients or forces from constraints will affect them. Rasmussen (1997) explains this adaptive search by comparing it with the 'Brownian movements' of the molecules of a gas. In these situations, the 'effort gradient' along with the management induced 'cost gradient' may push the ingoing actors to cross the boundary of functionally acceptable performance, where the risk of an accident to occur is amplified (Rasmussen, 1997). Rasmussen (1997) argues that this "setting of the stage" for an accidental course of events is very likely to stem from normal efforts. The normal efforts are performed over time by numerous actors, who in the context of their daily work only respond to the continuous pressure of being cost-effective.

Rasmussen (1997) argue that in order to increase the safety of the system, the approach to the control of system performance should be aiming at controlling the behaviour by making the boundaries explicit, known and visible for the actors, and by giving opportunities to develop coping skills at the boundaries, rather than controlling behaviour by fighting deviations. These coping skills can be achieved by increasing the margin from normal operation to the loss-of-control boundary or increasing the awareness of the boundary by means of instruction and motivation campaigns (Rasmussen, 1997).

Increasing the margin from normal operation to the loss-of-control boundary can be achieved by e.g redesigning the system to facilitate the work or increase budget, and hence reduce the pressure from the boundaries of workload or economic failure. However, the natural adaptation to the boundary will likely compensate (see Rasmussen 1997 for a further discussion on natural adaptation in terms of 'risk homeostasis'), why the ability to keep the margin depends on the recovery characteristics of the system (Rasmussen, 1997).

Increasing the awareness by highlighting and prioritizing safety can act as a 'counter-gradient' (see Figure 3) to the other forces applied on the system, enabling the creation or

preservation of a margin to the boundary of acceptable performance. However, in order for this to work the pressure needs to be continuously applied, since it needs to compensate for the functional pressure of the work environment.

It is important to consider which structures and processes to include in the system (or sub-system) that the organization intends to control (Rollenhagen, 2013). The limits of the system may be adjusted if necessary, but the scope of the system will define the quality of the information - if the level of control (that is, the size of the sub-system) is too inclusive and general, the aggregated information from the system might not show signs of being overloaded, even though one part of the centre is. If the level of control is too narrow, not all information needed in order to understand the interactions and behaviour of the system will be taken into consideration (Rollenhagen, 2013).

Mechanisms and tools for system safety

There are a number of proposed tools that follow the basic assumptions and explanatory models presented above. For shaping working behaviour, inspiration can be taken from the SEIPS (Systems Engineering Initiative for Patient Safety) model aiming at providing a framework for "understanding the structures, processes and outcomes in healthcare and their relationships" (Carayon, et al., 2006, p. i50). Inspiration on how to design tasks can be taken from human engineering and cognitive task design (Hollnagel, 2003) as mentioned above.

Furthermore, following the reasoning by Leveson (2004) and Rasmussen (1997), organizations working according to the system safety approach should consequently have accident models that are aligned with these basic concepts. Such accident models form the basis for both investigating and analysing accidents, preventing future accidents, and determining whether systems are suitable for use through risk assessments (Leveson, 2004). Leveson (2004) herself has contributed with a new accident model, STAMP (System-theoretic accident model and processes) in which the focus is on helping engineers or system designers to learn as much as possible about all factors, both social, technical and organizational, involved in the system.

There are however few tools available for identifying and monitoring boundaries as suggested by Rasmussen (1997). However, Arici, et al., (2010) have developed a way of "diagnosing" the system where he rather aims at identifying how the system is affected by the ingoing forces, based on the socio-technical factors that influence clinical practice, identified by Vincent (1998). These factors include for example institutional and organizational factors, team factors, individual factors and patient characteristics (Vincent, et al., 1998). Arici, et al., (2010) use this information in combination with so called Clinical "Risk Control Rules" in order to predict and prevent risk against patient safety in clinical settings. These rules are used to guide the system depending on which factors that are currently affecting the system, and how they interact (Vincent, et al., 1998). This through an approach characterized by being both retrospective and proactive, that includes dynamic risk assessment (through continuous monitoring), in an adaptable domain, with integrated risk management tools and extensive real time control.

Additional tools include the CREA (Clinical Risk and Error Analysis) method developed by Trucco and Cavallin (2006), a joint prospective-retrospective quantitative method aiming at

analysing and assessing risk from a systems perspective, as well as their statistical process method ERASMO (Error and Risk Antecedent Statistical Monitoring) aiming at monitoring systemic factors that constitutes the antecedents of error. The ERASMO method also aims at fostering patient safety and quality improvement in healthcare (Trucco, et al., 2008).

2.3.1. Main properties of System Safety

Table 2 The main properties of System Safety

	General insights	The two dimensions of safety	Working behaviour and unsafe actions	Environmental and operational conditions and dangerous setting
Main contributors	Leveson, Rasmussen, Rollenhagen, Trucco	Trucco and others	Leveson and others	Rasmussen, Rollenhagen
	Holistic systems view "A system is more than the sum of its elements" Safety is a control structure embedded in an adaptive socio-technical setting The system need to be modelled accordingly – neither too narrow, nor too broad	An accident will only occur when an unsafe action takes while the system operates in a dangerous setting	Constraints necessary to ensure safety need to be identified Accidents are caused by a loss of control due to • lack of safety constraints • inadequately communicated constraints • constraints that are not enforced correctly at lower level Imposing constraints to limit the behavior of the process below to safe changes and adaptations	Focus on shaping control of behaviour by - making the existing boundaries explicit and known - creating coping skills at boundariesS Systems often have multiple goals, and those goals (including safety) may be in conflict with each other

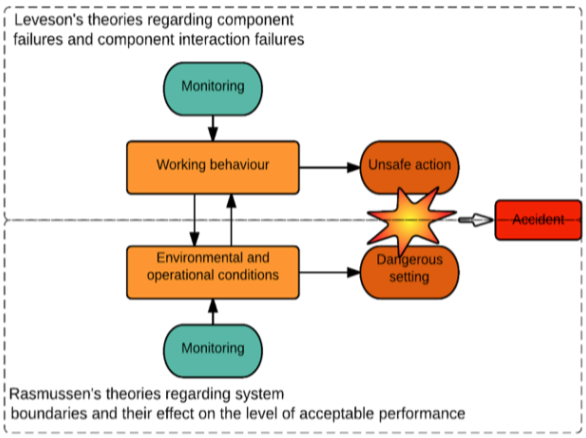
In accordance with the concepts and explanatory models presented above, a number of main properties can be identified as defining the concept of system safety. These are presented in Table 2 above. These theoretical fields are related to each other, which is illustrated in the combined and comprehensive framework in Figure 4 below.

Shaping working behaviour

- Identify real root causes

Identify context and non-context dependant activities

- Use constraints for standard activities
- Design for “right” behaviour for context-dependent activities



Identify scope

- Not too broad, nor too narrow

Visualize and manage

- Identify and visualize boundaries
- Create margin to boundary
- Create coping skills at boundary

Figure 4. The relationships between the research done by Trucco, Leveson and Rasmussen

3. Method

In the following chapter, the methods used for this study will be described. The choice of research strategy and design will be described and motivated, along with the choices regarding methods for data collection and data analysis. The procedure of reviewing the literature and developing a theoretical framework will also be described. Ethical aspects and delimitations of the study will be discussed at the end of the chapter.

3.1. Research strategy and design

In order to identifying how a perinatal centre can increase the level of patient safety by adopting a system view on safety, the choice of the main research strategy was a qualitative single case study of the perinatal centre at Skaraborgs Hospital, Sweden. The choice of a qualitative approach as research strategy is suitable when a social phenomenon is to be studied and when the research aims to understand the participants'' perspective (Bryman & Bell, 2011; Malagon-Maldonado, 2014). In healthcare, qualitative research is a valued method for understanding how healthcare systems can improve outcomes for those receiving and providing care (Malagon-Maldonado, 2014). The basic case study is a detailed and intensive analysis of one (1) single case. The case study as research design is characterized of a high focus on a bounded situation or system (Bryman & Bell, 2011). In this research, the choice of performing case study research depended on the intended outcome of studying one complex case thoroughly (Bryman & Bell, 2011).

An abductive research approach has been deployed, which can be seen as a mixture of deductive and inductive approaches (Dubois & Gadde, 2002). An abductive approach is suitable when the objective is to generate new concepts and develop new theoretical models by combining existing theories, rather than generating new ones or confirm existing ones (Dubois & Gadde, 2002).

3.2. Literature review

The study was initiated by performing a literature review. A literature review can be seen as one of the most important parts in carrying out a research project (Bryman & Bell, 2011). The main purpose of the literature review is to create an analytical framework and to gain an overview on the relevant available research literature on the topic(s) being studied (Cronin, et al., 2008). Further, according to Cronin *et al.* (2008), the literature review is an objective process where the researchers through summary and critical analysis of available research study the topic. The review helped in building of the research design (Bryman & Bell, 2011). Additionally, the review supported the writers in defining the scope, as well as informing on how to collect data and by enabling the development of a descriptive and comparative theoretical framework, which in turn enabled an informed way of analysing the data (Bryman & Bell, 2011).

The literature review was conducted in a traditional manner, and aimed at summarizing the key findings in works from prominent researcher within each subject (Cronin, et al., 2008). The approach for the literature review is described in Table 3 below.

Table 3. The literature review process (Cronin, et al., 2008)

Step	Comment
Selecting a review topic	The main topic for this paper is system safety. Related topics are complex system dynamics and High Reliability Organizations (HRO)
Searching the literature	Searching and accessing relevant literature was done by using the library services from Chalmers University of Technology and University of Gothenburg, along with Google Scholar. Additionally, pieces of work from well-cited and prominent contributors on the subject were identified using back-tracing through reference lists. The final literature was selected by identifying key contributors and pieces of work within the research fields of System Safety, HRO. For the theory on complex adaptive systems, well-cited pieces of work were used as basis for the descriptive theory.
Gathering, reading and analysing the literature	A gathering of theoretical pieces on all three safety theories were made, through identifying key contributors and processing key pieces of literature first. For the ease of reading, the concept of HRO was then briefly presented. The theory of System Safety, which is fundamental for the analysis and the recommendations, is more elaborated.
Writing the review	The theory and underlying principles of HRO was briefly presented, along with its identified shortcomings but also its contribution to the safety management within healthcare. The key concepts in each dimension of System Safety are however more thoroughly, with the key characteristics being summarized in a table in the end of each chapter.
References	All references used for this paper can be found in the bibliographical list. The reference style used for this paper is the Harvard system of referencing. The authors made use of the Harvard reference tool in Microsoft Word.

A theoretical framework was developed from the prominent literature on System Safety. The theoretical framework aims at examining how the perinatal centre work within the two dimensions that influence safety; the working behaviour and the environmental and operational conditions.

3.3. Data collection

The data has been collected using different methods and from different sources, in order to strengthen the validity of the data according to the concept of triangulation (Bryman & Bell, 2011). Primary data has been collected through semi-structured interviews, participant observations and through a questionnaire. Secondary data has been collected through review of policy documents and other organizational documents. Details regarding these different methodologies are described below.

3.3.1. Semi-structured interviews

In order to obtain rich data, interviews were conducted. Interviewing is one of the most commonly used methods within qualitative research, and is a valuable method, although the preparation, execution and transcription of interviews are time-consuming activities (Bryman & Bell, 2011). Interviewing is also an effective way to get access to information that is difficult to capture in other ways, such as knowledge and experience (Bryman & Bell, 2011).

The choice of using semi-structured interviews for this research was based on the aim to obtain a cohesive set of interviews, while maintaining a certain degree of flexibility (Bryman & Bell, 2011; Kvale & Brinkmann, 2014). The approach was useful by providing a framework of general questions in order to cover essential parts of the information needed, while allowing to adapt the questions to the interviewee and his/hers competence and knowledge, as well as enabling elaboration regarding areas of interest. The goal was to obtain a rich picture of the present state, why co-workers and managers having different competences and perspectives was interviewed. The number of interviews performed was not predetermined, but a primary interview list was developed that included representatives from different levels of the organization as well as from different disciplines. Other individuals that were identified as carriers of valuable information or knowledge that enriched the picture were added to the list along the way. A comprehensive list of interviewees can be seen in Table 4 below. In total a number of 11 in-depth interviews were conducted. The questions were developed around a number of areas: i) general questions regarding background and current work situation, such as a work description, ii) questions regarding the interviewee's perceptions of safety iii) questions of how the interviewee (and their co-workers) work with safety, iv) which tools the interviewee (and their co-workers) use and how these are used, v) questions regarding interviewee-specific areas, such as the patient safety representatives role in patient safety work. A general interview guide can be found in Appendix II.

Table 4. List of interviewees

Number	Position	Division
1	Manager of Operations	Child and Women´s business area
1	Head of Clinic	Obstetrics clinic
1	Head of Clinic	Maternity ward clinic
1	Head of Clinic	Neonatal clinic
1	Patient safety representative/midwife	Obstetrics clinic
1	Patient safety representative/midwife	Maternity ward clinic
1	Patient safety representative/neonatal nurse practitioner	Neonatal clinic

1	Coordinator/Mid-wife	Obstetrics clinic
1	Obstetrician/medical supervisor	Gynaecology/Obstetrics clinic
1	Obstetrician/Head of clinic (Gynaecology)	Gynaecology/Obstetrics clinic
1	Construction Project Manager	Perinatal center

All interviews were conducted face-to-face and lasted for 30-90 minutes depending on numerous reasons (depth of interview, amount of information available, effectiveness in responding to questions, etcetera). All interviews were recorded, transcribed and compiled in a systematic manner.

3.3.2. Participant observations

In order to obtain a better understanding of the daily activities and operations, sessions of participant observation were carried out. Three to four-hour sessions was spent on the maternity and newborn care, neonatal clinic and obstetrics clinic, respectively. The observations were performed in an overt manner, where the researchers took on the roles of *observer-as-participants*. In this role, the researchers acted mainly as interviewers, including observations but no participation, except for intervening by asking questions (Bryman & Bell, 2011).

The overt approach to the observation may have affected the observed result, since there is risk that the observed actors adopted their behaviour since they were being observed (Bryman & Bell, 2011). However, for practical, ethical and logical reasons, an overt manner was the only feasible solution.

The documentation of the observations was performed both by taking notes and summarizing thoughts in individual diaries. The rationale behind this was that taking notes during observation can be difficult (Bryman & Bell, 2011), while it is simultaneously risky to rely exclusively on memory (Bryman & Bell, 2011). By documenting using individual diaries, both the objective observations of what happened, as well as the subjective understandings and impressions were collected, which has enriched the understanding of the present state at the departments.

3.3.3. Questionnaire

Aiming at gathering perspectives from the voices that were not assembled during interviews, a simple questionnaire was distributed. The questionnaire included two questions regarding safety, were the respondents were allowed to write comprehensive answers, and three shorter questions regarding demographics. A link to the questionnaire was distributed to the front-line personnel (doctors, nurses, midwives etcetera), who answered the questions anonymously through Google Forms. In total, 19 out of approximately 200 employees responded (~10 % response rate), ranging from interns, nurses, nursing assistants, midwives and doctors from different divisions. The years of experience from healthcare ranged from 6 to 37 years, with an average of approximately 25 years.

There are several reasons for why the response rate was low. Firstly, the time frame for responding to the questionnaire was fairly short (5 days) due to time constraints. Secondly, the questionnaire was distributed online, through email. As observed, not everyone access their e-mail on a daily basis, and due to high workload the co-workers that were reached by the e-mail might not prioritize work that they may not consider to be directly value-creating.

The obtained result might be biased, since the respondents might constitute a group of people having a high interest of the subject, which implies that they are not representative for the population observed. However, the result was in accordance with results obtained through other methods. Since the results were considered to strengthen the validity of the overall data, the decision was made to use the results. This in accordance with the strategy of triangulation.

The questions were:

- From a health care perspective: What do you consider to be safety?
- What is most important in order for you to work in a safe manner?
- Which position do you have?
- Which division to you mainly belong to?
- How long (approximately) have you in total been working within health-care?

A print screen of the original questionnaire in Swedish can be found in Appendix III.

3.3.4. Qualitative content analysis

The last, but not least, method for data collection was a qualitative content analysis of in total 21 organizational documents, with either a clinic scope, a perinatal scope or a more or less hospital-wide scope. The key information (quotes or information-carrying sentences) regarding the perceptions, practices and tools (described further in chapter 3.4) were extracted and listed for each document. This is in accordance with the concept of qualitative content analysis (Bryman & Bell, 2011).

3.4. Data analysis

In order to organize the vast amount of data, the process of coding was pursued. Coding entails that the data are broken down into component parts, which are given name (Bryman & Bell, 2011).

To be able to structure the coded data, a categorization strategy was employed (Bryman & Bell, 2011). The categories were segmented according to two sets of criteria depending on the origin of 'the voice' from which the data was collected: level of hierarchy and organizational affiliation. For the level of hierarchy, three main levels were identified and labelled as macro, meso and micro. Figure 5 aims at describing how these hierarchical levels have been identified.

In general, the voices originating from the front-line practitioners, including midwives, nurses, neonatal nurse practitioners, nursing assistants, interns and doctors have been identified

as micro, along with the observations gathered when participating in the daily operations. No documents have been identified as originating from the micro level.

Furthermore, the meso level includes all identified actors at mid-managerial level, along with documents were these actors could be identified as responsible. The meso voices include the heads of clinics of the obstetrics clinic, maternal ward clinic, neonatal clinic and others with mid-managerial experience or responsibilities.

The macro level include the voices from the top management, including the operations manager and the project leader for the new perinatal centre, along with documents were these actors, or actors above them in the system (such as the hospital CEO or the government), could be identified as responsible.

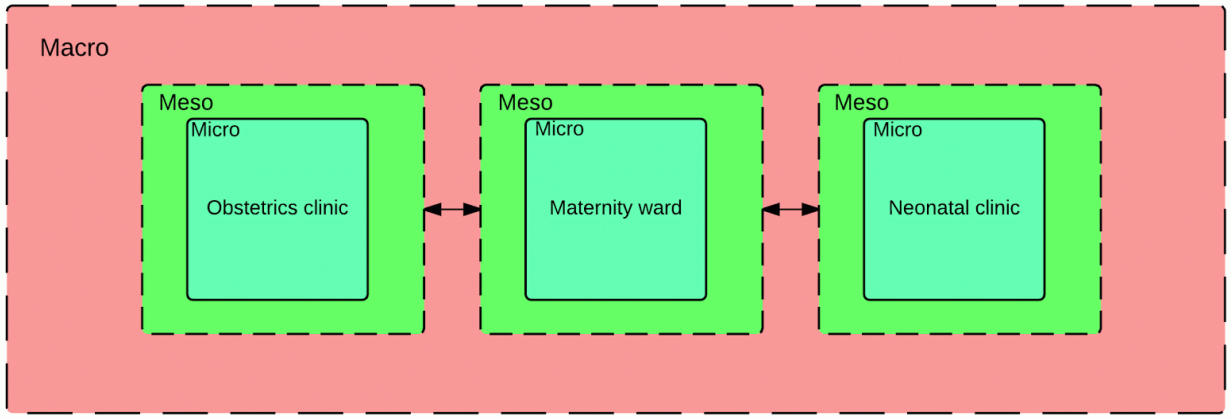


Figure 5. Visualization of the micro, meso and macro levels within the perinatal center

The second segmentation was done according to organizational affiliation. In the micro and meso levels, the identified segments were the clinics (obstetrics, maternity ward, neonatal) and 'Others', referring to front-line personnel that operates within one of these contexts but have other organizational affiliation (e.g. doctors from gynaecology). For the macro level, the segments were divided per actor (operations manager and project leader for the perinatal centre), while the documents were merged into one "affiliation".

Furthermore, the data was arranged according to a third dimension: namely the characteristics of the content. For this, an adapted version of the Dean and Bowen (1994) framework for total quality was used. Instead of segmenting it according to Dean and Bowen's version of *principles, practices* and *techniques,* the concepts of *perception, practices* and *tools* were introduced. In summary, *perceptions* can be considered as "how we see the world". In this specific context, it is rather "our views on safety" – the perception of what safety is. *Practices* are the voiced actions of safety – the processes or activities where we somehow exercise safety, or that affect the level of safety. Last but not least, *tools* imply the identified and voiced tools, techniques, functions and mechanisms associated with safety. A summary of these can be seen in Table 5.

Table 5. Characteristics: Perceptions, practices and tools

Perceptions	How we perceive safety What we claim to be safety Our views on safety
Practices	How we exercise safety The operations that affect safety The actions associated with safety
Tools	Physical or immaterial tools, techniques, functions and mechanisms associated with safety

All the coded information were mapped according to the three categories, or 'dimensions' (hierarchical level, organizational affiliation and characteristic). Within each three-dimensional "box" (that is - within each group on the same hierarchical level, with the same organizational affiliation and the same characteristics) an affiliation mapping was performed, where all ingoing data points (ranging from 10-60 per "square") were listed on a whiteboard and clustered into sub-groups. Each sub-group was given a descriptive headline.

The first comparison was done between organizational affiliations for each hierarchical level. Since only small differences were found for each level, these were merged when presented in the result (chapter 4). The result was then analysed both horizontally (between hierarchical levels) in order to identify similarities and differences, as well as vertically (between perceptions, practices and tools) in order to see if each perception was supported by practices and tools, or if there existed some "maverick" – a lone perception, practice and tool, disconnected from others. Finally, the perceptions, practices and tools were evaluated according to the theoretical framework.

These three dimensions have, together with the observations and the analytical framework, been the foundation for the final conclusions and the recommendations. In the write-up of the empirical data and the analysis, no references to e.g. specific interviews were made, partly due to the respect towards the respondents anonymity, but also because the information mainly is interesting in an aggregated and contextualized setting.

3.5. Research Quality

The research quality criteria that have been considered in this thesis are the criteria for trustworthiness in qualitative research, namely: credibility, transferability, dependability and confirmability (Bryman & Bell, 2011). The criteria, along with the efforts for coping with each criterion, are presented below.

Credibility

The credibility criterion deals with whether the research can be seen as feasible and credible, that is – is the researchers' description of the reality acceptable to others (Bryman & Bell, 2011)? One effort made to achieve this is that the research has been performed in good faith, with the intention of describing an objective view of reality. Furthermore, the results have been obtained using several different methods as well as different sources of data in order to work according to

the validity strengthening concept of triangulation (Bryman & Bell, 2011). Additionally, the results have been presented to a group of people within the organization, which allowed for group respondent validation, which also aimed at strengthening the level of acceptability of the result (Bryman & Bell, 2011). The choice upon group respondent validation may entail a risk of being

Transferability

By performing a single case study, the ability to generalize the results is limited compared to other research strategies (Bryman & Bell, 2011). However, the aim is that the findings of the research can be used as contribution for the general understanding on the applicability of system safety in healthcare. By offering a thick description, including rich accounts of details, the purpose is to enable others to make judgement about the possible transferability of the findings to other contextual settings (Bryman & Bell, 2011).

Dependability

To establish the merit of research in terms of the criterion of dependability, it is proposed that researchers should adopt an 'auditing' approach, entailing that all detailed records for all decisions, actions, processes, transcripts etcetera for all phases of the research process are kept in an accessible manner (Bryman & Bell, 2011). By employing external auditing, it may be established that the research has followed proper procedure. For this research, most records have been kept; however, no external auditing has taken place. The reasons for this are mainly due to time and resources constraints.

Confirmability

Confirmability relates to the understanding that complete objectivity is impossible in business research – the previous knowledge and values of a researcher will always have impact on the conducted research (Bryman & Bell, 2011). However, the researchers should aim at acting in good faith (Bryman & Bell, 2011). For this thesis, the researchers had limited experience of healthcare, however, some feelings, values and opinions along with prior ideas and experiences may have affected the outcome of the research. Furthermore, the knowledge and prior experiences of the different theoretical concepts of safety was fairly low. For both areas, the authors aimed at having an open mind and a willingness to act according to good faith.

In summary, the quality of the research may be questioned due to the lack of external auditing. However, the research has been performed in good faith and according to established practice.

3.6. Ethical considerations

The four areas of ethical considerations, which are used for examining the ethical level of the report, are the following (Bryman & Bell, 2011):

1. Whether there is harm to participants
2. Whether there is a lack of informed consent
3. Whether there is an invasion of privacy
4. Whether deception is involved.

The intention is that the respondents and participants in this study should not been directly harmed nor adversely affected by the study. The names of the interviewees have been anonymised and the answers are in this study presented in an aggregated manner, which entails that the individual identities of the respondents should not be able to be identified. However, some hierarchical levels consist of small samples, hence, there is an increased possibility to link specific answers or information to an individual. Each interviewee and respondent has been informed about their anonymity, and the interviewees were informed about that the interviews were recorded and transcribed. Therefore, the invasion of privacy remains intact.

The interviewees were verbally informed about the study, where especially the aim of the study and the purpose of the interviews were presented. The interview did not start until the interviewee had no further questions. Whether this is enough to conclude that informed consent is in place could be debatable, however, the assumption is that this is the case for all interviewees.

The study was conducted in an overt manner, which for ethical reasons often is considered as preferred. However, this may have effect on the final result. When reading this report, consideration should be given to that the result is built upon the biased voices within the organization, in combination with the biased interpretive mindset of the researchers. Active consideration to this matter has been taking place throughout the entire research process.

Additionally, all participants were informed if any type of recording took place. In general, the dialogues with the participants were open and honest, and questions that have aroused throughout the process have been answered in good faith and with an open and honest approach. Therefore, no intentional deception has taken place.

4. Empirical data

In this chapter the result of the case study is presented along with a general description of the case. As presented in the previous chapter, the result has been mapped according to a framework including key perceptions ("how we perceive and talk about safety"), key practices ("what we do" - the operations associated with safety) and key tools ("what we use"). In order to observe different hierarchical and social contexts, the result has also been divided into three subgroups: macro, meso and micro, depending on where the 'voices' originate. For example, data gathered or observed in interviews with front-line personnel has been defined as micro, data gathered from e.g. documents or interviews from the head of clinics has been defined as meso, while data gathered or observed in interviews with e.g. the manager of operations has been defined as macro. A further elaboration on the hierarchical division of data can be found in chapter 3. Furthermore, a more thorough mapping of the result can be found in Appendix IV.

4.1. General description of the case

As mentioned in Chapter 1, the organization of focus is the perinatal centre of the Skaraborg Hospital Group (SkaS). The perinatal centre is located at the Skövde division of SkaS. The term perinatal describes the processes before, during and after childbirth, in this case the antenatal care, the obstetrics care, the maternity ward care and the neonatal care (Bergman, 2014). At SkaS these processes are divided into three clinics: the obstetrics clinic, the maternity ward clinic and the neonatal clinic. Each clinic has approximately 50 employees, working in shifts both day and night (3 shifts per day). The business area has continuously performed different improvement projects regarding patient safety, logistics and care processes. At the moment, SkaS is building a new house where the Child and Women's business area (to which the clinics within the perinatal centre belong) will move in fall of 2015. The new facilities will also entail a restructuring of the organization, where the intention is to integrate the processes of three clinics into one perinatal process. Therefore the management has expressed a desire to increase the cooperation and integration between the three clinics to function more as one. These changes also allow for an opportunity to adjust the structure with the care processes in order to improve the level of patient safety.

According to the patient safety plan developed at SkaS, the hospital works systematically with patient safety. This can be exemplified with the quotation below (Johansson, 2015, p. 1).

"*We provide a care with good quality and high level of patient safety in active collaboration*"

The hospital's patient safety work is influenced by a high patient-centred focus and the patients perspectives are seen as key for the patient safety improvement. Furthermore, the patient safety work consists of working with development of processes and continuous improvements. This includes for example risk analyses, risk assessments, incident reporting, daily follow-ups of control boards and decreasing small failures in the daily care (Johansson, 2015). Also, the patient safety work includes basing decisions on facts and personnel involvement in the work.

Management commitment is seen as important for a successful patient safety work, implying that the management needs to be motivated to work with patient related issues. Moreover, the patient safety work should be characterized with a holistic view regarding the patient's journey through the system, including risk handling and continuous improvements (Johansson, 2015). One of the employees explains the holistic view as "now we do not act as we are working in these silos any more, rather as a whole. As it was before, when everybody acted differently, it was not especially good since the parents go through the whole centre". Moreover, the centre highlights the importance of continuous improvements, and that all co-workers are required to report any deviations and events in order to improve the patient safety work. This was demonstrated in the observations; the management of the perinatal centre is open for change and wants to become safer for the patients. In Figure 6 the principles relevant for an offensive organizational development regarding patient safety is presented (Johansson, 2015).

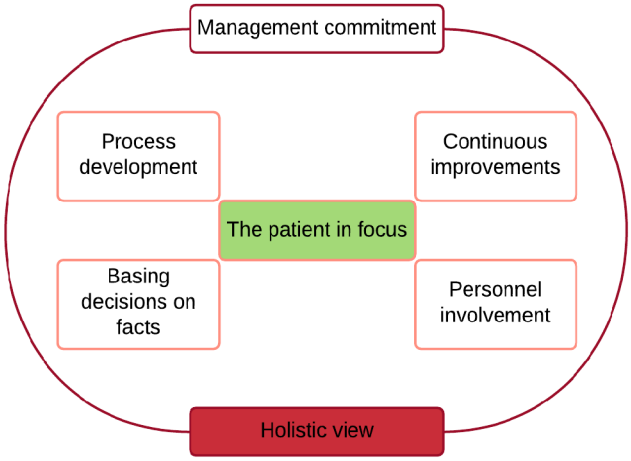


Figure 6. Principals for an offensive patient safety development work adapted from the patient safety plan (Johansson, 2015)

In Figure 7 below, a flowchart presenting the primary care, antenatal care, obstetric care and the maternity and newborn care is visualized. As mentioned in Chapter 3, the primary care is not a part of SkaS and therefore the primary care will only be considered as a source of information. At the centre of the workflow, the obstetrics care can be found. Every day, the obstetric clinic takes care of approximately 7 childbirths, however there are some seasonal variations as well as day-to-day variations (Skaraborgs Sjukhus: Informationsenheten, 2015). Hence, the predictability of the operations is low. Furthermore, the workload does not only depend on the number of patients within the clinic, but also much on the complexity and combination of patients. As one of the heads of clinic put it *"the workload is not very easy to predict. It can be fully occupied at the clinic and everything is still very calm and everything works out fine. And then it can be half full and loads to do - nothing works, nothing runs smoothly"*.

The process also include two types of newborn care clinics: care of the mother and child at the maternal ward clinic, and care of the premature child at the neonatal clinic. All the clinics have similarities, but also some differences, which will be presented further in the sections below.

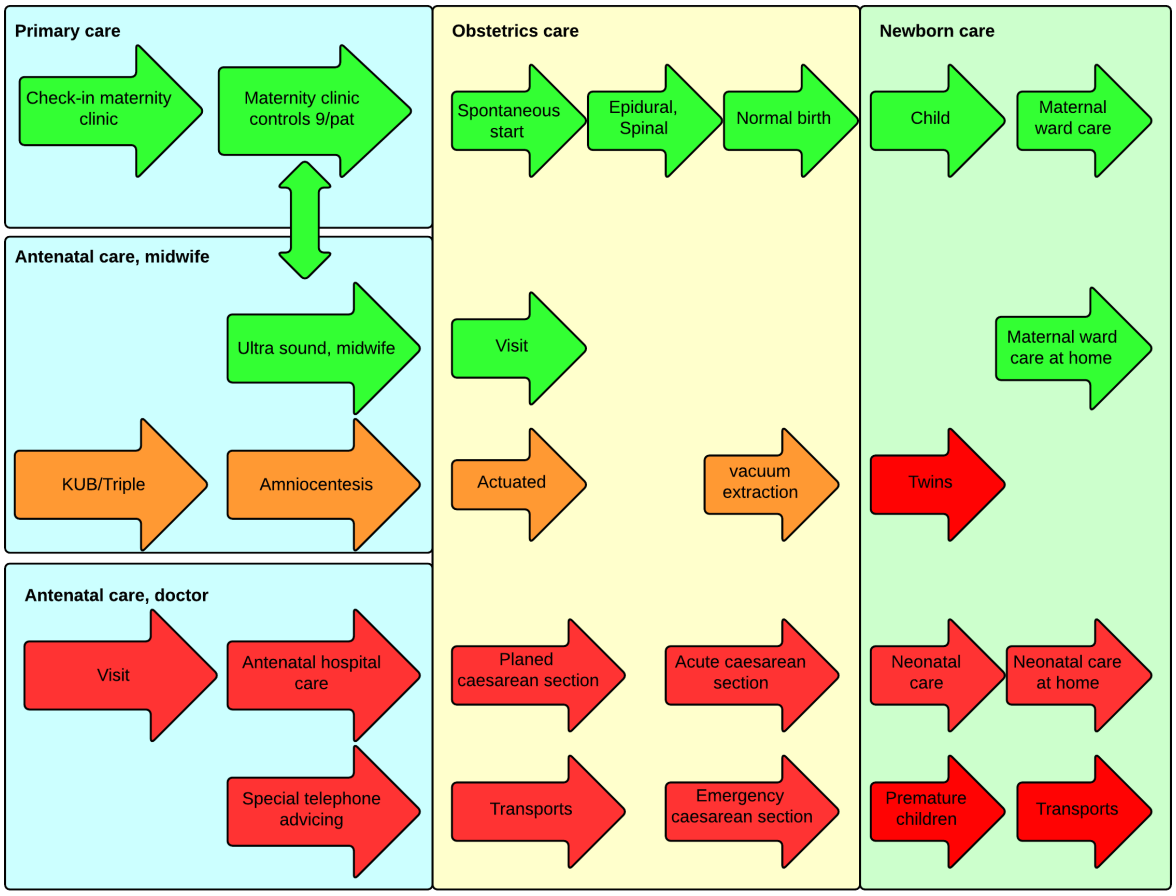


Figure 7. Flowchart presenting the perinatal process: primary care, antenatal care, obstetrics care, maternity and newborn care

Below, the identified result is presented. A more thorough descriptive summary of the result, presented by each hierarchical level and their respective perceptions, practices and tools, is available in Appendix IV.

In this report, the empirical result is aggregated and presented according to the identified main headlines from the perceptions. Similar headlines from the perceptions of different hierarchical levels have been grouped together, and the practices and tools have been presented together with the perception to which they primarily belong. All perceptions of safety, and practices and tools used for patient safety work are presented in Table 6.

Table 6. Summary of the identified perceptions, practices and tools at the perinatal centre

	MICRO	MESO	MACRO
Perceptions	□ Patient-centred focus	□ Patient/family-focused care	□ Patient-centred, value based care that is

	□ Care that does not endanger the patient □ High theoretical and practical knowledge among front-line personnel □ Training and maintenance of knowledge among front-line workers □ Systematic work, according to proven and formalized rules & procedures □ Reliable processes □ Adequate level of human resources for the workload (personnel & time) □ Communicating teams with open climate □ Strong leadership □ Human day-to-day factors	□ Medical 'know-how' □ Work according to proven and formalized rules and procedures □ Reliable processes and equipment □ Well-functioning support processes □ Adequate level of human resources for the workload (personnel, competence & time) □ Communicating teams with open climate □ Well-functioning logistics and facilities □ Overall overview on the clinic □ Avoid the emergence of stressful situations	accessible, perceived as safe, and which do not endanger the patient □ That the patient is involved in the care □ Engaged and competent co-workers □ Clear and proven instructions and routines □ Continuously develop and improve the organization and its processes □ Work within resources constraints □ Well-functioning teams with an open climate □ Clear leadership □ Perceiving)the facilities comfortable and safe (patients & co-personnel) □ A holistic view of the organization □ Monitoring, evaluating and focusing on patient safety
Practices	□ Front-line patient-related assessment, coordination and control □ Care-related actions □ Documentation □ Operating-related assessments and coordinations □ Personnel related processes (incl. training) □ Operating-related actions	□ Front-line patient assessment and monitoring □ Care-related processes □ Include the patient in the care process □ Exchange of information internally □ External cooperation □ Active and continuous development of the patient safety □ Organizational development and improvement through research, goals and measurements, and process improvement □ Work systematically, according to formalized rules & procedures	□ Day-to-day care operations □ Patient-care/nursing staff interaction □ Communication □ Cooperation between clinics and/or external parties □ Work according to laws and restrictions □ Development and improvement of the organization and its operations □ Training and development of competences and skills □ Have well-functioning logistics and facilities □ Managing the daily administration

		□ Developing the employees through education, training and managerial support □ Manage and secure resources	□ Managing the daily operations □ Providing information to the staff
Tools	□ Information system tools (storage & download) □ Tools for developing the organization □ Communication tools □ Tools for performing care □ Monitoring tools □ Formalized instruction tools	□ (Mainly) internal functions and tools for developing the operations □ Tools for cross-functional organizational development □ Tools for continuously managing and coordination of daily operations □ Securing human resources □ Tools for supporting and developing the co-workers □ Tools for developing skills and competences □ Tools for team-based communication □ Tools for organizational standardization □ Support systems □ Tools for patient/parent learning	□ Organizational development tools and functions □ Mechanisms for increasing the level of knowledge and experience among the co-workers □ Regulating and guiding publications □ Tools for treating and caring patients □ Tools for monitoring and diagnosing patients and tools for treatments □ Supporting systems in daily operations □ Tools for communication □ Group interaction □ Tools for visualizing improvements and regulations □ Cooperation and preparation for the new facilities

Patient-centred care

The perception that safety includes a patient-centred care that does not endanger the patient recurs at all three hierarchical levels (micro, meso, macro). The macro level also includes the need of involving the patient/parents in the design of the care, while the meso and micro levels rather highlight the need of educating patients/parents in order to enable a safe environment when the patients and parents leave the hospital. This includes educating the parents through organized inspirational lectures and through patient-care/nursing staff interaction, as well as allowing the patients/parents to provide input regarding their care by having a dialogue with the patient/parent. An example of a more formalized technique for this is e.g. teach back, allowing the nursing/care staff to ensure that the patient/parent has understood their alternative choices of action.

The patient-centred care is not only about the physical care, but also concerns the psychological side of the care. As one of the heads of clinics described it as: *"Safe care is when*

we have parents that are content, that the parents have the perception that "they saw me". That they were seen in every step".

Medical "know-how"

One perception voiced at all levels in the organization is that it is important for co-workers and front-line personnel to have a high level of theoretical and practical professional knowledge. The micro level highlights that maintenance and training of knowledge is important in order to be able to provide a safe care, and the macro level argues that the co-workers should be engaged and competent. For example, one of the heads of clinics claimed: "*The midwives are not just like interchangeable bricks in a game, but every brick has its own unique function*". The micro, meso and macro levels confirm this perception by conducting trainings and educations for improving co-workers skills in acute situations. The tools used for this are for example education days, lectures and internet-based trainings. According to the observations, competence and education is key since much work is performed by experience and knowledge among front-line workers, and there is a mutual understanding that not all workers can perform any type of tasks. One midwife claimed: "*A very ill patient should not be treated by a new midwife, instead the most experienced midwife should have responsibility for that patient*".

Systematic work according to proven and formalized rules and procedures

The perception that the work should be conducted in a systematic manner, according to proven and formalized rules and procedures, is widely acknowledged and voiced at all hierarchical levels. One reason for this might be that the violation of formal rules or procedures is argued to be one of the main reasons to why accidents occur. For example, one midwife claimed that: "*We have many memorandums that we can rely on, that tells us: this is what we usually do here, and this is what we should do. I consider our memorandums to be comfortable and safe*".

This can be seen within the practices related to front-line patient care (assessment, coordination and control) and documentation voiced in all levels, through the use of numerous memorandums for guiding the medical staff in their care of the patient, along with checklists used for assuring that all relevant patient-related procedures have been carried out. Additionally, numerous check-lists and memorandums are used for other operating-related actions such as for example refilling of disposables in the delivery rooms or for controlling the functionality of the technical equipment. The tools or support systems for these tools (such as the memorandum database) are mentioned within all hierarchical levels, and according to the co-workers the clinics have more memorandums and check-lists than other similar workplaces. One of the patient-safety responsible described it like this: *"Safety is to follow the guidelines we have, and the memorandums. We have many memorandums at our clinic - all who come here and work, who have worked in other places, tell us that".*

As mentioned in chapter 4, the memorandums are stored in a home-built memorandum database or in printed versions stored in binders in the nurses' or doctors' offices.

According to the co-workers and managers at the perinatal centre, they have a high degree of formalized rules and procedures. For context-depending actions there are memorandums that

need to be actively retrieved by the user, either through searching the database or by going through the binders. For standardized procedures, such as checking the technical equipment, the check-list is available in the near proximity of the particular device.

Having reliable, well-functioning processes

To have reliable, well-functioning processes have been highlighted as important for the patient safety on every hierarchical level (micro, meso, and macro). The meso level highlights the importance of well-functioning equipment and the macro level emphasises the importance of continuous development and improvement of the organization and its processes. At the micro level, this is done by performing operating-related assessments such as replenishing and controlling medical tools. However, at the meso and macro level the focus is to develop and manage the processes in a reliable way – in order to have "reliable processes". The tools used for this are the organizational development tools highlighted at all hierarchical levels. At the micro level, the tools used are the communication and interaction tools, the guidelines and memorandums and also the coordinating functions within the clinics. At the meso and macro levels there are support functions and mechanisms that are used to improve the reliability of the processes. Each level highlights that they report deviations and accidents so that the organization can learn from experiences and outcomes, and that they have several tools to support the reporting. Furthermore, the organization conducts risk analyses before initiating major changes in the organization in order to be prepared for risks and possible accidents.

Managing and securing human resources

One perception voiced at all levels (micro, meso, macro) of the organization is that in order to perform a good safety work, co-workers need to have an adequate level of human resources to cope with the actual workload. One of the heads of clinics describes the issue as follows: *"One risk that affects the patient safety can for example be that we do not have enough staff, a risk that is present here all the time"*. The macro level also pinpoints the importance of working within resources constraints, meaning that the clinics need to work according to and within the existing budget. At the micro level, the possibilities to affect the level of human resources are mainly done by cooperation between clinics if needed. Additionally, members of the personnel try to plan their days so that the operational work is performed when the workload is lower, thereby lowering the stress when the workload is higher. At the meso level, the scheduling is planned and managed, and revisions of the schedules are done at the meso level. The meso level secures that the right competences are present and that the decided amount of personnel is present on each working shift. The macro level, however, has also the responsibility to maintain a good economy. Therefore, the main effects at the level of human resources are the economic constraints, i.e. how much human resources are affordable. Additionally, the macro level is responsible for measuring attitudes among co-workers. The tools used for securing human resources are mainly the scheduling and time-reporting system (Heroma). Also, email and telephone communication is used for the revision of the schedules and co-worker surveys are used for measuring attitudes.

In the observations it was noticed that the personnel do not often have time for their breaks and lunches. Additionally, it has been observed that there is a high level of stress among co-workers during some work shifts, why the personnel is not able to perform as good care as they desire. Also, when working under stress, the communication and information sharing gets affected which, according to the interviewees, often is a cause of accidents and deviations. One of the heads of clinics described the issue as: *"That is often when things have gone wrong if we look at it. Many times, it is all about communication, if it has been a very stressful day, that day, you have not been able to keep up the way you should"*.

Team dynamics and leadership

Another perception found at all three hierarchical levels concern the team dynamics as well as the leadership. Having well-functioning teams with an open climate and a strong and clear leadership is considered paramount in order to act in a safe manner. One could identify two types of 'teams' within the clinics - 'functional' teams consisting of similar types of disciplines (e.g. nurses, midwives, and doctors), but also cross-functional and multi-disciplinary teams involving all personnel needed in the care for a patient.

Regardless of the type of team, the perception of team dynamics is supported directly by quite few practices, where team training and team discussions regarding organizational development can be considered as the two major issues. In addition to these, many "regular" processes, conducted within the team, affects the development of how the teams interact and work together, such as the day-to-day collaborative work. The tools supporting team dynamics are tools for team-based communication and group interactions, such as meetings, development projects performed in groups, along with team training. This has traditionally primarily been true for what above was called 'functional' teams, but recently increased attention has also been given to the cross-functional and multi-disciplinary teams.

The strong and clear leadership is highlighted at all levels, and the practices and tools associated are the ones concerning the management of operations (in meetings, development projects, day-to-day management etcetera) along with the development of employees through managerial support, such as staff appraisals and salary discussions. One co-worker explained it as: "*The heads of units have a great responsibility to be a driving force for the co-workers*".

The open climate, including a mind-set beyond the 'shame-and-blame' perception, does not seem to be directly supported by any formal practice or tool, but in observations the open climate is a recurring subject that seems to have been anchored through top-down communication at all levels. All clinics have seen an increase in the reporting of deviations, which indicates that this understanding of an open climate has somewhat been adopted by the employees. However, some scepticism towards how well the reporting systems are working was still voiced at all hierarchical levels, both during interviews and in observations. It has been mentioned in several interviews that not all deviations are reported, due to time constraints, lack of knowledge and experience of the system and/or hesitation towards the concept.

Well-functioning logistics and facilities

The perception of having well-functioning logistics and facilities is voiced at the meso and the macro levels. The macro level also highlights the importance of having facilities that are perceived comfortable and safe among personnel and patients. The practices for achieving this is the building of the new perinatal centre where the organization hopes to achieve better logistics and functioning results for the facilities. At the moment there is much work concerning the preparation of the new facilities, with risk analyses and cooperation regarding new guidelines and routines.

A holistic view of the organization

The meso and macro levels voiced that it is important to get an overall overview of the clinic and organization respectively in order to be able to improve safety. At the micro level, however, the co-workers mean that "*it is not possible for everyone to know everything about everyone*". However, the practices and tools voiced at each level pinpoints that it is possible for everyone to get an overall overview of the organization. The macro level communicates with the other levels through meetings, the intranet and through verbal communication. Additionally, the meso level performs workplace meetings, uses the control- and information boards in order to get an overview. In the micro level, the personnel can get an overview by using the whiteboards in each nurses' office, in the morning meetings and rounds, by verbal communication with their co-workers, and through the IT-systems. Moreover, the coordinating function at the obstetrics clinic has the responsibility to have a full overview of the clinic in the micro perspective.

Human day-to-day factors

There is an understanding in the micro perspective that human day-to-day factors affect the ability to perform in a safe manner. In observations, it has been identified that this might even be depending on hour-to-hour human factors, affected by workload, stress, absence of lunch breaks etcetera. One nurse explains it as: "*The work I perform is affected by my own daily condition, and if I feel insecure I will ask for help*".

There are few practices and tools aiming at reducing the variation in the day-to-day factors. The coordinator within the obstetrics, or the internal collective coordinative function in the neonatal and the maternal ward, may adjust the workload for an individual if she notices or are enlightened about an individual being able to perform at a lower level one day.

However, some attempts to reduce the occurrence of the root causes have been made, such as adjustment of lunch scheduling and prioritizations of activities when the workload increases.

Avoid the emergence of stressful situations

The meso level highlighted the importance of being able to avoid the emergence of stressful situations in the daily operations. One doctor claimed that: "*It is important to have a system that works automatically, so that when something happens or the workload increases, more personnel should be summoned so that we are able to avoid an overheating. If there is an overheating in the system, people have a tendency to become more stressed*". There are no

outspoken practices for this perception, however it is perceived that it is important for all personnel to be able to prioritize and plan their work and that support systems exist to avoid overheating of the operations. In order to be able to prioritize and plan what is most important, the co-workers need high theoretical and practical professional knowledge and experience, hence educations and trainings are perceived to be important tools.

Monitoring, evaluating and focusing on patient safety

The monitoring, evaluating and focusing on patient safety includes a methodological approach to the gathering and evaluation of data through the different systems available, such as for example the deviation system, the accident analyses and the risk analyses. Another practice supporting this perception is the cooperation between clinics and/or external parties in order to share ideas and best practices. The tools associated are the internal meetings concerning patient safety (including practical support such as the idea board and the tools for visualising improvements), and the multidisciplinary or regional conferences aiming at increasing the level of patient safety. The laws and restrictions regarding patient safety, enforced by government or through hospital policies, are also a supporting tools aiming at putting the patient safety high on the agenda.

5. Analysis

In the following chapter, the empirical findings presented in chapter 4 are analysed. The analysis focuses on the interrelationship between hierarchical levels as well as the relationship between the perceptions, practices and tools. Furthermore, the empirical findings are compared to the underlying principles and mechanisms of system safety. The analysis is structured according to the same perceptions' headlines as in chapter 4. The analysis is summarized in the end of this chapter.

Patient-centred care

The shared focus on having patient-centred care at all levels indicates a unanimous view on the role of the patient among the co-workers at the different hierarchical levels. However, the actual practices and tools for doing this are voiced only in the meso and macro perspective. In the observations, the practices and tools were present also in the micro perspective; however, they were not actually voiced. In general, it seems to be a quite unstructured approach to the practice of involving the patient in the design of the actual care, but a more structured approach towards educating the patients/parents for the future.

When the patient or a parent is in the system, he or she can be considered to be a component of the system, comparable to the actors and other physical components. Therefore, it is good that the perinatal centre highlight the importance of including the patient in the patient safety work. Also, recognizing the safety of the patient as a paramount issue can act as a counter-gradient stemming from 'campaigns for safety', which will support the maintaining of a margin to the boundary of acceptable performance – and thus, facilitate for the system to stay on the right side of the boundary (Rasmussen, 1997).

Furthermore, the education of the parents entails that the parents obtain the tools and knowledge needed in order to act in a safer manner, which in long term might lower the pressure on the entire healthcare system.

Medical "know-how"

The highlighting of training and educating personnel in specific acute situations corresponds to that it is important in order to act in a safe manner, that is – to know how to act in the specific context. However, the design of the training and education must recognize that being reliable not always entails the connotation of being safe, and the practitioners should be educated to understand when "reliable" actions are in place, and when they are not, in order to avoid unsafe actions.

Furthermore, the training and education should include tools for prioritizing, in order to temporarily lower the pressure of the system. This is important since the variation of work pressure is high, and when the system migrates towards the boundary of safe performance (the acceptable performance boundary), actions need to be taken in order to keep the margin to the boundary (Rasmussen, 1997). Such coping skills for keeping the margin to the boundary will in turn decrease the risk of letting unsafe actions turn into accidents (Rasmussen, 1997).

Systematic work according to proven and formalized rules and procedures

Today, the actors of the system manage context-dependent situations by using experience and/or standardized memorandums. In extreme situations, the practitioner's ability of making the right decision is crucial, and at such moments there is no time for using on-line or off-line support systems. However, in non-extreme situations, both a human's experience and memory, along with memorandums, are "tools" that have limitations. Even though the mind is able to assess the context of the situation by processing the available information, the human's ability of taking *all* information into account has limitations. To develop memorandums that take all possible scenarios into account would be unpractical. There is instead a need for a system that would be able to process large amounts of interrelated and context-dependent information.

However, some procedures or actions are less context dependent, or not context dependent at all. Such procedures can be performed by using standardized instructions, such as checklists. As long as checklists and standardized instructions are facilitating the work for the co-workers, it will also decrease the pressure on the system that originates from the boundary of work-load level.

In order to choose the right strategy for the right procedure or action, the perinatal centre need to identify which procedures that are context dependent, and which that are not.

Having reliable, well-functioning processes

The perception of having reliable and well-functioning processes is evidently high. However, the system safety theories (Rasmussen, 1997; Leveson, 2004; Trucco, 2010; Leveson, 2011a) entail that reliability and safety is not equivalent, meaning that accidents can occur even if every component in the processes acts reliable. The continuous aim towards reliability may take focus from the relevant property, which is safety. It is important that the hospital is aware of that reliability is in fact a context dependent property (Leveson, 2011a). Instead, the focus should shift towards shaping the working behaviour within the system, so that the design of the system prevents unsafe actions. The appropriate design needs to consider how context-dependant the task is, and also needs to take both the components and the interactions into account.

The basic understanding of reliability versus safety also affects the purpose and processes of learning from past events. Today, the deviation and event analysis aims at identifying single root causes, but the analysis often become shallow and the result of the deviation analysis often become that a new memorandum or new policy is developed, which merely acts as a plaster instead of healing the wound. By changing the basic understanding of why accidents occur, along with deploying a system based event analysis approach, may allow for deeper understanding of the actual causes of the accidents or deviations, together with capabilities for identifying where constraints are needed in order to manage the working behaviour in a safe manner (Leveson, 2004).

Managing and securing human resources

Human resources continues to be an issue that will be difficult to manage. Hopefully, the development of coping skills and appropriate constraints in other areas (Rasmussen, 1997) will also improve the working environment and thus decrease the pressure on the co-workers.

Team dynamics and leadership

The importance of the team dynamics, the open climate and the strong and clear leadership is important in all theories concerning safety. There are few voiced practices and tools aiming directly at improving for example the team dynamics or the open climate, even though many different practices affect the different components of an open climate. To consider and prioritize the team dynamics will further be of high importance (Leveson, 2011a), both for enabling a well-functioning work environment, but also in order to enable well-functioning interactions between the ingoing actors. Since there is still a level of hesitation among the co-workers to report deviations, the message of that the organization has left the 'shame-and-blame'-mentality behind need to be highlighted in the communication also in the future.

Well-functioning logistics and facilities

At the moment the organization's facilities are not functioning optimally, but with the new building the organization hopes to solve the logistics problems. According to the system theories, it is important to use methods that entail system integration and adaptation, meaning that e.g. the facilities and logistics are mechanisms in the organization that need to be integrated with the processes and people in the organization (Tien & Goldschmidt-Clermont, 2009). Therefore, an understanding of how the products, processes and people are integrated is important, even at the micro level.

A holistic view of the organization

In conclusion, there is some understanding of the importance of a holistic view at the meso and macro levels. However, even though the micro level does not see this as a perception, co-workers at the micro level have the possibility to get an overview of the ingoing patients of each respective clinic. A full overview of all three clinics does not exist, since the tools used for getting an overview does not interact with each other. The system safety theories highlight the importance of getting a "full overview" in order to be able to identify when the organization has crossed the boundaries of acceptable level of performance (Rasmussen, 1997). That being said, the full overview does not imply knowing everything about everything, rather than having access to all the information relevant for the identified sub-system. For the future, the perinatal centre needs to identify the right level of overview within the system, that is, the right scope of the sub-system (Rollenhagen, 2013). As discussed in previous chapters, a too inclusive and general level of information, can lead to that the system might not show signs of being overloaded, even though one part of the centre is. However, if the level of control is too narrow, not all information needed in order to understand the interactions and behaviour of the system will be taken into consideration (Rollenhagen, 2013).

Human day-to-day factors

Co-workers' ability to perform is depending on day-to-day factors that can be caused by external factors (outside of the hospital) or internal factors (high pressure, poor managerial support, absence of breaks etcetera) (Hollnagel, 2004). To actively remedy these variations by having well-functioning conditions must be of high priority. To identify how different conditions (such as absence of breaks) affect the staff may result in an increased understanding in how to prioritize managerial efforts (Vincent, et al., 1998), which in fact is an issue that is more related to the meso and macro level. Today, for example, the absence of breaks and lunches are considered to be an issue that is difficult to manage, however, when accepting these mechanisms the hospital in fact accept a lower level of performance. These aspects also need to be incorporated and viewed upon as information that affects the environmental and operational conditions, and not only as circumstances that cannot be managed (Rasmussen, 1997).

Avoid the emergence of stressful situations

To avoid stressful situations is indeed an important issue for enabling a high level of patient safety. To enable early identification of when prioritization must take place will increase the ability of preventing the system from crossing the boundary of acceptable performance (Rasmussen, 1997).

Monitoring, evaluating and focusing on patient safety

The macro perspective's focus on monitoring, evaluating and focusing on patient safety is important for putting the subject high on the agenda. The perception, practices and tools are aiming at learning from others (sharing of competence) as well as tracking all types of failures in order to learn from past events. However, the lessons learned might be of little use if they stem from an inaccurate understanding of how accidents occur. As previously mentioned, the focus needs to shift from handling the issues by using simple solutions (such as creating a new memorandum) towards identifying and shaping the underlying working behaviours that in turn leads to unsafe actions (Leveson, 2011a).

5.1. Summary of analysis

In summary, there are some parts of the way the perinatal centre perceives and works with safety that is in accordance with the system safety approach. First, the perinatal centre put high priority on safety. This is in accordance with all patient safety theories, and the commitment from the organization need to continue in order to attain results. The understanding of that safety is a trade-off, just as economics and work pressure, may seem trivial but is in fact crucial (Rollenhagen, 2013). However, the management needs to not only voice the priority of safety, but also turn the words into actions.

Furthermore, the perinatal centre considers team dynamics and an open climate to be of paramount importance. This is also something that is in line with the theories of system safety,

since it has positive effect on both the working environment and the shaping of human behaviour (Leveson, 2011a).

The management of the perinatal centre is open for change, which is a prerequisite needed in order to actually achieve the desired change. The management must however understand their role within the system, and how they affect the final level of patient safety. This is not only true for the role of the management, but the perinatal centre need to obtain a general understanding i) which the ingoing components of the sociotechnical system are, ii) how they interact and iii) how the interactions affect the system (Paley, 2007). There is some understanding of these concepts, along with understanding of how accidents occur (the concepts of Figure 8) residing within individuals today; however, the understanding must be deepened and organization-spread.

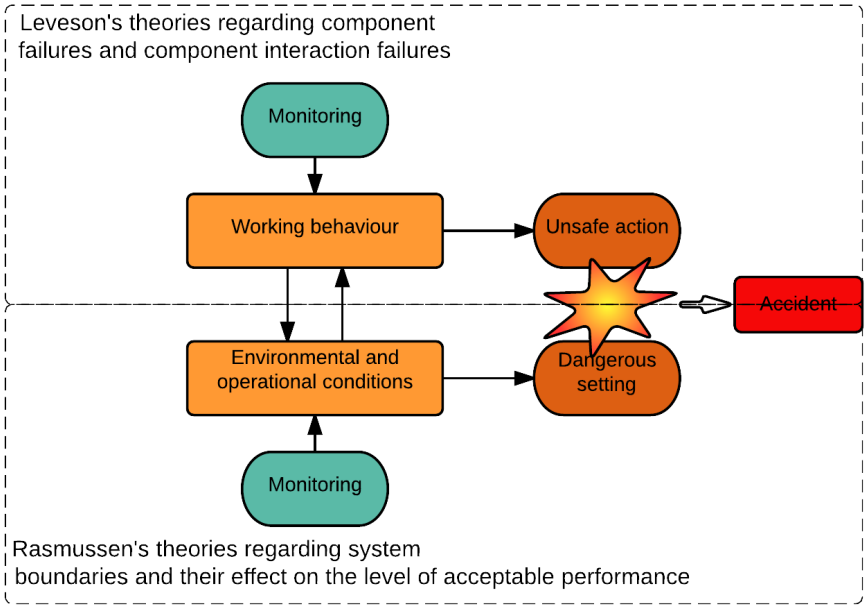


Figure 8. The three theoretical fields of system safety combined

Today, the shaping of working behaviour is mainly done by increasing front-line expertise and standardized and formalized procedures. The standardized procedures can be deployed, and constraints can be used, when the procedures are not context dependent, however, when the procedures indeed *are* context dependent, the centre need to shape the working behaviour by identifying the real root causes (not necessarily only one) and design the procedures so that it is 'easy to do right' (Carayon, et al., 2006). This in order to prevent unsafe actions, as presented in Figure 8 above.

Additionally, the perinatal centre needs to identify and visualize the boundaries of the system. In order to do so, the centre needs to identify which scope the system, or sub-system, should have (Rollenhagen, 2013). Identifying the scope and the boundaries will enable the perinatal centre to create and maintain the margin to the boundary of acceptable level of performance by managing the boundaries and forces affecting the system. Additionally it allows for developing essential coping skills when the system is close to crossing the previously named boundary

(Rasmussen, 1997). This in order to avoid the system from being in a ‘dangerous setting’ as presented in Figure 8 above.

Finally, the understanding of system safety must influence the entire system and the knowledge must be spread throughout the whole organization, including the management, the front-line workers and the education efforts.

6. Discussion

The aim for this thesis was to build a bridge between theory and practice by identifying how a perinatal centre can increase the level of patient safety by adopting a system view on safety. Even though many have tried to improve the practices associated with patient safety, the performance within the field has neither been satisfactory nor acceptable (Chuang, Pan, & Huang, 2008). However, numerous researchers (Reason, 1990; Institute of Medicine, 1999; Institute of Medicine, 2001) have identified that the application of a systems approach is key in order to improve the patient safety performance. Even though system safety is not a new research area, there have been few attempts aiming at giving a complete set of recommendations for how a single healthcare organization can increase the level of patient safety by adopting a system view on safety. Hence, this was the gap identified and is addressed in this thesis. This thesis addresses the gap by providing a full set of recommendations for how to adopt system safety in a healthcare setting in order to increase the patient safety performance. This study has potentially contributed not only to the perinatal centre at SkaS but also to a general understanding of how system safety can be adopted in healthcare in order to increase the patient safety.

For the perinatal centre at SkaS, the aim is that this study will give insight into a new way of considering safety, which includes considering the system as a sociotechnical and complex system, consisting of interacting components. Even though this might seem like a difficult and complicated concept, the hopes are that the recommendations within the three areas of focus in chapter 7 may inspire and encourage the perinatal centre to consider the system safety approaches when continuing on with their efforts to increase the level of patient safety.

The combination of the three theoretical areas provided mainly by Trucco, Leveson and Rasmussen allows for a two-dimensioned approach towards safety. The two dimensions include shaping the working behaviour and environmental and operational conditions, and the theoretical framework also describes how these two dimensions relate to each other. By combining the three theories of system safety in this thesis, a generic and practical framework containing key elements for how healthcare organizations can take the first steps towards system safety are presented. Additionally, the way of structuring these efforts into a practical set of recommendations based on these two dimensions of system safety, can hopefully inspire practitioners and theorists to continue the developing of effective tools that will enable safer care. These recommendations aim at bringing understanding of how system safety can support patient safety by giving practical advice on how to manage the shaping of working behaviour long with the environmental and operational conditions.

The thesis provides a two-dimensional approach towards system safety that seem suitable for healthcare organizations that are characterized by high pace, high level of variation, high level of unpredictability and potentially fatal outcomes for the patients. However, for the potential contribution to society, it would be of great interest to further investigate the effects on patient safety by introducing these two dimensions to similar healthcare settings, such as other perinatal centres or emergency departments.

The case study has shown that the developed framework could be suitable for a perinatal centre within Skaraborg Hospital group. It would be of great interest for the theoretical practices of patient safety to further investigate the effects of these dimensions implemented in practice. Additionally, such investigation could allow for further development of the practical framework in order to be able to develop a more comprehensive framework.

Finally, it would be interesting to investigate how the basic assumptions of system safety presented within this thesis could be refined and adopted to a healthcare setting. This could enable a more dynamic approach to patient safety in healthcare settings than what the historical assumptions of patient safety have allowed.

7. Conclusions

This concluding chapter aims at answering the formulated research questions.

RQ1: How can the level of patient safety be increased according to system safety theory?

The theoretical field of system safety allows for understanding that unsafe actions occur due to poorly shaped working behaviours, but that the effect of such an unsafe action only results in an accident if the system allows it to. The system will allow for a higher degree of accidents when the system operates beyond the acceptable performance boundary, that is, when the setting of the system is unable to identify and absorb or manage unsafe actions. This takes place when there is insufficient monitoring and handling of the environmental and operational conditions.

System safety is a beneficial approach in the healthcare setting since the healthcare is a complex system, with complex interactions between ingoing components. The system approach to safety is assumed to be of particular use when there is a high level of variation, low predictability and where adverse events might turn into fatal outcomes.

Instead of avoiding complexity and interactions, the system safety approach provide a way of coping with the complexity of the system. To truly become safe, these issues need to be properly addressed, rather than avoided.

RQ2: What are the opportunities and challenges for a perinatal centre's work with patient safety?

There are a number of opportunities and challenges that affect how the perinatal centre can work with patient safety from a system safety approach. First and foremost, the perinatal centre puts high priority on safety and is open to change. They have a high focus on patient-centred care and patient-safety work. There is a high engagement and interest from both the management but also the front-line personnel. Additionally, the co-workers perceive team dynamics and an open climate to be of paramount importance. There is also some understanding of that a perinatal centre is a complex, socio-technical system on individual level. All these factors provide a good starting point for making the transition towards system safety.

However, the way that the management prioritizes safety is mainly through words – that not always are turned into real actions. The perinatal centre lacks an organization-wide understanding of which factors affect the patient safety, and of how accidents occur. They also lack proper perceptions, methods and tools for having a system safety based approach to patient safety. There is an over-belief on the use of memorandums and standardized solutions. The analyses of accidents and deviations often result in superficial solutions, such as a new memorandum or instruction.

Furthermore, the perinatal centre overall lacks an approach towards working systematically with the environmental and operational conditions. There are also some different ideas on how to organize the perinatal centre, and therefore it will also be a challenge to set the scope of the subsystems.

In order for the perinatal centre to increase its level of system safety, the shaping of working behaviour and the environmental and organizational conditions affecting the system need to be

identified, monitored and managed. The recommendations listed below are based on the description of an anatomy of an accident presented in chapter 2. Firstly general recommendations are given, in order for the centre to get a general understanding of how complex systems function and how its ingoing components interact and affects the system. Hence, these recommendations are given for the basic understanding of system safety. Secondly, recommendations for how the perinatal centre can shape working behaviour in order to reduce the occurrence of unsafe actions are given. The last recommendations given will enable the organization to manage the environmental and operational conditions when the system is in state of elevated risk.

1. **General recommendations**
   - Ensure high commitment of management, also in the future.

     Safety is an organization-wide property, and if the management does not prioritize safety, the organization cannot expect that the front-line personnel will either.

   - Maintain a high priority of safety at all levels of the organization, and turn these voiced priorities into actions.

     It is important to prioritize safety, not only in words but also in actions. In order to truly show these prioritizations, the management need to create real opportunities for the co-workers to work with these issues. Resources need to be earmarked and made good use of.

   - Obtain a better understanding of safety in a complex socio-technical system, with other words: the basic assumptions of system safety.

     It is important that the perinatal centre understands the principles of system safety, and that this understanding is spread within the organization. Otherwise, the further proposed recommendations will be less likely to succeed.

2. **Shaping the behaviour in order to reduce the occurrence of unsafe actions**
   - Identify real root-causes (not necessarily only one) of recurring accidents in order to adapt the level of standardization.

     A thorough analysis of the real root causes should be performed, and not only be cured by new memorandums and routines. This can be achieved by using system safety-based accident analysis tools, such as STAMP (Leveson, 2004), or simply by using the current analysis tools but with new insights. The solutions should have a high focus on how the processes and tasks are designed, in order to shape the future behaviour accordingly.

   - Identify context and non-context dependent activities in order to adapt the level of standardization.

Standard (non-context dependant) procedures need to be identified so that proper constraints can be enforced. Constraints can be designed in terms of check-lists which visually communicated if a step is missed or through pop-ups in the IT systems that force the user to insert certain information.

Context dependant procedures need to be identified so that the processes and tasks included can be designed so that it is 'easy to do right'. For example, the perinatal centre should consider the implementation of decision support systems, in order to allow for a high level of information processing in context dependent settings.

3. Managing the setting by identifying when the system is in state of elevated risk

- Identify the scope of the system or sub-system

  In order to access all the information relevant for the identified sub-system, and delimit for all non-relevant information, the perinatal centre need to decide on how to organize their system. The entire perinatal centre is probably a too large system to start with, and should therefore be divided into several subsystems. Instead, the integration between subsystems should focus on what information and interactions that are needed between the subsystems. However, the information available depending on size of the system can be relevant for different reasons at different hierarchical levels of the organization, why the ideal solution in the future would be to be able to choose which system to look at for the moment. For this, the information needs to be integrated through an IT system.

- Identify and visualize boundaries of acceptable level of performance.

  There are no tools today that allow for identification and visualization of the boundaries of acceptable level of performance. Instead they should focus on identifying and monitoring the parameters that affect the system. Here, the perinatal centre could make use of the socio-technical factors that affect the system, identified by Vincent (1998) in order to identify the status of the system. This information can be used in order to build a rule-based system where the perinatal centre can decide on what actions that should be allowed, depending on the status of the system. The centre should introduce a three-graded colour scale that communicates the status of the system in terms of levels of risk. A proposal of how this system could look like is found in Figure 9 below.

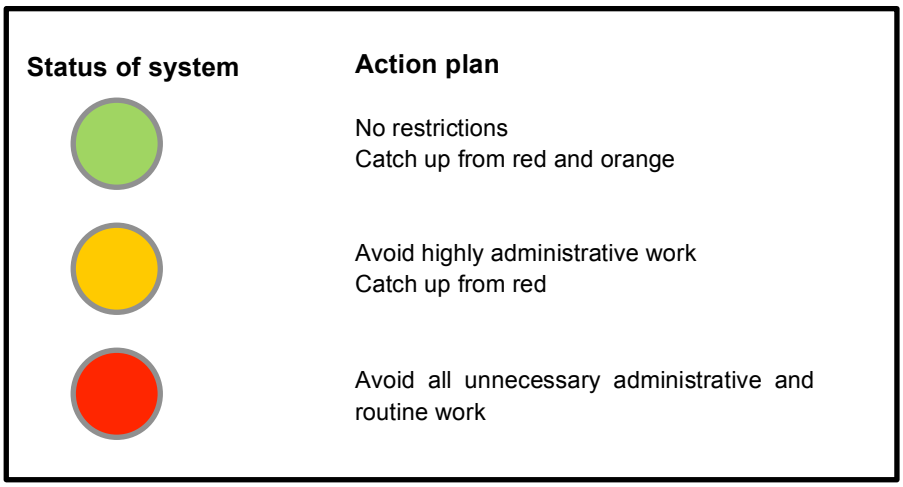


Figure 9. Proposal of colour-coded system status and corresponding action plan

- Create margins to the boundary of level of acceptable performance, as well as creating coping skills to that boundary.

  Even though we cannot identify the boundary of level of acceptable performance, it does indeed exist. Therefore, we should aim at creating and maintaining the margin to the boundary. This can be achieved by i) lowering the pressure from other boundaries or ii) by increasing the pressure from the boundary of acceptable level of performance. Lowering the pressure from other boundaries can be difficult, since the economical boundary is difficult to affect, and it is difficult to get access to more human resources since there currently is a national shortage of midwives and neonatal nurses. However, by making better use of the time available, by for example only doing administrative work when there is actual free time instead of scheduling it on a specific day (see the recommendation in Figure 9), the pressure could hopefully be lowered overall. This can also be achieved by employing safety campaigns or by putting safety high up on the agenda; however, these campaigns or efforts need to be continuously updated in order to not loose effect over time.

  The suggestion in Figure 9 can also be used as coping skills at the boundary. By knowing what to do, and what to not do, when the system is close to crossing the boundary of acceptable level of performance, the perinatal centre can stay on the "right side" of the boundary, and thus prevent unsafe actions from turning into accidents.

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Appendix I. Glossary

akutrum neonatal	emergency room for natal care
arbetsplatsträff (APT)	workplace meeting
arbetsmiljörond	work environment assessment
avvikelseanalys	deviation analysis
avvikelsesystemet	deviation system
bakjour	standby duty
barnmorska	midwife
barnsjuksköterska	neonatal nurse practitioner
barnläkare	pediatrician
BB	maternity ward
BB-vård i hemmet	maternity home care
blödning	bleeding
borum	overnight room
byggmöten	construction meetings
chefsläkare	chief medical officer
ekonomisystem	accounting system
fosterdiagnostik	prenatal diagnostics
födsel	birth
förlossning	labour
förlossningen	obstetrics clinic
förlossningsläkare	obstetrician
förlossningsrum	delivery room
händelseanalys	accident analysis
Inspektionen för Vård och Omsorg (IVO)	public authority for health care
karantänsrum	isolation room
kejsarsnitt	caesarean section/C-section
kompetenskort	competence card
ledningsgruppsmöte	executive meeting
Lex Maria	national reporting obligation (Lex Maria)
läkare	doctor
läkemedelsmodul	pharmaceutical system
medicinskt ledningsansvarig	medical supervisor
mått	metrics
mätningar	measurements *or* surveys *(depending on context)*
mödravårdscentral	maternity clinic
neonatalavdelningen	neonatal clinic
neovård i hemmet	neonatal home care
nyfödd	newborn, infant
operationssal	operating room
patientsäkerhetskultursmätning	patient safety-culture survey
patientsäkerhetsombud	patient safety representative
PM	memorandum

provtagning	sampling
reflektionsblad	reflection sheet
rond	round
sekretess	confidentiality
sfinkterruptur	anal sphincter rupture
sköterskeexpedition	nurses' office
slutenvård	inpatient care
specialistmödrarvård	specialist maternal care
spädbarn	infants, newborn
stabsmöte	staff management meeting
sugklocka	ventouse
tavla (förslag, post-it)	idea board
tavelmöte	idea meeting
teknisk apparatur	technical equipment
telefonrådgivning	telephone counselling
transport	transportation
triage	triage
triagering	triaging
trycksår	pressure sore
undersköterska	nursing assistant
urakut kejsarsnitt	emergency ceasarean section/C-section
utvecklingsdagar	development days
verksamhetsberättelse	annual report
verksamhetschef	operations manager
verksamhetsplan	organizational plan
verksamhetssamordnare/-utvecklare	organizational developer/coordinator
vårdnadshavare	caregiver
vårdplats	hospital bed
vårdskada	care injury
vårdtyngd	nursing workload
åtgärdslista	action list
åtgärdsplan	action plan
överläkare	chief physician
överlämningsmöte	handover meeting

Appendix II. Detailed mapping of perceptions, practices and tools

i. Micro - Front line property

The result below is a summary of the result from the different clinics (obstetrics, maternal ward, neonatal) presented by its categories, which for the practices and tools have been supplemented with examples for each category for facilitating the understanding. The result conducted at the micro level includes voices from 4 interviews 19 responses from the questionnaire. If a result is unique for one or two of the clinics, this is noted in the comments.

a. Perceptions

In summary, all clinics have similar perceptions of safety at the micro level and they are summarized in Table 7 above. The perceptions include a patient-centred focus, with high attention to practical and theoretical professional knowledge, and an adequate level of staff (and other resources) that work according to formalized routines, rules and procedures. Furthermore, the safety includes well-functioning teams with team dynamics, including individuals whose ability to perform may depend on day-to-day factors. Finally, the safety is also to have reliable processes and tools. The ingoing points are further described below.

Table 7. Perceptions in the micro perspective

Micro: Perceptions		
Safety is…		
...a patient-centred issue, including that the care should not endanger the patient	...that the staff works according to formalized routines, rules and procedures	...to have well-functioning communication, good team dynamics and a strong leadership
...depending on practical and theoretical professional knowledge among the front-line staff	...to have an adequate level of resources for the current workload	...to have reliable processes and tools
		...dependent on surrounding factors or day-to-day conditions

Safety is a patient-centred issue

In general, the co-workers operating in the micro level consider safety to be a patient-centred issue. It is important that the care does not endanger the patient and that co-workers keep an open dialogue with the caregiver (parents).

Safety depend on practical and theoretical knowledge among the front-line staff

The micro-level puts much focus on theoretical and practical knowledge and competence as they perceive it as paramount in order to operate in a safe manner. Theoretical knowledge derived from education and theory is as important as practical competence. Practical competence involves for example that the co-workers are able to avoid mistakes and to act and think “one

step ahead". Therefore there is a mutual understanding among front-line personnel to maintain their knowledge and competence regarding different situations and equipment.

Safety depend on the staff working according to formalized routines, rules and procedures

The perception is that safe operations are depending on that there are formalized rules and procedures, such as checklists, memorandums, guidelines and procedures, guiding the work. These should in turn be based on proven experience. A common viewpoint from the interviewees is that accidents often are caused by a violation of a formal rule or procedure.

Safety is to have an adequate level of resources for the current workload

The system is considered to be unsafe when there is an inadequate level of human resources for the current workload. As mentioned several times in interviews and during observations, the level of human resources does not only concern the number of co-workers working in parallel, but also the level of knowledge within the working team. The same is true for the workload - it is not only depending on the number of patients within the clinic at the same time, but rather a combination of number of patients, and severity of each patient's case.

Safety depend on well-functioning communication, good team dynamics and a strong leadership

There is mutual understanding between the clinics that well-functioning communication and teamwork is of high importance for the safety performance. The issue regarding the exchange of information is one of the most recurring topics in the interviews. Furthermore, an open climate, beyond the 'shame-and-blame' mindset, is highlighted as a key component for learning from previous mistakes and accidents, in order to prevent potential future ones. To have a clear and strong leadership and aim towards the same goals are also highlighted as prerequisites for getting everyone on board towards the mission of safe performance.

Safety is to have reliable processes and tools

The co-workers perceive that having reliable processes are important for the patient safety, which means that one should be able to trust that all documentation is classified and that IT and equipment systems should be intact at all situations. Also, making sure that the right equipment and facilities are available at the right time is key to keeping a high safety level. Many co-workers also acknowledged that the people working in healthcare are only humans, and that the individuals' ability to constantly perform in a reliable manner is dependent on the current situation and setting, which in turn can depend on surrounding factors or day-to-day conditions of a single individual. Consequently, some midwives and nurses highlighted that processes should not be dependent on memory.

b. Practices

In general, the practices are fairly similar in all clinics. Some of the differences are highlighted in the text below, as for example the coordinating function at the obstetrics, and the transports

occurring within the neonatal clinic. Additionally, during the observations and interview, it was found that the clinics handle the patients in different ways. In the neonatal clinic, patients are seen as ill, and they treat illnesses. However, in the maternal ward, the co-workers most often treat viable and healthy pregnant women and women having or having had their babies. In one interview this was mentioned as something that can cause a minor conflict between the clinics, for instance when a patient is transported from one clinic to the other. The practices in the micro perspective are summarized in Table 8 below.

Table 8. Practices in the micro perspective

Micro: Practices		
□ Front-line patient-related assessment, coordination and control	□ Human-human, human-system and system-system exchange of information	□ Operating-related assessments and coordination
□ Front-line patient-related decision making regarding treatment, care and reduction of risks	□ Personnel related processes (incl. training)	□ Operating-related actions

Front-line patient-related assessment, coordination and control

The front-line patient-related assessment, monitoring and coordination includes multidisciplinary communication and coordination concerning the care and nursing of individual patients, including the assessment of risk associated with the patient.

Assessing the risk for each individual patient aims at allowing the medical staff to choose the right path of action in time. The process includes gathering as much information as possible about the factors that may contribute to changing the state of the patient. The gathering of information is partly conducted by following routines, procedures and memorandums, but also by making individual, situation-based decisions related to e.g. gathering additional information about the patient by running tests or deciding on technical support (as for example the decision to connect a patient to the monitoring system in order to have increased access to real-time data). According to the interviewees, the ability to make the right decisions depend on the medical competence and skills residing in the decision-maker, but also the ability to think and act one step ahead.

The obstetrics clinic operates slightly different in terms of that their operations include risk assessment and diagnostics of non-present patients over the telephone, which is conducted by an appointed coordinator. The coordinator is a rotating position within the obstetrics clinic that is manned per shift by one of the more experienced midwives.

Front-line decision-making regarding treatment, care and reduction of risks

The front-line decision making includes decisions related to treatment, care and patient-related reduction of risk (e.g. having a translator present if the patients speak other languages than the

staff). At the obstetrics, the coordinator function is responsible for the coordination and guidance of patients. All clinics perform both planned and acute care actions, prescribe and control medicines, and inform patients of treatments. At the neonatal clinic, transports can occur if there is a premature baby that needs to be sent to other neonatal clinics within the region. In the interviews, the employees highlighted that they work according to proposed verbal instructions, routines, instructions and memorandums when caring for, and treating patients.

Human-human, human-system and system-system exchange of information

In order to operate safely, the information concerning the individual patient needs to be exchanged between the people or systems included in the care of the patient. The exchange of information includes for example verbal or written communication between nurses and doctors (human-human), documentation of information related to the patient (such as decisions or symptoms) or the obtaining of information from the monitoring-system (human-system), or the exchange of information between systems.

The exchange of information includes documentation of events and decisions made regarding patients, which is seen as important for the patient safety work. Also, documentation of medical records are continuously on-going in real-time but also in hindsight. When patients are supported and guided via telephone one of the staff members makes notes in the patient´s medical record. Every action that is taken upon a patient is documented in the medical records.

The practices related to safe operations include follow-ups of patients in order to assure that the patients recover or develop accordingly. This is done either through patient revisits or through the home care programs within the maternal ward and neonatal clinic (‘BB-vård i hemmet’ and ‘Neonatalvård i hemmet’). As for the risk assessments, the aim with the follow-ups is to gather information in order to evaluate whether the patient recovers accordingly or needs further treatments or follow-ups. The follow-ups are also mainly conducted according to routines and procedures, however, as for the general risk assessment, complementary information gathering might be needed, which needs to be identified and acted upon by the responsible clinician.

Furthermore, there is an on-going work with conducting statistics on specific parameters that are measured within the clinics, such as measuring that the hygiene prescriptions are followed, or keeping statistics of bleedings related to the delivery of the child, since the clinic aims at reducing the occurrence of bleedings that exceed 1000 ml. Also, the maternal ward and neonatal clinic keeps track of the number of undelivered mothers at the obstetrics clinic. This in order to predict how the workload will be for them in a close future.

Personnel related processes (incl. training)

Other safety practices regard personnel related processes such as performing daily tasks that eliminates risks, like controlling the technical equipment (e.g. the acute table) or handing out disposable shoe covers when it is raining or snowing outside, so that no one will slip (especially important since the employees have to run when emergencies occur). It was noticed that some co-workers actively thinks about their ergonomics since the work contains a high level of tough

movements and heavy lifts. Even though employees highlighted that they seldom have time for it, they need to take breaks and have lunch in order to work efficiently. Furthermore, when it is needed, the co-workers are required to get individual educations that can increase their competence and knowledge in specific situations.

Operating-related assessments and coordination

The clinics communicate and coordinate internally continuously during the shifts. The most important information related to the patients is written up on whiteboards, located within the nursing offices at each clinic. The number of nursing offices varies, from having one (1) office in the obstetrics clinic, while they have two (2) within the maternal ward and neonatal clinic, respectively. The boards are manually updated according to a predefined and standardized way. However, the exact configuration and content on the boards differ from clinic to clinic. The most formalized way can be found in the obstetrics clinic, where the co-workers make use of a colour-coded triage system in order to increase the structure of the communication concerning the patient. In the obstetrics clinic, the coordinator is responsible for the white-board and the general coordination within the clinic, which includes prioritizing patients and actions, gathering and sharing information on patients, monitoring equipment and facilities, and delegating activities between the midwives and nurses. The maternal ward and neonatal clinic have no such function, but rather coordinate, prioritize work and delegate within the group collectively.

The clinics also communicate and coordinate with each other. This is especially true for the obstetrics clinic and the maternal ward, where also some human resources are shared. The obstetrics clinic and the neonatal clinic have a higher degree of exchange of information than the neonatal clinic and the maternal ward. In general, the information forwarded from the obstetrics clinic to the neonatal clinic and maternal ward concerns the amount and type of patients in the current system as well as patient-specific information. The information going ‘backward’ in the process, from the maternal ward and neonatal clinic, concerns logistics information about for example the number of occupied beds or the current work-load. The exchange of information is mostly done verbally, over telephone or face-to-face. Additionally, the overall information on occupied beds for each clinic can also be obtained through the medical record systems. However, it was observed that numerous midwives and nurses mostly discussed internal matters, and paid little attention to the other clinics within the perinatal centre.

As for the internal coordination, the responsibility for the coordination between clinics lies on the coordinator in the obstetrics clinic, while the maternal ward and neonatal clinic state that they try to appoint someone as ‘responsible for the telephone’ for each shift, or else the coordination is done ad hoc.

Operating-related actions

The last identified practices are related to operating actions taken on a daily basis but not in a close connection to the patient. These practices include reporting irregularities and deviations, performing follow-ups of accidents and deviations and learning from poor patient outcomes and experiences. All adverse events and near misses that take place in the clinics are required to be

reported, whether it is an accident, a deviation or an irregularity. Also, regardless of whether the event affects a patient immediately, indirectly or not at all it should still be reported. However, some co-workers claim that not all staff members report these events, even though the report rate is continuously improving. Still, there are some occurrences that never get reported. Furthermore, many co-workers claim that accidents and deviations often occur due to miscommunication or stress. At the neonatal clinic, practices such as booking of transports and controlling seekers and technical equipment are continuously performed. All personnel claim that they perform daily tasks such as cleaning and replenishing stock, and that they work according to proposed routines, instructions and memorandums in order to reduce risk. Also, in order to constantly get better at practicing care, the clinics continuously update their guidelines and memorandums.

c. Tools

The tools identified in the micro perspective are summarized in Table 9 below. They include information system tools, communication and monitoring tools and formalized instruction tools, as well as tools for performing care and for developing the organization.

Table 9. Tools in the micro perspective

Micro: Tools		
□ Information system tools (storage & download)	□ Communication tools	□ Monitoring tools
	□ Tools for performing care	□ Formalized instruction tools
□ Tools for developing the organization		

Information system tools (storage & download)

The tools identified at the micro level are seen as useful for the operations to work. First, all clinics use information system tools including different systems for medical records, pharmaceuticals, memorandums, hospital check-ins, keeping statistics, and systems for reporting deviations and event. Also, they have lists of number of occupied beds. It was *observed* that these tools are used on a daily basis and often staff members need to work in parallel with many of them at the same time. According to one midwife, it would be beneficial if some of the systems interacted and were easier to visualize. Other systems are used less frequently, for example the event analysis and deviation system. Additionally, it was *observed* that the tools are not automated and therefore staff members need to use their individual memory and experience in order for the systems to work.

Tools for developing the organization

Furthermore, the clinics use systems for developing the organization. One important tool is verbal communication, which is used in most communications internally in one clinic and also

externally with both patients and other clinic and divisions. Each clinic has a patient safety representative who has time dedicated for safety related work and development. Every day, the clinics respectively have rounds or morning meetings to go through the status of the patients and the clinic, as well as checks after each working shift. Also, the staff has to fill out a reflection sheet after each work shift so that statistics of the days can be kept. However, it was mentioned that sometimes the staff wants to avoid conflicts or just to go home, and therefore they do not take the reflection sheets seriously.

Every week each clinic performs workplace meetings and idea-workplace meetings to go through important information for the organization. More seldom or when needed, the clinics are required to have debriefings, for example when a major accident has happened that needs to be discussed or dealt with. The deviation system is also used when required and for organizational development. The co-workers believe that the system is important in order to learn from mistakes and near misses. Also, the clinics performs yearly educations of personnel such as CTG (Cardiotocography), CPR (Cardiopulmonary Resuscitation) and ALSO (Advanced Life-Support in Obstetrics for the obstetrics clinic). Further, the neonatal clinic uses competence cards to encourage learning and to visualize individual competences.

Communication tools

For the communication, the clinics use different types of communication tools - on-line and off-line, verbal and non-verbal, for group and individual communication. The most generic 'tool' for interpersonal communication is the verbal communication, either face-to-face or using telephones, seekers, computers, e-mails etcetera. A technique for standardizing and structuring this verbal communication is SBAR, ('Situation, Background, Assessment and Recommendation') aiming at both increasing the efficiency of the communication, as well as eliminating risks of miscommunication (such as that of poor prioritization of information).

The nursing offices become natural meeting points where daily group interaction and communication take place, mainly for the midwives, neonatal nurse practitioners, nurses and nursing assistants, which the nursing offices are intended for. However, as the doctors frequently visit (or even occupy) the nurses' office, this also allows for interdisciplinary communication and coordination. The office also includes several visual tools for communication, including in particular the whiteboard where the patients are listed, along with the most important information concerning each patient. At the obstetrics clinic, a triaging system, using a scale of colours (red, orange, green) is used to enable clear communication regarding patients and their risk status (where red patients are critical, orange need extra attention and green ones are following a 'normal' progress). Continuous information-sharing and coordination in groups also take place in the daily morning-meetings, rounds, and handover between shifts. Furthermore, time for the nursing staff is dedicated for reflection after each shift. Along with natural meeting points, such as the lunchrooms, these meetings and offices make up for the setting of the day-to-day group communication.

Workplace meetings and idea meetings take place in slightly different forms in each clinic. Also, the obstetrics clinic and the maternal ward have occasional workplace meetings together.

As support for these meetings, each clinic has an idea board where individuals can put up their thoughts and ideas using post-its. However, the knowledge and utilization of the idea boards seem to be rather sparse. Along with the development days (once a year), these structures and functions aim at generating and identifying ideas for improvement, as well as diffusing these ideas within or between clinics. Other mechanisms for diffusing information are the letters to the employees that each head of clinic send out periodically through email. However, all employees do not access their email why the information also often is put up or distributed in physical form.

Tools for performing care

On a daily basis, the clinics treat and care for patients and the tools required for that includes the facilities with rooms, beds, emergency tables at the obstetrics and neonatal clinics. There are rooms for overnight stays in the maternal ward and neonatal clinic where there also is one infection room. In the obstetrics clinic there are delivery rooms, one operating theatre and one room dedicated to patients with infectious diseases. In order to perform a safe care, technical and medical equipment such as for example alarm systems, medication templates and pumps is used frequently. Several samples (e.g. blood or urine samples) are taken in order to assess and control the patients. In the maternal ward prenatal diagnostics are performed. As for the monitoring over patients the clinics use for example CTG-monitoring and keeping track in the medical record system.

Furthermore, the formalized instruction tools are frequently used when treating patients and when conducting administrative tasks. These are for example memorandums, checklists and guidelines.

ii. Meso - Clinic properties

The meso level represents voices from 3 heads of the clinics, one chief medical officer, one medical supervisor and a questionnaire response from one chief physician. Also, the meso level includes documents such as risk analyses for the obstetrics clinic and annual reports from the concerned clinics.

a. Perceptions

In general, the perceptions of patient safety at the meso level are to focus on having safe and reliable components, processes, rules and procedures. Also, it has been highlighted that communication between components is important. Overall, it is a patient-centered focus and the organization should be characterized with an open climate.

Table 10. Perceptions in the meso perspective

Meso: Perceptions		
Safety is…		
…a patient-centred issue, including that the care should	…to have an adequate level of human resources for the	…to have reliable processes and equipment

not endanger the patient □ …depending on medical 'know-how' □ …to work according to proven and formalized rules and procedures □ …to have overall overview on the clinic	workload (personnel, competence & time) □ …to have well-functioning logistics and facilities □ …to have well-functioning support processes	□ …to avoid the emergence of stressful situations □ …to have communicating teams with open climate

Safety is a patient-centred issue

First and foremost, safe care is perceived as a patient/family-focused care, including non-endangered patients (mothers or children) and satisfied parents that feel noticed.

Safety is depending on medical 'know-how'

Medical "know-how" has been highlighted as key by the interviewees, signifying the capability to know what to do at the right time and to do the right thing. This entails such as that the right prescriptions should be given to the right patients, and to have the right competence for the task that is given to you.

Safety is to work according to proven and formalized rules and procedures

To work according to proven and formalized rules and procedures entails that every process should have clear routines to follow and memorandums to use for information checking and backup. Also, it was highlighted that every action taken should be according to proven methods and with use of clear directives in action plans.

Safety is to have an adequate level of human resources for the workload

Another identified key perception to patient safety is to have the adequate level of human resources for the workload. It was noted during some interviews that one risk that can occur is when there is not enough personnel present and the personnel do not have enough experience or competence for the tasks. Therefore it is perceived as important to have the right amount of staff for each work shift, as well as to ensure that competent and qualified staff attending on every work shift. In addition, the meso level perceives that it is important to have an overall knowledge about potential risks for all patients present in the clinic.

Safety is to have well-functioning logistics and facilities

An identified risk regarding patient safety is the long distances between the clinics, why it was highlighted that well-functioning logistics and facilities for the tasks are important.

Safety is to have well-functioning support processes

Well-functioning support processes includes well-defined and maintained methods and routines (such as memorandums), technology that supports safety thinking, and 'automated processes' in

the sense that when something occurs (an accident or sudden increase of workload), an automated chain reaction should be triggered so that the functions needed to support the situation respond automatically.

Safety is to have reliable processes and equipment

Additionally, all processes and equipment, such as the IT system and alarm functions, need to be reliable in order to perform safely.

Safety is to avoid the emergence of stressful situations

Additionally, it is pointed out that the organization needs to avoid the creation of stressful situations, in order to allow the ingoing actors to perform safely. Therefore, it was highlighted that it is of high importance that memorandums and guidelines should be up-to-date, that all co-workers should actively think about and prioritize what is most acute.

Safety is to have communicating teams with open climate

It is important to have an open climate where the culture supports safety thinking. The clinics should be characterized by good cooperation between co-workers and the communication needs to be well-functioning. Also, it is seen as important to share the same goals and values.

b. Practices

The practices found in the meso perspective can be found in Table 11 below. These are highly focused on the patient-related activities, however, some practices reaches beyond front-line work such as managing and securing human resources and developing the employees. These are seen as necessary for the organizational development and support.

Table 11. Practices in the meso perspective

Meso: Practices		
□ Front-line patient assessment and monitoring □ Care-related processes □ Include the patient in the care process □ Exchange of information internally	□ External cooperation □ Active and continuous development of the patient safety □ Organizational development and improvement through research, goals and measurements, and process improvement	□ Work systematically, according to formalized rules & procedures □ Manage and secure resources □ Developing the employees through education, training and managerial support

Front-line patient assessment and monitoring

By monitoring the status and assessing risks of patients periodically or when required the front-line personnel maintains up-to-date information of the patients. Also, assessing patients allow the staff to make the right decisions for treatments of patients.

Care-related processes

The clinics conduct general and intensive care. At the neonatal clinic the personnel conducts neonatal care on infants and new-borns and care for patients at home. In the maternal ward clinic, the care of patients is conducted at the clinic and at home. The obstetrics clinic conducts care at the clinic. If the patients or families are included in an accident, care-related injury or face some kind of trauma, they are offered psychologist or counsellor help.

Include the patient in the care process

Furthermore, the patients are encouraged to participate in the care process by for example performing educations and inspiration lectures for parents to be.

Exchange of information internally

Furthermore, information sharing is seen as a key practice at the meso level. That includes informing each other of patients' status verbally and on the information boards at the clinics. At the obstetrics clinic, the staff uses the triaging board to share information about patient's status and keeping patient records updated during the work shifts. Also, it includes coordinating and structuring patients and rooms front-line. During handover meetings the personnel is able to coordinate work and share information and the heads of clinics are able to inform personnel if necessary.

External cooperation

Cooperation between clinics and with other divisions is highlighted as an important practice at the meso level. For example there can be cooperation regarding reducing the number of occupied beds and workload at one clinic, but also when performing studies, the cooperation between clinics is important.

Active and continuous development of the patient safety

Continuously and actively working with patient safety development and organizational development has been identified as relevant practices at the meso level. Regarding the patient safety, all staff members are required to report irregularities and deviations if there is something that is deviating from the normal processes. The clinics puts much focus on learning from experiences and mistakes retroactively and therefore, the identification of improvement areas along with a good reporting of deviations are seen as important practices. Continuously checking rooms and materials are important for the prevention and minimization of risks.

Organizational development and improvement

Furthermore, the clinics measures and identifies important improvement areas in order to increase safety. For example, there is a study group studying breastfeeding support via telephone at the maternal ward. By identifying important metrics the clinics can work with e.g. improvements regarding documentation and monitoring of patients, improvements regarding hygiene, measure ordinations and temperatures among patients and improve the balanced-

scorecard (BSC) boards. They also study best practice in order to constantly improve processes and routines, and additionally the meso level continuously receives missions for performing accident and risk analyses. Also, for the new perinatal centre the meso level is working on finding areas of improvement.

Work systematically, according to formalized rules & procedures

The clinics have a high degree of formalized rules and procedures, such as memorandums and check-lists. The memorandums are gathered in a database and updated on demand, alternatively (and more common) once per year or every second year. The staff is encouraged to work according to these routines and procedures, but a recurring subject in interviews was that this is not always the case. The irritation especially seemed to arise between individuals from different disciplines, e.g. between nurses and doctors in the neonatal clinic.

Manage and secure resources

The practices include the managing and 'securing' of resources. Resources signify both physical resources (equipment and facilities) as well as human resources. No matter which type of resource, there is a trade-off between the budget demands and the demands on ensuring resources.

If considering human resources, this is done through scheduling, considering each shift to be manned by a team with complete competence. From a long-time perspective, this also includes recruiting new personnel in order to ensure regeneration of competence, as well as training and educating current employees. In the short-term, it includes continuous revisions of the schedule (in order to compensate for absence) and balancing staff between maternal ward and the obstetrics clinic.

Developing the employees through education, training and managerial support

The development of skills and knowledge within the clinics involve education and training. There is both mandatory and voluntary education/training, which is either performed individually or in groups. The group education/trainings are either held for one function (e.g. midwives) or multidisciplinary. Several respondents highlighted that multidisciplinary training is of paramount importance. Examples of supplementary educations conducted by SkaS, is training in CPR or anal sphincters (using patient simulation training). The obstetrics clinic also offers educations in ALSO ('Advanced Life Support in Obstetrics') to external actors. The heads of clinics also have a social responsibility for the entire clinic but also the individual co-worker. This responsibility includes uniting the personnel around common goals and principles, as well as having staff appraisals and meetings.

c. Tools

In general, ***the tools for team-based communication, continuously managing the daily operations, support systems,*** and ***formalized rules and procedures*** were also voiced in the micro level. These will, for the reader's sake, not be repeated, however it should be highlighted and

noted that these tools also are mentioned in the meso perspective. The tools identified in the meso perspective are summarized in Table 12 below.

Table 12. Tools in the meso perspective

Meso: Tools		
□ (Mainly) internal functions and tools for developing the operations □ Tools for cross-functional organizational development □ Tools for continuously managing and coordination of daily operations	□ Securing human resources □ Tools for supporting and developing the co-workers □ Tools for developing skills and competences	□ Tools for team-based communication □ Formalized rules and procedures □ Support systems □ Tools for patient/parent learning

(Mainly) internal functions and tools for developing the operations

There are several internal functions and tools that are used for developing the operations. The identified functions are the hygiene groups, documentation groups, the patient safety representatives at each clinic respectively, the medical supervisors and the organizational developer/coordinator operating within all clinics. Additionally the neonatal clinic uses a nutrition group and technology representatives for the internal development. Also, each clinic uses goals and metrics, a patient safety publication and a BSC-board to identify and visualize important development areas. Each year, the heads of clinics respectively gives out an annual report along with a clinic action plan to highlight improvement areas.

Other tools that are used are the risk analysis system, the deviation system and the accident system for reporting of deviations and accidents that need to be dealt with. According to the patient safety act each clinic are responsible for reporting, and informing of any occurrence that can cause harm to the patient. If required the clinics acts according to the national reporting obligation (Lex Maria).

Tools for cross-functional organizational development

In order to have cross-functional organizational development, the clinics make use of multi-disciplinary project and process groups for specific improvement projects. The cross-functional development work includes multi-disciplinary conferences and development days, as well as network meetings where similar functions in different clinics exchange experiences and knowledge, for example the patient safety representatives. The cross-functional organizational development also includes multi-disciplinary further educations and trainings.

There are also regional cooperation for developing the operations, such as the regional meetings for obstetricians in the region of Västra Götaland, and the cross-functional meetings between hospitals and primary care. Other external cooperation includes periodical improvement

projects such as the project for safer obstetric care initiated by the Swedish patient insurance (LÖF).

Securing human resouces

The mechanisms available for 'securing' human resources is the long-term and short-term scheduling, including the scheduling system, the holiday staffing, as well as some shared resources that can allow for acute relocation of human resources between the obstetrics clinic and the maternal ward.

Tools for supporting and developing the co-workers

In order to support and develop the co-workers, the head of clinics conduct salary discussions and co-worker appraisals. If needed after accidents or turbulent events, the co-workers can receive psychological support.

Tools for developing skills and competences

The tools and mechanisms used for developing the skills and competences of the personnel is different types of mandatory or non-mandatory educations, training through simulation exercises according to (CEPS (Centre for Education in Paediatric Simulator)), cross-disciplinary development days, ALSO-education and annual in-service training in relevant areas. In addition, the neonatal clinic has competence cards in order to visualize and have information of the team-members current status of skills.

Tools for patient/parent learning

In order to support the parents in the safe care of their future child, inspiration lectures are held.

iii. Macro - Organizational properties, perinatal centre

The results conducted from the macro level include voices from 2 interviews and 10 regulating documents. The documents highlighted that focus should be on being close to the operations.

a. Perceptions

In general, the perceptions voiced within the macro level are that safety is to have a holistic view of the organization along with a patient-centred care. Furthermore, it is perceived important to have clear and proven instructions and routines to work according and to continuously develop the organization. Other key perceptions are to have a clear leadership along with well-functioning teams and an open climate in order to have a good patient safety performance. A summary of the perceptions identified at the macro level is presented in Table 13 below, followed by exemplifications of the perceptions.

Table 13. Perceptions in the macro perspective

Macro: Perceptions

Safety is…

- … to have a patient-centred and value based care with patient involvement
- … to have a holistic view of the organization
- … to have a clear leadership along with well-functioning teams and an open climate
- … to continuously develop and improve the organization and its processes
- … to perceive the facilities comfortable and safe (patients & co-personnel)
- … to have clear and proven instructions and routines
- … to have engaged and competent co-workers
- … to monitor, evaluate and focus on patient safety
- … to work within resources constraints

Safety is to have a patient-centred and value-based care with patient involvement

In the macro perspective, a patient-centred care, that has good medical results, is accessible, perceived as safe and which do not endanger the patient, is considered key for a safe performance. The patient should also feel welcomed and informed, and should not have to experience unnecessary wait. It is also argued that the patient should be involved in the care, and that the parents should have an active role in nursing the child.

Safety is to have a holistic view of the organization

The macro perspective highlights the need of a holistic view of the organization. This includes seeing the entire process for the pregnant woman, her child and her partner, as one. It also includes a holistic perception of the operations, including not only the patients and processes, but also the co-worker and economy perspectives.

Safety is to have a clear leadership along with well-functioning teams and an open climate

Other key perceptions of safe performance are to have a clear and strong leadership along with well-functioning teams with an open climate. This means that the organizational culture should make co-workers feel safe to report deviations and accident without being punished, that the cooperation among co-workers should range multidisciplinary and that the staff should be well-being and healthy.

Safety is to continuously develop and improve the organization and its processes

Furthermore, the macro level perceives that by continuously developing the organization and its processes the safety performance will increase. Important aspects of organizational development are to work carefully with processes, having an intensive strategy towards development and continuously identifying and working with improvement areas. Also, the macro level highlights the importance of well-prepared activity plans.

Safety is to perceive the facilities comfortable and safe (patients & co-personnel)

There is also a perception that it is important that both patients and co-workers perceive the facilities comfortable and safe. Therefore, it is important to have the appropriate facilities for the intended purpose, that the clinics are quiet and calm, that the premises are flexible and easily accessible. Consequently, the facilities should entail a good working environment.

Safety is to have clear and proven instructions and routines

The perception that clear and proven instructions and routines are needed in order to have a safe performance recurs also in the macro perspective. As for meso and micro, the existence of, and compliance to, clear and easily accessed routines and memorandums is considered to be of paramount importance. The routines and memorandums should be based on science and proven experience.

Safety is to have engaged and competent co-workers

Another perception is that a safe performance is dependent on engaged and competent co-workers, which themselves are responsible for performing good co-worker ship and for fulfilling their duties, and perceive safety to be of paramount importance.

Safety is to monitor, evaluate and focus on patient safety

Also, the monitoring, evaluating and focusing on patient safety are perceived as important for having a safe performance. Therefore the clinics should work methodologically with patient safety by being given the possibilities to assign time for patient safety work, by monitoring and improving patient safety and make it easier for the patients to report malpractices. The focus should be on evaluating outcomes.

Safety is to work within resources constraints

Finally, the macro level highlights the need to consider the resources constraints associated with the operations, namely the existing budget and the physical and human resources. The aim is to have optimal resource allocation.

b. Practices

Overall, the practices voiced in the macro perspective are highly operational and focuses a lot on the front-line components or actors role in the patient safety. The practices found in the macro perspective are summarized in Table 14 below.

Table 14. Practices in the macro perspective

Macro: Practices		
Day-to-day care operations	Cooperation between clinics and/or external parties	Have well-functioning logistics and facilities
Work according to laws and restrictions	Development and improvement of the organization and its operations	Managing the daily administration and operations
Communication	Training and development of competences and skills	Providing information to the staff
Patient-care/nursing staff interaction		

Day-to-day care operations

The operational day-to-day care activities, include for example decision-making concerning care, performing routine examinations, following hygiene routines, risk assessments of patients and more.

Work according to laws and restrictions

The practices include complying with laws and restrictions, or other instituted policies or instructions.

Communication

Communication is seen as an important practice at the macro level, and therefore it is suggested at the macro level that the new perinatal centre should gather a group of co-workers with focus on developing communication systems. Also, the continuous improvement and development of the communication is necessary and therefore the clinics should continue communicating through SBAR.

Patient-care/nursing staff interaction

There is much focus on the interaction between staff and patients, which involves including the patient in the safety work, inspiring and educating parents in caring of their child/children, consulting with parents about treatments, individually adjust the information of the patients and conduct patient surveys that covers the patient's experiences over the whole process. For a more detailed exemplification of the patient-related interactions, see Appendix I.

Cooperation between clinics and/or external parties

The cooperation regards the coordination and cooperation of facilities, staff resources along with improvement and knowledge sharing between clinics. Also, there is cooperation with external parties, such as the regional collaborations within the region of Västra Götaland. In addition to the internal collaborations mentioned at the meso level, that are also being mentioned in the macro level, the sharing of resources within the entire hospital are voiced, such as security companies, interpreters and the IT support.

Development and improvement of the organization and its operations

There are several practices related to the development and improvement of the organization and its operations. Some examples will be provided but for a detailed overview, see Appendix X. The macro level has the overall responsibility for the systems related to deviations, risks and accidents and to lead the processes of learning from experiences and deviations. Therefore, the active development of the organization is referred to as the quality, activity, and process development within the clinics. This is done by for example conducting risk analyses, evaluation of the deviation system, providing opportunities for the clinics to perform patient safety work and to conduct follow-ups on the patient safety work. Also, the macro level is responsible of conducting, introducing, performing and reintroducing measurements that are coupled with

patient safety and improvement work. This is done by participating in, following-up and leading patient safety related measurements and initiating measurements from previous outcomes and results.

Training and development of competences and skills

The macro level highlights the need of training and development of the competence and skills of individuals and teams, in order to enable the ingoing actors to behave in a safe manner. This includes, as mentioned at the micro and meso levels, education of co-workers in specific medical areas such as interpretation of CTG, or training of acute situations. It also includes improving the knowledge and awareness regarding administrative activities associated with safety, such as how to report deviations and the importance of doing so.

Have well-functioning logistics and facilities

The logistics and facilities should be well-functioning and suitable for the operations and context they operate in. Such well-functioning logistics are for example good monitoring systems that enable easily accessed information regarding a patient's status. The facilities need to support a good working environment for the staff, as well as they should be viewed upon as safe and calm - both for patients and employees. Also, well-planned facilities allow for well-functioning logistics, in that for example transportation time between clinics can be shortened.

Managing the daily administration and operations

For the administrative work, the macro level manages the administrative tasks through being responsible for the administrative guidelines and the economy (budget). Also, the macro level coordinates hospital beds and resources, and works with ensuring the operational capacity. For the daily operations, the macro level is responsible for leading the managers, steering the co-workers, updating of the situation in the clinics, measuring staff attitudes and maintaining balance in the economy. Additionally, the macro level is responsible for following-up of action plans, daily following-up and control and performing self-controls.

Providing information to the staff

Furthermore, in order to have a safe performance, some information needs to be provided to the staff. This includes the spreading of information regarding new practices (for example regarding new breastfeeding directives) or providing information regarding changes in the operations.

c. Tools

The tools identified at the macro level include organizational development tools and functions, competence and knowledge enablers, regulating publications, treating, caring and monitoring tools, communication tools and visualization tools. They are presented in Table 15 and will be further described below.

Table 15. Tools in the macro level

Macro: Tools		
□ Organizational development tools and functions □ Mechanisms for increasing co-workers' knowledge and experience □ Regulating and guiding publications	□ Tools for treating, caring, monitoring and diagnosing patients, and tools for treatments □ Supporting systems in daily operations	□ Tools for communication, group interaction and for visualizing improvements and regulations □ Cooperation and preparation for the new facilities

Organizational development tools and functions

The organizational development tools refers to the goals and metrics of the organization patient safety culture measurements, the organizational plan, the action plan, risk analyses, accident analyses, the deviation system, the clinic/clinic-wise and marker-based reviews and the control card dialogues among hospital executives and operation executives. The functions for developing the organization are local collaboration groups, the focus groups, the organizational developer/coordinator, the development leader with focus on nursing activities, the chief medical officer-function and the hospital overall support functions. Additionally, the macro level uses the patient safety act and the national reporting obligation (Lex Maria) when required. Regional and other external cooperation are also mechanisms for coordinating and exchanging experiences with others in order to improve the overall performance.

Tools and mechanisms for increasing co-workers' knowledge and experience

The tools and mechanisms for increasing the level of knowledge and experience among the co-workers being voiced in the macro level are the educations and trainings presented both at the micro and meso levels.

Regulating and guiding publications

At the macro level a number of regulating publications are highlighted. These include action plans for the hospital, the entire division, each clinic, specific improvement areas (such as care-related infections or pressure sores) as well as common instructions for the hospital or region (e.g. basic hygiene routines and rules for clothings). In addition, the patient safety act, 'Patientsäkerhetslagen' and other government-regulated documents are highlighted. There are also publications that rather act as guidance, both for the co-workers, but also for the patients, such as information on what to do when injured in care. The publications are distributed in physical form or through the patient safety web ('Patientsäkerhetsportalen'), a part of SkaS's IT-portal.

Tools for treating and caring patients

The tools for monitoring, diagnosing, treating and caring patients voiced at the macro level are described below. They are similar to the ones mentioned in the micro and meso levels.

Supporting systems in daily operations

The support systems and technology voiced at the macro level are mainly the ones used for the operations, and thus they are the same as for the meso and micro levels (IT-systems, telephones, memorandum database etc.). In addition, the accounting system is mentioned as support for the administrative work deployed.

Tools for communication group interaction and for visualizing improvements and regulations

The communication tools voiced at the macro level are mainly verbal communication and e-mailing. Additionally, the macro level uses functions for group interactions such as executive meetings, staff management meetings, medical supervisor meetings and daily resource meetings. Also, work environment assessments are conducted by interaction in groups. Furthermore, the macro level uses tools for visualization of improvements and regulations such as control and improvement boards.

Cooperation and preparation for the new facilities

The cooperation and preparation for the new facilities is made by having rigorous planning, consisting of e.g. construction meetings with the head of the clinics, dialogues with the construction companies (‘Västfastigheter’), risk analyses etc. A project manager has been assigned to have the overall responsibilities for the new center.

Appendix III. Interview guide

The generic interview guide exemplifies the questions asked during the interviews. The questions were however adapted to each interviewee. This interview guide was designed for an interview with a patient safety representative.

Bakgrund

Fråga 1: Hur länge har du arbetat på SkaS?

Fråga 1a: Vad är din bakgrund?

Fråga 2: Hur länge har du haft rollen som patientsäkerhetsombud?

Arbetssituation

Fråga 3: Kan du beskriva rollen som patientsäkerhetsombud?

Fråga 3a: Beskriv en vanlig dag som patientsäkerhetsombud?

Fråga 3b: Vilka är dina huvudsakliga arbetsuppgifter?

Fråga 3c: Hur beslutas vem som skall bli patientsäkerhetsombud?

Fråga 3d: Varför valde du att bli patientsäkerhetsombud?

Fråga 3e: Hur stor del av din arbetstid är reserverad för patientsäkerhetsombudsarbete?

Fråga 3f: Anser du att den tiden är väl anpassad till det behov som finns?

Fråga 3g: Är den tiden flexibel ifall behovet för säkerhetsarbete skulle öka?

Säkerhet & risk

Fråga 4: Hur definierar du risk?

Fråga 4a: När upplever du att risker uppstår?

Fråga 4b: Hur mäts risk hos er?

Fråga 5: Vad anser du vara säker vård? (När du hör begreppet säkerhet i vården, vad tänker du då?)

Fråga 5a: Hur arbetar du med säkerhet i ditt arbete?

Fråga 5b: Hur arbetar avdelningen med säkerheten?

Fråga 5c: Hur samverkar ni med andra avdelningar när det kommer till säkerhetsarbetet?

Fråga 5d: Vad påverkar säkerheten enligt dig?

Vid situation

Fråga 6: När någonting går fel/en akut situation inträffar – vad är din roll då?

Fråga 6a: Vilka rutiner följs i ett sådant läge?

Fråga 6b: Hur fattas beslut i ett sådant läge?

Fråga 6c: Vem fattar beslut i ett sådant läge?

Fråga 6d: Hur följs sådana situationer upp och hur drar man lärdom av dem?

Variation

Fråga 7: Vilka utmaningar innebär den inneboende variation (av patienter/vårdbehov) som finns på avdelningen?

Fråga 7a: Hur hanteras dessa utmaningar?

Fråga 7b: Vilken ytterligare information skulle behövas för att kunna hantera inneboende variation? (beläggning, lokaler, personal, personalspecifika parametrar som tillstånd etc.)

Information och kommunikation

Fråga 8: Hur håller sig personalen uppdaterad under sitt arbetspass?

Fråga 9: Anser du att personalen på avdelningen har den information de behöver (för att kunna utföra ett säkert arbete) under sina arbetspass?

Fråga 9a: Vilken ytterligare information skulle kunna behövas?

Fråga 9b: Finns informationen tillgänglig för personalen vid rätt tidpunkt/tillfälle?

Rapportering och system för risk, säkerhet och avvikelser

Fråga 10: Kan du beskriva hur arbetet med riskanalyser går till?

Fråga 10a: Vad för information?

Fråga 10b: Var hämtas informationen?

Fråga 10c: Vilket ramverk/vilken metodik används? Standardiserad inom..?

Fråga 10d: Hur mycket i riskanalyserna avgörs av subjektivitet?

Fråga 11: Kan du beskriva hur arbetet med händelseanalyser går till?

Fråga 11a: Vad för information?

Fråga 11b: Var hämtas informationen?

Fråga 11c: Vilket ramverk/vilken metodik används? Standardiserad inom..?

Fråga 11d: Hur mycket i händelseanalyserna avgörs av subjektivitet?

Fråga 12: Anser du att de system som finns idag (riskanalyser, händelseanalyser, avvikelsesystem?) fungerar väl, och används som de ska?

Fråga 12a: Ser du någonting som skulle kunna fungera bättre i detta avseende?

Appendix IV. Questionnaire

Två frågor gällande säkerhet

Vi är två studenter vid Chalmers Tekniska Högskola som för tillfället skriver vårt examensarbete med ämne säkerhet inom vården. Som en del av vårt arbete är vi nyfikna på vad medarbetarna anser vara säkerhet.

Formuläret är anonymt, konfidentiellt och svaren kommer sammanställas till en helhetsbild, så inga enskilda svar kommer kunna identifieras och kopplas till en person. Däremot är det viktigt för oss att förstå vilken roll man har och var i organisationen man är, varför vi hoppas att ni också vill bidra med information om er roll och hur länge ni arbetat inom vården.

Tack för er medverkan!

* Required

Utifrån ett vårdperspektiv: Vad anser du vara säkerhet? *

Längre resonemang är välkomna, men helst en kort formulering, på ca 5-6 meningar.

Vad är viktigast för att du skall kunna bedriva ett säkert arbete? *

Längre resonemang är välkomna, men helst en kort formulering, på ca 5-6 meningar.

Vilken titel/position har du? *

Ex: Barnmorska, undersköterska, barnsjuksköterska, obstetriker etc.

Vilken avdelning hör du främst till? *

Hur lång tid (på ett ungefär) har du totalt sett arbetat inom vården? *

Submit