

FALLIBLE HUMANS IN INFALLIBLE SYSTEMS? LEARNING FROM ERRORS IN HEALTH CARE

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Abstract - This study both explores the multi-level system of managing errors in Norwegian health care and maps interfaces of importance for learning from errors. A multi-level case study has been conducted using Rasmussen's (1997) socio-technical risk management system as a framework for studying the following levels: Government, regulators and associations, company, management, staff, and work operations. The results document that different system levels are dependent on each other in the process of error prevention in Norwegian health care. Healthcare reforms constitute framework conditions that complicate error management, and the blame culture characterising the healthcare system counteracts learning from errors. The systems for error prevention and learning from errors are fallible due to imperfections at all levels. Fallible humans are prone to cultural aspects such as underreporting and occupational differences, organisational aspects such as workload and error reporting demands, and societal aspects such as healthcare reforms' demand for higher production and an individualistic control system.

1. INTRODUCTION

Treating patients is a complex process involving sophisticated technology, dangerous medicines, diverse patients, multiple work processes, and various professional disciplines experiencing an increasing level of specialization (Spath, 1999; West, 2000). Delivering health care in a wider context is even more complicated, involving governmental healthcare legislation and budgets, regulatory authorities' control activities, and a loosely coupled system of numerous organisations. This paper studies the management of errors in this setting. By errors we mean misdiagnosis, medication errors, or erroneous processes of medical treatment in general. The aim of the study is to explore the multi-level system of managing errors in Norwegian health care and to map interfaces of importance for learning from errors.

Norwegian health care is currently subject to structural changes involving reorganizing and cost effectiveness so that more patients can be treated with better quality and the same number of employees. Presently, not only do inspections from the regulatory authorities indicate errors and deficiencies in health care, but there is also a growing media focus on patient safety. Given these framework conditions, the system of managing errors in the healthcare sector involves several challenges. Despite an increasing workload, employees in healthcare institutions are supposed to report, correct, and learn from errors. Healthcare institutions are expected to build routines and systems to report, analyse, and learn from errors, despite reduced budgets. Regulatory authorities must maintain their systems for reporting of serious errors and their ability to sanction employees and institutions, despite an increase in cases.

Viewing error prevention as a continuous process, rather than a product of certain activities or behaviours (e.g., Gherardi & Nicolini, 2000), involves the exploration of the entire healthcare system to map dependencies and interfaces that influence the error prevention process. Furthermore, a process view implies that learning from errors is a collective capacity that produces organisational and inter-organisational error prevention practices. Given the complexity of the healthcare system, producing such a collective capacity involves learning processes across different levels and occupational groups.

2. PREVIOUS RESEARCH

2.1 Error prevention as a multi-level process

Different levels of healthcare processes and framework conditions constitute what Rasmussen (1997) has named a socio-technical risk management system, involving the following levels: Government, regulators and associations, company, management, staff, and work operation. All levels are interconnected, and, in different ways, will influence the bottom-level work operations. At each level, changes or environmental stressors may be introduced, including new legislation, a changing political climate, changing market conditions, changes in company competency levels, and technological changes. Given the interconnectedness between levels, such changes will affect the entire system. A few studies within other industries have been conducted using this relational approach to safety (van der Geest et al., 2003; Leveson, 2004; Snook, 2000).

Despite a substantial literature on patient safety during the last ten years (e.g., Kohn et al., 2000; Rosenthal & Sutcliffe, 2002; Spath, 1999), empirical studies with a multi-level system approach are limited. Most likely due to the complexity of the healthcare system, studies are conducted within one level of the system, often with an organisational, group or individual focus (Ruchlin et al., 2004). Research has often failed to follow the causal chains back to the managers, civil servants, or politicians who may have failed in their decisions to provide an environment conducive to patient safety (West, 2000). Firth-Cozens (2001) argues that using the systems approach is important for spreading responsibility throughout all levels and thereby reducing the focus on errors in the sharp end.

2.2 Error prevention as a learning process

The ideal error prevention approach is to view errors as symptoms of underlying problems so they become sources of information to understand how systems work. Accidents and near misses should be seen as useful tools that contribute to defining margins of risk and safety and to learning how to prevent harm (Edmondson, 2004; Johnstone & Kanitsaki, 2005; Morath & Turnbull, 2005). This approach is based on the premise that humans are fallible, errors must be expected, and individuals' poor performance is a non-issue; instead, the focus is on the failure in the group, team, organisation or procedure. Emphasis is on feedback from work processes, accurate information, rules of inference, reflection and discussion between colleagues, and possibly dialogue with users (Allsop & Mulcahy, 1996).

Research on patient safety has applied the concept of the clinical microsystem (Mohr et al., 2004) as a framework for approaching learning from errors. Healthcare organisations comprise smaller interconnected microsystems; some argue that opportunities for cross-microsystem learning are essential for learning about the systemic errors within institutions. Fostering collaborative relations among microsystems should be an important goal for healthcare organisations (Mohr et al., 2004). The microsystem approach has much in common with theories of communities of practice (e.g. Brown & Duguid, 1991; Gherardi, 2000; Wenger, 1998; Wenger & Snyder, 2000). Communities of practice are informal groups of people that evolve over time on the basis of shared expertise and joint activities and where dialogue, analysis, reflection and socialization are important learning conditions (Aase & Nybø, 2004; Aase & Tjensvoll, 2003). Other studies have highlighted the role of teamwork to improve learning and error prevention (Adorian et al., 1990; Firth-Cozens, 1998; 2001; Reith, 1998). Due to the size and complexity of the healthcare system, Firth-Cozens (2001) argues that, unless an appropriate culture and structures are created to enable smaller groups and teams to create safe work practices, error prevention can only be achieved to a limited extent by interventions at an organisational level.

2.3 Barriers to error prevention

According to Leape (1994; 1999), there are several reasons for the substantial error rate within medical practice. One reason is a lack of awareness regarding error-related patient injuries within medical practice. Another reason is that most errors do no harm. But the main reason is found in the culture of medical practice. Medical personnel are socialized to strive for error-free practice during education; role models in medical education reinforce the concept of infallibility; and in the hospital practice, the sense of duty to perform faultlessly is strongly internalized. This need to be infallible generates a pressure that encourages intellectual dishonesty; that is, to cover up rather than admit mistakes. Almost every medical employee experiences mistakes that harm patients in their career, but the fallible physician rarely admits or discusses errors (Leape, 1994; 1999). Physicians also find it difficult to criticize a colleague's unprofessional or unethical conduct (Aasland & Førde, 2005) due to a widespread tradition in health care of naming, shaming and blaming individuals involved in unsafe acts (Reason, 2000).

The blame culture (Morath & Turnbull, 2005; Vuuren, 1999) has counteracted the exploration of weaknesses in work processes at different levels, causing a loss of rich information about how individuals, medical work, and organisational processes interact. The implication for learning from errors is that individuals may learn from errors and change their practice, but the adjustments often take place in a vacuum. Lessons learned are shared privately (if at all), and external evaluations of what went wrong seldom occur (Førde, 2000; Leape, 1994; 1999; Vuuren, 2000).

Errors also tend to be underreported (Kohn et al., 2000). In Norway, research indicates that more than half of the mandatory reportable errors are not reported (Aasland & Førde, 2005). Despite a substantial change in thinking in recent years with regard to practicing error management in health care, the fear of negative reactions, media publicity and being criminalized still leads to underreporting (Firth-Cozens, 2001; Johnstone & Kanitsaki, 2005; Mulcahy & Rosenthal, 1999). Studies on cultural barriers to error reporting (Waring, 2005) revealed that physicians viewed errors as an 'inevitable' and unmanageable feature of medical work; reporting was thus regarded as pointless. Reporting was also discouraged by an anti-bureaucratic attitude and by rejection of excessive administrative duties.

3. METHODOLOGY

A study of the multi-level system of managing and learning from errors in health care requires multiple methods and multiple data sources. A qualitative research perspective and methods were chosen to explore and map the dynamics of organisational change and learning in health care to provide insight into organisational matters, error management processes, and discourses (Benson-Rea & Myers, 2006). More specifically, our main research design is a case study approach (Ragin & Becker, 1992; Yin, 1994; 1999; 2004) within a regional Norwegian hospital whose regulatory authorities belong to both local and national levels. We apply the case study approach due to the characteristics and conditions of the healthcare system, which comprises multiple components, complex processes, and rapid changes. The case study approach is particularly applicable for gaining insight into, and understanding the structure of, a complex system and how its interdependent individuals, groups, and institutional components function (or fail to function) together (Berkwits & Inui, 1998; Hurley, 1999; Yin, 1999). The study covers the levels of government, regulator, company, management, staff, and work operations according to a socio-technical system perspective (Rasmussen, 1997). Table 1 shows the different system levels with the accompanying data collection methods, data sources, and informants included in the case study.

System levels	Methods	Data sources and informants
Government	Document analysis	Krogstad (PhD thesis, 2005), White Paper (NoU, 1997:2), healthcare legislation
Regulator (national/local) Associations	11 structured interviews (A)	National level: 4 Local level: 5 Patient representative association: 2
	Document analysis	Labour inspection report, directive 1-54/2000, annual reports, policy documents
	Observation	Regulator-Hospital meeting
Hospital	6 structured interviews (A)	Top management: 6
	Document analysis	Labour inspection report, annual report from the Chief County Medical Officer
	Observation	Regulator-Hospital meeting
Management	16 structured interviews (B)	Middle management: 16
	Document analysis	Labour inspection report, inspection reports from the Chief County Medical Officer, guidelines for hospital quality committee
Staff	16 structured interviews (B)	Hospital staff: 16
	Document analysis	Regional psychosocial environment survey (Holte et al., 2004).
Work operations	Statistical analysis of error reports	894 written error reports

Table 1. Data collection methods within a multi-level system approach.

Data were collected using method triangulation of qualitative and quantitative methods, such as interviews, statistical analysis of reported errors and near misses, observation, and document analysis (Patton, 1990; 1999). Within the different system levels, the application of methods has varied (as illustrated in Table 1) due to practicalities, time constraints, and information needs. At the governmental level, document analysis (Health care legislation; Krogstad, 2005; Norwegian White paper, NoU 1997:2) was used to describe the vital changes the Norwegian healthcare sector has undergone in past years. At the regulator/association level, we performed 11 structured interviews (interview guide A) with inspectors at the national and local level regulator and with representatives from the patient representative association. Furthermore, documents such as inspection reports, annual reports and policy documents were analysed, and the first author observed a regulator-hospital meeting. Data collection at the health care institution level was divided in four sub-system levels: hospital, management, staff, and work operation. At the hospital level, which included the top management, we performed six structured interviews (interview guide A) with top managers and division managers, analysed inspection reports from the Norwegian Labour Inspection Authority and the Chief County Medical Officer, and observed the interaction between the hospital and the regulator in a hospital-regulator meeting. The management level included hospital middle management, in which we performed 16 structured interviews (interview guide B) with head nurses and head physicians at two hospital divisions, and we conducted document analysis of inspection reports and guidelines for the hospital quality committees. At the staff level, we interviewed 16 nurses and physicians within

two hospital divisions (interview guide B). In addition, we analysed a regional psychological environment survey (Holte et al., 2004) as second order data. The work operation level included work operations and processes carried out within the hospital that were at risk for medical errors. To get data about such work operations at the case hospital, a total of 894 written error reports from two hospital divisions were registered and analysed in an Excel-database.

A total of forty-nine tape-recorded interviews were performed using two structured interview guides. Seventeen interviews focusing on the relationship between the local health regulator and the regulatee (hospital) with regard to managing errors were performed using interview guide A (legislation, error reporting, learning, risk perception, and prevention). Informants included inspectors, the patient representative association, and hospital management. Thirty-two interviews focusing on how two hospital divisions managed errors were performed using interview guide B (amount and categorization, human and organisational factors, learning, power issues, and regulators role).

Qualitative data were analysed by transcribing summaries and memos with relevant quotations from all data collection activities. To enhance the credibility of the qualitative analysis, the two authors used a multiple analyst approach to review the findings. This technique is termed analyst triangulation (Patton, 1990; 1999), and both authors independently examined the total amount of data material. To analyze processes and activities important for error management within each system level, data were categorized, structured and analysed according to system levels and themes within the structured interview guides. To analyse the data material across system levels and map vital system interfaces of importance for error management involved a substantial methodological challenge due to the complexity of the data material. In the first stage of system interface analysis, both researchers independently analysed the material and developed categories according to their interpretation of the material as a whole, not according to specific system levels. In the second stage, the researchers discussed and challenged each other's interpretation of the material, resulting in modified and improved categories (Miles & Huberman, 1994). Quantitative data were analysed by statistical analysis of frequency with regard to error type, error severity, error causality, and personnel categories. Within analytic triangulation, it is common to have those who were studied review the findings. In this study, results were presented at the hospital in several announced open meetings, and informants were given the opportunity to react to the findings and the researchers' descriptions (Patton, 1990; 1999).

4. THE HEALTH CARE RISK MANAGEMENT SYSTEM

The Norwegian health care risk management system is presented by giving contextual descriptions of the different system levels with regard to framework conditions and learning from errors.

4.1 Governmental level

The governmental level involves legislation and governmental funding within five health regions, where hospitals are organised separately from primary care. The Norwegian healthcare sector has undergone several changes in the last ten years. New public management and its characteristics of cost control and effectiveness form the backdrop of the major changes at the governmental level (Krogstad, 2005). Three structural reforms are essential: 1) A change in hospital financing, which had a central purpose to reduce patient waiting lists, was implemented in 1997. This reform was intended to pay the hospitals based on the number of patients treated, thereby reducing the previous over-all payment to the hospitals. 2) A change in institutional management, first suggested in 1997 (NOU 1997:2) and followed up by a new law (Specialized Health Service Act, 1999); its rationale was to strengthen the leadership and management as a response to the growing complexity in the hospital organisations. This reform represented an explicit desire for increased efficiency and an inexplicit shift from clinical to managerial rationality. 3) A change in hospital ownership and central management, implemented in 2002, which involved a transfer of hospital ownership from the counties to the central government. This reform placed the responsibility with one owner. Furthermore, the hospitals were organised as enterprises that were legal subjects and no longer subjects to local political interference or influence (Krogstad, 2005).

4.2 Regulatory level

The Norwegian Board of Health is responsible for general supervision of health and social services at a national level. At a local level (county), this responsibility is delegated to the Chief County Medical Officer.

Normally, it is the local-level regulator¹ who interacts with the hospitals through activities such as inspections, inspection reports, error reports, phone calls, and meetings. The regulator enforces extensive health care legislation and has the power to sanction at both individual and organisational levels. Informants at both the national and local regulatory level assess the legislation as powerful and satisfying for performing the regulatory tasks, ensuring quality and safety in health care.

Hospitals are obliged to report to the regulator both those errors causing serious patient injury and any serious near misses. All error reports are stored in a national database. The purpose of this mandatory reporting system is to clarify why errors and near misses occur and to prevent their reoccurrence. According to policy documents, the regulator should take an active part in vitalizing the hospital's obligation to report and to manage errors internally. The regulator expects the hospital's error management system to include an internal reporting system and an active use of these error reports within the hospital divisions. The hospital's quality committee should play an important role in this work. The committee is mandatory with a mandate concerning overall hospital quality and safety. In practice, the local-level inspectors are not satisfied with the hospital's internal error management system or the work of the quality committee:

“The internal error management system is vital to patient safety. It is mandatory, just like the obligation to report, and should act as a tool to increase quality and learn from errors. The reporting culture is one matter; all reports should not necessarily be addressed to us. The hospital has to select reports related to degree of severity and manage them in the quality committee. This means they should learn from their errors, but here they fail. That doesn't work within the hospital” (local-level inspector).

Based on the severity of reported errors, the regulator can open cases against medical personnel at an individual level, or against the hospital at an organisational level. Medical personnel can thus be individually liable for errors reported by themselves or others. The local-level regulator collects information to evaluate whether someone is liable and should be sanctioned. The information collection mainly consists of written information such as journals and reports from the involved medical staff and departments. In cases of liability, the case is sent to the national-level regulator who holds the power to sanction. Informants within the regulator find the written information collection satisfactory for evaluating the cases, while informants within the hospital and the patient representative association are doubtful of this investigative practice, characterising it as too narrow and distant:

“They should be out there talking directly to the personnel, doing interviews to get rich information. Employees close to the accident often have the experience and knowledge that could contribute to better learning and understanding of the error. In addition, personnel indirectly involved in the error are not even asked for written information regarding the event. This results in mediocre error investigation, taking too long before the results are available. In the mean time dangerous routines go on” (hospital employee).

The regulator performs two types of inspections: Planned system revisions (all hospitals yearly) and event-based inspections (reactive response to reported errors or suspicion of insufficient practice). The planned system revision involves document analysis, meetings, and interviews and results in an inspection report that documents deviations and demands for correction. In the regulator's opinion, Norwegian hospitals in general apply inspection reports only to a certain degree to improve safety at an organisational level:

“The hospitals are not learning organisations and it is quite unbelievable. It's like they're happy that they're neighbour departments are caught and not themselves. Instead we want the hospital as a whole to read the inspection reports and correct deviations often current in all departments. Today, we write good reports but we don't get the hospitals to read them” (manager, national-level regulator).

In addition to enforcing the legislation, the regulator is supposed to give advice to the healthcare organisations to promote patient safety. Such activities are not predominant in the current study. Two regular meetings a year without a fixed agenda other than information exchange are held between regulator and hospital. Furthermore, the regulator does not seem to play an important role in the hospital's feedback and learning from errors. There was little knowledge of participation by regulators in knowledge transfer between hospitals or training activities to improve competence within error management. Several informants within the regulator see the advice part as important, since it involves dialogue and discussions without fixed answers, trying to encourage the hospital to find its own solutions. Despite this, the tendency during the last few years has been a clearer

¹ In addition to the Board of Health and the Chief County Medical Officer, the Directorate of Labour Inspection enforces legislation concerning health, safety, and environment for hospital employees.

separation between the inspector role and the advice role. Informants are worried about mixing roles and becoming biased:

“It is obvious that it is difficult for us as a regulator to give advice and at the same time be a regulator, but we are supposed to do both. We can give advice in matters of internal control, juridical matters and patient rights. Usually, these advices are given in relation to an inspection” (local-level inspector).

4.3 Hospital level

Healthcare reforms have changed the framework conditions for the case study hospital. According to the annual report from the local regulator, the hospital is underfinanced compared to other regional hospitals. In the period 2002 to 2004, the health region had operational budgets about 10% lower per inhabitant than the national average. This demanded that the hospital optimize production and increase efficiency and patient flow. The number of errors reported to the regulator during the last three years has indicated a falling tendency, resulting in an assumption of less safety focus at the hospital. Meetings between the local regulator and hospital managers were held, focusing on error reporting and learning from errors. Regulator representatives expressed their worries concerning obvious underreporting, since information from other channels (media, police, phone calls, complaints) indicated a higher number of factual errors than the hospital reported. One of the hospital top managers explained his view after the regulator-hospital meeting:

“Well, I have lived in a world believing we were quite good at error reporting. But the regulator claims there exists an underreporting. We must get this in order and communicate to the employees that they must report. The other thing they are preoccupied with is the learning loop on reported errors within the divisions and the quality committee. We haven’t been especially preoccupied with managing errors within the quality committee, but I recognize that the regulator is, so we have to keep this in mind and get it in place” (top manager, hospital).

At the hospital level, patient safety and quality improvement has been emphasized as an area of priority to promote patient safety as a competitive advantage:

“We focus on safety and quality. It’s going to be our competitive advantage to get patients in the future. I believe patients will choose hospitals according to treatment survival rates” (top manager, hospital).

Putting safety on the agenda has been perceived positively by the hospital employees, but specific results and activities are asked for. One example has been the introduction of an electronic error reporting system (EERS) that replaced the former written error reports. The former system was characterized by statistical exercises rather than learning processes. The intention behind the new EERS is to gather information and manage errors close to where they occur, to investigate active and latent errors, and to implement preventive measures. Informants characterized the new system as not properly implemented, with insufficient or no training. This resulted in a program of training “super users” within different parts of the organisation to spread knowledge of the system use. Further, the EERS was originally developed for the oil and gas business. Transferring it to the health care system without sufficient adjustments resulted in underreporting and frustration after the implementation:

“The EERS hasn’t worked good enough and it is not made for our system. I know that for my division, and I believe it’s current for all other divisions as well, it exists an underreporting of errors during the implementation phase. The system was “perfectly” introduced: here you’ve got it! Then the people involved disappeared, the training was not taken care of and we still struggle with it. You can’t just throw a new system into the organisation. I haven’t seen any training. We have super users, but this is established in theory and doesn’t work in practice. Of course this worries me because I have insufficient knowledge of the errors in my division” (division manager).

4.4 Managerial level

Changes in hospital financing and demands to reduce waiting lists have caused several changes at the managerial level, and the focus on economy, production and competition continuously influences decisions affecting the medical personnel. These changes are considered to have the potential to create a new set of emerging risks:

“It is one of the greatest challenges, I won’t call it a risk, but it can turn out to be one. It’s a challenge for us to deal with the yearly increase in patient volume, within the same buildings, and with no increase in total resources” (HSE manager).

The organisational changes have been challenging and caused internal conflicts. The hospital management encourage all divisions to report errors and prioritize patient safety, yet simultaneously express the importance of cost savings and budget balance. This compound pressure causes conflicts and limited time to error reporting, follow-up, and feedback to the involved medical personnel. Department managers refer to the pressure for budget

balance and express feelings of powerlessness and worries about understaffing and corridor patients due to lack of space:

“...there is a higher focus on deviation from budget, than on deviation from safety...” (middle manager).

In other words, the hospital organisation has limited resource slack (time, personnel, economy), and in practice, patient safety loses against budget balance. The hospital is organised to manage normal daily work operations, but has low reserve capacity to manage activities outside the short-term production perspective, such as error reporting, feedback, and training. These cross pressures are more present at the divisional and departmental level, since error management and the implementation of new routines and procedures to prevent errors are delegated to managers at these levels.

Different practices related to error management exist across divisions and departments. Results show a low degree of experience transfer concerning error management between divisions, and the quality committee that is formally responsible for this experience transfer is regarded as not fulfilling its obligation.

4.5 Staff level

Almost all informants at the staff level had experience with errors and believed errors occurred more often than were formally reported. Several types of errors were repetitive and not prevented, and the informants agreed that stress and work pressure had a negative impact on the error rate:

“I think there is a large number of errors, probably every day. An example of a repetitive error type is giving the wrong medication to the wrong patient” (assistant physician).

Underreporting is a challenge within the hospital. Most informants believe underreporting exists, which is confirmed by numbers from a psychosocial environment survey carried out in 2004 (Holte et al., 2004). Its results showed that 10.8% never report, 6.6% seldom report, 17.2% sometimes report, 44.3% usually report and 21.2% always report errors.

Informants referred to an open culture for discussing errors, but said that such discussions usually were characterized by informal person-to-person communication. Near misses were even more seldom discussed. The openness for discussing errors was to a certain degree hampered by fear of a negative response to error reporting, such as a feeling of awkwardness, loss of reputation, or media coverage. The results also indicated that collegial cover-ups occurred, especially among physicians.

Practices for error reporting varied between occupational groups, as did the perception of what should be considered as reportable errors. Physicians were not especially preoccupied with error reporting, and they did not view errors as a precondition for learning. Among the nurses, there was more systematic training related to error reporting, resulting in a higher degree of reported errors:

“Nurses definitely report the most, partly because they have a lower threshold to do so, and partly because they are more aware of these things” (physician).

The results of an analysis of written error reports within two hospital divisions show that nurses reported 65% of the total amount of errors. Compared to other occupational groups, physicians reported 4.6 %, auxiliary nurses 5.5 %, and bioengineers 9.5 %. Nurses are by far the largest occupational group at the hospital, so based on the numbers, one could not conclude that nurses commit errors more often than others. The difference between occupational groups is rather a result of different risk perception, different thresholds to report, and different reporting cultures. According to the informants, analysis and feedback on reported errors also varied, and learning from errors was sporadic.

“It would be better if we could see that error reports resulted in something, that it was used. For instance if someone outside the department participated at department meetings, analysed errors and deviations, and explained this to us” (head nurse).

4.6 Work operation level

The nature of medical work implies that risk is continuously involved in the work operations. Patients arrive at hospitals with illnesses or physical injuries and thereby introduce risks that may complicate the work operations. This fact can cause difficulties when comparing safety in health care with other industries:

“Risk is in the nature of medicine because we cut in peoples’ bodies. People arrive with dramatic stuff, serious illnesses that we are supposed to treat with surgery. That is a risk in itself. There is a grey zone where you must

assess if surgery is beneficial or harmful to the patient. You are in focus, and the results of your professional assessments always appear after your actions. If you choose not to do surgery and the patient dies it might be blameworthy, and if you choose to do surgery and the patient dies it might be blameworthy as well. That is probably why we receive complaints, because expectations to the results are unrealistic” (division manager).

To get a picture of the frequency, severity, and types of errors in medical work operations, the written error reports within two hospital divisions (approximately 500 employees in division A, 420 employees in division B) were analysed. During the years 2003 and 2004, 894 errors were reported at the two divisions, corresponding to 0.52 reports per employee in 2003 and 0.45 reports per employee in 2004. The reporting frequency was slightly higher within division A than within division B. Table 2 shows the distribution of reported errors related to degree of severity at the two hospital divisions.

Severity degree	Division A		Division B	
	2003	2004	2003	2004
Unnatural death	2	4	1	1
Considerable injury	15	17	5	3
Less serious personal injury	86	127	58	53
Incidents that could lead to injury	199	115	88	74
No severity degree registered	15	13	11	7

Table 2. Reported errors related to severity degree at two hospital divisions.

The table shows eight unnatural deaths at the two divisions during 2003 and 2004, and 40 considerable injuries. The following error types were identified on the basis of the 894 reported errors: Patient falls (66%), medication errors (16%), lack of patient identification (9%), complications (7%), infection (1%), and equipment damage (1%). Only minor differences were identified amongst the two hospital divisions regarding severity degree and error types. The substantial number of reported patient falls (66%) compared to other error types was explained by the harmlessness of the error type and the difficulty in preventing patients from falling.

5. LEARNING INTERFACES

In summary, the contextual descriptions of the health care risk management system have revealed that learning from errors is sporadic, individually based and occurs separately within the system levels, with limited knowledge transfer and activities between system levels (Department of Health, 2001; Donaldson et al., 2000; Edmondson, 2004). In the following section, we highlight some of the most striking learning conditions and interfaces in our study.

5.1 The effect of changes at the governmental level

The healthcare system’s ability to prevent and learn from errors was negatively affected by reforms initiated at the governmental level. Structural reforms concerning hospital financing and institutional management altered important framework conditions at all system levels. The reforms resulted in a cross-pressure concerning production, efficiency and safety at hospital, management, staff and work operation levels. The effects were time pressure, stress, increased workload, and understaffing (Bone, 2002), with a negative impact on the learning conditions within and across system levels. Studies of the UK National Health Service (NHS) showed similar results, stating that, although the UK government has given clear messages that safety takes priority over other goals, this goal is simultaneously subverted by the inadequacy of funding provided for the NHS (West, 2000).

5.2 The regulator–hospital interface

The regulator-hospital interface has a formally stated purpose of ensuring safe healthcare delivery and preventing errors, but in practice, the regulatory level has limited impact on learning from errors at the hospital level. There is a limited degree of feedback from the regulator to the hospital, management, and staff levels in cases of error reports. The hospital applies inspection reports only to a certain degree as a means for learning across divisions and departments. We claim that the control focus within this interface, and the individual focus usually taken in investigation and reactions, hamper openness, discussion and reflection related to errors (Johnstone & Kanitsaki, 2005; Morath & Turnbull, 2005; Reason, 2000). Furthermore, the regulator-hospital

interface is characterized to a large extent by written information exchange, such as error reports, inspection reports and investigations. From a learning perspective, this does not foster reflection on, or discussion of, the error prevention processes (Hansen et al., 1999; Wiig & Lindøe, 2007). The regulator expressed concerns regarding the combination of advice and regulation tasks, fearing a loss of reputation and trustworthiness. In this study, this resulted in a lack of experience transfer initiatives from the regulator, for instance from other hospitals in the region.

5.3 Error reports as an upward feedback system?

Ideally, error reporting systems should be viewed as learning mechanisms giving feedback on active and latent errors at the work operation level to all upward system levels in order to apply improvements and/or changes. Today, the error reporting system more or less focuses on statistics and is not systematically applied in feedback processes or proactive searches for new risk sources and prevention of errors across system levels (Kohn et al., 2000). The newly-introduced electronic error reporting system within the hospital is not yet working properly and causes frustration, underreporting and difficulties in learning from errors. Thus, errors, if reported and managed, only have an impact close to where they occurred, resulting in local corrections and new routines. Individuals may learn and adjust their practice, but the learning processes occur in a vacuum (Leape, 1994; 2005).

5.4 A multi-level individual focus

Our results indicate that a blame culture (Firth-Cozen, 2001; Johnstone & Kanitsaki, 2005; Mulcahy & Rosenthal, 1999; Reason, 2000) is still institutionalized in the Norwegian healthcare system. This promotes an individual focus in cases of medical error and causes learning difficulties within all system levels. According to legislation (governmental level), the ability to sanction at the individual level are much stronger than at the organisational level. Furthermore, investigation in cases of errors (regulatory level) is individually focused to a large extent, and there is an overweight of sanctions against individuals, compared to the organisational or system levels (Norwegian Board of Health, 2006). At the hospital level, error prevention work tasks are delegated to management and staff levels, distributing the responsibility to lower levels (Carthey et al., 2001). Additionally, media focus is often related to the individual healthcare employee, contributing to their fear of media coverage and negative reactions. At the staff level, an open climate to talk about errors has a positive effect on learning processes, but is negatively influenced by collegial cover-ups and fears of negative reactions and bad reputations.

6. CONCLUSIONS

Our multi-level case study in Norwegian health care has shown that different system levels are dependent on each other in the process of error prevention. Healthcare reforms constitute framework conditions that complicate error management, and the blame culture characterising the healthcare system counteracts learning from errors. The systems for error prevention and learning from errors are fallible, due to imperfections at all levels. Fallible humans are prone to cultural aspects such as underreporting and occupational differences, organisational aspects such as workload and error reporting demands, and societal aspects such as healthcare reforms' demand for higher production and an individualistic control system.

6.1 Implications for health care

Our study has shown that the premises on which error prevention in the healthcare system are based, and the processes of importance for error prevention, are all top-down driven, accumulating expectations and strain towards the lower levels of the system (staff and work operation). To prevent errors in health care in the future, we believe that bottom-up structures and upward feedback mechanisms should be strengthened. Error preventive needs and constraints should be clarified at the work operation level and communicated to all upward levels for responses and measures. We recommend the following areas of priority:

- Performing safety impact studies prior to future healthcare reforms.
- Introducing person-to-person approaches in regulatory error investigations.
- Prioritizing the advice role within the regulatory level.
- Developing measures to counteract the focus on individuals relative to errors.
- Conducting searches for emerging risks and trends based on error reports.
- Developing measures to support and integrate electronic error reporting in work operations.

6.2 Further research

Further studies are needed to explore the multi-level error prevention system in health care. We suggest the following focal areas for future research:

- The study of knowledge brokers (Wenger, 1998) or the interface between clinical microsystems (Mohr et al., 2004) or communities of practice (Brown & Duguid, 1991; 2001) across different levels of the health care system.
- The study of informal or mindful learning practices (Weick, 2002; Aase et al., 2005) within single system levels to develop common learning features across levels.
- The study of conflicting goals or cross pressures between efficiency and safety (Bone, 2002; West, 2000), and the study of safety consequences as a result of changes at different system levels.

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