PATIENT SAFETY IMPROVEMENT WITH CREW RESOURCE MANAGEMENT

Transformation from a blame culture to a learning culture

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SUMMARY

Background
Being able to learn from mistakes is a vital aspect of nurse’s professionalism and increasing patient safety. With Crew Resource Management methodologies, aviation and other High Risk Organisations have succeeded in enabling learning cultures that should be applicable also to healthcare.

Purpose
The purpose was to describe how Crew Resource Management and the inherent learning culture could improve nurse’s professionalism and patient safety within the healthcare system.

Method
A literature overview based on database searches in CINAHL, PubMed and a manual search, resulting in 25 scientific articles analysed using an integrated analysis method and quality review.

Results
Crew Resource Management implementations have a positive effect on the nurse’s professional role and patient safety but have still not reached the full potential. Incident reporting is a key factor in providing feedback but still encounters barriers as a basis for pre-emptive learning. Identified barriers are not using Crew Resource Management components as a whole, a lack of feedback and an insufficient learning culture. Feedback is connected to nurse’s perception and situational awareness strengthening morale and professionalism.

Conclusion
Nurses professionalism and patient safety is dependent on being able to learn from mistakes which is a key aspect of Crew Resource Management. Learning is enabled by the reporting of mistakes in incident reporting systems without the fear of being punished. Improvements to both systems and the reporting culture are seen as needed, as-well as changes to the education system promoting reporting as part of an overall safety and learning culture.

Key words: Crew Resource Management; Incident Reporting; Learning Culture; Patient Safety; Professionalism
# TABLE OF CONTENTS

**INTRODUCTION**............................................................................................................................................. 1

**BACKGROUND**............................................................................................................................................ 1

Patient Safety through nurse’s professionalism ......................................................................................... 1

Reporting systems, blame- and learning cultures ....................................................................................... 2

Crew Resource Management and human factors, a methodology ......................................................... 3

Errare humanum est, Human errors in healthcare .................................................................................... 5

Challenges to incident reporting in healthcare......................................................................................... 7

Incident reporting an implicit component of Crew Resource Management ....................... 9

Problem statement........................................................................................................................................... 10

**PURPOSE** .................................................................................................................................................... 10

**METHOD** ...................................................................................................................................................... 10

Research design ........................................................................................................................................... 10

Selection criteria ........................................................................................................................................... 10

Data collection ............................................................................................................................................. 11

Data analysis and Scientific Examination ................................................................................................. 14

Ethical considerations ................................................................................................................................. 14

**RESULTS** ..................................................................................................................................................... 15

Improvement of nurse’s professionalism and patient safety ................................................................. 15

A learning culture improving nurse’s professionalism and patient safety .......................... 17

**DISCUSSION** ............................................................................................................................................... 19

Results discussion ....................................................................................................................................... 19

Method discussion ...................................................................................................................................... 29

Conclusion .................................................................................................................................................... 32

**REFERENCES** ............................................................................................................................................ 34

**APPENDIX A-B**
INTRODUCTION

Recent statistics (The Health and Social Care Inspectorate [IVO], 2016) show a discrepancy between actual reported incidents affecting patient safety within Swedish healthcare (lex Maria incidents) and patient safety incidents reported directly by patients. The discrepancy shows that actual incidents that should have initiated an internal discrepancy report are either not initiated, or are lost within the current process. This can also indicate the lack of a solution for a structured incident/error reporting system and/or process. The latter have been key success factors within the aviation industry. (International Air Transport Association [IATA], 2012).

An article in Dagens Nyheter (Örstadius, 2016, November 15) highlights the issue of missing/unreported healthcare related incident reporting especially from private healthcare suppliers where a considerable under-reporting has been concluded by comparing the number of lex Maria reports and actual incident reports from patients. The article also states that the Swedish National Board of Health and Welfare has estimated the unreported number of incidents in Sweden that qualify as being lex Maria to be as high as 90 percent.

Both the authors of this thesis have a background within the aviation industry and are pilots. Based on our respective backgrounds, we have during our two initial years of nursing studies gained experiences in this for us, new field, especially during our placements in various departments and wards within the healthcare system in Stockholm. We have jointly observed a difference in the perception and management of incident reporting or possibly more importantly how we perceive incident reporting as being seen as punitive towards a team or as our main topic of interest, individual nurses.

BACKGROUND

Patient Safety through nurse’s professionalism

Patient safety

Florence Nightingale (Nightingale, 1863, referred to in Palmieri, 2010) realised the dilemma of Patient Safety when she wrote; “It may seem a strange principle to enunciate as the very first requirement in a hospital that it should do the sick no harm” (p. 9).

The issue of patient safety has internationally been regarded as an important topic where amongst others WHO (2007) draw attention to inadequacies within the area and have taken the initiative to an increased international cooperation in the field. The Swedish Patient Safety Act (SFS, 2010:659) defines patient safety as under the Act of Law protection against patient injuries. Furthermore, Patient Injury is defined as suffering, physical or psychological injury or illness and death that could have been avoided if adequate measures had been taken during the patient’s contact with health and medical care. According to the Swedish Law Act, known as lex Maria, an incident report should be submitted each time an event occurs that involves a patient being affected by either a serious injury, the risk of serious injury or serious illness as per the Patient Safety Act (SFS, 2010:659). Lex Maria incidents translate to the terms used and defined in the United States of America and the United Kingdom as Never Events and/or Sentinel Events. Within the Swedish healthcare system there is a stated purpose to learn from mistakes and/or incidents affecting patient safety.
This is a grounding principle within the Swedish Patient Safety legislation and involves the Law Act known as lex Maria (SFS, 2010:659). An incident is defined within the general healthcare system as an event and/or circumstance that could result or has resulted in unnecessary harm to a patient. Patient safety related incidents include events that actually cause harm to the patient as well as events that reach the patient but do not cause harm.

**Professionalism**

Dupree, Anderson, McEvoy and Brodman (2011) concluded from their study that professionalism is a necessary factor in creating a culture of safety. The study concluded that with the establishment of a multidisciplinary Code of Professionalism with encouragement from management and supported by healthcare employees as well as nursing unions, the organisational culture of safety could improve and act as the foundation for a safer delivery of patient care.

Professional responsibility is one of the core competencies of nursing and forms the basis of present day nursing. In the publication, The ICN Code of Ethics for Nurses (International Council of Nurses [ICN], 2012) one of the four main principles is stated as “3: Nurses and the profession”. Part of this principle is that nurses as members of a professional organisation participate and have a responsibility to create a positive practice environment, and in doing so maintain safe, equitable social and economic working conditions.

The World Health Organisation (WHO), (2007) defines a healthcare system as; all organisations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence determinants of health as well as more direct health-improving activities. A health system is therefore more than the pyramid of national publicly owned facilities that deliver personal health services. It includes, for example, a parent caring for a sick child at home, private providers, behaviour change programmes, health insurance organisations; occupational health and safety legislation.

**Reporting systems, blame- and learning cultures**

**Reporting system**

In the European Commission Report, *Reporting and learning systems for patient safety incidents across Europe* (2014) a number of key findings and recommendations are made, such as the possibility of anonymous and non-punitive reporting. Several countries, amongst others Sweden have reported to the Commission that systems are in place for both mandatory sentinel event / lex Maria reporting and systems for Root Cause Analysis (RCA) of adverse events/incidents.

WHO (2014) describe as part of their conclusion in the project report *The Minimal Information Model for Patient Safety Incident Reporting*, that the basis for improvements comes from effective reporting systems that focus on learning and fixing errors instead of blaming those involved within a so-called blame culture. A reporting system that is mandatory and rests on sanction free and clear rules of confidentiality.

**Blame and learning cultures**

A blame-culture is characterised by norms and attitudes within an organisation where individuals are unwilling to take responsibility for actions and/or errors based on their fear of criticism or management reprimands (Khatri, Brown & Hicks, 2009).
A learning culture is identified by a leadership actively enabling a two-way communication and where employees and management learn from adverse events or errors by analysing the contributing factors, that might prevent future errors (Kapur, Parand, Soukup, Reader & Sevdalis, 2016; Mitchell, Schuster, Smith, Pronovost & Wu, 2015). Edmondson (2004) further defines a learning culture as a culture where organisations such as within healthcare make a shared or organisational learning of failures and who actively look for the barriers. Edmondson emphasises the critical role of leadership in creating this learning culture or as it is also known a culture of safety. Leaders must actively create a compelling vision that enables change, psychological safety that encourages open reporting, active questioning and frequent sharing of concerns and/or insights. Non-punitive reporting is defined as the communication of faults, mistakes, errors or weak links without the fear of punishment or legal action to be taken against the individual who caused the error. Non-punitive reporting systems provide a basis through which individuals are able to report errors and mistakes without having to fear that they shall be reprimanded after submitting such reports. (European Commission, 2014)

One of the main success factors to increased flight safety over the last decades has been the transformation of the internal culture within the aviation industry enabling an open and honest reporting of mistakes and errors and the willingness at all levels to learn from these mistakes in order to ensure that they are not repeated. With the introduction of Crew Resource Management (CRM) principles, methods and tools, the internal culture within the aviation industry has transformed from a “blame culture” to a “learning culture” (Helmreich, 2000).

**Crew Resource Management and human factors, a methodology**

**Crew Resource Management**

CRM was initiated by the North American Space Agency (NASA) and was further developed within the aviation industry mainly during the years 1959-1989 with improvement work continuing to this day. CRM is today a well-known concept within all international airlines and within all levels of pilot training. Cockpit Resource Management, as it was first known, concentrated on communication when it was discovered that a large number of aircraft accidents in the 1970s and 1980s occurred as a result of non-technical human factor issues such as poor flight deck coordination, poor communication, lacking decision-making and weak leadership (Sharp, 2012). Salas, Wilson, Burke and Wightman (2006) define CRM training in aviation as a package of intentional strategies that have specifically been designed to improve teamwork in the cockpit by applying well tested training tools such as performance measurements, exercises and feedback mechanisms with tested training methods such as simulator training, lecture based education and target these tools and methods at specific content id Est teamwork knowhow, skills and attitudes. Salas et al. (2006) conclude that CRM training has spread to other domains and industries including healthcare and can be regarded in many shapes or forms but is essentially a strategy for team training with a specific focus on team performance and coordination improvements. Oriol (2006) takes the definition a step further and describes that CRM was originally designed to give flight crews the insight and training needed to realise the fallibility of human nature and also to measure the flight crew’s ability in leadership by seeing how effectively they could use the overall capabilities of the available resources or team in an atmosphere of unfettered communication.
The importance of CRM is emphasized in the discipline of Human factors and Limitations within the aviation educational system. CRM focuses specifically on components such as leadership, team working and communication both within the cockpit and other aircraft crew but also externally to and from other organisations and/or controlling organisations such as Air Traffic Controllers. From the outset, the culture and attitude of the aviation education system is based on an atmosphere of learning from mistakes and an open culture of reporting incidents without appointing blame at any level, so-called non-punitive incident reporting (Kapur et al., 2016).

Human Factors and Crew Resource Management within healthcare

Human factors relate to how people function in their living and working situations, their relationship and comfort levels with technology and the environment and about their relationships and interaction skills with other people. The science discipline of human factors is therefore concerned with all the factors that can influence people and their behaviour. The recognition and understanding of these factors is an important aspect of safety as they can be the cause of serious human errors (Civil Aviation Authority [CAA], 2002).

Kosnik, Brown and Mound (2007) suggest that successful implantations of CRM into the healthcare environment hinges on clinical champions who are both knowledgeable and passionate about the application of CRM behaviours and also a culture in which all team members are encouraged to speak freely. This culture enables front-line staff member’s opinions and ideas, giving them equal and non-judgemental acceptance within the overall team and where their options are seen as opportunities for additional information and as a resource. Flin O’Connor and Mearns (2002) follow this line of thought by stating that as in the aviation cockpit where CRM has its roots, the success of any high-risk function such as within the operation theatre is fully dependent on the team within it. The human interface problems found to be responsible for a large proportion of accidents in aviation are likewise similar to problems seen in the operation theatre and are due to human factor issues such as communication, teamwork, decision making skills and interpersonal conflicts. A conflicting view is put forward by Hunt and Callaghan (2008) who warn that the complex environment of medicine not always has an aviation analogy, and therefore an oversimplified belief that aviation style CRM implementations are a blanket answer to all problems without an understanding of the context in which they will operate is a risk. Hunt and Callaghan (2008) sought an understanding of what they call “surgical human factors” comparable but not the same as aviation’s “human factors” and mean that this needs to be recognised and addressed before general “blanket” implementations of CRM are rolled-out within healthcare systems.

Crew

The term Crew is central in the definition of CRM according to Sharp (2012) who defines the term as a group of people that work together in an operational environment with the goal of achieving a common goal. Irrespective of the term team or crew, Sharp means that communication and cooperation skills are essential and can be split into two levels. The first being between crew/team members working in The Sharp End of patient care entailing for example emergency room/surgery/operations and/or trauma teams and the second being The Blunt End which can be seen as less risky environments or tasks such as within patient wards, and the day to day patient care.
The communication demands in *The Sharp End* where the risks for patient safety and affecting incidents are considerably higher than at *The Blunt End* where communication is more focused on day to day tasks, organisational and compliance issues. Sharp (2012) describes that the term *Crew* within CRM lacks a sufficient translation in Swedish especially in the context of working within the healthcare system or indeed a hospital environment. The nearest relevant term is *team* but again this definition is not always clearly defined, especially within a hospital where team members can often consist of the same identified functions but where the functions can consist of varied staff and levels of experience. Within nursing and healthcare, it is commonly said that any group of people involved in a patient’s care are members of a defined permanent or temporary team. Functions such as nurses, doctors, junior nurses and even the hospital receptionist can be seen in this definition as part of the team.

Sharp (2012) deducts that CRM focuses on both communication and the cooperation/interaction in-between crew or team members and not on an individual’s know-how or technical skillsets. The concept has since been adopted amongst others by maritime operations and other groups or industries that work or deal with high risk processes such as the military, police and nuclear power plants.

**Sterile Cockpit and Situational awareness**

Hohenhaus and Powell (2008) describe in their article a result of CRM methodology by explaining the “Sterile Cockpit” rule. Starting in 1981 the Federal Aviation Administration (FAA) introduced policies for flight crews in order to reduce the number of accidents seen to have been caused by distractions. These regulations be known as the *sterile cockpit rule* which specifically prohibits non-essential crew activities during any time that the aircraft is involved in high-risk periods such as during taxi, take-off, landing, checklist reviews and flight operations below 10 000 feet. Non-essential activities include non-flight related conversations, eating and reading publications that are not related to the proper conduct of the flight. Hohenhaus and Powell further argue that the same regulation set should be applicable within healthcare during critical time periods and activities such as preparing and performing the administering of medications where errors and disruptions are frequent. Another key application of CRM concepts within healthcare and nursing is Situational Awareness (SA). Sitterding (2012) attributes 80 percent of medical errors to human factors and concludes that nursing attention is a vital aspect in perceiving and understanding the nature of any clinical situation. Being able to see the whole picture and maintain an awareness of the whole situation and avoid getting too focused on single issues or problems is as key to patient safety and care as it is to flight operations and safety.

**Errare humanum est, Human errors in healthcare**

An anonymous Latin saying, “To err is human” still defines a universal characteristic of human existence. Many industries and organisations such as aviation and healthcare strive for an error free state, which still today seems like an unobtainable goal. As long as humans are involved in complex environments, some degree of error will occur, with an even greater risk in combination with stressful or overly boring work environments (Helmreich, 1998).

*To Err is Human: Building a Safer Health System* is a report issued by the American Institute of Medicine (IOM) in 2000 that is generally regarded as the start of applying CRM methodology within the healthcare system. One of the key recommendations of this
report was that greater attention should be given to incident reporting within healthcare, analogous to the role it has played in aviation and other high-risk industries Mitchell et al. (2015).

**Human Error**
Reason (2000) defines two fundamental features of human error. Firstly, it is often the most qualified and best people that cause the worst mistakes, error is not in Reasons view the monopoly of an unfortunate few. Secondly far from being random as many might otherwise believe, mishaps and errors tend to be far from random, and tend to fall into recurrent patterns. This entails that the same set of circumstances can provoke similar errors or mistakes, regardless of the actual people involved. Reason further views human errors in two ways, firstly the *person approach* and secondly the *systems approach* and means that an understanding of the two different models has important practical implications for coping with the ever-present risk of mishaps within healthcare and clinical practice.

**Person Approach**
Reason (2000) states that the Person Approach is predominant within the healthcare industry as this model focuses on the concept of unsafe acts and mistakes of individuals at the sharp-end such as doctors, nurses, surgeons, pharmacists and all personnel with a patient contact especially in an acute phase. The Person Approach primarily focuses on the unsafe acts and mistakes arising due to aberrant mental processes such as inattention, forgetfulness, carelessness, and poor motivation. The countermeasures are focused directly on individuals and reducing the unwanted variability in human behaviour. These countermeasures include poster campaigns to induce fear of making mistakes, revised processes to existing processes, threats of legal action and disciplinary measures in short, naming, retraining, blaming and shaming. Those who believe in this method treat errors as moral issues, assuming that bad things happen to bad people, sometimes referred to by psychologists as the “just world hypothesis”.

**System Approach**
Reason (2000) goes on by defining the System Approach with a basic premise that humans are fallible and that errors are to be expected even within the best organisations. Errors are regarded as consequences rather than causes, having their origins in upstream systematic factors rather than being caused by the perversity of human nature. Countermeasures are based on the assumption that although we cannot change the individual human condition, we can instead change the conditions under which humans’ work. A central concept is that of system defences. When an adverse incident occurs, the important issue is not *who* blundered, but how and why the system defences failed.

Kim (2016) emphasises that a main premise of the systems approach is that a completely error-free system is impossible and therefore the learning from errors and preventing recurrences is essential. Kim goes on by writing that one of the ways to learn from errors is by implementing a reporting system in which errors can be analysed and possibly propose remedies and/or information that can lead to system changes that effect all healthcare organisations.

Reason’s (2004)”The three-bucket model” argues the three components of an error occurring being: self, context and task.
These three components are described as three buckets containing bad stuff and that the bad contents of each bucket can lead towards an error occurring. Reason further refers to the contents of each bucket as the “brown stuff” which is the same brown stuff that normally “hits the fan”. By equipping staff with sufficient education and foresight training that errors will inevitably occur, staff will more easily be able to recognise the buckets and the brown contents in context of why, where and when, and be better at adjusting, compensating, improvising and recovering when faced with the inevitably of error (Reason, 2004).

**Challenges to incident reporting in healthcare**

**Preventable harm**
Mitchell et al. (2015), inspired by the recommendations from the report by Reason (2000), explain that their research showed five main challenges to incident reporting: poor processing of incident reports, inadequate engagement of doctors with insufficient subsequent visible action, inadequate funding and institutional support of incident reporting systems and inadequate usage of information technology. If healthcare organisations were to rectify these challenges, they could learn from the mistakes and errors, mitigate the contributing factors and in doing so prevent future errors and ultimately make patient care safer. The term *preventable harm* is mentioned in the article by Pronovost, Cleeman, Wright and Srinivasan (2015) as a major cause of preventable death on a worldwide basis. Progress towards minimising these errors within healthcare is stated to have been proven difficult because healthcare lacks the robust measurement mechanisms and systems to be able to routinely measure and scope the magnitude of the actual issues. Henneman and Gawlinski (2004) focus their conclusions on the vital role of nurses in the prevention of errors by assisting in the creation of systems that lower the risk of patient harm and errors but also in developing wider strategies in order to deflect potentially dangerous situations in the early identification of incidents that could have caused serious patient harm if left unchecked. As far as direct caregiver roles, nurses often provide, or are the final defence barrier for human recovery of an error or potential error.

**Sentinel events and near-misses**
Powell and Hill (2006) in their article My copilot [sic] is a nurse—Using crew resource management in the OR, also refer to the report To Err is Human: Building a Safer Health System (IOM, 2000) and point to the large difference in the incident reporting numbers between aviation and healthcare. Whilst the aviation industry seems to achieve a 95 percent rate of incident reporting, they estimate that the equivalent figure within healthcare is 5 percent. Barach and Small (2000) have also compared available statistics between aviation industries incident reporting and the medical/healthcare system. They describe that healthcare has mainly focused on more serious mandatory incident reporting based on sentinel triggering events and not on the equivalent of the aviation’s near-miss incidents. If these although less serious incidents could be collaborated, essential process information and a basis to understand and rectify system/process errors could be gained.

**Safety culture**
Kapur et al. (2016) discuss the cultural aspects in relation to a safety culture focused organisation and draw conclusions based on the difference between the aviation industries blame-free culture and the more punitive culture that seems predominant within the healthcare sector.
Also, the economic factors of safety are seen to be regarded differently between the aviation- and healthcare industries, where safety permeates all levels and functions of the airline business, whereas safety within healthcare still seems to be prioritised after financial aspects and seems to be regarded as the priority of some and not the obligation of all (Kapur et al., 2016). The article by Hefner et al. (2016) describes a safety culture as an environment that enables and encourages vigilance, where learning is prioritised and where there is minimal blame. The safety culture also builds on standardisation of routine procedure and institutionalised reactions and behaviours in effectively handling unpredictable emergent situations. Hefner et al. (2016) describe CRM implementations as having the potential to improve safety cultures and increase patient safety by reducing errors but also point out that few hospital wide studies have been made. Tsao and Browne (2015) also relate to a culture of safety in which errors and near misses are seen as an opportunity to learn and improve. They point to the success of CRM in other high-reliability organisations (HRO) or industries such as the nuclear- and aviation industries and at the same time question why despite tremendous investments healthcare still has not achieved the same degree of error-free success as seen in other HRO’s (Tsao and Browne, 2015). This lack of success within healthcare is seen amongst other areas in the continued lack of reporting of errors and nears-misses which Tsao and Browne explain by the lack of a just and blame-free reporting environment. Nieva and Sorra (2003) explain in their article the view that exists within the nuclear industry who define a safety culture within an organisation as a product of both individual and group values, attitudes, perceptions, competencies and finally patterns of human behaviour that as a whole determines the commitment and proficiency of an organisations safety and health culture. Those organisations that have shown a positive safety culture are founded on a foundation of mutual trust, shared perceptions of the importance of safety and in the confidence in the efficiency of preventive measures. Another fact that Kim (2016) draws attention to is that several studies have shown that healthcare workers still often do not report adverse events in the fear of punitive action or being ostracized within the workplace. The only way around this is by allowing anonymity or confidentiality in reporting and protection from punishment in order to overcome the barriers of fear that seem to be evident.

**System failure**

Kim and Choi (2016) mean that the aviation industry recognised the reality of system (defence) failure as part of its CRM implementation strategy and thus revolutionised the way in which errors and mistakes are handled. Instead of blaming and punishing individuals for occurred wrong-doings, the aviation industry concentrated their efforts instead into learning from the mistakes and in doing so ensuring that the same mistakes or human-errors are not repeated. Barach and Small (2000) conclude that to enable an equally successful reporting culture also within healthcare, anonymous and/or protected and non-punitive voluntary reporting systems are a must in order to be able to collate vital near-miss/incident reporting data completely and objectively. Ralston and Larson (2005) also discuss in their review article, the necessary cultural change that is needed within healthcare to enable improved patient safety and incident reporting. Mistakes within healthcare are continually frowned upon and are basically not allowed with legal litigation as a further threat. This environment of blame naturally does not encourage reporting of mistakes or incidents which naturally leads to underreporting. If incidents, errors or mistakes would be more freely reported a culture of learning and patient safety could be achievable to at least the same degree as in aviation.
The United States Air Force (USAF) regional hospital Eglin developed and implemented during 1998-2001 a program focusing on patient safety that was named Medical Team Management (MTM). The model for this program was the CRM system from the aviation industry. The system focused on teamwork, communication and reporting. Prior to the implementation of the MTM program, Eglin Regional Hospital had similar to most hospitals been practicing a reactive error monitoring system. Due to the effects of a sentinel event (the equivalent of lex Maria) and after the consequent criticism from the IOM, a working group was formed to develop a new strategy to identify and reduce medical errors. The result is the patient safety program MTM (Woolever, 2005).

The MTM system emphasizes on the need for anonymous reporting of near misses and a removal of the blame culture. The system is directed to all members of the medical team and as a result of that miscommunication has been identified as a leading cause of preventable medical errors, the MTM system focuses primarily on clear communication in order to create a safer patient care environment. Similar to CRM, MTM emphasizes the importance of incident reporting, not a new concept but its evolution into a non-punitive system made a significant increase to the number of incident reports that were written. In the past acknowledging mistakes meant taking the blame. Furthermore, all the hospitals regulatory oversight organisations recognised the value of the system and all advocated the establishment of improved reporting system as a way to learn from errors. Mandatory reporting systems hold care organisations accountable for safety whilst voluntary reporting systems that are usually anonymous, can provide more information that leads to improved safety in systems and processes (Woolever, 2005).

**Incident reporting an implicit component of Crew Resource Management**

As Johnson (2003) points out incident reports assist in finding out why accidents don’t occur. Kapur et al. (2016) further emphasise this point of view by stating that within the aviation industry, reports of near-misses may often be as instructive as more serious adverse incidents. A safety culture including effective risk management, crucially depends on creating an environment where reporting is a natural aspect of the culture. Without the possibility to be able to perform detailed analysis or mistakes, errors, incidents and near-misses, there is no way to otherwise uncover or prove error traps or as Reason (2000) puts it, knowing where the “edge” is, unless we fall over it. Trust is a key component of a reporting culture and this in order to work requires a just culture. A just culture possesses an understanding of where a virtual line should be drawn between blameless and blameworthy actions. Enabling and engineering a just culture is an essential early step in creating a safe culture (Reason, 2000).

Wu, Pronovost and Morlock (2002) describe in their article the development of a web-based reporting system for Intensive Care Units (ICU). At the time of publication of the article, the system had been taken into use within 30 ICUs in the United States of America. The article observes that systems for reporting, analysis and the distribution of feedback concerning near-misses are already established as an integral part of the Safety Culture within other high-risk industries such as aviation and nuclear power plants. Reporting near-misses in addition to the more established reporting of solely occurred incidents has several advantages based on the fact that a broader base (due to the higher incidence rate of near-misses) allows quantitative analysis along with the important fact that employees feel that there are less hinders (due to blame and other legal consequences) in reporting near-misses.
According to the article the FAA reported that the risk during the period of 1967-1976 of dying in an aircraft related accident in the United States was one in two million flights. Towards the end of the 1980’s this risk had reduced to one in eight million flights. According to the FAA this significant reduction was partly due to the implementation of CRM techniques and the introduction of incident and near-miss reporting systems along with the success of encouraging pilots and other flight crews to report these incidents and near-misses (Wu et al., 2002).

**Problem statement**

There are indications that the existing process of incident reporting within the healthcare system is limiting or can directly be harmful towards the goal of enabling a learning culture. A success in such enabling would ensure nursing professionalism and ultimately increase patient safety and reduce the number of patient safety affecting incidents (European Commission, 2014).

We question if the lack of a blame-free, non-punitive, structured error management and reporting system that the aviation industry and aviation regulatory organisations see as a key factor within successful CRM, is an explanation to reporting discrepancies (Woolever, 2005). In connection with this we also question if healthcare organisations are still focusing on the Person Approach in regards to incident reporting instead of a necessary System Approach (Reason, 2000) and if indeed the cultural change that Ralston and Larson (2005) discuss, is the key to a transformation from the perceived blame-culture to the necessary culture of learning from mistakes.

**PURPOSE**

The purpose was to describe how Crew Resource Management and the inherent learning culture could improve nurse’s professionalism and patient safety within the healthcare system.

**METHOD**

**Research design**

The chosen method was a literature overview. Polit and Beck (2017) describe this method as that researchers commonly conduct research by analysing the content of existing knowledge and research presented within scientific articles by undertaking a thorough review of available literature within a specific field and correlate this knowledge. Scientific articles are presented in order to answer the study’s purpose (Friberg, 2012). The literature overview was based upon an inductive approach (Polit & Beck, 2017).

**Selection criteria**

Based on the fact that the discipline of CRM especially within the healthcare sector in general is relatively young as a discipline and that most relevant materials are written from 1997 onwards, we decided to use a search period of 20 years. According to Forsberg and Wengström (2015) inclusion and exclusion criteria for periods of time should be selected. Östlundh (2012) further suggests that additional limitation functions for database searches could be: time, language, journal type and peer review status.
By including research and articles as early as 1997 and onwards we have ensured that we not only present trends from the early primary research, but also the latest year’s scientific inroads within the subject. This entails that one of the search limitations is stated as being articles published during the years 1997 – 2017. Only English language articles were included as results and were a result of a manual review of the listed article results after each respective database search. No inclusion/selection of language was done within the database search engines although this is an inclusion option in both the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PubMed database search engines, neither were any inclusion terms included for specific journal types. The chosen inclusion terms are presented in Table 1. Within the database CINAHL an option exists to only select articles that are Peer Reviewed, meaning that the articles have been reviewed by at least two or more researchers within the same field and who have made recommendations to the publisher if they should accept or reject the base article manuscript (Polit & Beck, 2017). Further selection criteria are that the articles have a relevance from a CRM and a nursing research / healthcare, learning-culture and patient safety perspective. The latter including incident reporting.

Data collection
In order to include relevant articles for the overview, a number of available databases were searched for scientific articles. Two of the most relevant databases for nursing and healthcare related research are CINAHL and Medical Literature Online (MEDLINE) accessed via the PubMed website (Polit & Beck, 2017). According to Forsberg and Wengström (2015) MEDLINE is a broad database with content covering both medical- and nursing research. CINAHL is a specialised database towards the field of nursing research. Polit and Beck (2017) encourage the use of databases other than within the nursing field common CINAHL and PubMed, in order to widen the search perspective. As we also relate to aviation based articles, also wider general scientific databases such as Web of Science and Google Scholar were used within our search base.

Selection criteria
Polit and Beck (2017) describe a keyword as a phrase or word that encapsulates the key concepts of a search. Various types of search approaches exist, with specific search rules and methods depending on the database being searched and the specific search engines design. The databases were queried based on a number of Subject Headings known as Medical Subject Headers (MeSH) within the database MEDLINE and as CINAHL Headers (CH, MH) in the CINAHL connected databases. Polit and Beck define Subject Headings as indexed keywords or phrases that typically define and capture the key concepts of the question(s). The chosen keywords are presented in Table 2.

Some of the Subject Headers used were not applicable as search terms within certain databases, for example the MeSH term “Crew Resource Management, Healthcare” was only added as a MEDLINE MeSH term as recently as 2016, and is not a valid Subject Header in CINAHL at all. Polit and Beck (2017) describe the challenge of solely using the standard Subject Headers as a search basis within commonly used databases. In order to achieve as wide a search as possible in order to avoid missing relevant articles within the database searches, a combined and overlapping method of using free text searching in combination with keywords (MeSH and CINAHL Headers) were mainly used as database queries as per Polit and Becks (2017) suggestion.
Polit and Beck (2017) further explain the use of Boolean operators such as AND or OR denoting logical disjunction as tools in order to limit alternatively expand database searches. Within some of the executed database searches, so-called wildcard symbols as described by Polit and Beck were used. Within the CINAHL and MEDLINE (PubMed) databases the wildcard symbol is an * (asterisk) and this search tool permits searches that ensure that all relevant forms of a root word are included in the search. As an example, the search keywords and wildcard combination Report* returned results also on keyword terms such as reporting and reports. Further inclusion and exclusion criteria were adapted according to the various options available to us mainly in the CINAHL and PubMed search engines. The database searches were performed on the 17th and 18th of February 2017.

We have also via different combinations of search terms, had the ambition to enmesh varied conclusions from within the various articles as suggested by Forsberg and Wengström (2015). Within this thesis both the terms crew and team will be used as equal synonyms following Sharp’s (2012) definition.

Database searches
All database searches were performed in three main steps following the recommendations by Forsberg and Wengström (2015). Firstly, broad searches were made based on high-level individual keywords which typically returned a large number of hits. The searches were then narrowed further by combining a number of keywords into the search criteria (inclusion criteria) in order to reach a manageable number of search hits. Based on the returned search hits a number of articles were selected from the search outcome with titles that seemed to relevantly match the purpose of the thesis. Abstracts from the selected articles were then analysed again to check the relevance of the article. Articles that were deemed non-relevant were discarded and the remaining were then read in total again checking the relevance towards the purpose but also to control that the article fully qualifies as scientific. Ethical aspects of each article were also actively sought and identified but no article was disqualified based on lack of ethical information.
### Table 1: Presentation and overview of database Search Hits and Results.

<table>
<thead>
<tr>
<th>Database Date</th>
<th>Search term(s)</th>
<th>Limitations</th>
<th>Number of hits</th>
<th>Reviewed abstracts</th>
<th>Reviewed articles</th>
<th>Selected articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>CINAHL 2017-02-18</td>
<td>Crew Resource Management AND MH “Patient Safety” AND Nursing</td>
<td>1997-2017 Peer Reviewed</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PubMed 2017-02-18</td>
<td>Aviation AND Patient Safety</td>
<td>1997-2017 Abstract</td>
<td>393</td>
<td>15</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>CINAHL 2017-02-18</td>
<td>MH “Incident Report*” AND Culture</td>
<td>1997-2017 Peer Reviewed Abstract</td>
<td>105</td>
<td>8</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>CINAHL 2017-02-18</td>
<td>Nursing AND Error Reporting AND Culture</td>
<td>1997-2017 Peer Reviewed Abstract</td>
<td>15</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>PubMed 2017-02-17</td>
<td>(Patient Safety [MeSH]) AND Incident* AND Report* AND Nursing</td>
<td>1997-2017 Abstract</td>
<td>53</td>
<td>7</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CINAHL 2017-02-18</td>
<td>Error Reporting AND Safety Culture AND Nursing</td>
<td>1997-2017 Peer Reviewed Abstract</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PubMed 2017-02-17</td>
<td>(Patient Safety AND Healthcare AND Safety Culture AND Blame)</td>
<td>1997-2017 Abstract</td>
<td>89</td>
<td>7</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PubMed 2017-02-17</td>
<td>(Aviation [MeSH Terms]) AND safety culture</td>
<td>1997-2017 Abstract</td>
<td>285</td>
<td>12</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>PubMed 2017-02-17</td>
<td>Error reporting AND (Safety Culture [MeSH Terms])</td>
<td>1997-2017 Abstract</td>
<td>210</td>
<td>15</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>2119</strong></td>
<td><strong>126</strong></td>
<td><strong>54</strong></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

### Table 2: Overview of search keywords and free text terms.

<table>
<thead>
<tr>
<th>Utilised Search Keywords/Terms</th>
<th>MeSH term</th>
<th>CINAHL Header</th>
<th>Used as Free text search term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Blame</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Blame Culture</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Crew Resource Management</td>
<td>Yes (Healthcare)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Culture</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Error</td>
<td>Yes (Medical)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Error Reporting</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Healthcare</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Incident Reports / Reporting</td>
<td>Yes (Hospital)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Culture</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Learning</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Nursing</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Patient Safety</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Safety Culture</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Manual search

Based on the resulting articles from the database search process a manual search was also performed within the selected articles in order to eventually find further relevant articles as per Polit and Beck (2017) recommendations. Performing manual searches is an effective method in order to widen searches especially from initial database search results and based on the selected articles reference lists reach further articles of interest (Forsberg & Wengström, 2015). Four articles Holmström, Laaksonen and Airaksinen, (2015), Savage, Schneider and Pedersen, (2005), Sexton, Thomas and Helmeirch, (2000) and Staender, Davies, Helmeirch, Sexton and Kaufmann, (1997) were included in the Results section after the manual searches were performed resulting in a total of 25 articles within the result.

Data analysis and Scientific Examination

Based upon the outcome of the Database searches with the various Selection Criteria’s applied a number of research articles were selected based on the abstract and later on after reading and analysing the full article. In this process, the main goal has been to ensure that the selected research articles fulfilled the objective of actually answering the thesis’s purpose and were also of a sufficient quality as per the recommendations by Forsberg and Wengström (2015). Assisted by the method literature by Polit and Beck (2017) each selected article’s content was as the next step thematically analysed using an integrated analysis method. This was initially performed individually and a number of themes and patterns of information or topics were identified. The resulting listings of themes and topics were then edited and collectively discussed and merged into a theme coding. Each article was again reviewed and the agreed codes were written in the margin of each article as per Polit and Beck’s (2017) recommendation in order to as effectively as possible find and identify the relevant information both in the form of regularities and inconsistencies. The identified themes and patterns formed the basis for the result section that correlate the results from the included. The resulting two main themes and ten sub-themes are presented in Table 3. A tool was used to assist with the quality assurance of the articles is Sophiahemmet University’s assessment form (Appendix A) for Scientific classification and quality regarding studies with quantitative and qualitative methods adapted based on Berg, Dencker and Skärsäter (1999) and Willman, Stoltz and Bahtsevani (2011). As Wallengren and Henricsson (2012) point out, the fact that the thesis is written by two authors should increase the reliability of the overall analysis, as each article will be reviewed with four eyes instead of two giving the opportunity to also critically review each other’s deductions and conclusions. The resulting articles from the above search queries are accounted for in Table 5 (Appendix B).

Ethical considerations

Whilst ethical considerations are mainly considered in connection with quantitative and qualitative studies also Literature overviews need to follow ethical guidelines and standards (Kjellström 2012; Polit & Beck, 2017). The Swedish Research Council (Vetenskapsrådet, 2011) has published ethical guidelines which are recommended to be used or as a minimum to be considered before starting any form of study, and we have complied with these guidelines. One of the ethical recommendations is to only select scientific articles that have been through an ethical clearance process by ethical committees or articles that have a meticulous focus on ethical aspects. Each selected article in this thesis was reviewed in order to control if an ethical clearance was presented.
As per Polit and Beck (2017) care has been taken to include all relevant articles deemed to be of high enough quality in order to answer the purpose of the thesis whilst actively not excluding any article where the result may have been contradictory towards answering the purpose. Furthermore, based on the Swedish Research Council (2011) ethical guidelines we have not intentionally fabricated, neither stolen nor plagiarised data, hypothesis or methods, nor distorted the research process in any way. Mandal, Ponnambath and Parija (2016) point out the risks of falsified or fabricated research data where results have been manipulated to strengthen the articles or study’s conclusion. Any such falsified data can lead to false meta-analysis and misguided interventions.

RESULTS

The results are presented as two main themes and ten sub-themes (Table 3) based on the thesis’s purpose and selected articles (Appendix B).

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement of nurse’s professionalism and patient safety</td>
<td>Communication, Teamwork, Leadership, Briefing, De-briefing, Feedback, Attitudes and Human factors</td>
</tr>
<tr>
<td>Learning culture improving nurse’s professionalism and patient safety</td>
<td>Blame culture, Anonymous reporting, Incident reporting, Barriers to incident reporting</td>
</tr>
</tbody>
</table>

**Improve of nurse’s professionalism and patient safety**

Efficient communication skills were identified in Grogan et al. (2004), Staender et al. (1997), Sexton et al. (2000), and Tapson et al. (2011) as the most important factor to provide optimal patient care and to improve quality and safety in health care. Currie and Richens (2009), Sexton et al. (2000), Staender et al. (1997), and Tapson et al. (2011) rated communication as a contributing factor for optimal patient safety in healthcare. The direct impact from teamwork and efficient communication skills is an extremely important part in providing optimal patient care (Sexton et al., 2000). Results of safety-climate surveys from healthcare respondents including physicians and nurses and naval aviation pilots with both organisations striving to high-reliability organisations HRO’s, showed physicians and nurses providing a higher degree of problematic responses compared to naval pilots (Gaba et al., 2003). Sexton et al. (2000) compared perceptions and perspectives between aviation (pilots) and medicine personnel in relation to errors, stress and teamwork where a far higher percentage of medical respondents answered that they were able to perform effectively during critical times even when fatigued which was far higher than the aviation responses. Hospitals or healthcare institutions may need to make substantial changes in order to achieve a safety climate which is consistent with the defined status of HRO (Gaba et al., 2003). Small-scale local pilot project evaluation systems were suggested, to explore the resources to develop a national system (Holmström et al., 2015).
Post CRM training studies also showed a positive effect on the roles of coordination, leadership in teamwork (Grogan et al., 2004; Staender et al., 1997; Sexton et al., 2000; Tapson et al., 2011). CRM techniques as a method to improve safety and optimise teamwork in nursing showed a significant improvement in the nurse’s perception of safety and their ability to be able to identify process related factors (Gore et al., 2010; Tapson et al., 2011; West et al., 2012). Sax et al. (2009) performed a study following the compliance of using a preoperative checklist that was developed as an integral part of a CRM intervention. Compliance in following the checklist rose significantly during the study period. Haerkens et al. (2015) analysed the impact of CRM training, where the results showed a significant decrease in the complication incidence from the baseline year to the post implementation year. Kim et al. (2011) presented the participants three most effective strategies to avoid medical errors being; mental review, replenishing nursing staff (ensuring breaks were taken and shifts not too long), and the same nurse preparing and administering medicines. Furthermore, both Pape (2003), and West et al. (2012) pointed out from results in their studies that the “sterile cockpit program” could be applied to medication administration, with less distraction during the administration leading to increased patient safety and providing time-savings.

Pre- and post-briefings and debriefing increased the perception of teamwork between doctors and nurses in operating theatre and similar perceptions were found in intensive care units (Sexton et al., 2000; Tapson et al., 2011). A further consequence of CRM intervention as seen in Holmström et al. (2015), and Sexton et al. (2000) reports, where staff morale showed an improvement that could be linked to awareness gained from feedback systems that transfer the created knowledge back to different levels in the organisation from incident reporting. Doctors reported good levels in teamwork with nurses, where a considerably lower number of nurses reported good teamwork with doctors (Sexton et al., 2000).

Feedback gives more than knowledge of what could be done differently, it also builds confidence into the reporting system and a sense of that nurses are being listened to and are a part of the process (Hewitt et al., 2016; Rea & Griffiths, 2015). An organisational problem seen in healthcare systems that affects the willingness to report mistakes is the lack of feedback (Anderson et al., 2013; Currie and Richens, 2009; Hession-Laband et al., 2011; Hewitt et al., 2016; Rea & Griffiths, 2015). Two key reasons of non-reporting were a lack of feedback and a fear of reprisals. Mixed reactions were observed as to how feedback mechanisms either support or constrain the enabling of a safety culture within the organisation. Staff in managerial roles believed to a higher extent that feedback worked well in the form of information flows although there was a general concession that the same issues were reported, over and over. Another finding was that feedback from incident reporting was lacking and some participants did not receive any feedback at all to their submitted reports. Overall the lack of feedback was identified as a major weakness. Personnel meetings were used in order to dissipilate some information but in order to fully “close the loop” individual feedback was still the most appreciated method (Anderson et al., 2013; Currie and Richens, 2009; Hewitt et al., 2016).

Grogan et al. (2004), Haerkens et al. (2015), and Sax et al. (2009) identified a perceived belief in the attitude towards the potential of CRM training in order to improve quality and safety in health care.
Measuring the attitude to teamwork before and after CRM based team training gave a significantly favourable result, the attitudes towards the roles of coordination, leadership and communication in creating and maintaining efficient teams were positively impacted and exposed a significant decrease in the complication incidences (Grogan et al., 2004; Haerkens et al., 2015).

Grogan et al. (2004), and Staender et al. (1997) identified human factors as lack of situational awareness, lack of experience, not performing a check and a wrong judgement, human errors was acknowledged as contributing factors in critical incident reports. The attitude towards human factors showed a significant shift after aviation-based (CRM) teamwork training for health-care professionals. Anderson et al. (2013) view of incident reporting showed generally that staff were positive and more so in the realms of acute care than in mental care. There was a feeling that incident reporting could be improved and as such highlighted the difficulties in gauging the effects of such reporting. As a consequence, participants in Waring et al. (2005) study saw very little purpose in incident reporting because it failed to recognise that mistakes are an inevitable part of medical practice and importantly that mistakes are a natural part of the uncertainties of medial knowledge.

Currie and Richens, (2009) study expresses that incident reporting was a waste of time and not the responsibility of all in the mid-wife staff and a general confusion as to who should be completing an incident report. Waring et al. (2005), research saw that incident reporting was seen as red tape, and little else than bureaucracy. The perception of safe workplaces including incident reporting as part of a safety culture saw nurses reporting a significant improvement. From the doctor’s perspective, the nursing professions culture is familiar with form filling and paper work, associated with incident reporting as being a nursing task (Waring et al., 2005). The clinic with the highest number of reports was also the clinic where other staff professions including nurses had been involved and encouraged to report incidents as well (Kousgaard et al., 2012).

**A learning culture improving nurse’s professionalism and patient safety**

Scientific studies point out the fear of being blamed as a key reason for not reporting (Currie and Richens, 2009; Gorini et al., 2012; Hewitt et al., 2016; Kim et al., 2011). The fear of being blamed that vary in different sub-groups within healthcare. Nurses and nursing students fear is directed from being punished by physicians (Gorini et al., 2012). Holmström et al. (2015), and Savage et al. (2005) result showed that although a non-punitive and anonymous reporting culture is a principle for legislation that supports reporting, it still represents one of the most central disincentives for development of a functional reporting system as a part of a learning culture. Savage et al. (2005) study showed an 88 percent increase in incident reporting compared to post-implementation of an on-line incident reporting system and along with the increase in reporting being able to analyse and proactive prevent medication errors. Consensus was found in the perspective of learning from mistakes that is suppressed within a culture of fear and blame and the teachable moments are only found in a non-threatening organisation (Currie and Richens, 2009; Hewitt et al., 2016; Rea & Griffiths, 2015). Hewitt et al. (2016) described a culture change that had been moved from a culture of blame to a team-based culture of reporting and lessons were learnt through the reporting. Despite this success in feedback, enabling sufficient feedback to the reports origin still remained one of the challenges.
Incident reporting systems are considered a positive safety tool and possibilities in the system for improving the process as a way to change the mind-set on how to evaluate the risks in healthcare systems were seen (Anderson et al., 2013; Hession-Laband et al., 2011; Hewitt et al., 2016; Rea & Griffiths, 2015). Documented mistakes were seen as the key element in the process of learning from mistakes and valued as both important and achievable in health organisations that are non-punitive (Anderson et al., 2013; Rea & Griffiths, 2015). Nurses in particular addressed the factor of lack of time for reporting. This situation changed after the education of how and what should be reported (Hession-Laband et al., 2011), Hession-Laband et al. (2011), and Hewitt et al. (2016) more specifically looked at the role of nurses in reporting with an area of specific interest being the nurses reporting behaviour regarding near-misses which was defined as an error that is intercepted and averted before it reaches the patient. Results showed that nurses in general thought more about incident reporting, reported more near-misses and nearly all reports were filled with names. An improvement after education was related to a previous issue of not knowing when an incident report should be filed (Hession-Laband et al., 2011; Hewitt et al., 2016). Overall, Hession-Laband et al. (2011) study showed effects of an increase in reporting rates and a decrease in the severity of the collective reports as more and more near-misses in which there was no harm to the patient were filed. Similarly, Hewitt et al. (2016) showed that nurses mainly tended to report falls and medication errors, and that reports were outcome based. This has consequences for the reporting of near-misses as these per definition do not have a negative outcome. As such near-misses were seldom reported despite a corporate message that they should have been (Hession-Laband et al., 2011; Hewitt et al., 2016). Kousgaard et al. (2012), and Rea and Griffiths (2015) studied perceptions of incident reporting in clinics, the highest number of reports was where nurses had been involved and encouraged to report incidents. Similar results were reported by Rea and Griffiths (2015) who explored the attitudes to incident reporting with a focus on patient safety within British general practice.

Hogan et al. (2008) analysis identified some of the barriers that limited the scope of being able to monitor patient safety issues in routine systems were: poor quality of coding, delays in reports reaching databases, a narrow focus of some data sources, too limited time-periods in some reporting and the lack of centrally collation of the data. Professionals that fear consequences will also have a negative impact on the reporting process. A learning culture was perceived to promote a culture change with a further motivational value for professionals in healthcare, and an increased awareness of the moral obligation to report medication errors (Holmström et al., 2015). Financial and human resources hampered the development of reporting systems and one of the suggestions from Holmström et al. (2015) was support from governmental and international collaborations. Currie and Richen (2009) point out that a prioritisation of safety should be the main concern on board level but safety often had a lower priority than budget factors. The main determinants for incident reporting identified in Pearson et al. (2010) study identified that the obstacles to overcome were that nursing students were not engaged and not aware of the function and importance of the reporting systems as a learning method. A need for mandatory training and improved education was a necessary task of the safety organisation, and that university educational providers should develop an up to date curriculum for patient safety. Wakefield et al. (2001) performed a study with the intention to explore the measures of nurses’ perceptions of organisational culture, implementations of continuous quality improvements (CGI) and medical administration error (MAE) reporting.
Wakefield et al. (2001) asked: “What is the relationship between the reasons MAE are not reported and the estimated percentage of errors reported?”, results show in both the individual and unit-level analysis that higher barriers to reporting are associated to decreased reporting although these differences were only significant in the individual-level analysis. Howell et al. (2015) study showed no significant associations between the number of nurses per bed and the overall reporting rate or reported harm or deaths.

DISCUSSION

Results discussion

Grogan et al. (2004), and Staender et al. (1997) identified human factors attitudes as lack of situational awareness, lack of experience, not performing a check and a wrong judgement, human errors were acknowledged as contributing factors in critical incident reports. Sharp (2012) describes that CRM today is a well-known concept within all international airlines and within all levels of pilot training. Oriol (2006) takes the definition a step further and describes that CRM was originally designed to give flight crews the insight and training needed to realise the fallibility of the human nature and also to measure the flight crew’s ability in leadership by seeing how effectively they could use the overall capabilities of the available resources or team in the atmosphere of unfettered communication. CRM was first used in healthcare 1994 in an operating room of University Hospital in Basel (Oriol, 2006). Flin et al. (2002) follow this line of thought by stating that as in the aviation cockpit where CRM has its roots, the success of any high-risk function such as within the operation theatre is fully dependent on the team within it. The human interface problems found to be responsible for a large proportion of accidents in aviation are likewise similar to problems seen in the operation theatre and are due to human factor issues such as communication, teamwork, decision making skills and interpersonal conflicts. The effects of CRM are deliberately presented as a main theme in the results and as such is a key message in the fact that the key components of the CRM methodology are all grouped together. The combination of each individual component such as communication enabling feedback, teamwork, leadership, attitudes and human factors, is as we see it the main strength of CRM and one component without the other, or simply attempting to cherry-pick one of the components without the combination of the others whilst still calling the implementation as one of CRM is in our eyes missing the point.

The full methodology of CRM is designed to enable a Situational Awareness that the results show for example in Gaba et al. (2003), and Sexton et al. (2000) studies to be lacking in healthcare. According to Sitterding (2012) nurse’s attention to detail is a vital aspect in perceiving and understanding the nature of any clinical situation. This together with the ability to be able to see the whole picture and maintain an awareness of the whole situation whilst avoiding becoming too focused on single issues or problems is key to patient safety. With our experience this is possibly an answer as to why CRM still has not achieved the same success within healthcare as in the other identified HRO such as aviation. The application of CRM should be seen as a method to pre-empt, minimise or allay the consequences of errors that inevitably occur. The goal within healthcare is seen to be an increased level of patient safety and that incidents and/or errors should not occur which can also be described as a non-event. This results in a dilemma of not being able to from an objective perspective measure the results of CRM implementations fairly.
The studies that were included in the results overall provide evidence that CRM training has a positive effect on safety cultures, patient safety as well as staff morale and empowerment.

Several studies (Hession-Laband et al., 2011; Hewitt et al., 2016) showed that nurses valued CRM based team training whilst doctors still remained cautious to the potential of improvement from the training. Salas et al. (2006) conclude that CRM training has spread to other domains and industries including healthcare and can be regarded in many shapes or forms but is essentially a strategy for team training with a specific focus on team performance and coordination improvements. This is one of the areas where we see that healthcare seems to have the greatest potential of development. With the team and cooperation skills that CRM can offer and its implied positive effects on patient safety and the professionalism of nurses and other medical staff as a whole. This would be achieved with a focused implementation of a safety culture that is built on a foundation of taking responsibility, participation, an active consciousness of the risks within healthcare, together with an open climate where all levels of staff dare and act to speak up when they see a possible risk or danger of a deviation that could affect patient safety. If successful increased patient safety and higher quality care can be ensured towards patients.

The importance of communication as a way to provide optimal care and improve safety and quality was discussed by Currie and Richens (2009), Grogan et al. (2004), Staender et al. (1997), Sexton et al. (2000), and Tapson et al. (2011). Sexton et al. (2000), and Tapson et al. (2011) take this argument a step further by identifying that communication in their study as the most important factor. Sexton et al. (2000) also links the CRM skills involving communication and teamwork with a direct impact on optimal patient care. Flin et al. (2002) findings showed that human interface problems that were responsible for a large proportion of accidents in aviation are likewise similar to problems seen in the operation theatre and are due to human factor issues such as communication, teamwork, decision making skills and interpersonal conflicts. From our perspective communication and teamwork are vital aspects in creating a shared reality that improves decision making and reduces the risk of interpersonal conflicts, and will also have a positive impact on patient safety.

The results of CRM training on teamwork could be seen in the studies of Grogan et al. (2004), Haerkens et al. (2015), Sax et al. (2009), Sexton et al. (2000), Staender et al. (1997), and Tapson et al. (2011) where a positive effect was seen within coordination and leadership within the team, both in regards to attitudes and in the team communication. This positive effect led to a significant decrease in complication instances. Gore et al. (2010), Sax et al. (2009), and West et al. (2012) studies respectively proved significant improvements in nurse’s perceptions of safety and also their ability to successfully identify process factors that could impact patient safety negatively. From the results, Sax et al. (2009) study shows one of the clearest examples of a successful CRM intervention with the use of CRM methodologies and tools such as communication, team member empowerment and checklists, patient safety was definitely increased with several potential errors identified before reaching the patient and the checklist compliance increasing from an initial 75 percent to full compliance by the end of the intervention. Haerkens results from an intensive care environment also saw a reduction in complication incidences post the CRM training intervention.
Gore et al. (2010), and Sexton et al. (2000) also noticed differences in the perceptions of good teamwork between the professions doctors and nurses where a higher degree of doctors responding their perception of good teamwork with nurses than the opposite feelings of nurses that teamwork with doctors was less than optimal. Nieva and Sorr (2003) findings show that organisations which have shown a positive safety culture are founded on a foundation of mutual trust, shared perceptions of the importance of safety and in the confidence in the efficiency of preventive measures. In our view this difference in the perception of optimal teamwork performance is something that needs to be addressed when designing CRM training programs. One suggested solution based on our aviation know-how could be an increased (case-study) simulation training focus as part of the nursing education where the simulation process is halted at points where critical decisions are to be taken and evaluations are made as to what is known and what the possible decisions are that can be taken at this point.

In a comparison between the effects of CRM training in aviation and healthcare in regards to errors, stress and teamwork a problematic response was seen in the answers from medical professions who had the belief that they could still perform effectively during stressful events or whilst being fatigued, compared with the responses from pilots (Gaba et al., 2003; Sexton et al., 2000). Gaba et al. (2003) suggests that the healthcare system may need to make substantial changes to this way of thinking in order to be able to aspire towards a culture of safety. Holmström el al. (2015) suggest that smaller scale pilot projects should be setup in order to explore the necessary resources needed for a national system. Applying Crew Resource Management techniques as a method to improve safety and optimise teamwork in nursing showed a significant improvement in the nurse’s perception of safety and their ability to be able to identify process related factors Gore et al. (2010), Tapson et al. (2011), and West et al. (2012). Feedback gives more than knowledge of what could be done differently, it also builds confidence into the reporting system and a sense of that nurses are a part of the process (Hewitt et al., 2016; Rea & Griffiths, 2015). Henneman and Gawlinski (2004) conclude as to the vital role of nurses in their direct caregiving role where nurses often provide the final defence barrier for human recovery of an error or potential error. Our own experiences show that nurses are a central component in all team constellations and this is a vital aspect in providing patient safety. Different situations, demand different team constellations with the nurse most often acting as the coordinating part. With an increased perception of safety based on CRM know-how, nurse’s professionalism will improve.

Communication and feedback is a contributing factor for optimal patient safety in healthcare (Currie and Richens, 2009; Sexton et al., 2000; Staender et al., 1997; Tapson et al., 2011). The direct impact from teamwork and efficient communication skills is an extremely important part in providing optimal patient care (Sexton et al., 2000). A further consequence of CRM intervention as seen in Holmström et al. (2015), and Sexton et al. (2000) reports, where staff morale showed an improvement that could be linked to awareness gained from feedback systems that transfer the created knowledge back to different levels in the organisation from incident reporting. Nurses in the studies by Hewitt et al. (2016), and Rea and Griffiths (2015) felt after receiving feedback a higher degree of confidence as to the point of reporting incidents and furthermore that they felt that they were being listened to. Anderson et al. (2013), Currie and Richens (2009), Hession-Laband et al. (2011), and Rea and Griffiths (2015) see that organisational issues within the healthcare system could be affecting feedback and therefore also affect the willingness to report mistakes to begin with.
Mixed responses were observed depending on staff’s level within the organisation where managerial staff believed to a higher extent that the flows of feedback worked well. Overall the lack of feedback was seen as a weakness (Anderson et al., 2013; Currie and Richens, 2009; Hession-Laband et al., 2011; Rea and Griffiths, 2015). Anderson et al. (2013), Currie and Richens (2009), and Hewitt et al. (2016) point out that although feedback in the form of staff meetings of which we also have observed to be one of the most common routes of distributing information, the most appreciated form of feedback was individual in order to fully close the communication loop. Hewitt et al. (2016) described that the culture within their study environments had been moved from a culture of blame to a team-based culture of reporting and lessons were learnt through the reporting. Despite this success in feedback, enabling sufficient feedback to the reports origin still remained one of the challenges. Feedback is an essential component of CRM and is a must in being able to learn from mistakes in a learning culture. Sharp (2012) defines feedback in its simplest form as a confirmation that a request or transfer of information has been understood via a closed-loop process where the transmitter of information ensures that the receiving part (or parties) are correct and then receives a confirmation that the information has been received correctly with the receiver repeating the information back to the transmitter. In our view a more advanced definition of feedback is to receive it after reporting a mistake and/or error, patient affecting or not. Thus being able to learn from an investigations information as to what went wrong, and even more importantly which steps have been taken to avoid the situation happening again.

Several articles such as Anderson et al. (2013), Currie and Richens (2009), Hession-Laband et al. (2011), Hewitt et al. (2016), and Rea & Griffiths (2015) refer to the lack of feedback as the main reason for not reporting incidents. Hronek and Bleich (2002) make the observation that healthcare providers typically regard feedback as a verbal exchange of information as in the realm of communication. In Hronek and Bleich (2002) view any (system) data that informs users of the effectiveness (or not) of processes in operation should also be regarded as feedback with the additional benefit of being able to circle this output back into the systems as input. The importance and role of feedback is one of the key-points that we wish to relay from our work. As evident from the presented articles and studies, feedback or lack or feedback lays the foundation for both incident reporting in itself and more importantly consists of the main opportunity to be able to learn from mistakes. The results also showed more clearly than we had expected that feedback is also seen as an important variable towards healthcare personnel’s professionalism, morale and work satisfaction. The differences in perceptions of sufficient feedback between healthcare professions such as doctors and nurses was also stronger than we had expected.

The results from Grogan et al. (2004), Haerkens et al. (2015), and Sax et al. (2009) showed a perceived belief in attitudes within healthcare in that CRM training has a positive impact on both quality and patient safety. A significantly favourable result was also measured within aspects of teamwork and the roles of leadership, coordination and communication. A positive impact was also observed in the creation and maintenance of effective teams. According to Waring (2005) an attitude amongst doctors was identified in the sense of them (doctors) not seeing incident reporting as useful or as any basis for learning lessons as many of the errors could never have been prevented and should therefore just be accepted as such instead of wasting time reporting and analysing the errors. Grogan et al. (2004), and Staender et al. (1997) identified human factors attitudes as lack of situational awareness, lack of experience, not performing a check and a wrong judgement, human errors was acknowledged as contributing factors in critical incident reports.
From an aviation CRM perspective, these are exactly the type of errors and mistakes that were observed within the aviation cockpit and are therefore far from unique to healthcare. The attitude pre- and post CRM training in Grogan et al. (2004), and Staender et al. (1997) studies showed a considerable shift in acknowledgement of the acquired knowledge of the impact of human factors as contributing effects in critical events. From Grogan et al. (2004), and Staender et al. (1997) studies a significant improvement in attitude towards human factors was seen after an aviation based CRM teamwork training for healthcare professionals. CRM based team training gave a significantly favourable result in the attitudes to teamwork and the attitudes towards the roles of coordination, leadership and communication in creating and maintaining efficient teams were also positively impacted and exposed significant decrease in the complication incidences (Grogan et al., 2004; Haerkens et al., 2015). Hunt and Callaghan (2008) point out the difference between aviation and surgical human factors that needs to recognised and addressed before implementation of CRM in healthcare. We suggest that the knowledge of human factors and that human errors are a part of how humans function is an essential knowledge in order to be able to examine the chain of events that leads to an adverse event or in worst case an accident. This involves considering the action of those involved, the conditions they were working in and most importantly seeing the organisational context where the adverse event or accident occurred.

Both Pape (2003), and West et al. (2012) point out from results in their studies that the “sterile cockpit program” could be applied to medication administration, with less distraction during the administration leading to increased patient safety and providing time-savings during the medication administration process. Hohenhaus and Powell (2008) further argue that the same regulation set should be applicable within healthcare during critical time periods and activities such as preparing and performing the administering of medications where errors and disruptions are frequent. In our view, again from an airline industry background, this is according to “standard operating procedures”, which are designed to keep a focus on one task when it has been identified as a critical moment or situation. Applying a “sterile cockpit” approach is part of building and retaining a situational awareness. One suggestion is that during the time-period when a nurse is administrating medicine ordinations, no disturbances such as irrelevant conversations or phone calls be allowed, and that the room used for medicine administration is handled as a restricted area with its own rules.

Sax et al. (2009) study where nurses were empowered from a management level to demand checklist compliance before surgical operations could be commenced by far more senior surgeons is an excellent example of working CRM techniques that gain even the initially reluctant senior medical professionals with the highest possible percentage result of compliance at the end of the studies duration. Oriol (2006) argues that the organisational culture of healthcare in general still is far more hierarchical than aviation and compares as an example a flight crew responsible for a flight with an operating room team. Within aviation it is a fully accepted fact that any member of the flight crew can put a flight operation on-hold or fully if there are any concerns, whereas Oriol (2006) doubts that a junior nurse would feel to have the same right or courage to question the authority of a Senior Surgeon and to stop a procedure.

Currie and Richens (2009), Gorini et al. (2012), Hewitt et al. (2016), and Kim et al. (2011) mean that a blame culture and blame are the main reasons that incident reporting is not done.
A fear of being blamed is also evident in Currie and Richens (2009), Gorini et al. (2012), Hewitt et al. (2016), and Kim et al. (2011) studies as well as Sexton et al. (2000), and Waring (2005) as one of the main reasons for not reporting incidents. Khatri et al. (2009) identified the reasons for the unwillingness in reporting to be the norms and attitudes within the organisation based on the fear of criticism or managements reprimands. The studies show differences within the medical professions where doctors are more afraid of receiving blame from the general public or media and where nurses are afraid of being blamed by doctors. Gorini et al. (2012), Holmström et al. (2015), and Savage et al. (2005) findings are in this sense also salient, stating that a non-punitive and anonymous reporting culture is the basis for most (European and North American) legislations these two factors still represent the main challenges for functional reporting as part of a learning culture. Currie and Richens (2009), Hewitt et al. (2016), and Rea and Griffiths (2015) study confirmed this with their deduction that a learning from mistakes culture is still suppressed by a culture of fear and blame. Holmström et al. (2015), and Hewitt et al. (2016) suggest that if professionals fear consequences of reporting, there will also be a negative impact on the actual reporting process. The documentation of mistakes was suggested by Anderson et al. (2013), and Rea and Griffiths (2015) as one of the main elements in the process of being able to learn from mistakes and as such was both valuable and achievable within healthcare organisations. Anderson et al. (2013), and Rea and Griffiths (2015) however emphasise that this is dependent on a blame-free and non-punitive environment.

A Swedish governmental decision taken in 2007 gave The Swedish National Board of Health and Welfare the instruction to review the previous Patient Safety Act (SFS, 1998:531). The result was presented in the Report of Patient Safety Inquiry Stockholm 2008, (Statens Offentliga Utredningar [SOU], 2008:117). One of the fundaments in this report is taken from the reports: To Err is Human: Building a Safer Health System (IOM, 2000) and the United Kingdom’s Department of Health report: An organisation with a memory (2000), that presented an assessment that approximately 10 percent of all patients treated at hospitals end up with serious injuries, and that the estimated extra cost for this is two billion pounds annually. Already in 2002, the 55th World Health Assembly, urged its member states to address the problems of a perceived lack of patient safety and based on scientific evidence address and carry-out the required improvements in the quality of care and patient safety. The report, (SOU, 2008:117) from the Swedish National Board of Health and Welfare resulted in the Governmental Bill (Proposition 2009/10:210), and the intention for the change of the legal text was to enhance healthcare personnel’s obligations towards reporting not only when an event occurred that involved a patient being affected by either a serious injury, the risk of serious injury or serious illness but also the events and/or circumstances that could have resulted in an event an adverse event. Pearson et al. (2010), found that the main determinants for incident reporting were the organisational and professional cultures and the system based approach in understanding the key factors for a risk assessment. From a system approach view it is essential to know when an adverse event occurs, how and why the system defence failed, and not who blundered (Reason, 2000). Since a completely error-free system is impossible, learning from errors and preventing recurrences is essential (Kim, 2016). Learning from errors will also promote a cultural change with a further motivational value for professionals in healthcare, and an increased awareness of the moral obligation to report medication errors (Holmström et al., 2015).

According to Currie and Richens (2009) the two key reasons of non-reporting being a lack of feedback as discussed above and a fear of reprisals.
The role of nurse’s reporting specially in regards to Gore et al. (2010), Hession-Laband et al. (2011), Hewitt et al. (2016) findings are interesting as they show that nurses in general thought more about reporting and also reported more near-misses. In our view this could be explained by the very nature of the nurse’s profession where we are educated to question all steps in the care process of our patients and with such a normal close patient/process contact it is far easier to notice the near-misses and to think about these in the context of what-if. Hewitt et al. (2016) results seem to confer with this with their findings that nurses tend mainly to report patient falls and medication-errors that demand a close patient contact and insight. More importantly Hewitt et al. (2016) note that the majority of the nurse’s incident reports were solely outcome based and therefore negatively impacted the reporting of near-misses as these per definition do not have a negative outcome or even reach the actual patient.

Howell et al. (2015) found no significant associations between number of nurses per bed and the overall reporting rate or reported harm or deaths. One of the outcomes from Kousgaard et al. (2012) study was the insight that although doctors indicated an interest in incident reporting, the clinic with the highest reporting rates was one where other professions including nurses were involved in the incident reporting process. No further conclusions as to the reasons to this was seen were made by Kousgaard et al. (2012) but it is fair to say that with our experience the difference is almost solely caused by the involvement of the nurses. Rea and Griffiths (2015) conducted similar research where there was a wide acknowledgement that not all incidents were reported. Holmström et al. (2015), found that the most valuable outcome of the implemented Medication Error Reporting (MER) system was the learning process provided through a comprehensive feedback process that ensured that knowledge was transferred back to all various levels within the organisation. Warring’s (2004) study suggests that doctors as a profession seem to have an aversion to rule-based and managerial tasks such as incident reporting and see this form of task as an opposite to the ideals that seem to characterise their medical profession and culture with incident reporting specifically regarded as “red-tape” and bureaucracy. Furthermore, the study states that doctors regard reporting as being a natural nursing task since the nursing professions culture is familiar with “form-filling” and paperwork.

Helmreich (2000) described one of the main safety increasing success factors within the aviation industry as the transformation from a blame culture to a learning culture motivated and assisted by CRM principles. Incident reporting systems are considered in several of the included studies Anderson et al. (2013), Hession-Laband et al. (2011), Hewitt et al. (2016), and Rea and Griffiths (2015) to be important and a positive tool towards improving patient safety. The systems also are seen as a part in a process of changing mind-sets in the evaluation of risks. Savage et al. (2005) study showed a significant increase in incident reporting with the introduction of an on-line incident reporting system, along with being able to analyse and proactive prevent medication errors. Wakefield et al. (2001) results show similar finding in that higher barriers to reporting are associated to decreased reporting.

In Sweden as well as several other countries, health-professional’s incident reporting is not about pointing out that individuals have committed human errors, but to notify and point out such information that healthcare providers needs to know in order be able to take preventative patient safety measures.
To reduce the focus from the personal responsibility the previous Law Act regulating patient safety was modified with the removal of individual/personal disciplinary sanctions, or warnings (SOU, 2008:117). The new Patient Safety Act (SFS 2010:659) is the established law to date. Based on information from the Swedish National Board of Health and Welfare the intention from the law-makers and the authority was to promote a system approach view of adverse event reporting, and not to point guilt at any individuals.

Even if the new Patient Safety Act (SFS 2010:659) has been in force for over six years, there is a recent estimate that only one out of ten adverse events or near-misses are reported and that this is a problem with the risk of losing valuable system information. One possible explanation is that the healthcare staff without updated knowledge about the newer system approach view in incident reporting, still maintain the personal blame perspective (from previous regulation) and that this still affects their approach to reporting adverse events. This could indicate that the Swedish healthcare system has not managed to communicate the change of the new laws intent into their information channels. One tangible example is the policy document for adverse event process handling from one of the main Emergency Hospitals in Stockholm. The policy gives background information of how important it is to report adverse explaining the reports use as a resource in the process of improving patient safety. The policy document however also contains a text that ends with the obligations to report adverse event according to the Patient Safety Act (SFS, 2010:659) but with no further information about how the information is handled in relation to the legal aspects of the Act and in regard to this, the removed personal disciplinary sanctions. Reprimands or warnings are no longer a factor. This can be read in the Governmental Bill (Proposition 2009/10:210) where the focus and intent was to improve the reporting process with a system approach perspective. In short there is a risk that healthcare personnel still work in a belief that incident reporting has a blame and punitive function whilst the law-makers have tried to remedy this, apparently not fully succeeding.

Further barriers to incident reporting in routine systems were found in Hogan et al. (2008) study to be; poor quality of coding, delays in the reports reaching the databases (probably assuming manual paper-based reporting), a too narrow focus of some data sources, time limits and a lack of central aggregation of the data. Fact-finding background material for this thesis showed that both lex Maria and/or incidents are reported (either electronically web-based or manually paper-based) in a format that is not sufficiently (data) structured nor coded and are almost in their entirety free-text based. Even with a basic level of knowledge of database queries and analysis it is difficult to understand how any detailed or specific deductions or data analysis of the reporting can be performed. The underlying data is as mentioned above mainly in a free-text, non-coded data format. An example of this is the reporting form for Lex Maria incidents from The Health and Social Care Inspectorate (IVO). Another related issue was seen during a demonstration of the Incident reporting system “HändelseVis” used within Stockholms Läns Landsting. This system consists of both free-text fields where information is written describing the incident and situation and also in some instances mandatory fixed-field/list choices that force the reporting user to choose within fixed parameters what type of incident occurred and where in system the mistake was made. These fixed mandatory fields sometimes are far too stringent or limiting as some mistakes or errors are made even though the underlying process was correct. The system is not flexible enough as to allow or handle human-decisions based on a number of other variables or facts to deviate from the process. From the systems perspective, the process is either correct or not, with no option to handle grey-areas that fall outside to remits of the systems coded parameters.
Hogan et al. (2008) study follows up this point, stating that the quality of the underlying data and coding, together with a far too narrow focus of data sources and lack of a central collation of the findings constitute the barriers to making best use of the data sources for monitoring patient safety. They do however also conclude that despite the issues with the data quality some analysis is possible, mainly related to triangulating information from different sources and some valuable conclusions can be deducted that improve patient safety. Boxwala et al. (2004) conclude from their work that the lacking standards in the representation of patient safety data has significant implications on being able to draw any conclusions or possibilities of learning lessons via data-driven interventions. Without a common data-model and representation of the data, any analysis across event types or sites is difficult specially in regards to benchmarking where it is of increased importance to be able to confidently compare like data with other like data. Boxwala et al. (2004) question the lack of regulatory insistence towards standard data reporting formats. Large-scale analysis of patient safety data can only be confidently done when this is in place.

If incident reporting is to achieve the benefits that have been accomplished within aviation and also to be able to serve as sufficient feedback to both satisfy the original submitter of the report, and also crucially form the basis of data where potential mistakes can be identified and to enable feedback, standards for coding and an appliance of more intelligent data-analysis must be made within healthcare. The risk of ending-up with massive data sources of basically unintelligible safety data is already apparent and needs to be addressed in order to fulfil the benefits that can be achieved using technology correctly. Currie and Richens (2009) point out in their study that a prioritisation of safety should be the concern of all, from board level and within the whole organisation but that safety within healthcare seldom is allowed to have a higher priority than budgeting factors. A recent example of this is Stockholm’s County Council’s (Stockholm Läns Landsting [SLL]) policy for safety that was approved the 15th of March, 2016 by the county council, stating the principles of “selecting cost effective actions to minimise the safety risks” (LS 2015:0093. p. 2). In our experience employees (within healthcare or any other industry) that need to balance cost-effectiveness against safety issues are put in a far more difficult situation compared to having a priority chain simply with safety as the highest priority. An example from another HRO is from Scandinavian Airlines System (SAS) who in their flight operation’s handbook give the clear introduction, “SAS flight preparation procedures shall ensure safe and efficient operation. The following order of priorities shall always be applied; 1: Safety and security, 2: Punctuality, 3: Care” (SAS, OM-A-01JUN12). Care in this context is services that are offered during flights and not related to patient care. With our experience from aviation and airlines safety is always prioritised higher. Holmström et al. (2015) suggests that governmental and international collaboration could be a way to overcome some of the financial barriers to incident reporting. Sharp (2012) describes this with the demands of high production and stringent financial control that exists within today's healthcare systems, can lead to a weakened safety culture. This trend needs to be changed with the insight that patient safety affecting incidents and accidents are extremely expensive both in monetary terms but also in human suffering.

Pearson et al. (2010) suggests that one of the main obstacles towards a learning culture of which incident reporting is vital is the lack of understanding even amongst nursing students as to the importance of reporting systems as a way to learn. The way to overcome this obstacle is by mandatory patient safety training for all healthcare personnel and changes to enable the update of university curriculum for nursing educations.
A further article by Leape et al. (2009) discusses that the necessary transformation within healthcare towards a safety culture still is insufficient. They argue that safety as often measured within healthcare in the form of practices and rules or specific improvement methods is not the way forward. Instead a safety culture depends on achieving and maintaining a culture of trust, reporting, discipline and transparency and this they see in every country and organisation requiring a major cultural change. In order to achieve this Leape et al. (2009) propose that change is necessary at the very beginning within medical and nursing education. The current education is according to Leape et al. (2009) almost solely focused on the acquisition of scientific and clinical knowledge instead of emphasising the development of other behavioural skills such as the ability to manage information, understanding human factors and limitations, patient safety, healthcare quality and system know-how and communication and teamwork skills. Based on our experience of flight and pilot training it can be seen that this specific education focuses from the onset on the importance of CRM methods and a whole discipline of the education from the basic level all the way to fully fledged commercial pilots is named Human Factors and Limitations where CRM methodology and techniques are taught and encouraged as methods to overcome or to be prepared for these limitations as well as encourage a culture of learning by reporting mistakes or incidents and learn from these. Leape et al. (2009) continue by stating that in the typical healthcare education environment little or no education is provided in engineering or management style concepts with systems thinking, safety sciences, human factors including leadership and teamwork which Leape et al. (2009) describes as producing square pegs for the care systems round holes. Also, WHO (2011) emphasise the need of further developing patient safety education within medical and nursing schools that almost completely follows the thoughts and concepts of CRM education.

“Students need to understand how human factors can be used to reduce adverse events and errors by identifying how and why systems break down and how and why human beings miscommunicate. Using a human factors approach, the human–system interface can be improved by providing better-designed systems and processes” (WHO, 2011, p. 29).

Reason (2004) also points out the benefits of equipping staff with education for them to be able to recognise with foresight both that errors will occur but also enable their ability to recognise risks and by doing so also increase their ability to handle any adverse situation.

With our current experience of nursing as nursing students and the nursing education system in Sweden, a culture of blame was “seen” and felt to be inferred still in today’s nursing profession. Despite this thesis indicating a close completion of our nursing studies, we are still drilled with the message that patient safety is ensured by simply not making mistakes, and that if we should dare to make a mistake this could inevitably lead to an incident report and the threat of losing our future nursing licence. Incident reporting as a method to learn from has hardly been stated throughout the current education path up to now. It should also be mentioned that during the writing process of this thesis it has emerged that the nursing educations curriculum has been changed for newer students and a course named Patient Safety is now part of the nursing education within Sophiahemmet University. There is also a course within the final (sixth) term containing a leadership education where some of the skills sought in this thesis together and by Leape et al. (2009) might be addressed.
Method discussion

The chosen method towards this thesis was a literature overview following the methodology described by Polit and Beck (2017). After a number of initial database searches returned a sufficient number of relevant articles that answered the purpose and problem statement (Forsberg & Wengström, 2015) we judged the method as suitable, applicable and reliable. We are convinced that by using the literature overview method as opposed to performing a qualitative interview method gave us the opportunity to reach a wider range of studies and background materials from a global perspective than had been the case with an interview study and therefore our chosen method increases both the validity of our study and global applicability of the findings. Our emphasis throughout on using a balanced mixture of both MeSH and CINAHL Headers as mandatory terms as well as a basis for free-text searches further enhances the reliability of this literature overview. Polit and Beck (2017) emphasise the importance of applicable search keywords as part of a search strategy and we focused on as far as possible perfecting the chosen search keywords as presented in Table 1.

Our decision to expand the search period to 20 instead of the more traditional period of a maximum of ten years was based on our wish to follow the development of CRM both within the aviation industry and healthcare in order to be able to compare and possibly draw deductions from each industries successes and failures in the implementations and the lessons learnt. Another important reason for the extended search period materialised whilst analysing the law review process towards the valid Swedish Patient Safety legislation (SFS 2010:659) where references from the same time period were found. The extended search period enabled us to backtrack and validate our findings and also to follow the reasoning of the respective law-makers. Being able to follow the legislator’s intents and recognising the same base-studies and articles that we also identified as part of our own background and results, allowed us to identify the areas where the intent of the legal aspects still have not succeeded in reaching their full intentions and also increases the reliability of our own study and conclusions.

The fact that this thesis has been written in English is seen as a strength in the aspect of being able to use the richness of the English language but also more importantly that issues of “loss of meaning” due to translations have been avoided as all the base material has also been written in English. We have seen this as benefit both in regards to increasing the overall reliability of our study, but also in being able to open up our findings and conclusions to a wider reading audience than had been the case if we had written the thesis in Swedish.

From the presented articles, a majority of the studies took place in either the United Kingdom or the United States of America which are both generally regarded as pioneering countries in the field of patient safety (WHO, 2005). Presenting these studies has increased the evidential basis of this thesis. Even though several likenesses can be seen between the healthcare systems in other European countries and the United States of America this thesis is based on experiences gained within the Swedish hospital and nursing environments and therefore all comparisons or differences have to be seen with this in mind. Another factor to consider is that Swedish or Scandinavian workplaces in general are known to be competitively flat in hierarchy with widespread delegation authorities given to even the most junior front line staff.
This especially compared with experiences from the English and American workplace environments. CRM has had great success in bridging or overcoming hierarchies and empowering all levels of staff within aviation also as seen from the presented studies. Since these results were proven outside Sweden there is no automatic conclusion that the results would be by default applicable to the Swedish healthcare system. Despite this we feel that our results, proposals of improvements and conclusions are relevant and applicable towards a global healthcare perspective.

During the process of using the powerful search engines it was noticed that a general confusion seemed to exist in regards to the use of MeSH and CINAHL Headers (MH). Initially the mistake was made of not explicitly specifying within the search engine that the searches should be performed specifically using MeSH and MH terms as mandatory terms. The searches proved after some further experimenting to have predominantly been performed as free-text searches. Once this was realised new searches were performed with a mandatory specification that the search was based on the use of MeSH and MH keywords. The combined use of both mandatory MeSH and CINAHL Header terms with fully free-text based searches albeit based on MeSH and CINAHL Header keywords ensured that the search results were widened as far as possible as per Polit and Becks (2017) recommendation. Shultz (2007), compared search results between the PubMed search engine towards the MEDLINE database and the relatively new search tool within the Google indexing database system named Google Scholar. The analysis showed that Google Scholar presented far more hits than PubMed and the resulting hits from the PubMed search were amongst the results. However far more irrelevant material was also returned from Google Scholar which Shultz (2007) refers to as “grey literature” that contains the search keywords but is otherwise totally irrelevant to the actual purpose of the search. MeSH and CINAHL index terms can be seen as having changed their initial role of increasing search hits, to instead assist in actually reducing the number of hits whilst ensuring that the hits are more relevant. In short more quality than quantity.

Throughout the writing process of both the project plan and this thesis we noticed the risk of not knowing when to stop the search process and that an interest in an articles path quickly opened new doors to yet again new articles and areas of interest. In short it became a challenge to know when to stop and to gain the experience of being able to state that we had enough material or articles in order to answer the purpose of the thesis. This seems to be a common issue within literature overviews where Webster and Watson (2002) share their experiences. Their rule of thumb is that the review is nearing its completion when no new concepts or new areas of interest are found. Within our own work this point became evident as we started to see both repetitions of topics and also cross referrals to authors and articles already included or rejected. During the analysis phase of the results we worked with two different methods (colour coding and theme coding) and approaches as to the review and subsequent analysis of each article that had been selected as the basis for the result section. The common basis was that the purpose and problem statement of this thesis was broken by us both individually into main themes and sub-themes that were considered to portray the overall message and purpose of the thesis. Using these themes and keywords each result article was independently analysed and sections of the articles were matched against the respective chosen keywords from the purpose and problem statement. Each selected section was then correlated with other relevant sections from other articles until all keywords and articles were completely analysed and each keyword defined with supporting texts.
With each of our individual reviews in place we then moved on to compare our individual results and discuss both the similarities of our results but also why we had different views and conclusions as to the key points of each article and as to the most relevant themes. During this stage and with our individual motivations we moved forward towards a consensus of which article sections and theme were most applicable and documented the end result as seen in the result section. This approach followed the recommendations of (Polit & Beck, 2017) in regards to avoiding that any individual bias or perspective was added and only our joint view was presented. The integrated analysis process was both rewarding but also at times frustrating before a sensible approach of coding the various articles evolved. Our coding process initially started as overly complex with too many codes for various themes being used. This initial work created an unnecessary complexity in the overall work and it became clear that fewer coding’s were needed as to avoid an overload of information and/or themes. Also, the paper based articles became overloaded with theme codes in the margins and colouring. To resolve this, we jointly agreed to cut down the number of possible themes which resulted in fewer code and colours combinations and with newly printed versions of the articles the work product became manageable again.

The selected studies and articles as presented in Appendix B, were assessed based on their perceived quality and were rated based on the assessment matrix by Berg, Dencker and Skärsäter (1999) and Willman, Stoltz and Bahtsevani (2011). The majority of the studies gained a rating of medium quality, one with the highest quality rating and three deemed to be of a low-quality standard. Although this could be seen to reduce the overall reliability of this thesis, all of the articles had a content that answered the purpose of the study and in our view, the mix of quality also has given a more realistic and broader result than if only high quality studies had been included. The apparent lack of high quality studies within the field of CRM implementations within healthcare could be explained by the findings of Bornmann (2016) who points out the difficulties of proving the impact of research within healthcare where there is one hand a great desire to be able to measure the impact of the often-costly research whilst as the same time handle the inherent unknowns and uncontrollable variables that healthcare entails. The fact that CRM is a methodology that relies on harder to measure indicators such as attitudes and perceptions increases the difficulty of studying the effects and/or impact even further.

An identified weakness within this thesis was the availability of recent (latest ten years) studies providing evidence of successful CRM results within the aviation industry. Active searches were performed in a number of wider scientific databases and other library sources in order to find any relevant scientific articles that could demonstrate this. Despite the overall impression that CRM has been a great success within the aviation industry, surprisingly few actual studies actually empirically prove this fact. Despite this lack of evidence, implementations of aviation style CRM team training have been enthusiastically encouraged also within other high-risk industries including healthcare. The expectation has been that such training should result almost by default in the same positive effects as within aviation. Musson and Helmreich (2004) warn that CRM training does not automatically transfer to other industries where other organisational and cultural differences normally exist. The lack of scientific studies within the aviation industry, where instead far more information is available within healthcare and medicine is probably explained by the latter industries far more cultural tendency to seek evidence via scientific research and studies.
Also, Sharp (2012) notes the risk of CRM being seen as the solution for all of the problems within the healthcare system and goes on by writing that this naturally is not the case.

Working as a team is a key concept within CRM, and possibly even more so when writing a thesis in regards to the importance of CRM. The strengths of two persons or more forming a team and writing as in this case a literature overview is mentioned by Polit and Beck (2017) with the term triangulation that implies the triangulation of several researcher’s interpretations and ideas whilst working together as a team. Irrespective of within or outside the cockpit or as nursing students writing a thesis, strengths are gained by the individual team members supporting each other towards a common goal. Decision making is also according to Sharp (2012) an important part of CRM where each team member has the responsibility to join in the decision-making process, but then also to follow the agreed decisions within the team. Communication is also according to Sharp (2012) a key component within successful teams and as seen in the results of this thesis. Another noticed strength of writing as a team apart from the afore mentioned fact that the thesis is written by two authors that should increase the reliability of the overall analysis, based on each article having been reviewed with four eyes instead of two giving the opportunity to also critically review each other’s deductions and conclusions (Wallengren & Henricsson, 2012).

**Conclusion**

Patient safety can be increased within a culture of safety where the nurse’s professionalism is a key factor. This is done through CRM training that gives clearly measurable results on the nurse’s perception and situational awareness with communication, teamwork and feedback. All of this is dependent on enabling a culture of learning from mistakes in an open non-punitive and blame-free environment. Furthermore, reporting systems are needed that both encourage reporting and are designed in a way that is understandable and from which correlatable information and feedback identifying the weaknesses of the healthcare systems can be given. A change to the healthcare education system is needed emphasising the importance of CRM and incident reporting to enable a system approach. We believe that this would lead to an optimisation of available recourses, reduced human suffering due to patient safety incidents and with this a reduction in healthcare costs.

**Clinical Implications**

The aviation and healthcare sectors share many similarities our hope is that our study can motivate further work and research within the field and ultimately bring around the necessary culture change also within healthcare fully enabling the learning culture supported by processes and systems for incident reporting. This will support the end goal of increasing nurse’s professionalism and patient safety and in doing so reduce the number of patient safety affecting incidents.

**Continued studies**

Future studies are suggested based on interview methods performed on a larger-scale basis with a focus on nurse’s perceptions towards incident reporting in general and their feelings of either working in a blame- or learning culture. Building an enhanced understanding of this area will contribute to the further efforts of encouraging incident reporting. Without the given time constraints in the process of writing this thesis, it could possibly have towards the results and conclusion been interesting to use a qualitative interview method or a mixed method instead.
As a fact-finding basis during the writing process of this thesis, two informal interviews were held. One face-to-face interview with a Patient Safety Controller within Danderyds Hospital in Stockholm, and a telephone interview with the subject expert of incident reporting within The National Board of Health and Welfare. Both of these informal interviews rendered invaluable information and it became clear that this would have been a useful method in continued studies of the subject especially if wider interviews could have been performed on a large-scale basis with a focus on nurse’s perceptions towards incident reporting in general and their feelings of either working in a blame- or learning culture.
REFERENCES

* = Article included within Result section


**APPENDIX A**


<table>
<thead>
<tr>
<th>KOD OCH KLASIFICERING</th>
<th>VETENSKAPLIG KVALITET</th>
<th>I = Hög kvalitet</th>
<th>II = Medel</th>
<th>III = Låg kvalitet</th>
</tr>
</thead>
</table>
| **Klinisk kontrollerad studie/Clinical controlled trial (CCT)** är prospektiv och innebär jämförelse mellan kontrollgrupp och en eller flera experimentgrupper. Är inte randomiserad. | Välplanerad och väl genomförda studier med adekvat beskrivning av protokoll, material och metoder inklusive behandlingsteknik. Antalet patienter/deltagare tillräckligt stort för att besvara frågeställningen. Adekvata statistiska metoder. | | Begränsat/för få patienter/deltagare, metoden otillräckligt beskriven, brister i genomförande och tveksamma statistiska metoder. | *
| **Icke - kontrollerad studie (P)** är prospektiv men utan relevant och samtida kontrollgrupp. | Väldefinierad frågeställning, tillräckligt antal patienter/deltagare och adekvata statistiska metoder. | | Begränsat/för få patienter/deltagare, metoden otillräckligt beskriven, brister i genomförande och tveksamma statistiska metoder. | *
| **Retrospektiv studie (R)** är en analys av historiskt material som relateras till något som redan har inträffat, exempelvis journalhandlingar. | Antalet patienter/deltagare tillräckligt stort för att besvara frågeställningen. Väl planerad och väl genomförda studier med adekvat beskrivning av protokoll, material och metoder. | | Begränsat/för få patienter/deltagare, metoden otillräckligt beskriven, brister i genomförande och tveksamma statistiska metoder. | *

*Några av kriterierna utifrån I = Hög kvalitet är inte uppfyllda men den vetenskapliga kvaliten värderas högre än III = Låg kvalitet.*

Randomiserad kontrollerad studie (RCT), Klinisk kontrollerad studie (CCT), Icke - kontrollerad studie (P), Retrospektiv studie (R), Kvalitativ studie (K)
I = Hög kvalitet, II = Medel kvalitet, III = Låg kvalitet
## Table 5: Matrix of included articles.

<table>
<thead>
<tr>
<th>Author</th>
<th>Year (of publication)</th>
<th>Country (where the study was performed)</th>
<th>Title</th>
<th>Purpose</th>
<th>Method (Design, selection, data collection and analysis)</th>
<th>Sample Size</th>
<th>Responders (Non-responders)</th>
<th>Results</th>
<th>Type</th>
</tr>
</thead>
</table>
| Anderson, J E., Kodate, N., Walters, R., Dodds, A. | 2013                  | United Kingdom                          | Can incident reporting improve safety? Healthcare practitioners’ views of the effectiveness of incident reporting | A study in order to examine the perceived effectiveness of incident reporting in improving safety in mental health and acute hospital settings | Design: Prospective non-controlled study  
Selection: Volunteered to participate  
Data collection: Semi-structured interviews  
Analysis: Framework analysis by two researchers iteratively developed the coding framework                                                                                                                                                                                                 | 62           | -                           | Respondents regarded incidents reporting systems as a positive safety tool with the possibility of improving processes, and change the way practitioners think about risks. Many respondents in both hospitals felt that the recommendations were of a poor quality and/or contained far too many recommendations, which could be contradictory or were regarded as too simple. This could lead the clinicians to simply dismiss the recommendations as not likely to have the desired effect. | III         |
| Currie, L., Richens, Y.                      | 2009                  | United Kingdom                          | Exploring the perceptions of midwifery staff about safety culture    | Exploration of the experiences and perceptions of safety culture by midwifery staff and also to make recommendations as to how a positive safety culture may be developed to benefit patients, staff and organisations | Design: Naturalistic research paradigm with phenomenological approach  
Selection: All midwifery staff at the study site  
Data collection: Group discussions in focus groups  
Analysis: Descriptions of group context, all transcripts read separately by both researchers, independently coded and categorised the data before identifying any themes                                                                                                                                 | 33           | -                           | Two key reasons of non-reporting: lack of feedback, and fear of reprisals. Feedback and learning showed, mixed reactions on how feedback mechanisms support or contradict a Safety Culture within the organisation. The study identified a shared concern amongst community midwives that management decisions such as to staffing levels and a decision how birthing to woman outside the organisations geographical coverage area had a negative impact on their ability to deliver safe care. Both midwives and managers shared issues in regards to handling and caring of very assertive woman who had clear expectations and the consequences for the midwives in their attempts to live up to the client’s high expectations. Communication reported as the second largest reason for failures in safety. | KII         |
<table>
<thead>
<tr>
<th>Author</th>
<th>Year (of publication)</th>
<th>Country (where the study was performed)</th>
<th>Title</th>
<th>Purpose</th>
<th>Method (Design, selection, data collection and analysis)</th>
<th>Sample Size (Responders (Non-responders))</th>
<th>Results</th>
<th>Type Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaba, D M., Singer, S J., Sinaiko, A D., Bowen, J D., Ciavarelli, A P.</td>
<td>2003</td>
<td>United States of America</td>
<td>Differences in Safety Climate between Hospital Personnel and Naval Aviators</td>
<td>Comparison of safety climate survey questions between health care and naval aviation respondents</td>
<td>Design: Safety assessment survey Selection: Selected personal groups Data collection: Internet based questioners Analysis: Principal component factor analysis, with a varimax rotation to maximize the loading on each factor</td>
<td>6 901 (1 308) 6 312 (3 323)</td>
<td>Problematic responses amongst high-hazard hospital workers were up to 16 times greater than amongst aviators.</td>
<td>RII</td>
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<tr>
<td>Gore, D C., Powell, J M., Baer, J G., Sexton, K H., Richardson, C J., Marshall, D R., Chinkes, D L. &amp; Townsend, C M.</td>
<td>2010</td>
<td>United States of America</td>
<td>Crew Resource Management Improved Perception of Patient Safety in the Operating Room</td>
<td>Before and after assessment and survey if Crew Resource Management training improved the perception of Patient Safety within the operating room environment</td>
<td>Design: A survey questionnaire and a follow up survey questionnaire 6 months after initiation training and 8 months after completion of CRM seminars. Selection: All hospital employees involved in operative procedures. Data collection: Survey questions distributed by e-mail. Analysis: Through a database and Mann-Whitney tests for statistical analysis</td>
<td>600 (393) 595 (409)</td>
<td>Gauged and emphasised teamwork showed no significant impact when comparing the two respective studies for all participants. A significant improvement in the perception of teamwork amongst nurses focused on reporting errors and adverse events. Significant improvement in the perception of reporting and discussing mistakes and errors within the overall survey base. No significant change could be seen in the responses from faculty physicians, but significant improvement among nurses and resident physicians.</td>
<td>PII</td>
</tr>
<tr>
<td>Gorini, A., Miglioretti, M., Pravettoni, G.</td>
<td>2012</td>
<td>Italy</td>
<td>A new perspective on blame culture: an experimental study</td>
<td>Study in order to explore and document the presence and pervasiveness of a blame and punishment culture within healthcare and its consequences on reporting of errors</td>
<td>Design: Experimental study Selection: Staff from different units Data collection: Questionnaires Analysis: Principal component analysis with Promax rotation on the scores of 24 items included in two scenarios</td>
<td>249</td>
<td>Fear of being blamed was significantly higher than the fear of being punished. In regards to blame the results showed no effects of the sub-groups or gender whilst with the fear of punishment a significant effect of the sub-groups was seen, but again no effect of gender. Nursing students had a higher degree of fear of being punished compared with other sub-groups. Nurses had a higher fear of being punished by physicians.</td>
<td>RIII</td>
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**III**

Randomiserad kontrollerad studie (RCT), Klinisk kontrollerad studie (CCT), Icke - kontrollerad studie (P), Retrospektiv studie (R), Kvalitativ studie (K)

I = Hög kvalitet, II = Medel kvalitet, III = Låg kvalitet
<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Purpose</th>
<th>Method</th>
<th>Sample Size</th>
<th>Results</th>
<th>Type Quality</th>
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</thead>
<tbody>
<tr>
<td>Grogan, E L., Stiles, R A., France, D J., Speroff, T., Morris, J A., Nixon, B., Gaffney, F A., Seddon, R., Pinson, C W., 2004 United States of America</td>
<td>The Impact of Aviation-Based Teamwork Training on the Attitudes of Health-Care Professionals</td>
<td>Study and evaluation of healthcare participant’s reactions and attitudes towards aviation based CRM training</td>
<td>Design: Pre-/Post knowledge surveys and a Human factor attitude Survey</td>
<td></td>
<td>Respondent attitudes regarding the utility of the course and its components showed favourable results. Attitudes of the potential of CRM training in order to improve quality and safety in health care received the highest mean score of the survey with 86 percent of the participants either expressing agreement or strong agreement. In addition, 95 percent agreed that CRM training would reduce incidents within their practices. Human Factors Attitude Survey (HFAS) showed significant attitude shifts.</td>
<td>II</td>
</tr>
<tr>
<td>Author</td>
<td>Year (of publication)</td>
<td>Country (where the study was performed)</td>
<td>Title</td>
<td>Purpose</td>
<td>Method (Design, selection, data collection and analysis)</td>
<td>Sample Size</td>
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</table>
| Haerkens, H T M., Kox, M., Lemson, J., Houterman, S., van den Hoeven, J G., Pickkers, P. | 2015                  | The Netherlands                        | Crew Resource Management in the Intensive Care Unit: a prospective 3-year cohort study | Study in order to determine whether implementations of CRM impacts the outcome of critically ill patients within the Intensive Care Unit over a three-year period pre-and post CRM training | Design: Prospective 3-years cohort study. Pre-during-post design  
Selection: All patient treated at the ICU  
Data collection: Patient clinical outcome data  
Analysis: Mann-Whitney U-test to compare continues data between two groups, Kruskal-Wallis test used to compare continues data between three or more groups and chi-square tests to compare proportions. Chi-square test to evaluate our null hypothesis | 7,271        | Results showed a significant decrease in the complication incidence from 67.1 percent in the baseline year and 66.4 percent in the implementation year to 50.9 percent in the post implementation year. | CCT I          |
| Hession-Laband, E., Mantell, P. | 2011                  | United States of America                | Lessons Learned: Use of Event Reporting by Nurses to Improve Patient Safety and Quality | Study in order to determine if event reporting by Nurses can improve Patient Safety and Quality | Design: SERS question survey in 2008 and a follow up in 2010  
Selection: All nurses in general medical, surgical unit and emergency department  
Data collection: Web-based survey  
Analysis: Statistic analysis before and after implementation of project | 675 (243)    | Results showed that nurses in general thought more about incident reporting, reported more near-misses and nearly all reports were filled with names. The main reason for not reporting was given as lack of time. An improvement after education was related to a previous issue of not knowing when an incident report should be filed. | PII           |
<table>
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<tr>
<th>Author</th>
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<th>Country</th>
<th>Title</th>
<th>Purpose</th>
<th>Method</th>
<th>Sample Size (Responders (Non-responders))</th>
<th>Results</th>
<th>Type Quality</th>
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</thead>
</table>
| Hewitt, T., Chreim, S., Forster, A. | 2016                      | United States of America     | Incident reporting systems: a comparative study of two hospital divisions | Comparative case study between two hospital divisions use of Incident Reporting and factors that help shape the process                   | Design: Semi-structured interviews  
Selection: Two different division with same electronic reporting system, one of the division had adopted the system later  
Data collection: recorded interviews  
Analysis: Thematic analysis of transcribed interviews                                                                                     | 85                                               | Nurse leaders sometimes had difficulties in drawing any opportunities of learning from the incident reports and many times focused on an individual (fault) view instead of a system (fault) view. A perspective of blame was also seen as nursing leaders stated that teachable moments were there when the approach was non-threatening and in the individual (nurse) felt safe to discuss incidents with the leader. Overall this lack of feedback was identified as a major weakness within one of the studied departments. In the second department with an alternative incident reporting system (IRS) both incident and near-miss reporting was far more commonplace. | CCTII          |
| Hogan, H., Olsen, S., Scobie, S., Chapman, E., Sachs, R., McKee, M., Vincent, C., Thomson, R. | 2008                     | United Kingdom               | What can we learn about patient safety from information sources within an acute hospital: a step in the ladder of integrated risk management | Assessment of the utilisation of data existing within hospitals for monitoring Patient Safety                                             | Design: Mapping exercise including semi structured interviews, examination of data sources and attendance of clinical governance meetings  
Selection: Seven sources for more detailed analysis.  
Analysis: Coded using category and level by the National Reporting and Learning System, NRLS. Assessed by identifying how many of the data items required by NRLS | 33                                               | 71 patient-safety incidents were found. Of these, 40 incidents were classed as an adverse event being “an unintended injury or complication of care leading to prolonged admission, disability at discharge or death and caused by healthcare management rather than the disease process”. | RII            |
<table>
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<tr>
<th>Author</th>
<th>Year (of publication)</th>
<th>Country (where the study was performed)</th>
<th>Title</th>
<th>Purpose</th>
<th>Method (Design, selection, data collection and analysis)</th>
<th>Sample Size</th>
<th>Responders (Non-responders)</th>
<th>Results</th>
<th>Type</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holmström, A-R., Laaksonen, R., Airaksinen, M.</td>
<td>2015</td>
<td>Finland</td>
<td>How to make medication error reporting systems work – Factors associated with their successful development and implementation</td>
<td>Study exploring factors as to the successful development and implementations of medication error reporting systems</td>
<td>Design: Descriptive cross-sectional online questionnaire comprising of open-ended and structured questions Selection: 32 medication safety experts in 26 countries Data collection: During Spring 2007 via an online questionnaire Analysis: Raw data received in Excel format was transferred to Word for theme analysis. A model was created was on the identified themes</td>
<td>32 (16)</td>
<td>The main findings were to create a operational environment for a MER system. The system must be constructed in order to support functionality and needs to be improved in many countries.</td>
<td></td>
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<td>KII</td>
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<tr>
<td>Howell, A-M., Burns, E M., Bouras, G., Donaldson, L J., Athanasiou, T., Darzi, A.</td>
<td>2015</td>
<td>United Kingdom</td>
<td>Can Patient Safety Incident Reports Be Used to Compare Hospital Safety? Results from a Quantitative Analysis of the English National Reporting and Learning System Data</td>
<td>An examination of whether annual hospital incident reporting rates can be used as an indicator of individual hospitals Patient Safety levels and secondly to access which hospital characteristics are correlated with high incident reporting rates. Finally, also a perspective into if high levels of incident reports from an individual hospital can indicate that the same hospital is safer than others</td>
<td>Design: Selection: All reports of patient safety incidents from NHS acute hospitals trust Those without inpatient approval were excluded. Data collection: During period 1 January 2003 to 31 May 2013 from the NRLS database. Analysis: Statistical analysis with SPSS version 20.0, non-parametric data was correlated using Spearman’s rank correlation coefficient</td>
<td>5 879 954</td>
<td>Main findings include that 70.9 percent of the overall incidents caused no actual harm to the patient. 0.9 percent were judged to have caused either severe harm or patient death. Clinicians were significantly most likely to report deaths as part of an incident compared to any other staff group.</td>
<td></td>
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<td>RII</td>
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<td>Author</td>
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<tr>
<td>Kim, K S., Kwon, S-H., Kim, J-A., Cho, S.</td>
<td>2011</td>
<td>South Korea</td>
<td>Nurses’ perceptions of medication errors and their contributing factors in South Korea</td>
<td>A study aimed at identifying Korean nurses’ perceptions of medication errors</td>
<td>Design: Cross-sectional descriptive study. Selection: Nurses with minimum 1 year clinical experience from seven hospitals. Data collection: After introduction, a self-administered confidential questionnaire. Analysis: Descriptively using SPSS version 17.0</td>
<td>330</td>
<td>106</td>
<td>63.6 percent responded that they had been involved in medication errors over the period of a month. Main occurrence of errors was in connection with intravenous administration performed during the day shift. A main contributing factor (45.5 percent) was unfamiliarity with the drug. Most of the reported medication errors resulted in no adverse effect. In regards to failing to report medication errors, the most frequent reason was a fear of being regarded as a troublemaker.</td>
<td>RII</td>
<td></td>
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<tr>
<td>Kousgaard, M B., Joensen, A S., Thorsen, T.</td>
<td>2012</td>
<td>Denmark</td>
<td>Reasons for not reporting patient safety incidents in general practice: A qualitative study</td>
<td>Explore the reasons behind non-reporting of safety incidents within general practices</td>
<td>Design: Qualitative, Semi-structured interviews. Selection: Respondents recruited among the clinics that had expressed an interest in using the system by acquiring a password. Data collection: All interviews were audio-recorded, interviews followed an interview guide. Analysis: Transcribed material analysed repeatedly, comparing and discussing the data to form central categories</td>
<td>12</td>
<td></td>
<td>Despite a stated general interest in incident reporting system it turned out that few actual incidents were reported. GP’s declared that they could have reported far more incidents. The clinic with the highest number of reports was also the clinic where other staff professions including nurses had been involved and encouraged to report incidents as well. Allocation of time was seen as problematic. GP’s did not consider formal incident reporting to have any considerable potential for improving working processes and patient safety in the clinic and failed to see any “lessons learnt” in the data.</td>
<td>KII</td>
<td></td>
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<tr>
<td>Author</td>
<td>Year (of publication)</td>
<td>Country (where the study was performed)</td>
<td>Title</td>
<td>Purpose</td>
<td>Method</td>
<td>Sample Size</td>
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<tr>
<td>Pape, T M.</td>
<td>2003</td>
<td>United States of America</td>
<td>Applying Airline Safety Practices to Medication Administration</td>
<td>Study of reasons behind mediational administration errors and possibility for applying Airline Safety practices as a remedy</td>
<td>Design: Quasi experimental three-group design Selection: All nurses at clinic, demographic data form to collect information about age, gender, ethnicity, level of nursing education and nursing experience Data collection: Observation and recording on Medication Administration Distraction Observation Sheet, MADOS Analysis: Fehring’s model for evaluation</td>
<td>24</td>
<td></td>
<td>The findings indicate that there were significantly fewer distractions occurring in the Medsafe group than in the protocol or control group.</td>
<td>CCT II</td>
<td></td>
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<tr>
<td>Pearson, P., Steven, A., Howe, A., Sheikh, A., Ashcroft, D.</td>
<td>Learning About Patient Safety: Organizational Context and Culture in the Education of Health Care Professionals</td>
<td>Study exploring findings in relation to organisational context and culture amongst nursing students in regards to patient safety</td>
<td>Design: Multiple qualitative method Selection: Health profession student through preregistration courses across England and Scotland. Courses were chosen to include student from different professions and including students from both old and new universities with both traditional and innovative curriculum Data collection: Through observation of case studies both in practice and academic context. Interviews and through documentation on patient safety collected from organisations that provided student placement Analysis: Data were transcribed and coded independently by more than one researcher. Analysis was iterative and on going throughout the study</td>
<td>183</td>
<td>Students were not engaged and/or aware of incident reporting schemes. They may not have access to existing systems in their organisation. The majority did not access employers’ induction programmes.</td>
<td>KII</td>
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<th><strong>Sample Size</strong> Responders (Non-responders)</th>
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| Rea, D., Griffiths, S. | 2015 | United Kingdom | Patient safety in primary care: incident reporting and significant event reviews in British general practice | To explore attitudes towards incident- and sentinel event reporting within British general practice | Design: Qualitative interviews  
Selection: GP’s identified as partners in a practice and holding a contact with the LHB to provide general medical services. GP’s who were locum practitioners and registrar GP’s were excluded  
Data collection: Confidential semi-structured interviews lasting no longer than 1 hour  
Analysis: Descriptive approach where a content analysis was performed for each transcript. Coding by both researchers | 17 (8) | GP’s had a positive attitude towards reporting within the domains of their own practice. All GP’s reported incidents and could describe their clinics reporting systems, but there was also a wide acknowledgment that not all incidents were reported. Only two of the respondents had reported further to the National Patient Safety Agency (NSPA) due to confusion as the which reports should be taken to this level and which were handled by the Local Health Board (LHB). most participants stated awareness that the system was not aimed at punitive measures and was fully separated from a parallel system for complaints over medical errors. | KII |
| Savage, S W., Schneider, P J., Pedersen, C A. | 2005 | United States of America | Utility of an online medication-error-reporting system | Evaluation study into the utility of an online medication-error-reporting system | Design: Survey to gather before and after information after implementing Medmarx system  
Selection: Hospitals and health systems that used the medication-error-reporting program  
Data collection: 32 question survey mailed including return envelop  
Analysis: Using SPSS version 12.0.0, descriptive statistics to evaluate facility responses | 550 (341) | Prior to the system implementation a monthly average of 32 medication errors were reported on a monthly basis. Post-implementation the monthly number of reported incidents increased by 88 percent along with the number of reports being able to be used for medication system analysis and proactive methods for preventing medication errors. 75 percent of the system users responded that they thought the system could be used in order to identify improvements to the medication-use process and 90 percent agreed that the program assisted them in identifying underlying problems. | RII |
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<td>Sax, H C., Browne, P., Mayewski, R J., Panzer, R J., Hittner, K C., Burke, R L., Colleta, S.</td>
<td>2009</td>
<td>United States of America</td>
<td>Can Aviation-Based Team Training Elicit Sustainable Behavioural Change?</td>
<td>A quantificational study into the effects of aviation-based crew resource management training on Patient Safety-related behaviours and perceived personal empowerment</td>
<td>Design: Prospective study of numbers of reports and severity Selection: all staff who participated in CRM training at two hospitals Data collection: amount of reports and severity, level 1 or 2 Analysis: Comparison of reports distributed before and after intervention was calculated via $x^2$ with Yates correction</td>
<td>857</td>
<td></td>
<td>Compliance in following the checklist rose from 75 percent to 100 percent during the period 2003 to 2007. A further increase was also seen in the self-reporting of incidents that increased from 709 reports per quarter in 2002 to 1 481 per quarter in 2008. There was also an increase in the willingness to report near-misses with reporting rates going from a level of 15.9 percent in 2002 to 20.3 in 2004 and consistently to 2008.</td>
<td>PII</td>
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| Sexton, J B., Thomas, E J., Helmreich, R L. | Error, stress, and teamwork in medicine and aviation: cross sectional surveys | A survey of operating theatre and intensive care units’ staff attitudes in regards to error, stress and teamwork and compare these attitudes with those of airline cockpit crews | **Design:** Cross sectional survey  
**Selection:** Doctors, nurses, fellows and residents working in operating theatres and intensive care units and cockpit crew members  
**Data collection:** Surveys were administered through hospital or airlines internal mail  
Respondents were given option of returning to an anonymous drop box or a stamped envelope addressed to laboratory in Austin, Texas  
**Analysis:** Surveys were merged into a combined database. Presented descriptive data | 1 033  
30 000 | In regards to stress and fatigue, 60 percent of the medical respondents answered that they are able to perform effectively during critical times even when fatigued far higher than the aviation responses. 67 percent of responded that true professionals are able to leave personal problems behind them whilst working. Pilots, anaesthesia consultants, residents and nurses were less likely to deny the impact of personal problems than surgical consultants. 70 percent of the medical respondents agreed that decision-making ability is as good in medical emergencies as in routine situations. To advocate flat hierarchies Consultant surgeons were the least likely,55 percent, 95 percent of cockpit and intensive care staff. Over 80 percent of medical staff responded that preoperative and postoperative discussions are an important part of teamwork and safety. Differences in the perceptions of teamwork between doctors and nurses were also found in regards to the quality of teamwork within intensive care. 25 percent do not encourage to report safety issues and concerns. 33 percent indicated that errors are handled appropriately within their hospital environment. Attitudes about errors and safety over 94 percent of intensive care staff disagreed with the statement “Errors committed during patient management are not important, as long as the patient improves”. 90 percent believed that “a confidential reporting system that documents medical errors is important for patient safety and over half the respondents indicated overall that they find it difficult to discuss mistakes and that they see several barriers to these types of discussions. | RII          |
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| Staender, S., Davies, J., Helmreich, B., Sexton, B., Kaufmann, M. | 1997                  | Austria                                | The anaesthesia critical incident reporting system: an experience based database | Study in order to gain insight into the nature of critical events and to collect cases that might have a teaching potential for other anaesthetists | Design: Prospective analysis of reports.  
Selection: Open to all  
Anaesthesia staff anonymously  
Data collection: Using the Critical Incident Reporting System to collect anonymous CI  
Analysis: With help of a template, an automatic re-mailer creates anecdotal text out of the entered information | 60           | Problems with communication was a contributory factor in 34 percent of the reported cases, lack of situational awareness in 30 percent, lack of experience 30 percent, not performing a check in 28 percent and wrong judgement in 23 percent. More than one option was allowed explaining the overall percentages.  
Human Error 42 percent, split into 55 percent being a slip/blunder and 45 percent as a knowledge based lack/error. Management error was recorded in 32 percent of cases and technical errors constituting for 6 percent. | PIII          |
| Tapson, V F., Bongiorno Karcher, R., Weeks, R. | 2011                  | United States of America               | Crew Resource Management and VTE Prophylaxis in Surgery: A Quality Improvement Initiative | Study to access the results of a quality improvement project involving combining evidence based information on VTE Prophylaxis in Surgery with CRM principles related to communication, teamwork and error avoidance | Design: A strategic assessment before and surveys during and after the educational intervention  
Selection: Surgical staff  
Data collection: And a series of surveys, interviews, focus groups and observations to evaluate communication strategies  
Analysis: Results were compared using x^2 tests and paired t test. QI measures were classified as meeting or not meeting guideline recommendations | 132 29       | No significant difference in the participants’ attitudes could be shown, pre-, between or post-intervention with CRM based training where nearly all the respondents responded that they regarded teamwork and efficient communication skills as extremely important in providing optimal patient care. Significant increase was related to increased confidence levels including the ability to be able to identify process related factors that may have led to medical errors in surgical settings using CRM related techniques to increase patient care. A follow-up survey 30-days with a limited sample of respondents that showed a continued significant improvement in regards to self-confidence in using the CRM-based tools. | PII           |
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| Wakefield, B J., Blegen, M A., Uden-Holman, T., Vaughn, T., Chrischilles, E., Wakefield, D S. | 2001 | United States of America | Organizational Culture, Continuous Quality Improvement, and Medication Administration Error Reporting | Study exploring the relationships among measures of nurses’ perceptions of organisational culture, continuous quality improvement implementations and mediational administration error reporting | Design: Descriptive and cross-sectional  
Selection: 6 Midwest hospitals, each hospital determined which nursing unit and nursing staff received a survey  
Data collection: Written surveys  
Analysis: A 1-way ANOVA with the individual-level data by hospital to compare the within-hospital variance to be between-hospital variance | 1 428 (1078) | Results show that at both the individual and unit-level analysis that higher barriers to reporting are associated to decreased reporting. The smaller institutions tended to have group-oriented cultures the larger showed more hierarchical structures. Higher barriers to reporting are associated to decreased reporting only significant at the individual-level analysis. Hospital-level analysis were not significant possibly due to the small number of hospitals. | RII   | XV       |

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<td>Waring, J. J.</td>
<td>2005</td>
<td>United Kingdom</td>
<td>Beyond blame; cultural barriers to medical incident reporting</td>
<td>Exploration of medical physicians’ attitudes towards adverse incident reporting in healthcare with particular focus on the inhibiting factors or barriers to participation in incident reporting</td>
<td>Design: A large qualitative study between 2001 and 2003 Selection: From 42 interviews with medical and managerial staff from across the District General Hospital in the English Midland, 12 respondents were theoretically sampled Data collection: Interviews followed a broad thematic guide that was concerned with gathering occupational narratives, accounts of recent development Analysis: All interviews were electronically recorded and transcribed verbatim into word processing packages. The data was then imported into the qualitative data analysis computer package Atlas ti for the purpose of coding and context analysis. Manually examining the interview data to identify descriptions, case, occurrences and attitude</td>
<td>28</td>
<td></td>
<td>Doctors are apprehensive about different external sources of blame as the public or the press and the increased presence of legal litigation within healthcare. Internal source of blame a fear that an increased openness about individual competence could lead to questioning of professional practise, poor references, reprimands from senior colleagues and could tarnish reputations. Fear of incident reports would be used in case of any future medico-legal disputes. Doctors remained both apprehensive and sceptical about the purpose and application of the reported incident data. Support was primarily based on the premise of being able to shift responsibility and blame for poor quality care higher up in the organisational hierarchy could be utilise to strengthen requests for organisational change, allocation of resources, staff and equipment Management and senior medical representatives and doctors saw incident reporting as a practical mechanism for encouraging patient safety and were more aware and saw it as part of a quality and service improvement.</td>
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<td>West, P., Sculli, G., Fore, A., Okam, N., Dunlap, C., Neily, J., Mills, P.</td>
<td>Improving Patient Safety and Optimizing Nursing Teamwork Using Crew Resource Management Techniques</td>
<td>Study describing the application of the CRM based technique of “sterile cockpit rule” targeted towards improving efficiency and safety with nursing assistants in their performance of patient care duties</td>
<td>Design: Before, under and after CRM project self-administrated questionnaire. Follow-up interviews. Selection: Nurses from one Veteran affairs unit. Data collection: Questionnaire, telephone follow-up interviews. Analysis: No info given</td>
<td>47</td>
<td>(7)</td>
<td>Within a period of months after the implementation of their “sterile cockpit program”, the nursing unit experienced extensive improvements to their efficiency, which further provided the unit more time for patient safety interventions. The average time for nurses to complete nursing assessments dropped from three to 1 hours. Staff responses in regards to staff morale showed dramatic improvements</td>
<td>PIII</td>
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