A 30-year journey in hip fracture care. An evaluation of how care process development affect lead-times and outcome.

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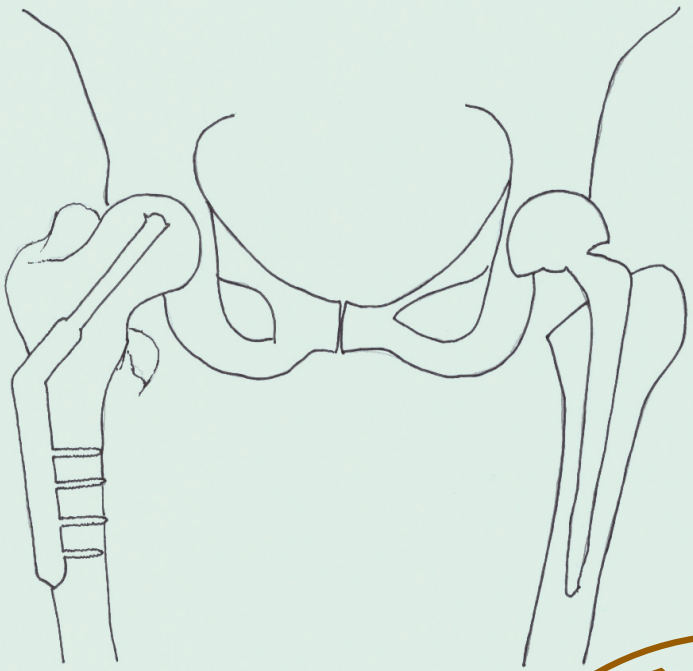

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An evaluation of how care process development affect lead-times and outcome

Data from the Swedish National Quality Register RIKSHÖFT

Emma Turesson

LUND
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Abstract

Hip fracture is one of the most common fracture types among the older population. The mortality rate in the patient group is high and the patients most often do not regain their previous functional level. Several factors are described to affect outcome, such as co-morbidity, pre-fracture function and care setting.

Health care development is a necessity for our older patients, as for the health care system itself and the general economics in society. As a consequence, the care process and management of hip fractures have changed over the years.

The overall aim of this thesis is to describe and analyse the management development over 30 years and put it in relation to patient outcome.

All papers in this thesis are based on retrospective review of data from the Swedish National Quality Registry of hip fracture patient care, RIKSHÖFT. Pathological fractures are excluded in all papers.

Paper I studies the functional outcome and operation method development between 1988 and 2012.

The results show an increase in mean age over the period studied. Sliding hip screw dominates as method of choice for the trochanteric fractures and for the cervical fractures there is a clear shift from osteosynthesis to arthroplasty. There is a significant decrease in functional outcome at follow-up compared to pre-fracture. No change can be seen over 25 years. Functional outcome is worse for the patients with trochanteric fracture.

Paper II describes and analyzes the implementation year of a care pathway for hip fracture patients in Lund and Helsingborg. The results show that use of the care pathway results in a time gain to x-ray in Lund and a time gain to surgery i Helsingborg. This differences could be explained by the previously conducted care process development as well as the differences in the implementation process.

Paper III continues the analysis started in Paper I regarding changes over time. This study includes the years 1999-2017 and aims to investige the impact of care process development and morbidity on functional outcome, mortality and time to surgery. The results show no correlation between outcome and the care process development, nor between mortality rate and time-to-surgery. The relative mortality rate has increased for patients with ASA 3, but for the group as a whole the mortality rate has decreased over time. The total length of hospital stay has decreased significantly over time.

Paper IV investigates the possible differences between the specific hip fracture care pathway and the traditional care process in regards to lead-times and outcome, as well as analyses the 10-year evolution of the pathway in regards to lead-times and mortality. The results show a time gain to surgery when using the pathway but no differences in outcome between the groups.

The overall conclusion of this thesis is that the impact of care process development on functional outcome and mortality is, in our context, limited. The hip fracture patients are not a homogeneous group which ought to be considered to a greater extent in the continuing improvement efforts.

Key words

Hip fracture, care process development, functional outcome, mortality, time to surgery,

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To Klas, Vera & Alva – with you all is possible.

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A brief introduction

Hip fracture is one of the most common fracture types in the older population. In Sweden approximately 18 000 people suffer a hip fracture each year. The mortality rate after a hip fracture is high and the patients most often do not regain their previous functional level. Several factors are described to affect outcome.

Health care development is a necessity for our older patients, as well as for the health care system itself and the general economics in society. As a consequence, the care process and management of patients with hip fractures have changed over the years.

The overall aim of this thesis is to describe and analyse the management development over 30 years and put in relation to patient outcome in an attempt to answer the questions – have the care process development for hip fracture patients improved their outcome? What can be done to further improve outcome for this large patient group?

List of papers

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

I. **Hip fractures – treatment and functional outcome.** ***The development over 25 years.***
Emma Turesson, Kjell Ivarsson, Karl-Göran Thorngren, Ami Hommel.
Injury 2018, **49**:2209-2215.

II. **The implementation of a fast-track care pathway for hip fracture patients.**
Emma Turesson, Kjell Ivarsson, Ulf Ekelund, Ami Hommel.
Eur Orthop and Traumatol 2012, **3**:195-203.

III. **The impact of care process development and comorbidity on functional outcome, mortality rate and time to surgery for hip fracture patients.** ***An analysis over 19 years.***
Emma Turesson, Kjell Ivarsson, Karl-Göran Thorngren, Ami Hommel.
Submitted.

IV. **The effect of a hip fracture care pathway ten years after implementation.** ***A comparison with a traditional care process.***
Emma Turesson, Ami Hommel, Karl-Göran Thorngren, Kjell Ivarsson.
Manuscript.

Populärvetenskaplig sammanfattning

Varje år drabbas cirka 18 000 personer av höftfraktur, vilket gör detta till en av de vanligaste skadorna bland äldre i vårt samhälle. Att drabbas av en höftfraktur är farligt och dödligheten är hög, omkring 30 % av de som drabbats har avlidit inom ett år. Det är inte bara dödligheten som är hög, utan det är också vanligt att de som drabbats inte återfår tidigare funktionsnivå och inte heller kan återgå till samma boendeform som före frakturen.

De vanligaste typerna av höftfrakturer är de cervikala (brott i lårbenshalsen) och de trochantära (brott i området nedanför lårbenshalsen) och trots att frakturområdena ligger så nära varandra ser både patienterna och operationsmetoderna olika ut. Patienter med cervikala frakturer är yngre och friskare, samt uppvisar bättre funktion före frakturen. Studier har även visat att dessa patienter klarar sig bättre efter frakturen, dvs. de har bättre funktion och högre överlevnad. För de cervikala frakturerna finns det två olika behandlingsmetoder att välja mellan – osteosyntes (frakturen fixeras) eller artroplastik (höftleden ersätts med en protes). Val av behandlingsmetod styrs av frakturens utseende samt patientens ålder och generella hälsa. För de trochantära frakturerna så använder man sig bara av osteosyntes. Där dominerar metoden ’glidskruv och platta’, vilket innebär att frakturen fixeras genom att en lång skruv skruvas in i lårbenshalsen och sedan fixeras i en platta som skruvas fast mot lårbenet. Man kan också välja att fixera frakturen genom att föra ner en grov och lång spik i lårbenets märghåla (märgspik).

Förutom att de olika frakturtyperna skiljer sig åt så har också många forskare studerat skillnaderna mellan kvinnor och män som drabbas av höftfraktur. Det är mycket vanligare bland kvinnor att drabbas av en höftfraktur, från 50 års ålder räknar man med att var fjärde kvinna och var tionde man kommer att drabbas. Anledningen till att fler kvinnor drabbas av höftfraktur är den högre förekomsten av benskörhet. Män som ådrar sig en höftfraktur är yngre men samtidigt vid sämre hälsa. Dödligheten efter höftfraktur är dessutom högre för männen.

En viktig del i höftfrakturforskningen har varit att studera utfallet efter fraktur, dvs. dödlighet, komplikationer, funktion etc. Det finns flera faktorer, utöver frakturtyp och kön, som påverkar utfallet. Faktorer som beskrivs är dels sådana som finns redan före frakturen, såsom ålder, sjuklighet och funktionsnivå, och dels sådana som uppstår till följd av frakturen (t.ex. komplikationer, sjukhusvård och väntetid till operation). Väntetiden till operation har studerats och debatterats de senaste åren, och även om de flesta är överens om att man inte ska fördröja väntetiden så har man inte kunnat nå någon enighet kring hur stor en rimlig fördröjning får vara. I Sverige har Socialstyrelsen fattat ett beslut som innebär att 80 % av alla höftfrakturpatienter ska vara opererade inom 24 timmar från

ankomsten till sjukhus, vilket är en av de tidsgränser som beskrivs i litteraturen. Andra tidsgränser som undersökts i olika studier är 12, 36 och 48 timmar.

De senaste decennierna har höftfrakturvården utvecklas och fått en helt annan uppmärksamhet än tidigare. I Lund startade arbetet i slutet på 90-talet med förändrade vård- och prioriteringsrutiner och 2007 mynnade arbetet ut i en ny vårdkedja för patienter med höftfraktur, den så kallade *Höftlinjen*. Denna vårdkedja innebar att patienterna nu fördes direkt från ambulansen till röntgen och därefter vidare in på en ortopedavdelning utan att behöva passera akutmottagningen. Detta var ett led i sjukhusets vårdprocessarbete och syftade till att minska väntetiderna, både för höftfrakturpatienterna men också för patienterna på akutmottagningen. Samma typ av vårdkedja finns nu på många sjukhus runt om i Sverige.

Syftet med detta avhandlingsarbete är att beskriva och analysera hur omhändertagande av höftfrakturpatienter har utvecklats de senaste 30 åren och att sätta detta i relation till patientutfallet i ett försök att försöka svara på frågorna – Har det förbättringsarbete som genomförts för höftfrakturpatienterna i Lund haft effekt? Finns det något vi kan göra för att ytterligare förbättra utfallet för denna stora patientgrupp?

Avhandlingen består av fyra arbeten som baseras på data från det svenska nationella kvalitetsregistret för höftfrakturpatienterna och deras behandling, RIKSHÖFT. RIKSHÖFT startades i Lund 1988 och har därefter spridits både nationellt och internationellt. I registret finns flera olika variabler, såsom information kring patienternas sjuklighet och funktionsnivå före frakturen, information kring frakturtyp och behandlingsmetod, olika ledtider för vårdtillfället (ankomstdag, operationsdag, utskrivningsdag etc.), funktionsnivå efter 4 månader, eventuella komplikationer samt information kring patienternas självskattade hälsostatus före och efter fraktur.

I arbete I, som inkluderar 8723 patienter, beskrivs och analyseras den utveckling som skett i höftfrakturomhändertagandet sedan 1988 och fram till 2012 med avseende på operationsmetodsutveckling och funktionsutfall. Resultaten där visar att det har skett ett skifte i operationsmetodval för de cervikala frakturerna där artroplastik blivit allt vanligare. Detta verkar dock inte ha påverkat funktionsutfallet eftersom funktionen vid 4-månadersuppföljningen inte har förändrats dessa 25 år. För specifika undergrupper visar resultaten sämre funktionsutfall för de med trochantära frakturer och man ser också att dödligheten bland män är högre än för kvinnorna, även om männens överlevnad över tid har förbättrats.

I arbete III fortsätter analysen över tid men inkluderar nu åren 1999-2017, detta för att bättre kunna studera effekten av vårdprocessutvecklingen beskriven ovan och

sätta utfallet (funktionsnivå och dödlighet) i relation till patienternas sjuklighet. I detta arbete ingår 7827 patienter och resultaten visar att det skett ett skifte i sjuklighet för gruppen, från friskare till sjukare patienter, över de senaste 19 åren. Ingen koppling kan ses mellan utfall och vårdprocessutvecklingen. Dödligheten vid 4 månader har relativt sett ökat över tid för de sjukaste patienterna, även om dödligheten för hela gruppen har minskat något över tid. Dödligheten kan inte kopplas till väntetiden till operation.

I arbete II och IV studeras vårdkedjan Höftlinjen och dess påverkan på ledtider och patientutfall närmare. I arbete II studeras implementeringsåret av Höftlinjen i Lund och jämförs, dels med de patienter som fortsatt omhändertas enligt det traditionella systemet (via akutmottagningen), och dels med implementeringen i Helsingborg två år senare (2009). Syftet med att jämföra Lund och Helsingborg är för att kunna studera skillnaderna i implementeringen mellan universitetssjukhus och länssjukhus inom samma region. Resultaten, som inkluderar 367 Lundapatienter och 322 Helsingsborgspatienter, visar en tidsvinst till röntgen för Höftlinjerna på båda sjukhusen men endast tidsvinst till operation för Höftlinjen i Helsingborg. Denna skillnad mellan orterna kan tolkas som en skillnad i process-implementeringen samt tidigare genomförda vårdoptimeringar.

Arbete IV, inkluderande 629 patienter, följer upp resultaten från 2007 och gör en analys av hur utfallet av Höftlinjen ser ut 10 år efter implementeringen, dvs. 2017. Höftlinjen jämförs även denna gång med de patienter som omhändertas enligt det traditionella sättet. Nu visar resultaten en tydlig tidsvinst till operation för Höftlinjepatienterna. Någon ytterligare vinst med att ingå i denna vårdkedja ses inte, varken på vårdtid eller funktionsutfall. Inte heller patienternas egenskattade hälsa skiljer sig mellan grupperna. Däremot ses en trend mot ökad dödlighet för Höftlinjepatienterna och faktorer som verkar påverka är frakturtyp, sjuklighet och en väntetid till operation på under 12 timmar. Resultaten indikerar även en ökad dödlighet om operation äger rum under jourtid.

Avhandlingens övergripande slutsats är att vårdprocessutvecklingen inte kan visa på förbättrad funktion 4 månader efter höftfraktur samt att dess effekt på den minskade dödligheten över tid sannolikt är begränsad. Men trots att patienterna har blivit äldre och sjukare, samtidigt som vårdtiden har minskat, försämras inte funktionen, och inte heller ökar dödligheten, vilket kan tyda på att vårdprocessutvecklingen ändå har betydelse. Höftfrakturpatienterna är, som grupp, inte homogen vilket bör tas i större beaktande i det fortsatta arbetet med denna stora, sköra och viktiga patientgrupp.

Abbreviations

ASA	American Society of Anesthesiologists
ECG	Electrocardiography
ED	Emergency Department
EQ-5D	EuroQol five dimension scale
EQ-5D VAS	EuroQol five dimension Visual analogue scale
LOS	Length of stay
NPG	Non-pathway group
PG	Pathway group
THA	Total hip arthroplasty

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Last, my dad **Ulf.** I didn't finish in time for you to see the result of this but I know you were proud all the way. Du fattas mig.

Background

The older Swedish population

By the end of 2017 the Swedish population measured to approximately 10 million people. Out of these, 2 million were 65 years or older. The average life expectancy in Sweden has increased for both genders and is now 84 years for women and 81 years for men. Since the 80's the gap in average life expectancy between the genders has decreased and the increase in life expectancy is a result of decreased late-life mortality [1, 2]. In 2006 Statistics Sweden released a report regarding the living conditions of the older and its development. The report addresses data from 1980 to 2003 [3]. Among other things the report describes an improvement in function regarding sight, mobility and Instrumental Activities of Daily Living (IADL). The improvements in function have been more favourable for the men compared to the women.

In 1992, a governmental decision called *Ädelreformen* was introduced in Sweden, transferring the responsibility for care of the older from the state to the municipality. This changed the institutional care and living arrangements for older persons and, as a result, a more widely spread home care system was developed. In a follow-up report Ädelreformen was evaluated and it was concluded that it had not had, in all aspects, the desired effect. The home care system had changed from a more caring setting to a more medical assignment with the result that fewer people were approved home care and the resources were concentrated to fewer individuals [4].

The hip fracture

Hip fracture is one of the most common fracture types among the older and nearly 18 000 people suffer from hip fracture on a yearly basis here in Sweden. By the age of 50 every fourth woman and every tenth man are at risk of sometime sustaining a hip fracture. The lifetime risk is 15% and 5% respectively, and the most important factors affecting the incidence rate are age and sex. The typical hip fracture patient is a woman in her early 80's with osteoporosis who has sustained

her fracture by falling. Hip fracture under the age of 50 is uncommon and is usually the result of high-energy trauma, i.e. motor vehicle accidents [5-7].

Are they all the same?

Depending on the anatomical localization, hip fractures can be divided into two major subgroups – fractures of the femoral neck (cervical) or fractures in the trochanteric region (trochanteric) [8].

The standard classification system for the cervical fractures is that of Garden. It comprises of four subgroups and describes the degree of dislocation of the trabecular structure in the femoral neck. Trochanteric fractures can be divided into un-displaced two-part, displaced two-part and multifragmentary, but numerous classification systems exist [8].

Patients with cervical fractures tend to be younger, have a higher BMI and a better pre- and post-fracture functional level [9-11]. In a review article by Cornwall et al. in 2004 the difference in outcome and mortality between different fracture types was addressed. This review showed that most studies made on the subject concluded that patients with trochanteric fractures had lower pre-injury function and worse functional outcome compared to those with cervical fractures. However, fracture type alone could not be used to predict outcome [11].

Gender differences

As for the fracture types the literature also describes differences between men and women sustaining a hip fracture. It is well established that women outnumber the men, mainly due to differences in age and osteoporosis prevalence [5]. Even though the women are older they have a better pre-fracture health and display a better functional outcome [12-14]. This is to be compared to the general population of older in the Nordic countries, where women report a higher number of illnesses and lower self-reported quality of life [15]. Several studies report a higher mortality rate among men after hip fracture [16-21].

Treatment

Over the last century the treatment options and surgical methods for hip fractures have gone from a non-operative regimen to an abundance of different screws, plates and prostheses.

As early as 1913 the Belgian surgeon Albin Lambotte described a method for surgical treatment of trochanteric fractures using crossed screws, but it was not

until the 1930s and 40s that the evolution really started, both for trochanteric and cervical fractures. In the early 40s the first prototype for intramedullary nailing was tried out and in the 1950s the first sliding hip screw was patented [22].

Regarding the cervical fractures the use of a three-flanged nail was reported by Smith-Pedersen in 1931 but the evolution of hip replacement therapy had started roughly ten years earlier, also by the same surgeon. Smith-Petersen managed to change the conservative attitude regarding the treatment of these fractures. In the 1940s Moore performed the first replacement of the femoral head but it was in the 1960s that John Charnley (later knighted for his work) revolutionized the world of total hip replacement [23, 24].

Today the treatment options for the different fractures, cervical and trochanteric, can be grossly divided into osteosynthesis or hip replacement. For the undisplaced cervical fracture the method of choice is fixation by nailing or screwing. For a displaced fracture the treatment options are hemiarthroplasty (replacement of the femoral head) or total hip arthroplasty (THA), where both the femoral head and the socket are being replaced. Nailing can, however, also be used, preferably if the patient is young. Regarding the trochanteric fractures the most common surgical method of treatment is dynamic hip screw. Intramedullary nailing is also an option but is used in a lesser extent. Intramedullary nailing is more often used for the subtrochanteric fractures [25].

Function

Limited function can be described as the discrepancy between the individual capacity and the demands set by the physical or social environment [26]. Several instruments exist to evaluate a person's function and Activities of Daily Living (ADL) [26, 27].

Since the older population in Sweden, as previously mentioned, have improved in mobility the past decades it is possible that the demands on function have increased. With the introduction of the rollator in the 1980's the possibilities for the older to walk independently (without the need of human assistance) have increased. Since no published research is done regarding the development of waking aid use in Sweden the real impact of the rollator is hard to establish. Studies have, however, been made regarding the use and experiences of mobility devices among the older in Sweden [28-30]. These show an increased use of mobility devices with age and even though a mobility device is an enabler in everyday life it can also be regarded as an obstacle. In a study by Vogt et al. from 2010 the results showed that rollator use did not interfere with rehabilitation outcome [31].

When it comes to hip fracture patients the literature agree that sustaining a hip fracture results in a decrease in functional status [32-37].

Several studies have addressed factors that can influence functional outcome and this has been used to create prognostic instruments [11, 38-43]. Apart from age and fracture type studies also show that patients admitted from nursing homes display worse outcome [44, 45] as well as those with prolonged postoperative in-hospital immobilization [46].

Mortality

All over the medical field mortality rate is a well-studied and important factor for describing outcome. As the hip fracture patient group is generally fragile the mortality rate is both high and increased compared to controls [32, 47-50]. There are several factors that correlate with increased mortality (apart from previously mentioned male gender), such as poor pre-fracture mobility, high age, abnormal electrocardiography (ECG), cognitive impairment and high ASA grade (American Society of Anesthesiologists physical status classification system)[51, 52].

The factors listed above are all of such nature that they are presented with the patient upon admittance. Other factors that have been shown to have an association with the mortality rate are of a different character and the deaths due to them could be seen as avoidable. Such factors include perioperative regimen, the orthopaedic surgeon's level of experience, admission day, length of stay (LOS) in hospital, time to surgery and what form of housing the patient is discharged to [52-56].

The 'time-to-surgery'-debate

The impact of time to surgery on the outcome after hip fracture has been the subject of many studies and debates during the past years. Although all agree on the importance of not delaying surgery, the definition of 'delay' varies, as shown in an extensive review article by Lewis and Waddell from 2016 [57]. For example, Uzoigwe et al. 2015 as well as Bretherton and Parker 2015 describe an improved survival rate among patients operated within 12 hours [58, 59] whereas other studies have shown a beneficial outcome when not delaying surgery over 24 to 48 hours [60-62]. On the other hand, there are studies that have shown no association between time to surgery and mortality [63-65]. In a study by Kelly-Pettersson et al. 2017 no correlation was seen between mortality rate and time to surgery. They could however show an increase in serious adverse events by every 10-hour delay, even though no clear cut-off time could be identified [66].

Most studies addressing this topic are limited in regards to patient volume, of the above mentioned only Bretherton et al. 2015 and Grimes et al. 2002 had a patient material exceeding 5000 patients. The study by Bretherton et al. includes patients from 1989 to 2013, a time period during which the hip fracture management ought to have undergone changes. Even so, they do not address the impact that care process development might have had on the outcome.

Care process development

Clinical pathways

The development of health care is a necessity for patients, the health care system and the society as a whole.

The term 'clinical pathway' has been used in health care systems since the mid 80's along with synonyms such as 'care pathway' and 'critical pathway'. The definition of a clinical pathway varies between studies but they all deal with issues of efficiency, outcome, improvement and evaluation [67, 68]. In general, a clinical pathway is a method to structure and organize care processes in a multidisciplinary setting [69] and several studies have shown the benefits of using such a method [70-72].

When specifically addressing clinical pathways for hip fracture patients the literature is somewhat inconclusive, some studies report benefits on different outcome measures when using a clinical pathway whereas others report no difference in outcome compared to traditional care [73-76]. A study by Butler et al. from 2017 reported a decrease in functional ability with prolonged stay in the Emergency Department (ED) awaiting admission [77]. There are also studies addressing whether or not hip fracture patients benefit from orthopaedic care, geriatric care or a multidisciplinary approach [55, 75, 78-80]. These studies show no relation between 'care setting' and functional outcome or rehabilitation, but a reduced mortality rate and LOS among those cared for in a geriatric or orthogeriatric setting.

A study by Adie et al. in 2009 showed a decrease in mortality rate when changing the priority to surgery by transferring the hip fracture patients from the emergency list to the scheduled orthopaedic operation list. The decrease in mortality rate was explained by fewer cancellations and after-hour operations, as well as an increased consultant supervision [81].

Hip fracture management at Skåne University Hospital in Lund

During the past decades an evolution has taken place regarding the care of hip fracture patients in Lund, especially concerning the clinical pathway. Until the beginning of the 21th century hip fracture patients had been taken directly to the ED by the ambulance crew and the main function of the ambulance was to transport the patient. No specific strategy for pain relief regime, leg immobilization, blood samples or ECG existed for the ambulance crew. When arriving at the ED the patient had to wait for a physician's examination and x-ray referral, four floors up. After x-ray the patient was taken back to the ED to wait for a physician to assess the radiographs and then admit the patient to the orthopaedic ward (figure 1a). There was no fixed strategy for pain relief. Blood samples and ECG were taken once prescribed by the physician.

An action to improve outcome for hip fracture patients started in 1999 with a change in the routines at the ED. Up-prioritization of the hip fracture patients was made and a supervised waiting room for bedridden patients was introduced together with a pain relief regimen where paracetamol combined with morphine was given more frequently. At the orthopaedic wards and in the operating theatre all mattresses were changed to help the prevention of pressure ulcers. These changes improved the outcome for hip fracture patients [82].

In 2003 a new way of handling the hip fracture patients was implemented to further improve outcome. The intervention, which already started in the ambulance, consisted of administration of oxygen and intra-venous fluid, early pain management, transport directly from the x-ray unit to an orthopaedic ward, risk assessment for pressure ulcer and up-prioritization on the waiting-list to surgery (figure 1b). This intervention showed that by faster transferal from stretcher to bed, faster initiation of pain relief and fewer shifts of care personnel attending to the patient from the pre-hospital setting to the ward, the incidence of pressure ulcers and confusion would decrease [83, 84].

On April 1st 2007 a new clinical pathway was introduced in order to further optimize the care for the hip fracture patients. The pathway was created in collaboration between the ED, the Department of Orthopaedics and the Centre for Medical Imaging and Physiology at Lund University Hospital together with the pre-hospital ambulance organization. When implementing the new pathway the previously conducted interventions as described above were adopted.

The new pathway consists of several steps. First, hip fracture patients have been up-prioritized by SOS Alarm, the Swedish emergency dispatch centre. Second, when reaching the patients location, the specialized ambulance nurses follow a specific checklist including patient and trauma history, immobilization of the affected limb, early pain management, blood-samples and ECG (figure 2).

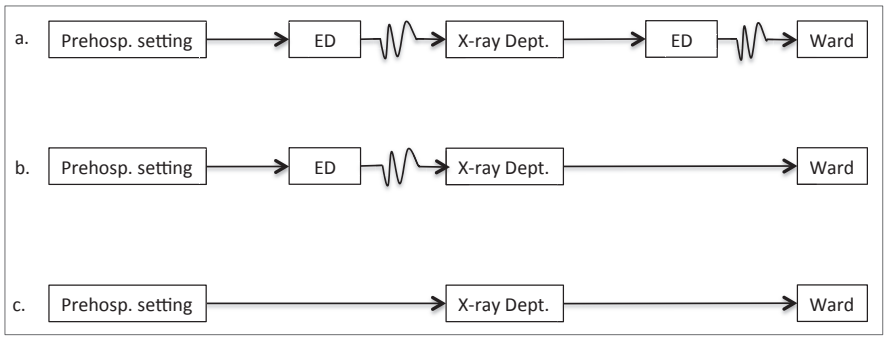

Figure 1.
The evolution of the hip fracture care process from the traditional pathway (a), through the intermediary step (b) to the hip fracture care pathway (c).

The ECG is sent electronically to the cardiac intensive care unit for assessment. Third, if the ECG is cleared, the ambulance nurses notify the orthopaedic surgeon on call, who orders x-ray and notifies the orthopaedic ward. Fourth, at the hospital the ambulance nurses take the patient directly to the orthopaedic ward via the x-ray unit without passing the ED (figure 1c). The orthopaedic surgeon then assesses the patient at the ward. Both pre- and post-operatively the patient stay at the same ward and room in order to reduce the risk of confusion.

To be included in the new pathway the patient should have sustained a low-energy trauma to the hip and have pain around this area when examined by the ambulance nurses. Hip fracture patients with another medical problem of higher priority or a concomitant injury are not included in the pathway and are handled as before the implementation, that is, brought directly to the ED. Hip fracture patients who are not taken to the hospital by ambulance, e.g. those transported to the ED by a relative, are also not included in the pathway. The ambulance nurses are not obliged to include a patient in the new pathway although the criteria are met, and the orthopaedic surgeon on call has a right to redirect the ambulance to the ED if necessary. Patients not included in the new pathway can be handled both according to the traditional way or the intermediary way, meaning either taken back to the ED after x-ray or transferred directly to the ward.

At Skåne University hospital in Lund, the hip fracture patients are cared for in an orthopaedic ward, with orthopaedic surgeons responsible for the care. Patients are however admitted to other wards when the orthopaedic ward is full. Those patients are seen daily by an orthopaedic consultant who is responsible for the care. In 2007 a decision was made to avoid placing hip fracture patients in other wards. This decision was based on a study by Hommel et al. 2008 showing increased LOS, delayed rehabilitation efforts and increased complications rates for hip fracture patients when treated in other hospital departments [85].

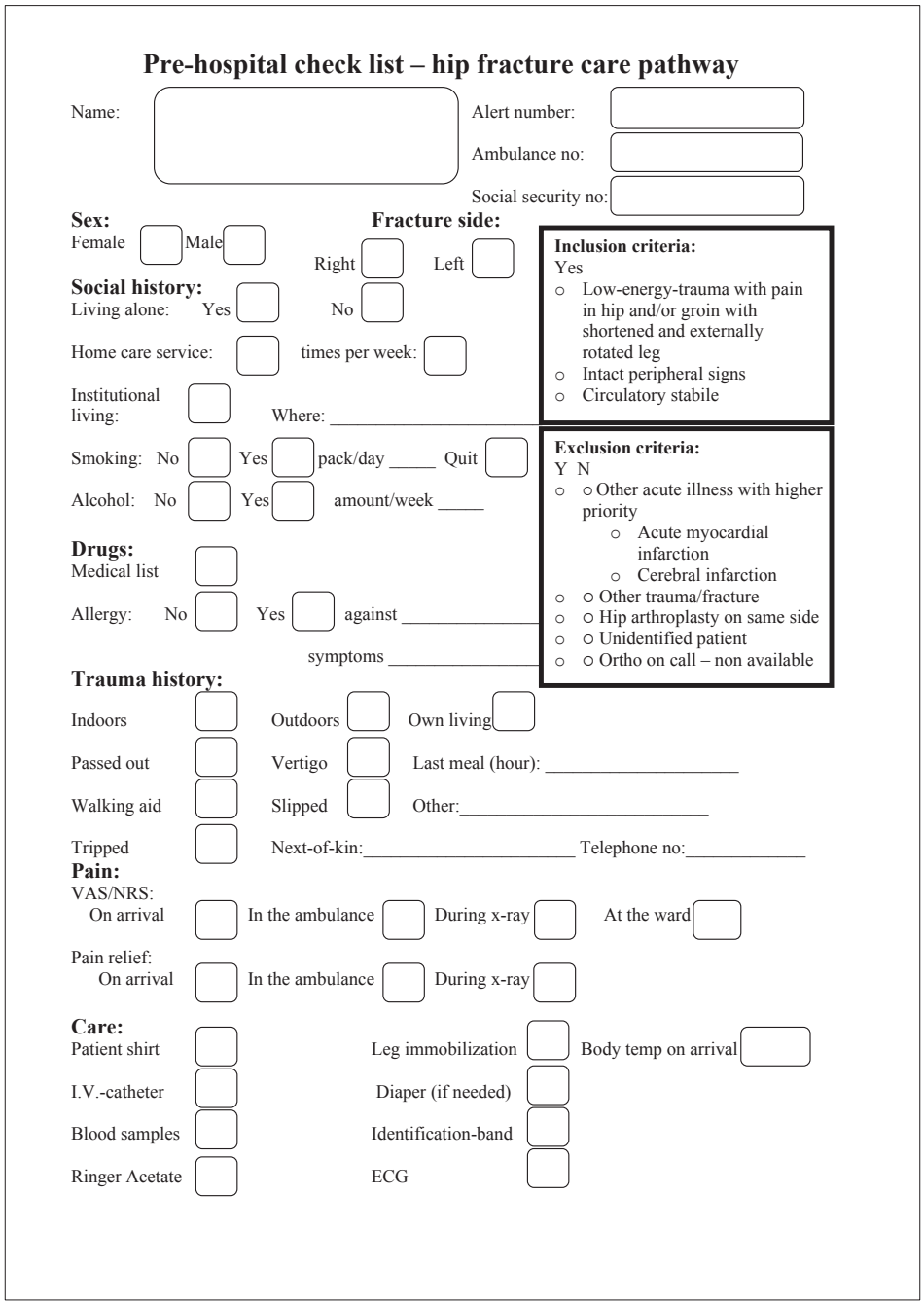

Figure 2.
The pre-hospital checklist used for the hip fracture care pathway.

The Swedish National Quality Registries

Sweden has a long history of national quality registries and orthopaedic registries go back as far as to the 70's when the Swedish Knee and Hip Arthroplasty Registers were started [86, 87]. The purpose of registries is to offer a feedback mechanism to the health care in order to enable quality improvements.

RIKSHÖFT

In 1988 Professor Karl-Göran Thorngren started the Swedish National Quality register for hip fracture patient care, RIKSHÖFT, in Lund. The hip fracture register differed from the previously existing orthopaedic registers, the Swedish Knee Arthroplasty Register and the Swedish Hip Arthroplasty Register, in the way that this register, besides from data regarding fracture type and treatment method, also handled information about patients' functional and social conditions [88]. Together with the start of RIKSHÖFT 'the Swedish multicentre hip fracture study' was commenced. A nationwide project to enable follow-up on treatment results and facilitate comparison between different hospitals and regions. Annual reports describe the results of quality improvement efforts on a number of parameters [89, 90]. During 1995-1998 the hip fracture register was spread to Europe through a project called SAHFE (Standardized Audit of Hip Fractures in Europe). The project was supported by grants from the European Commission [91].

The RIKSHÖFT registration consists of several forms, three for general registration and five for extended registration. For this thesis information from four of the eight forms has been used (Appendix 1). The primary operation form is filled in prospectively during the patient's hospital stay by a nurse at the ward and consists of demographical data, data regarding patient background and functional status, as well as time variables and information about the fracture and its treatment. These variables are since 2018 automatically transferred to RIKSHÖFT from the medical record if the patient has given permission to be included in the register. The second form consists of a 4 months follow-up, which is carried out by the register nurse for all the patients, either by telephone or questionnaire, and the form includes information about walking ability, pain and care continuum. The third form is for those who undergo reoperation. The five forms for extended registration are designed to enable a wider analysis and also to provide the patient's perspective with the use of EuroQol five dimension scale (EQ-5D) as a patient-reported outcome measure (PROM).

Other than the predetermined variables in the forms the register also enables for departments to set up separate variables, for example information regarding the use of a fast-track system. Such variables are used in the Lund registry.

Aims

The overall aim of this thesis is to describe and analyse the care process development over 30 years and to put the development in relation to patient outcome in an attempt to answer the questions – has the care process development for hip fracture patients improved their outcome? What can we do to further improve outcome for this large patient group?

The overall aim can be divided into several more specific aims:

- To describe and analyse how the functional outcome at 4-months follow-up has changed between 1988 and 2017 and to put it in relation to the care process development, operation method development, fracture types and gender differences (Paper I and III).
- To analyse the implementation of a fast-track care pathway for hip fracture patients (Paper II).
- To investigate whether the care process development over 19 years has had any impact on mortality as well as time to surgery (Paper III).
- To describe and analyse the relation between function, comorbidity, fracture type and mortality over the last 19 years (Paper III).
- To analyse the evolution of the hip fracture care pathway in regards to lead-times and outcome (Paper IV).
- To investigate differences in lead-time and patient outcome, as well as patient self-reported health status, between a hip fracture care pathway and a traditional care process (Paper IV).

Methods

Design and geographical context

All studies are performed through retrospective review of data RIKSHÖFT. In paper II a review of medical records and radiographs was also made. The studies were all conducted at Skåne University Hospital in Lund, formerly Lund University Hospital, in southern Sweden. The hospital has a total of 420 beds and a caring responsibility for approximately 300 000 of the 10 million inhabitants in Sweden, as well as the ability to offer high-specialized care for the 1,8 million people in the Southern health care region. In paper II patients from Helsingborg County Hospital were also included. Helsingborg County Hospital, located in the northwestern part of Skåne, is a medium-sized hospital with approximately 250 beds and a caring responsibility for 250 000 inhabitants.

Data collection

RIKSHÖFT data from all patients registered in Lund between 1988 and 2017 has been retrieved. The patients have been divided into different datasets to match the objectives of each paper.

Variables from RIKSHÖFT included in the papers are listed in table 1.

In the registry, the cervical fractures are classified as undisplaced (Garden I-II) or displaced (Garden III-IV) and the trochanteric fractures as two-fragment or multifragmentary fractures. The registration is based on information retrieved from the operational chart.

The assessment of cognitive status in the registry is made by the nurse upon admission to the ward. To categorise the patients she uses both information from the medical records as well as the Short Portable Mental Status Questionnaire (SPMSQ), a widely used assessment instrument for cognitive status [92].

Table 1.
Variables included from RIKSHÖFT.

		Paper I	Paper II	Paper III	Paper IV
Patient characteristics	Age	X	X	X	X
	Gender	X	X	X	X
	ASA grade		X	X	X
	Anticoagulant therapy		X	X	X
	Mental status		X	X	X
Pre-fracture function	Housing	X		X	X
	Walking ability	X		X	X
	Walking aids	X			X
Fracture type		X		X	X
Operation method		X		X	X
4-month follow-up function	Housing	X		X	X
	Walking ability	X		X	X
	Walking aids	X			X
	Hip pain	X		X	X
	Use of painkillers*	X		X	X
Lead-times	Date of admission	X	X	X	X
	Time of admission		X		X
	Date of x-ray				X
	Time of x-ray				X
	Date of surgery		X	X	X
	Time of surgery		X		X
	Date of discharge		X	X	X
EQ5D VAS	Pre-fracture				X
	4-months follow-up				X
Pathway inclusion			X		X

*The question regards use of painkillers due to remaining pain in the operated hip.

For this thesis ASA grade is used as the primary measure to assess patient morbidity, with cognitive status and use of anticoagulant therapy as supplements. The information about ASA grade was included in the registry in 1998 whereas information on cognitive status and anticoagulant therapy were added to the registry in 2007. The different ASA grades used in this thesis, as defined by the American Society of Anesthesiologists, are:

- ASA 1 – A healthy person
- ASA 2 – A person with mild systemic disease
- ASA 3 – A person with severe disease
- ASA 4 - A patient with severe systemic disease that is a constant threat to life
- ASA 5 - A moribund patient who is not expected to survive without the operation

In Paper III and IV the ASA grades are used both separately and paired into ASA 1-2 and ASA 3-4. This is done in order to create larger groups that are more clinically applicable (healthy/sick).

Another view on patient health was the decision to include self-reported health status as a variable. In RIKSHÖFT this is registered in the form of EQ-5D, an internationally used instrument to measure patient self-reported health outcome [93]. In Paper IV EuroQol five dimension scale Visual Analogue Scale (EQ-5D VAS) was used to assess both pre-fracture and 4-months follow-up health status.

As primary measures of function the variables housing and walking ability were chosen. The variable regarding use of walking aids was used as a supplement. These three variables are the only ones in RIKSHÖFT that can be used to describe a patient's function.

The forms in RIKSHÖFT used for this thesis have changed over time, usually with fewer categories to choose from as time has passed, i.e. in the forms used between 1988 and 1997 there were nine different categories regarding housing, but with the changes in the care system for older people the different forms of housing have also changed. Due to this, the RIKSHÖFT forms today only consist of six different categories of housing. This has posed an issue in the work with the data. To be able to make a comparison over time some of the categories were recoded and as the work with the projects continued the decision was made to further combine the categories to simplify the statistical analysis and interpretation of the results. The same applies for the variable walking ability, in this thesis categorized as 'Independent', 'Dependent' or 'Could not walk'. The definition of 'independent walking ability' is when the patient can walk without human assistance indoors but might need it outdoors. To be categorized as 'dependent' the patient needs human assistance for walking both indoors and outdoors. For recoding key, see Appendix 2.

For paper II RIKSHÖFT data was also collected from Helsingborg County Hospital on hip fracture patients admitted during April 1st – December 31st 2009. For this paper data was also retrieved from the x-ray database in Lund and from the electronic patient charts, since RIKSHÖFT not yet contained information about x-ray date and time or time for discharge. No radiographs were examined further; the information retrieved from the x-ray database was that regarding time for x-ray and, if needed, to verify a correct inclusion. The patients were divided according to hospital affiliation and then further into 'Pathway group' (PG) or 'Non-pathway group' (NPG). In Lund, the categorization was done by using information from RIKSHÖFT-Lund, where this variable is registered since 2007. For the Helsingborg dataset the PGs were identified via the patient log at the ED with the help from an administrator.

The inclusion process

In all four papers patients with known pathological fractures were excluded from the dataset. During the first 9 years of registration in RIKSHÖFT (1988 – Aug 1997) no patients with pathological fractures were included in the registry and therefor data regarding this is missing in the early material. Hence, in those cases where data has been missing for this variable during that time period it has been assumed that the fracture is non-pathological. Since September 1997 pathological fractures are documented in the register. Regarding missing data for other variables in the dataset they have been coded as "unknown". This was done to avoid an incorrect exclusion of patients and to make the dataset as complete as possible for statistical analysis. However, cases missing data regarding personal identification number (thus making it impossible to calculate age), gender, fracture type and date of admission has been excluded.

In paper I, III and IV patients with basocervical or subtrochanteric fractures were excluded. These fracture types represent 10% of all patients admitted due to hip fracture in Lund between 1988 and 2017. The decision was made for the purpose of being able to compare the two largest hip fracture patient groups. Based on clinical experience the basocervical fractures can be misinterpreted as either cervical or trochanteric fractures. To exclude them from the start reduced the risk of erroneous results. The subtrochanteric fractures were excluded for somewhat the same reason – there has been an inconsistency in classification in the literature [94].

In Paper I and III all patients younger than 50 years of age were excluded and in Paper II and IV patients under the age of 65 years were excluded.

For paper II and IV further exclusions were made. Since the aims of the papers was to investigate and analyse the possible time gain by implementing a fast-track care pathway in-hospital fractures, x-ray conducted at another health care unit, missed fractures, old fractures or incomplete data also posed as exclusion criteria. In Paper II the basocervical and subtrochanteric fractures were included in the dataset. This study was conducted first of the four and the thesis' focus on the cervical and trochanteric fractures had not yet been decided. The basocervical and subtrochanteric fractures represented 6.2% of the fractures in Paper II. In Paper IV the dataset from Paper II was updated with data on functional status to be able to make a comparison with the 2017-material. For this reason, the basocervical and subtrochanteric fractures were excluded.

In table 2 an overview of the inclusion process for the different papers can be seen.

Table 2.
Inclusion overview for the different papers.

		Paper I	Paper II	Paper III	Paper IV
Hospital		Lund	Lund(L) Helsingborg(H)	Lund	Lund
Time period		1988-2012	2007(L) 2009(H)	1999-2017	2007 and 2017
Pathological fracture		No	No	No	No
Incomplete data		No	No	No	No
Age	≥ 50	Yes	No	Yes	No
	≥ 65	No	Yes	No	Yes
Fracture type	Cervical	Yes	Yes	Yes	Yes
	Basocervical	No	Yes	No	No
	Trochanteric	Yes	Yes	Yes	Yes
	Subtrochanteric	No	Yes	No	No
Miscellaneous	Non-operative treatment	Yes	No	Yes	No
	Old fracture	Yes	No	Yes	No
	Missed fracture	Yes	No	Yes	No
	In-hospital fracture	Yes	No	Yes	No
	X-ray conducted at another health care unit	Yes	No	Yes	No

A total of 1503 patients (11.9%) have been excluded from the datasets, apart from the basocervical and subtrochanteric fractures; 923 in Paper I, 140 in Paper II, 391 in Paper III and 49 in Paper IV. Of these, 693 have been excluded due to missing data (670 in Paper I and 23 in Paper II).

Statistics

For Paper I, III and IV a statistician performed the statistical calculations and for paper II the author made the calculations.

The datasets for the different projects all comprises of a majority of non-normally distributed data, wherefore, non-parametrical test have been used. To test for normality the Shapiro-Wilk test was used. Most of the variables in the datasets are categorical and for that reason Fisher's exact test and Chi-two-test were used when comparing variables. For lead-time analysis in Paper II and IV the Mann-Whitney-Wilcoxon test was used since it was a combination of categorical and continuous variables. In Paper IV the Kruskal-Wallis test was also used to compare the lead-

times. To test the dependency and correlation between variables in Paper III Spearman's rank correlation coefficient was used for the categorical data and Pearson correlation coefficient for the continuous. To analyse the changes over time in Paper I and III different regression models were used - Cox regression with Breslow method for ties (Paper I), multi-nominal logistic regression (Paper I) and linear regression (Paper III).

The level of significance was set to <0.05 in all studies.

Ethical considerations

Upon registration in RIKSHÖFT all patients are informed about the registration and that data might be used in research. All patients that do not actively decline participation are registered. Apart from this information they are also given oral and written information on how to withdraw consent at any time. No further information about the specific projects in this thesis has been given since the results are presented in large scale on an aggregated level and the individual patient is impossible to identify.

The Regional Ethical Review Board in Lund has approved the projects included in this thesis (ref. 2008-684 and 2015-182).

Results

Patient characteristics

This thesis comprises of data from 11 156 patients and table 3 shows the total number of patients in each paper, as well as the gender distribution and mean age. Over time there is a statistically significant increase in mean age from 81.0 to 82.0 years, as described in Paper I. The women are significantly older than the men and for both genders the mean age at when they sustain their fracture has increased. All papers display a higher number of female patients. Over the years the gender ratio has changed and we now see an increasing number of male patients, however not statistically significant.

Table 3.
Patient characteristics.

	Paper I	Paper II	Paper III	Paper IV
Total, n	8723	549	7827	629
Men, n(%)	2412(27.7)	143(26.0)	2265(28.9)	199(31.6)
Women, n(%)	6311(72.3)	406(74.0)	5562(71.1)	430(68.4)
Mean age	81.6	83.2	81.9	83.0

Morbidity

In Paper II, III and IV the patients' pre-fracture health status is addressed and in all three papers there is an overweight of patients with ASA 3-4. The only subgroup displaying a different ratio is the Helsingborg-patients in Paper II where 51.2% are ASA 1-2. In Paper III the results show that there have been a shift in morbidity over the past 19 years as seen in figure 3.

Between 1999 and 2017 there is a decrease in mean age for patients with ASA 1 (75.4 years to 71.0 years) and ASA 2 (81.9 years to 80.3 years), whereas the mean age for ASA 3 and 4 does not show any convincing time trend with an overall mean age of 83.3 years and 82.6 years respectively. Apart from ASA grade, the papers also look at cognitive impairment and the use of anticoagulant therapy. Approximately one third of the patients in the material have cognitive impairment (28.6% to 36.5%) and between 7.3% and 18.1% use anticoagulant therapy, with

the highest prevalence in Paper IV. Over time, there has been a significant increase in the use of anticoagulants.

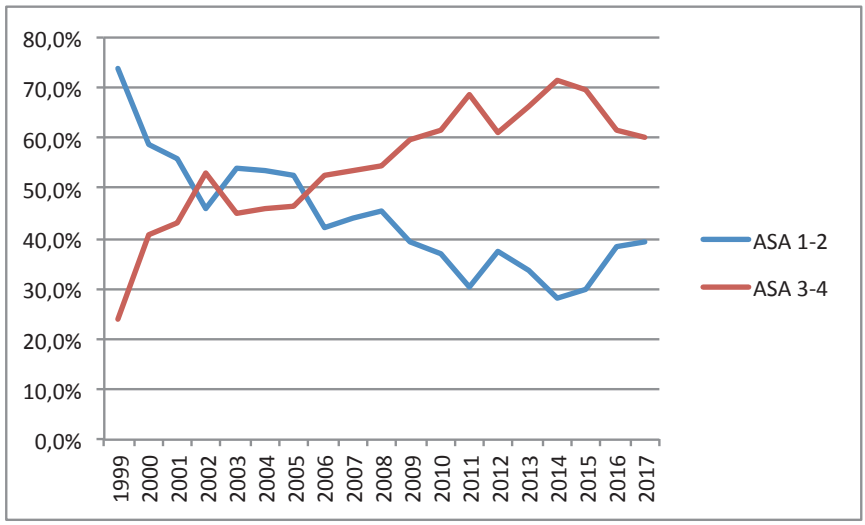

Figure 3.
Changes in ASA grade over time.

Pre-fracture function

This issue is addressed in Paper I, III and IV. The majority of patients are admitted from own home and have an independent walking ability pre-fracture. A higher proportion of the women lives alone (47.0% vs. 30.6%) and uses walking aids (37.3% vs. 32.0%). Of the men, however, a slightly larger share lives in own home (65.5% vs. 63.4%). No gender difference is seen in pre-fracture walking ability.

In Figures 4a-6a the pre-fracture function is described in regards to housing, walking ability and use of walking aids. In Paper I no significant change in pre-fracture function is seen over time. In Paper III, however, the study shows a significant increase over time in the group with dependent walking ability (5.8% in 1998 and 29.2% in 2017) as well as an increase in number of patients living in own home (62.4% in 1998 and 75.1% in 2017). The use of walking aids pre-fracture is fairly consistent – 35.8% in Paper I and 38.1% in Paper IV (figure 4a-6a).

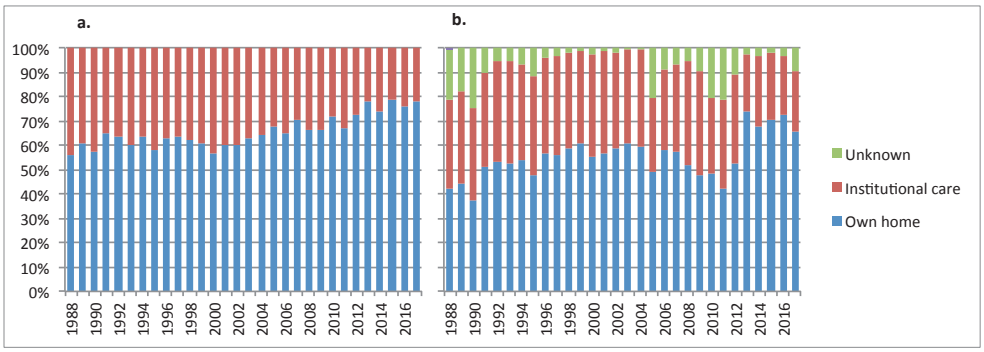

Figure 4.
Changes in housing over time, pre-fracture (a) and at 4-months follow-up (b).

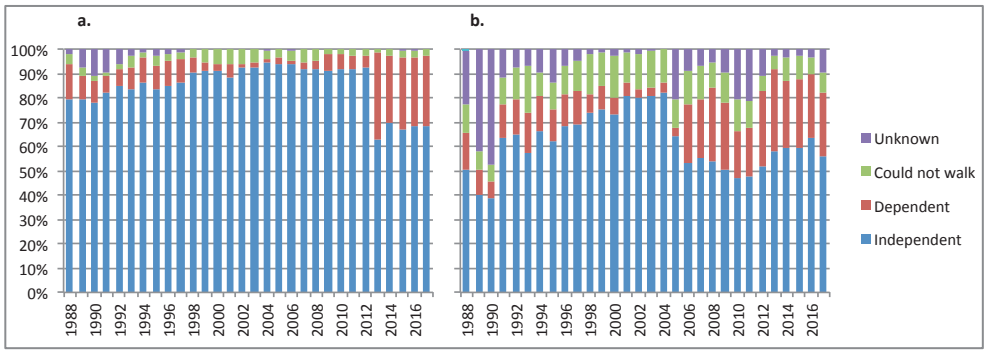

Figure 5.
Changes in walking ability over time, pre-fracture (a) and at 4-months follow-up (b).

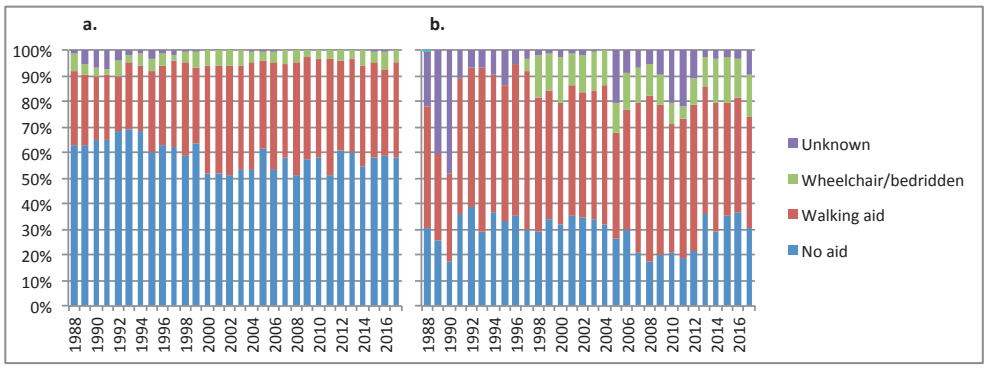

Figure 6.
Changes in walking aids over time, pre-fracture (a) and at 4-months follow-up (b).

Fracture types

Over this 30-year period the ratio between the cervical and trochanteric fractures has been fairly stable with only a minor overweight for the cervical fractures as seen in figure 7. The figure also displays an increase in number of patients with displaced cervical fractures (31.7% in 1988 to 45.2% in 2017) and multifragmentary trochanteric fractures (12.3% in 1988 to 26.8% in 2017).

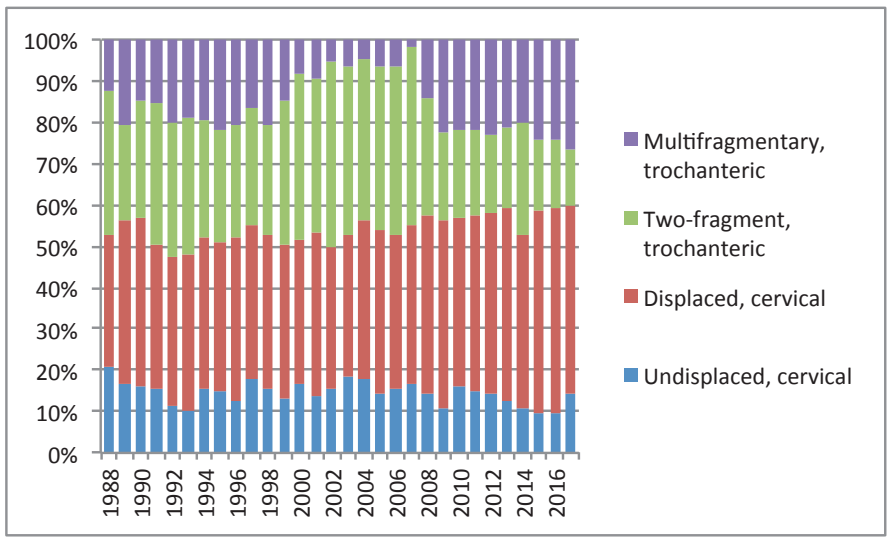

Figure 7.
Fracture type distribution 1988-2017.

In Paper I the results show that the men more often sustain undisplaced cervical fractures whereas more women have multifragmentary trochanteric fractures. The patients with trochanteric fractures are 2.3 years older and rely on walking aids in a higher extent.

When further analysing the mean age over time for the different fracture types no clear time trend can be seen (figure 8).

In regards to morbidity no difference is seen in distribution between the fracture types (table 4). The ratio between the ASA grades is the same as for the whole material. Over time, however, there is an increase in number of patients with ASA grade 3-4 in the group with displaced cervical fractures as well as in the group with multifragmentary trochanteric fractures.

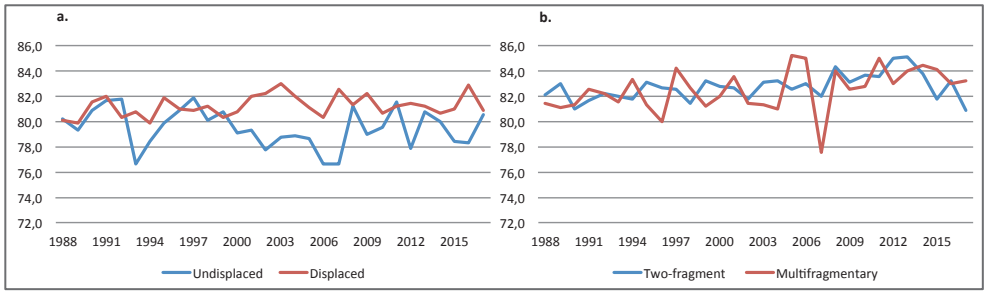

Figure 8.
Changes in mean age over time where (a) displays the cervical fractures and (b) shows the trochanteric fractures. In 2017 the mean age for the patients with cervical fractures types and the two-fragment trochanteric fractures is the same at 81 years, whereas the mean age for the patients with multifragmentary fractures is 83 years.

Table 4.
Distribution in morbidity in regards to fracture type.

	Cervical	Trochanteric
ASA 1-2	46.0%	44.5%
ASA 3-4	54.0%	55.5%

Operation method development

Over the years there is a clear shift from osteosynthesis to arthroplasty for the cervical fractures, as described in Paper I (figure 9). For the trochanteric fractures the results show a significant increase in the use of intramedullary nailing although sliding hip screw and plate still dominates as method of choice. The results also show that THA and osteosynthesis is mainly used for displaced cervical fractures in the younger age groups (figure 10).

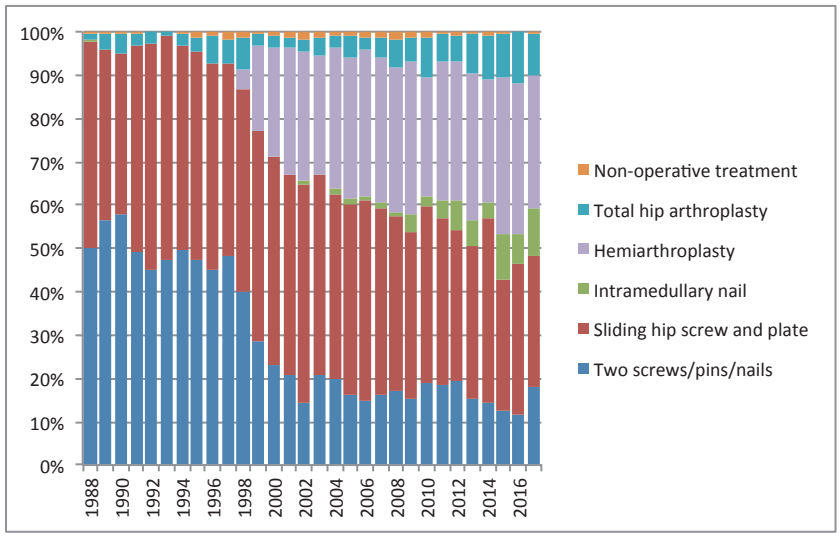

Figure 9.
Operation method distribution over time.

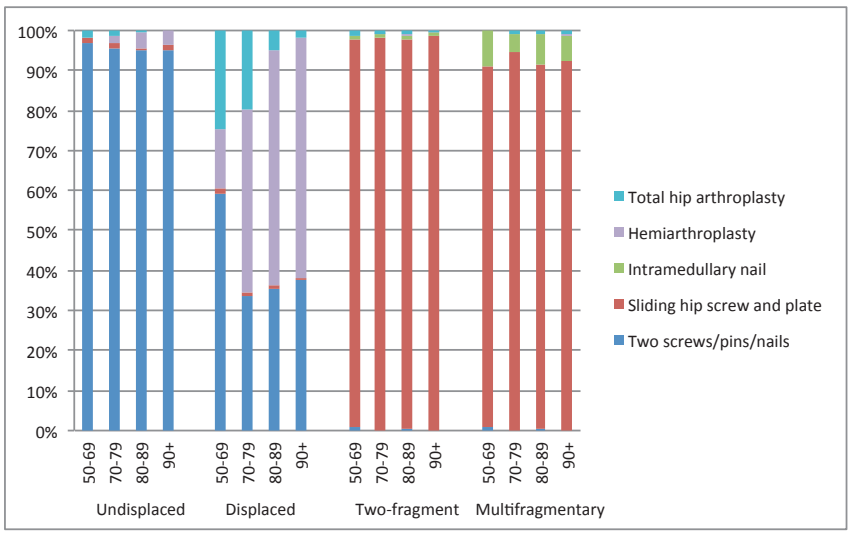

Figure 10.
Operation method distribution (1988-2012) in regards to age groups and fracture type. Cervical fractures are divided into undisplaced and displaced, and trochanteric into two-fragment and multifragmentary.

Outcome

Function

When comparing follow-up function to pre-fracture status the results show a decrease in both walking ability and number of patients living in own home all through the 30-year period, as well as an increase in the use of walking aids (figures 4-6).

When looking at the function at follow-up there is no statistically significant change during the first 25-year period. In 2006 there is a shift in walking ability at 4 months, with an increased number of patients with a dependent walking ability, making the change statistically significant for the period between 1999 and 2017, as described in Paper III.

When relating functional outcome to specific subgroups the results in Paper I, III and IV show that there is a significant difference in follow-up walking ability and housing between both fracture type and operation method. Those with most favourable outcome, in regards to independent walking ability and living in own home, are the patients operated with THA and those suffering from an undisplaced cervical fracture. Those operated with THA are also the ones with least remaining hip pain at 4 months. Patients operated with arthroplasty due to cervical fracture have better walking ability at follow-up compared to those operated with osteosynthesis. Those with the least favourable follow-up function are the patients with multifragmentary fractures, who also report the highest frequency of remaining hip pain, as well as those operated with intramedullary nailing. No conclusive trend can be seen when relating ASA grade and functional outcome over time.

Over time, more patients have returned to their own home at follow-up (61.3% in 1988 and 76.4% in 2017). The same trend is seen for those admitted from institutional care, 57.3% in 1988 and 73.6% in 2017.

EQ-5D VAS

Regarding self-reported health status, described in Paper IV, no relation is seen between pre-fracture EQ-5D VAS-score and age, ASA grade, fracture type or pre-fracture functional level. At follow-up, however, a correlation is seen between the EQ-5D VAS-score and ASA grade, housing and walking ability (table 5).

Table 5.
EQ-5D VAS score at follow-up.In EQ-5D VAS, the patient grades their health status on a scale between 0 and 100, where 0 is the worst possible status and 100 is the best.

		Mean value
ASA grade	ASA 1-2	65.0
	ASA 3-4	60.2
Housing	Own home	64.6
	Institutional care	56.6
Walking ability	Independent	67.6
	Dependent	56.0
	Unable to walk	46.5

Mortality

This aspect on outcome has been addressed in Paper I, III and IV. The 4-month mortality rate for the entire group display a slight decreasing trend over the past 30 years from 12.7% in 1988 to 10.0% in 2017 (figure 11).

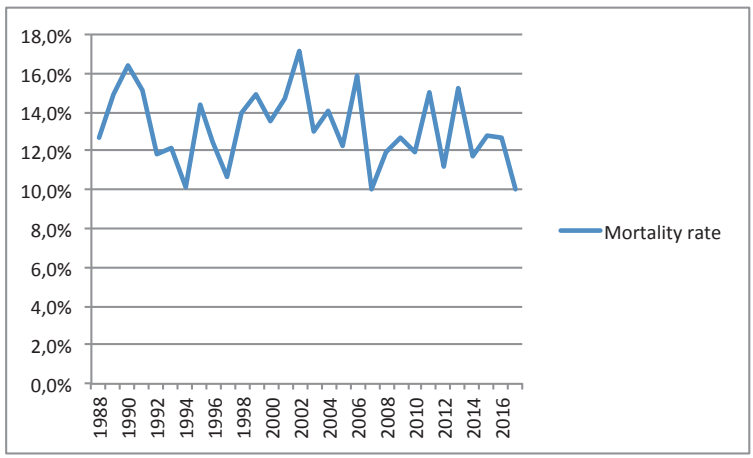

Figure 11.
Overall mortality rate at 4-months and the changes over time.

Specific subgroups presented in the papers are gender, ASA grade, age, fracture type and timing to surgery. Men have a significantly higher mortality rate compared to women even though the survival rate for men has improved over time (77.1% in 1988 to 88.9% in 2017). The mortality rates for the subgroups are presented in table 6.

Table 6.
Mortality rate at 4-months in regards to different subgroups as presented in Paper I and III.

		Mortality rate(%)
Gender	Men	16.5
	Women	12.0
ASA	1-2	7.0
	3-4	17.6
Age group	50-69	5.5
	70-79	7.9
	80-89	13.0
	90+	23.3
Fracture type	Undisplaced, cerv	11.2
	Displaced, cerv	12.9
	Two-fragment, troch	14.3
	Multifragmentary, troch	13.1
Days to surgery	0	13.0
	1	12.7
	2	12.5
	3	15.7

Between 1999 and 2017 the results in Paper III show no change in mortality rate over time for the different fracture types. For the ASA grades the results show a statistically significant decrease in mortality rate for both ASA 1-2 and ASA 3-4. However, when further analysing the distribution among the deceased the results in Paper III show a relative increase in mortality rate for the patients with ASA grade 3 (figure 12) when relating it to the morbidity shift (figure 3). The opposite is seen for the patients with ASA grade 2.

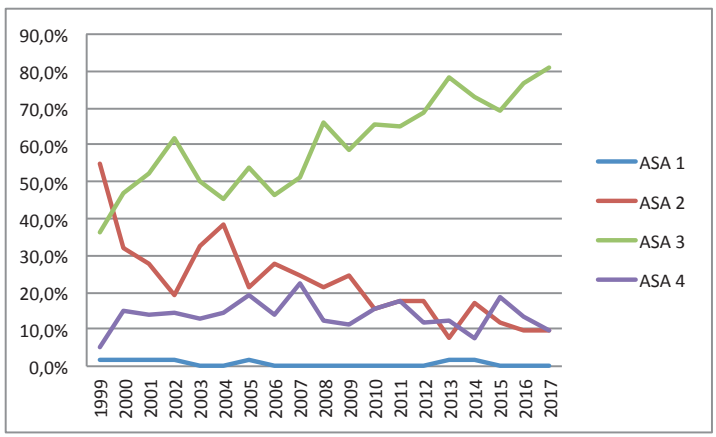

Figure 12.
Distribution of ASA grades among the deceased.

No statistically significant difference in mortality rate is seen in regards to time to surgery.

The mortality rate is higher for those admitted from institutional living (figure 13). No convincing change is seen over time. The same relation applies for walking ability; those with impaired walking ability display a higher mortality rate compared to those with independent walking ability. A slight decrease in mortality rate is seen over the last few years for the patients with independent walking ability pre-fracture (figure 14).

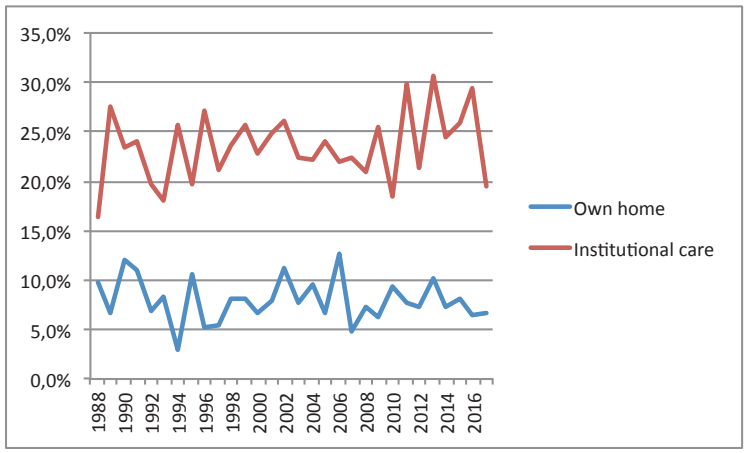

Figure 13.
Mortality rate in relation to pre-fracture housing.

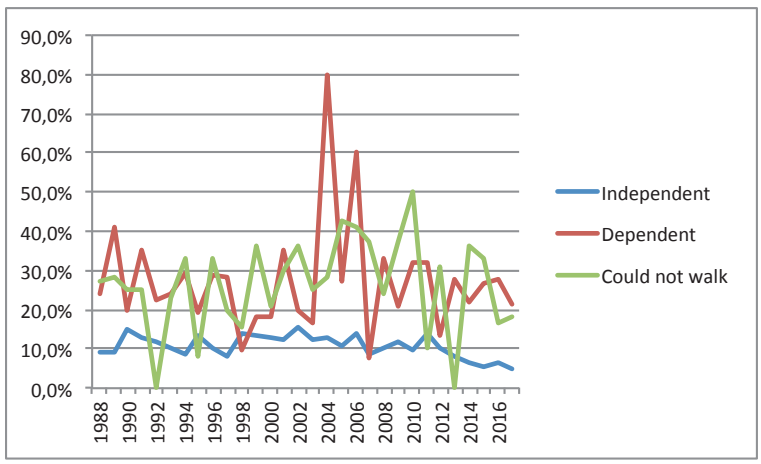

Figure 14.
Mortality rate in relation to pre-fracture walking ability. Between 2002 and 2007 the registered number of patients with dependent walking ability was very low whereas the number of deaths in the group remained relatively unchenged, hence the high mortality rate.

Care process development

The implementation of a care pathway

Paper II addresses the challenges in implementing a care pathway. The results show a significant time gain from arrival to X-ray in both Lund (2h3min) and Helsingborg (2h58min). The continuing pathway is after that without significant time gains in Lund with the PG being just 1 hour and 13 minutes faster. The pathway in Helsingborg is, up until surgery, significantly faster than the traditional care process by 15 hours and 14 minutes. No differences are seen in LOS, neither in Lund nor Helsingborg when comparing PG and NPG. In both Lund and Helsingborg there is a shorter time from arrival to surgery for those with ASA 1-2 (both NPGs) and those without anticoagulant therapy (both PGs).

The impact of care process development

This issue was first discussed in Paper III by analysing data from the three intervention periods described in the Background (Jan 1999-Sept 2003, Oct 2003-Mar 2007, Apr 2007-Dec 2017). When relating the functional outcome (housing and walking ability) to the three interventions no clear relation is seen. The LOS has significantly decreased between 1999 and 2017 and the change in LOS is statistically significant in the first and last intervention period (figure 15). No correlation is seen between the intervention periods and time to surgery.

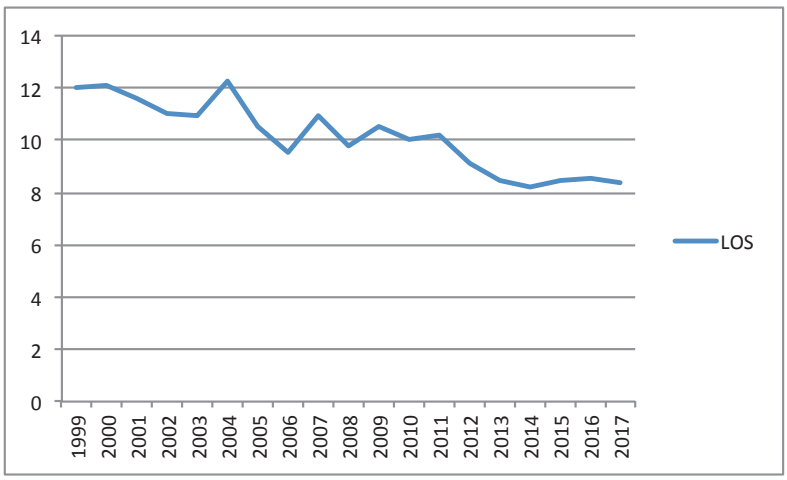

Figure 15.
Change in LOS over time.

In Paper IV the impact is further investigated by comparing the pathway with the traditional care process, as well as with the pathway ten years earlier. When using a specific, well implemented, care pathway the result show a time gain from arrival to surgery by 5 hours compared to the traditional care process. This is also seen when comparing the PGs over time. No difference is seen in LOS between PG and NPG.

No difference is seen in housing, walking ability or use of walking aids at 4-months follow-up when comparing the groups, nor can any difference be seen in regards to remaining hip pain or need of painkillers at 4-months. No difference is seen in pre-fracture or follow-up EQ-5D VAS-score.

There is no statistically significant difference in mortality rate, but a trend can be seen in favour for the traditional care process. Between 2007 and 2017 the mortality rate for the PG has increased from 6.8% to 10.5%, whereas it has decreased for the NPG from 11.0% to 8.8%. When further analysing the cause for this, three factors stand out. In 2017 more patients with ASA 3-4 came through the pathway (56.5% vs. 46.2% in 2007) and a higher number of these were deceased within the first 4 months. The same pattern is seen for the multifragmentary trochanteric fractures.

Timing to surgery

The last factor to stand out in Paper IV is time to surgery. In the group of deceased a higher number of patients in the PG has undergone surgery within 12 hours from admittance, both when comparing the PG with the NPG 2017 and when comparing the with the PG 2007. The specific subgroup analysis is presented in table 7.

When further analysing the impact of early surgery on mortality the 2017-data displays a relation between after-hour surgery and mortality. Among patients operated after-hours those operated within 12 hours from admittance had a higher mortality rate than those operated between 24 and 47 hours. The results also show a higher share of patients operated after-hours in the group who underwent surgery within 12 hours (Table 8).

As previously mentioned from the results in Paper III, there is no clear relation between time to surgery and mortality rate. What the results however show is that over 80% of the patients are operated within the first two calendar days from arrival. Moreover, the results show that patients in age group 70-79 years of age, as well as those with ASA grade 3-4 and patients with undisplaced cervical fractures are more likely to have to wait more than two calendar days for surgery.

Table 7.
The table display the distribution of deceased between PG and NPG for different sub-groups. The table also enables comparison between the years. The columns 'All' represent the total number of patients, alive and deceased, in each categorie. The ratio in percent is shown inside the parentheses.

		2007			2017		
		PG	**NPG**	**All**	**PG**	**NPG**	**All**
Time to surgery	<12	2(28.6)	2(11.8)	37(14.3)	9(42.9)	0(0)	71(19.2)
	12-23	3(42.9)	6(35.3)	87(33.6)	8(38.1)	7(46.7)	187(50.5)
	24-47	1(14.3)	7(41.2)	112(43.2)	3(14.3)	6(40.0)	89(24.1)
	48+	1(14.3)	2(11.8)	23(8.9)	1(4.8)	2(13.3)	23(6.2)
ASA grade	1	0	0	8(3.1)	0	0	15(4.1)
	2	2(28.6)	4(23.6)	106(40.9)	1(4.8)	2(13.3)	130(35.1)
	3	3(42.9)	10(58.8)	126(48.6)	20(95.2)	11(73.3)	214(57.8)
	4	2(28.6)	3(17.6)	19(7.3)	0(0)	2(13.3)	11(3.0)
Fracture type	Undisplaced, cervical	1(14.3)	4(23.5)	38(14.7)	2(9.5)	1(6.7)	50(13.5)
	Displaced, cervical	4(57.1)	8(47.1)	110(42.5)	8(38.1)	10(66.7)	161(43.5)
	Two-fragment, trochanteric	2(28.6)	5(29.4)	106(40.9)	3(14.3)	2(13.3)	52(14.1)
	Multifragmentary, trochanteric	0	0	5(1.9)	8(38.1)	2(13.3)	107(28.9)

Table 8.
The relation between mortality and after-hour surgery for different time-to-surgery groups in 2017.

Hours to surgery from admittance to hospital	Distribution (%) of after-hour surgery for each time-group	Mortality rate (%), after-hour surgery	Distribution (%) among the deceased operated after-hours
<12	66.7	15.9	77.8
12-23	19.3	15.2	33.3
24-47	25.9	4.8	10.0
>48	21.7	0.0	0.0

General discussion

With this thesis the author wanted to raise the question – what impact have all these management changes had on the hip fracture patients in regards to functional outcome and mortality? In this context, the short answer seems to be 'Limited'. During the past decades there is no improvement in follow-up function and the decrease in mortality rate 4 months after surgery for the whole patient group is only 2.7 percentage points over 30 years. The development of a specific care pathway for hip fracture patients does not show any clear advantages compared to the traditional care process apart from a reduced time to surgery, a variable that, in this context, does not affect the studied outcome variables.

For the orthopaedic community these results can play an important role in the future work with this patient group and give other aspects of the care a greater influence, rather than just focusing on the time-to-surgery- and mortality-aspects. The results in this thesis are not intended to be interpreted as a reason for not prioritizing this frail patient group to surgery, but merely point out other factors of importance in the further improvement efforts.

The patients and their hip fractures – are they all the same?

No.

As several researchers already have shown, cervical and trochanteric hip fractures are two different fracture types with different patient characteristics, treatment options and outcome, as described in the Background. The results of this thesis support that. The patients with multifragmentary trochanteric fractures are the high-risk patients in the hip fracture group with the lowest functional outcome. Even so, they are still cared for, and prioritized, in the same way as the fracture types with better outcome.

Apart from fracture type there are also gender differences. The women are more likely to live alone. It is fair to guess that this is due to the differences in life expectancy, the woman sustaining a fracture is older and thereby more likely to be

a widow. The gender differences in the use of walking aids might be explained by two factors; again, the age difference. Women are older and would therefore be at greater risk of decreased walking ability. By using a walking aid they can preserve their walking ability. The other factor could be the social context. As previously described in the Background the experience in using a walking aid vary and it could be seen as an obstacle, both emotionally and socially. It might be that men have a higher threshold in accepting the use of walking aids.

Outcome

Function

The fact that hip fracture patients do not regain their functional level, in terms of walking ability and housing, after the fracture is not surprising given that it is an old and frail group of patients. What is more surprising is that the results do not show any improvement in functional outcome over the first 25 years of this material. The general older population in Sweden did improve in mobility during the same time period and if the hip fracture patients were similar to the general population this would have been reflected in the results. The improvements made in hip fracture care would also have made a difference in outcome. However, the results do not show this. Two different reasons for this could be suggested. First, the patients have become somewhat older and there has been a shift in morbidity. That would increase the risk for deterioration in function but, due to the improvements made in the management, the patient group is able to remain on the same outcome level. Second, comparing the hip fracture patients to the older population in general might not be possible. Given the results in this thesis the thought that comes to mind is if patients sustaining a hip fracture already have 'proven themselves'. It could be that the health care system is able to create a care process for these patients that minimize complications, but the ability to improve function and mortality rate with clinical significance for this group is a much harder task – these outcome measures might be 'pre-destined' as soon as the hip fracture is a fact.

The patient's functional outcome seems to impact the follow-up EQ-5D VAS, regardless of the pre-fracture function, which is interesting. The same applies to ASA grade. The question is what role the home rehabilitation process plays in this. With the introduction of *Ädelreformen* the referral of responsibility drove a change towards more resources being given to fewer people, as previously mentioned. This made it difficult to conduct larger rehabilitation efforts to older still living in own home. And since there is an increase in number of patients that return to their

own home, this possible lack in rehabilitation opportunities might lead to a lowered self-reported health.

Not only could the home rehabilitation setting affect the outcome. A study by Gesar et al. in 2017 revealed that the staff at the ward, while the patient was admitted, could influence outcome in the sense that the healthy hip fracture patients, with a good pre-fracture function, became passive and insecure early in the rehabilitation due to the attitude from the staff, hence affecting the outcome [95].

Even if the rehabilitation after hip fracture still is an area for improvement the society can, on the other hand, witness the effect of the fracture-preventing efforts made. This since the older population increases in number but the hip fracture incidence does not.

The sudden increase in dependent walking ability in 2013 (pre-fracture) and in 2006 (at follow-up) is difficult to interpret. In 2006 the results display a tendency towards increased use of walking aids at follow-up (figure 6). Could it be that the increased use is misinterpreted as a sign of decreased walking ability? In the beginning of the millennium the rollator increased in popularity and more patients were prescribed one upon discharge from the hospital. This could lead to the interpretation that the walking ability has declined even though that might not have been the case.

Mortality

Even though the mortality rate has decreased with statistical significance during the last 19 years the question is whether or not it is a clinically significant decrease. Over the last 30 years the difference is only 2.7 percentage points and the different years display a wide variation as seen in figure 11. So, most likely, the clinical effect of the statistically significant decrease is limited. What is interesting is that over time the results display a relative increase in mortality rate for patients with ASA 3 together with a decrease for the patients with ASA 2. The reasons for this are unclear but might partly be a result of the age difference between the patients with ASA 2 and 3. However, for the patients with ASA 3 the mean age have remained relatively unchanged over time, and even though their mortality rate has decreased over time they have become overrepresented among the deceased over time. When analysing this, three factors should be addressed. The first is the reduction over time in LOS, where Nordström et al. 2015 described an increased risk of death when discharged from hospital earlier than 10 days after admission [54]. This thesis shows a significant reduction over time with a mean LOS of 8.3 days in 2017. The second is the discharge location. In another study by Nordström el al 2015 the result showed an increased risk of death when a

shortened LOS was combined with discharge to institutional care. Since the majority of the patients discharged to institutional care in this material are of ASA 3 (72.3%), the discharge location might have an impact. The third factor is the in-hospital location of care. As described in the Background the Skåne University hospital in Lund does not have any tradition in orthogeriatric collaboration for the hip fracture patients. Several studies have, however, shown beneficial outcome for hip fracture patients when managed in a geriatric setting. It might be that the patients of higher ASA grades would benefit from a transfer from orthopaedic to geriatric care, hence lowering the relative increase in mortality.

Another change in mortality over time is that for the male patients. Their improvement in survival rate needs mentioning. Could this be an effect of the increased knowledge about men sustaining hip fracture? As for the trochanteric fractures, it is well known that men sustaining a hip fracture are frailer to begin with and suffer a worse outcome. It could be that the health care, unconsciously, therefor prioritize their care differently than for the women. Also, since it is much less common for men to sustain a hip fracture more attention might be given to them due to that, leading to an improved survival rate.

Lead-times and the effect of timing to surgery

With the implementation of the hip fracture care pathway time gains were naturally of interest. However, the results show that the time gains made were not as large as one might have hoped, especially during the implementation year in Lund. The results in Paper II suggest that the possible time gains made are dependent on previously conducted improvement efforts as well as the implementation process used. One of the reasons for the lack of time gain in Lund was likely the missing commitment from the orthopaedic surgeons who experienced a lack of involvement in the early planning process. This shows the importance of 'uniting the forces' in the implementation process.

Even so, the care pathway continued to function and ten years later the wanted time gain to surgery was evident. Over the years the results also show a significant reduction in LOS. However, the effect of the time gains, in regards to the parameters studied in this thesis, are none.

In an attempt to bring a new aspect on the subject the choice was made to add a timing-to-surgery analysis to this thesis. No previous study, to the authors knowledge, have set the timing to surgery in relation to the care process development and used data spanning over such a long time period. Unfortunately, these results will probably not bring the international research community closer to a consensus in the matter. In this context, there is no apparent impact on patient mortality or functional outcome when surgery is done within 24 or 48 hours. There

is a trend of higher mortality rates among patients in the PG operated within 12 hours. Also, there seem to be a relation between early surgery, increased mortality rate and after-hour surgery. These results are however hard to draw any conclusions from since it was a very limited number of patients. To be able to answer that question properly a larger dataset is needed. But for the results regarding the lack of difference between surgery within 24 or 48 hours in Paper III this could have an impact nationally and should add to the debate on timing to surgery here in Sweden, even though the thesis do not address reasons for surgical delay. This thesis shows that there are other factors than timing to surgery that have an impact on the outcome variables studied here.

Operation method development and outcome

When it comes to operation method development it does not seem to have any impact on functional outcome on the group as a whole. The results do however show a difference in the specific operation methods in regards to walking ability and remaining pain, in favour for the THA. Even though the patients with displaced cervical fractures display a higher ASA grade over time.

Over time the results show a significant increase in the use of intramedullary nailing but also the least favourable outcome in regards to remaining pain compared to the other operation methods. The number of patients treated is however too small to really be able to make a fair conclusion.

The care process development

At Skåne University Hospital, and in the Department of Orthopaedics, all personnel work very hard to prioritize the hip fracture patients and the changes made in the general care for the patients have been enormous throughout the years. This might be one of the reasons to why the results do not display any improvement in functional outcome or why time to surgery seems of less importance. The hip fracture patients have become older and sicker but because of the care they are given they have not deteriorated. And it does not matter if they are taken through a care pathway or a traditional care process. The care is the same. The hospital's way of managing this patient group makes the timing to surgery, in this context, not as important. Within reasonable time limits of course. To support this idea a Hungarian study from 2005 compared outcome after hip fracture between Hungary and Sweden and found a better outcome for the Swedish patients [96]. Other factors, rather than timing to surgery, might be of

greater importance, such as postoperative rehabilitation or perioperative nursing care. This was suggested by Foss and Khelet in 2006 when they showed an increased short-term mortality among hip fracture patients admitted during weekends and holidays [97].

However, some improvements can still be made. First, stop thinking of the hip fracture patients as a homogenous group and only prioritize them to surgery according to admission time. They are not the same, as this thesis, as well as other studies, show. The next step in the care process development might be to, once in the ward, take fracture type and morbidity into more consideration. A prospective, randomised, controlled trial conducted by Prestmo et al. 2008-2010 showed improved mobility at 4-months for patients in orthogeriatric care compared to usual orthopaedic care [98]. The benefits of geriatric rehabilitation have also been shown by Nordström et al. 2016, as previously mentioned.

Have we reached the top in optimization?

The lack of differences/changes/improvement in the results of this thesis might be perceived as somewhat of a failure. Despite all the efforts made the functional outcome has not improved. The author chooses to see it in a different way. The hip fracture patients have become both older and sicker, but even so they don't die in a higher extent. It is not farfetched to think that this is due to the attention given to this patient group. But could it be that the optimization made have reached its top? The result is dependent on what outcome parameter we study. There is still much work that needs to be done, both to improve the care for hip fracture patients and for the older population in general.

There is a great value in creating specific care processes. This enables evaluation and further optimization and development of the healthcare. However, it is important to structure and align the process throughout all of the activities based on the goal set, hence making the objective apparent for everyone in the team.

Limitations and strengths

For this thesis it might have added power to the findings to compare the patient outcome to the general population by using data from the National Board of Health and Welfare. More patients and more variables could also have been included to the datasets, either the whole Skåne Region or the entire country. This would however had in impact on the reliability of the data. The strength in the Lund registry is that it has had a high completeness all through the lifetime of the

registry, giving the results in this thesis a high reliability, even though a larger dataset could have given more information in certain aspects. The use of only the Lund registry raises the question on external validity but since many Swedish hospitals now work with similar pathways and the care process development for hip fracture patients is not limited to the hospital in Lund alone, the results in the thesis are regarded as applicable in a larger context.

Using data from a registry to conduct research requires internal validity in the registry. The variables in RIKSHÖFT are all validated and were tested early on in different settings. The primary variable to assess morbidity, ASA grade, is well established and widely used. And even though the use of the ASA classification system has its limitation in regards to fully enabling a morbidity assessment, it is, together with cognitive impairment and use of anticoagulant therapy, the only variables used in RIKSHÖFT to assess morbidity.

For this thesis the choice was made to combine categories in some of the variables. This has several advantages. First, to create larger groups add to the power of the results as well as making the results more clinically applicable. Second, it reduces the risk of misinterpretation of the results due to registration errors in specific variables.

To conduct studies that are retrospective in their nature could be seen as a limitation when wanting to evaluate the impact of a care process, or the impact of timing to surgery, on outcome. For this it might be a strength to conduct a prospective study, randomizing patients into different groups. This could however pose a problem in regards to the ethical considerations if the outcome in one group is suspected to be better than in the other. Also, this randomization already exists naturally since patients are handled both according to the new clinical pathway and in the traditional way, and information about that is registered in RIKSHÖFT. With a prospective study on care process development comes the risk of the Hawthorne-effect, meaning that if individuals know that they are being observed they automatically change their behaviour in response to that, hence modifying the outcome. Therefore it might be better to be able to conduct a larger, nation-wide study where the registration of pathway-use is implemented in all of the registries participating hospitals that use such a pathway.

Conclusions

- The impact of care process development for hip fracture patients is, in our context, limited in regards to functional outcome, and the functional outcome for hip fracture patients, in terms of housing and walking ability, has not improved over the last 30 years.
- Certain subgroups are displaying a worse outcome compared to the group as a whole; male patients, patients with trochanteric fractures and patients with ASA 3.
- The implementation of a specific hip fracture care pathway is likely dependent on previously conducted improvement efforts and the current implementation process.
- A specific hip fracture care pathway results in a time gain to surgery compared to a traditional care process. The results in this thesis do not show any impact on mortality or functional outcome.
- Over time there is no significant change in mortality rate when relating it to timing to surgery, although there is a tendency towards higher mortality rates when the patient is operated after-hours and within 12 hours after admittance.

Future research

To further optimize the management and care process development for hip fracture patients, other aspects than operations methods, mortality and time to surgery needs to be studied. With the on-going changes in the society and the increasing demands from the patients, as well as the welfare system, a wider perspective has to be considered. It has to be made clear what the incentive behind the care process development is and to do so more studies regarding rehabilitation, nursing strategies and health economics are needed. The focus in the future research on hip fracture patient care should be made with a multidisciplinary approach with the patient, rather than the diagnosis, in the centre.

In Lund studies are already conducted regarding the further optimization of the hip fracture patient care. One study analyses the effect a pre-operative carbohydrate-rich drink have on outcome and the results indicate that the use of such a drink can decrease the number of postoperative complications. More studies concerning the care of the patients need to be done.

As a first step to further analyse the impact of the hip fracture care pathway the author aim to investigate the hip fracture related readmission rate. For this approval has been sought from the Swedish Ethical Review Authority.

Furthermore, a closer look has to be taken on the specific subgroups where outcome is worse. A randomized prospective study for hip fracture patients with ASA 3, selecting them to either geriatric or orthopaedic in-hospital care and then analyse outcome might bring light on the question regarding the relative increase in mortality rate for this group. Another randomized study that could be set up is that concerning the different fracture types.

To be able to further analyse the impact on time to surgery a nationwide collaboration needs to be set up and the variable in RIKSHÖFT regarding reason for delay should be assessed.

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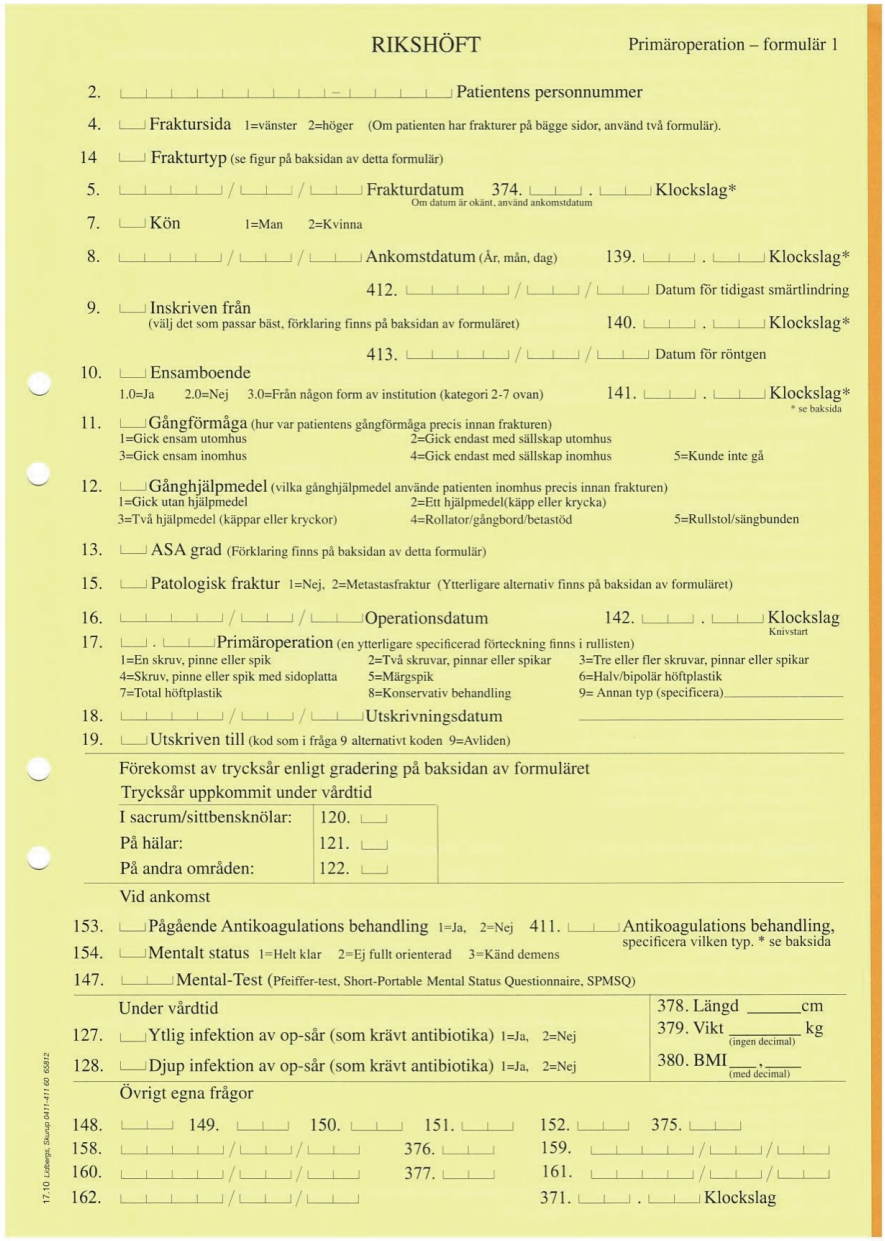
Appendix 1.

The RIKSHÖFT forms used in this thesis.



RIKSHÖFT — Primäroperation – formulär 1

2. Patientens personnummer

4. Fraktursida 1=vänster 2=höger (Om patienten har frakturer på bägge sidor, använd två formulär).

14 Frakturtyp (se figur på baksidan av detta formulär)

5. Frakturdatum 374. Klockslag* (Om datum är okänt, använd ankomstdatum)

7. Kön 1=Man 2=Kvinna

8. Ankomstdatum (År, mån, dag) 139. Klockslag*

412. Datum för tidigast smärtlindring

9. Inskriven från (välj det som passar bäst, förklaring finns på baksidan av formuläret) 140. Klockslag*

413. Datum för röntgen

10. Ensamboende
1.0=Ja 2.0=Nej 3.0=Från någon form av institution (kategori 2-7 ovan) 141. Klockslag* * se baksida

11. Gångförmåga (hur var patientens gångförmåga precis innan frakturen)
1=Gick ensam utomhus 2=Gick endast med sällskap utomhus
3=Gick ensam inomhus 4=Gick endast med sällskap inomhus 5=Kunde inte gå

12. Gånghjälpmedel (vilka gånghjälpmedel använde patienten inomhus precis innan frakturen)
1=Gick utan hjälpmedel 2=Ett hjälpmedel(käpp eller krycka)
3=Två hjälpmedel (käppar eller kryckor) 4=Rollator/gångbord/betastöd 5=Rullstol/sängbunden

13. ASA grad (Förklaring finns på baksidan av detta formulär)

15. Patologisk fraktur 1=Nej, 2=Metastasfraktur (Ytterligare alternativ finns på baksidan av formuläret)

16. Operationsdatum 142. Klockslag (Knivstart)

17. Primäroperation (en ytterligare specificerad förteckning finns i rullisten)
1=En skruv, pinne eller spik 2=Två skruvar, pinnar eller spikar 3=Tre eller fler skruvar, pinnar eller spikar
4=Skruv, pinne eller spik med sidoplatta 5=Märgspik 6=Halv/bipolär höftplastik
7=Total höftplastik 8=Konservativ behandling 9= Annan typ (specificera)_____

18. Utskrivningsdatum _____

19. Utskriven till (kod som i fråga 9 alternativt koden 9=Avliden)

Förekomst av trycksår enligt gradering på baksidan av formuläret
Trycksår uppkommit under vårdtid

I sacrum/sittbensknölar:	120.
På hälar:	121.
På andra områden:	122.

Vid ankomst

153. Pågående Antikoagulations behandling 1=Ja, 2=Nej 411. Antikoagulations behandling, specificera vilken typ. * se baksida

154. Mentalt status 1=Helt klar 2=Ej fullt orienterad 3=Känd demens

147. Mental-Test (Pfeiffer-test, Short-Portable Mental Status Questionnaire, SPMSQ)

Under vårdtid

127. Ytlig infektion av op-sår (som krävt antibiotika) 1=Ja, 2=Nej

128. Djup infektion av op-sår (som krävt antibiotika) 1=Ja, 2=Nej

378. Längd _____cm
379. Vikt _____ kg (ingen decimal)
380. BMI___,___ (med decimal)

Övrigt egna frågor

148. 149. 150. 151. 152. 375.
158. 376. 159.
160. 377. 161.
162. 371. Klockslag

17:10 Lidingö, Skurup 0417-417 60 65812

Boendeformskoder (Fråga 9 och 19)

1 = Eget hem, ett oberoende boende, där personen kan få hjälp av närstående, privat eller kommunal hemtjänst. Seniorboende (ex +55 boende), eget eller släktings hem.
2 = Gruppboende ex. demensboende, förståndshandikappade. Möjlighet till mycken hjälp finns.
3 = Särkilt boende, alla former av äldreboende, före detta ålderdomshem och sjukhem. Där tillgång till gemensamma utrymmen finns, tillgång till en sjuksköterska, vård och omsorg finns dygnet runt.
6 = Rehabiliteringsavdelning, korttidsboende. Dit patienten går för rehabilitering i landstings- eller kommunal regi, eller i väntan på ett nytt boende.
7 = Akutsjukhus. Annan klinik eller sjukhus.
8 = Annat
9 = Avliden (användes endast vid svarandet på frågorna 19 och 34).

Antikoagulations behandling, som kan fördröja knivstart (fråga 411)

1. Waran
2. Heparin inkl LMWH(Lågmolekulära hepariner) (t ex Klexane, Fragmin, Innohep)
3. Övriga Vit K antagonister (t ex Marcoumar, Sintrom)
4. Trombocythämmare inkl. DAPT (dual antiplatelet therapy) (t ex Plavix, Brilique)
5. NOAC´s (factor Xa-hämmare t ex Eliquis, Xarelto, Trombinhämmare t ex Pradaxa)
6. Kombinationer av perorala antikoagulantia och trombocythämmare

ASA-koder (fråga 13)

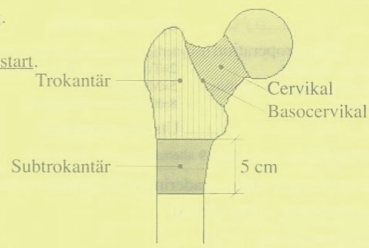
1 = Helt frisk.
2 = Väl kontrollerad sjukdom som inte påverkar det dagliga livet (t.ex. hypertoni).
3 = Symptomgivande sjukdom men med lindriga restriktioner i det dagliga livet (t.ex. mild diabetes).
4 = Symptomgivande sjukdom som ger allvarliga restriktioner (t.ex. svår kronisk bronkit eller instabil diabetes).
5 = Moribund.

Klockslag (fråga 139, 140, 141 142 och 374)

139. Klockslag för ankomst.
140. Klockslag för tidigaste smärtlindring.
141. Klockslag för röntgen.
142. Klockslag för operation, som är knivstart.
374. Klockslag för fraktur.

Frakturtyper (fråga 14)

1 = Odislocerad cervikal (Garden 1-2).
2 = Dislocerad cervikal (Garden 3-4).
3 = Basocervikal.
4 = Trokantär tvåfragmentfraktur.
5 = Trokantär flerfragmentfraktur.
6 = Subtrokantär.



Patologisk fraktur-koder (fråga 15)

1 = Nej.
2 = Metastasfraktur.
3 = Malign primär bentumör.
4 = Bencysta.
5 = Paget's sjukdom.
6 = Annan typ (specificera).

Gradering av trycksår

0 = Inget.
1 = Kvarstående missfärgning.
2 = Epitelskada med blåsa, spricka eller avskavning av huden.
3 = Fullhudsdefekt utan djup sårhåla ner till underhuden.
4 = Fullhudsdefekt med djup sårhåla.

Pfeiffer – test (Short Portable Mental Status Questionnaire, SPMSQ)

På var och en av nedanstående tio frågor ger rätt svar 1 poäng, dvs. maximal utdelning på testet är 10 poäng.

1 = Vad är det för datum idag?
2 = Vilken veckodag är det?
3 = Var är du nu?
4 = Vilken adress har du?
5 = Hur gammal är du?
6 = När föddes du?
7 = Vad heter den nuvarande statsministern.
8 = Vad heter den förre stasministern?
9 = Vad var din mors namn som ogift? (Kvinnligt förnamn och ett annat efternamn än patientens räcker för rätt svar).
10 = Dra 3 från 20 och fortsätt så hela vägen ner.

RIKSHÖFT

2. ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋-⌊_⌋⌊_⌋⌊_⌋⌊_⌋ Patientens personnummer

4. ⌊_⌋ Fraktursida 1=vänster 2=höger (Om patienten har frakturer på bägge sidor, använd två formulär).

14. ⌊_⌋ Frakturtyp (Enligt registrering av primäroperation)

5. ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋ / ⌊_⌋⌊_⌋ / ⌊_⌋⌊_⌋ Frakturdatum (Om det är okänt, använd ankomstdatum)

7. ⌊_⌋ Kön 1=Man 2=Kvinna

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20. ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋ / ⌊_⌋⌊_⌋ / ⌊_⌋⌊_⌋ Uppföljningsdatum (År, mån, dag)

21. ⌊_⌋ Uppföljning gjord via
1=Ansikte mot ansikte intervju med patienten 2=Ansikte mot ansikte intervju med vårdare/släkting/vän 3=Telefonsamtal med patient
4=Telefonsamtal med vårdare/släkting/vän 5=Skriftligt svar av patienten
6=Skriftligt svar av vårdare/släkting/vän 7=Annat 8=Går ej att nå

22. ⌊_⌋ Boendeform (välj det som passar bäst, förklaring finns på baksidan av formuläret)
1=Eget hem 2=Gruppboende 3=Särskilt boende
6=Rehabiliteringsavd 7=Akutsjukhus 8=Annat 9=Avliden

23. ⌊_⌋ Gångförmåga (hur är patientens normala gångförmåga 4 månader efter frakturen)
1=Går ensam utomhus 2=Går endast med sällskap utomhus
3=Går ensam inomhus 4=Går endast med sällskap inomhus 5=Kan inte gå

24. ⌊_⌋ Gånghjälpmedel (vilka gånghjälpmedel använder patienten 4 månader efter frakturen)
1=Går utan hjälpmedel 2=En käpp eller krycka
3=Två käppar eller kryckor 4=Rollator/gångbord/betastöd 5=Rullstol/sängbunden

25. ⌊_⌋ Smärtor i höften (välj det som passar bäst)
1=Smärtan i min höft är svår, den finns där hela tiden även när jag inte rör mig.
2=Smärtan i min höft är svår när jag rör mig, den hindrar all aktivitet.
3=Smärtan i min höft är tolerabel men tillåter aktivitet.
4=Smärtan kommer endast efter vissa aktiviteter och försvinner fort vid vila.
5=Jag har endast lätt smärta som kommer ibland främst när jag börjar gå men släpper efter några steg.
6=Jag har ingen smärta i min höft.
7=Kan inte svara.
370= ⌊_⌋ Kvarstår på smärtstillande på grund av frakturen 1=Ja 2=Nej

26. Vistelse under 4-månadersperioden (120 dagar)
Använd samma nummer för boendeform som i fråga 22. Försök även ange antal dagar och för orsak, använd följande koder:
1 = Komplikation i höften som lett till om operation.
2 = Komplikation i höften, men ingen om operation.
3 = Komplikation från annan del av kroppen, men orsakad av höftskadan.
4 = Har inte kunnat återvända hem p g a höftskadan.
5 = Inlagd av annat skäl, ej orsakat av höftskadan.
6 = Åter i tidigare boende.
7 = Vet ej/inte uppgett orsak.
8 = Rehabilitering.

1: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
5: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
2: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
6: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
3: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
7: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
4: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋
8: typ ⌊_⌋, dagar ⌊_⌋⌊_⌋⌊_⌋ och orsak ⌊_⌋

27. ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋ / ⌊_⌋⌊_⌋ / ⌊_⌋⌊_⌋ Avliden
(Om patienten avlidit inom 4 månader från frakturtillfället, ange datum med fyra siffror för år, t ex 2005, månad och dag.)

Övriga egna frågor

372. _____ 373. _____

15.04 Lidbergs, Sävsjö 0411-411 60 62451

RIKSHÖFT

EQ-5D-5L preoperativt för ..... (personnummer)

☐ Fraktursida 1 = vä, 2 = hö ☐ Besvarad 1 = självuppskattad, 2 = proxi, anhörig

Frakturdatum _ _ _ _, _ _, _ _ Ankomstdatum _ _ _ _, _ _, _ _ Intervjudatum _ _ _ _, _ _, _ _

Markera, genom att kryssa i en ruta i varje nedanstående grupp, vilket påstående som bäst beskriver Ditt hälsotillstånd veckan innan frakturen. Se även baksidan

RÖRLIGHET

Jag har inga svårigheter med att gå omkring	❑
Jag har lite svårigheter med att gå omkring	❑
Jag har måttliga svårigheter med att gå omkring	❑
Jag har stora svårigheter med att gå omkring	❑
Jag kan inte gå omkring	❑

PERSONLIG VÅRD

Jag har inga svårigheter med att tvätta mig eller klä mig	❑
Jag har lite svårigheter med att tvätta mig eller klä mig	❑
Jag har måttliga svårigheter med att tvätta mig eller klä mig	❑
Jag har stora svårigheter med att tvätta mig eller klä mig	❑
Jag kan inte tvätta mig eller klä mig	❑

VANLIGA AKTIVITETER

(t ex arbete, studier, hushållssysslor, familje- eller fritidsaktiviteter)

Jag har inga svårigheter med att utföra mina vanliga aktiviteter	❑
Jag har lite svårigheter med att utföra mina vanliga aktiviteter	❑
Jag har måttliga svårigheter med att utföra mina vanliga aktiviteter	❑
Jag har stora svårigheter med att utföra mina vanliga aktiviteter	❑
Jag kan inte utföra mina vanliga aktiviteter	❑

SMÄRTOR/BESVÄR

Jag har varken smärtor eller besvär	❑
Jag har lätta smärtor eller besvär	❑
Jag har måttliga smärtor eller besvär	❑
Jag har svåra smärtor eller besvär	❑
Jag har extrema smärtor eller besvär	❑

ORO/NEDSTÄMDHET

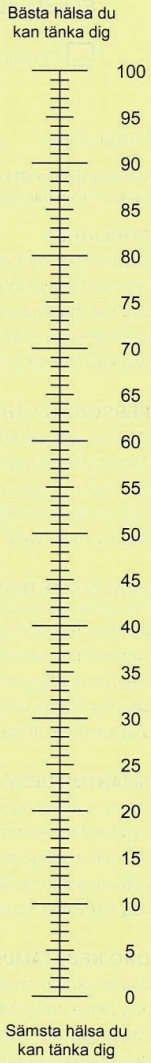
Jag är varken orolig eller nedstämd	❑
Jag är lite orolig eller nedstämd	❑
Jag är ganska orolig eller nedstämd	❑
Jag är mycket orolig eller nedstämd	❑
Jag är extremt orolig eller nedstämd	❑

Var god vänd!

17:10 Lidbergs, Skurup 0411-411 60 110344

- Vi vill veta hur bra eller dålig din hälsa var veckan innan frakturen.
- Den här skalan är numrerad från 0 till 100.
- 100 är den bästa hälsa du kan tänka dig.
  0 är den sämsta hälsa du kan tänka dig.
- Sätt ett X på skalan för att visa hur din hälsa var veckan innan frakturen.
- Skriv nu i rutan nedan det nummer du har markerat på skalan.

DIN HÄLSA VECKAN INNAN FRAKTUREN = ☐



RIKSHÖFT

EQ-5D-5L vid uppföljning för ..... (personnummer)

☐ Fraktursida 1 = vä, 2 = hö ☐ Besvarad 1 = självuppskattad, 2 = proxi, anhörig

Frakturdatum _ _ _ _, _ _, _ _ Ankomstdatum _ _ _ _, _ _, _ _ Intervjudatum _ _ _ _, _ _, _ _

Markera, genom att kryssa i en ruta i varje nedanstående grupp, vilket påstående som bäst beskriver Din hälsa IDAG.
Se även baksidan

RÖRLIGHET
- Jag har inga svårigheter med att gå omkring ❑
- Jag har lite svårigheter med att gå omkring ❑
- Jag har måttliga svårigheter med att gå omkring ❑
- Jag har stora svårigheter med att gå omkring ❑
- Jag kan inte gå omkring ❑

PERSONLIG VÅRD
- Jag har inga svårigheter med att tvätta mig eller klä mig ❑
- Jag har lite svårigheter med att tvätta mig eller klä mig ❑
- Jag har måttliga svårigheter med att tvätta mig eller klä mig ❑
- Jag har stora svårigheter med att tvätta mig eller klä mig ❑
- Jag kan inte tvätta mig eller klä mig ❑

VANLIGA AKTIVITETER
(t ex arbete, studier, hushållssysslor, familje- eller fritidsaktiviteter)
- Jag har inga svårigheter med att utföra mina vanliga aktiviteter ❑
- Jag har lite svårigheter med att utföra mina vanliga aktiviteter ❑
- Jag har måttliga svårigheter med att utföra mina vanliga aktiviteter ❑
- Jag har stora svårigheter med att utföra mina vanliga aktiviteter ❑
- Jag kan inte utföra mina vanliga aktiviteter ❑

SMÄRTOR/BESVÄR
- Jag har varken smärtor eller besvär ❑
- Jag har lätta smärtor eller besvär ❑
- Jag har måttliga smärtor eller besvär ❑
- Jag har svåra smärtor eller besvär ❑
- Jag har extrema smärtor eller besvär ❑

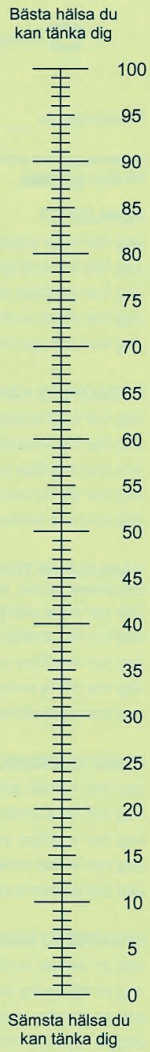
ORO/NEDSTÄMDHET
- Jag är varken orolig eller nedstämd ❑
- Jag är lite orolig eller nedstämd ❑
- Jag är ganska orolig eller nedstämd ❑
- Jag är mycket orolig eller nedstämd ❑
- Jag är extremt orolig eller nedstämd ❑

Var god vänd!

17:10 Lidbergs Skrivtryck 0411-41160 110345

- Vi vill veta hur bra eller dålig din hälsa är IDAG.
- Den här skalan är numrerad från 0 till 100.
- 100 är den bästa hälsa du kan tänka dig.
  0 är den sämsta hälsa du kan tänka dig.
- Sätt ett X på skalan för att visa hur din hälsa är IDAG.
- Skriv nu i rutan nedan det nummer du har markerat på skalan.

DIN HÄLSA IDAG = ☐



Appendix 2.

Recoding key.

Variable	Old categories	New categories	Old categories combined
Admitted from/housing at 4 months	1. Own home	1.Own home	
	2.Group/service housing	2. Institutional care	2-6
	3. Full-service unit, nursing home		
	6. Rehabilitation unit, convalescent home		
	7. Acute hospital	3. Other	7-8
	8. Other		
Walking ability	1. Could walk alone outdoors	1. Independent walking ability	1-3
	2. Could walk accompanied outdoors		
	3. Could walk alone indoors		
	4. Could walk accompanied indoors	2. Dependent walking ability	
	5.Could not walk	3. Could not walk	
Walking aids	1. No aid	1. No aid or one stick	1-2
	2. One aid (crutch or stick)		
	3. Two aids	2. Walking aids	3-4
	4. Rollator/walking frame		
	5. Wheelchair/bedridden	3. Wheelchair/bedridden	
Hip pain at follow-up	1. Severe and constant	3. Severe	1-2
	2. Severe when moving		
	3. Tolerable, allow activity	2. Light/Moderate	3-5
	4.Pain in certain activities		
	5. Light and occational		
	6. No pain	1. No pain	

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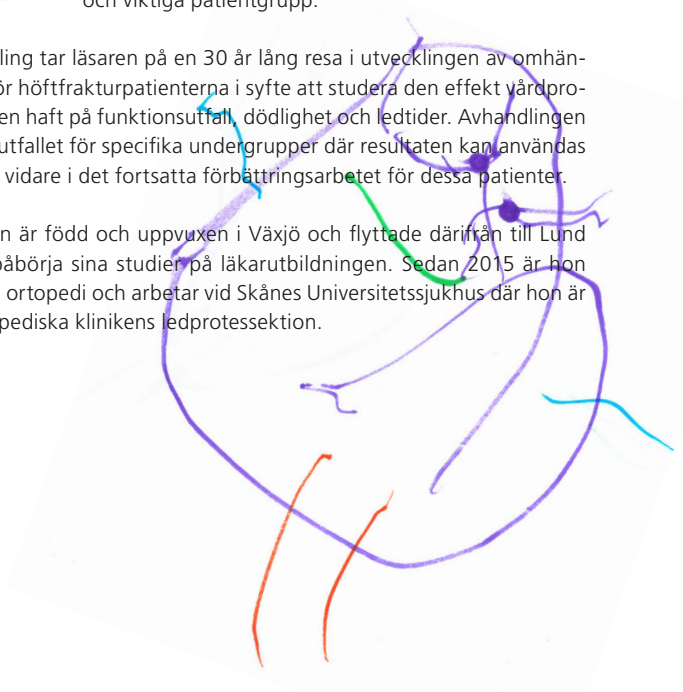
A 30-year journey in hip fracture care

Att alltid sträva mot förbättringar är en av vårdens hörnstenar. Men vem är det som ska gynnas av förbättringarna och vilka utfall är viktiga att studera? För höftfrakturpatienterna har förbättringsarbetet kring omhändertagandet varit aktuellt de senaste decennierna och Lund var ett av de första sjukhusen i landet att börja registrera behandling och utfall för denna stora och viktiga patientgrupp.

Denna avhandling tar läsaren på en 30 år lång resa i utvecklingen av omhändertagandet för höftfrakturpatienterna i syfte att studera den effekt vårdprocessutvecklingen haft på funktionsutfall, dödlighet och ledtider. Avhandlingen tar också upp utfallet för specifika undergrupper där resultaten kan användas för att komma vidare i det fortsatta förbättringsarbetet för dessa patienter.

Emma Turesson är född och uppvuxen i Växjö och flyttade därifrån till Lund 2002 för att påbörja sina studier på läkarutbildningen. Sedan 2015 är hon specialist inom ortopedi och arbetar vid Skånes Universitetssjukhus där hon är en del av Ortopediska klinikens ledprotessektion.



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