1

Introduction and Outline of the thesis

Introduction

Patient safety has become a major concern in healthcare. But how much of a problem is patient safety? The unsettling fact is that no one knows. What we "know" depends on how we gather information and on how we determine that a patient has been injured by an error. Not all errors and incidents leading to injury or damage are systematically recorded; obtaining a reliable estimate of errors is difficult.

Two questions therefore arise. How can systematic action be taken to avert preventable errors? In particular, how can we identify and prioritize remedial actions?

In accidents and injuries in other hazardous industries, such as aviation and nuclear power industry it was possible to reduce accidents and injuries by the application of lessons from cognitive psychology and human factors. The report: "To err is human: Building a Safer Health System", from the Institute of Medicine also shed a new light on the causes of medical error.[1] According to this report and other studies conducted around the globe, approximately 10% of all patients admitted to hospital suffer some kind of harm, about half of which is preventable with current standards of treatment.[2-5]

The focus of this thesis is on the Operating Theatre (OT) and Intensive Care Unit (ICU). Both are dynamic environments, with constant change and time stress in which a wide variety of high-technology equipment is used. These areas are known to have a high incidence of errors and negative outcomes. [6-8]

Errors occur where the work is done, where practitioners interact directly with the system in their roles as anaesthesiologists, surgeons, and nurses. Those events emerge from a chain of failures elsewhere in the organization, from conditions that are not directly visible. According to

the Swiss cheese model, errors and serious adverse events are often preceded by a chain of individually unimportant errors and problems, in turn influenced by a wide variety of contributory factors.[9]

How medical errors occur, how they can be addressed within the health care system and how the work environment provokes errors re topics of particular interest. Deficiencies at many different levels in the organization create the context in which human error can have a negative impact. As an illustration we distinguish three levels at which errors occur (figure 1).
The highest level is personal errors. Personal it refers to the individual skills of the professional. Such human errors can be classified as knowledge-based, rule-based or skill-based and imply a specific deficit in an individual's knowledge, ability to apply procedures or specific technical skills.[10] For a long time a *person-centred* analysis and prevention approach has been dominant in proposals to improve patient safety in health care. In this approach the focus is on the ever-present 'human factor', concentrating on the individual responsible for making an error. The person-centred approach tends to concentrate on individual failure, with individual consequences, such as retraining, coaching, working under supervision and at worst punishing the employee. This approach rarely improves the behaviour of the group, leads to concealment of errors and cover-up. The end result is that safety does not improve.

At the next level are errors of team performance. The interprofessional team setting is one in which lack of broad oversight and understanding of individual functions is a core problem. In the OT team, team members often do not fully understand where everyone's work fits into the whole process. Moreover, nurses do not tend to work consistently with the same

anaesthesiologist, surgeon and team, and their rotating assignment may (further) reduce understanding of system processes as they relate to particular services and procedures. Surgeons and anaesthesiologists division of labor also undermines the identification of safety issues and solutions as well as the identification of problematic practice routines in everyday work. [11] ICU team members have divergent perceptions of their communication behaviors, with more nurses than doctors reporting difficulties in speaking-up about problems with patient care.[12] Recognition of problems in team performance in aviation led to the development of training programs in team coordination, leadership and decision making known generically as Crew Resource Management. CRM is currently introduced in anesthesia and surgery.[13]

The lowest level at which errors can occur are the preconditions. Because they are not directly visible in the working environment they are described as Latent Risk Factors (LRFs). LRFs are usually identified in the analysis of accidents and incidents and therefore also described as general failures types.[14] Generally, a single underlying failure will be compensated for. It is when multiple factors come together that an incident becomes increasingly likely, as expressed in Reason's Swiss cheese model.[9] The model assumes that if errors occur, several simultaneous failures must have occurred within the organization. Error-producing conditions are poor design, maintenance failures, unworkable procedures, deficiencies in training, equipment design and use as well as poor team coordination.

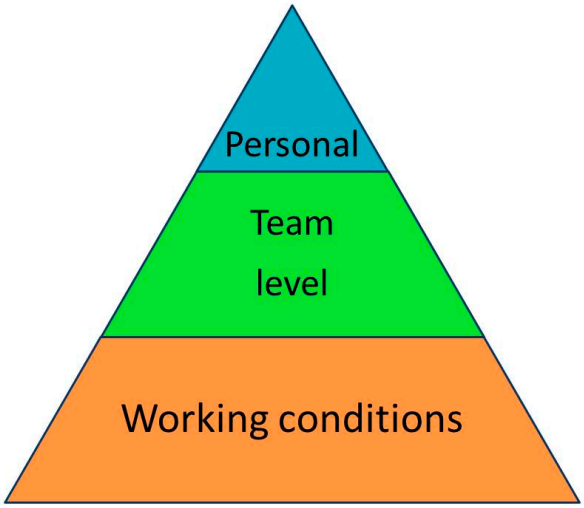

Figure 1

As a result of the recognition of the fact that individuals evoke incidents (the sharp edge), within an error predisposed environment (the blunt edge), a different approach to errors was developed. The alternative to the person centered approach to errors is the *systems approach* which focuses on the conditions under which individuals work rather than on errors by individuals.[9] This approach assumes that the work environment can shape behavior and can make certain kinds of errors less or more likely. Bringing the systems approach into medical practice clearly entails a fundamental shift in thinking about error and handling error in practice and required a comprehensive strategy for change. While most attempts to improve safety in health care are reactive, responding after someone is harmed; efforts to proactively identify and eliminate hazards have the potential to significantly and systematically improve safety.

A proactive safety management system, designed to measure and reduce the adverse impact of LRFs within an organization, may provide the

answer. Proactive systems work in part by asking people to judge how frequently each of a number of factors such as training, equipment, procedures and communication impacts adversely on specific aspects of their work. This type of proactive approach allows the identification of LRFs before they give rise to errors that can compromise patient safety. Such a system may serve not only to reduce error, but also to foster a culture that, by moving away from blaming the individual and encourages reporting. This thesis describes a method for a proactive system approach.

Outline of this thesis

The hypothesis that correcting LRFs and concentrating on systemic rather than individual issues in patient safety will result in safer care was the cornerstone of the Leiden Operating Theatre Safety (LOTS) project.

The studies presented in this thesis aimed at answering the following questions:

1. Are the LRFs measured valid and reliable by the Leiden Operating Theatre and Intensive Care Safety (LOTICS) scale?
2. Has an intervention based on a safety program an effect on the LRFs: material, staffing resources and training?
3. Is there a relationship between LRFs and job satisfaction, job stress and intention to leave in anaesthesia teams?
4. Is there a difference in perception on LRFs between clinical area (OT vs. ICU) and disciplines?

Chapter 2 gives an overview of accident theories and of LRFs. Accident theories are frameworks to study accidents. LRFs exist within the systems analysis theory. These LRFs describe the total working environment as they emerged from the analysis of accidents. They have been identified

through a combination of factor analysis of questionnaire data and logical analysis adapted from the original structure developed for oil and gas.

Chapter 3 reports details of the development and the psychometric properties of the Leiden Operating Theatre and Intensive Care Safety (LOTICS) scale. The scale assesses the state of the individual LRFs through a questionnaire of personnel working within the Operating Theatre and the Intensive Care Unit. The questionnaire is analogous to a health check, assessing a limited number of well-chosen diagnostic vital signs

Chapter 4 describes a prospective study, concerned with the question whether an intervention leads to improvement on LRFs. It was anticipated that addressing specific LRFs, rather than just a general awareness campaign, will contribute to the prevention of future errors and consequently to improved patient outcomes. It describes the implementation of a patient safety program in the Operating Theatre.

Chapter 5 emphasizes the causal relationship between working conditions and the delivery of quality of clinical care. It was determined that LRFs, which enhance patient safety, can have a positive effect on the well-being of specialist anaesthetists, trainees in anaesthesia and nurse anaesthetists.

Chapter 6 explores the influence of the clinical area (Operating Theatre and Intensive Care Unit) and disciplines on rating of LRFs. Identification of differences between clinical areas or disciplines would allow tailoring the measures directed at LRFs that are below standard. Tailoring is necessary because correction of the various LRFs would require entirely different preventive actions. Obtaining input from all workers in the

clinical areas guarantees that a broader spectrum of LRFs will be addressed, since each discipline has its focus for LRFs.

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