PhD thesis

Title: The effect of establishing a new, reorganized emergency department on quality of clinical healthcare and patient satisfaction

PhD-student: Maria Søe Mattsson, RN, MHSc, Department of Emergency Medicine, Nykøbing Falster Hospital, Denmark

Submitted: July 1, 2015

Academic supervisors:
Terkel Christiansen, Professor, cand.oecno. (Main supervisor) COHERE, Department of Business and Economics University of Southern Denmark, Denmark

Hanne Blæhr Jørsboe, MD, MPA, Senior Consultant, Department of administration, Nykøbing Falster Hospital, Denmark

Assessment committee:
Christian Backer Mogensen, Clinical Associate Professor, MD, PhD, Emergency Centre Aabenraa, Hospital of Southern Jutland, Aabenraa University of Southern Denmark, Denmark (Chair)

Knut Stavem, Professor, MD, PhD, Institutt for klinisk medisin, Det medisinske Fakultet. Akershus Universitetssykehus University of Oslo, Norway

Ulrika Enemark, Associate Professor, M.Sc., PhD, Department of Public Health - Department of Health Services Research Aarhus University, Denmark

Financial support:
Afdeling for kvalitet og udvikling i Region Sjælland
Forskningsenheden under Sygehus syd
Edith og Henriks Henriksens mindelegat
Lokale forskningspulje, Sygehus syd
Region Sjællands Sundhedsvidenskabelige Forskningsfond
Nykøbing Falster Sygehus
The present PhD thesis is based on the following four papers

Paper I
Mattsson MS, Mattsson N, Jørsboe HB
*Improvement of clinical quality indicators through reorganization of the acute care by establishing an emergency department - a register study based on data from national indicators.*

Paper II
Mattsson, MS, Jørsboe, HB
*Patient satisfaction in a reorganized emergency department: A quasi-experimental study* (Submitted)

Paper III
Mattsson, MS, Jørsboe, HB
*The correlation between clinical healthcare indicators and patient satisfaction in a newly established emergency department – a cross-sectional study* (Draft)

Paper IV
Mattsson, MS, Jørsboe, HB
Preface

“Everybody wants development and progress – nobody wants change”

– unknown author

As stated above, the challenges of setting up a 3 year study in a busy department with a huge patient-flow are enormous and take a lot of time and effort. Many changes in the Emergency Department had already been planned at the start of the study and were obviously carried out during the study, creating an ever changing environment for the ED staff and for patients. I am therefore very pleased and grateful that it was possible to conduct a study like this in the present setting and it is my deepest hope that this could clear the way for other projects in the future. This thesis have been carried out at the Emergency Department, Nykøbing Falster Hospital, Region Zealand.

First of all, I would like to thank my main supervisor, Professor Terkel Christiansen, Department of Business and Economics at University of Southern Denmark, for your professionalism and practical guidance doing the long working process. Always calm and patient when needed and despite the distance, we always managed to meet – at least online.

I also wish to thank my co-supervisor, Dr. Hanne Blæhr Jørsboe, who first outlined this project, and who believed in me from the start until the very end. Thank you for your great commitment to the project and for the late hour/last minute changes and for personal backup when needed - it means a lot to me.

A great appreciation goes to Director (Danish: koncerndirektør) in Region Zealand, Lars Onsberg Henriksen and former Deputy Director (Danish: Vicedirektør) at Nykøbing Falster Hospital, Pia Bruun Madsen, for initiation of the project and the important organizational and financial support.

I also wish to thank my closest colleagues in the department for showing me around in the department and helping the students with inclusion of patients in the study. Obviously I am also deeply grateful for the help from the health professionals in general at the Emergency Department - I know that the conduction of this study demanded a lot of effort from you as well. A special thanks to Bettina Romme Rasch, for the help with extraction of data.
A very special thanks goes to the patients without whom this study could never have been carried out. Thank you for the willingness to participate in the study and for the time and trust you provided in the questionnaire study. Also, a special thanks to all the students who helped with the data collection in a difficult setting. Thank you to my fellow ph.d-students around the Region Zealand for meetings, discussions and support when needed.

Thanks to Metropol, Department of Nursing, and all of my new colleagues for your interest in my work and for giving me space and support to finish the work I started before my present employment.

Finally, my deepest gratitude goes to my family and friends for their great friendship and support, my parents and my in-laws for always being there for us and especially for our two kids. My deepest appreciation goes to my husband Nick. I am truly grateful for your endless support and encouragement – without you, this thesis would never have been a reality.
The last words go to our two twin sons, Gustav and Christian, for filling our everyday life with meaning and being the best supporters one could ask for.

Rødovre, October 2015
Maria Søe Mattsson
The effect of establishing a new, reorganized emergency department

Contents

1. Introduction .................................................................................................................... 9
2. Background ..................................................................................................................... 10
   2.1. National recommendation ...................................................................................... 10
   2.2. International experience ....................................................................................... 10
   2.3. Intervention, local organizational change and status .............................................. 11
   2.4. Measuring health care quality ................................................................................. 14
3. Aims ................................................................................................................................ 16
4. Materials and methods ...................................................................................................... 17
   4.1. Clinical healthcare quality (Study I, paper I) .......................................................... 21
      4.1.1. Study population ............................................................................................... 21
      4.1.2. Data source ....................................................................................................... 23
      4.1.3. Reference group ............................................................................................ 24
      4.1.4. Data procession and analysis ......................................................................... 24
   4.2. Patient satisfaction (Study II, paper II) ................................................................. 26
      4.2.1. Study population ............................................................................................... 26
      4.2.2. Data source ....................................................................................................... 26
      4.2.3. Data collection .................................................................................................. 27
      4.2.4. Drop-out analysis ............................................................................................ 30
      4.2.5. Data procession and analysis ......................................................................... 30
   4.3. The correlation between healthcare quality index and patient satisfaction (Study III, paper III) ................................................................. 33
      4.3.1. Study population ............................................................................................... 33
      4.3.2. Data source ....................................................................................................... 33
      4.3.3. Data procession and analysis ......................................................................... 34
   4.4. Ethical considerations .............................................................................................. 35
5. Results ............................................................................................................................... 36
   5.1. Clinical healthcare quality (Study I, paper I) .......................................................... 36
   5.2. Patient satisfaction (Study II, paper II) ................................................................. 39
   5.3. The correlation between indicators and patient satisfaction (Study III, paper III) ................................................................. 44
6. Discussion .......................................................................................................................... 47
   6.1. General discussion ................................................................................................... 47
      6.1.1. Structure ............................................................................................................ 47
      6.1.2. Process .............................................................................................................. 48
      6.1.3. Outcome .......................................................................................................... 49
6.2. Discussion of strength and limitations .................................................. 52
   6.2.1. Internal validity ........................................................................... 52
   6.2.2. External validity ........................................................................ 54
7. Conclusion ............................................................................................... 55
8. Future research ....................................................................................... 56
9. English summary ..................................................................................... 57
10. Dansk Resumé ....................................................................................... 59
11. References ............................................................................................. 61
12. Appendix and papers ............................................................................. 68
Abbreviations

ED: Emergency Department
New ED: Reorganized Emergency Department
NFS: Nykøbing Falster Hospital
HOL: Holbæk Hospital
RKKP: The Regions' Clinical Quality Development Programme (Danish: Regionernes Kliniske Kvalitetsudviklingsprogram)
NIP: National Indicator Project (Danish: Det nationale indikator projekt).
LUP: National Danish Survey of Patient Experiences (Danish: Landsundersøgelsen for patientoplevelser)
Kip: The quality in patient meeting (Danish: Kvalitet i patientmødet)
DDKM: The Danish Health care Quality Programme (Danish: Den danske kvalitetsmodel)
LPR: The Danish National Patient Registry (Danish: Landspatientregisteret)
The effect of establishing a new, reorganized emergency department
1. Introduction

This thesis aims to address changes in health care quality and patient satisfaction in a group of acutely ill patients admitted to a newly established emergency department (ED) with observation beds at a regional hospital in Denmark. The study was initiated in 2009 at the same time as a nationwide reorganization of acute care was introduced in Denmark, with the focus of enhancing the general quality of the acute care. Some of the major national demands were “one door into the hospital”, senior physicians up front, shorter waiting times and a more rapid patient-flow.

The thesis is based on a clinical study at a local community hospital, Nykøbing Falster Hospital (NFS), one of Region Zealand’s four acute hospitals (Figure 1). Initially the new ED at NFS was the product of a fusion between a former emergency room and a local unit with expertise in acute internal medicine (Figure 2). The new ED was established in 2009 and has been expanded with a new building in June 2011 as a result of an increasing need of more beds and examination rooms.

In 2009, access to data concerning the quality of acute care was limited and research on acute care in a Danish context was sparse. Therefore, this thesis was set up to monitor the development in the acute healthcare at NFS based on a set of national indicators from the Regions' Clinical Quality Development Programme (RKKP) databases as well as the patients’ experiences of care using the National Danish Survey of Patient Experiences (LUP) as a guideline. Data were compared with another community hospital in Region Zealand as well as with national data. Furthermore an analysis of the correlation between patient satisfaction and health care quality was performed.

**Facts box**

- NFS serves 140,000 citizens in Lolland, Falster and South Zealand
- NFS has around 32,000 acute contacts each year
- 16,000 patients a year are admitted for more than 2 hours
- NFS has 255 beds

**Figure 1**
2. Background

2.1. National recommendation

A large reorganization of acute care in Denmark was initiated by the Danish Health and Medicines Authority in 2007. The aim was to create high and uniform quality, coherent patient pathways and effective use of resources (1,2). Danish Health and Medicines Authority advised the five regions in Denmark to organize EDs with observation units in fewer and larger hospitals with a “one door” concept for the patients. It was expected that this new EDs would ensure more effective patient treatment through shorter waiting times, triage, fast flow, high quality and improved patient safety. Furthermore, more patients should be discharged from the ED or be seen and treated by senior physicians within few hours.

As a central issue in the reorganization, senior physicians would be “up front” to supervise young and unexperienced physicians and manage patient flow. Consequently, as a part of a regional strategy, Region Zealand decided in 2008, to reorganize the former acute ward at NFS to a new joined ED with observation beds. Already in 2009, during the local organizational planning, the present study was set up to investigate how health care and patient satisfaction would be influenced by the establishment of the new ED. Figure 2 shows the organization changes that took place in the reorganization of the joined ED at NFS.

2.2. International experiences

The organizational changes were designed on the basis of international experiences, with the expectation that reorganized EDs would improve health care quality as well as patient satisfaction (3–10). Currently the medical discipline “Emergency Medicine” is not yet approved by the Danish Health Authorities, but internationally, it has existed in the last 40 years. It has generated extensive medical literature that supports the efficacy and value of both emergency medicine (EM) as a medical discipline (11) and of emergency patient care delivered by trained EM physicians (3), all of which demonstrates the potential use of EM physicians and reorganized EDs in Denmark. Studies supports the assumption that treatment in the EDs can be improved through optimizing patient flow (6,12,13) as well as fast-track diagnostic workups for patients.

---

1 Danish Health and Medicines Authority recommended that all reception of emergency patients at the hospital is through a unified emergency department and that the reception takes place after visitation.
with less severe symptoms, and that these changes will result in shorter waiting time, shorter length of hospitalization and fewer patients leaving without being seen by a physician (6). International studies have also demonstrated that the presence of observation units in the ED increases the number of patients who are discharged directly to their homes within a short period of time (14,15).

### 2.3. Intervention, local organizational change and status

The reorganization of the ED with observation beds at NFS consisted of a package of interventions, with the aim of improving the delivery of acute care. Based on Region Zealand’s advice, the design of the interventions was finished and approved by the local administrators of the ED in collaboration with the director of the hospital in the spring of 2009 and qualified through international collaboration with the Beth Israel Deaconess Medical Center in Boston, MA, USA. The interventions were gradually implemented during the whole study period and included changes in organization as well as changes in healthcare delivery (16). Table 1 provides an overview and timeline of the interventions. The patients’ access to the ED has undergone several major changes through the recent years. Patients are required to call a
specified emergency telephone number, operated by a specialist nurse, in order to be referred to the ED and can no longer gain access just by self-referral. When arriving to the ED, all patients are received in a central unit operated by a secretary and a nurse with backup from an emergency physician. All patients admitted to the ED are risk stratified – triaged – by the receiving nurse, who is trained in the triage process (Appendix 1). These changes are thought to enhance patient flow and induce efficient high quality treatment, ultimately resulting in optimized patient care.
Table 1 Interventions at the emergency department at Nykøbing Falster Hospital in the study period 2009 – 2012

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Plan</th>
<th>Status in 2013</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of senior physicians in the ED</td>
<td>Initially it was planned to hire eight senior physicians to the ED to cover 24 hours daily, but due to economy and lack of qualified candidates, the paradigm changed in 2010 to three. The senior physicians represented various medical specialists’ areas.</td>
<td>Three senior physicians Daily from 8 am to 6 pm</td>
<td>(1–3,7,17,18)</td>
</tr>
<tr>
<td>Establishment of triage</td>
<td>To build up a triage based on trained triage nurses. Local, regional and international education.</td>
<td>All patients are triaged by triage nurses</td>
<td>(7,10,19–23)</td>
</tr>
<tr>
<td>Electronic display boards</td>
<td>To develop and implement an electronic overview of patient flow and services in daily routines.</td>
<td>Daily meetings in the ED concerning patient priority and planning. Each department of the hospital has an electronic board to manage patient flow.</td>
<td>(24)</td>
</tr>
<tr>
<td>Electronic patient records</td>
<td>To develop and implement an electronic patient records system in OPUS adapted to the documentation needs for acutely ill patients.</td>
<td>The system is in use but presents challenges</td>
<td>(25,26)</td>
</tr>
<tr>
<td>Optimizing care through patient pathways</td>
<td>Specific patient pathways were planned to be used as role models for more unified delivery of care</td>
<td>A pathway for stroke has been implemented and sepsis</td>
<td>(25,27–31)</td>
</tr>
<tr>
<td>Increasing qualifications among staff</td>
<td>Education and training of physicians and nurses who work in the ED. Physicians have followed an national and international education programme and 110 nurses are now examined acute nurses</td>
<td></td>
<td>(32,33)</td>
</tr>
<tr>
<td>Expansion of the ED with a building</td>
<td>600 m² new building comprising: Triage, fast track, trauma and X-ray.</td>
<td>Finished in 2nd half of 2011</td>
<td></td>
</tr>
</tbody>
</table>

ED = Emergency department with observation beds
2.4. Measuring health care quality

Managing and improving quality is a complex issue because quality, in a healthcare setting, is a multidimensional concept. In healthcare, quality is determined not only by the ability of physicians making diagnoses and providing treatment, but also by other attributes of service delivery such as attentiveness, care, and diligence (34).

The national strategy for quality in health care are based on the WHO definition, and describes good quality as a high level of achievement and a good result for the patient. The following elements should be included in the assessment and be present in a high quality setting: High treatment standard, efficient use of resources, minimal patient risk, high patient satisfaction and coherent patient flows (35).

In this thesis, the evaluation of quality of care is based on the concept formulated by Dr. Avedis Donabedian. The Donabedian model is a conceptual model that provides a framework for examining health services and evaluating quality of healthcare. Donabedian proposed that one could assess whether high quality care was provided by examining the structure of the setting in which care is provided, by measuring the actual process of care, and/or by assessing what the outcomes of care are (Figure 3) (34,36).

Structure describes the context in which care is delivered, including hospital buildings, staff, financing, and equipment. A motivation for focusing on structure is the premise that the setting can be a strong determinant of care quality and given the proper system, good care will follow. Process denotes the transactions between patients and providers throughout the delivery of healthcare. Process indicators describe how the procedures are performed and might be important for the result; however, the weakness of process indicators is that it is an indirect measure of outcome, although processes are important for both staff and patients; an example is waiting time. Finally, outcomes refer to the effects of healthcare on the health status of and populations. Outcome indicators are the synthesis of a structure and a process (36). Morbidity and mortality are major impact indicators, but patient satisfaction is also an important and commonly used indicator for measuring the quality in healthcare. Patient satisfaction affects clinical outcomes, patient retention, and the number of legally actions regarding medical malpractice. It affects the timely, efficient, and patient-centered delivery of quality healthcare and these three

---

2 Dr. Avedis Donabedian was a major figure in health care assessment, described the quality of medical care as structure, process, and outcomes in 1950.
different ways to analyze the quality should always be considered as a whole (34). Thus, patient satisfaction could be considered a proxy variable; however, it is considered a very effective indicator (37).

The purpose of measuring quality of care has two perspectives. First, the aim is to implement and achieve the planned care, and secondly, it should be seen as a learning process and the gained knowledge should result in future improvements. Dr. Donabedian suggests different methodological steps, in which the quality can be assessed on the basis of process data, outcome data, or as a combination (38). In this thesis, we are interested in both the clinical healthcare quality provided by health professionals as well as patient experienced quality. The structure, when investigating quality in acute treatment is the ED with the different task forces and the process and outcome indicators are generated by staffs working in the field. The national set up with databases makes it possible to compare results to explicit national standards, and afterwards perform a learning process with a regional audit conference by discussing the results and provide plans for improvements. Likewise, analysis of patient experienced quality can be based on the principles from the national investigation of patient satisfaction.

This investigation were based on validated questionnaires and primarily addressed the patient’s experiences in terms of different process issues. In clinical practice, data is evaluated in order to improve quality gaps compared the national standards. The data are outcome responses and finally this thesis will discuss some learning points and give suggestions to future improvements.
3. Aims

The overall aim of this study was to investigate the effect of establishing an ED with observation beds at NFS with respect to reported health care quality and patient perceived quality.

The specific aims were:

1. To investigate the efficacy and health care quality for patients with stroke, acute gastrointestinal bleeding and perforation, heart failure, hip fractures and chronic obstructive pulmonary disease (COPD) including COPD with pneumonia, measured after three years of specific organizational interventions. (Study I)

2. To investigate changes in patient satisfaction, including information, waiting times and treatment, in selected groups of patients in the reorganized ED. (Study II)

3. To investigate whether a correlation was seen between reported clinical health care quality and patient satisfaction. (Study III)

4. To investigate whether changes in readmission frequency and all-cause mortality are seen after the reorganization of the ED. (Thesis, results Study III)
4. Materials and methods

The three studies utilized different data sources and designs (Table 2 and studies I-III). Mixed-method approach was used, measuring healthcare quality with quantitative methods pre- and post-reorganization of the new ED. The studies are carried out between the years of 2008 to 2012. NFS was chosen because of its location as the only acute hospital in the local region and the timeline in terms of the reorganization process.

Study I and II were done as a prospective quasi-experimental design without control group. The design was chosen, because the opportunity of key components of a true experiment was missing, including an randomization opportunity and the use of a control-group (39). The nationwide reorganization and establishment of the EDs, where the concept was interpreted in very different structure and staffing nationwide and also with very different phases of implementation with unclear timelines, eliminated the opportunity to find a suitable control-group.

In the evaluation of the changes, we considered the intervention (Table 1) as a whole package of several procedures, rather than a number of separate interventions. This was considered necessary, as the procedures were to be implemented over time with no specific time framework through the study period. Furthermore, some of the interventions changed over time (e.g. a varies number of senior physician in front due to cost-reductions in the period). Finally, some of the interventions were initiated almost simultaneously, making it impossible to separate the evaluation of individual interventions (40). Therefore, a two-group (Study I)/one-Group (Study II) pretest-posttest design was used. This requires collection of data on study participants’ level of performance before the intervention (pre-), and collection of the same data after the intervention (post-). In this instance, pre-intervention serves as the “control” period (39). Study II was performed, not pre-reorganizational, but in the initial phase of the reorganization, with only minor impact on indicators, due to a gradually implementation of the concept (Figure 4) (40).

The pre-post test design allows us to make inferences on the effect of our intervention by looking at the difference in the pre-test and post-test results. To address problems concerning validity, national validated indicators and validated questions in the survey was used. Furthermore, to strengthen the reliability we included a reference group in study I (41). Study III was performed as a cross-sectional study (42), showing whether there is an association between the measured patient satisfaction and the clinical healthcare quality three year after establishment of the ED, in terms of process- and outcome-indicators. This could be useful in generating hypotheses for
future research.

Three kinds of data were used in the studies, including two national databases and data from the patient operative system and patient records. The RKKP (NIP) and LUP were chosen since they provided the study with a unique possibility to collect baseline data and to follow the development in health care quality locally, as well as nationwide, during the establishment of the ED. Donabedian’s conceptual model for examining health services and evaluating quality of care as a framework for examining structures, processes and outcomes will be applied.

In the following, the methodological details as well as the methodological choices will be presented.
The effect of establishing a new, reorganized emergency department.
<table>
<thead>
<tr>
<th>Study</th>
<th>Source population</th>
<th>Data source</th>
<th>Design</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Patients admitted with stroke, heart failure, COPD, ulcer or hip fracture, at Nykøbing Falster and Holbæk Hospitals; January 1, 2008 – December 31, 2008 and January 1, 2012 - December 31, 2012. N=4584</td>
<td>Register data: National indicator project (NIP) and Region’s Clinical Quality Development Programme (RKKP).</td>
<td>Quasi-experimental study</td>
<td>Health care quality</td>
</tr>
<tr>
<td>III</td>
<td>Sample of patients, meeting the inclusion criteria, discharged from the emergency department September 24, 2012 – December 16, 2012. N=2009</td>
<td>Archive, survey: Archive from electronic patient files and the patient operative system and survey data from study II.</td>
<td>Cross-sectional study</td>
<td>Correlation between reported clinical health care quality and patient satisfaction</td>
</tr>
</tbody>
</table>
4.1. Clinical healthcare quality (Study I)

Study I investigated the efficacy and the clinical healthcare quality for patients with stroke, acute gastrointestinal bleeding and perforation, heart failure, hip fractures and chronic obstructive pulmonary disease (COPD) including COPD with pneumonia, measured after three years of specific organizational interventions.

4.1.1. Study population

The study population consisted of acutely ill patients who sought medical attention in the ED at NFS and HOL between 1st of January 2008 and 31st of December 2008 (pre-intervention) and again between the 1st of January 2012 and 31st of December 2012 (post-intervention). Furthermore the patients met the criteria as reported to the Region’s Clinical Quality Development databases (43) concerning the following diagnoses: stroke, COPD, heart failure, hip fracture and acute gastrointestinal bleeding and perforation (44–48). All are among the twenty most common illnesses seen in an emergency care setting (49). A total of 4584 patient cases were assessed. NFS has an uptake area with 140,000 citizens. The activity level in the ED changed from 2008 to 2012. Thus, a reduction of 3,476 patients with small injuries was observed during this time period from 24,249 in 2008 to 20,773 in 2012, whereas the total number of patients admitted to the ED increased by 3,427 (12,861 in 2008; 16,288 in 2012) (OPUS: local administrative patient file system). All outpatient visits were excluded.

**Stroke**: All acutely ill patients >18 years with acute stroke or a transient ischaemic attack (TIA)\(^3\).

In this context acute is defined as an onset of symptoms within one week. Patients were registered and classified according to the ICD-10 diagnosis codes I61, I63, I64, which had to be registered as primary diagnosis or secondary diagnosis at discharge (45).

Eight of the 18 national process indicators and one outcome indicator were used in this thesis (Table 3). We excluded indicators, which were not relevant to the intervention, including indicators of thrombolysis, a treatment provided at another hospital.

---

\(^3\)Stroke is defined by the Danish Stroke Registry in accordance with the WHO as a clinical syndrome characterized by rapidly developing clinical symptoms and/or signs of focal, and at times global loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.
COPD (Chronic obstructive pulmonary disease): All acutely ill patients >30 year, admitted due to acute exacerbation with primary diagnosis DJ44.X or as secondary diagnosis with one of the following diagnoses as primary diagnosis: DJ96.X, DJ13.X, DJ14.X, DJ15.X, DJ16.X, DJ17.X, DJ18.X (44). One process and two outcome indicators were measured in relation to patients admitted with COPD (Table 3).

Heart failure: Patients >18 years with newly diagnosed heart failure. This is defined as clinical symptoms of heart failure at rest and/or on exertion; signs of cardiac dysfunction, either reduced systolic function and/or diastolic dysfunction or elevated filling pressure; and a positive response to treatment for heart failure (ICD-10: I11.0, I13.0, I13.2, I42.0, I42.6, I42.7, I42.8, I42.9, I50.0, I50.1, I50.2, I50.3, I50.8, I50.8a, I50.9).

Seven processes and two outcome indicators were measured in relation to admitted patients with heart failure (Table 3). Data from the reference hospital HOL in the post-intervention year, 2012, are missing (47).

Acute gastrointestinal surgery: All patients ≥18 years admitted or transferred from another hospital unit with an acute clinical problem in the form of bleeding or perforated gastro duodenal ulcers. The registration of patients with a diagnosis of bleeding was classified using the following ICD-10 diagnosis codes: DK250, DK254, DK260, DK264, DK270 or DK274, which had to be registered as primary diagnosis or secondary diagnosis at discharge. Four of six process and two outcome indicators were measured in relation to bleeding gastro duodenal ulcers (48) (Table 3).

The registration of patients with diagnosis concerning perforation was classified using the following ICD-10 diagnosis codes: DK251, DK252, DK255, DK256, DK261, DK262, DK265, DK266, DK271, DK272, DK275 or DK276, which also had to be registered as principal diagnosis or secondary diagnosis at discharge. Four of six processes and one outcome indicator were measured in relation to perforated gastro duodenal ulcers (48) (Table 3).

Hip fracture: Patients >65 years with hip fracture as primary principal diagnosis (S72.0, S72.1, S72.2). Two of six process indicators and one outcome indicator were measured in relation to admitted patients with hip fracture (46) (Table 3).
4.1.2. Data source
The first data set to measure the healthcare quality were based on national process and outcome indicators collected since 2003, where Danish hospitals systematically began reporting data to a national indicator project (NIP, RKKP). This database monitored the treatment of a selected group of acute critical conditions and was the only existing sources of accessible Danish acute data in 2009.

Five of the disease groups in NIP have been extracted as indicators in this study, as they represent frequent diagnoses in the ED at NFS. The NIP database included national standards and processes and outcome indicators have been defined and is registered and audited by a specialist group four times each year. Inclusion criteria and validation of the indicators and the results of a nationwide audit process are thoroughly described in the homepage of the RKKP within each diagnostic database (43).

Briefly, the indicators were validated on a clinical assessment of three main issues: does the indicator measure the clinical pathway of interest?, is the indicator able to identify known variations in the quality of different healthcare departments - including considerations about the patient population - and are golden standards available? (43)

To measure the quality of healthcare, a national board of specialists within each disease group selected a series of measures (indicators). The indicators have been selected as they are considered particularly important in the assessment of whether the quality of care is at the desired level (43). Specific indicators for each disease were selected based on their relevance for the acute admission of patients and their potential benefits early in the patients’ pathway through the acute care process. The indicators measure either entire processes or specific outcomes. The data on processes represent data on examinations, treatment by physicians, treatment by other health professionals, and screenings, and outcome indicators represent data regarding readmissions and mortality. The RKKP (former called “the NIP database”) has expanded its scope through the years, limiting this thesis to the use of indicators present in both 2008 and 2012. Because of the very few hospitalized patients with heart failure at HOL, the head of the department decided to stop reporting patients to RKKP in 2011 resulting in missing data in the results. Furthermore, indicators were only used if the definition was unchanged over the study

---

4 Now “Regionernes Kliniske Kvalitetsudviklingsprogram” (RKKP). Before 2012, the databases was a part of the former national indicator project (NIP).
period from 2008 and in 2012 (Table 3). We used these data as a benchmark for critical indicators and as a quality standard in the reorganization of the EDs with pre- and post-analyses. As reporting of data to RKKP is a national requirement, data sets from a given hospital can be measured against comparable hospitals as well as data on a national level.

4.1.3. Reference group
We chose Holbæk Hospital (HOL), another community hospital in Region Zealand (Figure 1), as a reference hospital because HOL underwent the same organizational changes as NFS did, with regards to the establishment of an ED, and the change was carried out two weeks later than NFS. Additionally, they have comparable patient intake and demographic similar patients compared to NFS (50); However, two major differences were present. In the post-interventional setting HOL had senior physicians available 24 hours pr. day compared to 10 hours pr. day in NFS. Furthermore, HOL had no observation beds pre- or post-interventional. As the similarity in the organizational settings in the two hospitals is only an approximation, the use of HOL as a reference hospital was considered as the best alternative in order to strengthen the reliability.

4.1.4. Data processing and analysis
An application regarding use of data was sent to the NIP (RKKP) secretariat and after approval, the data were sent continuously through a file-sharing-program to the study-investigator. Frequency distributions were constructed for the datasets and the chi-squared test was used to test for the significance of pre- and post-intervention data. A two-proportion z-test was used to compare the experimental groups with the reference group (HOL). Any category with less than five patient responses was removed, and the responses were allocated to the closest positive or negative category that remained. In all analyses p <0.05 was considered statistically significant. Data were analyzed using STATA version 11 software.
### Table 3 Indicators used in study I

<table>
<thead>
<tr>
<th>Stroke</th>
<th>COPD</th>
<th>Heart failure</th>
<th>Ulcer</th>
<th>Hip-fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proces</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Patients admitted directly/transferred within second day of hospitalization to a stroke unit?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hospitalized for acute exacerbation and receive NIV treatment</td>
<td>Echocardiography</td>
<td>Endoscopy within 24 hours from admission/time from decision about treatment</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Patients in antiplatelet therapy within second hospitalization days?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NYHA classified</td>
<td>Treatment / therapeutic endoscopy</td>
<td>Rehabilitation</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Patients in oral anticoagulation therapy within 14 days?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Started or attempted started treatment with ACE-inhibitor/ATII-receptor antagonist?</td>
<td></td>
<td>Rebleeding after primary treatment</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Patients in ct/mr scanned on the day of admission?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Started or tried started treatment with beta blockers</td>
<td></td>
<td>Endoscopic treatment of rebleeding</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Patients assessed by a physiotherapist within second hospitalization day?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Started or tried started treatment with aldosterone antagonist</td>
<td></td>
<td>Surgical treatment of primary bleeding or rebleeding</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Patients assessed by a occupational therapist within second hospitalization day?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Referred to physical exercise by physiotherapist</td>
<td></td>
<td>Time for operation within 6 hours</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>Patients nutrition screened within second hospitalizations days?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initiated a structured training program</td>
<td></td>
<td>Reoperation</td>
</tr>
<tr>
<td><strong>8</strong></td>
<td>Ultrasound/CT-/MR angiography of the neck vessels within 14 days?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Weight control (daily)</td>
</tr>
<tr>
<td><strong>9</strong></td>
<td></td>
<td></td>
<td>Fluid balance (daily)</td>
<td></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td></td>
<td></td>
<td>Postoperative monitoring (daily)</td>
<td></td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Readmission within 30 days</td>
<td>Readmission within 4 weeks</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>30 days Mortality</td>
<td>30 days Mortality</td>
<td>1 year mortality</td>
<td>30 days Mortality</td>
</tr>
</tbody>
</table>
4.2. Patient satisfaction (Study II)

Study II investigated the changes in patient satisfaction in selected groups of patients early- and post-implementation of the reorganized ED, including information, waiting times and treatment, based on outcome indicators, cf. Donabedians framework. A questionnaire survey was performed.

4.2.1. Study population

Acutely ill patients admitted to the ED at NFS.

The inclusion criteria were:
- Patients over 18 years of age who were referred for medical attention in the ED.
- Patients with non-life-threatening conditions (triage orange, yellow and green)\(^5\).
- Patients who were considered legally competent and willing to give informed consent.
- Patients who had been admitted to the ED for a minimum of 2 hours.
- Patients who were discharged on weekdays between 10 am – 10 pm

4.2.2. Data source

Before initiation of the questionnaire survey, the problem area was explored and an overview of the patients’ pathways was generated in the department by a qualitative pilot observational study. The observations were used to generate the hypothesis and to suggest supplementary questions to be used in the patient survey. The author observed the treatment in the ED at NFS of 15 patients (5 medical, 5 orthopaedic and 5 surgical patients) from reception to discharge. The study showed that the nursing staff and physicians worked separately to some extent, and they were rarely bedside at the same time. Although some confusion about “who did what” occurred intermittently, we generally observed a strong focus on assessment and treatment, patient flow and handling. The preliminary data from the qualitative pilot study shows, that patients were generally satisfied with the treatment (Table 4).

\(^5\) Triage is the process of determining the priority of patients’ treatments based on the severity of their condition. Triage category: Red (resuscitation, seen within 0 min) (not included in this study), orange (urgent, seen within 15 min), yellow (less urgent, seen within 60 min) and green (not urgent, seen within 180 min).
The effect of establishing a new, reorganized emergency department

Table 4 Observation study autumn 2008 in the ED and medical admission unit at Nykøbing Falster Hospital

<table>
<thead>
<tr>
<th>Themes</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staff and collaboration</strong></td>
<td>Nurses and physicians working separately to some extent</td>
</tr>
<tr>
<td></td>
<td>The physicians works alone (e.g. sterile procedure)</td>
</tr>
<tr>
<td></td>
<td>Physicians and nurses are rarely together in the ED</td>
</tr>
<tr>
<td></td>
<td>Insufficient matching of expectations</td>
</tr>
<tr>
<td></td>
<td>Many students in the area</td>
</tr>
<tr>
<td><strong>Communication and co-ordination</strong></td>
<td>Coordination takes place in the departmental office</td>
</tr>
<tr>
<td></td>
<td>The delivery of the messages is not always clear</td>
</tr>
<tr>
<td></td>
<td>Referral of patients sometimes undone by the physician</td>
</tr>
<tr>
<td></td>
<td>Uncertain continuity of documentation in relation to the patient pathway</td>
</tr>
<tr>
<td><strong>Patient satisfaction</strong></td>
<td>Generally satisfied with their care</td>
</tr>
</tbody>
</table>

Content of the questionnaire

The focus of the questionnaire was on identification of patient satisfaction before or during the initial phase of the reorganization of the ED at NFS and three years after. On admission to the ED, patients were asked questions taken from the questionnaire used in the LUP in 2009 in hospitalized patients (51) as well as questions from a former local study "Quality in patient meeting" (AMA) in 2007.

Patient satisfaction, in this thesis, is described on the basis of the three main themes identified as important according to our observational study and national and international experiences on the field of patient satisfaction (52–58): 1) waiting times 2) information 3) treatment and service. These three themes was found to be relevant to each stage of the patient pathway. Patients admitted for more than 48 hours are, by Danish law, assigned to a specific doctor and nurse in order to optimize the individual patients care (59).

Comparing studies, concerning patient experiences, can be difficult since several studies do not define their populations thoroughly. Inclusion and exclusion criteria vary or are directly unclear in the design of the study. The expectation regarding satisfaction is controversial and needs more investigation, since there is no agreement as to what hospitalized patients generally consider important (60). Measuring patients' attitudes has been shown as a good estimate of their satisfaction (61–63).
Construction of the questionnaire

The questionnaire was developed after determining and prioritizing the themes. It was based on the traditional scientific method in questionnaire construction (64–66) including explicit consideration of the project’s purpose; to generate new knowledge about patients’ experiences in the new ED. It was essential in the design of the questionnaire that questions were chosen specifically in relation to the project, both for the organizational set up and for the selected patient groups. Additionally we aimed at the uncovering of multiple facets and elements of patients' needs and wishes. The three themes are individually more or less complex and each comprises several elements. Thus, the corresponding questions should be both adequate and sufficient to cover the experiences within the process and situations and were also considered relevant and meaningful for patients. The questionnaire consists of 15 questions. For the generalization of the results of the questionnaire, closed questions and the response categories with pre-determined response categories were used when possible. For the majority of the questions an ordinal scale response option was used; three, four or five response categories ranging from very satisfied to not satisfied – in order to uncover a form of relative rank in the patients' answers without assigning a numerical value (67).

Another document recorded was the Danish civil registration numbers (CPR) of the patients, followed by a serial number (same as the number on the questionnaire), which was necessary in order to be able to match data later on, in terms of patient perceived quality and health care quality. The patients’ CPR number and questionnaire were kept separate to comply with law (Appendix 2).

Validation of the questionnaire

The questionnaire was developed and validated through discussions with a project team, staff from the Quality Department and staff from the ED. The questionnaire was assessed by following characteristics; (i) simplicity and viability (ii) reliability and precision in the wording (iii) adequacy for the problem intended to measure (iv) reflect underlying theory or concept to be measured and (v) for the capability of measuring change (63,66,67). We consider, after critical reading of the appropriate literature, that this validation process was comprehensive. The comments were in some ways consistent and at other points more scattered. The outcome of the discussions was a further reduction in the number of questions and reformulation of individual questions and / or response categories. Subsequently, the questionnaire was tested on a group of patients with further clarification and focusing of questions to follow. As we also know that Wording of
questions is very critical and should be taken into consideration; appropriateness of the content, level of sophistication of language, type and form (64,67). Twenty patients answered the questions, and commented on the formulation of questions and response categories. Some response categories were changed, because the pilot participants noted that the response category was unclear.

A pilot study was performed in the new ED (summer 2009) to test feasibility. The nurses asked patients to answer the questionnaire, and here it was up to patients to hand in the form before discharge. We quickly became aware of a too low response rate (60 questionnaire in 8 weeks). Presumably the low response rate was reflecting some important issues; lack of focus by the nursing staff, as several other new developments were taking place at the department at the same time, and some patients simply forgot to deliver the form at discharge, even though an easy access mailbox was available for that purpose. Therefore, the distribution method was changed accordingly as described in the data collection section.

4.2.3. Data collection

All acutely ill patients answered the same questionnaire at discharge. Due to the preparation of the survey, including the pilot study, the present study was not initiated until after the new ED was in its first phase of establishment. The study was conducted in a three-year period from September 2009 to December 2012. Early- and post- intervention survey data were collected during two 12-week periods from September to December 2009 and again in September to December 2012 (Figure 4). All patients who met the inclusion criteria were asked to participate just before they left the department to make sure that they had completed as much as possible of the admission in the ED.

External interviewers were hired in order to increase the response rate. A joined effort between the interviewers and caregivers helped to get as many responders as possible. Seven different nursing students interviewed patients in the period from 10 am to 10 pm on weekdays in the ED, which was the high activity period according to daily patient intake data. Before the study began, the students were trained at an information session and by “one day” practical introduction to the interview method in the ED, first as an observer, since as the interviewer. The students gave patients in-depth information about the study and the patients were asked to provide oral consent. Respondent anonymity was protected throughout the research process.
The use of nursing students were monitored thoroughly by the researcher; partly by observing the students in the ED and partly by telephone guidance in case of problems. Furthermore, the researcher and the two groups of interviewers (year 2009 and year 2012) met in staff-meetings. All surveys were tested concerning interviewer confounders. No significant difference was seen between interviewers.

4.2.4. Dropout analysis

The purpose of this dropout analysis is to examine whether the respondents acts as a representative sample of the patient population. Thus, we examined whether there was a statistically significant difference in some crucial characteristics (gender, age, admission time and diagnosis) between acute patients meeting inclusion criteria and the respondents. Evaluation was done for both pre- and post-intervention. Gender, age and diagnosis from OPUS were used, since these data are available for all patients. The results of the dropout analysis are reported in Table 5. As the table shows, there are some differences between the total group of acute patients meeting inclusion criteria and the respondents in the year 2009 (early-intervention). The admission-time-range of all included patients in 2009 was significantly different from the rest (26 h). Seven outliers in the dataset were identified; however, a recalculation of the mean in the range 0.5 to 99.5 percentile, did not change numbers significantly. Four out of the five most common diagnoses in the study period in 2009 were the same. We saw a greater proportion of patients with mental and behavioral disorders, due to psychoactive substance use, in the inclusion group and a tendency towards more patients with symptoms and signs involving the digestive system and abdomen in the responders group.

4.2.5. Data processing and analysis

The author entered survey data into the program EpiData (version 3.1), which is used to document data structures and analysis of quantitative data. The data entered was done two times per questionnaire and subsequently, the two entries were compared using a validation process in EpiData so that errors in documentation could be corrected (68).

A small ad hoc survey at NFS revealed that 92% of the acute patients were satisfied with the overall treatment of their illness. To gain a power of 85%, detecting a significant difference in overall satisfaction rate from 92% to 97% between early- and post-intervention, 350 questionnaires in each group were required. For comparison between groups (i.e. early- and
post-intervention), Chi-square test was used for dichotomous- and ordinal variables. Additionally chi-square was used to test for association between positive/negative answers and patient characteristics. Student t-test was used for the continuous variables, age and admission time. Two proportion z-tests was used to test for differences in proportions I relation to early- and post-intervention. Statistically significant differences are reported in the results section. Categories with less than five patient responses were removed and the responses were allocated to the closest positive or negative category that remained. Statistical significance was set at p<0.05. Responses of “not applicable” or “not relevant” were regarded as missing data in the analysis, but shown in the tables. The data collected in the study were analyzed using STATA (version 11). Frequency distributions were constructed for the datasets and interpreted using frequencies and percentages.
### Table 5 Dropout analysis

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patients included</td>
<td>Responders</td>
</tr>
<tr>
<td></td>
<td>n=735</td>
<td>n=380</td>
</tr>
<tr>
<td><strong>Mean gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>47.3</td>
<td>48.4</td>
</tr>
<tr>
<td><strong>Mean age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years (SD)</td>
<td>65.5 (17.7)</td>
<td>63.1 (17.5)</td>
</tr>
<tr>
<td><strong>Mean admission time</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours (SD)</td>
<td>26 (22.3)</td>
<td>14 (13.7)</td>
</tr>
<tr>
<td><strong>Diagnose (blocks) (ICD10 codes)</strong></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>(A30-A49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(F10-F19)</td>
<td>38 (5.2)</td>
<td>68 (3.4)</td>
</tr>
<tr>
<td>(G40-G47)</td>
<td>43 (5.9)</td>
<td>15 (3.9)</td>
</tr>
<tr>
<td>(I60-I69)</td>
<td>66 (9.0)</td>
<td>22 (5.7)</td>
</tr>
<tr>
<td>(J09-J18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(R10-R19)</td>
<td>15 (3.9)</td>
<td>147 (7.3)</td>
</tr>
<tr>
<td>(R50-R69)</td>
<td>39 (5.3)</td>
<td>12 (3.1)</td>
</tr>
<tr>
<td>(Z00-Z13)</td>
<td>250 (34.0)</td>
<td>120 (31.9)</td>
</tr>
<tr>
<td>Other</td>
<td>299 (40.7)</td>
<td>196 (51.6)</td>
</tr>
</tbody>
</table>

* t-test, significant differences between patient included and responders

**(hours: 25.09 (18.99), 99.5 percentile)

1 International Statistical Classification of Diseases and Related Health Problems.

2 (DA30-DA49) Other bacterial diseases (Other sepsis, erysipelas, bacterial infection of unspecified site)

(DF10-DF19) Mental and behavioural disorders due to psychoactive substance use (Harmful use)

(DG40-DG47) Episodic and paroxysmal disorders (Epilepsy, migraine and transient cerebral ischaemic attacks and related syndromes)

(DI60-DI69) Cerebrovascular diseases (Intracerebral haemorrhage, Cerebral infarction)

(DI09-DI18) Influenza and pneumonia (Bacterial pneumonia, not elsewhere classified and pneumonia, organism unspecified)

(DR10-DR19) Symptoms and signs involving the digestive system and abdomen (Abdominal and pelvic pain, nausea and vomiting, dysphagia and ascites)

(DR50-DR69) General symptoms and signs (Fever, headache, pain, malaise and fatigue, syncope and collapse, convulsion, enlarged lymph nodes, oedema and symptoms and signs concerning food and fluid intake)

(Z00-Z13) Persons encountering health services for examination and investigation (Medical observation and evaluation for suspected diseases and conditions)
4.3. The correlation between clinical healthcare indicators and patient satisfaction (Study III)

Study III investigated whether a correlation was seen between reported clinical health care and patient satisfaction. Furthermore, we evaluated, whether changes in readmission frequency and all-cause mortality were seen after the reorganization of the ED (Thesis, results Study III).

4.3.1. Study population

The patients who participated in the questionnaire survey (study II) in 2012 were included. Figure 4 shows the flow of patients included in the study. The primary diagnostic blocks were registered for all of the responders. The diagnoses are based on the ICD-10 coding (69).

4.3.2. Data sources

Data from the questionnaire survey (study II) in 2012 was used. Furthermore, clinical healthcare data, from the respondents in the questionnaire survey (study II), were extracted from an electronic patient file system, OPUS (vers. 1.30, CSC).

The evaluation of the process indicators, as well as readmission tendency, was based on patient-file review. In Denmark all deaths are reported to the national central registry within two weeks and mortality data in this study were collected consecutively at 30 day and 1 year after admission. The operational diagnoses were collected from all of the patient records.

Construction of indicators

The definition of the indicators was based on key processes in the acute phase of treatment and to reflect the different interventions that were essential for the reorganization of the ED (2). Their definition were based on guidelines and “The Danish Healthcare Quality Programme” (DDKM7) (70) to measure clinical healthcare quality we focused on nine process indicators and three outcome indicators (Table 6). Obviously, the pain management indicators are only valid for patients admitted with pain. Our definition of a senior physician is a medical doctor with a certified specialist degree or within one year of completion of the specialist training. We used the authorization registry or asked the specific departments in the hospital for verification of seniority.

---

6 The operational diagnosis is the primary diagnosis given by termination of patient contact in the ED (e.g. in case of discharge) that is the most representative of the condition that led to hospitalization.

7 The programme is a result of collaboration between the national government and the Danish regions, hereby covering the public healthcare sector in full.
Table 6 Clinical healthcare quality indicators

<table>
<thead>
<tr>
<th>Indicators</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic emergency patient file utilized (versus used earlier version)</td>
<td></td>
</tr>
<tr>
<td>(DDKM 1.3.2.)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Does the patient record describe consent and information about treatment</td>
<td></td>
</tr>
<tr>
<td>(DDKM 2.1.1)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Triage done at admission (DDKM 2.7.1)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Triage process</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Is vital parameters described at admission (min. BT, P)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Is there any description of pain management in the patient record (only</td>
<td></td>
</tr>
<tr>
<td>patients admitted with pain (DDKM 2.7.5)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Is there any evidence that the patient is seen by a senior physician and</td>
<td></td>
</tr>
<tr>
<td>when?</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Is there a clarification, treatment, - and plan of care within 24 hours</td>
<td></td>
</tr>
<tr>
<td>(DDKM 2.7.1)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Has it been considered to discharge/admit to a specialty department within</td>
<td></td>
</tr>
<tr>
<td>6 hours</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Is there a discharge letter, and when? (DDKM 2.17.2)</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Readmission within 4 weeks after discharge?</td>
<td>(yes=1, no=0)</td>
</tr>
<tr>
<td>Mortality, 30 days and 1 year</td>
<td>(yes=1, no=0)</td>
</tr>
</tbody>
</table>

Patient files often include the initial investigation and treatment plan done by a junior physician followed by a secondary examination by a senior physician with the opportunity to correct or elaborate the initial plan – substantiated by notes from the nurses, lab tests, x-ray investigations etc.

4.3.3. Data processing and analysis

All data from the electronic patient records were entered into EpiData (68). The testing for significant differences was done using the chi² test and two proportion z-tests. Any category with less than five patient responses was moved and allocated to the closest positive or negative category.

We used an index based on nine of the healthcare quality indicators by adding the dichotomised responses. The index then represented a proxy variable for healthcare quality. In principle, healthcare quality is seen as a latent variable, which is measured indirectly by the aggregate of the scores on each of the nine indicators. The data collected in the study were analyzed using STATA (version 11). Frequency distributions were constructed for the datasets and interpreted using frequencies and percentages. We tested the association using Spearman’s rank coefficient, \( p \leq 0.05 \) was considered statistically significant.
4.4. **Ethical considerations**

The study was approved by the Danish Data Protection Agency as well as the ethics committee of Region Zealand. In addition, permission to proceed with the study was obtained from the head of department.

After application to the RKKP, including the databases of the Joint Secretariat, we obtained access to the relevant databases and permission to use data in the study (study I). Patient anonymity was protected throughout the research process.

In Study II, nursing students were hired to read the questionnaire to the patients as well as providing in-depth information concerning the study and about the use of the patient records. The patients were asked to provide oral consent and were first asked to participate in the survey at the time they were about to be discharged from the department. Before entering patient data into the study, the nurses were asked relevant questions concerning patients’ mental status including deteriorating dementia or psychological crisis, which could make the patient unable to answer the questions (judged by the interviewer/nursing staff).
5. Results

5.1. Clinical healthcare quality (Study I, paper I)

We assessed 4584 patient cases from RKKP. In 2008 (pre-intervention) 1914 patient cases were included and in 2012 (post-intervention) 2670 patient cases. The mean age and gender of the participants in the pre- and post-intervention groups did not differ significantly in NFS. Fewer women with hip fractures were admitted in 2012 in HOL. Between hospitals, significant gender differences were seen for COPD in 2012 and hip-fracture both pre- and post-intervention (Table 7). Changes of indicators of each of the six diagnoses from pre- to post intervention are described in the following.

Stroke

The outcome in stroke patients (NFS) did not meet expected standards in 2008, which is why the ED chose to focus on improvement of stroke treatment, by developing a specific patient pathway, as well as increasing competencies among staff. This intervention could be used as a role model for other pathways. In 2012, significant positive changes were seen in all of the additional eight indicators in patients admitted to NFS with a tentative diagnosis of stroke (Table 2, paper I). Despite the general improvement in three indicators at NFS, the ED still has to improve early assessment of the need for occupational therapy, nutrition screening and ultrasound/CT-/MR angiography of the neck vessels.

At HOL, five of eight stroke indicators showed a positive significant change, while early “Assessed by a physiotherapist” was still inadequate (Table 2, paper I).

COPD

COPD indicators were unchanged on comparing the pre- and post-intervention data from NFS and HOL. Although not significant, there was a decreased tendency in readmission of patients with COPD treated at NFS (25% vs. 19%, p=0.21). In the same period an increasing tendency towards readmission was seen in HOL (14% vs. 19%, p=0.29) (Table 3, paper I).
The effect of establishing a new, reorganized emergency department

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Location</th>
<th>Pre-intervention 2008</th>
<th>Post-intervention 2012</th>
<th>p-value (between years at hospital level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>NFS</td>
<td>293 72.46 (12.21)</td>
<td>212 72.63 (12.91)</td>
<td>0.133</td>
</tr>
<tr>
<td></td>
<td>HOL</td>
<td>652 70.76 (13.37)</td>
<td>634 71.21 (12.36)</td>
<td>0.356</td>
</tr>
<tr>
<td>COLD</td>
<td>NFS</td>
<td>69 71.28 (10.90)</td>
<td>530 70.60 (10.67)</td>
<td>0.490</td>
</tr>
<tr>
<td></td>
<td>HOL</td>
<td>121 70.75 (9.79)</td>
<td>437 70.64 (10.67)</td>
<td>0.247</td>
</tr>
<tr>
<td>Heart failure</td>
<td>NFS</td>
<td>136 69.90 (11.03)</td>
<td>204 70.82 (12.17)</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>HOL</td>
<td>109 66.30 (13.55)</td>
<td>n/a n/a</td>
<td></td>
</tr>
<tr>
<td>Bleeding ulcer</td>
<td>NFS</td>
<td>29 71.29 (12.26)</td>
<td>104 72.14 (12.53)</td>
<td>0.237</td>
</tr>
<tr>
<td></td>
<td>HOL</td>
<td>10 78.17 (14.47)</td>
<td>64 73.79 (12.09)</td>
<td>0.061</td>
</tr>
<tr>
<td>Perforated ulcer</td>
<td>NFS</td>
<td>6 65.80 (**)</td>
<td>16 72.50 (14.92)</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>HOL</td>
<td>4 61.53 (**)</td>
<td>8 65.23 (**)</td>
<td>0.203</td>
</tr>
<tr>
<td>Hip fracture</td>
<td>NFS</td>
<td>214 81.47 (10.19)</td>
<td>248 82.14 (8.00)</td>
<td>0.108</td>
</tr>
<tr>
<td></td>
<td>HOL</td>
<td>271 84.29 (8.42)</td>
<td>212 81.73 (8.43)</td>
<td>0.009</td>
</tr>
</tbody>
</table>

NFS: Nykøbing Falster Hospital  HOL: Holbæk Hospital
COPD: Chronic obstructive pulmonary disease
*: z-test p<0.05 Gender differences between NFS and reference hospital (HOL)
**: too small sample. n/a Data from HOL 2012 are missing

Heart Failure

In NFS, two of eight heart failure indicators were significantly improved after the reorganization: “echocardiography” (89% vs. 98%, p < 0.001) and “exercise by physiotherapist” (11% vs. 41%, p < 0.0001), while data demonstrated a significant decrease in two out of eight indicators, “NYHA classification” (96% vs. 91%, p < 0.050) and “initiated a structured training program” (93% vs. 85%, p < 0.050). Comparison to HOL is not possible because of missing data from HOL in 2012 (Table 4, paper I).
Bleeding and perforated Ulcer

In patients admitted with a bleeding ulcer, two of five indicators were significantly improved after the reorganization at NFS: “endoscopy within 24 hours” (60% vs. 84%, p <0.005) and “endoscopy treatment of rebleeding” (40% vs. 100%, p <0.05). In HOL, two of five indicators also improved significantly (both: p <0.050) (Table 5, paper I). No significant improvements were seen in patients admitted with a perforated ulcer at NFS, consistent with results from HOL, although the indicator measuring “daily weight control” improved at HOL (33% vs. 100%, p <0.05).

Generally, the numbers of patients in this section were low (Table 6, paper I).

Hip fracture

Both hospitals showed significant improvements in the two indicators concerning hip fracture with regards to pre- and post-intervention measures (all: p <0.005), except for the decreasing rehabilitation indicator in NFS in the same period (96% vs. 82%, p <0.0001) (Table 7, paper I).

Mortality

Significant reductions in the 30-day mortality in patients admitted with stroke were seen when the pre- and the post-intervention data were compared for both NFS (12% vs. 6%, p <0.05) and HOL (12% vs. 8%, p <0.05). A significant reduction in 1-year mortality was also observed at NFS in patients with heart failure (45% vs. 15%, p <0.0001). Despite the small numbers of patients in the category, mortality due to bleeding ulcers was significant lower at NFS before the reorganization than after, whereas data from HOL showed significantly decreased mortality in the same period (Table 8, paper I).
5.2. Patient satisfaction (Study II, paper II)

A total of 2744 patients meeting the inclusion criteria, and 929 patients participated (Figure 5). The response rate early-intervention represented 52% (n=380) of the acute patients meeting inclusion criteria and post-intervention 29% (n=579).

Characteristics of the responders are presented in Table 9. Some missing values concerning gender and age is due to errors in the appreciation of civil registration numbers and the fact that some patients didn’t have a Danish civil registration numbers. A significant association was seen between the two groups in relation to triage. More patients were triaged in the more urgent group (orange) in 2012 compared to 2009 (p <0.05), with significantly fewer patients in the less severe group (green) in 2012 compared to early-intervention (p <0.05). Fewer patients were admitted in the ED in less than 24 hours in 2012 compared to 2009, as demonstrated by an increase in mean admission time. Finally, more patients in 2012 were referred to another department at NFS, and fewer to another hospital.

Table 8 Main reasons for non-responders

<table>
<thead>
<tr>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient felt too ill to participate</td>
</tr>
<tr>
<td>Patient didn’t want to participate</td>
</tr>
<tr>
<td>Patient considered cognitive impaired by interviewer</td>
</tr>
<tr>
<td>Interviewer was absent</td>
</tr>
<tr>
<td>Patient missed due to other interview</td>
</tr>
<tr>
<td>Discrepancy in the actual time of discharge (&lt; 2 h) and the time registered in the patient file (&gt; 2 h).</td>
</tr>
</tbody>
</table>

Figure 5 shows the population flow in the survey (responders) including the number of subjects entering study II.

*Table 8
The effect of establishing a new, reorganized emergency department

Table 9 Characteristics of the responders

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Early-intervention (n=380)</th>
<th>Post-intervention (n=579)</th>
<th>Diff. between early and post-intervention</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-39 years</td>
<td>45</td>
<td>12.4</td>
<td>51</td>
<td>8.9</td>
</tr>
<tr>
<td>40-59 years</td>
<td>91</td>
<td>25.0</td>
<td>152</td>
<td>26.5</td>
</tr>
<tr>
<td>60-79 years</td>
<td>157</td>
<td>43.1</td>
<td>257</td>
<td>27.4</td>
</tr>
<tr>
<td>≥80 years</td>
<td>71</td>
<td>19.5</td>
<td>113</td>
<td>12.4</td>
</tr>
<tr>
<td>missing</td>
<td>16</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>63</td>
<td>64</td>
<td>1.0 year</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>184</td>
<td>50.5</td>
<td>283</td>
<td>49.6</td>
</tr>
<tr>
<td>Male</td>
<td>180</td>
<td>49.5</td>
<td>288</td>
<td>50.4</td>
</tr>
<tr>
<td>missing</td>
<td>16</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triage code*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td>54</td>
<td>23.2</td>
<td>195</td>
<td>37.6</td>
</tr>
<tr>
<td>Yellow</td>
<td>109</td>
<td>46.8</td>
<td>234</td>
<td>45.2</td>
</tr>
<tr>
<td>Green</td>
<td>70</td>
<td>30.0</td>
<td>89</td>
<td>17.2</td>
</tr>
<tr>
<td>missing</td>
<td>147</td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admission time*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 8 hours</td>
<td>155</td>
<td>42.2</td>
<td>199</td>
<td>35.5</td>
</tr>
<tr>
<td>Between 8-24 hours</td>
<td>157</td>
<td>42.8</td>
<td>187</td>
<td>33.3</td>
</tr>
<tr>
<td>&gt;24 hours</td>
<td>55</td>
<td>15.0</td>
<td>175</td>
<td>31.2</td>
</tr>
<tr>
<td>missing</td>
<td>13</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean admission time* (SD)</td>
<td>14 (13.7)</td>
<td>16 (13)</td>
<td>2.0 hours</td>
<td></td>
</tr>
<tr>
<td>Discharged to?*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>187</td>
<td>51.1</td>
<td>255</td>
<td>46.6</td>
</tr>
<tr>
<td>Different department</td>
<td>140</td>
<td>38.3</td>
<td>273</td>
<td>49.9</td>
</tr>
<tr>
<td>Different hospital</td>
<td>29</td>
<td>7.9</td>
<td>15</td>
<td>2.7</td>
</tr>
<tr>
<td>Another</td>
<td>10</td>
<td>2.7</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>missing</td>
<td>14</td>
<td>32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05 significant differences between early and post-intervention (chi-square test)

** p<0.05 significant differences between the mean proportion (Two-sample t test)
The overall satisfaction was generally high before and after establishment of the ED (Figure 6). The figure shows the proportion of positive answers (yes, I have experienced that) between 2009 and 2012. A special effort in the ED was done to reduce waiting time and only 14% of the patients experienced a prolonged waiting time at the reception desk at the post-reorganization measurement, compared to 40% of the patients before the reorganization (p <0.005) (Table 5, paper II). Further analyses showed that the perception of waiting times was negatively correlated with the triage category; more patients in the “less urgent” category (yellow) experienced waiting time at the reception desk compared to the other two categories (orange and green). Furthermore, the perception of waiting times was negatively correlated with the length of time they had to wait before being admitted. In relation to the experience of unnecessary waiting time for treatment and examinations, this appears to have been increased (2009: 22%; 2012: 26%, p =0.160) (Table 5, paper II).

Most of the patients seen in the ED stayed for a relative short period of time, which made it difficult to provide general information and to involve them in their treatment. However, the results showed that a high percentage of the patients reported that they have received the necessary information (p <0.005) and felt sufficiently involved in their treatment (Table 6, paper II).

An important aspect of the development of the ED is to enhance competencies and teamwork especially in the reception of a patient. Patients expressed a continuously high degree of satisfaction with the staff; this was unchanged. There was a significant increase in patients’ perception of the level of collaboration between staff members after the establishment of the new ED (p <0.050). Respondents admitted for more than 24 hours perceived a lower level of collaboration between staff than those admitted for shorter periods. After the intervention, significantly more patients experienced more than one personal contact associated with their treatment and care, and more patients’ experienced having a contact person (Table 7, paper II).
An important intervention in developing the ED is an increased focus on patient safety, which includes making the patients feel safe. One perspective is the patients’ perception of feeling comfortable upon being discharged from the new ED. As mentioned above, about half of the patients were discharged to their home in both study periods. Overall, these patients felt comfortable going home (Table 5, paper II). Significantly, more respondents admitted for more than 24 hours felt less comfortable going home, and this was negatively correlated with the length of their admission. Very few patients experienced mistakes with their medication or treatment (Table 7, paper II).
5.3. The correlation between clinical healthcare and patient satisfaction in a newly established emergency department (Study III, paper III)

A quasi-experimental study was performed in the group of patients admitted acutely to NFS. Data showed a significant improvement in almost all of the studied process indicators that dealt with treatment and care in the first 24 hours and in the indicator “consideration about discharge/admission within 6 hours”.

Important outcome measures are readmission frequency and all cause mortality after the reorganization of the ED. As seen in Table 10, no significant changes were found in relation to readmission, 30-day mortality or 1-year mortality. Only data from post-intervention study were used in the following analysis and paper III.

The 579 patients who were interviewed in the study represented 29% of patients meeting inclusion criteria in the period (Figure 5).9

The characteristic of the participants at NFS are shown in table 3 in paper III. The five most frequent diagnoses are presented, and represent 37% of respondents. In total, the respondents present 156 different diagnostic codes (DXxx), and 72 diagnostic blocks (DXxx-DXxx) (69).

These data are comparable to all acutely ill patients admitted in the ED during the investigation period because four of the five most frequent diagnostic groups are the same. Data suggest that we interviewed slightly more patients admitted with syncope and collapse and a little less with mental and behavioral disorders due to the use of alcohol.

Patient satisfaction concerning treatment and care were generally high (Table 1a, paper III). The lowest percentage of satisfaction was seen in the question related to “Informed about the length of waiting time at the reception desk”, only 6.9 % experience that the staff informed them about waiting time at reception, although relatively few patients answered this question (63%).

The highest percentage of satisfaction was seen in relation to perceived errors with treatment and examination and administrative errors. Through reorganization of the ED, a focus was concentrated on good documentation using an electronic system, early planning and prioritizing of patients by a senior physician as well as involvement of the patients in their

---

The effect of establishing a new, reorganized emergency department

Table 10 Department-specific healthcare quality indicators early-and post-intervention

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Early-intervention 2009</th>
<th>Post-intervention 2012</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=380)</td>
<td>(n=579)</td>
<td></td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT support</td>
<td>Standardised electronic medical emergency records</td>
<td>4.5 (16)</td>
<td>52.8 (558)</td>
</tr>
<tr>
<td>Information and consent (written in the patient file)</td>
<td>Evidence of given information to the prepared treatment</td>
<td>63.0 (225)</td>
<td>76.0 (424)</td>
</tr>
<tr>
<td></td>
<td>Evidence of given consent to the prepared treatment plan</td>
<td>61.9 (221)</td>
<td>76.9 (429)</td>
</tr>
<tr>
<td>Triage</td>
<td>Evidence for performed triage</td>
<td>78.9 (269)</td>
<td>94.6 (525)</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>23.2 (54)</td>
<td>37.6 (195)</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>46.8 (109)</td>
<td>45.2 (234)</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>30.0 (70)</td>
<td>17.2 (89)</td>
</tr>
<tr>
<td>Vital parameters / Pain management</td>
<td>Performed measurement of vital parameters within one day (min, BT, P)</td>
<td>97.0 (326)</td>
<td>91.4 (507)</td>
</tr>
<tr>
<td></td>
<td>Evidence for pain management (only relevant for patient admitted with pain)</td>
<td>16.5 (56)</td>
<td>23.7 (127)</td>
</tr>
<tr>
<td>Specialist treatment</td>
<td>Specialist treatment (senior physician)</td>
<td>89.9 (322)</td>
<td>93.7 (523)</td>
</tr>
<tr>
<td></td>
<td>Number of hours? (Mean(SD))</td>
<td>13.9 (8,7)</td>
<td>11.6 (9,5)</td>
</tr>
<tr>
<td>Treatment-plan</td>
<td>Treatment and care plan within 24 hours</td>
<td>99.4 (355)</td>
<td>99.5 (557)</td>
</tr>
<tr>
<td></td>
<td>Number of hours? (Mean(SD))</td>
<td>2.7 (2,4)</td>
<td>3.4 (3,6)</td>
</tr>
<tr>
<td>Discharge-plan</td>
<td>Considered discharge/referral within 6 hours.</td>
<td>91.3 (326)</td>
<td>87.8 (490)</td>
</tr>
<tr>
<td></td>
<td>Number of hours? (Mean(SD))</td>
<td>3.0 (2,9)</td>
<td>3.7 (3,8)</td>
</tr>
<tr>
<td>Discharge -summary</td>
<td>Discharge letter</td>
<td>81.3 (291)</td>
<td>84.7 (472)</td>
</tr>
<tr>
<td></td>
<td>Number of days after discharge? (Mean (range))</td>
<td>3.9 (0-73)</td>
<td>1 (0-90)</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readmission</td>
<td>Readmission within 4 weeks after discharge from the ED</td>
<td>14.2 (50)</td>
<td>13.9 (77)</td>
</tr>
<tr>
<td>Mortality</td>
<td>30-day mortality</td>
<td>3.1 (11)</td>
<td>2.3 (13)</td>
</tr>
<tr>
<td>Mortality</td>
<td>1-year mortality</td>
<td>15.9 (57)</td>
<td>16.6 (81)</td>
</tr>
</tbody>
</table>

p<0.05 considered statistical significant (chi-square test)

care. Data demonstrated a high degree of implementation of these interventions except for pain management (23.7%) and documentation in a specific electronic template (Table 1b, paper III).

To correlate patient satisfaction and health care quality an index was constructed. The results of the rank correlation analysis between an overall health care quality index and patient satisfaction are shown in table 4, paper III. The strengths of the association are weak, with the
highest being 0.08 (“confident with physician treatment”), and none of the correlations were statistically significant (Table 4, paper III).

The more satisfied with “involvement in decisions about treatment and care” the less chance of readmission ($p < 0.05$). In contrast, the more likely the patients felt they had a special “staff contracts” ($p < 0.05$), the more chance of readmission, although the strength of association was low (0.09). (Table 5, paper III).

The correlation between patient satisfaction and mortality was studied (Table 6 & Table 7, paper III). Among patients who were most satisfied a significant association between “confident with doctor treatment” and low mortality after both 30 days ($p < 0.001$) and 1 year ($p < 0.05$) was seen. Likewise a significant negative association between “confident with nursing care” and both 30 days ($p < 0.001$) and 1 year mortality ($p < 0.001$) was seen. Again, the strength of association was very weak. The result of the rank correlation analysis between patient satisfaction and mortality also showed a negative significant association between “involvement in decision about treatment and care” and 1 year mortality, although the strength is very weak (0.10).

We did not see any association between the overall measured health care quality index and readmission or mortality (Table 8, paper III).
6. Discussion

6.1. General discussion

6.1.1. Structure

This thesis aims to address and evaluate the changes in a completely reorganized ED from a clinical healthcare quality point of view and from the perspective of patients. Our population was patients admitted in the new ED. We used five specific acute conditions as cases and demonstrated improved healthcare quality and reduced mortality of patients with stroke, heart failure, bleeding ulcer and hip fracture. Furthermore, in a different cohort of acutely ill patients admitted to the ED, we found that these patients in general were very satisfied, especially with respect to waiting time at the reception desk and the patient’s perception of the level of collaboration between members of staff.

The choice of study setting was primarily based on Region Zealand’s decision to invest in and reorganize the infrastructure determining the handling of acute patients. Acknowledging the fact that NFS is the only acute hospital in the local region, we expected that almost all patients would be seen in the ED and would not be pre-hospital-referred to a more specialized hospital. Thus, the patient intake in the ED should reflect the need for acute treatment in the population and the ED would have to be able to handle many different kinds of illnesses in the same setting. If the same study was initiated in an acute hospital in a big city, patients would most likely be referred to different hospitals depending on their illness as well as the pre-hospital evaluation done by paramedics and emergency physicians in the ambulance. The development of the new ED in NFS was largely done as an explorative process with several initiatives to qualify acute patient care based on a package of recommendations from the Danish Health and Medicines Authority. Due to the explorative nature of the study, identification of the time of implementation of the specific interventions have been difficult. We observed that the quality of healthcare in the acutely ill population was significantly improved during the study period - along with the development and implantation of the new ED. The improvement seen could be due to the reorganization itself or just reflect a general nationwide tendency (43,71). In 2009, it was difficult to identify another ED, since the Danish EDs had very different configurations and different implementation plans in terms of the reorganization. In addition, due to DDKM, it would not be possible to find a hospital who did not work with improvements of quality. Thus, the general improvement of quality of
The effect of establishing a new, reorganized emergency department

care and patient satisfaction in the national hospital sector is a major confounder. Furthermore, the statistical association regarding improved outcome before and after intervention does not imply causality, making it difficult to conclude whether improvements happened only because of the reorganized ED or in addition to other external factors.

6.1.2. Process

Obviously healthcare quality is important but is very difficult to measure reliably. The choice of method could be addressed in several ways. We demonstrated healthcare quality with the use of the concept suggested by Dr. Donabedian; measuring quality with both process and outcome measures.

To our knowledge, this is the first study to investigate the quality of acute care over a long period of time in a representative group of acute conditions before and after reorganization of an ED. Earlier studies in Denmark have focused on groups of specific diagnoses (72). The studies are however, not consistent and often done in various ways (73). In the absence of a standard definition of quality, measuring clinical healthcare quality in an ED is complex and difficult, and the choice of indicators as well as which specific indicators are the most representative of a specific clinical setting is controversial (73,74). The use of process and outcome indicators from the chosen national databases (RKKP) elicits some issues concerning the generalizability, as only 10% of acute admission diagnoses are represented; however, the five diagnoses represents patients from the three predominant specialties: general surgery, internal medicine and orthopedic surgery. Several improvements in the indicators were observed, including the ones tackling stroke. The nationally defined protocol for the handling of patients with stroke has been used in the acute medical ward at NFS since 2007, but was chosen as a specific role model when the ED was established. The aim was to implement standardized routines, improve processes and subsequently increase competencies among staff in other care areas as well (75). In addition, it has created faster options for special x-ray diagnostics, enhancing the process indicators reflecting this issue. These data are consistent with the trends in the national mean regarding the same indicators (43).

Overall, our data shows a significant positive change in the quality of clinical healthcare at the ED. We argue that it could reflect improvement in patient safety issues and flow indicators in five common diseases seen in the ED. Internationally, other studies have demonstrated that
The effect of establishing a new, reorganized emergency department

reorganization, in relation to the establishment of EDs, optimizes patient safety as well as the flow of patients into and out of the ED (3,10,13,21,76).

6.1.3. Outcome

Clinical healthcare quality

Several studies have shown that EDs with observation units and senior physicians up front, might improve decision-making and workflow, making more efficiently use of hospital space. Patients are discharged earlier using fewer bed days, and readmission rates are less than or equal to the first-time admission rates (14,15,43,77), indicating that the earlier discharge does not disadvantage some patient conditions. Our results indicate a general decreased mortality in five of the disease groups at NFS; however, they include a COPD group with unchanged or higher mortality after reorganization, even though readmission rates showed a consistent decrease during the same period. An explanation can be found in the pre-reorganizational handling of patients with COPD, as some patients were admitted directly to the intensive care unit or to the pulmonary department and were not accounted for in the analyses. Secondly, in the post-reorganization setup, all patients, including those with respiratory failure, are seen in the ED, and this is a possible explanation of an increased mortality among this group of patients with delay to NIP-treatment.

Mortality decreased significantly in patients admitted with stroke at both hospitals, and patients admitted with heart failure at NFS. The mortality data are credible because they were crosschecked with mortality data from The Danish National Patient Registry (LPR). Our results supports international literature indicating that these improvements may originate from the implementation of the new concept for diagnosing and treating acute patients (6,12,78). A consensus of indicators seems generally to be missing in the literature.

Patient experienced quality

Patient satisfaction is another important perspective. Studies have shown that one of the interventions – triage - is strongly correlated with patient satisfaction; higher triage-scores warrants faster medical attention resulting in a higher patient satisfaction level (55,57). Through triage score we excluded the most severely ill patients for ethical reasons, knowing that these patient’s expectations of the non-clinical component of their care are lower and decreases with increasing severity of their disease (79).
A previous study indicates that longer patient stays are associated with a decrease in satisfaction (57). This is consistent with our finding, that among patients admitted for more than 24 hours, we found significantly more respondents who felt less comfortable going home after discharge. Our results also show that the respondents in the post-intervention survey were interviewed a few hours later than the patients in the pre-intervention study, which introduced a potential for bias.

In the new ED all patients were seen by nurses as well as doctors and the results show the patients perceived an increased collaboration among the staff. Earlier studies suggest a variation in patients' satisfaction based on their impression of the staff and whether the patients are treated by a nurse or a doctor (80,81).

Recently published results from the Danish National Survey of Patient Experiences (LUP) as well as the international literature that describes patient satisfaction when admitted to an ED suggest that the following issues correlate with patient satisfaction: empathy and attitude of staff members, an acceptable waiting time, technical competence, pain management and the availability of information (5,52,54,55,58,82–86).

Other studies have shown that staff professionalism, work experience, environment and patients' personal income are also correlated with patient satisfaction (5,80,82,85,87).

Equal to the Danish National Survey of Patient Experiences (LUP) the lowest satisfaction in our study were; the staff-handling of adverse events, delivery of written information, information about the impact of lifestyle on health and information regarding a personal contact nurse. Those who experienced these irregularities also had a more negative overall assessment in all survey questions (88). In a study from Sweden, where reorganized EDs have been established for several years, patients admitted as emergencies assigned lower scores for the quality of information and doctors' care compared to patients with planned admissions (89). These results provide important information for improving services in the EDs, where patients are admitted acutely, for a short period of time and often in a critical state. Our study identified general and specific outcome issues to monitor and improve - in order to enhance patients' satisfaction after the development and reorganization of the ED.
**Correlation between clinical healthcare quality and patient satisfaction**

Finally in this study, we have studied the association between a constructed department specific healthcare quality index and patient satisfaction. Earlier studies have shown that there is not necessarily a correlation. Whether it depends on the patients’ expectations or methodological challenges is questionable. We could not find an association, which may relate direct to the actual measurement method in terms of health care quality and patient satisfaction. In fact the majority of patients were very positive, which could have weakened the analysis due to lack of negative responses. The health care quality index is based on several separate indicators and all of them influence the index equally. Some would argue that some of the indicators are more important than others, advocating for an index with a more graded use of each indicator. This is, however, very complex and would require extensive elaboration of each separate indicator, making it much more time consuming to apply the index as a measurement tool.

Our finding that; “involvement in decision about treatment and care” and “whether the patients felt that some staff had specific responsibility for their treatment and care”, shows an association to “readmission”. This is consistent with previous studies, showing that overall patient satisfaction and patient satisfaction, in the context of discharge planning, were associated with lower 30-days risk-standardized hospital readmission rates including adjustments for clinical quality (90,91). Patient satisfaction is in literature shown to be positively related to the patients’ interaction with hospital personnel, especially nurses and doctors (81). These results suggests that low overall patient satisfaction is associated to a low grade of patient interaction with hospital personnel, which subsequently could be a predictor for increasing risk of readmission.

We demonstrated an association between increased “confidence with physician treatment and nursing care” and decreased 30-days as well as 1 year mortality. As we had no initial hypothesis about the association, the results can only be considered exploratory. One could infer that the positive association between patient satisfaction and outcome can be explained by healthier patients being more likely to report being satisfied; however, studies support our result that worse triage category, indicating a more sick patient, is strongly correlated with an increased patient satisfaction.
6.2. Discussion of strengths and limitations

The design is a quasi-experimental study with a demographical matched pre-intervention group; however, as the pre-intervention group is serving as a control “group”, which is not specifically defined, problems regarding internal and external validity are discussed in details below.

6.2.1. Internal validity

Risk of selection bias

The unification of the national clinical databases under the administration of the RKKP was created for the evaluation of acute diseases with high rates of morbidity and mortality. The stringent unified data management results in a low inter-hospital or inter-departmental variation and the implicated indicators are all highly reproducible. The indicators were chosen to meet the demands of consistency across the country in different years and were selected to benchmark health care quality in all the Regions of Denmark (71). The majority of the indicators are process indicators, thought to reflect a broader quality of processes in the ED. These indicators convey information on important practices in the assessment of acute patients and the endpoints of their hospitalization.

Data from the five specific diseases were chosen to act as surrogate markers of healthcare quality in the new ED because the validity for the specific indicators had already been tested by the RKKP (71). It could be argued that using these indicators as a surrogate marker of clinical quality is inadequate because of the simplicity of the indicators; however, the indicators are the measuring tool of national choice, making them necessary to relate to. Additionally, the simplicity entails easy handling and reporting of the indicators in a clinical setting. All the Danish EDs have the opportunity to monitor department-specific datasets, reported to the national database (71), creating data transparency and providing the opportunity to test internal and external validity.

As great differences in accessibilities to different paraclinical tests exist between hospitals, as well as availability of various medical specialists, it is important to compare similar hospitals. Great concerns have been raised from the peripheral hospitals that the national indicators reflects a standard care in a university-hospital-setting, but does not consider the conditions in a peripheral hospital. That issue raises the question of whether it is fair to compare the reorganized ED in NFS to the national mean.
Patients were referred to the ED by different health services, triaged into different categories, arrived at different times, and presented with different care needs. These issues might influence patient satisfaction, resulting in large standard deviations that would be challenging in a data analysis (55,57,79,89). More patients in the post-intervention group were hospitalized for more than 24 hours, which should be seen in the context of an increased number of observation beds. We found no association between patient satisfaction and age or gender, which is comparable to a prior study (82). The composition of the patient groups in the two study periods is crucial in terms of the resulting answers. A difference in patient composition pre- and post-organizational was also seen in the triage distribution, with a tendency towards increasing morbidity in the patients after reorganization.

Our survey study was performed in a department with acutely ill patients, which might explain the relatively low response rate. Either the patients were too ill to participate or because the interviewers overlooked the presence of the patients in a hectic department - although the interviewers always sought to include all patients fulfilling the inclusion criteria.

Part of the data used in study II is also applied in study III, resulting in some of the same issues concerning reliability and validity. The collection of data from patient records, however, elicits some considerations regarding reliability. We rely on data in the patient record, which could introduce possible biases in terms of whether the data as well as the timeline in the record is correct (92). General experience is that timelines are often difficult to define based on patient-records because a lack exists between a doctor seeing the patient and the time of documentation in the record.

The quality index was based on the major changes constituting the intervention and, as previously mentioned, seven of the indicators were validated by DDKM. In literature, mortality and readmission tendencies are often included as endpoints in health care quality measurement. We use the same measurements, but adds additional strength to the measurement of quality by using a broader approach with several types of healthcare quality indicators. This approach is useful when complex quality evaluations are needed – as in the evaluation of a new reorganized ED.
**Observation/information bias**

The questions used in this study were not primarily developed for acute patients, but were the best validated tools available at the time the study was designed. The relevance of the questions to our study population was later supported by the national questionnaire (LUP), in which the same questions were included for evaluating patient satisfaction in the new EDs in Denmark (93).

Recall bias is of no relevance for Study I, because data was based on register data. However, Study II and III relies on self-reported responses to questions. Recall bias was limited since we interviewed the patients in the department instead of sending the questionnaire to their homes after discharge. However, the use of an interview-based survey might have influenced the patients towards a more positive thinking - subsequently influencing their response in a positive way. To limit this potential bias, our interviewers were hired externally and were instructed to inform the patients of their anonymity with respect to the staff providing the healthcare. Since there were three years between the pre- and post-organization studies, it was necessary to hire two different groups of students, which could result in a potential conflict in terms of observational reliability. All though a comprehensive collection of data was performed, a risk of information bias, cannot be excluded resulting in a possible problematic observer reliability (81,82). The patient file search was only done by the same person, creating possible observer-related biases. The search could have been done by two individuals with cross-references or alternatively as a random testing, which could have increased validity.

**6.2.2. External validity**

Even though the indicators in study I are broadly founded, they only represent five disease groups. These five groups are represented in all hospitals in Denmark, making inter-hospital comparisons possible.

The possible variables across the survey in study II were not equivalent as the categories varied between 3-5, making it very difficult to compare and describe them in tables. If a comparison across the survey had been possible, an index of patient satisfaction could have been constructed. Our study only focused on short-term readmission rates and provided little information about long-term outcome.
7. Conclusions

This thesis demonstrates that during the period of the establishment of an ED, it was possible to improve the health care quality in selected services that reflects early diagnosis and treatment. It is questionable whether the improvements observed were due to the reorganization of the ED alone or as a result of an increased quality culture among staff. We interviewed acutely ill patients in the ED, based on surveys, which provides important information about the future handling of patients in a new ED. The experienced waiting times at reception have been reduced and patients’ perceive an increased collaboration between staff. No association was seen comparing the health care quality index and patient satisfaction, however we have suggested some associations between patient satisfaction and readmission and mortality. Important outcome measures are readmission frequency and all-cause mortality.

We find it important to continue investigating whether this huge national reorganization of acute treatment continues to improve services, treatments and patients satisfaction over time.
8. Future research

Establishment of reorganized EDs is a new field for research in Denmark (paper IV).

This thesis highlights the fact that indications of improvement in health care quality and patient satisfaction is seen after reorganization of an ED in NFS. However, this is a single centre study, and a multicentre study is needed to confirm data.

We have addressed issues and questions that we have learned patients are concerned about in relation to the admission in an ED. In the post interventional setting, clarification of the parameters that did not improve after the reorganization could be done with a semi-structured interview in order to address some of the more subjective issues. A later similar study could potentially benefit with the incorporation of methods from social sciences, all though they should not act alone.

The studies in this thesis have focused on services in relation to health care quality and patient satisfaction. There seems to be a general belief in different administrative and political levels, that health care quality is measurable by looking at patient flows and different timetables, including waiting time, in-hospital time and time of discharge. To add further evidence and knowledge to the field, we suggest an increased focus on measurement of the healthcare quality in a health professional’s point of view and the association with the patient-perceived quality, as these factors cannot alone be extracted from timetables.
9. English summary

During the past few years, emergency services in Denmark have been reorganized following recommendations by the Danish Health and Medicines Authority. The goal is to improve the quality of the acute care of all patients, by organizing a single entrance to the emergency department with primary assessment and treatment in focus. This approach is thought to strengthen the initial diagnostic workup as well as ensuring a treatment plan for the patient before any transfer to the relevant specialist department. The quality of this service is enhanced by the presence of senior physicians at first patient contact contributing to a more precise and comprehensive referral and triage of patients and optimizing patient flow. Additionally, an early access to diagnostic capabilities and electronic patient safety solutions, e.g. electronic information display boards and electronic medical records, as well as increased competences of doctors and nurses, adds efficiency and safety to each patients need for acute care.

The overall aim of the thesis was to investigate the quality of healthcare and patient-perceived quality before and after the reorganization of an ED into a new emergency department with observation beds, and to determine whether a consistency was seen between the treatment given and the patients’ experience of the treatment. Study I describes the quality of care before and after the establishment of a new emergency department at Nykøbing Falster Hospital by measuring five common disease groups based on data from the National Indicators Project. The study showed an overall improvement of 48% (15/31) in the indicators. The greatest improvement was seen in stroke patients, which had been a special focus in the emergency department investigated. In Study II patient satisfaction in the emergency department was assessed by a questionnaire before and after the establishment of the new emergency department. In particular, there was a positive difference in the perceived waiting time and degree of staff collaboration in the new department. The shorter waiting on arrival was, however, matched by what the patients experienced as an excessive delay with regard to treatment and investigation. Study III examined the association between an index of health care indicators and the patient satisfaction that was examined in Study II. This showed no correlation, but there was a correlation between patient satisfaction and readmissions and mortality. In summary, we saw an overall improvement in healthcare quality and patient satisfaction after the establishment of the new emergency department at Nykøbing Falster Hospital. During the same period, a general improvement in the quality of emergency healthcare in Denmark is
seen. The quasi-experimental design of this study makes it difficult to conclude whether the observed improvement is directly related to the establishment of the new emergency department; however, significant results seems to be associated to the specific initiatives in the reorganization. The development of consensus indicators for monitoring acute treatment in Denmark is recommended to facilitate new studies in the future.
10. Dansk Resumé


akutafdelingen. Dog synes flere af de signifikante resultater at være tæt associeret til konkrete indsatser. En generel konsensus om udvikling og brug af fælles indikatorer til monitorering af den akutte behandling i Danmark vil være at anbefale i forhold til fremtidige studier.
11. References


8. Mayor S. Acute medical units reduce deaths and stay in hospital, studies show. BMJ. 2008;337.


The effect of establishing a new, reorganized emergency department


43. Central Denmark Region. Regional clinical quality development programme [Internet]. Region Midtjylland; [cited 2015 Jun 26]. Available from: http://www.rkkp.dk/om+rkkp/de+kliniske+kvalitetsdatabaser

63
44. Regional clinical quality development programme. COPD [Internet]. Region Midtjylland; 2012 [cited 2015 Jun 26]. Available from: http://www.kcksvest.dk/kliniske+kvalitetsdatabaser/kol?


70. The Danish Healthcare Quality programme. DDKM [Internet]. [cited 2015 Jun 25]. Available from: www.ikas.dk


The effect of establishing a new, reorganized emergency department

75. Allen D, Rixson L. “care pathway technologies” on service integration in stroke care been measured and what is the strength of the evidence to support their effectiveness in this respect? Int J Evid Based Heal. 2008;6:78–110.


The effect of establishing a new, reorganized emergency department


12. Appendix and papers

Appendix 1

[Diagram of Pre-reorganisation 2009 and Post-reorganisation 2012 processes]
Appendix 2 Questionnaire

Spørgeskemaundersøgelse (ptop1)

Dato: ___________ Löbenummer: ___________

1. Hvordan udskrives/overflyttes du til?
   Hjem   Anden afdeling   Andet sygehus   Andet
   [ ] [ ] [ ] [ ]

2. Hvordan vurderer du personaets imødekommende, da du blev modtaget på akutafdelingen?
   Meget tilfreds   Tilfreds   Mindre tilfreds   Ikke tilfreds
   [ ] [ ] [ ] [ ]

3. Oplevede du, at der opstod ventetid ved din modtagelse på sygehuset?
   Ja, i høj grad   Ja, i nogen grad   Nej, kun i mindre grad   Nej, set ikke   Det kan jeg ikke vurdere
   [ ] [ ] [ ] [ ] [ ]

4. Blev du informeret om længden af ventetiden, da du blev modtaget på sygehuset?
   Ja, i høj grad   Ja, i nogen grad   Nej, kun i mindre grad   Nej, set ikke   Det kan jeg ikke vurdere
   [ ] [ ] [ ] [ ] [ ]

5. Oplevede du, at der opstod umiddelbar ventetid på undersøgelser eller behandlinger, der forlængede dit ophold på sygehuset?
   Ja, i høj grad   Ja, i nogen grad   Nej, kun i mindre grad   Nej, set ikke   Det kan jeg ikke vurdere
   [ ] [ ] [ ] [ ] [ ]

6. Oplevede du, at én eller flere kontaktpersoner på afdelingen/i modtagelsen havde særligt ansvar for dit forløb? (En kontaktperson er en sundhedsperson, der skal informere dig og sikre sammenhæng i dit forløb)
   Ja, én kontaktperson   Ja, flere kontaktpersoner   Nej
   [ ] [ ] [ ]

7. I hvilket omfang blev du involveret i de beslutninger, der skulle træffes om din behandling og pleje?
   For meget   Pasende   For lidt
   [ ] [ ] [ ]

8. Oplevede du at plejepersonalet og fælgerne samarbejdede om din pleje og behandling?
   Ja, i høj grad   Ja, i nogen grad   Nej, kun i mindre grad   Nej, set ikke
   [ ] [ ] [ ] [ ]

9. Fik du de informationer, du havde brug for under din indlæggelse (Om sygdommen, undersøgelser, behandlinger, bivirkninger, m.v.)
   Ja   Både og,   Nej   Ikke relevant
   [ ] [ ] [ ] [ ]

69
10. Var der sammenhæng i det, du fik at vide, når du talte med forskellige ansatte på Akutafdelingen?  
Ja  Både og  Nej  Ikke relevant

11. Oplevede du, at der skete fejl i forbindelse med dit indlæggelsesforløb?  
(Sæt venligst et kryds i hvert række)  
ja  nej  Jeg fik ikke udleveret medicin

a) Udleveret forkert medicin?  

b) Skade opstået under undersøgelse/operation/behandling?  


c) Administrativ fejl (bortkommet journal/fejlergistering m.v.)?  


d) Andet

12. Er du tryg eller utryg ved at skulle hjem fra sygehuset eller overtjættles til anden afd.?  
Meget tryg  Tryg  Utryg  Meget utryg

13. Har du tillid til, at du har fået den rette lægelige behandling, mens du var indlagt?  
Ja, i høj grad  Ja, i nogen grad  Nej, kun i mindre grad  Nej, slet ikke  Jeg meldte ikke leger

14. Har du tillid til, at du har fået den rette sygeplejeskiflige behandling og pleje, mens du var indlagt?  
Ja, i høj grad  Ja, i nogen grad  Nej, kun i mindre grad  Nej, slet ikke  Jeg meldte ikke sygeplejeriker

15. Har du været tilfreds med akutafdelings behandling af din sygdom?  
Ja, i høj grad  Ja, i nogen grad  Nej, kun i mindre grad  Nej, slet ikke  Ikke relevant

Til Projektmedarbejder:

1) Noter cpr. i logbog, efterfulgt af løbenummer.

2) Hvor udfylder du skemaet?  
AMA  Modtagelse  Skadestuem

3) Tid på døgnet  
<16  >16  Hvor mange timer har pt. været indlagt?

4) Hvilken ugedag udfyldes skemaet?  
Mandag  Tirsdag  Onsdag  Torsdag  Fredag  Lørdag  Søndag

5) Hvem gav svarene?  
Patienten  Pærnørdede