

The cost of pressure ulcers in the UK

GERRY BENNETT¹, CAROL DEALEY², JOHN POSNETT³

¹Barts and the London, Queen Mary's School of Medicine and Dentistry, London, UK*

²School of Health Sciences, University of Birmingham and University Hospital Birmingham NHS Trust, Nuffield House, Queen Elizabeth Hospital, Birmingham B15 2TT, UK

³University of York and Smith & Nephew Wound Management, Hull, UK

Address correspondence to: J. Posnett, Smith & Nephew Medical, PO Box 81, Hessle Rd, Hull HU3 2BN, UK.
Fax: (+44) 1482 673307. Email: john.posnett@smith-nephew.com

Abstract

Objective: to estimate the annual cost of treating pressure ulcers in the UK.

Design: costs were derived from a bottom-up methodology, based on the daily resources required to deliver protocols of care reflecting good clinical practice.

Setting: health and social care system in the UK.

Subjects: patients developing a pressure ulcer.

Methods: a bottom-up costing approach is used to estimate treatment cost per episode of care and per patient for ulcers of different grades and level of complications. Also, total treatment cost to the health and social care system in the UK.

Results: the cost of treating a pressure ulcer varies from £1,064 (Grade 1) to £10,551 (Grade 4). Costs increase with ulcer grade because the time to heal is longer and because the incidence of complications is higher in more severe cases. The total cost in the UK is £1.4–£2.1 billion annually (4% of total NHS expenditure). Most of this cost is nurse time.

Conclusions: pressure ulcers represent a very significant cost burden in the UK. Without concerted effort this cost is likely to increase in the future as the population ages. To the extent that pressure ulcers are avoidable, pressure damage may be indicative of clinical negligence and there is evidence that litigation could soon become a significant threat to healthcare providers in the UK, as it is in the USA.

Keywords: *pressure ulcers, cost, burden of illness, elderly*

Introduction

The aim of this study was to estimate the annual cost of treating pressure ulcers in the UK. Pressure ulcers are a painful, debilitating and potentially serious outcome of a failure of routine medical and nursing care, and one which represents a significant unnecessary cost to the health and social care system.

Approximately 412,000 individuals will develop a new pressure ulcer annually in the UK. There are no contemporary estimates of the cost of treating pressure damage. The most recent study was carried out in 1993 [1]. That study suggested that the cost to the NHS was in the range £180–£321 million (0.4–0.8% of health spending). Even allowing for inflation, more recent evidence from other countries suggests that this is a substantial underestimate [2].

*This paper was submitted for review shortly before Professor Gerry Bennett's final illness. Sadly, he died on 13th April 2003. This joint article is one of his last contributions in a long and distinguished career.

Methods

Cost of treatment

Costs were derived using a bottom-up methodology. Protocols of care were developed which reflect good clinical practice in the treatment of pressure ulcers of different grades (defined by the European Pressure Ulcer Advisory Panel classification, Table 1). These protocols define the typical daily resources required to provide the recommended treatment. Costs were assigned to resources using representative UK NHS unit costs at 2000 prices [3–5].

The costing assumes that patients are cared for in an institutional setting (hospital or long-term care) but are not admitted solely for the care of a pressure ulcer. Resources include nurse time (for dressing changes, patient repositioning and risk assessment), dressings, antibiotics, diagnostic tests, support surfaces and inpatient days where appropriate. The cost of support surfaces assumes equipment is purchased rather than rented (which is generally more expensive). Inpatient costs are only included for a small proportion of the patients who develop complications such

Table 1. Pressure ulcer classification. Classification agreed by the European Pressure Ulcer Advisory Panel (EPUAP) (www.epuap.com)

Grade 1	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 2	Partial thickness skin loss involving epidermis, dermis or both. The ulcer is superficial and presents clinically as an abrasion or blister.
Grade 3	Full thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through underlying fascia.
Grade 4	Extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures with or without full thickness skin loss.

as cellulitis or osteomyelitis. We have not accounted for the additional costs of treating ulcers developing on the heel in patients with primarily peripheral vascular disease or pressure ulcers occurring in patients with diabetes. The costs of infection do not include costs associated with the special precautions required for patients with MRSA. In this sense our cost estimates are deliberately conservative.

Daily costs were estimated by ulcer grade for patients who heal normally (without significant ulcer-related complications) and for three further conditions reflecting the most common sources of delayed healing: critical colonisation, cellulitis and osteomyelitis. This produced a 4×4 health state matrix with up to 16 different daily treatment costs reflecting ulcer grade and the presence or absence of complications (Table 2). Allowance was made in estimating a mean daily cost for the fact that the cost may vary at different stages in a treatment episode (for example, most diagnostic procedures will occur at the beginning of an episode).

Daily costs are of limited value without information about time to heal and the incidence of complications. Estimates of the mean expected time to heal and the incidence of complications were derived from a review of clinical literature [6–17]. Table 3 provides a summary of the sources used to derive expected rates of healing.

Table 2 shows average daily treatment cost for each grade of ulcer with and without complications. Daily costs range from £38 to £196. These costs vary relatively little with the grade of ulcer (£38–£50 for an ulcer without complications). The main driver of cost is the presence of complications, which typically involve diagnostic tests, additional monitoring, more expensive pressure relieving surfaces and extended inpatient length of stay.

Table 2 also shows the expected cost of resolving an ulcer in each health state. For example, the expected cost of healing an uncomplicated grade 4 ulcer is £7,750 (155 days @ £50). The expected cost of healing a grade 4 ulcer which develops cellulitis is £9,670 (155 days @ £50 + 10 days @ £192). For a patient with an ulcer of grade 4, the probability of cellulitis is 0.15. Thus 15% of patients with a grade 4 ulcer are likely to give rise to costs of £9,670. Episode costs increase substantially in the presence of complications, partly because of the higher daily costs of treatment and partly because of the longer episode length. A single episode of osteomyelitis may cost more than £24,000.

Table 4 shows the expected cost of healing an ulcer of a given grade. The expected cost is a function of the treatment cost associated with each ulcer-related health state and the probability that a patient with that grade of ulcer will be in that health state. Thus, the expected cost of healing a

Table 2. Treatment cost per patient per day and treatment cost per patient per episode of care, by grade of ulcer and by health state

Ulcer grade	Normal healing	Critical colonisation	Cellulitis	Osteomyelitis
Grade 1				
Cost per day	£38			
Cost per episode	£1,064			
Probability	1.0			
Grade 2				
Cost per day	£42	£56	£91	£196
Cost per episode	£3,948	£4,340	£4,858	£20,412
Probability	0.90	0.05	0.025	0.025
Grade 3				
Cost per day	£50	£62	£192	£196
Cost per episode	£6,350	£6,784	£8,270	£22,814
Probability	0.80	0.10	0.05	0.05
Grade 4				
Cost per day	£50	£62	£192	£196
Cost per episode	£7,750	£8,184	£9,670	£24,214
Probability	0.60	0.10	0.15	0.15

An episode is the length of treatment required to heal an ulcer. Probability is the proportion of patients with a particular grade of ulcer expected to be in a particular health state.

Table 3. Expected rates of healing (percent healed by week indicated and mean time to heal) for patients with pressure ulcers, by grade of ulcer

Author	Week	Grade 1 % healed	Grade 2 % healed	Grade 3 % healed	Grade 2–3 % healed	Grade 4 % healed
Gerding [6]	4	58%	37%			
Bale [7]					28%	
Thomas [8]	6–7				33%	
Berlowitz [9]			65%	14%		0%
Bale [10]	8				44%	
Motta [11]					40%	
Sebern [12]			64%			
Brandeis [13]	12		55%	32%	48%	23%
Burgos [14]				18%		
Kraft [15]					42%	
Brandeis [13]	24		74%	59%	70%	33%
Kraft [15]					42%	
Xakellis [16]			94%			
Brandeis [13]	52		87%	79%	84%	59%
Xakellis [17]			97%			
Mean time to heal						
	Weeks	4.06	13.4	18.2		22.1
	Days	28.4	93.8	127.4		154.7

Derived from a summary of literature.

Table 4. Expected cost of healing an ulcer by grade of ulcer—mean cost per patient

	Mean cost per patient	Range (+/– 10%)
Grade 1	£1,064	£958–£1170
Grade 2	£4,402	£3,962–£4,842
Grade 3	£7,313	£6,581–£8,044
Grade 4	£10,551	£9,496–£11,606

grade 2 ulcer is £4,402 ((0.9 × £3,948) + (0.05 × £4,340) + (0.025 × £4,858) + (0.025 × £20,412)). These cost estimates are subject to uncertainty because cost per day, episode length and the probability of complications all vary between patients.

Incidence of pressure ulcers in the UK

Because the costing methodology generates estimates of the expected cost of a complete episode of care, in order to assess the total cost in the UK we need an estimate of the number of new pressure ulcers presenting annually.

The mean incidence of pressure damage among hospital inpatients in the UK is approximately 40 cases per 1000 admissions in the population at risk [18]. In this context the population at risk includes acute medical and surgical admissions but does not include obstetrics or psychiatry. In 1999/2000 there were 8.8 million inpatient admissions in the UK (excluding mental illness and learning disabilities). Deducting admissions relating to pregnancy and childbirth gives a population at risk in that year of approximately 7.95 million. At an incidence rate of 4.0%, the number of new pressure ulcers developing in hospital patients amounted to 320,000 in 1999/2000.

One UK study reported that 25% of residents in 10 long-term geriatric wards in Glasgow developed a pressure ulcer within 6 months [19]. Respondents to a questionnaire survey of nursing homes carried out between September 1991 and August 1992 reported 957 admissions and 55

patients developing a pressure ulcer post-admission – an annual incidence of 5.7% [20]. We are not aware of any other studies reporting the incidence of pressure ulcers in long-term care in the UK. A study of nursing home residents in the United States reported incidence in the range 9.5–13% (grade 2 (broken skin) and above) after one year [13]. A recent study reported an incidence rate of 11.6% after 40 days among residents of two long-term care facilities in Canada [21]. On a conservative estimate, the incidence of new pressure damage in long-term care probably lies in the range 12–13% annually.

At March 2000 there were 240,000 places in residential homes and a further 150,000 beds in nursing homes, private hospitals and clinics for people aged over 65 in England [22]. Assuming an occupancy rate of 80%, this suggests a population at risk in long-term care of around 300,000. At an incidence rate of 12.5%, there are likely to be at least 37,500 patients annually with a new pressure ulcer.

The point prevalence of pressure ulcers in patients under the care of the community nursing service has been reported at 3–5% [23, 24]. There are no estimates of the incidence of pressure ulcers in this population. However, a recent study of grade 2+ pressure ulcers in General Practice found an overall incidence of 0.58 per 100 person-years in patients aged over 65 visiting their GP [25]. This gives a conservative estimate of 55,000 new patients with pressure ulcers developed under the care of a GP.

Taken overall, around 412,000 people are likely to develop a new pressure ulcer annually in the UK – one in every 150 of the general population and one in 23 of the population over 65.

Distribution of ulcers by grade

Studies which report both the prevalence and the incidence of ulcers in a given facility usually show that the median grade of new ulcers is less severe than the median grade of

Table 5. Annual incidence of pressure ulcers in the UK, by grade of ulcer

	Grade distribution (%)	Annual incidence (000)	Range (+/- 10%) (000)
Grade 1	34.9	140	130–160
Grade 2	41.2	170	150–190
Grade 3	12.9	50	50–60
Grade 4	11.0	50	40–50
Total	100.0	410	370–460

prevalent cases [20]. This is most likely because some ulcers progress to a more severe state over time. We believe that the grade distribution of prevalent cases provides a more accurate reflection of annual treatment costs. The grade distribution used in the costing exercise was derived from the literature [13, 24, 26–28]. This is shown in Table 5.

Results

The expected cost of healing a pressure ulcer in the UK varies with the grade of ulcer, from £1,064 (grade 1) to £10,551 (grade 4). The cost increases with ulcer grade partly because the time to heal is longer for a more severe ulcer and partly because the incidence of complications is higher in more severe cases. Costs per day are relatively insensitive to ulcer grade but are sensitive to the presence of complications. The cost impact of complications is driven primarily by the incidence of additional hospitalisation. A single episode of osteomyelitis may cost £20,000–£24,000, primarily because of the need for prolonged inpatient treatment.

These figures are consistent with estimates produced in other studies. Clough [29] estimated the average daily cost of prevention in an acute NHS hospital at £38 per day per patient (at 1990/1991 prices) and the cost of treatment at £82 per day – equivalent to £51 and £110 per day at 2000 prices. In our model the corresponding costs are £38/day for prevention (as grade 1 ulcer) and £42–£196/day for treatment, depending on health state. Thomson and Brooks [30] carried out a detailed costing of one patient with osteomyelitis in a geriatric unit in Glasgow. The cost was £10,610 for a 72-day stay at 1995 prices – £147/day (approximately £167 per day at 2000 prices). In our model the equivalent cost is £196 per day. In the US, the average cost per patient for a cohort of 12 patients with osteomyelitis treated between 1994 and 1998 was \$59,600 (approximately \$71,000 per patient at 2000 prices) [31]. Other US studies have reported additional health care costs associated with a pressure ulcer equivalent to \$20,000–\$28,000 per patient at 2000 prices [32, 33].

Our central estimate of the cost to the health and social care system overall in the UK is £1.77bn (£1.43bn–£2.14bn) annually at 2000 prices (Table 6). To put this in context, £1.77bn represented 4.1% of gross NHS expenditure (£43.5bn) in the 1999/2000 financial year [34], although not all of the cost of treating pressure ulcers will fall on the NHS. Some of the cost relating to residents in long-term care will be borne by the private sector or by local authority social services departments.

Table 6. Total cost of pressure ulcer treatment in the UK (2000 prices), by grade of ulcer. The range is derived by combining the range of costs per patient (Table 4) and the range of annual incidence (Table 5).

	Central estimate (£million)	Range (£million)
Grade 1	£153 m	£124–£185 m
Grade 2	£748 m	£606–£905 m
Grade 3	£389 m	£315–£471 m
Grade 4	£479 m	£388–£579 m
Total	£1,769 m	£1,433–£2,140 m

The overall cost is a function of the number of new pressure ulcers annually, the distribution of ulcers by grade and the expected cost per episode. All of these are subject to uncertainty.

- i. The majority of new cases arise in hospital inpatients. Our model assumes an incidence rate of 4%. If the rate is actually 2%, the central cost estimate is reduced from £1.77bn to £1.1bn.
- ii. Omitting all of the grade 1 ulcers has a small effect on the overall cost (reduced from £1.77bn to £1.6bn). More important is the proportion of cases at grade 3 or 4. The model assumes these constitute 24% of the total. If this is reduced to 10%, the total cost falls to £1.40bn.
- iii. Reducing treatment costs by 25% across the board reduces the central estimate of total cost to £1.35bn.

The resource cost of treatment is dominated by the cost of nurse time. Nurses (and nursing auxiliaries in some cases) are required for dressing the wound, repositioning the patient, monitoring and risk assessment. Because of the importance of regular repositioning and risk assessment, pressure ulcer care is necessarily labour intensive. Nurse or auxiliary time accounts for almost 90% of the cost overall and for 96% of the cost in ulcers of grade 1 or 2. In the more severe ulcers the other main determinant of cost is inpatient admission following the onset of complications (8% of cost overall and 30% in grade 3–4 ulcers). The cost of other resources such as dressings, antibiotics and pressure-relieving equipment is relatively low (3.3% of cost overall). We have not included the cost of amputation, nor any costs associated with surgical intervention to close an ulcer.

Discussion

Treating pressure ulcers represents a very significant resource cost to the health and social care system in the UK. In 1999/2000 the cost of pressure ulcer care was in the range £1.4–£2.1 billion and this was broadly equal to total NHS expenditure on mental illness or the total cost of community health services. Most of this cost is nurse time and it is clear that reducing the incidence of pressure damage will not release substantial cash resources. However, nurse time is a valuable resource with significant (and increasing) alternative uses.

Our estimate is considerably higher than any which have been produced previously and it may be that our costs are overestimated because they are based on the resource use required to implement best practice standards of care. Costs may be lower in practice to the extent that the actual care

offered falls some way short of these standards. Nonetheless, even if daily costs are lower than we have indicated, overall costs may well be higher in the long run because episode length (time to heal) is longer and/or because rates of complications are higher.

The overall cost estimate is very sensitive to the assumed number of new ulcers arising annually. Few of the studies which report incidence rates for the UK are recent and it may be that with improvements in clinical practice current rates are lower than those reported in the literature. To the extent that this is the case our estimates will be overstated. However, it is more likely that without concerted effort, incidence rates will tend to increase over time, rather than decline. The majority of new cases occur in hospital inpatients. The mean incidence rate is currently around 4% of admissions. However, the rate varies between specialties (from 2% in general surgical patients to 10% in orthopaedics) [18] and this is due in part to systematic differences in the age of patients in these groups. As the population ages, the incidence of pressure ulcers will increase. Between 2000 and 2020 the UK population over 65 is forecast to increase from 9.2 million to 11.3 million, an increase of 23%. By 2020 those over 65 will comprise one in five of the total population [35].

To the extent that pressure ulcers are avoidable, the incidence of pressure damage may be *prima facie* evidence of clinical negligence. In the United States the risk of litigation for negligent care increased after passage of the Omnibus Budget Reconciliation Act in 1987 (OBRA-87). OBRA-87 meant that for the first time Federal standards of care were established for nursing homes and other healthcare providers. This made it easier for claimants to prove that a provider had been negligent following the development of pressure damage. Between 1992 and 1996 the median settlement value following successful litigation for negligence regarding a pressure ulcer was \$279,000 [36].

Patients in the UK are increasingly willing to pursue a legal claim against the NHS where care is perceived to be inadequate. The NHS receives around 10,000 new claims for clinical negligence annually, and this number is rising [37]. The total annual charge to NHS accounts for settling claims has risen 7-fold since 1995–1996. Relatively few of the current claims relate to pressure damage and in the UK the mean value of settlements in these cases is relatively low (typically less than £10,000) [38]. Nonetheless, there have been cases which establish that hospitals and nursing homes are liable for pressure damage caused by inadequate care and it is likely that such claims will increase in the future.

Not all pressure damage can be avoided, but it is likely that the incidence can be reduced. From the cost analysis it is clear that the focus of prevention should be on avoiding the main drivers of cost. The most obvious is to prevent damage occurring in the first place. Even a grade 1 ulcer can cost more than £1,000 to resolve, but more important is the risk that once damage has occurred an ulcer will progress to a more severe state, with significant consequences for patients and for treatment costs. For example, transition from grade 1 to grade 2 increases the expected cost per patient more than 300% (£3,300) from £1,064 to £4,402

(Table 4). Progression from grade 2 to grade 3 increases cost by a further 66% (£2,900) to £7,313. Preventing progression of an ulcer to a more severe grade should be a key objective of care. The other main driver of cost is infection. The *additional* (incremental) cost of a single episode of cellulitis in a patient with a grade 3 or 4 ulcer is £1,920 (Table 2). Osteomyelitis can add an average of £16,500 per episode: in individual patients, or in cases of MRSA, the cost may be significantly higher.

Traditionally, the prevention and management of pressure ulcers has been the domain of nurses. Hopefully, recognition of the significant costs of the problem, both to patients and to the health and social care system, will encourage all healthcare professionals to become more involved.

Key points

- Pressure ulcers are a painful, debilitating and potentially serious outcome of a failure of routine medical and nursing care.
 - The total cost of pressure ulcer care in the UK is £1.4bn–£2.1bn – 4% of total NHS expenditure. Much of this cost should be preventable.
 - More than 90% of the cost of treatment is the cost of nurse time.
 - Without concerted effort this cost is likely to increase in the future as the population ages and the incidence of pressure damage increases.
 - The focus of attention should be on prevention—prevention of initial tissue damage, prevention of progression of an ulcer to a more severe grade and prevention of infection.
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Conflicts of interest

John Posnett is Head of Health Economics at Smith & Nephew Wound Management.

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