Failure-Free Pharmacies?

An Exploration of Dispensing Errors and Safety Culture in Swedish Community Pharmacies

ANNIKA NORDÉN-HÄGG
Dissertation presented at Uppsala University to be publicly examined in Minus auditorium, Museum Gustavianum, Akademigatan 3, Uppsala, Friday, October 8, 2010 at 13:15 for the degree of Doctor of Philosophy (Faculty of Pharmacy). The examination will be conducted in English.

**Abstract**


Quality in pharmacies includes aspects such as error management and safety issues. The objective of this thesis was to explore these aspects of quality in Swedish community pharmacies. The specific aims were to compare a paper-based and a web-based reporting system for dispensing errors, regarding reporting behaviour and data quality. The impact of an intervention; a technical barrier, for preventing dispensing errors was evaluated. A survey tool, the Safety Attitudes Questionnaire (SAQ), was adapted to Swedish pharmacies and used to describe the safety culture in these pharmacies. The potential relationship between safety culture and dispensing errors was also explored. Data was retrieved from the paper- and web-based reporting systems, semi-structured interviews as well as from a survey, using SAQ.

The change in reporting system for dispensing errors increased the reporting of errors and enhanced the completeness of reported data. The web-based system facilitated follow-up and identification of preventive measures, but was associated with implementation problems. The intervention was associated with a significant decrease in the overall number of dispensing errors and, specifically, reports on errors with the wrong strength, and errors caused by registration failure in the pharmacy computers. The Swedish version of the survey tool, SAQ, demonstrated satisfying psychometric properties. No correlation between the SAQ Safety Climate dimension and dispensing errors was seen, while a positive relationship between the SAQ Stress Recognition dimension and dispensing errors was established. A number of other pharmacy characteristics, such as number of dispensed prescription items and employees, displayed positive relationships with dispensing errors. Staff age demonstrated a negative relationship with dispensing errors while other demographic variables such as national education background showed a positive relationship.

**Keywords:** pharmacy, quality, dispensing errors, safety culture, safety climate, Sweden

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List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.


II Nordén-Hägg A, Andersson K, Kälvemark Sporrong S, Ring L, Kettis-Lindblad Å. Reducing dispensing errors in Swedish community pharmacies – the impact of a barrier in the computer system. Quality & Safety in Health Care (Accepted)


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This thesis emanates from my work as a quality assurance manager at the National Corporation of Pharmacies (Apoteket AB). Becoming a PhD student represented a natural development from the work I hitherto had performed. I believed that combining practice and research would add a scientific stringency to, and further evolve my already ongoing work and also make it possible for me to contribute in a more distinct way to increase the knowledge within my field of expertise. Both the Department of Pharmacy at Uppsala University and my employer agreed and the understanding was that research was to occupy fifty percent of my working hours and create a complement to my work assignment. Taking the decision to return back to university, after having spent 22 years as a working professional, was not easy. The welcome I received was however warm, even though it is not usual for a pharmacy professional in Sweden to take on a journey like this, to return to university after having spent so much time in the working world outside. It is a great pity as the interchange between professional and academic life ought to be much more developed – both worlds would without doubt benefit from this!

Before I was employed at the Quality Department of the National Corporation of Pharmacies, I worked in pharmacies. I dispensed medicines, provided information and education to pharmacy professionals, as well as other health care personnel. I have also worked as a pharmacy manager. When I was employed at the Quality Department in 2002, my primary task was to design and implement a nationwide web-based reporting system for the reporting of dispensing errors to replace the existing paper-based system. This process is described in Paper I. After having concluded this initial assignment, I gradually became responsible for the management of dispensing errors within the company. I performed in-depth analyses of the reported errors, resulting in the design of a technical barrier that targeted dispensing errors which was integrated into the computerised prescription registration process nationwide. The result of this intervention was evaluated and is presented in Paper II. The work with errors brought about a need for a deeper understanding of the context in which errors occur, and my interest in the concept of safety constituted a natural progress. After some exploration, I identified the Safety Attitudes Questionnaire and in Paper III the adaptation and validation of this questionnaire is described. Paper IV, finally, reports on the exploration of a
relationship between safety culture and dispensing errors in Swedish pharmacies.

Before I did this research work, I imagined that to make an evaluation of the organisation you work in might be like trying to balance on a slack rope, since there might be a risk of my employer not fully appreciating the importance of scientific integrity. This turned out, however, not to be a problem. The other main problem would be to carry out an evaluation of my own work. What about my own bias? I was – and still am – very much convinced of the importance of quality management, and of course this has influenced my work. Nevertheless, my tutors, my fellow authors and the research group have supplied me with additional perspectives, to ensure that my pre-understanding of this research area has not been unchallenged. Performing this research work has made me aware of a whole new world as it forced me to reflect, and reflect again upon my findings and what they truly mean. I could conclude, though, that my view on the importance of error management remains unchanged. This journey has brought my understanding of the phenomenon to a higher level, however, which has enriched me both professionally and personally.

The empirical parts of the studies were performed prior to the great restructuring of the Swedish pharmacy market that has since happened. The conditions for repeating the studies have since changed and a national reporting system for dispensing errors no longer exists. The advantage in doing the studies prior to the restructuring was that it is much easier to carry out these studies in one national system, than in many small systems with a number of different owners. I believe that the results of the studies on dispensing errors underline the advantages of having such a national system, a fact I feel needs to be emphasized in these changing times. As regards the studies on safety culture, the original intent was to make a baseline assessment, followed by an intervention, and then repeat the assessment. This was not possible, due to the changing umwelt. The importance of establishing a baseline value regarding safety attitudes in Swedish community pharmacies, as has been done in my studies, is however useful. This provides the new pharmacy owners with benchmarking values in the future assessments that will need to be done.

My research work started off as a way to view my own professional area with new eyes. It has resulted in a contribution to the research on dispensing errors, and has added to the knowledge in this field of pharmacy failures. It has also underlined the importance of focusing on safety issues in pharmacies. Before I started my research everything seemed simple, but today I have gained the insight that the main part of knowledge is hidden below the surface – and you have to get beneath! Quality practice is a complex inter-
play between ideas and concepts. You are supposed to adhere to guidelines and laws, but at the same time a multitude of other variables influence your work, and these might not be easy to grasp or handle. This research work has certainly been a challenge. However, I love challenges – so who knows what will come next?

Annika Nordén-Hägg
Uppsala; August 2010
INTRODUCTION

To make no mistakes is not in the power of man; but from their errors and mistakes the wise and good learn wisdom for the future.
Plutarch

Community pharmacies constitute essential parts of the health care system. Care, responsibility and patient safety issues are important in these pharmacies just as they are in other parts of the system. Consequently quality management is as significant in community pharmacies as in other health care settings. The framework for quality in pharmacies needs to comprise not only information on how to create a quality structure, but also knowledge about how to maintain quality as well as how to achieve continuous improvement.

A systematic approach to errors constitutes an essential part of the quality work in any organisation. Errors are thus also important markers for quality in health care [1], as errors provide information on practice processes that do not fulfil requirements. Error reporting constitutes a solid foundation for work with patient safety [2, 3], as this provides health care with information about where the risks for the patients are to be found.

The occurrence of errors depends on quality management and on other factors such as attitude, i.e. beliefs and values concerning risks and hazards existing within an organisation [4]. Promoting a culture of safety awareness is considered to influence the numbers of errors in health care [5]. The concept of safety culture has gained much interest in all parts of health care and studies have demonstrated relationships between safety culture and different kinds of deviations, including medical errors [6, 7].

The four studies on which this thesis is based deal with different aspects of quality management in community pharmacies. Primarily, two aspects are
studied: errors and safety. It is mandatory to report dispensing errors in Swedish pharmacies and in the first study the media for reporting, i.e. the formats in a paper-based versus a web-based reporting system, are compared. Dispensing errors were routinely analysed and based on this, an intervention targeted to prevent specific errors was designed. The objective in the second study is to evaluate the impact of this intervention. The last two studies explore safety culture and climate in Swedish community pharmacies; an instrument is translated and adapted for use in these settings. In the third study the psychometric properties of this instrument are evaluated and in the fourth study a hypothesized relationship between safety climate and dispensing errors is explored.
Quality means doing it right when no one is looking.
Henry Ford

Quality is a comprehensive and complex concept and the task of describing all aspects is extensive and goes far beyond the scope of this thesis. The modern version of the concept of quality is however claimed to originate from the 1930s when the manufacturing industry created a systemic approach to quality. This was a measure more or less forced into existence, due to the increasing awareness of the cost of unnecessary waste and revisions of the final products. [8] Thus the original intent of quality practices was to forestall costly errors, and the production processes were easy to provide with standardized operation procedures. The focus on handling risks has become more pronounced and risk analysis is nowadays a well-known tool in quality management. Over time, the concept has also been applied to services.

There are several definitions of quality [9] and one of these describes quality as the properties desired in an organisation, taking into consideration the fact that customer satisfaction is the key goal [10, 11]. It could be argued that this definition includes two assumptions, namely that the customers know what they want and what they expect. But then it could also be argued that these two assumptions might not be applicable to all kinds of operations nor to all customers.

Since the outline of the basic quality concept, a wide variety of quality systems and management philosophies have been introduced. Simple rules for assuring quality in production have evolved to comprise complex management processes encompassing whole organisations. Many of these quality philosophies have become a business in themselves, which explains the multitude of different approaches. The ideas of quality performance in organisations are for instance operationalized in philosophies like Lean and Six Sigma, representing two well-known models [12]. Lean was originally developed for Toyota and is also known as “just-in-time” production. Important issues are elimination of waste, do it right the first time and the creation of a culture of continuous improvement [12]. Six Sigma contains a statistical approach aimed at reducing process variations [13]. Kaizen is another con-
cept that often is presented as one of the underlying principles of Lean and total quality management; TQM. Kaizen emphasizes the importance of continuous improvement [14] while TQM is a management philosophy with a broad and systematic approach to managing customer-focused organisational quality, engaging all employees in continual improvement [15]. As is obvious several, more or less different, models for dealing with management and quality within organisations are prevalent, including others than those presented here. Common features are focus on customer satisfaction and high quality as part of the business process improvement, with continuous improvement as a main feature. [12-15]

A highly structured hands-on approach towards quality is represented by the International Organization for Standardization1 (ISO) standards, introduced in 1987 with the original intention to provide a universal quality language and thereby reduce confusion surrounding the variety of existing quality standards [16]. A characteristic of ISO is the process approach and the recommendation to use tools such as the PDSA2 cycle [17] for continuous quality improvement. Experiences from error reports are also to be used for continuous improvements [18]. The ISO standards are criticized, as are most quality practices; they are claimed to be too general [16], they apply too much of a command and control orientation rather than the customer-focused approach wished for today [19] and the application of too much structure may counteract more efficient approaches [16]. Another overall criticism is about the importance of the knowledge and skills of the staff not being adequately recognized [20].

The balance between the sometimes opposite aims of improving both productivity and quality is delicate. It is questioned whether quality assurance helps to decrease production costs, by incorporating controlling measures throughout the production process, or implies an increase in production costs that enforces unnecessary demands and formalization of production [21-23].

1 Developer of international standards, as for instance the ISO 9001:2008 which is about quality system requirements

2 Plan – Do – Study – Act (or C for Check if called PDCA cycle) – a method for continuous improvement. During the P phase the desired change is planned, Do is carrying out what is planned, S is to study or check (C) the results of the change and, the actions during the A phase depends on the results of the previous phase. Introduced by Deming, it is also called the Deming cycle.
Health care and quality

Organising quality in health care is a challenge. Customer satisfaction is the goal of quality, but who is the customer in health care? Is it the decision-makers who supply the economic basis and hence prioritization for the care, but who are not present in the actual care situation? Is it the patient, who might be able to assess some aspects of care but who might not know what a good medical outcome of the treatment is? And what is good quality in health care – surviving one month longer than the average patient, or being satisfied with the treatment? Different categories of customers have varying needs and preferences.

Evaluation of the quality of care often focuses on structure, process and outcome [24] as it reflects the proceedings in health care; when patients enter the health care system they join a process consisting of diagnosis, treatment and follow-up. The process requires the presence of a structure composed of, among other variables, qualified personnel and access to appropriate medicines. The outcome is the result of the combined efforts.

In the 1980s, encouraged by the movement toward evidence-based medicine, health care leaders and regulators became interested in developing detailed protocols for care, creating guidelines for many procedures in order to enhance quality [25]. The process of care thus was regulated to obtain what is supposed to be the correct treatment, based on current knowledge. The fact that many patients have several symptoms/diseases was however not addressed – i.e. the relationship between different guidelines when they are contradictory [26].

In order to measure structure, process and outcome, operationalisation of the concepts is needed. Today so-called indicators are elaborated worldwide [27-29]. The indicators allow for national comparisons. In Sweden different sets of national indicators are elaborated. The indicators are supposed to target important aspects in health care and the aim is to ensure that the health care supplied nationally is knowledge-based, adapted to its purpose, safe, focused on patients, effective, equal and supplied within reasonable time. [29]

Quality in community pharmacies

Nationally, a framework of laws usually establishes the basic requirements to ensure the quality of services and safety of people served by pharmacies. In addition, procedures and guidelines based on recommendations by professional bodies, accumulated experience and research evidence might be added. For instance, quality practices for pharmacies are outlined by the
International Pharmaceutical Federation (FIP), endorsed by the WHO, providing pharmacies worldwide with guidelines for Good Pharmacy Practice (GPP). These guidelines are considered an important part in ensuring the quality of pharmaceutical services and national pharmaceutical organisations are supposed to use the GPP to develop national standards. [30]

In order to ensure that requirements are met there is, as in other enterprises, a need for assurance of quality in structures, processes and outcomes, as well as a need for continuous quality improvement [24]. In Sweden, a requirement of the National Board of Health and Welfare, demands that a management system for quality and patient safety shall be present in all health care settings including pharmacies. The aim is to safeguard and develop the quality in health care. The work that is to be carried out should be specified in processes, guidelines for procedures should be in place, responsibilities clarified and errors handled in a systematic way. [31]

Pharmacies could also be accredited when they meet a set of professional and business standards. In some countries, such as the UK, primary care organisations have used clinical governance accreditation schemes to ensure that pharmacies have systems in place [32]. In Denmark IKAS, the Danish Institute for Quality and Accreditation in Health Care, develops, plans and runs a quality program, which also includes pharmacies [33]. In other countries such as Australia, a quality assurance scheme accrediting pharmacies is carried out by an organisation for pharmacy owners [34].

Literature on the overall quality in community pharmacy is limited and further research is needed to establish an overall view of quality in these settings [35]. The tools commonly used to assess quality in community pharmacies are by no means unique to pharmacies, but rather developed in other areas and organisations. As in other parts of health care, structure, processes and outcomes are evaluated [24]. Some instruments measure the effectiveness of pharmacy services, i.e. assessments that might include all three aspects. For instance, practice audits measure pharmacies against standards. These standards can be set by the pharmacy and an external organisation [36], or a combination of both. By collecting a large number of samples, either from one pharmacy over time, or from many pharmacies, overall conclusions about service quality can be made [37]. Processes have been measured by using mystery shoppers/simulated patients to assess behaviour in pharmacy teams and quality of service provision [38, 39]. Outcomes such as customer/patient satisfaction have been assessed using questionnaires and interviews [35, 40]. However, although the patients’ perceptions are important, they can be insufficient when assessing the professional quality of service in pharmacies [41]. As stated earlier, patient satisfaction is a complex area, and the result might not always reflect the fulfilment of medical or pharmaceutical needs.
Recently indicators, as markers for quality in pharmacies, have begun to be developed and are used in Danish pharmacies. These indicators include the presence of a standard on introduction of newly employed personnel, a standard regarding communication and information being submitted to customers in a way adjusted for each customer, and a standard for ensuring that personnel are adequately trained to use the instruments they are supposed to handle. [33] Similar indicators have been used in Apoteket AB [42].

Quality systems in pharmacies create a foundation for good quality. It should be noted however, that although quality management systems are in place, the end product might not correspond to the need of the customer; i.e. patient – and may not demonstrate good quality! If developed, implemented and followed, quality management systems contribute to safe practices in pharmacies. The pharmacy staff must however accept working according to quality schemes, and in this the individual has a ruling impact on whether the system will work or not.

With or without quality systems, however, errors, both minor and more devastating ones, can occur, contributing to harm and injury in patients. These errors need to be studied in detail, in order to learn from mistakes.
A multitude of definitions and theories on errors exist. One example, widely recognized, is the work on error theory by James Reason [43, 44]. He uses a causal classification, based on assumptions about the underlying mechanisms generating the error. According to this, errors are a failure of a planned action. When actions deviate from intention, a failure will occur at the level of execution. These errors are, dependent upon the reason why they happen, divided into slips, lapses, trips and fumbles. Reason also defines a second group of failures in which the actions may go entirely as planned, but the plan itself deviates from some adequate path towards its intended goal. [43, 44]

Another distinction is made between active errors or failures, and latent errors – i.e. conditions. Active errors occur at the point of contact between a human and some aspect of a larger system (for instance a human-machine interface). These errors are generally readily apparent (e.g. in a pharmacy selecting the erroneous medicine from the list presented on the computer screen or picking the wrong drug from the shelf) and almost always involves someone at the front line. Latent errors in contrast refer to less apparent failures of organisation or design, which contribute to the occurrence of errors or harm being caused to patients in the pharmacy. This could be due to a programming error in the computer systems in pharmacies, made by a computer technician. [44, 45] Latent errors are considered to pose the greatest threat to the safety of high-technology systems [44].

Individual versus systemic standpoint

There are two important perspectives regarding errors. The predominating, and traditional, way of considering errors has been by applying an individual approach, which could be characterized by the phrase “name, blame, shame and retrain”. [45, 46] The modern, systemic way of regarding error, have been formed during the past few decades and considers the organisation as a
main constructor of the errors that occur. Leape concluded that “Each system is perfectly designed to get the results it achieves” [47]. The field of aviation is seen as successful in focusing on building safe systems that prevent errors, without blaming individuals [48]. According to the American Institute of Medicine, “the biggest challenge to moving toward a safer health system is changing the culture from one of blaming individuals for errors to one in which errors are treated not as personal failures, but as opportunities to improve the system and prevent harm” [49].

The traditional way to look at errors has been considered to obstruct any possibility of learning [3, 49, 50] since a culture of blame-and-shame will make individuals refrain from reporting errors in fear of retaliation. However, in being able to achieve a blame-free culture, individuals also must have an understanding of the line that does exist between acceptable and non-acceptable actions. They must have a trust in the system in which they are working and feel that they can rely on the management, i.e. that their working environment is accommodating a just culture [51].

Why do errors occur?

Theories have been developed to illustrate the relationship between an error and the underlying reasons why it occurs. The simplest model is the sequential model, describing the accident as the result of a sequence of events. The idea of a “root cause” is linked to this thinking. The epidemiological model is characterized by the perception that the accident is the result, in analogy with the spreading of diseases, of a combination of several contributing factors. Two of the best recognized and widely accepted accident concepts, the blunt end/sharp end interaction as well as the Swiss cheese model are both examples of this model (see below). The systemic model is yet another one that describes how accidents occur. This model views accidents – or errors and mistakes – as a natural part of the course of events. [52]

When originally analysing accidents, attention was only paid to the event and the people closest to causing or maybe preventing it. This focus on the active errors only at the sharp end often resulted in inconclusive explanations for the incident [53]. The concept of sharp end/ blunt end comprises organisations and systems, and creates a more comprehensive understanding of accidents. The sharp end is the meeting point between professionals and end users [43], e.g. the community pharmacy where a pharmacists meets his/her patients. The blunt end is constituted of administrators, economists and policy makers. This end sets out the framework for the work carried out at the sharp end, i.e. it decides which resources are available and the rules of the game, which might cause conflicts between the representatives of the two
The Swiss cheese model provides a structure that makes it easy to understand the design of error-producing situations and thus the safety awareness in the environment. It is the sharp end/blunt end idea of errors, provided with barriers. Each barrier has however unintended weaknesses – holes – which are inconstant, i.e. the holes are open or closed at random. The barriers with the holes make for the similarity with a Swiss cheese and the model is pictured in Figure 1. When by chance all holes are aligned in health care, the hazard will reach the patient and might cause harm. [54] The errors that are stopped on their way through the cheese slices are thus near misses.

Figure 1 The Swiss cheese model describing how a hazard could pass successive layers of defences, barriers and safeguards and result in an error; i.e. might harm a patient. Adapted from Reason [45].

Models have also been elaborated for errors and accidents in complex systems which are considered especially problematic. These models, or theories, are outlined to clarify relations between organisational factors and errors and accidents, and might also contribute to the understanding of errors in pharmacies. High Reliability Organisations (HROs) have been defined in slightly differing ways. A recent one defines HROs as organisations that function in a “nearly error-free fashion” [55]. HROs have also been characterized as “mindful” organisations, thus trying to highlight what an organisation needs to do. A main part is about organisational learning. HROs are preoccupied with failures rather than successes and commitment to resilience.
is one characteristic. That is, HROs mobilize themselves when errors occur and deal with them. Decisions might, when operations need to be carried out at high rate, “migrate” to the people with the greatest expertise or knowledge about the events in question. These people may be relatively low in the hierarchy. [56] There is, however, evidence that accidents may be the result of decisions made by people who are unaware of the full implications of their decisions [57]. HROs also might display an extensive use of redundancy [55], to make sure that a task is executed even if the primary unit fails. This model has been criticized and is considered to oversimplify the cause of accidents [57] as it contains the idea that redundancy is the primary way to handle risks.

An alternative model, called a systems approach to safety, has been advocated. This approach takes into account the human factor and is based on a background in systems engineering and human factor research. It considers the relationship between man, technology and organisation, i.e. the human component, within complex socio-technical systems. Errors and the sometimes subsequent accidents have always been a part of human life. Changes in technology and the development of more structured organisations have brought about increased risks [58]. Thus the interplay between man, technology and organisation decides the level of risk of errors happening in a workplace [59]. The concept originates from aviation and other complex industrial settings and the idea is that the human factor; i.e. decisions and actions, is considered to have a major influence on almost all accidents. The result of this influence is either evident through active or latent failures [60].

Errors in the health care systems

Errors are prevalent in all health care settings and in “To Err is Human” [3] the extent of the problem is illustrated by the finding that medication errors inside or outside hospitals, are the causes of death of more than 7,000 Americans a year. Two European studies provide more recent figures. In a study of 21 Dutch hospitals it was found that the incidence of adverse events was 5.7% and preventable adverse events 2.3%. Preventable adverse events that contributed to death was found in 4.1% of all hospital deaths and extrapolating to a national level resulted in 1,482 – 2,032 potentially preventable deaths occurring in Dutch hospitals in 2004. [61] Studying Swedish hospital admissions, it was concluded that preventable adverse events were common, causing both suffering and excess costs. In total, 12.3% of the investigated admissions had adverse effects, of which 70% were preventable. Of these preventable events, 9% led to permanent disability and 3% of the adverse events contributed to patient deaths. Preventable adverse events led to a mean increased length of stay in hospitals of six days. [62]
Errors in pharmacies

Medication errors within health care (Table 1) are a public health concern of great significance. In community pharmacies, several types of errors might occur. The errors of prime concern in this thesis are dispensing errors – errors that occur in the process of dispensing a prescription medicine to a patient. Errors reported in community pharmacies may however include not only dispensing but also prescribing errors, dispensing near misses and adverse drug events [63-68]. These errors are recorded by different methods, such as through observations while prescriptions are filled [64] or by recording in case report forms [63, 66-68]. The reported frequencies of dispensing errors are inconsistent and differences in definitions and methods used for data collection contribute to this. For instance, the reported error percentage was 0.01% in a Danish study defining dispensing errors approximately in accordance with the definition in Table 1. Registered reports on dispensing errors were identified retrospectively by collecting already filed reports. [66] In another study trained shoppers presented prescriptions to pharmacies and the filling of the prescriptions were video-taped, using hidden cameras. Here, dispensing errors were identified as deviations from the physician’s written order, and of 100 prescriptions dispensed, 22 had one deviation or more. [69] The reports on these errors were filed by trained shoppers, which might contribute to a more literal interpretation of “dispensing error”. In Sweden 10,800 prescriptions were included in an unpublished study in 2003, where a secondary recording in community pharmacy computers was carried out and then compared to the original recording of the prescription. In all, 19 errors were reported, corresponding to an error frequency of 1.75% in dispensed prescriptions. [70] This Swedish study is in several ways comparable to the Danish study [66], defining dispensing errors as shown in Table 1.

The varying types of dispensing errors in community pharmacies include selection errors, i.e. improper choices of medicines, dosage forms, strengths or quantities, as well as erroneous dosage instructions [63-68]. The causes of dispensing errors vary, even though work conditions are noted as a common explanatory factor [65, 68, 71]; these can include fatigue, high workload, overwork and interruptions. Other causes are look-alike packages and similar brand names [66, 72]. In some studies a cause of errors is found to be the way medicines are presented on pharmacy computer screens; i.e. selection errors based on what is presented on the screen [65, 68].
Table 1 *Definitions of some error-related terms*

Adapted from Glossary of terms related to patient and medication safety [74]. Neither Dispensing near miss nor Medical error is defined in the glossary (see Comments).

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adverse drug events</strong></td>
<td>Any injury occurring during the patient’s drug therapy and resulting either from appropriate care, or from unsuitable or suboptimal care. Adverse drug events include: the adverse drug reactions during normal use of the medicine, and any harm secondary to a medication error, both errors of omission or commission.</td>
<td></td>
</tr>
<tr>
<td><strong>Dispensing error</strong></td>
<td>A deviation from an interpretable written prescription or medication order, including written modification of the prescription made by a pharmacist following contact with the prescriber or in compliance with the pharmacy policy. Any deviation from professional or regulatory references or guidelines affecting dispensing procedures is also considered as a dispensing error.</td>
<td>In Sweden the term “Felexpeditioner” encompasses not only dispensing medicines but also services such as drug counselling and OTC sales, provided by pharmacies.</td>
</tr>
<tr>
<td><strong>Dispensing near miss</strong></td>
<td>Any error that is detected up to and including the point at which the medication is handed over to the patient or the patient’s representative.</td>
<td>Please note that this term is not from the Glossary but from Quinlan et al. 2002 [73].</td>
</tr>
<tr>
<td><strong>Drug-related problem</strong></td>
<td>An event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes.</td>
<td></td>
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<tr>
<td><strong>Error</strong></td>
<td>A generic term to encompass all those occasions on which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some change agency. Failure of planned actions to achieve their desired ends, without the intervention of some unforeseeable event.</td>
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<tr>
<td><strong>Medical error</strong></td>
<td>An adverse event or near miss that is preventable with the current state of medical knowledge.</td>
<td>Please note that this definition is not from the Glossary but from Kohn et al. 1999 [3]</td>
</tr>
<tr>
<td><strong>Medication error</strong></td>
<td>Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient or consumer. Such events may be related to professional practice, health care products, procedures and systems. They include prescribing, order communication, product labelling, packaging and nomenclature, compounding, dispensing, distribution, administration, education, monitoring and use.</td>
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<tr>
<td><strong>Prescribing error</strong></td>
<td>A medication error occurring during the prescription of a medicine that is about writing the drug order or taking the therapeutic decision, increased by any non-intentional deviation from standard references such as: the actual scientific knowledge, the appropriate practices usually recognized, the summary of the characteristics of the medicine product, or the mentions according to the regulations. A prescribing error notably can concern: the choice of the drug (according to the indications, the contraindications, the known allergies and patient characteristics, interactions whatever nature it is with the existing therapeutics, and the other factors), dose, concentration, drug regimen, pharmaceutical form, route of administration, duration of treatment, and instructions for use, as well as the failure to prescribe a drug needed to treat an already diagnosed pathology, or to prevent the adverse effects of others drugs.</td>
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To report medical errors

Error reporting is considered one of the key factors in achieving effective risk management [51]. In order to ensure that lessons learnt from events in one area are shared across the whole system, reporting schemes have to be implemented in all parts of the health care system [72, 75], including pharmacies [74].

National reporting systems for medical errors are introduced in the UK [72] and Denmark [76], run by authorities. In other countries as for instance the US, organisations such as the Institute for Safe Medication practices have implemented similar systems [77]. Locally adopted systems used in one single hospital or ward are also employed [78, 79]. Information about whether pharmacies report to these systems is lacking and if they are available, they most probably contribute only to a small fraction of the reports. It is reasonable to believe that a reporting system adapted to the scope of specific practices enables a more efficient analysis and use of reported data for prevention of errors within that defined context [80].

In order to arrange well-functioning reporting systems certain demands such as anonymous reporting without risks of punishment as well as provision of feedback are present [80-82]. Mandatory and voluntary reporting schemes are used [80, 83]. One of the main concerns regarding a mandatory system is that the error reports are rarely used to warn others about risks, but instead are used almost exclusively to punish individual practitioners or health care organisations. It is also argued that the information submitted in voluntary programs provide more useful information about errors, as a more complete story is reported when no fear of retribution exists [84]. Other authors however state that mandatory medication error reporting can provide useful information about systems contributing to errors [85]. Factors to consider regarding reporting systems, irrespective of voluntary reporting or not, are usability aspects [86, 87], including easy access and ease of use, as well as guidelines regarding who should report errors [88].

Reporting of medical errors is sometimes lacking [89, 90] and there are many reasons why reports are not filed, including lack of common definitions and classification of errors [91], shortcomings in abilities to follow existing guidelines and impact of inter- and intra-professional values and interactions [92]. Sometimes a report is only filed if there are consequences for the patient [93]. Fears of retaliation also contribute to low reporting rates [94]. The aim of reporting has also been found to be unknown to the medical staff [95]. Other reasons might be lack of time or ignorance of how to file a report [92]. One major issue is that staff do not see any result of their reports due to lack of feedback [82, 92, 94]. There is no reason to believe that the
problems related to reporting dispensing errors are significantly different from medication errors in general [81, 93, 95].

**Preventing errors**

Different preventive measures have been developed in order to decrease the number of errors in health care, including dispensing errors. A first step, as mentioned earlier, is to establish quality systems including reporting systems for errors in order to provide the basis for a systematic analysis of errors [96, 97]. The results should be used for continuous improvement and be fed back into practice where solutions to prevent harm should be presented [72]. The challenge, though, is to find an efficient way to use the recorded data to improve quality and patient safety [50]. Nevertheless, the reporting in itself puts a focus on errors and might induce a change in attitude towards patient safety issues.

Analyses of dispensing errors have brought about presumably preventive changes regarding working conditions and environment as well as other measures [68, 71, 97]. Examples of such changes in pharmacies are the introduction of guidelines regarding acceptable workload levels [68] and a greater diversity in drug packages and drug names to avoid confusion [63, 68].

Of course, to secure quality, proactive measures have to be implemented in addition to reactive actions based on error reporting. Processes should be mapped and operating procedures introduced, including elements like requirements on qualifications of the staff, to proactively influence potentially error-prone processes in an organisation. These can, to a degree, be identified by conducting risk analysis [18, 31].

There are limits however to the efficiency of rules and regulations. Such measures cannot safeguard against every possible negative situation that might occur in pharmacies or elsewhere. A more critical staff awareness of quality issues needs to be encouraged as a part of daily working life.

Much effort is – and has been – devoted to develop measures to prevent mistakes from occurring. An understanding of the reasons for why and how people perceive and act on quality and safety issues the way they do is vital.
It is becoming clearer that one of the underlying reasons for why errors occur is related to what is referred to as the safety culture of the workplace.
SAFETY CULTURE

Culture hides more than it reveals and strangely enough what it hides, it hides most effectively from its own participants. Years of study have convinced me that the real job is not to understand foreign culture but to understand our own.

Edward T. Hall

The concept of safety culture originates from the idea of organisational culture and the understanding of safety culture in pharmacy thus has to begin here.

The concepts of organisational culture and climate developed during the 1970s and 1980s [98] even though the ideas were not new. There are several definitions of organisational culture, but the idea of shared behaviours, beliefs, attitudes and values is a recurring theme. Helmreich et al. proposed one definition: “a complex framework of national, organisational and professional attitudes and values within which groups and individuals function” [99]. Another way of defining the concept is expressed by Cooper: “Organisational culture is a concept often used to describe shared corporate values that affect and influence members’ attitudes and behaviours” [100]. The concepts of culture versus climate have generated discussions over time and climate was initially used, but has gradually been replaced by culture. A conclusion in a review is that organisational culture is considered to express itself through organisational climate [98]. But differentiation is not at all clear and the reviewer also points out that this deduction is valid only if the particular researcher distinguishes between the two concepts. Another debated issue concerns whether an organisation has a culture or is a culture. The former implies that culture is a variable that can be manipulated while the latter considers it as a way of describing the organisation [101].

Safety culture and climate

Safety culture has been regarded as a part of the organisation’s culture, which in turn is a part of societal culture [102]. Within industries and organisations worldwide the concept of safety culture has been considered an aid in reducing the risk for accidents and errors associated with routine tasks [100].
The modern concept originates from the nuclear power plant disaster in Chernobyl in 1986 [103], which resulted in an intense debate on safety issues. This led to a systematic approach, with a structured focus on safety issues, adopted early in aviation. The ideas have since spread to other types of high-risk industries.

There are several slightly varying definitions. One defines safety culture as a subset of organisational culture, relating specifically to the beliefs and values concerning health and safety within an organisation [104]. In another definition, safety culture is considered to reflect the “ability of individuals or organisations to deal with risks and hazards so as to avoid damage or losses and yet still achieve their goals” [4]. Safety culture is also frequently referred to as “the way we do things around here” [105]. Thus safety culture is a collective concept, but created by the individuals working in a specific setting.

It is worth noting that even though the safety culture concept has been widely used for years, the meaning of the idea is sometimes considered to be “not precisely clear” [106]. As with the concepts of organisational culture and climate, safety culture and safety climate have ambiguous definitions and have been used interchangeably. Safety climate has been said to describe employees’ perceptions, attitudes and beliefs about risk, while safety culture is more complex and reflects fundamental values, norms, assumptions and expectations, which to varying extents exist in societal culture. [107] A summary from NASA concludes that safety climate refers to the attitude the staff in the organisations have towards safety (constituting the foreground) while culture is viewed as the background influence in the organisation [108]. However, the term “safety culture” is often used in conjunction with “safety climate”, with little or no differentiation between the two concepts. In fact, a corruption of the official term is present, and thus the distinction between safety culture and safety climate in health care, as well as in other organisations, is often unclear.

Different models have been used in order to try to understand the concept of safety culture. The concept is described by Reason as being composed by different subcultures that will all together contribute to formulating an informed culture, which is believed to equate a safe culture [51]. In another model the concept is described as an interactive relationship between psychological, behavioural and situational factors. The individuals’ internal psychological factors, the environment in which he or she works and the behaviour he or she engages in, all operate as interacting determinants that influence each other. [100]
Measuring safety culture and climate

How then to decide the level of safety climate within organisations? An operationalisation of the concept has to be made and key elements considered to contribute to the safety within organisations have to be identified. These characteristics include a commitment to the idea of safety, an open communication, a tendency for resilience and flexibility as well as a prevailing attitude of constant alertness. The organisational commitment is highly dependent upon the managerial dedication as is also maintaining an attitude of vigilance, while personal flexibility is a significant trait in accident prevention. In addition to these characteristics other dimensions distinguishing safety are suggested to be supervisor competence, an awareness of the balance between pressure for production/work pressure and safety, risk perception and regard for procedures [110].

Reviews of the studies conducted on safety climate have identified the use of twelve to eighteen different scales [111-113]. While the questionnaire surveys are considered to constitute the way to assess safety climate in organisations, it is evident that additional methods are needed to provide comprehensive information about the state of safety culture in an organisation, such as qualitative approaches.

Health care and safety climate

The increasing attention to the importance of safety culture and safety climate has created a demand for valid yet feasible methods for conducting assessments of these parameters. Health care organisations have used survey questionnaires that measure frontline caregiver assessments, thereby providing only a snapshot of the larger culture through multiple dimensions, such as safety climate, teamwork climate and perceptions of management. In this thesis “Safety climate” is regarded as but one domain of a snapshot of the larger safety culture, in that it provides a single point in time assessment of the local safety norms and behaviors. Safety culture is the wording predominately used when referring to the “background” influence and climate when referring to the foreground, as described in the NASA summary.

Several international studies have been published on safety attitudes in health care [115]. Keeping to the definition of safety culture versus climate as discussed above, these studies are mainly studies of safety climate, and they are based on surveys measuring the attitudes to areas such as adherence to guidelines and safety apprehension [111, 115]. One example of such a validated tool is the Safety Attitudes Questionnaire (SAQ) [114, 115]. The SAQ is used to explore the relationship between safety climate in health care
and patient outcomes [115, 116]. Another example of a patient safety question-naire is promoted by the Agency for Healthcare Research and Quality (US Department of Health and Human Services) and is intended for use in hospitals, medical offices and nursing homes [117]. This questionnaire has been adapted for use in Swedish health care settings [118].

One way to classify cultures that are subsequently linked to safety cultures was developed by Westrum, who examined the ways in which information was handled within organisations. Three types of organisational cultures were differentiated: pathological, bureaucratic and generative. [119] The concept was later developed into a five-level model, constituting a framework for assessing the development and maturation of organisational safety culture [120]. This method, the Manchester Patient Safety Framework (MaPSaF) has also been developed for use within primary care and has been shown to help teams recognize the complexity of safety and understand the degree of maturity in an organisation [121].

The assessment of safety culture in pharmacies has recently begun to develop. However, the use of methods and instruments used across pharmacies is limited. Hospital pharmacies have been included in overall hospital-based safety assessments, but these results have only been reported on an aggregated level [122-125]. A few studies describe the development of survey instruments to assess safety in community pharmacies. In the UK the MaPSaF has been adapted for use in community pharmacies [126]. This instrument allows the staff to self-report their level of safety culture maturity. Another way to measure safety was recently established by Ashcroft and Parker; it is a questionnaire directed towards pharmacists working in community pharmacies [127]. The SAQ has been used in community pharmacies [128], and was concluded to work just as well in pharmacies as in other parts of the health care system. There is another survey tool and even though it is not a safety culture or climate assessment, certain similarities exist. It is used by the Institute for Safe Medication Practice (ISMP) within different institutions including community pharmacies to assess the medication safety practices, providing the possibility to compare the result of one organisation to the aggregate experience of similar organisations [129]. Despite the existence of these instruments, no safety culture or climate results from pharmacies can be found in the peer review literature.

The MaPSaF, as well as other safety questionnaires, have been criticized for representing a relatively superficial evaluation of the culture of an organisation, rather than resulting in a holistic assessment of health care quality and performance [130]. These instruments thus, according to the definitions, measure climate rather than culture.
The characteristics identified as contributing to the overall safety in organisations are also identified in the peer review literature on safety in healthcare, such as management commitment and regard for procedures. Employees’ perception of management commitment to safety was found to be a key factor in enhancing staff compliance and reducing their exposure incidents in a blood-borne pathogen safety program [131]. Among nurses, it is found that a positive safety climate might increase compliance with safe work practices [132].

Varying correlations have been described between safety and medical errors. In hospitals, the overall safety climate was found to significantly predict medication errors; i.e. the more positive a safety climate is, the fewer incidents occur [6]. A strong safety climate is believed to increase adherence to medication administration practices and also to encourage an open and constructive way to manage errors. Moreover, it has been found that the more staff members perceive procedures as suitable and safety information as available, the higher the willingness to report treatment errors will be [7].

The studies in this thesis explore dispensing errors and safety culture on a national level in Swedish community pharmacies. Nationwide compilations of these markers have not been published previously, nor have studies on potential relationship between dispensing errors and safety culture in the pharmacy context been made before.

The studies presented are conducted from the organisational, i.e. the pharmacy perspective, not primarily focusing on the individual pharmacist, although this aspect is occasionally commented upon. This perspective seemed to be appropriate, as errors are nowadays primarily considered a result of systems, rather than of the individual. Also, culture and climate is about groups of people, not individuals.
The aim of this thesis is to explore aspects of quality; primarily error and safety, in Swedish community pharmacies.

Specific aims are to:

- Compare two different systems for reporting of dispensing errors, i.e. a paper-based and a web-based system, regarding reporting behaviour and the quality of the reported data.

- Evaluate the impact of an intervention, a technical barrier, in the computerised prescription registration process, for preventing dispensing errors.

- Translate and adapt a survey tool to be used for assessment of safety culture.

- Describe the safety culture.

- Explore a potential relationship between safety climate and dispensing errors.
MATERIAL AND METHODS

Great services are not cancelled by one act or by one single error.
Benjamin Disraeli

A short methodological summary of the papers is provided in Table 2.

According to Swedish regulations at the time of the studies, no approval was needed from an ethics committee for any of the studies included. Ethical requirements were however fulfilled. Participation in the questionnaire survey was voluntary and all data were de-identified.

Study setting

The Swedish pharmacy system is, to a large extent, similar to the pharmacy context in other developed countries. What distinguishes Sweden’s pharmacy system is the previously existing national, government-owned monopoly, which was initiated in 1971 and officially ended in July 2009. The National Corporation of Swedish Pharmacies; Apoteket AB, was the sole owner and operator of all pharmacies in Sweden. In 2007 the staff comprised 11,000 people of which the majority was pharmacists\(^3\), who dispensed 63,000,000 prescription items during that year.

The developments that have taken place in pharmacy services in Sweden are similar to those happening in other countries. The existence of the monopoly might however have brought about a smoother introduction of changes on a national level than would otherwise have been the case. Both efficacy and quality have been enhanced by factors like the introduction of dose-dispensing units, producing multi-dose packages of medicine for patients requiring regular medication. Production of these items formerly took place in individual pharmacy units, which are today replaced by a few central

\(^3\) In Sweden there are two pharmaceutical degrees, the five-year master degree and the bachelor degree with three years of education. The pharmacists receiving three years of education are called prescriptionists. Pharmacists and prescriptionists have equal medication-dispensing certification. In this thesis, both these categories are referred to as pharmacists.
units, thus bringing about a rational handling, improving production quality and reducing cost.

The dispensing of medicines in Sweden was, as in other countries, once a completely manual procedure. As elsewhere, new technology and aides have been introduced and the dispensing of medicines is nowadays a procedure supported by computers. Such technical innovations have changed quality in work in pharmacies, as they not only brought about a rationalization of work but also liberated time for staff to interact with patients. The role of pharmacies has changed from being an institution providing medicine, to one of also supplying patients with advice and information on drug use, self care and health promotion [133, 134]. The introduction of pharmaceutical care and the interest in drug-related problems are examples of a changed focus [133-135].
Table 2 *Outline of papers included in this thesis*

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Data collection</th>
<th>Study population</th>
<th>Assessment &amp; Analysis</th>
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<tr>
<td>I</td>
<td>Before-and-after study</td>
<td>• Data retrieved from paper- and web-based error reporting systems&lt;br&gt;• Semi-structured interviews</td>
<td>All Swedish pharmacies, i.e. approximately 880 community pharmacies and 80 hospital pharmacies with a staff comprising 11,000 people. Interviews performed with four members of a project group, and one administrative assistant.</td>
<td>• Incidence of dispensing errors measured in a descriptive analysis&lt;br&gt;• Completeness of reported data assessed with chi-square (Fischer’s exact) analysis&lt;br&gt;• Perceptions of the introduction of the new system qualitatively analysed</td>
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<td>II</td>
<td>Time-series design</td>
<td>Data retrieved from web-based error reporting system</td>
<td>All, approximately, 880 Swedish community pharmacies.</td>
<td>Numbers of dispensing errors were analysed in a linear segmented regression analysis</td>
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<td>III</td>
<td>• Translation and adaptation of a survey tool&lt;br&gt;• Cross-sectional study</td>
<td>Survey using the Safety Attitudes Questionnaire (SAQ)</td>
<td>870 Swedish community pharmacies. In total, 7,244 staff members received a questionnaire.</td>
<td>Translation/back translation&lt;br&gt;The translated and adapted questionnaire was psychometrically validated. Cronbach’s alpha, confirmatory factor analysis and Pearson’s intercorrelations were used in the analyses.</td>
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<td>IV</td>
<td>Cross-sectional study</td>
<td>As above</td>
<td>As above</td>
<td>Relationships between dispensing errors and SAQ dimensions were explored using correlation analysis and a negative binominal regression. Prior to conducting the analyses, psychometric validation was performed on the group of pharmacies included. Also, as the analyses were performed on team (pharmacy) level, analyses establishing within-unit agreement and between-unit variance were performed.</td>
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Various measures have been implemented in Swedish pharmacies in order to improve quality. In 1991 an agreement was made between the Medical Products Agency and Apoteket AB, the so-called MoA agreement. It not only set the standard for the provision of medicines in the Swedish pharmacy system, but it has also had a ruling influence on the international understanding expressed in what became the GPP guidelines. [136] Monitoring operations has always been an important part of the activities in Apoteket AB, and both indicators on productivity as well as staff and customer satisfaction were used. The company also used methods for continuous improvement, based on TQM, to handle quality [42]. During recent years there has been a more obvious process orientation and a structured quality management system, based on ISO 9000, introduced. Changes in the umwelt, as for instance new laws introduced by authorities, have influenced the quality management in pharmacies.

The manager of the pharmacy or an especially appointed pharmacist has been responsible for the quality. There has been a quality department with an overall quality responsibility; it has thus been dominant in regulating and managing the quality practices within Swedish pharmacies [42]. A legal demand for the presence of a specially appointed pharmacist, supposedly to monitor the quality of the activities in every community pharmacy, now exists in the new market situation [137].

In Swedish pharmacies all prescriptions are registered in a computerised prescription registration process. All details of the prescriptions are either recorded by pharmacy staff into the system, or the prescriptions are fed into the system through electronic transmission, conveyed by the prescriber. The prescription information includes data on prescribed medicine (name, strength, dosage, etc.), name and birth date of patient, name of prescriber, etc. The layout and content of the prescription is regulated by law [138].

By law, it is mandatory to report dispensing errors in Swedish pharmacies [31,137]. The errors are usually detected by patients, health personnel or pharmacy staff. The staff file the reports and the reporting is semi-anonymous, as the identity of the staff responsible for the errors is known only in the working pharmacy. All dispensing errors are assessed by specially appointed and qualified pharmacists. Serious dispensing errors are forwarded to authorities. Disciplinary actions have rarely been taken by authorities towards pharmacists.

Study population
The studies on dispensing errors in Paper I included dispensing errors reported from all Swedish pharmacies, approximately 880 community phar-
macies and 80 hospital pharmacies. Also in Paper I, a series of semi-structured interviews was carried out, encompassing members of a project group (four pharmacists) in charge of the implementation of a new web-based system for reporting dispensing errors, as well as one administrative assistant involved in the help desk function.

The dispensing errors in Paper II were reported from all approximately 880 community pharmacies in Sweden, while the dispensing errors in Paper IV were generated by the 546 community pharmacies included in this study.

The safety attitudes questionnaire survey (Paper III) included all Swedish community pharmacies, which at the time of the study encompassed approximately 870 pharmacies. All staff listed as employed on December 1st 2007 in these pharmacies were invited to participate. In total, 7,244 questionnaires were distributed. The staff consisted of pharmacists, 7% with master’s degrees and 54% percent with bachelor’s degrees. The rest of the staff was made up of pharmacy technicians with secondary school education (29%), pharmacy assistants with company training only (1%) and others (9%). In Paper IV a subgroup of the 870 pharmacies was included, i.e. those pharmacies with a minimum of three respondents per pharmacy. An additional inclusion criterion was set, stating that only pharmacies with at least 1,000 DPIs during the first half year of 2008, were included. (Only one such pharmacy was found and consequently excluded). This sub-group thus comprised 546 pharmacies.

**Design**

**Before-and-after study (Paper I)**

In a before and-after study a quantitative and qualitative comparison was made between the original paper-based reporting system for dispensing errors and a new, web-based, reporting system.

**Times-series design (Paper II)**

A times-series design was used to evaluate the effect of an intervention, a technical barrier, on the number of reported dispensing errors. This technical barrier was designed as a result of analyses, identifying the dispensing of medicines with the wrong strength as the most common error. The technical barrier was introduced to the computerised prescription registration system and resulted in a demand for verification of the opted medicine’s strength when a prescription was registered.
Translation and adaptation of a survey tool (Paper III)

The safety culture in Swedish pharmacies was measured using a survey, the Safety Attitudes Questionnaire (SAQ). The SAQ was translated into Swedish and distributed to all staff in Swedish community pharmacies in the spring of 2008. The adaptation for Swedish community pharmacies was ensured by conducting a psychometric validation.

Cross-sectional study (Papers III and IV)

In Paper IV the relationship between safety climate and reported dispensing errors was studied. The survey questionnaire included items on safety attitude as well as additional questions on such factors as age, birth country, educational level, and information on the country in which the highest educational degree was obtained.

Data collection and instruments

Error reporting systems (Papers I, II and IV)

In the studies the working definition of dispensing errors, as defined by Apoteket AB (Table 3) is applied. Since August 1998 reports on dispensing errors have been filed in a nationwide system administered by Apoteket AB. Initially a paper-based system was used, that was changed to a web-based system in 2004. Reports on dispensing errors are included in three of the studies presented (Papers I, II and IV).

Table 3 Definition of dispensing errors \(^a\)

<table>
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<th>Dispensing error is a deviation which includes incorrect dispensing, counselling or service to a patient. This comprises:</th>
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<tr>
<td>• Wrong medicine, wrong strength or wrong dispensing form</td>
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<tr>
<td>• Wrong quantity</td>
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<td>• Wrong dosage</td>
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<td>• Passed expiry date</td>
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<tr>
<td>• Wrong written or verbal information</td>
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<tr>
<td>• Wrong patient or unit</td>
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<tr>
<td>• Missing medicine</td>
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<tr>
<td>• Missing or delayed delivery</td>
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<tr>
<td>• Interaction or double prescribing not noted</td>
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\(^a\) As defined by Apoteket AB, 2008

The dispensing errors are categorized according to types of errors and causes of errors (see Paper II, boxes 1 and 2, respectively).
In Paper I reported numbers of dispensing errors, comprising all Swedish pharmacies, were included, both prior to and after the introduction of the web-based reporting system; i.e. the total time period encompassed data from January 1999 until December 2005. The reports that were assessed for completeness of data were randomly selected from the paper-based and web-based reporting systems, respectively.

In Paper II monthly data on the reported dispensing errors from July 2004 up until December 2007 were obtained from the web-based error reporting system. Data was thus collected for multiple occasions before and after the intervention (the introduction of the technical barrier).

In Paper IV information on the numbers of reported dispensing errors was collected from the web-based reporting system. The data was compiled for each pharmacy, for the first half year of 2008. In this study it is assumed that the reported number of dispensing errors is a fairly true reflection of the actual numbers of errors detected. This assumption is based on the findings in Paper I, regarding the enhancement of the reporting system that was found when the web-based reporting format replaced the paper-based. These findings, in addition to the renewed focus on dispensing errors in Apoteket AB, underscored this assumption. Also, the reporting system has been in effect for some time, and thus is likely to be well implemented. The existence of a clear-cut definition of a dispensing error and specific guidelines regarding handling of errors is believed to positively impact the reporting, especially after the introduction of the web-based system. A comparison between the actual number of errors in some pharmacies (unpublished study, November 2003) [70] and reported total number of errors in Sweden in July 2004, showed that the same magnitude of errors were detected in the study, as were reported.

Dispensed Prescription Items; DPIs (Papers I, II and IV)
Data on dispensed prescription items (DPIs) were obtained by a manual process from the National Corporation of Pharmacies up until the web-based reporting system was introduced (March 2004). From then on, this data was available in the reporting system.

Interview guide (Paper I)
Perceptions on the introduction of the web-based system were collected through semi-structured interviews, using an interview guide (Appendix 1). This guide was developed to get a deeper understanding of the effects of the
implementation of the web-based system. A draft was compiled and then reviewed by an experienced researcher.

Safety attitudes questionnaire (Papers III and IV)

In this thesis safety culture – and climate – is measured by using the Safety Attitudes Questionnaire (SAQ). It was developed over a period of 15 years to assess the quality of safety- and teamwork-related norms and behaviours of individual workers, in a particular setting [114]. The questionnaire is a development of the Intensive Care Unit Management Attitude Questionnaire [139], which is derived from the Flight Management Attitudes Questionnaire, a questionnaire used in commercial aviation [140, 141]. This questionnaire was elaborated after the finding that most airline accidents were due to breakdowns in aspects like teamwork, leadership and communication.

The SAQ is composed of 30 items, grouped in six dimensions/scales: Job Satisfaction, Teamwork Climate, Safety Climate, Perceptions of Management, Stress Recognition and Work Conditions. The SAQ [114] is a validated tool, providing benchmarking data and thus allowing for comparisons with other settings. It had also been used previously in pharmacies [128].

The translation of the SAQ Community Pharmacy version into Swedish was carried out in a back-translation mode [142] involving discussion with the creator of the original questionnaire. The questionnaire was initially translated by a Swedish pharmacist, fluent in English. Face validity was established by testing this preliminary Swedish version of the questionnaire on pharmacy staff members of varying educations and ages. The respondents were asked to comment on their perceptions of the items in a “think aloud” manner. The respondents read the questions and pondered the answers aloud, thus allowing for information about misinterpretations. Based on this procedure, the questionnaire was reformulated. Following this, a back-translation was performed by a professional non-pharmacist translator, and again discussed between the research group and the creator. To further ensure the validity and the psychometric properties of the Swedish version of the questionnaire, a pilot study was carried out in November 2007. The questionnaire was administered to senior students during their pharmacy internship at the end of their training. The Safety Attitudes Questionnaire – The Swedish Community Pharmacy Version is included in Appendix 2.

The SAQ Swedish community pharmacy version was distributed by e-mail to all staff in Swedish community pharmacies. The response rate was monitored and several reminders were sent out. The responses were collected electronically.
SAQ is originally validated for units with at least five respondents, which was also done in Paper III [114]. The rationale behind this cut-off is that it takes a minimum number of individuals to make up a culture [116]. However, a considerable number, approximately 27%, of Swedish pharmacies have three or less employees. Allowing the use of lesser numbers of respondents per pharmacy when using the SAQ results, would increase the usability of this survey tool. Consequently, this changed cut-off was used in Paper IV, assuming that a unit of three or more individuals may make up a culture.

Assessments & Analyses

Paper I

In Paper I the incidence of reports on dispensing errors in relation to the volume of filled prescriptions was studied, before and after the introduction of the web-based system, i.e. 1999-2003 and 2004-2005, respectively, in a descriptive analysis.

The completeness of the data recorded in the reports, i.e. the difference in documentation prior to and after the introduction of the new system, was evaluated by a chi-square analysis: p>0.05. Elements compared were those considered essential for the assessment of the seriousness of the error and the impact of the error on the patient.

The responses from the five interviews, presumably reflecting views on the introduction of the web-based error reporting system, were subjected to a descriptive analysis [143] carried out by the author. This meant that the responses were read over, grouped according to content and then each group was summarized. After the analyses the summary was scrutinized by the interviewer to make sure that it correctly reflected the content of the interviews.

Paper II

The incidence of reports on dispensing errors in relation to the volume of filled prescriptions (DPIs), before and after the introduction of the technical barrier were analysed in total in Paper II, and also subdivided by type and cause of error. Observations before the intervention constituted historical controls, used to investigate whether the intervention had an effect that was significantly greater than the underlying trend. Types and causes of errors presumably not affected by the intervention were considered to be control groups.
An interrupted time series design was applied for evaluating longitudinal effects of the intervention and segmented regression analysis [144] was used for estimating intervention effects. The basis of this time series was constituted of values of dispensing errors per 100,000 DPIs, taken at regularly spaced intervals over time. A change point in this time series (interruption) was presumably inflicted when the technical barrier was introduced. Two parameters define this time series. These are the level; i.e. the number of dispensing errors in the beginning and immediately after intervention and the trend, or slope, which displays the change in dispensing errors. Shifts in level or slope with p<0.01 related to the intervention, were considered statistically significant. Linear segmented regression was performed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA).

Data was also analysed in order to initiate measures to correct for autocorrelation, if this would be needed. This is a usual complication when performing this kind of analysis as error terms of consecutive observations are often correlated. Failing to correct for autocorrelation may lead to overestimated significance of the effects of an intervention. [144]

Paper III

Scale psychometrics for the Swedish Community Pharmacy SAQ were established as well as scale reliability and intercorrelations for the scales. Positive SAQ scale scores ≥ 75 out of 100, i.e. agree slightly or strongly, were calculated and also means and standard deviations. Reliabilities and internal consistencies of the six scales were assessed using Cronbach’s alpha. These calculations were performed using SPSS 16.0 (SPSS Inc., Chicago, IL, USA). Multiple group confirmatory factor analysis (CFA) was conducted using SPSS AMOS 17.0 (SPSS Inc., Chicago, IL, USA), thus producing goodness-of-fit indices. The Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) were evaluated using AMOS 17.0.

All responses were used in the evaluation, even though a minimum number of five respondents and a minimum threshold of 60% response rate are often used in SAQ administration to generate reliable consensus safety culture domain scores from people who are working in a particular setting [116].
Paper IV

In this study 3,654 (54.7%) out of the originally 6,683 eligible respondents (870 pharmacies, Paper III), were included, constituting the staff in the 546 participating pharmacies. As this group was based on a new cut-off, a renewed psychometric validation was carried out. This validation demonstrated a moderate fit of the data to the hypothesized model.

Also, as the analysis was conducted at the pharmacy level the aggregation of scores from the individual to the unit level had to be justified by demonstrating homogeneity, i.e. within-unit agreement and between-unit variance. A package of three indices was used to demonstrate homogeneity; the $r_{wg(j)}$, ICC(1) and ICC(2). Together the results suggested that within-group homogeneity and between-pharmacy variance were sufficient to justify scale aggregation.

Subsequently the relationships between SAQ dimensions, pharmacy characteristics (e.g. number of employees), demographic variables (e.g. age, education), and dispensing errors were explored. Intercorrelations among the variables and outcomes (errors reported) were calculated using a package of R (R 2.10.0, 2010). A negative binomial regression model was used to further examine the relationship between the dimensions of the SAQ, pharmacy characteristics, demographic variables and dispensing errors. This model is appropriate when modelling a non-zero, count-based outcome such as this, in which there is overdispersion [145]. The number of dispensed prescription items and the response rate were controlled for. Functions in the MASS package of R were used to estimate the negative binomial models.

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4 Out of the original 7,244 distributed questionnaires some reached staff members employed by regional offices and over-the-counter stores. Only respondents from community pharmacies are included in the results.
SUMMARY OF FINDINGS

If you think you're too small to have an impact, try going to bed with a mosquito in the room.

Anita Roddick

Paper 1

In the first paper effects of replacing a paper-based reporting system for dispensing errors with a web-based system were described. The new system was introduced in March 2004. In the years prior to the replacement, in 1999–2002, the number of reports on dispensing errors annually was almost unaltered and averages of 11.48 dispensing errors were reported per 100,000 DPIs. In 2003 an increase was noted, which became more evident in 2004, after the introduction. This increase continued and in 2005 the numbers of reported dispensing errors per 100,000 DPIs were 21.38 (Figure 2).

Analysis of the completeness of information in the reports revealed that the information identified as essential for a proper analysis and assessment of the errors regarding the seriousness of the errors and their impact on the patients was more comprehensively reported in the web-based system than in the paper-based reports. The extent to which incidents were described in the new system (which also provided details of the involved medicine, age
and gender of the patient) differed significantly from the paper-based system; p<0.001, for all these variables.

The interviewees reported on initial technical problems that needed time to handle and thus resulted in a more costly system than had been initially estimated. Despite this, the web-based reporting system was thought to be fairly well received. One obstacle however was that the interviewees expressed worry that a time-consuming system had been introduced. Time was required for administrative actions as well as new ways of handling recorded errors. It was experienced to have taken more than six months before the users realized that the advantages of the newly introduced system outweighed the disadvantages.

Paper II

In the second paper the impact of a barrier on the incidence of dispensing errors was evaluated. This barrier was introduced (June 2006) into the computerised prescription registration process in Swedish community pharmacies. The findings were based on analyses of dispensing errors reported in the web-based error reporting system. The analyses demonstrated that the number of reports with error types of wrong strength, error cause registration failure (failure of the registration of a prescription in pharmacy computers) as well as dispensing errors in total, increased from the baseline values in July 2004, when 4.89 (strength), 11.03 (registration failure) and 17.59 (total) errors were reported per 100,000 DPIs (Table 4). This continued up until February 2006 when the corresponding values were 7.07, 14.16 and 22.04, respectively. At the end of the study period, in December 2007, they were 1.77, 7.53 and 14.99, respectively.
Table 4 *Brief summary of reported number of dispensing errors, with type strength, registration failure as cause and in total. The figures are presented as errors per 100,000 DPIs.*

<table>
<thead>
<tr>
<th>Year</th>
<th>Dispensing errors, error type strength</th>
<th>Dispensing errors, cause registration failure</th>
<th>Dispensing errors, total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004; July (baseline values)</td>
<td>4.89</td>
<td>11.03</td>
<td>17.59</td>
</tr>
<tr>
<td>2006; February (peak values)</td>
<td>7.07</td>
<td>14.16</td>
<td>22.04</td>
</tr>
<tr>
<td>2007; December (end of study period)</td>
<td>1.77</td>
<td>7.53</td>
<td>14.99</td>
</tr>
</tbody>
</table>

The time-series analysis demonstrated that the intervention coincided with a distinct decrease in overall reports on dispensing errors (Table 5). Prior to intervention a monthly increase (slope = 0.09) in numbers of these of reports was evident, which switched significantly to a decrease (slope = -0.026), \( p=0.0035 \), after the barrier was introduced. The average number of reported errors prior to the intervention was 19.41 reports per 100,000 DPIs a month, which after the intervention decreased, albeit not significantly, with an average of -2.42 reports a month.

In the beginning of the study period the average number of reports on medicines dispensed with the wrong strength was 5.4 reports per 100,000 DPIs, with a minor monthly increase by 0.08 reports per 100,000 DPIs. This changed significantly after the intervention with an average of -2.49 reports per month. Also, the slope changed; the minor increase in reporting switched significantly, from 0.08 to -0.27 (\( p<0.0001 \)).

The average number of reports on dispensing errors caused by registration failure prior to intervention was 12.86 reports per month and 100,000 DPIs. This decreased significantly after the intervention, by – 2.15 reports on average monthly (\( p=0.0046 \)). These errors also demonstrated a significant change in slope, time-associated with the intervention, and it changed from 0.05 to -0.29 (\( p<0.0001 \)).

Consistency with the changes displayed for errors in total, errors with wrong strength and errors caused by registration failure, was also established by the change in average slope, i.e. the sum of the slope (\( \beta \)-value) before and after intervention, which was 0.35 for all three categories.

Autocorrelation, which might be a concern in time series analyses, was not found to be present.
Table 5 Parameter estimates, standard errors and p-values for dispensing errors in total, dispensing errors with Wrong Strength error type and Registration Failure cause of error. Before and after intervention relates to the condition prior to and post the introduction of the technical barrier.

<table>
<thead>
<tr>
<th>Error Type</th>
<th>Before Intervention</th>
<th>After Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>Slope</td>
</tr>
<tr>
<td>Total number of dispensing errors</td>
<td>19.41 0.66 0.0000</td>
<td>0.09 0.05 0.0693</td>
</tr>
<tr>
<td>Error type - Wrong strength</td>
<td>5.40 0.30 &lt;0.0001</td>
<td>0.08 0.02 0.0006</td>
</tr>
<tr>
<td>Cause of error - Registration failure</td>
<td>12.86 0.48 &lt;0.0001</td>
<td>0.05 0.03 0.1346</td>
</tr>
</tbody>
</table>
Paper III

In the third paper a psychometric validation of the Safety Attitudes Questionnaire – Swedish Community Pharmacy version was done. The questionnaire had been distributed to all staff in Swedish community pharmacies. Data were returned from 4,090 out of 6,683 eligible responders, resulting in an overall response rate for individual staff members of 61.20%. At least one questionnaire was returned from the staff in 828 (95.2%) out of the 870 pharmacies. All responding pharmacies were included in the evaluation, as well as subgroups. One of these comprised pharmacies with a minimum of five respondents (n=343), one comprised pharmacies with at least five respondents and 60% response rate (n=252) and a third group of pharmacies had less than five staff members (n=282).

The internal attrition, i.e. missing data, comprised on average 3.1% for all items, with a range from 1.5 to 4.9%. These values were higher than benchmarking data [114]. The “Not applicable” answer alternative was used on average in 2.2% of the responses, with a range of 0.1 to 13.8%. All four items in the Working Conditions dimension had high proportions of “Not applicable” answers, ranging from 7.4 to 13.8%.

The majority of the responding staff had finished their education more than 11 years prior to the survey (68%) and had spent more than five years in their present workplace (60%).

Item responses regarding scale means, standard deviation and proportions of positive scores (≥ 75 out of 100) were skewed towards the positive but showed considerable variation. Scale means varied from 70.25 (Perceptions of Management) to 83.20 (Teamwork Climate). All factors with the exception of Stress Recognition displayed higher means than benchmarking data [114]. Proportions of positive scores (≥ 75 out of 100) varied from 53.58 (Perceptions of Management) to 78.08 (Teamwork Climate). The psychometric validation of the scale displayed that coefficient alpha value for each of the scales ranged from .72 to .89.

A multiple group confirmatory factor analysis was performed on all the different groups of pharmacies, as described above, and the analysis indicated an acceptable goodness-of-fit of the Swedish SAQ model to the dataset, as well as when analysing the smaller pharmacy groups [146]. The CFI [147] was above 0.90 for all groups with the exception of the small pharmacies. RMSEA values were well below 0.08 and in fact closer to 0.05, indicating a good fit of the model [148].
Using the pharmacies meeting the conditions of at least five respondents constituting a minimum of 60% of the respondents in those pharmacies (n=252), dimensions were moderately to highly correlated with one another (i.e. Teamwork Climate, Job Satisfaction, Perceptions of Management, Safety Climate, and Working Conditions) whereas attitudes about stress (Stress Recognition) had only low correlations with other factors.

In order to provide insight into the variability in different social, psychological and organisational factors pertaining to the safety culture across Swedish pharmacies, percents of positive SAQ scale scores (≥ 75 out of 100) were charted and this demonstrated substantial variability ranging from 0% to 100% in the percent of positive scores for each of the factors across the pharmacies (n=252). Perceptions of management showed the most variability across pharmacies (SD = 26.66), whereas Stress Recognition showed the least (SD = 18.58). The percent of positive scale scores were generally lower for Perceptions of Management and Working Conditions, relative to the other four factors. As compared to the norm from outside pharmacy [114], the Swedish pharmacies displayed a higher percent of positive scale scores for all factors.

**Paper IV**

In Paper IV the relationship between all aspects of safety culture as measured by the SAQ, with special emphasis on the safety climate dimension, and dispensing errors was studied. Also, the correlations between pharmacy characteristics, demographic variables and dispensing errors were explored.

Dispensing errors were found to correlate significantly to several of the SAQ dimensions. A significant negative correlation was found between dispensing errors and Safety Climate, Job Satisfaction and Teamwork Climate. Thus high scores in these dimensions were associated with low levels of errors. A significant positive relationship was found with the Stress Recognition dimension. This correlation analysis also demonstrated a number of significant bivariate correlations between dispensing errors and pharmacy characteristics and demographic variables. Thus a significantly positive relationship was found between errors and number of employees, birth country, education, educational background (Swedish/non-Swedish), and number of dispensed prescription items. Pharmacies with high levels on these variables demonstrated a higher number of errors. A negative correlation was displayed between response rates and dispensing errors; pharmacies with a high response rate had low error levels. Also, a negative correlation was demonstrated between errors and mean age.
The results of the negative binomial regression analyses gave further insight into the association between dispensing errors and the other variables. The number of dispensed prescription items and number of employees were both significantly positively related to errors. Mean age was found to be significantly negatively related to dispensing errors while pharmacies with a staff with a high diversity in national educational background demonstrated a significantly positively relationship to error. Also, response rate was significantly negatively related to dispensing errors. The only SAQ dimension demonstrating relationship to dispensing errors was Stress Recognition, displaying a significant positive relation to dispensing errors.
DISCUSSION

We shall not cease from exploration. And the end of all our exploring will be to arrive where we started and know the place for the first time.

T. S. Eliot

This thesis has contributed to the research on quality at community pharmacies. It has underscored the importance of a systematic handling of dispensing errors as it makes it possible to identify trends, which in turn allows for introduction of directed preventive measurements. It has also put a focus on the safety culture in community pharmacies, an area that might influence the occurrence of dispensing errors and thus is of importance for patient safety.

Specifically, the results relate the experiences of the transition from a paper-based to a web-based reporting system for dispensing errors. The effect of introducing a barrier in the pharmacy computer systems in order to prevent dispensing errors from occurring is evaluated. In a methodological study, the translation and adaptation of an instrument for assessing safety culture in Swedish pharmacies is described and validated. The relationship between safety climate and dispensing errors is subsequently explored.

The main strength of this thesis is that it is designed to represent contemporary pharmacy reality and that it includes national data, i.e. data from all community pharmacies in Sweden. Before turning to the implications of the findings, some methodological considerations will be mentioned.

Methodological considerations

A major concern when conducting research in an area that is also one’s own professional working field is the undertaking of dual roles. The background to the research presented in Papers I and II stems from the work I performed in my capacity as quality assurance manager. This has probably influenced the interpretations of the research findings. At the same time there is strength in combining practical knowledge and research, as it ensures a multiperspective approach. I had good knowledge of dispensing errors in phar-
macy practice, which vouched for the fact that the research was relevant, and could also facilitate implementation of research findings in pharmacies. The potential negative consequences of mixed roles were attended to throughout the entire research process. Having co-authors from outside, continuous discussions at seminars and in the research group, presenting at conferences, as well as using statistical tests all helped to elucidate topics from different angles.

Quantitative assessments

A major part of the research in this thesis is based on reports on dispensing errors filed by pharmacy staff. The problems in conducting research based on this kind of data, regardless of whether they are filed in a paper-based or a web-based system, are several. One issue is whether the reported numbers of errors truly reflects reality, i.e. the actual number of errors. As described in the background chapters a multitude of reasons exist for why reports are not filed and these reasons most probably also encompass Swedish pharmacies, which is the assumption in Paper I. The introduction of a new reporting format, as described in this paper, brought about changes that are presumed to modify this assumption. The change in formats put a focus on dispensing errors in Apoteket AB and high-lighted problems regarding errors. Measures were introduced to deal with this, such as clarification of guidelines on the management of errors. In addition, the new web-based system proved the handling of errors to be easier, in the long run. This in addition to the already existing, clear-cut definition of a dispensing error used in all pharmacies as well as guidelines on how to report errors, and the fact that the reporting system was rather well-established is believed to underscore this assumption. The unpublished study investigating the proportion of errors found when conducting a secondary recording of prescriptions in Swedish pharmacies [70], although conducted on a minor scale, indicated that this was a reasonable assumption. Thus in Paper I the change to a web-based reporting system was theoretically likely to facilitate reporting, but not to increase the numbers of errors per se. In Paper II the decrease in reporting was believed to reflect a decrease in actual errors, since the intervention was likely to prevent errors rather than stimulate reporting. The study in Paper IV is carried out well after the introduction of the web-based reporting system, which then could be considered to be a mature system, giving further strength to the assumption that reported number of errors is close to the actual numbers errors.

There is a risk that dispensing errors are misclassified and hence not recorded. Drug-related problems (DRPs) were reported systematically in a similar electronic database and in the spring of 2007 a survey on 400 reports on DRPs was conducted. The survey revealed that out of the scanned re-
ports, 61 were erroneously classified as DRPs – i.e. they were not DRPs. Eight of these reports were in fact dispensing errors. [149] The reports filed in the system for dispensing errors are however handled differently from the DRPs. The error reports are processed step-wise, which means that different persons will see each report. Thus the risk of erroneous reports being filed in this system is reduced. The risk of dispensing errors being recorded as something else, such as DRPs, remains however.

In Paper I, the completeness of the data in the reports was analysed by scrutinizing the information held in randomly selected reports from the paper-based and web-based reporting systems, encompassing 100 reports from each system. The evaluation of these reports was conducted by one person only. The reliability of the assessment might have benefited from involving a second person. However, as the procedure only involved extracting and not interpreting information, the method used was deemed adequate.

In Paper I the changing of the format of the dispensing error reporting system from paper-based to web-based resulted in an increase in the numbers of reports on dispensing errors. Other factors aside from changing the system formats might have contributed to this change. These include an increase in the actual numbers of errors, increased focus on patient safety issues overall in the Swedish health care, and also the awareness in pharmacies, prior to the introduction, that this new way of reporting errors was about to be introduced. An association was found, in Paper II, between the introduction of the technical barrier and a decrease in numbers of reported errors. Again, it cannot be ruled out that the result was influenced not solely by the intervention but that other variables such as increasing focus on the issue of dispensing errors in the pharmacies might have influenced the result.

Qualitative assessments

In Paper I a series of individual semi-structured interviews were performed four years after the introduction of the web-based system. The interviews included all members of the project group and one administrative assistant, and were supposed to convey an insight into the reactions of the users, to the feasibility of this new system. It would have been preferable to interview the frontline workers, the pharmacy staff, instead of using this second-hand source of information. This was not an option as too much time had passed from introduction of the system to evaluation, and the users were found to mix up the two systems. The risk of recall bias was deemed to be lower in interviewing those who had actively worked with the implementation.
Assessing safety

Besides the selected tool, the SAQ, other instruments were identified, for instance the Manchester Patient Safety Framework; MaPSaF [126]. The decision to use the SAQ rested on literature searches. Variables used in the selection process included whether an instrument was validated and/or had been previously used in pharmacies. This was true for the SAQ but not for instruments like the MaPSaF, as a comprehensive validation was not available for this instrument [126] at the time. The MaPSaF however could be an interesting alternative if these kinds of assessments are to be repeated, as it has been developed further and is used in pharmacies in Europe. As yet however, no formal evaluation of the framework in the work setting has been undertaken. [150]

Translating surveys, as in this case translating an American survey to Swedish, always poses a risk of including translation misses [151] and thus essential points might be lost in translation.

In the pilot study the survey was administered to senior students and the cultural adaptation of the questionnaire might thus have been insufficient. An alternative approach might have been to use a few pharmacies and their staff as pilots instead, as the students might have limited experience of the conditions in pharmacies. However, in order to avoid using the same respondents twice, the pragmatic choice was to ask the students.

A web-based survey method was employed for distribution of the SAQ, and subsequently for data collection. This was an established and trusted mode of administration in Apoteket AB. Even though the questionnaire was marked with the logotype of the University of Uppsala and signed by my university-based supervisor, it was also signed by me. There is a risk that the company employees, recognizing my name, believed that their answers were to be registered by the company and thus decided not to respond. Even though it was clearly stated that strict confidentiality would be kept, this might have presented a risk of selection bias, if it made some staff members refrain from responding. Further, some of those who choose to respond might have provided social desirability answers. These risks however, were balanced against the advantages of using the existing system in the company, which facilitated the research.

In Paper IV, 546 pharmacies (66% of the responding pharmacies in total) were incorporated in the study; this included all pharmacies with a minimum of three responding individuals. In the evaluation, response rate was found to be significantly negatively related to dispensing errors. Response rate is presumably a marker of staff involvement in quality issues and thus a marker of responsible behaviour; those who are professionally engaged make fewer
dispensing errors. Therefore, there is a risk of having captured a specific group of pharmacies and thus having a risk of selection bias.

The use of the SAQ Swedish Community Pharmacy version has left some question marks. The dimensions, as demonstrated in Paper III, had overlapping correlations, but this was also the case with the American version of the questionnaire [114]. However, two negative items did not work well (Appendix 2, items 2 and 11) and thus the positively worded items might be used instead, as has also been done in Paper IV.

**Generalization of findings**

The findings in this thesis could well be generalized to pharmacies in other countries, as well as to other health care settings. The experiences from switching from a paper-based to a web-based system (Paper I), as well as the positive experiences of impacting the numbers of reported errors with a technical barrier (Paper II), might convey important information regarding the benefits of a structured error management as well as give insight into how to administer these kinds of errors in any system.

No previous study has been published in the peer-reviewed literature on the degree of safety culture in pharmacies. The studies presented in Papers III and IV thus provide benchmarking values. The wider generalizability of the findings, beyond the Swedish community pharmacy setting, may however be limited, as they reflect a setting where quality issues have been thoroughly considered for several years on a systematic, nation-wide basis. The identified associations between safety climate and error reporting may however have a bearing on other community pharmacy settings as well.

**The issue of dispensing errors**

Several demands can be made, in order to achieve a well functioning error reporting system, such as presence of definitions on the errors and guidelines regarding how to manage them [88] as well as more hands-on measures such as having a system that is easy to use [86, 87]. In Sweden all these demands were already met prior to the change of the format of error reporting systems. Even so, the introduction of this new format proved important, especially considering the fact that the reporting behaviour seems to have changed. In the end it proved utilizable, even though both technical and administrative problems were encountered (Paper I).

The new system strengthened the possibility of a structured analysis of reported data. One example of such an analysis of systematically collected
data laid the foundation for the implementation of a pro-active measure, resulting in a significant decrease in dispensing errors (Paper II). This use of information available in the reporting system – to identify problems and subsequently initiate actions – functions as an important feedback to pharmacy personnel. Thus, one of the main requisites for a well-functioning reporting system has been met [71, 72, 74, 97]. This kind of feedback makes staff aware of the fact that management take error reporting seriously, and handle these reports in an appropriate way, hence contributing to the creation of a well-functioning safety culture [51].

Also important is the fact that this web-based system is specially adapted for use in the pharmacy context, and hence brings about opportunities that other error reporting systems do not offer [80]. Systems receiving reports from a broad range of actors in health care may be confused by “noise”; i.e. reports coming from sources outside pharmacy. Such reports describe problems of little relevance to pharmacies. [80] This has also been noted within High Reliability Organisations, where noise is mentioned as one of the challenges [56]. The Swedish system does not bring about the need for information selection when analysing reports. The process of designing the technical barrier in Paper II demonstrated the benefit of having such a specialized reporting system. The latent errors, created in the computer system in which all prescriptions in Swedish pharmacies were managed, were captured as the error reporting system provided a strong, clear signal.

The relevance of the blunt/sharp end models [43] and the Swiss Cheese model in pharmacies is also well illustrated in the process leading up to the introduction of this barrier. In addition, the input from the sharp end, i.e. the reports on the detected errors, were analysed at the blunt end and preventive measures initiated. In the light of the Swiss Cheese model [45], some of the holes in the cheese were blocked. When discussing errors and the barrier, it is important to note that although a multitude of these errors are due to systemic causes, such as identified when designing the barrier, not all errors of the “Strength” type are disposed of. Other causes for these errors exist, and not all of them are due to organisational or technical causes – some might also be created by humans on the pharmacy staff.

Data recorded in reporting systems have been found to be of somewhat doubtful quality [152]. One of the findings in implementing the web-based reporting scheme (Paper I) was that the content of the reports became more complete after introduction of this scheme. Much of this could be attributed to the introduction of pre-defined options or categories to choose between, rather than accepting free text. In systems like these, where a rather large amount of reports are filed, there is a balance issue of how much control you must have of report contents and when you can allow for free text. However,
free text might provide for a richer description of the event [153], as staff members are allowed to use their own words. Pre-defined choices, on the other hand, might lead to difficulties in finding suitable options, which makes correct reporting problematic. It cannot be ignored, though, that many may find it difficult to formulate a written report and what is written might sometimes be tricky to decipher, as the capacity to provide an understandable narrative does not come naturally to all employees. Another balance issue is the problem of demanding too much information to be included in the reporting schemes, which might make staff refrain from reporting. Also, managing large quantities of information will demand allocation of resources to conduct analyses and initiate preventive measures.

Implications of the findings on management of dispensing errors

The importance of a working interplay between man, organisation and technology [58] is easily understood. In Paper II, a successful example of how the interplay can be fine-tuned is presented. One example of the vulnerability of this interplay, however, is the introduction of electronically conveyed prescriptions. This innovation decreased some errors while others increased, as for instance errors caused by erroneous dosage instruction. Introduction of new techniques might have benefits but as it will also interact with organisation and man [59], it presents a delicate balance that might as well present a negative outcome. Preventing errors is hence an ongoing and seemingly endless task.

Having a reporting system for dispensing errors results in a large amount of reports, as is established in Papers I and II. However, the importance of near-misses is also emphasized when errors are systematically managed; one of the reasons is that the number of near misses by large exceeds the number of errors and thus provides more extensive information about the errors that can occur, if the holes in the Swiss cheese happen to align [51]. What important information could the reporting of near misses provide in Swedish pharmacies that are not already present in the reports on dispensing errors? Analysing information takes time and costs money. Thus, when an error reporting system is used only by community pharmacies and the reporting rate is high, it is questionable whether reporting of near misses will add enough new information about error-prone processes in relation to the costs involved. The resources might better be used in other ways to improve quality. It could be argued, by applying the thinking in the Swiss Cheese model [54], that a substantial number of errors might be prevented; they will result in near misses. Thus it might still be of importance to investigate these errors also, to find out which functioning barriers do exist. One solution might be to not arrange large-scale reporting systems for near misses, but to investi-
gate them through occasionally arranged surveys and on a case-by-case basis at individual pharmacies.

The national design of the system for reporting dispensing errors was facilitated through the structure of the Swedish pharmacy market, which existed until June 2009, when all pharmacies were owned and operated by one state-owned company, Apoteket AB. The community pharmacies had, through the existence of this national error-reporting system, the possibility to decide on national interventions and guidelines and also enough data for meaningful analysis. They had the means to work in a structured way to eliminate their part of the medication errors, and thereby establish an important step in securing quality and patient safety in pharmacies. The fact that the Swedish pharmacy market is undergoing substantial restructuring will reduce the possibilities to monitor dispensing errors at this level. Quality issues have not been of foremost concern in the de-regulation process so far.

Safety culture in the Swedish community pharmacies

In the studies on safety culture and climate in pharmacies in Papers III and IV, components of a safe culture are based on the structure provided in the SAQ, encompassing six dimensions. The Swedish community pharmacies were found to display a higher percent of positive SAQ scale scores for all dimensions, as compared to other health care settings in other countries. An explanation for this might be the fact that Apoteket AB for a long time put great effort into quality management and worked intensively on initiating measures for continuous improvements [42]. This included elements like the existence of definite guidelines, standard operation procedures for the dispensing process and other processes. Various indicators have also been used to assess quality in each pharmacy. All staff went through quality education around 2000. Thus it could be assumed that a good quality awareness, with a ruling influence on safety issues in these pharmacies and the whole organisation, was present and impacted the outcome of this survey.

In Paper IV it was hypothesized that it ought to be a relationship between the results obtained in SAQ, with special emphasis on the Safety Climate dimension, and dispensing errors, in the Swedish pharmacies. While relationships between safety climate markers and errors have been established previously [6, 7] no such association was established in this study, when controlling for covariance between variables. The lack of correlation may have several explanations. To begin with, there is a possibility that no such relationship exist in the pharmacy context, which in light of the relationships already established seems less likely. Another explanation is that SAQ was not able to capture the relationship. This might depend on the fact that the
instrument was not suitable for pharmacies or that it was not sufficiently adapted for use in the Swedish community pharmacies. This however is contradictory, as the validation proved the SAQ to work satisfactorily in these settings. Another explanation might be a ceiling effect because of the high SAQ scores in Swedish pharmacies, making it difficult to distinguish between pharmacies. This can be seen in light of the above mentioned previous emphasis on quality in the pharmacies. In addition, the reporting system for dispensing errors is considered to be mature, having existed for more than ten years, and it has been suggested, that the more mature a reporting system is, the more the relationship between SAQ dimensions and errors declines [154]. The study was conducted on a national basis and thus the number of observations was high; i.e. lack of power should not be an issue, even though the incidence of dispensing errors was relatively low.

There was however, a positive relationship between the SAQ dimension of Stress Recognition and dispensing errors. This dimension is an indicator of individual attitudes rather than a group characteristic. Nevertheless, it could be argued that when pharmacy staff experience several dispensing errors, this presumably will bring about increased risk awareness, as the errors should bring about both preventive measures as well as discussions among staff. Increase in Stress Recognition might subsequently follow, which will leave an impression on the pharmacy as an entity – this might explain the relationship found.

The other findings, i.e. the association between pharmacy characteristics and dispensing errors is in line with earlier findings as there are, in some questionnaires, items included on the balance between pressure for production/work pressure and safety [110]. The present results included a positive relationship with numbers of dispensing errors and also employees. The bigger the pharmacy, the busier the surroundings and the more difficult it might be to exchange information on prescriptions, and on safety issues in general.

In addition a relationship was found between dispensing errors and demographic variables. The higher the age, the lower the numbers of dispensing errors are. It might be that senior staff make less mistakes, or maybe they can more easily sort between them and decide not to report the less serious ones, or they might find it easier to disregard these errors and decide not to report them at all. The positive relationship between having a heterogeneous staff, with regard to Swedish and non-Swedish educational background, and dispensing errors might be explained by differences in culture and language leading to misunderstandings that result in errors [155, 156].
Safety culture and climate – the role in community pharmacies

A routine use of questionnaires such as the SAQ may give basic insight and knowledge, and also put focus on safety issues in pharmacies. The questionnaire itself can serve as an intervention, highlighting the importance of safety issues; it can serve as a trigger for reflection and discussion. The impact of such an instrument as the SAQ can however only be assessed by obtaining a baseline value, as performed in Paper III, and then, at regularly spaced time intervals, repeating the survey. Introducing interventions like the technical intervention in Paper III that provides feedback on error reports will further increase the possibilities of impacting safety climate. The SAQ can, of course, also be used to evaluate interventions aiming at increasing the overall safety culture by other means, such as by provision of education.

The safety climate is to some degree assumed to reflect the level of safety awareness, which obviously should encompass a reactive approach towards errors. Attempts to improve safety in pharmacies are to a large extent reactive; they respond after the occurrence of errors, as described in the intervention in Paper II. What is even more important however is a proactive attitude towards risks and hazards [115], including attentiveness to protocols and regulations. The presence of a tool to assess safety culture (Paper III) provides a starting point for discussions that serve as a basis for a more overall insight into both safety and quality concepts. High scores on SAQ dimensional values are presumably a marker for a high level of safety awareness while low scores should prompt preventive measures such as discussions on safety among staff.

Highlighting the safety concept in community pharmacies does not come naturally to all stakeholders, which is obvious when scrutinizing the safety culture assessment (a questionnaire produced by the National Board of Health and Welfare in Sweden [118]). This questionnaire is meant for health care personnel but does not include pharmacy personnel. Thus discussions with authorities might be a challenge for the new pharmacy companies. Other initiatives such as the adaptation of the MaPSaF to the community pharmacy setting [157] indicate, however, an increasing focus on safety issues in the community pharmacy setting in other countries.

The results presented raise questions regarding the concept of safety culture in general and the SAQ instrument in particular. The concept of safety culture, as related in the background chapter, is composed of different aspects on safety that differ depending on the questionnaire used. The concept appears to be rather unclear and loosely defined. Operationalisation thus becomes complicated and most probably has led to compromises. This might very likely contribute to why no relationship with dispensing errors is found.
in Paper IV. The exploration of safety culture in pharmacies is just beginning – a more extensive use will contribute to an explanation of the findings in this study and give clues on possible refinements, in order to adjust it even more for use in the pharmacy setting.

In this thesis, the safety culture in pharmacies has been explored, based on previous research conducted in health care. Further elaboration of the components of safety in pharmacies might need to be performed, in order to achieve a clearer view. Also, Reason’s model on safety culture, describing the concept as the summary of several subcultures [54], also seems appropriate for use in pharmacies. The model is appealing as it encompasses individuals and their essential role in the work setting; they must be able to report errors and trust their superiors not to punish them. In this way a blame-free error reporting environment is achieved. Also, the staff need to know that the reports will be used to prevent other errors from occurring. This helps to create a collective understanding and responsibility of what a safety culture can mean.

Implications for pharmacy quality

The results presented have highlighted the importance of having an organised structure to ensure systematic handling of dispensing errors, including systematic reporting and assessment of frequency and seriousness of the different types of errors. There are a number of quality management systems that can be applied to ascertain this structure. A pragmatic approach would be that it is less important what kind of quality system is used, as long as it ensures continuous quality improvement and safety in community pharmacies. The multitude of quality management systems might be an asset, as different organisations have different needs. To some extent the development has not only been needs based on, but also driven by, commercial interests. However, the presence of a process approach within the organisation as a whole is of importance, as this will facilitate systematic reviews of the services and hence also make it easy to find the holes in the Swiss Cheese.

The situation existing when the studies in this thesis were carried out is no more; the Swedish monopoly is a part of the past. Authorities such as the Medical Products Agency have specified new quality demands, for instance stating that if there are or are likely to be serious deficiencies or errors, a specially appointed pharmacist should report this to the Agency [158, 159]. This has to be guaranteed in order to allow new pharmacy actors authorization for running pharmacies. Whether such requirements will be enough to secure quality and safety in pharmacies is yet unknown and it also remains unclear how the new actors will arrange their quality management systems.
including reporting systems – hopefully this thesis will contribute to enhanced quality.

This thesis has focused on aspects of quality in community pharmacies; i.e. management of dispensing errors and exploration of the safety culture. It has demonstrated that systematic work with dispensing errors is productive and helps to decrease the number of errors. It has contributed a tool to assess the safety culture in Swedish pharmacies, which may be useful in further investigations of the area. It has elaborated benchmarking values to be used in the future, when continued explorations are made, and thus provides a basis for further exploration of the impact of safety culture.
MAIN CONCLUSIONS

Results are what you expect and consequences are what you get.
Author unknown

- The change from a paper-based to a web-based reporting system for dispensing errors increased the reporting of errors and enhanced the completeness of reported data.

- The web-based reporting system facilitated follow-up and identification of possible preventive measures, but was associated with implementation problems.

- A directed technical barrier in the pharmacy computer system, targeted to prevent certain kinds of dispensing errors, brought about significant decreases in the overall number of reports on dispensing errors and, specifically, reports on errors with the wrong strength and errors caused by registration failure.

- The translation and adaptation of an instrument for assessing safety in Swedish community pharmacies, the SAQ, demonstrated satisfying psychometric and feasible properties. The instrument might need some elaboration before further use in research and pharmacy practice.

- No relationship, although such was hypothesized, was established between dispensing errors and safety culture as measured by SAQ. This could be due to the good safety culture and homogeneity among Swedish pharmacies.

- A positive relationship was established between the SAQ Stress Recognition dimension and dispensing errors in Swedish community pharmacies.

- A number of other pharmacy characteristics, such as number of dispensed prescription items and employees, displayed positive relationships with dispensing errors. Staff age demonstrated a negative relationship with dispensing errors while other demographic variables such as national education background showed a positive relationship.
FUTURE PERSPECTIVES

In all human affairs there are efforts, and there are results, and the strength of effort is the measure of the results.

James Allen

Pharmacies are a part of health care. The importance of also having high safety awareness in pharmacies is paramount. In this thesis some aspects of quality in pharmacy have been explored, but the area needs further study.

The restructuring of the Swedish pharmacy market has resulted in changing conditions. One disadvantage has been a negative effect on the overall picture of the dispensing errors occurring in Swedish pharmacies. The national reporting system most probably will be reduced to a fragmented array of different reporting systems run by several stakeholders. The impact of this change on quality and safety climate in Swedish pharmacies needs to be further explored. What are the pros and cons regarding the new infrastructure for reporting of dispensing errors, compared to the previously existing system? What will it look like? A comparative study on safety culture and climate, comprising several pharmacy actors, might contribute to the understanding of factors that have a positive influence on safety in pharmacies.

In this thesis an organisational approach has been used, and applying individual aspects will add information on how the pharmacy staff relate to quality and errors. Interviewing both key personnel and staff will provide a deeper understanding of the safety awareness and will help map safety structure in pharmacies.

The fact that no relationship was established regarding the Safety Climate dimension and dispensing errors in Swedish community pharmacies needs to be further explored, as it might be that SAQ does not capture safety climate in pharmacies. For instance, safety could also be assessed by using alternative instruments such as the MaPSaF. Comparison between this method and the SAQ would identify similarities and differences. It might be that one of these methods is more sensitive in assessing safety climate in the pharmacy setting. Measuring safety culture in Swedish community pharmacies, comparing SAQ to other safety survey tools or other methods such as the
MaPSaF, is a future challenge that could bring additional knowledge to the findings in this thesis.

Other relationships worth exploring include additional deviant outcomes such as dispensing near misses and customer complaints. Identification of drug-related problems might be considered a marker of both patient care and patient safety interest in pharmacies, and may be associated with safety climate. The exploration of these relationships could contribute to the definition of quality indicators, which could be used to level quality in pharmacies.

The relationship between the SAQ Stress Recognition dimension and dispensing errors is intriguing, and further analysis of this association might add important information. Also, the relationships between dispensing errors and age and educational background merit further studies as this might contribute to the awareness of behavioural differences in staff groups, which might need to be addressed. Qualitative methods can be relevant to use in these more in-depth studies.

The importance of structured handling of dispensing errors has been highlighted in this thesis. These findings are awaiting further elaboration both in research and practice. Also, the tool used in the Swedish community pharmacies, has supplied information on safety culture in these pharmacies that pharmacies in other countries, might benefit from as benchmarking values. Thus this contribution to knowledge on safety culture in pharmacies could be used in forthcoming research worldwide!
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Gratitude is the memory of the heart
Italian proverb

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Annika
Avvikelsen av fel och brister utgör grunden för arbete med patientsäkerhet inom hälso- och sjukvården eftersom de ger kunskap om var riskerna finns. Fel och brister är också ett mått på kvaliteten, då de ger information om vilka delar i en verksamhet som inte fungerar. Inom svensk hälso- och sjukvård skall det finnas kvalitetsledningssystem, både för att säkerställa att en hög kvalitet finns och främja att ständiga förbättringar initieras. Även andra faktorer kan ha betydelse för att fel inträffar, som anställdas uppfattning om, värdering av och attityd till de risker som finns. Denna inställning till säkerheten på arbetsplatsen, kan också kallas säkerhetskultur och den, på en arbetsplats, förhärskande säkerhetskulturen misstänks ha betydelse för de fel som inträffar inom hälso- och sjukvården, inklusive apotek.


De rapporter som lagrades i det datoriserade systemet analyserades för att förstå vilka felexpeditioner som var de vanligaste förekommande. Resultatet användes för att skapa en teknisk barriär i det system som användes på svenska öppenvårdsapotek, för att registrera recept. Barriären hade som uppgift att säkerställa att vald styrka på aktuell medicin verkligl var den som avsågs. Genom s.k. tidsserieanalyser undersöktes effekten av denna barriär på totala antalet rapporterade fel, fel som berodde på att man expedierat lä-
Kemedel med fel styrka, samt fel som berodde på att man gjort en felaktig registrering av receptet i apotekens system. Resultatet av studien visade att barriären var effektiv och att felet minskade signifikant.


Sambandet mellan felexpeditioner och säkerhetskulturen på svenska öppenvårdsapotek undersökte i den avslutande delen av forskningsarbetet. Resultatet avvek från det förväntade, då det kunde konstateras att inget samband fanns mellan uppfattningen om säkerhet och avvikelser. De samband som konstaterades innebar att ju fler på ett apotek som insåg hur stress påverkar arbetsprestationen, ju fler fel konstaterades. Andra faktorer som t.ex. hög medelålder på ett apotek var förbundet med färre fel, medan sådant som en blandad nationell utbildningsbakgrund var knutet till fler fel.

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APPENDICES

Appendix 1 – Interview guide used in Paper I

**Questions regarding the work in the project group**
1. What do you remember specifically from the project?
   - What was your task?
   - What worked well / less well?

**Questions regarding the pilot testing**
2. Tell me about the pilot test!
3. In what way were you involved in the pilot?
4. Do you remember - how did the pilot test go?
   - Good / Less good?
   - What did the participants in the pilot test think about the new system?

**Questions regarding the introduction of the web-based system:**
5. Tell me what was your task, in the project group, prior to the introduction!
   - Information / education / special preparations?
6. What happened *when* the system was introduced?
   - Users’ reactions?
   - Your reaction?
7. Do you remember anything special from the introductory period?
8. If you should try to summarize – what was the perception of the system when it was introduced?
   - Your opinions / the opinion of others?
   - Good/Less good?
9. What could have been performed differently?

**Questions regarding the effects of the system introduction**
10. How does the system work today?
   - Your opinion / the opinion of others?
   - What is good / less good?
   - What has changed since the introduction?
11. Has the system filled the expectations?
12. Has the system had an impact on the handling of dispensing errors?
13. What are your reflections about the difference in reporting; paper vs web-based format?
   What do you think is the view of the users?
   What is good / less good?
   Differences in quality?
14. Did the system bring about effects not anticipated on beforehand?
   What is your view on new the system?
15. How would the deviation system be improved?
   Does it need to be improved?
Appendix 2 - The Safety Attitudes Questionnaire – The Swedish Community Pharmacy Version used in Papers III and IV

Please note that each item is presented in the Swedish Community Pharmacy version and in the original version. (A more comprehensive version, including the back-translation of the Swedish Community Pharmacy Version, is to be found in the additional file of Paper III.)

Team Work
1. Mina synpunkter och förslag – min input – tas väl emot på det här apoteket. (*My input is well received in this clinical area.*)
2. Om jag upptäcker problem med läkemedelshanteringen är det svårt att saga ifrån på det här apoteket. (Med läkemedelshantering avses all verksamhet som har med läkemedel att göra, som exempelvis varuhantering och expedition, i både receptur och egenvård). In this pharmacy, it is difficult to speak up if I perceive a problem with patient care. (*In this pharmacy, it is difficult to speak up if I perceive a problem with patient care.*)
3. Om vi i personalen är oeniga om något, så löses det på ett bra sätt (d.v.s. det spelar ingen roll vem som har rätt, utan vad som är bäst för kunden). (*Disagreements in this pharmacy are resolved appropriately (i.e., not who is right but what is best for the patient).*
4. Jag får det stöd jag behöver från andra på det här apoteket, för att hjälpa kunderna. (*I have the support I need from others in this pharmacy to care for patients.*)
5. Det är lätt för personalen här att ställa frågor när det är något de inte förstår. (*It is easy for personnel here to ask questions when there is something that they do not understand.*)
6. Personalen på det här apoteket arbetar tillsammans som ett välfungerande team. (*The people in this pharmacy work together as a well-coordinated team.*)

Safety Climate
1. Jag skulle känna mig trygg som kund här. (*I would feel safe being treated here as a patient.*)
2. Felexpeditioner hanteras på ett korrekt sätt på det här apoteket. (*Medication errors are handled appropriately in this pharmacy.*)
3. Jag vet hur jag lämpligen kanaliserar frågor om patientsäkerhet på det här apoteket. (*I know the proper channels to direct questions regarding patient safety in this pharmacy.*)
( I receive appropriate feedback about my performance.)
5. På det här apoteket är det svårt att diskutera misstag. (In this pharmacy, it is difficult to discuss errors.)
6. Jag uppmuntras av andra på det här apoteket att ta upp alla tänkbare funderingar jag har om patientsäkerheten. (I am encouraged by others in this pharmacy, to report any patient safety concerns I may have.)
7. Miljön på det här apoteket gör det lätt att lära av andras fel. (The culture in this pharmacy makes it easy to learn from the errors of others.)

Job Satisfaction
1. Jag tycker om mitt arbete. (I like my job.)
2. Att arbeta här är som att vara del av en stor familj. (Working here is like being part of a large family.)
3. Det här apoteket är en bra arbetsplats. (This pharmacy is a good place to work.)
4. Jag är stolt över att arbeta på det här apoteket. (I am proud to work in this pharmacy.)
5. Det är en god stämning på det här apoteket. (Morale in this pharmacy is high.)

Stress Recognition
1. När min arbetsbörda blir för stor försämras min arbetsinsats  
(When my workload becomes excessive, my performance is impaired.)
2. Jag är mindre effektiv på arbetet när jag är trött. (I am less effective at work when fatigued.)
3. Det är mer troligt att jag gör fel i spända eller otrevliga situationer. (I am more likely to make errors in tense or hostile situations.)
4. Trötthet försämrar min arbetsinsats i pressade situationer. (Fatigue impairs my performance during emergency situations.)

Perceptions of Management
1. Ledningen på det här apoteket stöttar mig i mitt dagliga arbete.  
(Management in this pharmacy supports my daily efforts.)
2. Ledningen på det här apoteket äventyrar inte medvetet patientsäkerheten. (Pharmacy management doesn’t knowingly compromise patient safety.)
3. Det här apotekets ledning ger mig i god tid nödvändig information om händelser som kan påverka mitt arbete. (I get adequate,
timely info about events that might affect my work, from pharmacy management.)

4. Bemanningsnivån på det här apoteket är tillräcklig för att hantera antalet kunder. (The staffing levels in this pharmacy are sufficient to handle the number of patients.)

Working Conditions

1. Det här apoteket gör ett bra arbete för att skola in nyanställd personal. (This pharmacy does a good job of training new personnel.)

2. Jag har rutinmässigt tillgång till den information som krävs för att bedöma huruvida en förskrivning är rimlig. (All the necessary information for therapeutic decisions is routinely available to me.)

3. På det här apoteket är nyanställd personal under adekvat tillsyn. (Trainees in this pharmacy are adequately supervised.)

4. Problematisk personal hanteras på ett konstruktivt sätt av ledningen på det här apoteket. (Problem personnel are dealt with constructively by our pharmacy management.)
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