Incidents in accident and emergency and anaesthesia

Eindhoven
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Research Report

FACULTY OF TECHNOLOGY MANAGEMENT

Incidents in Accident and Emergency & Anaesthesia

by

Wim van Vuuren

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1. Introduction

In this report the results of a three month research project into the causes of incidents in Accident & Emergency (A&E) and Anaesthesia are briefly discussed. The project was carried out in two large teaching hospitals in England and was part of my PhD research into the organisational causes of safety related incidents. Part of this PhD research has been carried out in the Dutch steel industry, part in the medical field. This report will **not** focus on the contribution of this three month project to my PhD research, but on the lessons that can be learnt from the collected data by the hospitals involved.

In this report the results of the PhD project of dr. Christine Shea, currently working for the Safety Management Group at the Eindhoven University of Technology, will also be included. During her project in the same A&E department, she also collected a large number of incidents, which were analysed in the same way. These initial results will be compared with the results of this follow up project, to find out if the same strengths and weaknesses are detected. Together they will give a solid basis for the conclusions for the A&E department in the last section of this report. Conclusions for Anaesthesia will only be based on the findings of the latter project.

Before discussing the results, I want to spend a few pages on the use of incident reporting. During this project it became clear that incident reporting is not universally considered important. Some reasons for this belief are understandable, most are based on a misunderstanding of the concept of incident reporting. Hopefully these pages can make a difference.

I want to thank everyone in the hospitals who has made a contribution to the success of this project. Without your help this project would not have been possible. I also want to thank Prof. N.C. Boreham, Department of Education of the University of Manchester, for his efforts to get access to the hospitals, and for his constructive support.

2. Incident reporting

2.1 The present situation

When I think back to the incidents that were reported to me, I come to the conclusion that only a few doctors reported incidents. This might give the impression that only a few doctors were involved in incidents. I don't think this is the case. Both doctors in A&E and Anaesthesia have to work in a complex system, under high pressure, and with serious organisational constraints. This report will give some insight into these constraints. There is no doubt that this will lead to numerous incidents, of which fortunately the vast majority can be prevented from developing into actual consequences for the patient. Why then are these incidents left unreported? Informal discussions gave some insight into this issue.
A&E departments are mainly run by senior house officers (SHOs), with only limited practical experience. Most SHOs therefore have difficulties in detecting incidents, because they don't know what is acceptable or not. Detecting deviations is only possible if you know what the standard is. One SHO once said "for me all the cards that I take from the box are problems". How can you expect this SHO to detect minor incidents. The majority of the incidents were therefore reported by more experienced doctors.
Another problem, which you find almost everywhere, is that some doctors don't see the use of incident reporting. This is mostly the problem of the more experienced doctor. Based on experiences from the past, they claim that nothing will ever change. So why all the effort? They already work many hours a week, and therefore don't need another time consuming job. However, by saying that nothing will ever change, indeed nothing will change. One must collect evidence to support change first.
The third problem is already mentioned: time. Incident reporting and analyses can take a lot of time, which medical staff don't have. Also the right amount of expertise is needed to perform the right steps, to draw the right conclusions, and to provide the right kind of feedback. All factors are lacking in the contemporary A&E and Anaesthesia department.
The last possible problem I want to mention is the fear of consequences related to a reported incident. Incidents can be used to blame the person involved, or to question the doctors qualities. Only one negative example is needed to kill the reporting spirit effectively.

2.2 How it could be

Incident reporting is more than a just another time consuming job, or something that is legally motivated. There is a lot to gain from it. One issue is mentioned already. Incident reporting can be used to make changes. However, before you are able to convince management that something must change, you have to collect evidence to support your claim. The first thing most managers will say when they are asked to change something for the sake of safety is "I haven't seen any incident reports that show that what you are saying is dangerous". With a database of incidents this excuse can never be used again. Incident reporting is therefore about collecting evidence to support change.

A more important aspect of incident reporting is the ability to gain insight into the incident causation process. Incidents can only be prevented effectively if you understand the processes that lead to them. It is easy to predict and prevent errors, because many errors take on

predictable forms and are expressed in known ways. However, a single error will rarely ever lead to an incident. Incidents are the product of multiple factors, and sometimes unlikely coincidences. Preventing single errors therefore only makes incidents less likely to happen, but does not give any guarantees. Incident reporting is therefore about understanding the incident causation process.

Proper in-depth analysis of incidents will show why incidents happened, rather than what happened. It will also show the mechanisms that prevented incidents from evolving into actual accidents. Both insights, the incident causation process and the recovery mechanisms, are crucial in the drive to achieve a safer system. Incidents can be prevented from happening by both removing the failure causes and promoting the recovery possibilities. Proper incident reporting and analysis makes it therefore possible to take the most effective and most efficient counter measures.

2.3 Implications

Successfully implementing an incident reporting system is not easy, and requires expertise, time and effort. Time in particular is something that is in short supply in the medical field. In most hospitals doctors are required to implement incident reporting systems themselves, without any backup, or extra time and resources. With patient care as their first priority, these restrictions will never lead to a system that is used to its full potential. Therefore the first step to a successful incident reporting system is management support in every possible way. It is not enough for hospital management to say that they want doctors to report all incidents that happen. They have to provide them with time, money and expertise to make this possible. Only when there is time and expertise to deal with incidents in the right way, can an incident reporting system function successfully.

The second step which is mentioned already is anonymity, or a no-blame policy. Incidents should only be used as a learning opportunity for everyone, not to blame individuals who were unlucky enough to find themselves at the centre of a web of numerous failures culminating in an incident. Blaming people for the incidents they have reported will only kill the reporting spirit, and with that definitely kill the system. By doing this, all learning opportunities will be lost.

Perhaps one of the most important steps, which is frequently neglected, is to provide proper feedback to all involved. Only by explaining the types of causes that result from the analyses, the actions that are taken and why, will the system serve as a learning tool. This is also the only way to keep people motivated to report incidents, because it shows that changes happen based on their input.

3. Results in Accident & Emergency

3.1 Introduction

During the three month follow up project 19 incidents were analysed. It would have been possible to analyse more incidents, because many more incidents were reported. However, a selection was made to obtain different types of incidents instead of numerous similar incidents (e.g. missed fractures on x-rays). The first priority of this project was to gain insight into the types of causes of incidents in an Accident & Emergency department, not to get a perfect overview of all the incidents that happen. To get an insight into the strengths and weaknesses of the department a perfect overview is also not necessary. This insight can be obtained by analysing the causes of a representative subset of incidents.

For the follow up project two sources of input were used. The main source of input was the casualty card (cascard) review by one of the two consultants. Every time a card was found which showed a mistake, or an incorrect or sub-optimal treatment, this was reported. Based on this input interviews were performed with the doctors involved, to obtain all the causes leading to the incident. Besides input from the cascard review, incidents were reported directly by the doctors. Again interviews were performed to obtain all the necessary information. Based on the interview results, causal trees were built and root causes were analysed and classified.

In this chapter the results, based on the causal trees and the root causes, will be discussed. Also the data collected in the initial study by Shea during her stay at the same department will be included in this chapter, and compared with data the data of this follow up study. The initial data has been reclassified according to the model used in this project, to make a comparison possible.

3.2 Results follow up project

This project has resulted in 19 incidents, containing 93 root causes, giving an average of 4.9 root causes per incident. Of these 93 root causes, 28 originated outside the department and are therefore beyond the control of the department (e.g. misdiagnoses made by radiologists or priorities of other departments). Because the aim of this project is to gain insight into the failure factors within the A&E department, the main focus in this report will be on the 65 internal root causes. These are also the most interesting factors for the department, because these are the ones the department can control. The external causes will be briefly discussed in the last section of this chapter.

Table 1 shows that of the 65 internal root causes the majority (45%) are organisational, closely followed by the human causes with 37%. Technical causes are negligible, and 15% of the root causes are unclassifiable. These appear to be predominantly patient related factors which are beyond the control of the doctors (e.g. physical or mental state of the patient).

	Technical	Organisational	Human	Unclassifiable	Total
Number of root causes	2	29	24	10	65
Percentage	3%	45%	37%	15%	100%

Table 1: Distribution of root causes over main categories in follow up study.

The fact that there are rarely any technical problems is not surprising. The majority of the work has to do with making the correct diagnosis and performing interventions, so that a patient can be referred to the right department for further treatment, or sent home. Technical equipment is rarely used in this process and existing equipment is very reliable.
The analysis of the organisational and human root causes showed that there are some structural problems. Of the 29 organisational root causes, 12 are related to a lack of knowledge and experience. New SHOs in particular have problems with reading x-rays, making the correct diagnosis, or prescribing the right type of drug. For most of the SHOs involved in this project it was their first job as a senior house officer, and therefore their first real practical experience. The fact that there is limited senior staff available, and only during day time, makes it also almost impossible for these SHOs to deal with this knowledge problem successfully (e.g. asking a senior doctor for advice).
Of the 24 human root causes, 7 are related to checking and 11 to work planning. Because of the high waiting times in the department, SHOs try to process patients as quickly as possible. This sometimes leads to forgetting certain steps, which actually need to be taken (e.g. forgetting to look at all the x-rays, or forgetting or omitting to do certain tests). An incorrect diagnosis is the most common consequence of these errors.
The unclassifiable, or patient related factors mainly have to do with the physical or mental state of the patient (e.g. patient being drunk or very violent). Although they are beyond the control of the doctors, they can seriously influence the diagnosis. Poor communication skills of patients can also make the diagnostic phase very difficult.

3.3 Results initial project

In the initial project 26 incidents were analysed, containing 127 root causes, giving an average of 4.9 root causes per incident. Again part of these root causes originated outside the A&E department and will therefore not be included in this study. In total 91 root causes originated within the A&E department. Table 2 shows a similar pattern as table 1.

	Technical	Organisational	Human	Unclassifiable	Total
Number of root causes	2	44	40	5	91
Percentage	2%	48%	44%	6%	100%

Table 2: Distribution of root causes over main categories in initial study.

Again most of the incidents can be explained by looking at the human and organisational causes. Of the organisational causes a lack of knowledge and experience is again the main problem (13 out of 44 root causes). But a lack of protocols is also considered to be a significant problem (11 out of 44 root causes). This is not very surprising, because one way to deal with knowledge and experience problems is to provide inexperienced doctors with protocols which can be used as guidelines. So this second problem is mainly a consequence of the previous one.

The human causes are similar to the ones described in the previous section. Failures in work planning (15 out of 40 root causes) and checking (10 out of 40 root causes) are considered to be the main problems. Again the high workload is the main reason for these mistakes.

3.4 Combined results

The combined results as shown in table 3 just strengthen the conclusion of the previous two sections, without adding new insights. Both studies show the same type of root causes, and stress similar problems. Knowledge and experience problems at the organisational level (25 out of 73 root causes), and work planning (26 out of 64 root causes) and checking (17 out of 64 root causes) at the human level are shown to be the main precursors of incidents in this Accident & Emergency department.

	Technical	*Organisational*	*Human*	*Unclassifiable*	*Total*
Number of root causes	4	73	64	15	156
Percentage	2%	47%	41%	10%	100%

Table 3: Distribution of combined results over main categories.

3.5 External factors

Of the 64 external root causes, 29 deal with priorities of hospital management. Consequences of these priorities, that influence day to day practice in the A&E department, are mainly staffing problems (not enough senior staff) and bed problems (the continuous closing of beds on the wards). Most knowledge and experience problems could be solved by having more senior staff around to help and advise the SHOs. Due to the shortage of beds in the hospitals, most patients have to wait for hours to be admitted, leading to an increased workload for A&E staff, contributing to other internal problems.

4. Results in Anaesthesia

4.1 Introduction

During the three month project (only) 15 incidents were reported and analysed. Half of them were reported directly to me, half of them were reported through the existing incident reporting system. Perhaps if the hospital could have been visited more frequently, the number of reported incidents would have been higher. However, it does give a correct representation of the number of incidents that are currently reported. Despite this limited number of incidents, the results can be used to get a first insight into the distribution of root causes in this department. Hopefully this insight will lead to improvements and an increasing interest in reporting and analysing incidents.

4.2 Distribution of root causes

The project in Anaesthesia has resulted in 15 incident descriptions, containing 79 root causes, giving an average of 5.3 root causes per incident. Table 4 shows that the majority of root causes are human (38%). However, both organisational (28%) and technical root causes (27%) play a significant role in the incident causation process as well. The remaining 7% of the root causes are unclassifiable, which means that they are patient related and therefore beyond the control of the doctors involved.

	Technical	*Organisational*	*Human*	*Unclassifiable*	*Total*
Number of root causes	21	22	30	6	79
Percentage	27%	28%	38%	7%	100%

Table 4: Distribution of root causes over main categories in Anaesthesia.

At this point it is not possible to draw conclusions based on the collected data. With only 79 root causes, and 23 possible categories (within the main categories technical, organisational and human) to classify them in, it is impossible to talk already about structural problems. However, it is possible to give some first impressions based on these incidents. The remaining part of this chapter will give some of these first impressions.

The majority of the technical problems are design related. On different levels the design of equipment can lead to problems directly (e.g. a superfluous power switch on a switch board next to the light switches), or influence the behaviour of the person using this equipment (e.g. all the new and extra graphical displays and alarms on the new anaesthetic machines). Mismatches between equipment and user need to be documented and evaluated. Only this way a situation can be reached where equipment will fit the needs and expectations of the user, reducing the number of mistakes.

The organisational root causes are equally divided between problems related to the structure of the organisation, problems related to safety culture, and problems related to management priorities. Structural problems involve the absence of protocols, and a poor transfer of knowledge and experience. This can lead to problems in the decision making process of the

anaesthetist. Particularly in critical situations, this can be extremely dangerous. Cultural problems are mainly related to attitudes towards following safety procedures. Every anaesthetist told me that "when everything goes right, anaesthesia is boring". This lack of 'excitement' can easily lead to a situation in which safety procedures are taken less seriously. When nothing ever happens it is hard to stay fully alert, and easy to reduce vigilance. Management priorities are mainly focusing on reducing costs, mainly resulting in equipment problems (availability, or quality of equipment).

The two most predominant human errors are forgetting to check the system before using it (e.g. leading to problems in ventilating a patient), and slips and lapses in the planning of work (e.g. forgetting to use an airway to protect the tube against biting on it). Forgetting to check the system is considered a human error at this stage. One should do it, and this is known to everyone. However, when it appears that no one checks the system before use (e.g. because nothing is ever wrong with it), it has progressed into a cultural problem as described earlier. There is not enough data to support this yet, however it is important to know for sure before taking any counter measures. Cultural problems are not simply solved by training anaesthetists in following safety procedures.

The unclassifiable root causes are patient related, and therefore beyond the control of the doctors involved. A good example is the case of a morbidly obese lady for whom it was impossible to check if both lungs were ventilated. The size of the lady made it impossible to hear or see the functioning of the lungs. Although the anaesthetist cannot influence the physical characteristics of a patient, it sometimes does influence treatment. Therefore it is also important to report these types of root causes. Only when failure factors are known, can solution development be started.

5. Discussion

5.1 Accident & Emergency

As mentioned in the chapter 3, the cascard review by the consultants was used as one source of input in this follow up project. Based on the incidents detected this way, interviews were performed with the doctors (mainly SHOs) involved. Instead of feeling 'attacked from behind' the SHOs really liked this approach, because this way they received a kind feedback they would normally never get. Particularly in the first few months of their six month rotation, they can use every possible learning opportunity. The reason for this lack of feedback is completely time related, and therefore difficult to solve with the present staffing levels. However, it would be worthwhile to discuss some of these cases in the weekly training sessions.

After the second month it became clear that everyone was focusing on the 'product' only: a happy patient who in the end receives the best possible treatment. However, by focusing only on the product, many learning experiences are missed. If one wants to learn about the strengths and weaknesses of the contemporary A&E department it is also useful to look at the process: what does it take to get to the final product? In the end, almost every patient gets the best possible treatment. However, the process to get to this point is often full of mistakes and problems. Fortunately they are usually dealt with successfully. Neglecting the process aspect means that all these learning opportunities are missed, and that the department is completely relying on its current defence mechanisms, without improving the process.
Product and process incidents are also very likely to have different causes. Product incidents (e.g. prescribing the wrong drug) are most of the time related to the knowledge and experience of the doctor. An incorrect diagnosis is made, or an incorrect treatment is suggested. Process incidents on the other hand (e.g. an anaesthetist doesn't show up in time) are mostly related to communication problems, inter-departmental differences, etc., and often beyond the control of the doctor involved.
Ignoring one type of incident therefore automatically means ignoring certain types of causes. Effective improvements can only be made if all causes leading to incidents are considered.

It is clear that on the organisational level most incidents in A&E are related to a lack of knowledge and experience of SHOs. Senior staff mainly work 9 to 5, while the SHOs have to cover the whole 24 hours. This means that they are on their own for most of the time, with no real possibility to consult a senior colleague. With the limited knowledge and experience of the SHOs this very often leads to mistakes, or sub-optimal treatment. There are several causes of this knowledge problem, of which most are beyond the direct control of the department. One problem is the national training system of SHOs. SHOs work on a six month rotation, which means that they change departments every six months. For the department this means that every six months they get a new group of inexperienced doctors (at least for that speciality), and by the time they have gained the necessary experience they leave again, and the department has to start all over. It would for example be much better to have some overlap in the rotation of SHOs (e.g. change half every three months, so only half the group is completely inexperienced). If there is no senior staff available to supervise inexperienced SHOs all the time, it would be better to have some 'senior' SHOs to take up this responsibility. This of course makes the assignment of SHOs to different departments much

more complicated and requires a change in the training system within the department, but would definitely increase the average knowledge level of the SHOs in the department.

Another problem is time related. SHOs have to start immediately, and training has to take place while doing the job. There is no spare time available to spend on training before they start working. Training sessions are weekly, but are short because of the high work load, and not accessible to everyone because of the 24 hour shift system.
It is unlikely that the rotation system will change. Also it is very unlikely that in the near future there will be more time available to train the SHOs. One can only evaluate the training approach that is currently used. Most of the knowledge and experience problems could be solved by having senior staff around 24 hours a day, so that there is someone around to ask for advice.

On the human level most incidents in the A&E department have to do with haste. Because of the high workload most SHOs feel a certain pressure to process patients as quickly as possible. This feeling is completely understandable when you are frequently confronted with a five hour waiting time in the waiting room. However, haste commonly leads to slips and lapses which can have serious consequences when you are dealing with patients. Particularly in the medical field, quality is more important than quantity. Adding senior staff to the department would also solve part of this problem. Due to their knowledge and experience, senior staff are able to process patients more quickly, and are therefore able to decrease the waiting times.

The external factors appear to be mostly money related. The easiest way for hospital management to cut expenses is to close beds on wards, and to reduce the number of senior staff. The incidents have clearly shown that there is a toll to be paid for this behaviour. However, how many more incidents are needed to convince hospital management that they are not only decreasing their expenses, but also their safety performance?
I want to conclude this subject with another external factor that has not been mentioned, but that definitely deserves some attention. During the follow up project in the A&E department it became very clear that A&E doctors are regularly considered to be inferior by doctors of other departments. Too often this attitude leads to unnecessarily questioning the opinion of the A&E doctor. In most cases however, the A&E doctor is most capable of making the correct diagnosis. A&E doctors have to deal with all different types of problems every day, and therefore often have broader experience and greater perspective than specialists focusing on specific types of care and treatment. The scope of specialists of other departments is often limited to their own speciality. Considering A&E as inferior shows a clear lack of knowledge about what occurs in this department.

So far this chapter might have given the impression that A&E departments are dangerous places to go to. The reverse is true. Although there are weaknesses that are open for improvement, the system has several in-built recovery mechanisms to prevent these weaknesses from developing into actual negative consequences for the patient. Particularly in organisations where improvements are hard to accomplish (because of financial restrictions, departmental differences, etc.), promoting recovery mechanisms can be an effective alternative. I want to mention three of these mechanisms within the A&E department, that definitely have a positive effect on safety performance.
The first one is team work. Within the A&E department consultation with other A&E doctors while on the job, particularly in doubtful cases, is encouraged. Because everyone gets together

in the duty room to write their cascards, it is easy to discuss patients, look at x-rays together, or decide what drug to prescribe. Many mistakes are prevented this way.
The second mechanism is the cascard review. Although it could be used more effectively as a learning tool, it definitely serves as an effective safety net. As was stated before, because of a lack of knowledge and experience, SHOs regularly make incorrect diagnoses, prescribe the wrong drug or suggest an incorrect or sub-optimal treatment. Most of these mistakes are detected the next morning by one of the consultants during the cascard review. In the vast majority of these cases it is then still possible to correct the mistake without serious consequences for the patient. Most patients view this post-hoc recovery as 'extra care' and not as sub-optimal recovery.
The last one is the daily review clinic by the consultants. A&E, like many other departments, hold a review clinic in which follow-up is given for certain types of problems, although this is beyond the primary aim of the department. SHOs can use this review clinic as a safety net in doubtful cases. Particularly at night SHOs can, if immediate treatment is not necessary, refer doubtful cases to the review clinic next morning. This way the treatment is delayed for a few hours, but the patient is given the best possible care.

5.2 Anaesthesia

Again it is emphasised that for this department not enough data was collected to draw solid conclusions. Incident databases are meant to prevent people from jumping to conclusions, based on single incidents. It is therefore not my intention to make this mistake in this report. However, the data definitely gives a first insight into possible strengths and weaknesses of the system. It also shows the different types of causes that are involved, and how combinations of technical, organisational and human factors lead to incidents. Not only human and technical factors are involved, but also organisational and patient related ones.

The data also shows the usefulness of proper incident analysis. So far the audit reports of the department have mainly focused on symptoms of incidents (what?, where?, when?, who?), and rarely on the processes behind the incidents (why?, how?). Focusing on symptoms is not very useful because similar incidents can have completely different causes. Only by analysing the causes of incidents the real strengths and weaknesses of a system will be detected.
The audit reports are also solely based on the brief descriptions on the incident form, without performing any additional interviews. It is dangerous to think that an incident description can be interpreted completely, based on own experiences as an anaesthetist. Failure factors occur in numerous, unknown, and unpredictable ways. Only additional interviews can give insight into the incident process, and the root causes involved.

5.3 A&E and Anaesthesia compared

Looking at the results, there is an interesting difference between both sets of data. In Accident & Emergency the vast majority of root causes originate on an organisational or human level, while in Anaesthesia the causes are almost equally divided between the three main failure categories (technical, organisational and human). This result was expected considering the task characteristics of the two departments. As mentioned already in chapter 3, technical equipment is rarely used, or very reliable in Accident & Emergency departments. Major problems on a technical level are therefore unlikely. In Anaesthesia on the other hand, a lot of

technical equipment is used to anaesthetise and monitor the patients. Often this equipment is shown to be poorly designed or unreliable. The differences in organisational causes can be explained considering the level of teamwork that is required to perform a task in the two departments. In Accident & Emergency, doctors of other departments are often needed to admit the patient to the hospital, or to help with the diagnosis, leading to all sorts of communication problems or problems related to cultural differences. Also priorities of hospital management (like closing beds to cut expenses) influence the work of the A&E doctors directly. Similar problems rarely occur in Anaesthesia because 'the team', influencing the work in progress, is normally limited to only a few persons. This partly explains why there are less organisational problems in Anaesthesia.
The fact that even with this limited number of incidents this difference is shown, gives an indication about the face validity of the collected data.

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