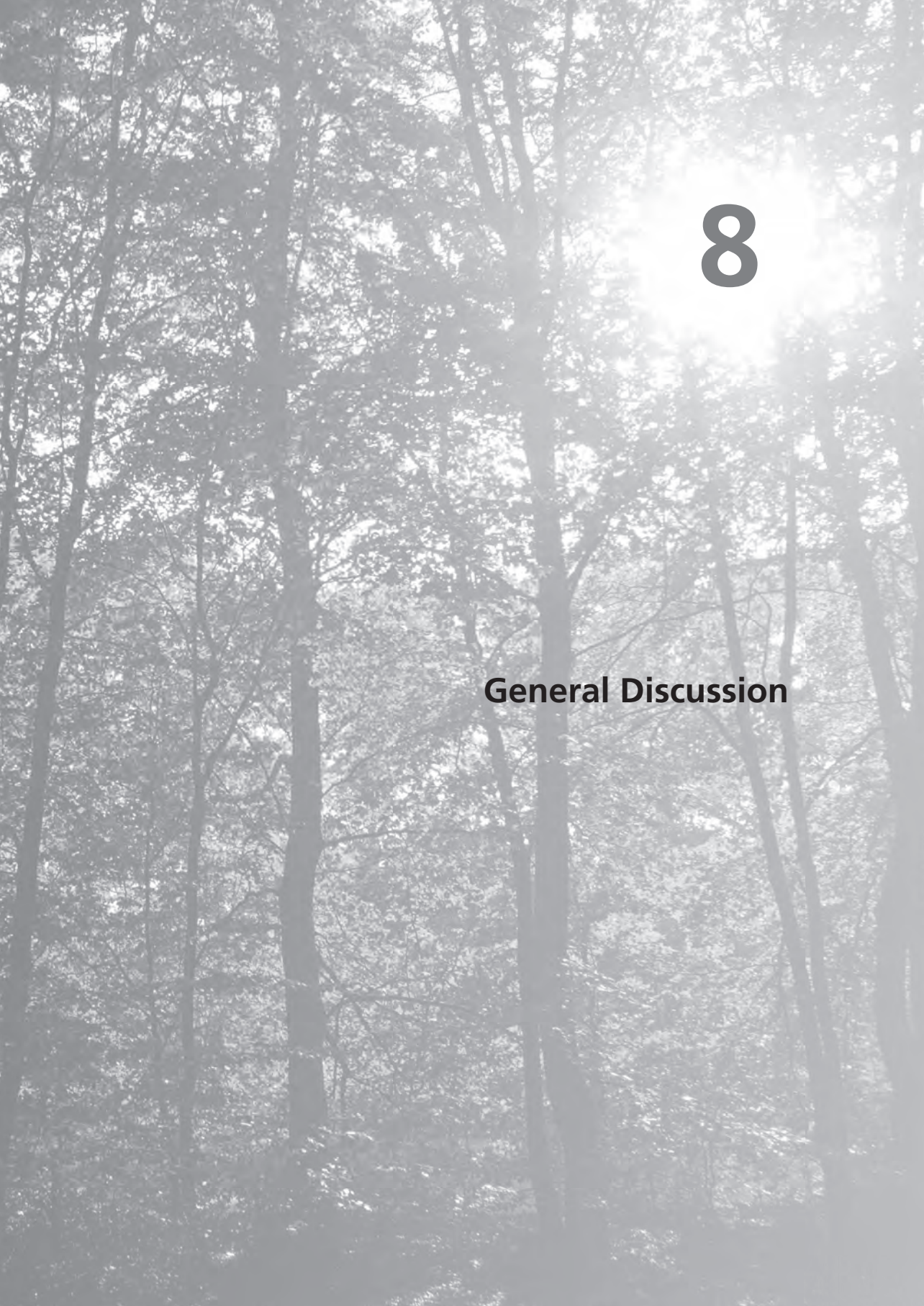

8

General Discussion

The ultimate goal of conducting research on diagnostic reasoning and diagnostic error in medicine is to reduce the number of patients that are harmed due to diagnostic errors (diagnoses that are unintentionally wrong, late or missed). The studies described in this thesis all contribute to this goal by examining the diagnostic reasoning process, diagnostic errors, the underlying causes and the consequences for a patient. The results of the studies provide useful information for developing interventions to reduce the number of patients that are harmed due to diagnostic errors in medicine.

In the introductory chapter of this thesis, five research questions were presented. These research questions were investigated in chapters 2-7 of this thesis. In this final chapter of the thesis, the main findings are summarized and discussed. Furthermore, special attention is devoted to the research methods used in the studies and their strengths and limitations. Finally, recommendations for further research on diagnostic reasoning and diagnostic errors are formulated and some preliminary recommendations for physicians are given.

Main findings

As shown by our study, diagnostic errors related to patient harm, i.e. diagnostic adverse events occur regularly in the general hospital population. When compared to other error types, diagnostic adverse events were more often considered to be preventable and were judged as more severe than other error types (i.e. more often related to the patient's death). These characteristics clearly indicate a need to reduce the occurrence of diagnostic adverse events.

When studying the diagnostic reasoning process in relation to diagnostic error and patient harm in a patient sample with a higher risk on diagnostic errors i.e. dyspnea patients, we found that diagnostic errors as well as cases with patient harm were often preceded by multiple reasoning faults. In cases with few or no reasoning faults, diagnostic errors or patient harm were less likely to occur. However, reasoning faults caused not all diagnostic errors and patient harm. For example an atypical presentation of the disease could lead to a diagnostic error as well.

The reasoning faults that were most often found were classified as mistakes, meaning that a physician did not realize that he/she reasoned incorrectly. The causes of diagnostic errors and patient harm were studied in more detail. First, selectivity in the diagnostic reasoning process of dyspnea patients was studied. Physicians need to be selective in the information-gathering and information-

processing of the diagnostic process in order to diagnose a patient within a reasonable amount of time and without too many diagnostic tests. Sometimes however, physicians are too selective which can lead to a diagnostic error. The results described in this thesis showed that selectivity was related to diagnostic error and patient harm. Particularly, selectivity during information processing stages i.e. selective integration of information and selective review of laboratory tests, were more often related to adverse outcomes than selectivity during information gathering.

While the described causes mostly focus on the cognitive aspects of diagnostic reasoning, external factors also play a role. The subjectively experienced workload as well as the amount of work experience may play an important role in diagnostic reasoning. The results of this thesis showed a relationship between subjective workload and adverse outcomes (diagnostic error and patient harm). A higher subjective workload as well as less work experience were related to more adverse outcomes. Interestingly, we could not detect an interaction between subjective workload and work experience, so even the performance of more experienced physicians suffered when the subjective workload was high. A higher subjective workload was related to the absence of a co-worker to divert tasks to, the absence or short duration of the physician's break, a larger number of patients and a larger number of unexpected events.

One of the interventions to reduce diagnostic error and patient harm that has been proposed in the literature involves the use of evidence-based decision rules to support the physician's diagnostic decision making. The results of a study described in this thesis, showed that an implemented evidence-based decision rule for diagnosing pulmonary embolism was not followed in the majority of the cases in everyday practice. Physicians seemed to follow their subjective assessment of the likelihood of pulmonary embolism rather than the evidence-based decision rule.

Interpretation of the main findings

Incidence of diagnostic error

Research showed that diagnostic errors occur in 5-15% of the patients.[1,2] A diagnostic error is defined as a diagnosis that was unintentionally delayed, wrong or missed. The diagnostic adverse events that were found in the population-based study (described in Chapter 2 of this thesis), probably represent the top of the iceberg because only cases were selected in which a faulty reasoning process

of the physician, and/or technical or organizational failure led to a diagnostic error that harmed the patient. Cases in which the patient was diagnosed incorrectly but did not suffer from any harm, or when the diagnostic error was not caused by a faulty reasoning process were not included in this study. Further, a diverse sample of hospitals and hospital departments was studied to obtain results representative of the population. This may explain that the incidence of diagnostic adverse events is lower than in many other studies where a patient group with a high risk of a diagnostic error was studied.[1-3]

When the occurrence of diagnostic error and patient harm was studied into more detail in a different patient population (Chapter 4) we found that not all cases with faulty reasoning led to a diagnostic error, and diagnostic errors were not always related to a faulty process. Figure 1 illustrates the diagnostic process in terms of the signal detection theory, explaining how people make decisions under conditions of uncertainty. As suggested in chapter 1, the occurrence of diagnostic errors can be illustrated by this theory, since diagnostic reasoning typically involves decision-making under uncertainty.

In conditions of uncertainty the important information (signal) that the operator needs to detect is embedded in irrelevant information (noise).[4,5] A physician begins the diagnostic process by gathering information about the patient's symptoms and complaints. Some of the gathered information is relevant in order to find the underlying disease (signal) while some information might involve a coincidental finding (noise) and is therefore not helpful for diagnosing the underlying disease. The physician has to determine whether a disease is present based on all gathered information (both signal and noise). The amount and strength of evidence a physician needs to determine whether a disease is present or absent is called the threshold. If the threshold is not reached (i.e. insufficient evidence is available to establish the diagnosis), the physician decides that the disease is absent. If the threshold is reached (there is sufficient evidence supporting the diagnosis), the physician establishes that disease. These considerations occur for each of the diseases that the treating physician considers. For example, while only a cough and a fever might not be sufficient to diagnose the patient with pneumonia, in combination with a sputum culture and a CT thorax consistent with pneumonia, the threshold is probably reached and the physician diagnoses pneumonia. This threshold, which determines whether a disease is diagnosed or not, is based on many factors. In addition to the amount and strength of the evidence for a particular diagnosis, as well as the likelihood of alternative diagnoses plays a role. People typically have the

cognitive capability to process information and to distinguish between different situations and patterns. However, sometimes it is impossible to correctly determine whether a disease is present or absent. For example, when a patient presents with atypical signs and symptoms, the threshold can also be reached when the patient does not have the disease. In chapter 2 of this thesis, cases with diagnostic adverse event are described. In those cases, the diagnostic reasoning process was incorrect leading to a diagnostic error. This means that for example insufficient information was gathered, leading to an incomplete overview due to which the decision threshold was not reached and therefore a disease was not diagnosed. Another reason why diagnostic adverse events occur is because of an incorrect decision threshold, i.e. even though there already is sufficient evidence to diagnose a patient, the physician incorrectly considers that the threshold is not reached and does not diagnose the patient with a certain disease. In chapter 4 of this thesis, a broader perspective was studied also including cases in which despite an incorrect process the established diagnosis was correct, and cases in which a correct reasoning process led to diagnostic errors. When physicians made suboptimal decisions, e.g. missing or gathering irrelevant information, in most cases this did not affect whether the decision threshold was reached. For example, if the physician incorrectly decided that he did not need to perform a CTa to rule out pulmonary embolism, pulmonary embolism might be missed. Luckily in most cases, the patient did not have pulmonary embolism and the result of the CTa would not have led to reaching the decision threshold to diagnose the disease. The cases in chapter 4 in which the reasoning process was correct, but a diagnostic error occurred, could be explained by the overlap in the distributions. When looking at the neutral decision criterion, we can see that with the gathered evidence the probability of having the disease is equal to the probability of not having the disease. In those cases the physicians could diagnose the patient incorrectly, while the reasoning process was correct. For some diseases there is more overlap in distributions than for others. The example described in chapter 4 of this thesis in which a cryptogenic organizing pneumonia (bronchiolitis obliterans organizing pneumonia) was not detected. The reasoning process was correct, but the fact that this is a very rare disease similar to other types of pneumonia was the reason for not detecting the diagnosis initially.

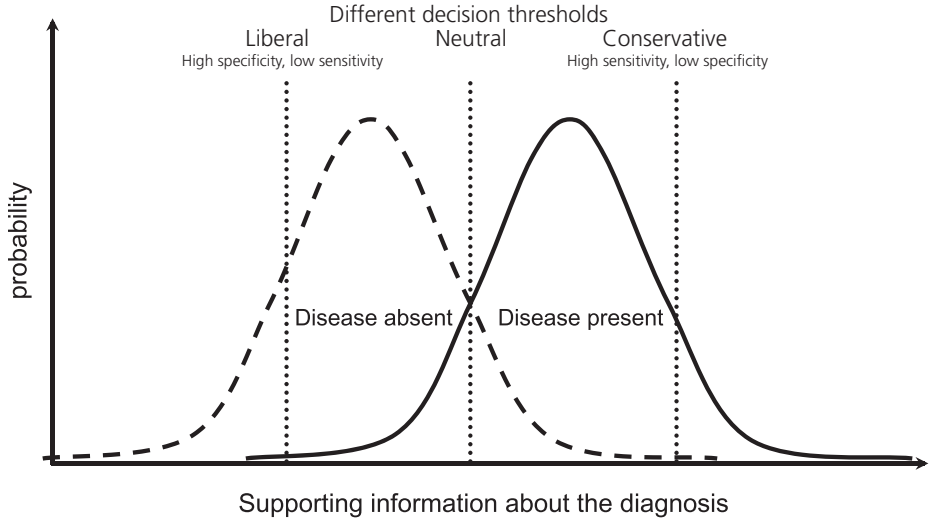

Figure 1. Signal Detection Theory

The causes of diagnostic error and situation awareness

Although the SDT explains the occurrence of diagnostic errors and illustrates how a suboptimal process sometimes leads to a diagnostic error, the causes of the suboptimal decisions are not yet explained. The causes of suboptimal decisions are explained below with the situation awareness model.

The situation awareness model

To select the relevant information and to interpret it correctly, the physician needs to understand the patient's situation (the severity, and the possible diagnoses). Understanding a situation and knowing what is going on is called situation awareness (SA). The more formal definition of SA is: "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and a projection of their status in the near future".[6,7] Loss of SA has been identified as the main factor in the occurrence of human error in complex environments with a high information flow such as the ones in aviation and military.[8,9]

Endsley has developed a model of SA in dynamic decision making (See Figure 2). Three main levels of SA are distinguished, which are part of the decision making process.[10,11] The first, and most basic, SA level is perception. When important information is not (correctly) perceived it is likely that an incorrect mental model

of the situation is formed which is the most frequent cause of loss of SA. The perception level of SA involves detection and recognition of information. The second level of SA is the comprehension level. Here the gathered information needs to be integrated and interpreted. This often causes loss of SA due to the use of an incomplete or incorrect mental model. Projection is the third and highest level of SA in which is anticipated on what will happen and the implications are considered.[11-13] Loss of SA at this level is also caused by an incomplete or incorrect mental model or by over-projection of current trends.[11,13] The three levels of SA influence the decision that is made and consequently the performance. Each of the levels refers to different cognitive operations and failures on the different levels lead to different consequences. The higher SA levels depend on the lower levels; if a physician does not notice something, it cannot be interpreted and no implications will be based on it. Besides SA, decision and performance can also be influenced by other factors. For example, individual factors (e.g. preconceptions) as well as task or system factors (e.g. stress and workload) play an important role (see Figure 2).

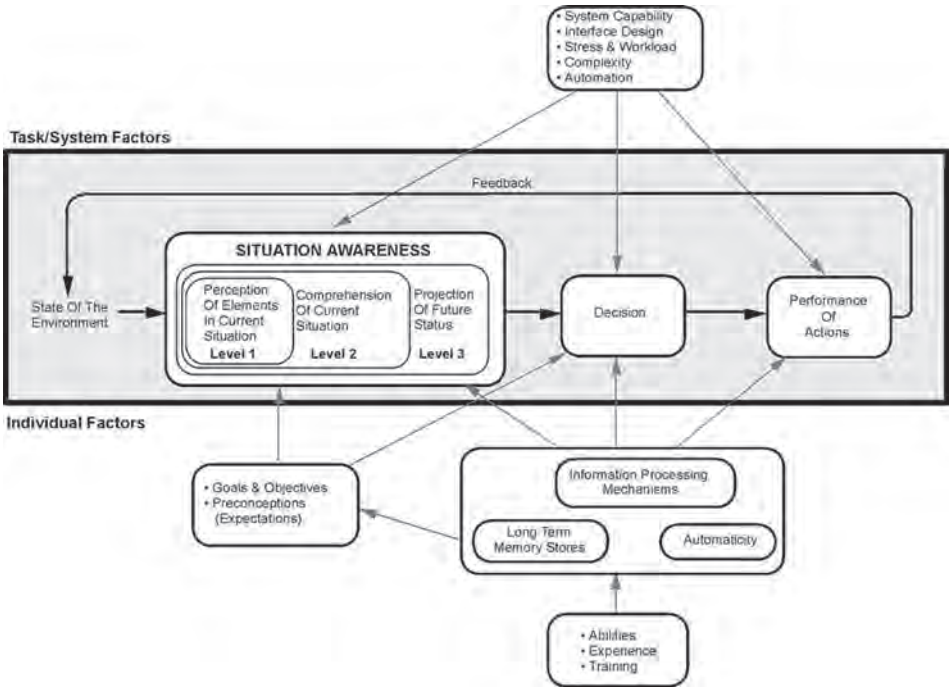

Figure 2. Endsley's model of situation awareness (SA) in dynamic decision making[10]

Situation awareness in the diagnostic process

The SA model has been applied in several industries, mostly in aviation (pilots and air traffic controllers) and in the military. Pilots have to make difficult decisions while flying a plane and during the military's assessments of their enemy's location. Similarly, physicians have to make difficult decisions under uncertainty, e.g. should the treatment start right away or do we need to run more tests. In medicine, the situation awareness model has been applied as well, particularly in simulation studies with anesthesiologists.[14,15] In diagnostic reasoning Singh et al. have proposed to study diagnostic error using the SA perspective and showed that the SA model was applicable to diagnostic reasoning and diagnostic error as well.[16] They consider the SA model as particularly strong because the SA model includes both system and cognitive errors.

Situation awareness applied to the studies in this dissertation

The findings described in Chapter 2 and 4 of this thesis indicate that lack of knowledge or inadequate application of knowledge plays a substantial role in the occurrence of diagnostic adverse events. This is, however, not as straightforward as it seems. According to the SA model there are several reasons why these knowledge-based errors can occur.[17] For example, factors such as a high workload and incomplete handovers may underlie an inadequate application of knowledge.[3,18-20] Typically for errors as a result of reduced situation awareness is an overload of information. Information needs to be correctly perceived and understood to take the right action. In contemporary medicine, and particularly in the diagnostic process, the difficulty is often not the lack of information, but the overload of information from which the physician needs to select the relevant information.[13] The knowledge based errors that are described in chapter 2 of this thesis probably influence the perception and interpretation levels of situation awareness. The causes of error described in chapter 4 are likely to be related to situation awareness. Slips are probably errors of perception since they were unintended, e.g. because deviations were not noticed, while mistakes involve the failure in the comprehension of the (current) situation, since the physicians thought they were acting correctly.

In chapters 5-7 of this thesis, some of the levels of SA are studied as well as individual and task/system factors that influence situation awareness.

Chapter 5 described cases in which physicians were too selective in their information-gathering and information-processing. Selectivity was more often related to diagnostic error and patient harm. Interpreting these data using the

SA model, it seems likely that selectivity influences through preconceptions (biases) and information-processing mechanisms, which influences the way the physician perceives the patient's situation (see Figure 2.).[11] Information-gathering encompasses the information the physician receives from the patient as well as on knowledge and ideas of the physician about the patient's assumed disease. If a physician does not consider a certain disease as likely (e.g. due to an incorrect mental model), it is possible that diagnostic information for that disease is not perceived correctly due to narrowed attention or misperception of information.[11] This failure to correctly perceive the situation causes loss of SA and can therefore affect the decision and may lead to diagnostic errors and patient harm. Selective information-processing relates to the perception level, the comprehension level as well as the projection level of SA. The information is available, but is not correctly interpreted or the considered action is incorrect. If the physician is fairly sure about a diagnosis, information supporting this diagnosis is often considered to be more relevant than information supporting a diagnosis that the physician considers less likely.[21] In cases in which abnormal laboratory results are not followed up, this may be due to failures of perception or projection. Perception errors can occur due to e.g. distractions or a high workload. Errors in projection of the future status could, for example, occur when the physician does not consider that anaemia might precede colon cancer and is therefore worth reviewing further.

The results described in chapter 7 of this thesis, in which the use of an evidence-based decision rule to diagnose pulmonary embolism was studied, may also be related to a loss of SA, particularly to incorrect interpretation and incorrect projection. The physicians followed their own intuition and insufficiently took into account the objective elements of the decision rule to diagnose pulmonary embolism. By over-emphasizing their own intuition, the objective elements of the decision rule were not interpreted correctly, affecting the decision to conduct further tests. Following one's intuition can affect the interpretation of information, because findings that are incompatible with intuition might not be considered relevant.[21] This also affects the projection of future events, as a diagnostic error may lead to an incorrect or inadequate treatment plan.

In Chapter 6 of this thesis, a task related factor of the situation awareness model was studied, i.e. subjective workload. Research has shown a relationship between workload and situation awareness. Although SA is not completely dependent on workload, excessive workload leads to a loss of SA.[22] The study described in chapter 6 showed that performance deteriorates under high levels of subjective

workload. Chapter 6 also studied an individual factor of the situation awareness model, i.e. work experience. Work experience mostly influences the information processing mechanisms. More experienced physicians make more use of pattern recognition as an information processing mechanism, while less experienced physicians more often use hypothetico-deductive reasoning as a strategy. It is likely that pattern recognition is faster and does not urge as much investigation as hypothetico-deductive reasoning. Consequently, maintaining SA is easier when using pattern recognition than hypothetico-deductive reasoning which may explain why diagnostic errors occur more frequently in the less experienced physicians.

Interventions to increase SA have been developed in other research fields (mostly aviation), and could be helpful to reduce diagnostic errors and patient harm. In the SA literature several interventions to improve SA have been proposed.[13] In aviation, task management strategies focused on assessing the importance and severity of the situation were shown to be successful in stressful situations.[23] Such task management strategies that focus on what is important and urgent, contribute to better anticipation of what will happen next. Anticipating on possible future events is important because a situation that is anticipated is recognized better and more quickly. Furthermore, in the field of aviation considering more than one possible plan was found to be helpful to maintain good SA.[24] For diagnostic reasoning this would mean to actively consider several possible differential diagnoses that the patient might have, how these diseases can express themselves and what action needs to be taken in case the patients develop symptoms of the considered differential diagnoses. By anticipating several possible situations, the physicians may be able to better recognize deviant symptoms or unexpected events. Another strategy for maintaining a high SA, is to actively seek out critical information by checking the validity of one's own situation assessment.[24] Actively trying to falsify working diagnosis can effectively counteract false expectations and incorrect mental models.[13] Such strategies have already been proposed in diagnostic reasoning (e.g. prospective hindsight, 'consider the opposite', 'what diagnosis can I not afford to miss'), but should be investigated further to test their effectivity on clinically relevant outcomes.[2,16,25-27]

Methodological considerations

There are several difficulties for studying diagnostic reasoning and diagnostic error which are: the method to study diagnostic reasoning, the criterion to

evaluate whether an error in the process occurred and the relation between reasoning faults and patient harm.

Difficulties in studying diagnostic reasoning and diagnostic error

To study the diagnostic reasoning process, we would like to follow the physician's considerations during the diagnostic reasoning process, to find out the reasons why faults in the reasoning process occur and when they lead to diagnostic error. The method that is most likely to gather this information is think-aloud protocols. During think-aloud studies, physicians are asked to say out loud what they are thinking and direct insights into the reasoning process are obtained.[28] Another method that has been used to answer specific questions about the diagnostic reasoning process is an experiment with written case scenarios. These studies have the advantage of controlling for the situation and therefore information about the information processing of the physicians can be revealed.[21,29-32] Particularly, when eye-tracking of physicians is monitored when the physicians are solving the cases. When eye-movements are followed while executing a task, this could provide insights into the information processing of physicians. The disadvantage of these methods is that it is usually conducted in an artificial (laboratory) setting and therefore less generalizable to an everyday clinical setting. A retrospective method for studying the diagnostic process is gathering error reports of physicians. By asking physicians to report the diagnostic errors that they have come across, many diagnostic errors can be gathered. And by asking the physicians about their considerations, some data about the reasoning process can be obtained as well.[18,33]

In order to know whether a diagnostic error occurred, it is important to have a definitive measure of the diseases a patient has. One of the methods that provides a definitive measure of diagnostic errors involves autopsy reports.[34,35] Autopsy reports can adequately determine most of the diseases a patient had and whether this disease was undetected during the patients stay. Naturally autopsy can only be applied to a biased patient sample, i.e. deceased patients. In addition, autopsy reports are not very useful to determine whether a missed or wrong diagnosis was clinically relevant and whether it was detectable during the patient's hospital stay. Another type of more definitive measures are reports of malpractice and liability claims.[36,37] The information of both the patient and the physician is used determining whether a diagnostic error was made. This judgment also takes into account whether it was possible for the physician to establish the diagnosis at the time of diagnosis. It is however, a biased sample

since it only involves the cases that patients report.
It is further important to know the extent to which the diagnostic error or faults in the reasoning process contributed to patient harm. In most cases, when a patient is harmed or even dies after a diagnostic error, this cannot be entirely attributed to the diagnostic error itself.[38] There are many factors that influence the course of the patient's illness. Therefore, it would be more accurate to say that the diagnostic error contributed to the patients' injury or death.

The strengths and limitations of the studies in this thesis

In this thesis two types of record-review studies are described. The main advantages of the record review study described in Chapter 2 involve the large number of hospital admissions that were reviewed in a diverse sample of hospital departments and patients, leading to population-based information on diagnostic adverse events. In addition, a lot of information was available to determine whether a diagnostic adverse event occurred, i.e. information from previous and later hospital admissions, laboratory results and imaging. The follow-up of the patients after the hospital admission time was long which was important for finding diagnostic adverse events because the majority of them were discovered during a subsequent hospital admission. This makes record review a good method to detect diagnostic errors and diagnostic adverse events.[39] The clinical relevance of adverse events found in a record review study is considered to be high. In order to detect a diagnostic adverse event, the patient has symptoms and/or complaints of the disease that were missed, wrong or diagnosed late. This study could however, not provide much information about the diagnostic reasoning process. Therefore, a second record review study was conducted.
The study described in Chapter 3-7 used a combination of research methods. The record review study examined the diagnostic reasoning process in detail and was based on a Delphi method to determine the optimal diagnostic process for patients suffering from shortness of breath. This allowed us to follow the reasoning process of the physicians into more detail. In addition, information about the differential diagnosis was obtained from the treating physicians, which provided insights into their reasoning process. The subsequently conducted interviews with the treating physicians allowed the identification of causes of faults in the reasoning process and diagnostic errors.
The studies described in this thesis also have various limitations. In spite of the large amount of information that is gathered with a record review it is not a

definitive measure of diagnostic errors. Diagnostic errors might go undetected due to limited information in the patient record or the limited follow-up time (if a patient dies after discharge due to a diagnostic error, this remains undetected). In contrast, the causality and preventability of diagnostic errors and diagnostic adverse events might be overestimated due to hindsight bias of the reviewers. Furthermore, the inter-rater reliability of record reviews is modest, and differences in interpretation exist between reviewers.[40] Additionally, the extent to which the diagnostic error or the diagnostic adverse event contributed to the consequences for the patient cannot be determined based on a patient record review.

The information about the differential diagnoses in the second record review study (Chapter 3-7) provided information about the reasoning process of the physicians and was measured at one specific moment. This was the same for the workload measurement. Therefore, the information about the reasoning process does not reflect the whole process but only a part of the reasoning process. Furthermore, the interviews with the treating physicians provided information about the reasoning process; they showed how physicians reflected upon the diagnostic process in retrospect. This can also be subject to both recall and hindsight bias since the interviews took place a while after the patient was discharged from the hospital. Another limitation of the second record review is that the study focused on patients who were admitted to the hospital with shortness of breath and our results might therefore have a limited generalizability to other patient groups.

Future research

Several studies have provided important insights into the incidence and causes of diagnostic error and diagnostic adverse events.[2,39,41-43] Specific patient groups and circumstances that are particularly prone to diagnostic errors have been identified. The next step is to further establish the underlying mechanisms leading to reasoning faults and diagnostic errors, e.g. whether insufficient information-processing occurs due to incorrect perception, comprehension or projection. When the underlying mechanisms of the diagnostic reasoning faults and diagnostic errors of physicians are better understood, specific interventions to improve everyday clinical practice can be developed. Based on this thesis, several weaknesses in the diagnostic process are particularly suitable for experimental studies.

Selective information-gathering and information-processing could, for example, be studied by using eye-tracking methods. This allows studying the process and

the causes of error (perception, comprehension or projection) more precisely. Specifically, selective information processing in patients with co-morbidity is an important topic for further research. Of the cases with selective review of laboratory tests many involved possible co-morbidity. Diagnosing co-morbidity is difficult and due to the increasing number of older and more patients with complex diseases, co-morbidity is more frequently present and should therefore more often be considered in the diagnostic process.

Furthermore, a high subjective workload was related to adverse outcomes. Research should determine in more detail how and under which circumstances subjective workload increases and how it can be reduced (e.g. shared responsibility or reduction in tasks).

With experimental research specific underlying cognitive processes involved in the occurrence of diagnostic error can be determined, free of the context that needs to be taken into account in a clinical everyday setting. Experimental research can therefore provide useful evidence of how cognitive processes in diagnostic reasoning occur. However, the situation awareness model showed that in everyday clinical practice performance is influenced by many different factors at the same time, which are difficult to simulate in experimental settings. While diagnosing a patient, physicians experience several constraints such as time pressure and workload. It is therefore also important to study diagnostic reasoning in diverse and dynamic situations with time and other constraints. Research on so-called naturalistic decision-making examines how people actually make decisions in complex environments. Naturalistic decision making has been applied to other areas of research and is often related to research on situation awareness.[44,45] For example, the Recognition-Primed Decision (RPD) model as developed by Klein et al[46] is a model of naturalistic decision making that would be applicable to diagnostic reasoning. In this model, Klein et al describe that when making decisions in naturalistic setting a combination of pattern recognition and mental simulation is used. Pattern recognition is used to quickly come up a possible solution, while the subsequent mental simulation is a more analytical process to check if the suggested solution, as identified by pattern recognition, is likely to work.[47] Research showed that the RCP model is used by 80-90% of the people while they are making decisions in complex environments.[46,48] It would also be valuable to apply this approach to the field of diagnostic reasoning.

Recommendations for physicians

The studies described in this thesis are exploratory and do not include the evaluation of interventions. Therefore, we cannot propose recommendation that have been tested on their effectiveness. However, some general recommendations can be made.

In the study on selectivity described in Chapter 5, the results showed that abnormal laboratory results were often not followed-up. Whereas in the study in chapter 7 about the evidence based decision rule for pulmonary embolism, physicians seemed to put too much weight on their intuition rather than the more objective aspects of the decision rule. During the interviews with treating physicians described in chapter 4, they reported that the findings that do not match with the working diagnosis are often ignored and not reported to the supervisor. Too much focus or following intuition only, can lead to a loss of situation awareness (SA) and therefore to inferior decisions.[10] Suggested strategies to maintain situation awareness that have been identified in other high complex industries involve: having more than one plan and the active use of falsification strategies. It is not in the nature of human beings to change initial beliefs and people tend to convince themselves that their initial ideas (i.e. about a working diagnosis) are correct. The use of such a verifying strategy in medicine, can lead to diagnostic errors. Therefore, physicians are advised to use more falsifying strategies. In diagnostic reasoning these strategies are called meta-cognitive strategies or reflective practice.[25-27,31,49] Particularly suitable moments for reflecting on a case are the existing moments in which physicians discuss a case, such as during supervision, handovers and when interpreting laboratory results. During these discussions it is important to try to falsify the working diagnosis, to explore whether the diagnosis is correct and examine whether co-morbidity is present, as opposed to defending the working diagnosis. It might be a useful intervention to alter these moments of reflection and to focus on the data that are not in line with the working diagnosis to sort out whether another diagnosis is (also) present.

The reduction of subjective workload can also increase SA and can reduce the occurrence of diagnostic error and patient harm. Subjective workload was related to the availability of co-workers for assistance. Therefore, taking a high subjective workload seriously and making sure that physicians are able to get assistance when the workload is considered to be high is recommended.

Another recommendation involves the use of evidence-based decision rules. It seems that physicians sometimes base their diagnostic strategy on their own

intuition rather than the decision rule. Since evidence-based decision rules are developed to support physicians during the diagnostic process, interventions to improve the diagnostic process lies in overcoming barriers to use them. Besides asking physicians to try to check their intuition by examining the more objective elements of the decision rule, it is important that the hospital departments pay continuous attention to the evidence-based decision rules and emphasize their importance and usefulness.

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