

# Reduced incidence of pressure ulcers in patients with hip fractures: a 2-year follow-up of quality indicators

LENA GUNNINGBERG<sup>1,2</sup>, CHRISTINA LINDHOLM<sup>1,2</sup>, MARIANNE CARLSSON<sup>1</sup> AND PER-OLOW SJÖDÉN<sup>1</sup>

<sup>1</sup>Department of Public Health and Caring Sciences, Section of Caring Sciences, Uppsala University, Uppsala, Sweden and <sup>2</sup>Department of Nursing Research and Development, University Hospital, Uppsala, Sweden

---

## Abstract

**Objective.** The aims of the present study were to (i) investigate the incidence of pressure ulcers in 1997 and 1999 among patients with hip fracture, (ii) study changes of nursing and treatment routines during the same period and (iii) to identify predictors of pressure ulcer development.

**Design.** The present comparative study was based partly on data collected in two prospective, randomized, controlled studies conducted in 1997 and 1999.

**Setting.** The study was carried out in the Accident & Emergency (A&E) Department and the Department of Orthopaedics at the University Hospital in Uppsala, Sweden.

**Study participants.** Inclusion criteria: patient with hip fracture,  $\geq 65$  years, admitted without pressure ulcers. Forty-five patients were included in 1997 and 101 in 1999.

**Interventions.** Risk assessment, pressure ulcer grading, pressure-reducing mattress and educational programme.

**Main outcome measures.** Incidence of pressure ulcers.

**Results.** There was a significant reduction of the overall incidence of pressure ulcers from 55% in 1997 to 29% in 1999. The nursing notes had become significantly more informative. Nursing and treatment routines for patients with hip fractures had changed both in the A&E Department and the orthopaedic ward through initiatives developed and implemented by pressure ulcer nurses.

**Conclusion.** In the framework of a quality improvement project, where research activities were integrated with practice-based developmental work, the incidence of pressure ulcers was reduced significantly in patients with hip fractures. The best predictor of pressure ulcer development was increased age.

**Keywords:** hip fractures, nursing documentation, pressure ulcers incidence, quality improvement

---

Definition, assessment, evaluation and improvement of the quality of health care have received major attention in many countries during the past decades [1–4]. Professionals, hospital administrators and politicians have discussed the significance of measures of health care processes and outcomes. Since 1996, quality improvement has been included in the Swedish Health and Medical Care Act [5], which states: ‘Quality in health care should be evaluated and assured systematically and continuously’. According to the regulations of The National Swedish Board of Health and Welfare, 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 [6]. A quality system is defined in terms of organizational structure, routines, processes and resources that are necessary for managing good quality in health care. The regulation also emphasizes patients’ dignity, integrity, participation and safety. For important processes, there should be measurable goals, indicators and audit routines.

Harvey and Kitson [7] argued that, despite the investment

Address reprint requests to L. Gunningberg, Department of Nursing Research and Development, University Hospital, SE-751 85 Uppsala, Sweden. E-mail: lena.gunningberg@adm.uas.lul.se

of considerable time, energy and resources in the development and implementation of a variety of quality and audit 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 underpinning 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 the direction of the programme. 'Action to improve' relates to contextual factors such as the feedback of data and support at practical as well as organizational levels. These factors are crucial for the achievement of a change in practice. A clear organizational strategy is important, explicitly led and supported from the top of the organization. The authors conclude that most nursing quality improvement programmes fail to embrace these two concepts simultaneously.

Prevention and treatment of pressure ulcers is one of seven nursing domains for which quality indicators have been developed in Sweden [8]. Pressure ulcers constitute an important problem in the ageing societies of the Western world. Pressure ulcers cause patients great suffering [9] and the treatment is a significant cost to health care systems [10]. Patients with hip fracture constitute a group with a high risk for developing pressure ulcers. Hofman *et al.* [11] and Gebhart [12] found incidences of 64% and 43%, respectively, during the post-surgery episode in the hospital.

In 1997, a long-term quality improvement project was initiated at the University Hospital in Uppsala, with the overall objective of preventing pressure ulcers in patients admitted with hip fracture. We integrated research activities with practice-based developmental work. The activities were performed in the framework of the Plan-Do-Study-Act model, which Deming [4] described as a method for learning and improvement. The philosophy underpinning the work has been a combination of the key factors 'ownership for quality' and 'action to improve' [7].

When the project started, no risk assessment tool or pressure ulcer classification was used systematically in the Accident and Emergency (A&E) Department or in the Department of Orthopaedics. Neither were there any audit routines for assessment of the prevalence/incidence of pressure ulcers. There were conflicting anecdotes about the incidence of pressure ulcers that were developed in the hospital. The first goal was to get evidence of the incidence and prevalence of pressure ulcers using a validated instrument. If there were pressure ulcers, our aim was to test whether the incidence could be reduced by research-based nursing activities such as daily risk assessment according to the Modified Norton Scale (MNS) [8] and skin observation with pressure ulcer grading [10,13–15]. To facilitate the nurses' assessments, a Pressure Ulcer Card was developed, with the MNS on one side and the pressure ulcer classification on the other [16]. In a prospective, controlled study [17], we found that approximately 20% of the patients admitted with hip fracture ( $n=124$ ) had pressure ulcers upon arrival at the A&E Department. At discharge, this rate had increased to

40%. Clinical use of the MNS made it possible to identify the majority of patients at risk for development of pressure ulcers. In a detailed study of the experimental group ( $n=55$ ) [18], it was shown that the incidence of pressure ulcers was 55% and that most of the pressure damage developed within the first 4 days after surgery. Nursing documentation of prevention was often lacking. A questionnaire for the nursing staff revealed that their knowledge regarding prevention and treatment of pressure ulcers could be improved [19].

These findings have served as a baseline for subsequent quality improvement activities. An extensive educational programme was developed and conducted in 1998. Twenty-five registered nurses from risk wards at the University Hospital were invited, as were registered nurses from the community setting. The programme consisted of 40 hours of theory and 40 hours of practical tasks, including themes such as risk factors, the skin of the elderly, nutrition, pressure-reducing mattresses and nursing documentation. The Pressure Ulcer Card was introduced and disseminated on all risk wards. Many unit-based quality improvement projects were initiated by the 'pressure ulcer nurses', who attended the course. They have since met regularly for continuous 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.

The quality improvement project continued in 1999 with the objective of reducing the incidence of pressure ulcers by introducing a pressure-reducing mattress throughout the hospital stay. From previous work, we knew that some patients with hip fractures were admitted with pressure ulcers and that others developed pressure ulcers during their hospital stay. We also knew that for these patients, there was no systematic use of pressure-reducing mattresses. In a randomized, controlled study ( $n=119$ ), we tested whether use of a visco-elastic foam mattress could reduce the incidence of pressure ulcers for patients with hip fracture, compared with the standard mattress [20]. There was no significant difference between the groups in the incidence of pressure ulcers. However, patients on standard mattresses were more likely to develop severe pressure ulcers. This group also had more documented preventive interventions. Thus, good nursing care may have compensated for the absence of an effect of the visco-elastic mattress.

The aims of the present study were to (i) investigate the incidence of pressure ulcers in 1997 and 1999 among patients with hip fracture, (ii) study changes of nursing and treatment routines during the same period and (iii) identify predictors of pressure ulcer development.

## Methods

### Study design

The present comparative study was based partly on cross-sectional data collected in two experimental studies conducted

**Table 1** Patient characteristics in 1997 and 1999

	1997 ( <i>n</i> = 45)			1999 ( <i>n</i> = 101)			Significant difference
	Mean	SD	Range	Mean	SD	Range	
Age	82.2	7.2	69–97	84.4	7.2	66–102	n.s.
MNS score upon arrival at the hospital	19.6 <sup>1</sup>	3.4	12–25	19.6 <sup>2</sup>	3.4	10–25	n.s.
Haemoglobin (mg/100 ml)							
Women	120.9	14.2	85–145	126.1	13.0	95–152	n.s.
Men	125.0	19.5	101–159	136.5	14.9	113–167	n.s.
Blood pressure systole (mm Hg)	162 <sup>3</sup>	27	100–220	156	26	110–260	n.s.
Blood pressure diastole (mm Hg)	87 <sup>3</sup>	12	60–120	83	16	60–170	n.s.

<sup>1</sup>(*n* = 42); <sup>2</sup>(*n* = 99); <sup>3</sup>(*n* = 44). SD, standard deviation; MNS, Modified Norton Scale.

in 1997 [17] and in 1999 [20]. In both studies, patients were included consecutively and randomized to an experimental and a control group. Due to insufficient nursing documentation in patient records, the present comparison includes only the experimental group [18] from the first study. No incidence figures could be computed in the control group.

### Setting

The study was carried out in the A&E Department and the Department of Orthopaedics at the University Hospital in Uppsala.

### Subjects

The inclusion criteria were patients with hip fractures, aged  $\geq 65$  years, who were admitted to the hospital without pressure ulcers. Forty-five patients were included in 1997 and 101 in 1999 (Table 1). There were no significant differences between the groups with respect to age, MNS score, haemoglobin or blood pressure on arrival at the hospital. The mean MNS score on admittance was 19.6 in both groups. Sixty and 56% of the patients were assessed to be at risk for pressure ulcer development in 1997 and 1999, respectively. In 1997, 38% of the patients were men compared with 20% in 1999 [ $\chi^2 = 5.3$   $P < 0.05$ , 1 degree of freedom (df)].

### Data collection

#### Data collected previously

Both previous studies used the same protocol for documenting risk assessment, pressure ulcer classification and data such as haemoglobin, blood pressure and time of important events in the hospital process.

#### Risk assessment

All of the MNS subscales (mental condition, activity, mobility, food intake, fluid intake, incontinence and general physical condition) have a score ranging from one to four, where one indicates complete lack of function and four normal function [21]. Patients with a total score of  $\leq 21$  are considered to be

at risk for developing pressure ulcers [8]. The MNS has proved to be valid and reliable [22].

#### Pressure ulcer classification

The stages of pressure ulcers were classified as follows [10, 13–15]: grade I, non-blanchable 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; grade IV, full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone or supporting structures. This classification system has been tested for inter-rater reliability. Cohen's kappa [23], was reported to be 0.81–0.97 [24], which is interpreted as excellent agreement [25].

The assessments were performed by the registered nurse on duty in the A&E Department and on the orthopaedic ward. To facilitate the nurses' assessments, a Pressure Ulcer Card was used throughout both studies [16].

#### New collection of data

##### Audit of patient records

A model for nursing documentation, the VIPS model [26], is widely used in Sweden. It is based on four key concepts: well-being, respect for integrity, prevention and safety, yielding the acronym VIPS in the Swedish spelling. 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 [27]. 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 [26,28].

For patients who developed pressure ulcers during their hospital stay, the records were audited retrospectively. A protocol was used, 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 [13,15,29,30]. Each patient record was studied by the first author. Presence or absence of these strategies was recorded, as was the timing 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 by word.

### Focus group

To investigate possible changes in nursing and treatment routines, a focus group interview [31] was conducted in May 2000 with a multi-professional group ( $n=6$ ) representing the patients' hospital episodes of care. This included an orthopaedic surgeon, registered nurses and technicians from the A&E Department, the operating theatre and the orthopaedic ward. The group met for two hours to discuss possible changes in nursing and treatment routines for patients with hip fracture 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.

### Data analysis

The patient groups from 1997 ( $n=45$ ) and 1999 ( $n=101$ ) were compared with respect to pressure ulcer incidence, patient characteristics and so on. Both patient groups were then combined to determine possible predictors of pressure ulcer development. Statistical analyses used were Student's  $t$ -test for continuous variables, Chi-squared test for dichotomous variables and logistic regression (statistical). In all comparisons  $P < 0.05$  was used to detect significant differences. In the logistic regression analysis, 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 this analysis.

The comprehensive nature of the nursing documentation concerning prevention and treatment of pressure ulcers was assessed by a five-level scale developed by Ehnfors and Smedby [32]. This scale has been tested for inter-rater reliability, and Cohen's kappa [23] was reported to be 0.65 [33, 34] and 0.72–1.0 [35], which is interpreted as good to excellent agreement [25]. 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.* [36], the Swedish law and regulations from 1993 [27,37,38] 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 focus group interview was analysed qualitatively by the first author, starting the day after the interview. The process of analysis is described in a flow chart (Figure 1). 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 was listened to several times and the content was extracted and sorted into descriptions of the A&E Department, the operating theatre and the orthopaedic ward. Characteristic quotations concerning each unit were chosen. 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.

Both original studies were approved by the Research Ethics Committee of the Faculty of Medicine at Uppsala University. 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 also included in the study, 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 pressure-reducing mattress would do any harm to the patient. Risk assessment and skin observation should be routine care.

## Results

### Incidence of pressure ulcers

There was a significant reduction between 1997 and 1999 of the overall incidence of pressure ulcers from 55 to 29% ( $\chi^2 = 9.6$ ,  $P < 0.005$ , 1 df). The number of pressure ulcers on heels had also been reduced significantly ( $\chi^2 = 4.5$ ,  $P < 0.05$ , 1 df). Furthermore, there was a tendency towards significant differences regarding the incidence of pressure ulcers of grade II or more severe ( $\chi^2 = 3.7$ ,  $P = 0.054$ , 1 df) and the reduction of pressure ulcers located on sacrum, buttocks and back ( $\chi^2 = 3.6$ ,  $P = 0.056$ , 1 df) (Table 2).

### Nursing and treatment routines

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. There were no significant differences (Table 3).

A significant improvement in the information included in

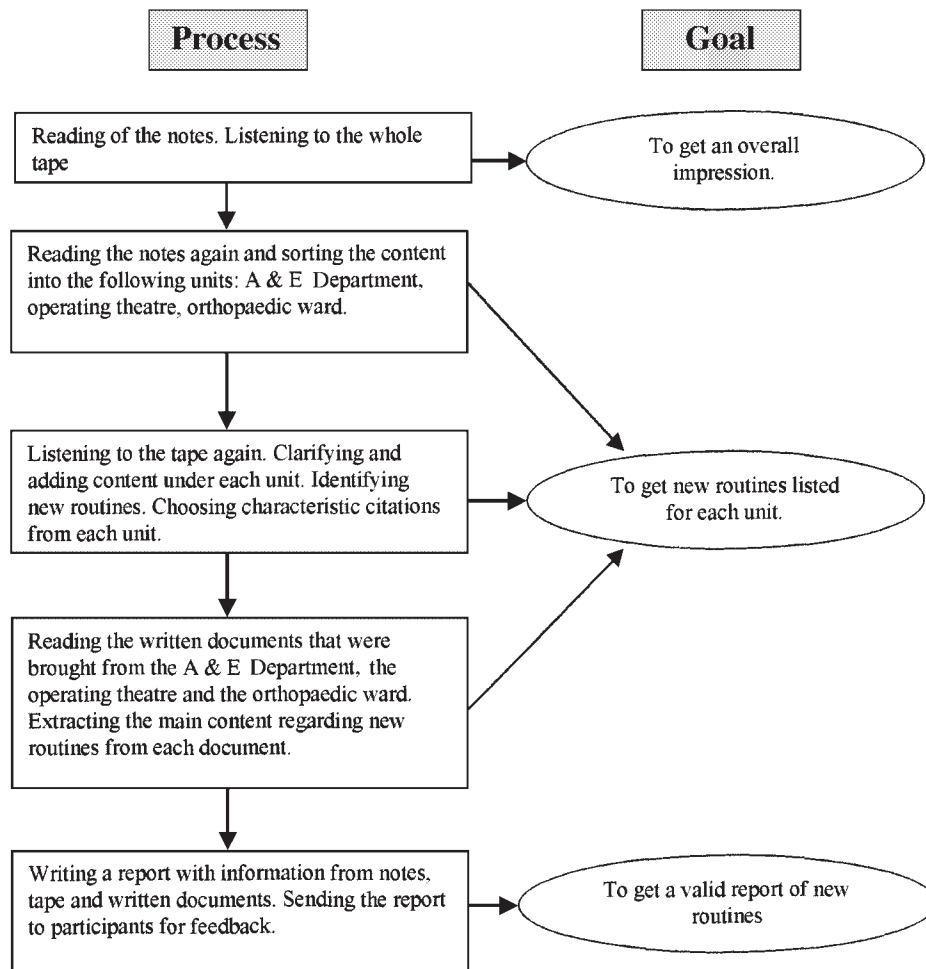


Figure 1 Flow-chart describing the analysis of the focus group interview data.

Table 2 Number and percentage of patients with pressure ulcers in 1997 and 1999

	1997 ( <i>n</i> = 45)		1999 ( <i>n</i> = 101)		Significant difference
	<i>n</i>	%	<i>n</i>	%	
Incidence of pressure ulcers	25	55	29	29	$\chi^2 = 9.6, P < 0.005, 1 \text{ df}$
Pressure ulcer $\geq$ grade II	11	24	12	12	n.s.
Sacrum, buttocks or back	17	38	25	25	n.s.
Heels	12	27	6	6	$\chi^2 = 4.5, P < 0.05, 1 \text{ df}$

the nursing notes ( $\chi^2 = 6.9, P < 0.01, 1 \text{ df}$ ) was found between the two study periods (Table 4). In 1999, 13 out of 29 patient records reached a score of four, compared with three 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 whether the patient was using 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.

The focus group data showed 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 'ripples on the water'. The pressure

**Table 3** Time intervals in 1997 and 1999

	1997 ( <i>n</i> = 45)				1999 ( <i>n</i> = 101)				Significant difference
	Mean	SD	Md	Range	Mean	SD	Md	Range	
Waiting time for surgery (hours)	24.0	19.9	20.0	3.2–123.5	21.5	14.7	19.3	3.2–96.5	n.s.
Time in the operating theatre (minutes)	138.7	52.8	140.0	60–320	144.2	58.4	135.0	60–465	n.s.
Length of stay (days)	11.8	5.5	10.0	5–27	12.6	6.6	11.0	3–39	n.s.

Md, Median.

**Table 4** Comprehensiveness of patient records regarding nursing problems recorded

	1997 ( <i>n</i> = 25)	1999 ( <i>n</i> = 29)	Significant difference
	<i>n</i>	<i>n</i>	
Score 0	3	2	$\chi^2 = 6.9,$ $P < 0.01, 1 \text{ df}$
Score 1	2	6	
Score 2	7	4	
Score 3	10	4	
Score 4 <sup>1</sup>	3	13	
Score 5	0	0	
Mean score	2.3	2.7	

<sup>1</sup> A score of 4 is required by law [37].

ulcer nurses had implemented several projects, for example unit-based education for nursing staff. A characteristic citation is:

‘Today, there is an awareness concerning pressure ulcer prevention, that did not exist when the Pressure Ulcer Network started.’

**A&E Department**

A fast track programme for patients with hip fractures was developed and implemented early in 1998. The registered nurse was given standard written permission 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 device (Lassekudden®) was used instead of traction. Risk assessment according to the MNS was performed at arrival. A characteristic citation is:

‘The staff are much more aware of these patients now and take care of them immediately upon arrival (within 15 minutes). A couple of years ago, it could be hours.’

**Operating theatre**

The surgical procedures did not change during the study

period and there is no reason to believe that the time for surgery was reduced. However, the surgical tables were continuously renewed, but patients with hip fractures were still placed on a standard operation table mattress, according to written guidelines. A characteristic citation is:

‘The mattresses on the new surgical tables feel as hard as the old ones.’

**Orthopaedic ward**

In February 1999, the pressure ulcer nurse developed and implemented written guidelines for pressure ulcer care in patients with hip fractures [13,15,29,30]. These were intended to encourage the use of risk assessments, heel cushions, 30° tilt position and inspection of the skin on every shift (three times a day). Nursing documentation was facilitated by a standardized care plan. The awareness of nutrition for the elderly had increased. A characteristic citation is:

‘Now we use heel cushions for all patients – we were not that good two years ago! The blue cushions (for 30° tilt position) are also used a lot. This is new to us. And we observe the patient’s skin daily and document much more. Even if we are not using the standard care plan right now, we have the pressure prevention programme in our heads.’

**Predictors**

Three variables differed significantly between patients with and without pressure ulcers; age, haemoglobin concentration at admission and time between arrival at the A&E Department and surgery. Patients who developed pressure ulcers were older (mean = 85.5, SD = 6.5, median = 86.0, range = 70.0–97.0) than patients without pressure ulcers (mean = 82.7, SD = 7.5, median = 83.0, range = 66.0–102.0) ( $t = 2.28, P < 0.05, 144 \text{ df}$ ). Patients who developed pressure ulcers also had lower haemoglobin concentration at admission (mean = 122.8, SD = 13.2, median = 125.0, range = 98–149) than did patients without pressure ulcers (mean = 128.6, SD = 15.5, median = 131.0, range = 85–165) ( $t = 2.27, P < 0.05, 143 \text{ df}$ ). Finally, patients who developed pressure ulcers waited longer for surgery (mean = 26.0 SD = 20.8, median = 20.6, range = 3.2–123.5) than patients without pressure ulcers (mean = 20.1 SD = 13.0 median = 19.3, range = 3.2–72.5) ( $t = 2.1, P < 0.05, 143 \text{ df}$ ).The result of the logistic regression analysis ( $\chi^2 =$

5.2,  $P=0.02$ , 1 df) showed that advanced age was the only significant predictor for development of pressure ulcers [odds ratio (OR) = 1.06,  $P=0.03$ ].

## Discussion

The incidence of pressure ulcers in patients with hip fractures has been reduced significantly since 1997 when the quality improvement project started (Table 2). No significant differences were found between the two patient groups, with respect to age, risk score and haemoglobin concentration at admittance, waiting time for surgery, time in operating theatre or length of hospital stay (Tables 1 and 3).

The information recorded in the nursing documentation had also improved significantly (Table 4). In 13 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. When the standardized care plan for pressure ulcer prevention was used, it was easy to identify both the planned and implemented interventions. However, more than half of the patient records were still lacking a care plan for pressure ulcer prevention and did not achieve a score of four [27,37,38]. The minimal level of care for this group of high risk 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. Changing practice is a dynamic process and in the last year the nurses in the orthopaedic ward were engaged in developing a standardized care plan for patients with hip fractures. This will include several aspects of nursing care, as well as pressure ulcer prevention. When this care plan is implemented, it will ensure that all patients have a care plan for pressure ulcer prevention.

The focus group revealed that there had been changes in nursing and treatment routines for patients with hip fractures both in the A&E Department and the orthopaedic ward since 1997. These initiatives were developed and implemented by the pressure ulcer nurses. The written guidelines in both departments made it clear to the nursing staff that pressure ulcer prevention in patients with hip fractures should be given high priority. The findings from the focus group indicate a general change in staff attitude to pressure ulcer prevention. Recently, Torrance and Maylor [39] and Maylor and Torrance [40,41] 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 5-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.

In the present quality improvement project, the philosophy was to encourage staff to improve care, supporting them with research-based instruments and guidelines. McCormack *et al.* [42] suggested that for change to be successful, it needs to be practitioner-owned, organizationally supported and undertaken using a systematic approach. In the context of practice development, it is crucial to help staff to understand

what they want or need to change and how they could change to achieve transformation of practice. The development work initiated by staff in the A&E Department and in the orthopaedic ward, is characterized by explicit signs of 'ownership', including the possibility to control the direction of changes. Support from several levels in the organization 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 practice.

In this long-term evaluation of clinical practice, it is impossible to decide exactly what activity had most influence on the results. This experience agrees with Gray *et al.* [43], who conducted a 3-year follow-up of the use of pressure-relieving mattresses. They found that the incidence of pressure ulcers changed very little during the two study periods and concluded that a pressure ulcer prevention policy and an extensive educational programme, as well as the use of pressure-relieving mattresses, had contributed to the low pressure ulcer incidence.

In the operating theatre, no development work was reported related to pressure ulcer prevention for patients with hip fractures. However, awareness of pressure-reducing mattresses is very important in the operating theatre. Most surgical tables are designed for utility not for comfort. During surgery, patients are positioned to maximize the ability to expose and manipulate the surgical site. Schultz *et al.* [44] suggested that a standardized set of guidelines should be developed for the operating theatre to delineate the best padding options for specific procedures. Also, patients with significant risk factors need to be cared for according to special guidelines for padding and positioning. When Defloor and De Schuijmer [45] tested five operating-table mattresses on 36 healthy volunteers, they found that none of the mattresses reduced pressure sufficiently to prevent the occurrence of pressure ulcers.

The model tested in the logistic regression analysis (including age, haemoglobin concentration at admittance and waiting time for surgery) was significant. However, the only significant predictor for pressure ulcer development was found to be old age, as has been reported in other studies [46,47]. Shultz *et al.* [44] investigated the aetiology of pressure ulcers in a surgical sample and found that patients with pressure ulcers were significantly older, had diabetes, were smaller in body mass and had a lower risk score on admission. Our findings confirm that it is important to include data on patients' ages when performing the risk assessment.

## Methodology

Because the present study is based mainly on historical data from 1997 and 1999 and 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. Because it was impossible to calculate 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 at admission to the hospital or at discharge, nor in age or gender, between the experimental and control groups in 1997.

One focus group was conducted with six participants. There is a possibility that the participants gave an ideal picture of the care given. However, the group itself might act as a control system, since staff with different professions and from several units participated. Data on the reduction of pressure ulcer incidence were presented to the group and they were asked to help identify changes that could help account for this. There was no conflict between the contents of the written documents and the dialogue in the focus group.

## Conclusion

In the framework of a quality improvement project, where research activities were integrated with practice-based developmental work, the incidence of pressure ulcers was reduced significantly in patients with hip fractures. The best predictor for pressure ulcer development was old age.

## Acknowledgements

Nursing staff, head nurses and heads of departments in the A&E Department and in the orthopaedic wards are acknowledged for their participation.

## References

1. Donabedian A. Evaluating the quality of medical care. *Milbank Mem Fund Q* 1966; **44**: 166–206.
2. Donabedian A. *The Definition of Quality and Approaches to its Assessment*. Ann Arbor, MI: Health Administration Press, 1980.
3. Donabedian A. The quality of care. How can it be assessed? *J Am Med Assoc* 1988; **260**: 1743–1760.
4. Deming WE. *Out of Crisis*. Cambridge, MA: Massachusetts Institute of Technology, Centre for Advanced Engineering Study, 1986.
5. *Health and Medical Care Act* (in Swedish). Stockholm: Svensk författningssamling 1996: 787 §31. <http://www.notisum.se/rnp/SLS/LAG/19820763.HTM> (Acc 000911)
6. *Regulations and Advisory Instructions on Quality Systems in Health Care Services* (in Swedish). Stockholm: National Board of Health and Welfare. Socialstyrelsens författningssamling 1996: 24 (M). [http://www.sos.se/sosfs/1996\\_24/1996\\_24.htm](http://www.sos.se/sosfs/1996_24/1996_24.htm) (Acc 010517).
7. Harvey G, Kitson A. Achieving improvement through quality: an evaluation of key factors in the implementation process. *J Adv Nurs* 1996; **24**: 185–195.
8. Ek A-C, Nordström G, Berglund B. Quality indicators for patients with or with risk of developing pressure ulcers. In Idwall E. (ed.), *Quality Indicators in Nursing*. Stockholm: Sprit publications, 1997, pp. 21–38.
9. Silén C. *Patients' Experiences in Relation to Pressure Ulcers* (in Swedish). Department of caring sciences, Hälsouniversitetet, Linköping, 1995. [http://huweb.hu.liu.se/en/](http://huweb.hu.liu.se/en/(Acc 010517)) (Acc 010517).
10. Dealey C. *The Care of Wounds*. Oxford: Blackwell Science, 1994.
11. Hofman A, Geelkerken R, Hamming J. et al. Pressure sores and pressure-decreasing mattresses: controlled clinical trial. *Lancet* 1994; **343**: 568–571.
12. Gebhart K. Preventing pressure sores in orthopaedics. *Nurs Stand* 1992; **6**: S4–S6.
13. Agency for Health Care Policy and Research. *Pressure Ulcers in Adults: Prediction and Prevention. Clinical Practice Guide 3*. Rockville, MD: US Department of Health and Human Services, 1992.
14. Lindholm C. *Ulcers. Care of Patients with Leg-, Foot-, or Pressure-Ulcers* (in Swedish). Lund, Sweden: Studentlitteratur, 1995.
15. European Pressure Ulcer Advisory Panel. *Pressure Ulcer Prevention/Treatment Guidelines*. Oxford: EPUAP, 1999. (Online). <http://64.33.115.36/epuap/home.htm> (Acc 010517).
16. Lindholm C. 1996. The Pressure Ulcer Card (in Swedish). Uppsala, Sweden: University Hospital, 1996. (Online). [http://www.uas.se/eng/](http://www.uas.se/eng/(Acc 010517))(Acc 010517).
17. Gunningberg L, Lindholm C, Carlsson M, Sjöden P-O. Implementation of risk assessment and classification of pressure ulcers as quality indicators for patients with hip fractures. *J Clin Nurs* 1999; **8**: 396–406.
18. Gunningberg L, Lindholm C, Carlsson M, Sjöden P-O. The development of pressure ulcers in patients with hip fractures: inadequate nursing documentation is still a problem. *J Adv Nurs* 2000; **31**: 1155–1164.
19. Gunningberg L, Lindholm C, Carlsson M, Sjöden P-O. Risk, prevention and treatment of pressure ulcers – nursing staff knowledge and documentation. *Scand J Caring Sci* (in press).
20. Gunningberg L, Lindholm C, Carlsson M, Sjöden P-O. Effect of visco-elastic foam mattresses on the development of pressure ulcer in patients with hip fracture. *J Wound Care* 2000; **9**: 1–5.
21. Ek A-C, Unosson M, Larsson J et al. The development and healing of pressure sores related to the nutritional state. *Clin Nutrition* 1991; **10**: 245–250.
22. Ek A-C, Bjurulf P. Interrater variability in a modified Norton scale. *Scand J Caring Sci* 1987; **1**: 99–102.
23. Howell D. *Statistical Methods for Psychology*, 4th edn. Belmont, CA: Wadsworth Publishing Company, 1997.
24. Bours G, Halfens R, Lubbers M, Haalboom J. The development of a national registration form to measure the prevalence of pressure ulcers in the Netherlands. *Ostomywound Management* 1999; **45**: 28–40.
25. Fleiss JL, Chilton NW. The measurement of interexaminer agreement on periodontal disease. *J Periodontal Res* 1983; **118**: 601–606.
26. Ehnfors M, Thorell-Ekstrand I, Ehrenberg A. Towards basic



- nursing information in patients records. *Vard Nord Utveckelt Forsk* 1991; **21**: 12–31.
27. *Advisory Instruction on Nursing* (in Swedish). Stockholm: National Board of Health and Welfare. Socialstyrelsens författningssamling, 1993; 17. [http://www.sos.se/sosfs/1993\\_17/1993\\_17.htm](http://www.sos.se/sosfs/1993_17/1993_17.htm) (acc 010517).
  28. Ehrenberg A, Ehnfors M, Thorell-Ekstrand I. Nursing documentation in patient records: experiences of the use of the VIPS-model. *J Adv Nurs* 1996; **24**: 853–867.
  29. Dealey C. *Managing Pressure Sore Prevention*. Salisbury: Quay Books, 1997.
  30. Defloor T. The effect of positioning and mattress on interface pressure. *Appl Nurs Res* 2000; **13**: 2–11.
  31. Morgan D, Krueger R. *The Focus Group Kit*. London: Sage publications, 1998.
  32. Ehnfors M, Smedby B. Nursing care as documented in patients records. *Scand J Caring Sci* 1993; **7**: 209–220.
  33. Ehrenberg A, Ehnfors M. Patient records in nursing homes. Effects of training on content and comprehensiveness. *Scand J Caring Sci* 1999; **13**: 72–82.
  34. Ehrenberg A, Ehnfors M. Patient problems, need and nursing diagnoses in Swedish nursing home records. *Nurs Diagn* 1999; **10**: 65–76.
  35. Ehrenberg A. In the pursuit of the common thread. Nursing content in patient records with special reference to nursing home care. Doctoral thesis. Uppsala University: Uppsala, 2000.
  36. Ehnfors M, Ehrenberg A, Thorell-Ekstrand I. *The VIPS-Book* (in Swedish). FoU, 48, Stockholm: Vårdförbundet, 1998.
  37. *The Patient Record Act* (in Swedish). Stockholm: Svensk författningssamling, 1985: 562 <http://www.notisum.se/rnp/SLS/LAG/19850562.HTM> (Acc 001110).
  38. National Board of Health and Welfare. *Regulations and Advisory Instructions on the Patient Record Act* (in Swedish). Stockholm: Socialstyrelsens författningssamling, 1993: 20. [http://www.sos.se/sosfs/1993—20/1993\\_20.htm#Sarskilda\\_foreskrifter\\_vid\\_dokumentering](http://www.sos.se/sosfs/1993—20/1993_20.htm#Sarskilda_foreskrifter_vid_dokumentering) (Acc 010517).
  39. Torrance C, Maylor M. Pressure sore survey. Part one. *J Wound Care* 1999; **8**: 27–30.
  40. Maylor M, Torrance C. Pressure sore survey. Part two: Nurses' knowledge. *J Wound Care* 1999; **8**: 49–52.
  41. Maylor M, Torrance C. Pressure sore survey: Part three: Locus of control. *J Wound Care* 1999; **8**: 101–105.
  42. McCormack B, Manley K, Kitson A *et al.* Towards practice development – a vision in reality or a reality without vision? *J Nurs Management* 1999; **7**: 255–264.
  43. Gray D, Cooper P, Campbell M. A study of the performance of a pressure reducing foam mattress after three years of use. *J Tissue Viability* 1998; **8**: 9–12.
  44. Schultz A, Bien M, Dumond K, Brown K, Myers A. Etiology and incidence of pressure ulcers in surgical patients. *AORN J* 1999; **70**: 434–449.
  45. Defloor T, De Schuijmer JD. Preventing pressure ulcers: an evaluation of four operating-table mattresses. *Appl Nurs Res* 2000; **13**: 134–141.
  46. Bergstrom N, Braden B, Kemp M *et al.* Multi-site study of incidence of pressure ulcers and the relationship between risk level, demographic characteristics, diagnoses and prescription of preventive interventions. *J Am Geriatr Soc* 1996; **44**: 22–30.
  47. Pieper B, Sugrue M, Weiland M *et al.* Risk factors, prevention methods and wound care for patients with pressure ulcers. *Clin Nurse Spec* 1998; **12**: 7–12.

Accepted for publication 8 June 2001