Prevention of Pressure Ulcers in Patients with Hip Fractures

Definition, Measurement and Improvement of the Quality of Care

BY

LENA GUNNINGBERG
Dissertation for the Degree of Doctor of Philosophy (Faculty of Medicine) in Caring Sciences presented at Uppsala University in 2001

ABSTRACT


The aims of the present thesis were to survey the prevalence and incidence of pressure ulcers in patients with hip fracture and to investigate nursing staff knowledge and documentation regarding pressure ulcer prevention for the same patient group. Another aim was to test the effect of three preventive interventions: risk assessment and pressure ulcer grading, a pressure-reducing mattress and an educational programme. Experimental, comparative and descriptive designs were used and quality improvement philosophy guided the research. In 1997 and 1999, a total of 124 and 101 patients > 65 years with hip fractures were included and followed with risk assessment and skin observation. Audit of patient records, a questionnaire to nursing staff and a focus group interview were also employed.

The findings from the first studies showed that 20% of the patients had pressure ulcers on arrival to the hospital. During the hospital stay, 55% developed new pressure ulcers. Nursing staff knowledge and documentation regarding pressure ulcer prevention was unsatisfactory. An extensive educational programme was developed and conducted in 1998. Twenty-five registered nurses participated from the hospital and the community setting.

There were no significant differences in the prevalence/incidence of pressure ulcers between the experimental and control groups in the two experimental studies. However, there was a significant reduction of the incidence of pressure ulcers between 1997 and 1999 (from 55% to 29%). The focus group indicated that there had been changes since 1997 in nursing and treatment routines in the Accident and Emergency Department and in the orthopaedic wards.

Key words: Pressure ulcer prevention, hip fractures, quality improvement.

Lena Gunningberg, Department of Public Health and Caring Sciences, Section of Caring Sciences, Uppsala University, SE-751 83 Uppsala, Sweden.

© Lena Gunningberg 2000
ISSN 0282-7476
ISBN 91-554-4889-5
Printed in Sweden by Uppsala University, Tryck & Medier, Uppsala 2000
To my family
Per, Sara and Jonas
ORIGINAl PUBLICATIONS

This doctoral thesis is based on the following papers, which are referred to by their Roman numerals:


Reprints of paper I, II and IV were made with permission of the publisher.
TABLE OF CONTENT

INTRODUCTION .................................................................................................................. 1
Pressure ulcers – some historical reflections................................................................. 1
Quality improvement in health care................................................................................... 1
Pressure ulcers – an area for improvement................................................................. 4
  Epidemiology of pressure ulcers ................................................................................ 4
  Pressure ulcers – definition and risk factors............................................................. 5
  Classification of pressure ulcers ................................................................................. 6
  Risk assessment .......................................................................................................... 7
  Prevention of pressure ulcers ..................................................................................... 7
  Costs of care related to pressure ulcers ....................................................................... 9
The rationale for the present research ........................................................................... 10

AIMS .................................................................................................................................. 11

METHOD ............................................................................................................................. 12
Design ................................................................................................................................. 12
Settings ............................................................................................................................... 12
Interventions ..................................................................................................................... 13
  Risk assessment and pressure ulcer grading (Study I) ............................................. 13
  Pressure-reducing mattress (Study IV) ..................................................................... 13
  Educational programme (Study V) ............................................................................ 14
Subjects ............................................................................................................................. 15
  Patients (Studies I, II, IV, V) ...................................................................................... 15
  Staff (Studies III, V) .................................................................................................... 16
Data collection .................................................................................................................. 16
  Risk assessment (Studies I, II, IV, V) ........................................................................ 16
  Pressure ulcer classification (Studies I, II, IV, V) .................................................. 16
Audit of patient records (Studies I-V) ........................................................................... 17
  Questionnaire ............................................................................................................ 18
  Focus group interview (Study V) .............................................................................. 18
Statistical procedures and analyses ............................................................................. 18
  Statistical procedures ............................................................................................... 18
  The audit of patient records ...................................................................................... 19
  The questionnaire ...................................................................................................... 19
  The focus group ........................................................................................................ 19
Ethical considerations .................................................................................................... 20
RESULTS .................................................................................................................. 22

The prevalence and incidence of pressure ulcers (Studies I, II) ......................... 22
Nursing staff knowledge and documentation (Studies II, III) ............................. 22
The effect of three preventive interventions (Studies I, II, IV, V) ......................... 23
Risk assessment and pressure ulcer grading (Studies I, II) ............................... 23
Pressure-reducing mattress (Study IV) ............................................................. 23
Educational programme (Study V) ...................................................................... 24
Predictors of pressure ulcer development (Studies IV, V) .................................... 25

DISCUSSION ............................................................................................................. 27

Pressure ulcers – some aspects of structure, process and outcome ................. 27
Reduced incidence of pressure ulcers – the effect of three preventive
interventions ............................................................................................................ 28
Predictors ............................................................................................................... 30
Quality improvement in clinical practice ............................................................ 31
Methodological considerations ........................................................................... 33
Further research ..................................................................................................... 34

CONCLUSIONS ....................................................................................................... 35

Nursing implications .............................................................................................. 35

ACKNOWLEDGEMENTS ......................................................................................... 36

REFERENCES .......................................................................................................... 38
Ten years ago, I heard of “quality assurance” for the first time. It was described as a
dynamic process of defining, measuring and improving the quality of care (Kitson,
1989). At that time, I was working as an intensive care nurse and I found this
approach, as well as the structure, process and outcome triad (Donabedian, 1966) to
be very useful models for nurses to analyse their practice and to find ways to
measure and to improve patient care. During the 1990s, these models have guided
me in several quality improvement projects, both in the University hospital and
nationally. The inspiration for this thesis has been the idea of measurement for
learning and improving patient care. While pressure ulcers are a common and costly
condition, causing the patient great suffering, I have chosen to study the prevention
of pressure ulcers with scientific methods.
INTRODUCTION

Pressure ulcers – some historical reflections

The earliest known pressure ulcers were found on the mummy of an elderly Egyptian priestess from the twenty-first dynasty (approximately 1000 years BC). The mummy was noted to have pieces of soft leather, probably gazelle skin, covering sores on the shoulders and buttocks (Rowling, 1961). In 1593, the surgeon Fabricius Hildanus from the Netherlands described the clinical characteristics of pressure ulcers. He identified external natural and internal supernatural factors as causes, as well as interruption in the supply of “pneuma”, blood and nutrients (Defloor, 1999). In France, the surgeon Ambrose Paré was famous for treating war injuries during the 16th century. He also treated pressure ulcers and his recommendations seem up to date; healthy nutrition, curing underlying illness, pressure relief, psychological support, and eventually surgical treatment and dressings. Paré became known for applying humanistic principles and sound medical practices to patient care (Levine, 1992).

Florence Nightingale (1860) was the first to recognise the responsibility of nurses in the prevention of pressure ulcers, maintaining that pressure ulcers could be prevented by good nursing care. She stated (p 8): “If he (a patient) has a bedsore, it is generally the fault not of the disease, but of the nursing”. Over time this view became reversed: rather than believing that good nursing prevented pressure ulcers, bad nursing was considered to cause them (Dealey, 1997). As a result, the development of pressure ulcers in patients caused great feelings of guilt among nurses, and the pressure ulcers were better not to speak of. This has been described as the conspiracy of silence (Bliss, 1979); the nurse was reluctant to admit that the patient had a pressure ulcer, and the doctor did not want to know about the pressure ulcers, because he had no training in their significance or management. Until recently, pressure ulcers were considered to be a nursing problem and of little interest to other health care professionals. However, for successful prevention of pressure ulcers, a multidisciplinary approach is important (Dealey, 1997; Land, 1995). Today, the incidence of pressure ulcers is deemed to be an indicator of the quality of care provided by a hospital (Dealey, 1997; Ek, et al., 1997). It serves as a reason for implementing quality improvement projects in hospitals both locally and nationally. In 1997, the European Pressure Ulcer Advisory Panel (EPUAP) was set up to deal with the problem at a European level.

Quality improvement in health care

This section includes a discussion about quality improvement in general, some Swedish approaches, as well as factors that may influence changes in clinical
practice. Furthermore, prevention of pressure ulcers will be presented as an area where quality indicators have been developed.

Definition, assessment, evaluation and improvement of the quality of health care have received major attention in many countries during the last decades (Deming, 1986; Donabedian, 1966, 1980, 1988; Kitson 1989). Working with quality is a dynamic process for learning and improvement in order to promote the best possible health care for patients. The terms continuous quality improvement (CQI) and total quality management (TQM) are often used interchangeable. However, there is a tendency in Europe to view CQI as a specific quality approach, one of many approaches that come under a TQM umbrella. A representative European definition of CQI is “an approach for ensuring that staff continue to improve work processes by using proven quality methods to discover and resolve the causes of quality problems in a systematic way” (Øvretveit, 1997, p 12).

In Sweden, there have been several approaches to the improvement of quality in health care. In 1990, representatives of the Swedish Institute for Health Services Development (Spri), the Swedish Federation of County Councils, the National Board of Health and Welfare, and nursing researchers proposed a national strategy for quality (Spri, 1990). This 10-point strategy suggested a broad-based involvement; focus on the local level in the health care system, participation of all categories of staff, and support from the executive level. Furthermore, the strategy highlighted the importance of quality indicators and audit routines. Subsequently, “organisational audits “ (Spri, 1996a) and quality award frameworks (Palmberg, 1997) have been used to create and maintain a quality culture. These models, reflecting a management perspective, are general and extensive, and external audit is part of the process.

Another approach is represented by the professional organisations, which developed quality indicators in several clinically relevant areas. In nursing, one starting point was a teaching package on the DySSSy-model (Spri, 1996b), which was disseminated nationally by the Swedish Nurses Association. That model used the following principles; patient-focus, practitioner-based, problem-solving, and team work. This project continued in the development of quality indicators in seven areas of nursing. One of these areas was prevention and treatment of pressure ulcers (Ek, et al., 1997). A quality indicator was defined as “a quantitative measure that can be used as a guide to monitor and evaluate the quality of important patient care and support service activities” (JCAHCO, 1989, p 330). Research in the area was reviewed to provide the foundation for quality improvement efforts, as well as for structure, process and outcome indicators. Structure refers to the attributes of the settings in which care occurs, as well as the material and human resources and organisation. Process refers to the activities that take place within and between patients and practitioners in the giving and receiving of care. Outcome refers to the effects of care on the health status of patients, including improvements in patients’ knowledge and
satisfaction with care (Donabedian, 1988). In 1996, this document was regarded as the best available knowledge base published in Swedish. It is considered as a Swedish quality guideline in the present work.

Since 1996, quality improvement has been included in the Swedish Health and Medical Care Act (SFS 1996:787 § 31) that states: “Quality in health care should be evaluated and assured systematically and continuously” (p. 9). According to the regulations of The National Swedish Board of Health and Welfare (SOSFS 1996:24), health care should include quality systems for planning, performance, evaluation and improvement of the care given, and the entire staff should be involved in this work. A quality system is defined in terms of organisational structure, routines, processes and resources that are necessary for managing good quality in health care. The regulation also emphasises patient’s dignity, integrity, participation and safety. For important processes, there should be measurable goals, indicators and audit routines.

However, Harvey and Kitson (1996) have argued that despite the investment of considerable time, energy and resources in the development and implementation of a variety of quality systems, there is still limited evidence to suggest that they have any significant impact in terms of changing practice and improving patient care. These authors identified two key factors that underpinned the quality improvement process. These were defined as “ownership for quality” and “action to improve”. “Ownership for quality” means to encourage meaningful participation in the quality programme and to give staff a sense of control over its direction. “Action to improve” relates to contextual factors such as the feedback of data and support at practical as well as organisational levels. These factors are crucial for the achievement of a change in practice. A clear organisational strategy is important, explicitly led and supported from the top of the organisation. The authors conclude that most nursing quality improvement programmes fail to embrace these two concepts simultaneously.

It is logical that changes in practice should build upon the best available evidence of clinical effectiveness. Quality improvement activities are increasingly incorporating evidence-based practice (Øvretveit, 1997). Evidence-based practice is defined as “the process of systematically finding, appraising, and using contemporaneous research findings as the basis for clinical decisions” (Rosenberg & Donald, 1995, p. 1122). In Sweden, the Swedish Council on Technology Assessment in Health Care (SBU, 1994) called for more experimental studies to decide the effectiveness of nursing interventions. Thus, more research-based knowledge is needed to improve patient care. Another problem is to implement research-based knowledge in clinical practice. According to Kitson, et al. (1998), successful implementation of research findings in practice is a function of the interplay between three core elements; the level and nature of the evidence, the context or environment into which the research is placed,
and the method or way in which the process is facilitated. In a survey of Swedish nurses’ perception of research utilisation in clinical practice, the major barriers were found to be the work organisation and the communication of research findings (Nilsson Kajermo, et al., 1998).

Pressure ulcers – an area for improvement

The following section focuses on the epidemiology of pressure ulcers, definition of pressure ulcers and causative factors, risk assessment and recommended preventive interventions. Finally, some examples of costs related to pressure ulcer prevention and treatment will be presented.

Epidemiology of pressure ulcers

Pressure ulcers are a common, costly and painful condition (Cullum, et al., 1999; Ek, et al., 1997), and it is commonly thought that most of them are avoidable (Cullum, et al., 1995). Prevalence and incidence data are used to identify patients with pressure ulcers in health care settings.

Prevalence is the number of persons with a specific disease or condition as a proportion of a given population, measured at a specific point in time or over a specific period of time. The most commonly used measure is point prevalence. Incidence is the number of persons developing a specific disease or condition as a proportion of a given population, measured over a period of time.

While prevalence surveys can provide useful baseline information, incidence studies are considered to represent more accurate assessment of pressure ulcer development (Dealey, 1993). Prevalence surveys provide only a snapshot of the situation and do not differentiate between those admitted to a hospital or unit with a pressure ulcer, and those developing ulcers after admission. The measurement of incidence gives a truer picture because it is taken over time and identifies those patients who develop ulcers while in a particular place of care.

The Fourth National Pressure Ulcer Prevalence Survey in the United States included 265 acute-care hospitals and found an overall prevalence of 10.1% (Barczak, et al., 1997). A recent study in the Netherlands reported prevalence rates of 10.1% in a university hospital (n=368), 12.7% in home health care settings (n=1541), and 83.6% in a nursing home (n=122) (Bours, et al., 1999). In the university hospital, maternity/obstetric, pediatric, and psychiatric wards were omitted from the survey.

Patients with hip fracture constitute a group with a high risk for developing pressure ulcers. Gebhart (1992) and Hofman et al. (1994) found incidences of 43% and 25-64%, respectively, during the post-surgery episode in the hospital. Hip fracture is one of the most common diagnoses in somatic short-term care, rendering it one of the most
important diagnoses in economic and social terms. In Sweden more than 18,000 hip fractures occur annually (Strömberg, 1998). Hip fracture is a collective name for two main types of proximal femur fracture – cervical and trochanteric fractures. The distribution of these types is similar, although patients with trochanteric fractures tend to be somewhat older. Today, approximately 90% of patients with hip fractures are 65 years or older (Strömberg, 1998).

In a prevalence study in Uppsala County (Lindholm, et al., 1999), patients with chronic wounds (leg, foot, and pressure ulcers, and other wounds that had not healed during the previous six weeks) were surveyed during a three-week period in 1996. The findings revealed 102 patients, age 65 years and older with pressure ulcers, yielding a prevalence of 0.24% for the population. Twenty-five percent of the pressure ulcers were reported to have developed during the patients stay in the University hospital, and hip fracture patients were mentioned to be particularly vulnerable to pressure ulcers. Neither in the Accident and Emergency Department (A&E), nor in the Department of Orthopaedics at the University hospital were there any audit routines for assessment of prevalence/ incidence of pressure ulcers or a systematic use of a risk assessment tool or pressure ulcer classification.

**Pressure ulcers - definition and risk factors**

The European Pressure Ulcer Advisory Panel (EPUAP, 1999) has defined a pressure ulcer as an area of localised damage to the skin and underlying tissue caused by pressure, shear or friction or a combination of these. Pressure ulcers usually occur over bony prominences or pressure areas such as the sacrum, heels, hips and elbows.

Pressure can be described as a force exerted perpendicularly to the tissue, while shear is a force exerted parallel to the tissue. The combination of shear and pressure appears to be particularly damaging. If a sufficient shearing force is present, only half the pressure is required to obtain vascular occlusion, compared with a situation without the presence of shearing. A pressure higher than the capillary pressure slows down the flow in the capillaries and lymph nodes, resulting in an insufficient supply of oxygen and nutrients and insufficient evacuation of metabolic waste (Defloor, 1999). The extent of the damage caused by pressure is a function of the degree of localised pressure and its duration (Dealey, 1997; Ek, et al., 1997). Friction increases the probability of pressure ulcer development when accompanied by pressure and/or shearing forces. Friction can result in superficial damage, such as stripping of the epidermis. It is exacerbated by the presence of moisture (Dealey, 1997; Defloor, 1999; Ek, et al., 1997). However, dry skin also increases the risk for injury since elasticity is decreased (AHCPR, 1992; Ek, et al., 1997).

It is well recognised that a combination of a number of intrinsic factors predisposes an individual to pressure ulcer development. These risk factors include high age, malnutrition, reduced mobility, reduced tissue circulation, incontinence, acute
illness, terminal illness, body weight, and neurological deficit (Dealey, 1997; Defloor, 1999; Ek, et al., 1997).

A number of external factors pertaining to medical and/or nursing interventions may exacerbate the extrinsic and intrinsic factors that have been mentioned earlier. For example, inappropriate patient positioning, and poor lifting and handling techniques may increase the risk of tissue damage due to pressure, shear or friction. Inappropriate clothing may also be a problem since imprints of stiff seams can cause pressure ulcers. Sedatives, hypnotics, and analgesics may make the patient excessively sleepy and thus reduce mobility. On the other hand, ineffective pain control may reduce mobility if the patient keeps still in order to reduce pain. Finally, poor nursing care and improper hygiene can result in the patient sitting or lying in excessive moisture of sweat, urine and/or faeces (Dealey, 1997; Defloor, 1999).

Based on a review of the literature related to the prediction and prevention of pressure ulcers, Defloor (1999) has developed a conceptual scheme on pressure ulcer development, highlighting pressure, shearing forces, tissue tolerance to pressure and tissue tolerance to oxygen.

**Classification of pressure ulcers**

A system for grading pressure ulcers is an attempt to identify the severity of the ulcer, usually by indicating the depth of tissue damage (Dealey, 1997). There are several grading systems. The European Pressure Ulcer Advisory Panel (EPUAP, 1999) has agreed on the following classification, which is consistent with the American Clinical Practice Guidelines: Pressure Ulcers in Adults: Prediction and Prevention (AHCPR, 1992).

Grade I. Non-blanchable erythema of intact skin. Discolouration of the skin, warmth, oedema, induration or hardness may also be used as indicators, particularly on individuals with darker skin.

Grade II. Partial thickness skin loss involving epidermis, dermis, or both. The ulcer is superficial and presents clinically as an abrasion or blister.

Grade III. Full thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through underlying fascia.

Grade IV. Extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures with or without full thickness skin loss.

The EPUAP grading system has been tested for inter-rater reliability and Bours et al. (1999) has reported Cohen's kappa to be 0.81-0.97, which is interpreted as excellent agreement (Fleiss & Chilton, 1983).
Risk assessment

A major aspect of pressure ulcer prevention is the correct identification of those at risk for pressure ulcer development (AHCPR, 1992; Dealey, 1997; Ek, et al., 1997; EPUAP, 1998). There are a number of scoring systems, which allow the nurse to calculate the degree of risk of an individual patient. The earliest scoring-system was published by Norton in 1962 in the United Kingdom. This was a new concept by providing a mathematical method for calculating pressure ulcer risk. The total score describes the patient’s risk for developing pressure ulcers. The Norton scale has been tested, modified and used in Sweden (Ek & Bjurulf, 1987; Ek, et al., 1997). The latest version of the Modified Norton Scale (MNS) consists of seven subscales: mental condition, activity, mobility, food intake, fluid intake, incontinence, and general physical condition. A low MNS score indicates risk for pressure ulcer development.

EPUAP guidelines (1998) stress that risk assessment should be used as an adjunct to clinical judgement and not as the only tool. A full risk assessment should include general medical condition, skin assessment, mobility, moistness and incontinence, nutrition and pain. Risk assessment should be performed immediately on entry into an episode of care, and should be seen as a dynamic process. Frequency of reassessment should be dependent on change in the patient’s condition.

Prevention of pressure ulcers

Once a patient is identified as being at risk, appropriate preventive interventions should be planned, implemented and evaluated. Failure to do so could be seen as negligence (Dealey, 1997). There is a range of prevention strategies requiring a multidisciplinary approach. The following strategies reflect the recommendations and guidelines issued by the U.S Agency for Health Care Policy and Research (AHCPR, 1992), the European Pressure Ulcer Advisory Panel (1998), Dealey (1997) and Ek et al. (1997). Even if there has been a considerable amount of research related to pressure ulcer prevention, several questions remain. Since it is essential that any initiative to reduce the incidence of pressure ulcers is based on the best available evidence of clinical effectiveness, independent well-designed randomised controlled trials have been called for (Cullum, et al., 1995).

Pressure relief

If pressure is the major cause of pressure ulcers, it follows that the relief of pressure should be a major strategy in any prevention plan. This can be achieved by regular repositioning of the patient. At present there is no evidence to indicate how frequently patients should be repositioned. It should be based on individual need and consideration of the surface upon which the patient is sitting or lying (Dealey, 1997; Ek, et al., 1997; EPUAP, 1998). In a randomised trial, Defloor et al (in press) evaluated the effect of different turning intervals and the use of a pressure-reducing mattress (visco-elastic foam) on the development of pressure ulcers in geriatric high-
risk patients. The authors concluded that turning every 4 hours on a visco-elastic mattress was a more effective and less labour-intensive method than the traditional 2- or 3-hour turning scheme. The 30° tilt position, where the patient is placed in an alternating tilted position by the use of cushions, is described by Dealey (1997). Recently, Defloor (2000) investigated which positions resulted in the lowest pressure to the skin of persons lying in bed. He found that when a laterally inclined position is indicated, the 30° tilt position is preferable.

Use of pressure-relieving devices/equipment

The Cochrane Wounds Group (Cullum et al., 1999) has recently performed a review with the objective to assess the effectiveness of pressure-relieving beds and mattresses in the prevention and treatment of pressure ulcers. Twenty-nine randomised controlled trials were identified, including four trials comparing foam alternatives with standard foam mattresses (Collier, 1996; Gray, et al., 1994; Hofman, et al., 1994; Santy, et al., 1994). The Cochrane reviewers concluded that there is good evidence of the effectiveness of high specification foam over standard hospital foam. The “standard” mattress was, however, poorly described in many of these studies and what is standard varies by hospital, country and over time. It proved to be impossible to determine the most effective surface for either prevention or treatment. The reviewers also stated that the confidence with which the conclusions could be drawn was greatly tempered by the poor quality of many of the 29 trials and the lack of replication studies.

EPUAP (1998) and AHCPR (1992) suggest that foam wedges and cushions should be used to help positioning the patient correctly.

Skin observation/assessment

Regular assessment of the parts of the body most at risk will enable detection of early indications of pressure damage. This may assist in determining the frequency with which repositioning should be carried out (AHCPR, 1992; Dealey, 1997; Ek, et al., 1997). The EPUAP (1998) recommends that the condition of the skin should be inspected and documented daily and changes should be recorded as soon as they are observed.

Reductions of shear and friction

Skin injuries due to shear and friction should be minimised through proper positioning, transferring, and turning techniques (AHCPR, 1992; Dealey, 1997; Ek, et al., 1997; EPUAP, 1998).
Nutritional support

Nutritionally compromised patients should have a plan of appropriate support and/or supplementation that meets individual needs (Unosson, et al., 1995; EPUAP, 1998). Ek et al (1991) investigated the relationship between nutritional state and the development of pressure ulcers, as well as the hypothesis that supplementary nutritional support might prevent pressure ulcers and improve healing. Significantly more patients with protein-energy malnutrition had, or developed, pressure ulcers. Patients who received extra nutritional support tended to develop fewer pressure ulcers and to heal existing ulcers to a greater extent than the control group.

Skin care/hygiene and moisture

Every effort should be made to optimise the condition of the patient’s skin. There seems to be a balance between keeping the skin clean and dry, and avoiding too frequent cleansing (AHCPR, 1992; Dealey, 1997; Ek, et al., 1997). As a person ages, the frequency of routine skin cleansing may decrease because there is less sebum and perspiration. During the cleansing process, some of the skin’s “natural barrier” is removed. The more the barrier is removed, the drier the skin becomes and the more susceptible it becomes to external irritants. Massage over bony prominences should be avoided (AHCPR, 1992; Ek, et al., 1985; EPUAP, 1998).

Education

Educational programmes for the prevention of pressure damage should be structured, organised and comprehensive. They should be made available to health care providers at all levels, and to patients and families (AHCPR, 1992; Dealey, 1997; EPUAP, 1998). The educational programme should be updated on a regular basis based on the best available evidence (EPUAP, 1998).

Documentation

It is agreed that all interventions and outcomes should be documented (AHCPR, 1992; Dealey, 1997; Ek, et al., 1997; EPUAP, 1998).

Costs of care related to pressure ulcers

Recently, the NHS Economic evaluation database in the Cochrane Library was searched by the author. The keywords “decubitus”, “decubitus ulcer”, and “pressure ulcer” were used. Only three papers, was classified as cost-effectiveness studies by the Cochrane reviewers (Gebhart, et al., 1996; Walker, 1996; Xakellis & Frantz, 1996). This is surprising since substantial sums of health care money and resources are involved. Haalboom (1998) argued that the costs of prevention and treatment of pressure ulcers approach those of cardiovascular disease and cancer. Most of the costs result from lengthy hospital stays and the use of special pressure-reducing devices, such as mattresses and beds.
In 1988, Hibbs brought attention to previously largely neglected economic factors of pressure ulcer treatment. She performed a detailed case study of a 75-year old hospital patient with a complicated hip fracture and a gangrenous sacral pressure ulcer (grade IV). The total cost of treating the patient (180 days) was calculated to be more than £25,000. It was calculated that during this time, 16 patients could have had hip or knee replacement for the same cost. Hibbs argued that there was a need to invest in a pressure ulcer prevention programme, especially in the context of an increasing population of older people.

A prevalence study in Uppsala County (population of 42,500 >65 years) showed that the median number of dressing changes per week for pressure ulcers (n=102) were 7.0 (range 0-35) (Lindholm, et al., 1999). If half an hour is calculated per dressing change, the nursing time for just changing dressings (excluding costs for devices, dressings, and travel) corresponds to nine full-time nurses. This nursing time is equivalent to 2.8 million SEK annually (in salary figures for year 2000). It is concluded that nursing time could be more productively spent on education, patient assessment and prevention.

The rationale for the present research

Several studies have shown that patients with hip fractures constitute a risk group for development of pressure ulcers. Findings from the study by Lindholm et al. (1999) indicated that development of pressure ulcers in this patient group could be a problem in the University Hospital. Research-based knowledge regarding prevention and measures/indicators for audit were available for nurses, but it was not known if these were used in clinical practice. More experimental studies regarding the effects of nursing interventions were called for (Cullum, et al., 1995; SBU 1994).

There have been several approaches to quality improvement in the University Hospital. Both unit-based quality improvement projects and top-down approaches have been applied. In the broader quality programme of the hospital, the interest has focused on the patient perspective, the processes and outcomes of care, as well as leadership. Yearly assessments conducted by the hospital management indicated a lack of outcome measures/indicators used on a regular basis in the departments. The key-factors for successful implementation of a quality system, “ownership” and “action to improve”, have not explicitly been used together (Harvey & Kitson, 1996). The challenge was to embrace these key-factors in a clinically relevant area.

In the present thesis, pressure ulcers in patients with hip fractures were studied. The philosophy underpinning the work has been a combination of the key-factors “ownership” and “action to improve”. The Plan-Do-Study-Act model, which Deming (1986) described as a model for learning and improvement has guided the process.
AIMS

The aim of the thesis is four fold. The first aim was to survey the prevalence and incidence of pressure ulcers in patients with hip fractures (Studies I, II). The second aim was to investigate nursing staff knowledge and documentation regarding pressure ulcer prevention for the same patient group (Studies II, III). The third aim was to test the effect of three preventive interventions: (a) risk assessment and pressure ulcer grading (Studies I, II), (b) a pressure-reducing mattress (Study IV), and (c) an educational programme (Study V). The fourth aim was to identify predictors for pressure ulcer development (Studies IV, V).
METHOD

Design
Experimental, comparative, and descriptive designs were used for the studies as displayed in Table 1. Study I utilized a prospective, controlled design. Patients were allocated consecutively to the experimental and control groups, following an established routine for admission of patients with hip fractures: each ward was sent every fourth patient with hip fracture. Study II utilized a prospective, comparative and descriptive design, in which the development and progress of pressure ulcers in the experimental group of Study I were analysed in detail. The design of Study III was descriptive. The results from a questionnaire and an audit of patient records were analysed and compared with the Swedish quality guidelines (Ek, et al., 1997). Study IV utilized a prospective, randomised controlled trial design. Finally, Study V had a comparative design.

Table 1. Design and data collection methods used in the studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Data collection method</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Experimental</td>
<td>Risk assessment, pressure ulcer grading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Audit of patient records</td>
</tr>
<tr>
<td>II</td>
<td>Prospective, comparative, descriptive</td>
<td>Risk assessment, pressure ulcer grading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Audit of patient records</td>
</tr>
<tr>
<td>III</td>
<td>Descriptive</td>
<td>Questionnaire to nursing staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Audit of patient records</td>
</tr>
<tr>
<td>IV</td>
<td>Experimental</td>
<td>Risk assessment, pressure ulcer grading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Audit of patient records</td>
</tr>
<tr>
<td>V</td>
<td>Comparative</td>
<td>Risk assessment, pressure ulcer grading</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Audit of patient records</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focus group interview</td>
</tr>
</tbody>
</table>

Settings
All studies were conducted between 1997 and 2000 in the A&E Department and the Department of Orthopaedics at the University Hospital in Uppsala. The research project was initiated and resources allocated by the Department of Nursing Research & Development in the hospital.
Interventions

Three interventions were tested: a) risk assessment and pressure ulcer grading, b) a pressure-reducing mattress, and c) an educational programme.

Risk assessment and pressure ulcer grading (Study I)

The intervention in the experimental group consisted of risk assessment, risk alarm and skin observation performed by the nurse on duty, in the A&E Department and daily throughout the hospital stay. To facilitate the nurse’s risk assessment and skin observation, a “Pressure Ulcer Card” had been developed for and used in a previous study (Lindholm, 1996, 1999). The “Pressure Ulcer Card” consisted of the MNS on one side and description of the four grades of pressure ulcers illustrated by coloured photographs on the other. Small risk stickers with the label “Low MNS score – pressure ulcer prevention/ active nursing care!” were attached to patient records in case of an MNS score < 21.

The control group was assessed in the A&E Department and at discharge. Results of the initial assessment were not available to the nurses on the orthopaedic wards. Both groups were provided with ordinary pressure ulcer prevention (cushions, regular positioning) and were finally assessed two weeks post-surgery by the nurse responsible for the patient in the community, elderly or primary health care.

Pressure-reducing mattress (Study IV)

The intervention consisted of a pressure-reducing mattress. Immediately on arrival to the A&E Department, patients in the experimental group were placed on a 10 cm thick visco-elastic foam mattress¹ (7 cm visco-elastic foam plus 3 cm 35kg/ m³ foam, T8513). When transferred to the ward, a 7 cm visco-elastic foam overlay was put on top of the standard mattress. A polyurethane cover on the mattresses was used as standard.

Patients in the control group were placed on the routine standard trolley (5 cm mattress). When transferred to the ward, these patients were placed on the standard hospital mattress² (10 cm foam 50 kg/ m³). These mattresses also had polyurethane covers.

Both groups received standard pressure ulcer prevention, including a fast track program, use of heel cushions, repositioning and inspection of the skin every shift.

¹ Tempur-Pedic®, Fagerdala, Sweden
² Prodenso®, Ranson AB, Sweden
Educational programme (Study V)

An extensive educational programme on pressure ulcer prevention was developed and conducted in 1998 by the researchers (CL, LG). Twenty-five registered nurses from risk wards at the University Hospital were invited, as well as registered nurses from community settings. The programme included education provided by a multidisciplinary team and consisted of 40 hours of theory and 40 hours of practical tasks (EPUAP, 1998) as shown in Table 2. The main practical task was to perform two case studies in the nurse’s own unit, in which the theory should be applied. The patients’ history and status were described, as were risk factors, risk scores, prevention and treatment. The pressure ulcers were photographed and graded. These case studies were presented and discussed in a seminar.

Table 2. Contents of the educational program

<table>
<thead>
<tr>
<th>Theory</th>
<th>Lecturer</th>
<th>Practical tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pathophysiology and risk factors for pressure damage</td>
<td>Physician</td>
<td>Pathophysiology and risk factors for pressure damage</td>
</tr>
<tr>
<td></td>
<td>Registered nurse</td>
<td>Practice risk assessment in own unit</td>
</tr>
<tr>
<td>Risk assessment tools and their application</td>
<td>Registered nurse</td>
<td>Practice pressure ulcer grading in own unit</td>
</tr>
<tr>
<td>Skin assessment and pressure ulcer grading</td>
<td>Registered nurse</td>
<td>Inventory of mattresses, overlays, and other devices in the nurse’s own unit (age, type, thickness etc)</td>
</tr>
<tr>
<td>Instruction in the use of pressure-reducing and other devices.</td>
<td>Occupational therapist Registered nurse</td>
<td></td>
</tr>
<tr>
<td>Nutritional support</td>
<td>Dietician</td>
<td></td>
</tr>
<tr>
<td>Development and implementation of individualised programmes of care</td>
<td>Registered nurse</td>
<td></td>
</tr>
<tr>
<td>Principles of positioning to reduce the risk for pressure damage</td>
<td>Physiotherapist</td>
<td></td>
</tr>
<tr>
<td>Wound cleansing and dressings</td>
<td>Registered nurse</td>
<td></td>
</tr>
<tr>
<td>Documentation of processes and patient outcome data</td>
<td>Registered nurse</td>
<td>Document relevant information in the patient record</td>
</tr>
<tr>
<td>Quality improvement and quality indicators</td>
<td>Registered nurse</td>
<td>Perform a clinical audit of pressure ulcers and risk score in own unit (prevalence data)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perform two case studies in own unit</td>
</tr>
</tbody>
</table>

The “Pressure Ulcer Nurses” who attended the course have subsequently met regularly for continuous updated education and exchange of experiences.
In cooperation with the Nursing Programme at Uppsala University, quality improvement has been introduced as a conceptual framework to student nurses. It is now mandatory for this group to assess the quality of care with respect to prevention of pressure ulcers or nutrition during their training in geriatric wards.

Subjects

Patients (Studies I, II, IV, V)

In Studies I, II, IV and V, the inclusion criteria were patients with hip fracture, >65 years, who were admitted to the A&E Department. In Studies IV and V, patients with pressure ulcers upon arrival were excluded. In order to decide how many patients should be recruited for Study IV, a priori sample size calculation was performed. To detect a clinically relevant reduction in the incidence of pressure ulcers with the statistical safeguards of alpha = 0.05, power = 0.80 and effect size = medium-large, 50 patients were needed in each group (Anthony, 1999). Patient samples in all studies are shown in Table 3.

Table 3. Patient samples

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of patients included</th>
<th>Exp group</th>
<th>Control group</th>
<th>Number of patient records</th>
<th>Number of staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>124</td>
<td>58</td>
<td>66</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>55</td>
<td></td>
<td></td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>55</td>
<td></td>
<td></td>
<td>55</td>
<td>85</td>
</tr>
<tr>
<td>IV</td>
<td>101</td>
<td>48</td>
<td>53</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>146</td>
<td></td>
<td></td>
<td>54</td>
<td>6</td>
</tr>
</tbody>
</table>

The decision about which patient records to audit was influenced by several factors. In Study I, records were audited for patients assessed to be at risk for pressure ulcer development, who did not develop pressure ulcers, and patients who were assessed to be at risk for pressure ulcer development and who did develop pressure ulcers. In Study II, all patient records were audited. This audit was utilised also in study III. In Study IV, patient records were audited for patients who developed pressure ulcers grad I and in Study V, all records were audited for patients who developed pressure ulcers during their hospital stay. The patients’ gender, age and length of stay are shown in Table 4.
Table 4. Patient characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Study I</th>
<th>Study II+III</th>
<th>Study IV</th>
<th>Study V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exp</td>
<td>Control</td>
<td>Exp</td>
<td>Control</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>38</td>
<td>53</td>
<td>36</td>
<td>43</td>
</tr>
<tr>
<td>Men</td>
<td>20</td>
<td>13</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Age, mean age</td>
<td>81.8</td>
<td>82.9</td>
<td>81.8</td>
<td>84</td>
</tr>
<tr>
<td>SD</td>
<td>6.8</td>
<td>6.4</td>
<td>6.9</td>
<td>7.8</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>10.4</td>
<td>11.2</td>
<td>11.6</td>
<td>12</td>
</tr>
<tr>
<td>mean</td>
<td>4.5</td>
<td>4.9</td>
<td>6.0</td>
<td>6.2</td>
</tr>
<tr>
<td>Range</td>
<td>4-27</td>
<td>5-27</td>
<td>3-31</td>
<td>3-32</td>
</tr>
</tbody>
</table>

**Staff (Studies III, V)**

In Study III, the target group consisted of all registered nurses and nursing assistants working on four wards of the Department of Orthopaedics at the University Hospital. In February 1997, a questionnaire was distributed to 60 registered nurses and 58 nursing assistants. It was completed by 41 (68%) and 44 (76%), respectively. The majority of nursing staff were women (82%) and the median number of years in nursing was 7 for registered nurses and 10 for nursing assistants.

The focus group in Study V was conducted with a multi-professional group (n=6), including an orthopaedic surgeon, three registered nurses and two technicians from the A & E Department, the operating theatre and the orthopaedic ward.

**Data collection**

**Risk assessment (Studies I, II, IV, V)**

In the MNS, each of the subscales (mental condition, activity, mobility, food intake, fluid intake, incontinence, and general physical condition) is scored between 1 and 4, where 1 indicates complete lack of function and 4 indicates normal function (Ek et al, 1991). A total score of ≤21 is considered to indicate risk for developing pressure ulcers (Ek et al, 1997).

**Pressure ulcer classification (Studies I, II, IV, V)**

The stages of pressure ulcers were classified as follows (AHCPR, 1992; Dealey, 1994; Lindholm, 1995; EPUAP, 1999). Grade I: non-blanching erythema of intact skin; grade II: partial thickness skin loss involving epidermis, dermis, or both; grade III: full thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through, underlying fascia; and grade IV: full thickness
skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone or supporting structures.

A protocol (the pressure ulcer card documentation) was developed with one section for recording the MNS score and one for recording the grade and location of pressure ulcers. These data were collected daily or on admission, at discharge and two weeks post surgery (Study I), and on four occasions: on admission to the A&E Department, on arrival to the orthopaedic ward, on the 4th post surgery day, and at discharge from the ward or two weeks post surgery (Study IV). The protocol also had a section for data such as hemoglobin, blood pressure, diagnosed diabetes, smoking, body constitution, and time of surgery.

In Study IV, when a pressure ulcer was detected, it was photographed. The ulcers in these photos (n=25) were graded by an expert nurse (CL), who was blinded to treatment, and compared with the classifications performed clinically by the nurses in the A&E Department and on the wards. Cohen’s kappa (Howell, 1997) was calculated to 0.86. According to Fleiss & Chilton (1983), this can be regarded as excellent agreement.

Audit of patient records (Studies I-V)

A model for nursing documentation, the VIPS model (Ehnfors, et al., 1991) is widely used in Sweden. It is based on four key concepts: well-being, respect for integrity, prevention and safety. The model supports systematic thinking and the use of common terms in nursing care. It consists of key words on different levels and follows the structure of the nursing process, which corresponds to the Swedish advisory instruction on nursing (SOSFS 1993:17). The first level of key words includes nursing history, status, diagnosis, goal, intervention, outcome and nursing discharge notes. Nursing history, status and interventions are further divided into more specific key words (Ehnfors, et al., 1991; Ehrenberg, et al., 1996).

In Study I, the pressure ulcer card documentation was used to collect information regarding the patient’s risk score and skin condition. In Study II, a protocol was developed including the following strategies for prevention and treatment of pressure ulcers: pressure relief (turning schedule, repositioning, cushions, overlays), use of the 30° tilt position, reduction of shear and friction, nutritional support, skin care (lotion), patient education, and dressings (AHCPR, 1992; Dealey, 1997; EPUAP 1998). Each patient record was studied by the first author. Presence or absence of these strategies was recorded, as was the time of the interventions and characteristics of the nursing notes (nursing history, nursing status, nursing diagnosis, nursing intervention, nursing outcome, nursing discharge note). Finally, the nursing notes regarding prevention and treatment of pressure ulcers were transcribed word for word. This protocol was also used in Studies III, IV and V.
Questionnaire

Nursing staff (Study III)

The questionnaire was designed for the present study and focused on the nursing care of patients with hip fracture. It was semi-structured and consisted of open- and close-ended questions regarding risk assessment, skin observation, prevention and treatment of pressure ulcers. The close-ended questions concerned the frequency of risk assessment and skin observation and had alternatives like never, sometimes and always. In the open-ended questions, participants were asked to describe (i) how they performed risk assessment, (ii) which body parts they observed for pressure ulcer development, and (iii) how they prevented and treated pressure ulcers. The face validity of the questionnaire was established by an expert nurse (CL), who is an executive member of the European Pressure Ulcer Advisory Panel.

Patients (Study IV)

The patients’ perception of mattress comfort was assessed by the Pressure Ulcer Nurse (Study IV), using a standardised question: “How did you experience the comfort of the hospital mattress?” The rating scale used was “Very good” (5), “Good” (4), “Adequate” (3), “Bad” (2), and “Very bad” (1).

Focus group interview (Study V)

To investigate possible changes in nursing and treatment routines, a focus group interview (Morgan & Krueger, 1998) was conducted with a multi-professional group (n=6). The group met during two hours to discuss the following theme: Possible changes in nursing and treatment routines for patients with hip fracture in the University Hospital, which may have influenced pressure ulcer development. The first author moderated the session, and notes were taken by an observer. The interview was also tape-recorded. The participants were asked to bring written documents that verified contemporary nursing and treatment routines.

Statistical procedures and analyses

Statistical procedures

For descriptive purposes, means, medians, standard deviations, range and percentage were used. For comparisons between groups, Student’s t-test was used for continuous variables that were approximately normally distributed. Mann-Whitney U-test was used for non-parametric comparisons of groups with small sample sizes, and Chi-square test for dichotomous variables. Logistic regression (statistical) was used to identify predictors for pressure ulcer development. In these analyses, the outcome was defined as presence or absence of pressure ulcers.
(including grade I) during the hospital stay. All variables that differed significantly between patients with and without pressure ulcers (p<0.05) were included in the analyses.

**The audit of patient records**

The comprehensiveness of the nursing documentation concerning prevention and treatment of pressure ulcers (Study II, IV) was assessed by a five-level scale developed by Ehnfors and Smedby (1993). This scale has been tested for inter-rater reliability and Cohen’s kappa (Howell, 1997) has been reported to be 0.65 (Ehrenberg & Ehnfors 1999a,b) and 0.72-1.0 (Ehrenberg, 2000), which is interpreted as good to excellent agreement (Fleiss & Chilton, 1983). The following criteria were used:

- **Score 1.** The problem is described or interventions planned or implemented.
- **Score 2.** The problem is described and interventions planned or implemented.
- **Score 3.** The problem is described and intervention planned or implemented and nursing outcome is recorded.
- **Score 4.** The problem is described and intervention planned and implemented and nursing outcome is recorded.
- **Score 5.** All key words on the first level of the VIPS model are recorded. Good description of the problem. Recording of relevance to nursing.

According to Ehnfors et al (1998), the Swedish law and regulations (SFS 1985: 562; SOSFS 1993:17; SOSFS 1993: 20) require a score of four. This means that for at least one nursing problem, nursing intervention has been planned and implemented, and nursing outcome has been recorded.

**The questionnaire**

Replies to the open-ended questions were categorised as follows. Responses regarding risk assessment were first categorised using the themes of the MNS subscales as categories. Remaining categories were generated from participants’ responses by selection of the most frequently used terms, as were the responses regarding prevention and treatment of pressure ulcers.

**The focus group**

The interview was analysed by the author, starting the day after the interview. In order to get an overall impression, the notes were read and the whole dialogue on the tape was listened to. The notes were then read and the tape listened to several times and the content was extracted and sorted into the following units: the A&E Department, the operating theatre and the orthopaedic ward. The written documents from the units were analysed. Finally, a report was written based on the notes, the
tape and written documents. It was sent to all participants in the focus group for validation of the content.

Ethical considerations

The studies were approved by the Research Ethics Committee of the Faculty of Medicine at Uppsala University (numbers 97036 and 99063). The patients were asked to give their verbal consent and were informed that data would be treated confidentially. Patients who were not able to give their verbal consent due to confusion or for other medical reasons, were included in the studies, since these patients were judged to constitute a group that would potentially benefit from pressure ulcer prevention. In these cases informed consent was obtained from relatives if possible. There was no reason to suspect that the mattresses in Study IV would do any harm to the patient. Risk assessment and skin observation in Study I should be routine care.

The process of the research project follows the Plan-Do-Study-Act model (Deming 1986) (Figure 1).
Figure 1. The process of the research project

Discussion with heads of departments and head nurses.
Questionnaire to nursing staff (n=85).
Risk alarm sticker developed.
Education of nursing staff, 0.5-1.0h (risk assessment, pressure ulcer classification).

Implementing risk assessment, risk alarm and classification of pressure ulcers as quality indicators for patients with hip fractures.

Controlled study of prevalence of pressure ulcers (n=124).
Retrospective audit of patient records (n=55).

Educational programme, 80h.
Pressure Ulcer Nurse - network.
Care plan for patients at risk with pressure ulcers.
Mandatory task for student nurses.

Discussion with heads of departments, head nurses and staff.
Inventory of mattresses used.

Randomised, controlled trial (n=119).
Retrospective audit of patient records (n=54).
Focus group interview.

Implementing visco-elastic mattress.
Risk assessment and classification of pressure ulcers in the A&E department, on admission to the ward, post surgery day 4, and at discharge.

Audit routines for regular use.
Education of staff in operating theatre.
Dissemination of findings to relevant patient groups.
RESULTS

The prevalence and incidence of pressure ulcers (Studies I, II)

On arrival at the hospital, approximately 20% of the patients (n=124) had pressure ulcers (exp group 20.4%, control group 18.8%). At discharge, this rate had increased to almost 40% (exp group 39.6%, control group 36.0%). In the detailed study of the experimental group (n=55), it was found that 25 patients developed pressure ulcers during their hospital stay. The incidence was calculated to 55%. Out of these 25 patients, the first report of pressure ulcers for 21 patients occurred between admission to the ward and the fourth day after surgery. The majority of the pressure ulcers were classified as grades I and II, and the most common locations were sacrum, buttocks and heels.

Nursing staff knowledge and documentation (Studies II, III)

The majority of the nursing staff reported that they performed risk assessments when caring for a patient with hip fracture. However, these assessments were not structured or comprehensive, and the majority of both registered nurses and nursing assistants used none of the MNS subscale themes. The most frequently used assessments were classified as activity/mobility and general physical condition. Factors such as food and fluid intake, incontinence, and mental condition were largely lacking. Other criteria used were the patient’s body constitution, age and other medical diseases, all of which represent relevant information. Regular observation of the skin for signs of pressure ulcers was reported as a routine by both registered nurses and nursing assistants. The most frequently inspected body areas were sacrum and heels. No particular pressure ulcer classification system was used.

The most frequently described nursing interventions for prevention were repositioning (85%), cushions (60%) and mattresses/overlays (29%). Treatment of pressure ulcers included local treatment of the wound using dressings and pressure relief by repositioning the patient. Some nursing staff reported exposure of the wound to air. This does not accord with scientific knowledge, which suggests that keeping the ulcer bed moist is most important.

Nursing notes regarding prevention and treatment of pressure ulcers were present in the nursing status on admission to the ward (22%), in the updated nursing status (40%), under nursing interventions (38%), and nursing outcome (24%) and on the discharge note (27%). There was a complete lack of nursing diagnoses and goals in all patient records, and hardly any planned interventions were documented. The mean values of documentation of different types of interventions were 2.2 in patients
who developed pressure ulcers (n=25), 1.4 in patients admitted with pressure ulcers (n=10), and 0.5 in patients without pressure ulcers. Interventions documented most frequently in the patient records were repositioning (29%), cushions (40%) and use of lotion (18%).

The reported and documented strategies regarding risk, prevention and treatment of pressure ulcer for patients with hip fractures were not in accordance with the Swedish quality guideline (Ek, et al., 1997).

The effect of three preventive interventions (Studies I, II, IV, V)

Risk assessment and pressure ulcer grading (Studies I, II)

There was no significant difference in the prevalence of pressure ulcers at discharge between the experimental (risk assessment and skin observation daily) and control groups. Actually, there was a tendency to more grade I pressure ulcers in the experimental group.

Clinical use of the MNS made it possible to identify the majority of patients at risk for developing pressure ulcers. For the MNS score assessed in the A&E Department, the sensitivity was 71% and specificity was 44%. These calculations were based on data from those 81 patients (experimental and control groups combined) who had no pressure ulcers upon arrival.

Furthermore, a significant difference was found between patients with and without pressure ulcers on discharge for the MNS subscale “mental condition”. Significantly more patients who were confused on arrival at the hospital developed pressure ulcers than those orientated to time and place ($\chi^2=7.53$, $p<0.01$, df 1).

The mean rank of the patients’ lowest MNS score was significantly lower for patients who developed pressure ulcers (n=25) than for patients without pressure ulcers (n=20) ($U=139.5$, $P<0.01$) (Study II).

Pressure-reducing mattress (Study IV)

According to the MNS score assessed on arrival at the hospital, 33 (69%) and 34 (64%) patients in the experimental and control groups, respectively, were at risk for pressure ulcer development. In the experimental group (visco-elastic mattress), 12 patients developed pressure ulcers (grade I; n=8, grade II; n=4), and in the control group, 17 patients did so (grade I; n=9, grade II; n=7, grade IV; n=1). The incidence of grade II-VI pressure ulcers was 8% in the experimental group and 15% in the control group. None of these differences reached statistical significance.
The audit of patient records demonstrated that the mean values of different documented interventions were 1.8 and 2.9 in the experimental and control groups, respectively, in patients who developed pressure ulcers grade I. Three patients in the control group received an overlay. Another two control group patients with pressure ulcer grade II or more were also placed on overlays.

The means of the patient ratings of mattress comfort were 4.2 and 4.0 (5-level scale) in the experimental and control groups, respectively. Thirty-eight patients out of 41 (both groups) reported that the comfort was good or very good. Thus, the patients found both mattresses to be comfortable.

Educational programme (Study V)

There was a significant reduction between 1997 and 1999 of the overall incidence of pressure ulcers from 55% to 29% ($\chi^2=9.6$, $p<0.005$, df 1). A more detailed analysis showed that the number of pressure ulcers on heels had been reduced significantly ($\chi^2=4.5$, $p<0.05$, df 1). Furthermore, there was a tendency towards significant differences regarding the incidence of pressure ulcers $\geq$ grade II ($\chi^2=3.7$, $p=0.054$, df 1) and the reduction of pressure ulcers located on sacrum, buttocks and back ($\chi^2=3.6$, $p=0.056$, df 1) (Table 5). No significant differences were found between the two study groups 1997 and 1999, with respect to age, risk score and hemoglobin concentration on admission, waiting time for surgery, time in operating theatre or length of hospital stay. Both in 1997 and 1999, waiting time for surgery was approximately 24 hours, time in the operating theatre was 2 hours and length of hospital stay was 12 days.

<table>
<thead>
<tr>
<th></th>
<th>1997 (n=45)</th>
<th></th>
<th>1999 (n=101)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incidence of pressure ulcers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P u ≥ grade II</td>
<td>11</td>
<td>24</td>
<td>12</td>
<td>12</td>
<td>ns</td>
</tr>
<tr>
<td>Sacrum, buttocks, or back</td>
<td>17</td>
<td>38</td>
<td>25</td>
<td>25</td>
<td>ns</td>
</tr>
<tr>
<td>Heels</td>
<td>12</td>
<td>27</td>
<td>6</td>
<td>6</td>
<td>$\chi^2=4.5$, $p&lt;0.05$, df 1</td>
</tr>
</tbody>
</table>

A significant improvement in the comprehensiveness of the nursing notes ($\chi^2=6.9$, $p<0.01$, df 1) was found between the two study periods. In 1999, 13 out of 29 patient records reached a score of 4, compared to 3 out of 25 in 1997. The audit of the patient records also revealed that in 1999, more detailed information was given regarding the interventions that were planned and implemented compared with 1997. For example, the patient records often gave information about the use of a cushion for a
30° tilt position or a cushion for the heels, or both. Nursing diagnoses and goals for pressure ulcer prevention were still lacking in 1999.

The focus group data indicated that the overall awareness of prevention of pressure ulcers had increased. Possible reasons discussed were inclusion in ongoing studies, the educational programme and the media. One nurse stated that these activities had started “rings on the water”. Since 1997, the Pressure Ulcer Nurses had developed and implemented new nursing and treatment routines for patients with hip fractures both in the A&E Department and on the ward. The following data were extracted from the focus groups interview.

A&E Department. A fast track program for patients with hip fractures was developed and implemented early in 1998. The registered nurses were given a written standard ordination to administer intravenous fluid, analgesics (morphine and paracetamol) and to refer the patient to x-ray without having to wait for the doctors’ order. A special antidecubitus heel protection and fixation device (Lassekudden®) was used instead of traction. Risk assessment according to the MNS was performed on arrival.

Operating theatre. The surgical procedures had not changed during the study period, and there is no reason to believe that the time for surgery has been reduced. The surgical tables were continuously renewed, but patients with hip fractures were still placed on a standard operation table mattress, in accordance with written guidelines.

Orthopaedic ward. In February 1999, the Pressure Ulcer Nurse developed and implemented written guidelines for pressure ulcer care in patients with hip fractures (AHCPBR, 1992; Dealey, 1997; Ek, et al., 1997; EPUAP, 1998; Defloor, 2000). These were intended to encourage the use of risk assessments, heel cushions, 30° tilt position, and inspection of the skin every shift (three times a day). Nursing documentation was facilitated by a standardised care plan. The awareness of nutritional needs for the elderly had increased, as reported by the nurses.

Predictors of pressure ulcer development (Studies IV, V)

Study IV (n=101) demonstrated three variables that differed significantly between patients with and without pressure ulcers; the time span between arrival at the A&E Department and surgery, the hemoglobin concentration on admission, and the moisture of the skin. Patients who developed pressure ulcers had waited longer for surgery, had lower hemoglobin on admission, or a drier or more moist skin, than patients without pressure ulcers. The result of the logistic regression analysis ($\chi^2=5.87$, p=0.024, df=1) showed that significant predictors for development of pressure ulcers were the time span between arrival at the A&E and surgery (OR=1.04, p=0.03) and hemoglobin (OR=0.97, p=0.04).
Study V (n=146) demonstrated that three variables differed significantly between patients with and without pressure ulcers: the time span between arrival at the A&E Department and surgery, the hemoglobin concentration on admission, and age. Patients who developed pressure ulcers had waited longer for surgery, had lower hemoglobin concentration on admission, or were older. The result of the logistic regression analysis ($\chi^2=5.2$, $p=0.02$, df 1) showed that old age was the only significant predictor for development of pressure ulcers (OR=1.06, $p=0.03$).
DISCUSSION

During the present research project, the incidence of pressure ulcers has been reduced significantly from 55% to 29%, and the comprehensiveness of nursing documentation has improved significantly. Contributing to the change of clinical practice is most likely a combination of three preventive interventions; risk assessment and pressure ulcer grading, a pressure-reducing mattress and an educational programme. The use of the key-factors “ownership” and “action to improve” for successful implementation of a quality system, as well as research-based guidelines and audit routines have facilitated the process of change.

Pressure ulcers – some aspects of structure, process and outcome

The high prevalence and incidence of pressure ulcers in patients with hip fractures were consistent with previously reported incidence figures for the same patient group (Gebhardt, 1992; Hofman, et al., 1994). The results (Studies I, II) showed that many patients had pressure ulcers already at arrival to the A&E Department, and that patients who developed pressure ulcers during their hospital stay did so within post surgery day 4. Prior to the present study, the nurses were not aware of the high prevalence/ incidence of pressure ulcers. If nurses do not recognize the problem, they probably have no motivation to make any quality improvements. This illustrates the importance of using outcome measures systematically. Most pressure ulcers detected in the hospital were superficial (grades I and II), but if not observed and treated correctly, they could deteriorate during the post rehabilitation phase.

The Swedish quality guidelines (Ek, et al., 1997) give very general directions regarding nursing care, merely suggesting which strategies that should be taken into account when caring for a patient at risk for pressure ulcer development. We found that the reported (Study III) and documented (Studies II, III) strategies regarding risk, prevention and treatment of pressure ulcers for patients with hip fractures did not accord with these guidelines. This may indicate deficient knowledge or an inability to express basic nursing care in writing. The results confirm those of Parker and co-workers (1998) who compared nurses’ knowledge and record-keeping with local guidelines for management of pressure ulcers and found significant deficits in preventive care. Baggerly and DiBlasi (1996) found that many of the nurses stated that they routinely provided interventions aimed at prevention and considered such interventions to be a component of basic care. However, “invisible” care activities and outcomes must be made evident in the nurses’ documentation. In Sweden, the need for nursing documentation has increased, with the communication between the nurses on different shifts relying more and more on written documentation. Our findings also indicate a weakness in the communication between the A&E Department and the wards, and between the wards and the post orthopaedic care.
For example, all patients who were discharged with pressure ulcers did not have a description of the ulcer in the nursing discharge note. A recent investigation of administrative routines in the University Hospital showed that approximately 80 papers/laboratory tests/protocols had to be filled in for each patient with a hip fracture. Thus, it was important to introduce routines that would facilitate the nursing documentation. Land (1995) suggested that pressure area care is such a fundamental activity that many health care professionals fail to recognise the importance of maintaining competence and keeping abreast of recent developments.

The way we addressed pressure ulcers as an area for improvement is in accordance with “Getting evidence into practice” (1999) and Berwick (1998). It is recommended that in any attempt to bring about a change, there should first be a diagnostic analysis to identify factors likely to influence the proposed change. This is also reflected in Donabedian (1980 p.121-122), who stated:

“In any system of monitoring, the measurement of outcome is only the first step in a succession of activities. In order to take corrective action, one must dig back into the processes that led to the unwanted outcomes. The identification of the errors in process will, itself, often lead to an examination of the structural features that were responsible for, or contributed to, less than optimal behaviour. These necessary activities reaffirm the interconnectedness, the wholeness, of the structure – process – outcome chain. And it is on this foundation that any approach to assessment and monitoring must finally rest.”

This analysis encouraged us to develop and conduct the described educational programme (Table 2).

Reduced incidence of pressure ulcers – the effect of three preventive interventions

There were no significant differences in the prevalence/incidence of pressure ulcers between the experimental and control groups in the two experimental studies (I, IV). However, there was a significant reduction of the incidence of pressure ulcers between 1997 and 1999. How should these findings be interpreted?

After the nurses received brief information regarding risk assessment and classification of pressure ulcers (Study I), including introduction of the “Pressure Ulcer Card”, they performed the assessments as part of their regular work and despite a heavy workload. Even though the nurses’ awareness of pressure ulcers was expected to increase in the experimental group due to the introduction of daily risk assessments and skin observation, it was obvious that nursing staff had not taken preventive actions accordingly. We found a tendency of more frequently reporting of pressure ulcers grade I in the experimental group.

Although there was a tendency towards a lower incidence of pressure ulcers in patients who were placed on the pressure-reducing mattresses (Study IV), compared
to patients on standard mattresses, this difference did not reach statistical significance. One interpretation of these findings is that there was no significant difference in pressure relief relevant to pressure ulcer development between the visco-elastic and the standard hospital mattresses. If so, these results do not support the conclusion of the Cochrane Library review (Cullum, et al., 1999), which stated that high specification foam mattresses are more effective than standard hospital foam mattresses. However, the nursing documentation of prevention and treatment of grade I pressure ulcers demonstrated a tendency towards more active interventions per patient in the control group. Repositioning, cushions for heels, and 30° tilt were documented somewhat more often in the control group. There were five patients in the control group who were placed on an overlay (hollow core fibre). Thus, the performed comparison in fact concerned the visco-elastic mattress versus standard nursing care including the use of overlays, and not only the standard mattress. This illustrates the difficulty to accomplish a “pure” comparison of mattresses only. It would have been unethical to have nurses refrain from preventing pressure ulcers when patients demonstrated early signs of pressure damage. Thus, an alternative interpretation of the results is that good nursing care may have compensated for the absence of the visco-elastic mattress in the control group. It is possible that the effect of the visco-elastic mattress would have been more pronounced in 1997, when the incidence of pressure ulcers was higher. Clark and Cullum (1992) investigated the prevalence of pressure ulcers in seven hospitals in the United Kingdom. They reported an increase in the prevalence of pressure ulcers from 6.8% to 14.2% over a three-year period, during which the number of pressure redistributing mattresses increased from 69 to 186. These authors argued that one of the reasons for this may be that the mattresses replaced other forms of nursing care directed towards the prevention of pressure ulcers. In contrast, nursing care has improved since the research project started in the University Hospital.

The two-year follow-up of quality indicators (Study V) demonstrated that the incidence of pressure ulcers was significantly reduced since 1997. No significant differences were found between the two patient groups with respect to age, risk score and hemoglobin concentration at admission, waiting time for surgery, time in operating theatre or length of hospital stay. The comprehensiveness of the nursing documentation had improved significantly. In 13 out of 29 patient records, there were nursing notes indicating that the nurse had a plan for pressure ulcer prevention, which was also implemented and evaluated. However, more than half of the patient records were still lacking a care plan for pressure ulcer prevention and did not achieve the score of 4 (SFS 1985:562; SOSFS 1993:17; SOSFS 1993:20; Ehnfors, et al., 1998). The minimal level of care for this high risk group of patients should be that all patients have a documented care plan, where their risk status is identified and adequate nursing interventions are planned, implemented and evaluated.
The focus group findings indicated that there had been changes in nursing and treatment routines for patients with hip fractures both in the A&E Department and on the orthopaedic ward since the research project started. These initiatives were developed and implemented by the Pressure Ulcer Nurses. Probably, the written guidelines in both departments made it explicit to the nursing staff that pressure ulcer prevention in patients with hip fractures should be given high priority. The findings from the focus group point out a general change in staff attitude to pressure ulcer prevention. Recently, Torrance and Maylor (1999 a, b, c) investigated the prevalence of pressure ulcers, and staff knowledge and attitudes to pressure ulcer prevention in one NHS trust in the United Kingdom. Over a five-year period, they found that monitoring of pressure ulcer prevalence was helpful in focusing staff attention on the problem. They concluded that staff attitudes and beliefs may contribute to or help prevent pressure ulcer development.

The educational programme was not directed especially to nurses in the A&E Department or in the orthopaedic wards, but to nurses working in risk wards in the hospital and in the community care of the elderly. Participation was voluntary and learning was focused on clinically relevant problems including practical tasks to perform in the nurses’ own unit. These “Pressure Ulcer Nurses” together with hundreds of student nurses performing quality improvement tasks related to the prevention of pressure ulcers have probably formed a “critical mass”. The subject of preventing pressure ulcers was brought to the surface. The philosophy was to encourage staff to improve care, supporting them with research-based instruments and guidelines. McCormack et al. (1999) points out that for a change to be successful, it needs to be practitioner owned, organizationally supported and undertaken using a systematic approach. Further, it is crucial to help staff to understand what they want or need to change, and how they should change their behaviour to achieve transformation of practice. The quality improvement work initiated by staff in the A&E Department and on the orthopaedic ward is characterised by explicit signs of “ownership”, including the possibility to control the direction of changes. Support from several levels in the organisation was gained through a dialogue between researchers, staff, head nurses and heads of departments. Traditional research activities have assured a systematic approach and feedback of results, which should be crucial to staff motivation to improve care. In the present research project, a quality system for pressure ulcer prevention in patients with hip fractures has been developed. Regular audit routines should now be discussed and implemented.

Predictors

Significant predictors of pressure ulcer development were found to be the time span between admission to the A&E Department and surgery, and the hemoglobin concentration on admission (Study IV). Reduced activity and mobility are known risk factors and these are represented as subscales in the MNS. These findings stress
the importance of surgery without delay. Hemoglobin is a routine blood test taken on admission to hospital. Our findings show that observation of a low hemoglobin level should lead to pressure ulcer prevention. The hemoglobin concentration reflects the oxygen-carrying capacity of the blood, and hence influences the survival of tissue during period of ischemia. In Study V, the only significant predictor was old age, which has also been reported in other studies (Bergstrom, et al., 1996, Pieper, et al., 1998). This finding confirms the importance of including data on patients' age when performing the risk assessment.

The MNS risk score was not a predictor for pressure ulcer development. However, 71% (sensitivity) of the patients who developed pressure ulcers were assessed with a risk score on admission to the hospital. The specificity was 44%, meaning that the MNS overestimated the risk of pressure ulcers. There is on-going research on the development and testing of risk assessment tools (Ek & Lindgren 1997). However, until there is evidence that these instruments are valid and reliable, it is suggested that clinical use of the MNS at regular intervals should guide nurses in their planning and implementation of preventive interventions. Furthermore, the use of the MNS has probably increased the awareness of important risk factors, thus resulting in educational effects.

Quality improvement in clinical practice

The present research project, based on quality improvement models and philosophy, has demonstrated significant improvement in one specific area of nursing. In this section, the findings will be related to the framework for successful implementation of research into clinical practice; evidence, context and facilitation (Kitson, et al., 1998).

Pressure ulcer prevention is an area of nursing care, where both randomised controlled trials and systematic reviews have been conducted. Research-based guidelines have been developed, even though there are still many gaps in our knowledge. In a systematic review, Thomas et al. (2000) conclude that there is some evidence that guideline-driven care is effective in changing the process and outcome of care. Specifically for pressure ulcers, Buss et al. (1999) conclude that implementing planned research utilization activities (including research-based guidelines) are effective in reducing the incidence of pressure ulcers. There is also a high level of consensus among clinicians that pressure ulcers should be avoided.

Several approaches to quality improvement in the University Hospital, including the departments where these studies took place, might have facilitated this specific project. During the last few years, the importance of the patient perspective, processes and outcomes of care, as well as leadership have been highlighted and assessed by internal audits by the hospital management. The present research project was initiated by the Department of Nursing Research & Development, and planned and implemented together with the specific departments. Kitson (1999) reflects upon
the balance between local ownership and the rigidity of evidence-based practice. Safeguards of the rigour of the evidence should be provided by experts/researchers, but the diffusion process may then be supported or facilitated to allow local ownership and control.

In the present research project, there have been both external (researchers) and internal (Pressure Ulcer Nurses) facilitators. The facilitation role of the researchers can be described in terms of two approaches. In the experimental studies, the researchers have provided focus, structure, direction and technical support (Loftus-Hills & Harvey, in press). For example, the Pressure Ulcer Card and the risk alarm sticker were introduced as practical tools to communicate research on risk assessment and pressure ulcer grading. On the other hand, in the educational programme, the facilitator role was to encourage problem solving, reflection, critical thinking, and to empower the group to seek its own solutions and to change practice. The network for Pressure Ulcer Nurses has been an appreciated forum for discussion of questions related to the prevention of pressure ulcers. The researchers have probably bridged the gap between research and clinical practice, communicating research-based nursing care and audit routines (Nilsson Kajermo, et al., 1998).

Health-care research (Getting evidence into practice, 1999) regarding research-utilisation continues to conceptualise the implementation stage as a point when discreet interventions such as continuous education, clinical guidelines and opinion leaders can be used to enhance the uptake of the innovations. Kitson (1999) argues that there is also scant knowledge of the complex interactions, interdependencies, power struggles, and general confusion that characterize most clinical settings.

Recently, two Swedish PhD-theses have studied quality in health care from other perspectives than patient outcome. Erlingsdóttir (1999) studied organisational audit with the aim of understanding the processes of institutionalisation both within and between organisational fields. She concluded that (p. 237) “using ideas in fields or spheres where they do not belong can constitute quite a risk” (from industry to health care) and “good intentions may turn into bad consequences when applied where they do not belong”. In my opinion, this author generalises findings from the study of one model for quality improvement to all quality improvement models in health care. The findings of the present research project demonstrate that it is possible to improve patient care using quality improvement models and philosophy. It can also be discussed if the professional approach, targeting a specific clinically relevant area, is a more productive approach than an extensive management approach focusing on the organisation. In a systematic review, Shortell et al. (1998) examined the effect of clinical application of quality improvement. They found the literature to be relatively sparse (42 single-site studies, 13 multi-site studies), the majority of the designs were before-and-after observations, and most studies reported favourable results. They concluded that clinical quality improvement
applications are more likely to be effective when they are carefully focused on areas of real importance to the organisations and addressed with clearly formulated interventions. Furthermore, the organisation has to be ready for change. These ideas are also reflected in a strategy for quality improvement in nursing, which was recently established by Swedish Nurses Association (SSF, 2000). The strategy emphasizes the development of clinical guidelines, clinical audits, research-utilisation and facilitation.

Thomsen (2000) has recently investigated the effects of a quality improvement program on staff and patients in a controlled, prospective study. The intervention consisted of a TQM-inspired quality improvement training programme and quality teams were formed as a result of the training. The findings revealed that there was no difference in patients' evaluation of care satisfaction before and after the intervention. Furthermore, the staff in the quality teams experienced more work-related exhaustion and less mental energy, than staff not involved in quality teams. There may be explanations to these findings that relates to evidence, context or facilitation. I have not studied staff perception of quality improvement systematically, but my professional experience is that nursing staff get rewards such as autonomy and respect when working with quality improvements. Improvements for the patients are probably the most rewarding. However, there are several phases in the quality improvement cycle and some phases are more stressful than others. Maybe the post-test in the study of Thomsen was conducted too early to assess the intervention. Two quality teams had been working for six months, new routines were in place for testing, but had not been evaluated. The present research project confirms that the change of clinical practice requires time (two years).

Methodological considerations

In Study I, a total of 61% of eligible patients were included. There were no significant differences in age or gender between the patients included and those not included, or between the experimental and control groups. Lack of communication due to the large number of staff (>90) may explain why patients were not included. There is no reason to suspect that systematic error (including, or allocating patients with specific characteristics) has influenced the findings. The nurse on duty was supposed to report the MNS score and grade of pressure ulcers. At the time of Study I, many nurses did not regard grade I as a pressure ulcer. Thus, there is the possibility that pressure ulcers may have been under-reported. The use of the Pressure Ulcer Card was expected to contribute to more reliable assessments.

In Study II, the audit of patient records was performed in the perspective of prevention and treatment of pressure ulcers. There is a possibility that some information may have been misinterpreted. According to Ehnfors et al. (1998), there are three levels of nursing diagnosis, i.e. problem identification, general nursing
diagnosis and specific nursing diagnosis. The first level means that the nurse has identified a nursing problem of importance, which has been given high priority in the nursing care. To be classified as a nursing diagnosis of the first level in this audit prevention and treatment of pressure ulcers had to be emphasized as one important problem of care for this patient, and not a side issue that would vanish in the daily nursing notes.

In Study III, the response rate to the questionnaire (68-76%) was considered satisfactory. The drop-outs were partly due to nursing staff being on sick-leave or vacation. Both close- and open-ended questions were used, since this was expected to give a more comprehensive view of nursing staff knowledge. No inter-rater test was performed for agreement of classification of replies to open-ended questions, since the used themes/ categories were explicit and categorisations involved only minor interpretation.

In Study IV, a total of 70% of eligible patients was included. There were no significant age or gender differences between the patients included and those not included. The power analysis yielded an estimate of 50 patients per group. However, due to the low incidence of pressure ulcers, this may have been too few to reveal significant differences.

The last study (V) was based on historical data from 1997 and 1999. Since the design was non-experimental, no causal inferences can be made. However, all patients were admitted to the same departments in the same hospital in both study periods. The routines for including the patients in the studies were the same in 1997 and 1999. Relevant factors were compared and showed no significant differences between the study periods. A methodological limitation is the small sample size from 1997. Since it was impossible to calculate the incidence rates on the basis of the data from the control group, we decided to use data from the experimental group only. It should be noted that there were no significant differences in the prevalence of pressure ulcers on admission to the hospital or at discharge between the experimental and control groups in 1997.

Further research

Firstly, it would be important to conduct a prevalence study of pressure ulcers in the University Hospital to identify other risk groups. It would also be interesting to test the specific approach presented in this thesis, i.e. research guided by quality improvement models and philosophy, for the identified risk groups. Further, it would be interesting to test the approach in other clinically relevant areas. A challenge would be to involve a multi-professional team and to study structure, process and outcomes, as well as the context and facilitation including the psychosocial work environment and staff perception of stress.
CONCLUSIONS

This research project has been a process of learning together. We have defined, measured and improved the quality of care related to pressure ulcers in patients with hip fractures.

The major conclusions drawn from the findings in this thesis are as follows:

- The prevalence and incidence of pressure ulcers in patients with hip fractures were high at the onset of the research project.
- The nursing staff knowledge and documentation regarding prevention and treatment of pressure ulcers was unsatisfactory.
- The incidence of pressure ulcers was significantly reduced. This was most likely the effect of a combination of three preventive interventions: risk assessment and pressure ulcer grading, a pressure-reducing mattress and an educational programme.
- Significant predictors of pressure ulcer development were waiting time for surgery, hemoglobin concentration on admission and age.

Nursing implications

The following nursing implications, related to the prevention of pressure ulcers in patients with hip fractures, are based on the results of the present research project.

- Risk assessment according to the MNS should be performed at admission to the A&E Department, the ward, and repeatedly as the patients’ condition changes.

- The skin should be carefully observed daily and any pressure ulcer should be graded (EPUAP, 1999). Pressure ulcers grade I should be recognised as pressure damage.

- Based on the risk assessment and the skin observation, relevant preventive interventions should be planned, implemented and evaluated.

- In order to communicate nursing care between different shifts and units during the patient’s episode of care, the patient record should show evidence of risk status, that adequate nursing interventions have been planned, implemented and evaluated. At discharge adequate information should be written in the nursing discharge notes.
ACKNOWLEDGEMENTS

This thesis could not have been accomplished without the support of many people, all of whom I cannot name here. However, I would like to acknowledge some of them who have been very important to me.

I have had the privilege of having three excellent supervisors with complementing competences. I would like to express my sincere gratitude to:

Christina Lindholm, my supervisor for excellent guidance, inspiration, support, and friendship. You have shared your expertise on pressure ulcers, and also your desire to bridge the gap between research and clinical practice. Thank you for allocating resources for this work and for providing me with generous working conditions.

Marianne Carlsson, my supervisor for methodological and statistical guidance, inspiration, support and friendship. Thank you for giving me the time I needed, and for your very systematic way of handling reviewers’ critical comments. After these meetings it has been an easy task to get the manuscript into better shape.

Per-Olow Sjödén, my supervisor and examiner for constructive advice and support. Your questions have always started a process of reflection and re-thinking. Thank your for teaching me how to conduct a randomised controlled trial in theory, as well as in clinical practice.

I also would like to acknowledge:

Tord, Karin and Lars for all creative, crazy and conflicting quality discussions and for cooperation throughout the years.

My colleagues and friends in the Department of Nursing Research & Development. Many of you have contributed to this work by organising financial support, course administration and teaching in the educational programme. Special thanks to Eva Berglund for showing me that SPSS and statistics can be a lot of fun. We have shared many laughs in our discussions.

The PhD-students in the Section for Caring Sciences for discussions and cooperation in courses and seminars.

The network for quality improvement, managed by the Swedish Nurses Association, has inspired me very much. Special thanks to Lars Wallin for constructive discussions and advice regarding the thesis summary.
The nurses, head of departments and head nurses in the A & E Department, the Department of Orthopaedics and in the Operating theatre, for cooperation and support in the experimental studies. Special thanks to Olle Thorell and Ingeborg Johansson for supervising the data collections, and to the Pressure Ulcer Nurses for your enthusiasm and for the joy of continuously learning together.

Per, my dear husband and best friend, for your love and every-day listening. Thank you for invaluable advice, stimulating discussions and support during this work, and for excellent computer guidance.

Sara and Jonas, for being the joy of life, reminding me of every day life activities, and for giving me the opportunities to either relax in front of “Ally McBeal” or getting excited in a soccer or floor hockey competition. Sara, thank you for feeding the computer with the data from the studies.

My dear parents, Inga-Maj and Åke, for all your love and support.

I am grateful for financial support from the University Hospital, the Department for Public Health and Caring Sciences at Uppsala University, and from the Swedish Nurses Association.
REFERENCES


Defloor, T., Grypdonck, M., Haalboom, J. A randomised clinical trial using different turning intervals as prevention of pressure ulcers (in press).


