The resource impact of wounds on health-care providers in Europe

Most of the literature focuses on the resources required to manage particular wound types, rather than the cost of wounds to health-care organisations. Until this information is available, wound care is unlikely to be a management priority

cost; health-care systems; surgical site infection; pressure ulcers; diabetic foot ulcers; leg ulcers

J. Posnett, BA, DPhil, Vice President of Health Economics, Smith & Nephew, UK;
F. Gottrup, MD, DMSci, Professor of Surgery, Copenhagen Wound Healing Centre and Department of Dermatology, Bispebjerg University Hospital, Copenhagen, Denmark;
H. Lundgren, MSc, External Affairs and Reimbursement Manager, Mölnlycke Health Care, Sweden;
G. Saal, BA, MA, HealthEcon Write Ltd, UK;
on behalf of the Eucomed Advanced Wound Care Sector Group.
Email: john.posnett@smith-nephew.com

Good wound care is important because any wound is at risk of bacterial contamination, which inhibits the healing process and prevents wound closure. Non-healing wounds impact on mortality risk, patient function and quality of life. The resource impact on health-care providers is equally important: a substantial proportion of acute hospital beds are occupied by patients with wounds[1] and in some areas most community nurse time is spent on wound care.[2] Wound complications are associated with longer and more intensive treatment, extended hospital stays, readmission and specialist medical or surgical intervention. Despite this, the true significance of wound care for health-care providers is poorly understood. This is important because lack of awareness inhibits local attempts to improve the quality of wound-care provision.

This paper reviews the evidence on the prevalence of wounds and their treatment costs in major European countries. As far as we are aware, this is the first review to do this. Its main purpose is to identify the type of information available, rather than to critique its quality. One of its objectives is to highlight gaps in the literature and assess the need for a new research focus in this area. Our hypothesis is that awareness of the importance of wound care is low partly because the literature has focused on the epidemiology and treatment costs of particular wound types, rather than on the resource impact of wounds in organisations providing wound care.

Search methodology

A search was conducted for published literature, with an abstract written in English, on the prevalence, incidence or treatment costs for any wound type and all treatment settings in any European country, with a focus on the UK, France, Germany, Italy and Spain. The search used Medline (MEDL) 1996 to February 2008, updated in January 2009. It was supplemented with a hand search of relevant journals. The search related to both chronic and acute wounds.

We looked for evidence of the resource costs of wound care (nursing, medical and surgical time, hospital bed days and cost of materials) to a local health-care system or individual hospital or community health-care providers. Where this was unavailable, we sought evidence on the prevalence and/or incidence of patients with a particular wound type, and the average treatment cost per patient.

Results

Impact on health-care systems

We identified three studies that reported the prevalence of patients receiving wound care across all health-care settings (hospital inpatient and outpatient care, community clinics, home care and long-term care) in a local population.

A wound care audit carried out in Hull, UK, covered both hospital and community health-care providers serving a population of approximately 590,000.[3] Adjusting for underreporting, the prevalence of patients with at least one chronic or acute wound was 3.7 per 1000 (2199/590,000).

Of the patients, 79% were treated in community clinics, long-term care or home care and 21% in the acute hospital. Forty-three percent of patients had a surgical or trauma wound, 18% had pressure ulcers and 39% had leg or foot ulcers.

On the basis of this audit, the cost of wound care was estimated to be £2.5–3.1 million per 100,000 population, or 2–3% of the local health-care budget (at 2005–2006 prices). Nursing time spent on dressing changes amounted to 88.5 full-time equivalents (fte), while the wound-attributable inpatient cost was 19,000–31,000 bed days per annum.

A similar survey carried out in Bradford and Airedale, also in the UK, reported a prevalence of 3.55 patients with wounds per 1000 covered population (1735/487,975), across all health-care settings.[4] Based on this, the attributable cost of wound care in the region at 2006–2007 prices was £9.89 million: £2.03 million per 100,000 population or 1.44% of the local health-care budget. Costs included £1.69 million spent on dressings, 45.4 full-time nurses

(valued at £3.076 million) and 60–61 acute hospital beds (valued at £5.13 million).

A study of patients with chronic wounds (unhealed within six weeks) treated in hospital and community settings in Uppsala, Sweden, identified 694 patients with wounds in a population of 288,433 (a prevalence of 2.4/1000).[5] These patients required the equivalent of 57 full-time nurses for dressing changes alone.

Most patients with a wound are treated by nurses in the community, so wound care represents an important cost for community health-care providers. We identified only one (unpublished) study that quantified the proportion of community nurse time spent on wound care. This audit of wound care provided to 253 patients treated either at home or in a community-based health centre was carried out in Dublin in 2005.[2] Excluding travel time, dressing changes required the equivalent of 5.3 fte nurses per annum or 66% of the total available community nurse resource.

A study carried out in Portugal between May 2004 and December 2005 in a random sample of 148 health centres identified 1115 patients with 1421 wounds treated at home or in a community-based clinic.[6] Of the wounds, 42% were leg ulcers (median duration 12 months), 35% pressure ulcers (median duration three months) and 23% foot ulcers, traumatic wounds and other wounds. No estimates were given of the population prevalence or treatment costs.

Although most patients are treated in the community, the majority of wound-care costs arise in the hospital sector. Information on the overall prevalence and/or costs of wound care in the acute sector is limited, but 27–50% of acute hospital beds are likely to be occupied on any day by patients with a wound.

A point prevalence survey carried out on one day in April 2005 covering all hospitalised patients in a 754-bed university hospital in Paris identified 327 patients (52% of 624 evaluated inpatients) with 933 wounds.[1] The most common wounds were surgical incisions (37% of patients) and grade II–IV pressure ulcers (11%).

In the Hull audit referred to above, which was conducted over two days in June 2005, 26.8% of acute hospital inpatients (348/1297) had a wound, of which 41% were surgical.[3] In the Bradford and Airedale survey, 30.7% of inpatients in three acute hospitals had a wound (329/1072 occupied beds).[4] A study carried out at a major university hospital in Sweden surveyed all hospital inpatients, all patients admitted to the hospital and patients attending outpatient clinics on the day of the survey.[7] Of the 2172 patients surveyed, 408 (19%) had a total of 668 wounds.

Surgical wounds

Most surgical wounds heal by primary intention, but any wound is at risk of bacterial contamination and infection. Surgical-site infection (SSI) is a common source of hospital-acquired infection (HAI) and is a major issue for hospitals because of its effect on patient morbidity and treatment costs.

All major European countries have some form of national or regional surveillance of surgical infection, covering a limited list of surgical procedures in a sample of acute hospitals:[8]

- In England, the Noscomial Infection National Surveillance Service (NINSS) monitors patients undergoing one of 12 surgical procedures in 118 participating hospitals
- In France, the incidence of SSI is monitored in four inter-regional surveillance networks covering approximately 500 hospitals
- The German Krankenhaus-Infektions-Suveillance System (KISS) monitors wound infections nationally in patients undergoing one of 20 surgical procedures in 158 hospitals
- In Spain, separate surveillance programmes monitor the prevalence of nosocomial infections (Estudio de Prevalencio de las infecciones noscomiales en Espana, EPINE) and the cumulative incidence of noscomial infections (Programa especifico para la vigilancia de las infecciones noscomiales de Espana, PREVINE) among patients in public acute-care hospitals nationwide.

Austria, Belgium, Finland, France, Germany, Hungary, Lithuania, the Netherlands, Poland, Spain and the UK are part of a European project (HELICS) designed to reduce rates of nosocomial infection by sharing surveillance data collected in accordance with an agreed protocol. In 2004, 111,361 surgical procedures in the participating countries gave rise to 3365 SSIs, with a cumulative incidence of 3.02% within 30 days.[9]

In England, national surveillance covering 149,745 surgical procedures performed in 1997–2003 identified 5457 surgical infections (3.6% overall).[10]

Astagneau et al. reported results from the surveillance network in Northern France (INCISO) for 1997–1999. Of 38,973 surgical patients, 1344 (3.4%) developed a SSI. Mean time from operation to detection was 10.9 days, and 42% of the infections were detected after discharge.[11] More recent results from the same network recorded 3661 SSIs (2.4%) in 150,440 surgical patients in the six years 1998–2003.[12]

An incidence study carried out among patients admitted to hospitals in the Emilia Romagna region of northern Italy identified 206 surgical infections following 6167 operations (3.3%).[13]

Analysis of 130 surgical departments in German hospitals participating in the national surveillance programme identified 3241 SSIs following 191,114 operations performed in 1997–2004 (1.7% overall). The median time to detection was nine days.[14]

The risk of SSI depends on factors including the type of operation and the patient's age. In the 2004 HELICS report, the incidence of SSI varied from 1.2–

1.3% (laminectomy and cholecystectomy), to 3.7% (coronory artery bypass grafting), to 8.8% (colon surgery).[9] Moro found that SSIs were twice as common in patients aged over 64 (risk ratio 1.6; 95% confidence interval 1.2–2.3).[13]

Surgical infections are associated with an increased risk of mortality. In the French study by Astagneau et al., the unadjusted mortality rate was significantly higher in SSI patients than in non-SSI patients (5.8% versus 1.3%, p=0.001) and the infection-attributable mortality rate was 4.5%. The mortality rate ranged from 10.7% for gastric surgery and laparotomy to 0.1% for appendectomy. Astagneau et al. estimated that 38% of deaths in patients with SSI were attributable to the infection (95% CI 23–55%).[11]

The impact on hospital costs is also important. Surgical infections are associated with an extended hospital stay, readmission and re-operation. In the UK, surgical infection is estimated to add an average 11 days per episode to the inpatient length of stay, with a range from 3.3 days to 21.0 days depending on the procedure.[15]

Successive surveys of the prevalence of HAIs carried out in a tertiary care hospital and a military hospital in the Netherlands between November 2001 and May 2004 found that the most common sources of HAI were respiratory tract infection (22.6% of HAI cases), followed by SSIs (19.4%). The latter was associated with a prolonged length of stay (mean 22.9 days: 41.3 days versus 18.4 days, p<0.001). Fifty patients required readmission for SSI detected after discharge, resulting in 147 additional surgical procedures and excess stays of 40 days in ICU. The impact on the hospital of these 50 patients was 2592 days in wards, totalling €831,016 in extra costs (€16,620 per patient).[16]

A study of patients undergoing hip replacements in 2000–2004 at a teaching hospital in Madrid recorded 1260 operations leading to 28 SSIs (2.2%). Matched analysis found that the postoperative length of stay was significantly higher (by 31 days) for patients who developed a SSI (p<0.001). The mean attributable cost of the SSI was €14,216 per patient.[17]

Defez et al. estimated the direct additional costs associated with HAIs in a 715-bed university hospital in Nimes, France. The additional costs of laboratory tests, radiology, surgery and exploratory procedures amounted to €1.7m in 21 months, which is approximately €1 million per year. Including the costs of extended hospital stays, the total cost to the hospital was €5.6 million for the 21 months or €3.2 million per year. The shortfall between DRG (Diagnosis Related Group) reimbursements and the actual hospital costs for patients with a HAI was estimated to be €3 million annually. Surgical site infection accounted for 22% of the hospital costs of HAI, an average of €5800 per patient (2001–2002 prices).[18]

To put this in context, in 2005–2006 7.2 million surgical procedures were carried out in acute hospitals in England,[19] of which approximately 5.4 million (75%) were associated with a risk of SSI. At an average rate of 3–4%, these operations would be expected to give rise to 162,000–216,000 surgical infections at a total cost of around 1.78–2.38 million excess bed days (11 days per episode).

In France the annual incidence of SSIs has been estimated at 140,000–210,000 (2–3% of seven million procedures).[12] On the basis of the mortality estimates reported by Astagneau et al., 8000–12,000 of these patients might die, of which 3000–4500 deaths would be directly attributable to the infection.[11]

Based on the above studies, an acute hospital performing 10,000 surgical procedures annually may have 300–400 surgical infections at a cost of 3300–4400 excess bed-days or €1.74–2.32 million (Table 1).

Table 1. Surgical site infection: estimated impact on an acute hospital performing 10,000 operations annually

	Central estimate	Hospital impact (annual)
Patients with surgical wound infection	3–4% of surgical procedures[9-14]	300–400 patients
Attributable length of stay	11 days[15]	3300–4400 bed days
Attributable cost per episode	€5800[18]	€1.74–2.32 million

Pressure ulcers

Pressure ulcers are a relatively common risk among hospital inpatients and residents in long-term care whose mobility is restricted. A severe ulcer may involve damage through the skin, extending into muscle, tendon and bone. This type of ulcer is at risk of deep infection, which can be life-threatening. Patients at risk of pressure damage require pressure-redistributing equipment and additional nursing time; a severe ulcer (EPUAP grade 3 or 4) is likely to result in a longer hospital stay.

We did not find any studies reporting the incidence of hospital-acquired pressure ulcers in European hospitals. Point prevalence studies are more common, and these generally suggest that between one in four and one in five acute hospital inpatients has a pressure ulcer at any time.

A survey of 5947 patients in 25 acute hospitals in the UK, Belgium, Italy, Portugal and Sweden identified 1078 patients with one or more pressure ulcers (18.2%).[20] Prevalence was similar in Belgium (21.1%), Sweden (23.0%) and the UK (21.9%) and was lower than average in Italy (8.3%) and Portugal (12.5%). Over the total sample, 31.8% of pressure ulcers were severe (full-thickness) ulcers (EPUAP grade 3 or 4).

A national pressure ulcer prevalence study carried out in France in 2004 covering 37,307 inpatients in

Table 2. Prevalence, annual incidence and cost of leg and foot ulcers in Europe

	Range	Total EU-27
Population with diabetes (2000)		20.2 million[34]
Diabetic foot ulcers:		
• Prevalence	5–7%[33]	1.0–1.4 million
• Incidence	2–3%[32]	400,000–600,000
• Cost per episode	€7700–25,200[38]	€10,000[38]
• Indicative annual cost		€4–6 billion
Adult population (2008)		414 million[41]
Population aged over 65 (2008)		84 million[41]
Leg ulcers		
• Prevalence (adults)	0.12–0.32%[40]	490,000–1.3 million
• Incidence (age over 65)	1.16% (venous only)[52]	980,000 (venous only)
• Cost per episode	€2500-10,800[45,47]	€6650
• Indicative annual cost		€6.5 billion (venous only)

1149 hospitals (excluding teaching hospitals) recorded a prevalence rate of 8.9% (3314 patients), with a mean of 1.5 ulcers per patient. Thirty-nine percent of ulcers were EPUAP grade 3 or 4, and 52% of patients had had their ulcer for more than one month.[21]

Studies in Sweden have reported prevalence rates of 27% at a university hospital,[22] 23.9% (university hospital)[23] and 13.2% (general hospital).[23]

In Germany, prevalence of pressure ulcers among hospital patients was reported as 24.6% (average of 1.9 ulcers per patient).[24] In this study 13.1% of ulcers in hospitalised patients were grade 3 or above.

A prevalence study carried out in an university hospital in Copenhagen, Denmark, found that 22.7% of patients had signs of pressure damage and 14.3% had a grade 1–4 pressure ulcer. For most patients with grade 1–3 ulcers, the ulcer was not documented in the medical or nursing notes.[25]

The point prevalence of pressure ulceration was 18.5% in 672 adult patients in three teaching hospitals in Ireland.[26]

Most pressure ulcers identified in hospitalised patients are hospital-acquired. European estimates range from 80% (in an acute-care hospital in France)[27] and 77% (in three teaching hospitals in Ireland),[26] to 51% (survey of 21,574 inpatients in 87 German hospitals).[24]

Few studies have quantified the costs associated with pressure ulcers in European hospitals. Results of an analysis of 838 patients admitted to hospital with a primary diagnosis of pressure ulceration in Florence in 2005 suggested that 64% were aged over 65 years and their mean length of stay was 13.8 days (range 1–134). The average cost per patient episode was €5500.[28]

A retrospective costing analysis carried out in one acute hospital in Ireland calculated the total cost of treating one patient with three grade 4 pressure ulcers during 2002–2003. The total cost for this patient was €119,094, which included 129 days of inpatient treatment at a daily cost of €923.[29] An audit at the same hospital identified 78 patients with a pressure ulcer, of which 13 patients (17%) had at least one grade 4 ulcer. If the cost of treating these patients was similar to the one patient studied in detail, the cost to the hospital would be more than €1.5 million for these 13 patients alone.

The cost of treating and preventing pressure ulceration in the UK across all care settings was estimated to be between £1.4 billion and £2.1 billion (€2.2–3.2 billion) at 2000 prices, which was approximately 3–4% of the total health-care spend in that year.[30]

In Spain, around 53,000 patients with pressure ulcers are receiving treatment at any one time across all care settings at an annual cost of €461 million (2006 prices), which comprises approximately 5% of total health-care spending.[31]

The national cost in Ireland has been estimated at €205 million (2002–2003 prices).[29]

Diabetic foot ulcers

Patients with diabetes are prone to foot ulceration because of the nature of their disease. Peripheral neuropathy and the resulting loss of sensation render the foot susceptible to even minor trauma. A combination of peripheral sensory neuropathy and compromised vascular supply may result in ulceration and deep infection, leading to amputation.

The annual incidence of foot ulceration in patients with diabetes in the US is 2–3%[32] and the point prevalence is approximately 5–7%.[33]

Applying these rates to the estimated diabetic population of Europe (20.2 million [EU-27])[34] suggests that 1.0–1.4 million patients have a foot ulcer at any time (Table 2). The prevalence of diabetes in Europe is expected to increase significantly in the next 20 years. Between 2000 and 2030 the number of individuals with type 1 or type 2 diabetes is forecast to increase by 7.5 million (37%), from 20.2 million to 27.7 million. In the same period, the prevalence of diabetes in the population aged 20 and above will increase from 5.5% to 7.3%.[34]

Because of the relatively high rate of serious complications, treatment costs are dominated by the costs of hospitalisation, particularly those associated with amputation. Resource use and costs were analysed for 30 patients admitted to an acute hospital in Ireland with a diagnosis of diabetic foot ulceration between April 2001 and March 2002. Eight patients (26.7%) required amputation, and two (6.7%) with a non-healing ulcer died. The average duration of each admission was 20.3 ± 30.7 days. Net hospital expenditure was €704,689 or €23,500 per admission.[35]

Of the 166 patients admitted to a general hospital in Spain in 2000–2001 with a diagnosis of diabetic foot ulceration, 57% required amputation (27% major and 73% minor amputation). The overall in-hospital mortality rate for these patients was 5%.[36]

In a review of lower-limb amputations performed at one hospital in Madrid between 1994 and 1996, 65% of amputations occurred in patients with diabetes; the incidence of amputation was 28 times higher in diabetics than in the non-diabetic population.[37]

The Eurodiale (European Study Group on Diabetes and the Lower Extremity) consortium has investigated resource use and associated costs for patients with diabetic foot ulcers. Between September 2003 and October 2004, patients presenting with a new foot ulcer at 14 diabetic foot centres in 10 European countries were enrolled into the study. A total of 1088 patients were followed for up to 12 months. The average treatment cost per patient was €10,091 at 2005 prices. Hospitalisation (38.6%), antibiotics (11.9%), other interventions (9.8%), amputation (8.8%) and revascularisation (5.5%) represented the main components of the total cost. The average cost was €7722 for patients who healed without amputation (78.8% of the total), €20,064 for patients who remained unhealed at 12 months (12.7%), and €25,222 for patients who required major amputation (4.4%).[38]

In Sweden, long-term costs of managing patients with a history of foot ulceration were estimated in the mid-1990s as between $16,100 (US dollars) in the three years following initial ulcer healing for patients who healed without amputation and $63,100 for patients requiring major amputation.[39]

Leg ulcers

Leg ulceration is a chronic and recurrent condition most commonly caused by venous hypertension. Unless the aetiology is corrected, recurrence is common and an ulcer may remain unhealed for years.

A systematic review of international prevalence studies of lower-limb ulceration in the adult population identified 22 studies.[40] Eight population-based studies with clinical validation reported prevalence rates of open ulcers ranging from 0.12% to 1.1%. Seven studies without clinical validation reported prevalence rates of open ulcers ranging from 0.12% to 0.32%. In most of the studies prevalence was higher in women and increased with age. Applying the most conservative of these rates to the adult population of Europe (414 million)[41] suggests that between 490,000 and 1.3 million patients have an open lower-limb ulcer at any one time (Table 2).

A population-based study in Spain found that the leg ulcer prevalence in the population aged over 14 (approximately 55,000 patients) was 0.16%. Of these, 56% were venous ulcers. The mean age of patients was 76 years and 81% of all leg ulcers occurred in patients aged over 65.[42]

A study carried out in one health region in Ireland found a prevalence of leg ulcers of 0.12% in the general population, rising to 1.2% in the population aged over 70. The average age of patients was 75 years.[43]

A UK study examined the prevalence of venous ulceration in a local population.[44] Prevalence was 0.03% in men and 0.05% in women. For patients aged over 85, the rates were 0.829% in men and 0.806% in women. Fifty-five per cent of the patients had had their current ulcer for longer than one year.

In the UK it has been estimated that 70,000–190,000 patients with an open leg ulcer are receiving treatment at any time.[45] In France, a comparable estimate puts the figure at 60,000–180,000.[46]

The cost impact of leg ulceration is not well documented in Europe and such estimates as do exist differ widely in their methodology. Even though most leg ulcer patients are treated in the community, most estimates relate to the costs of treatment in a specialist clinic setting, so may underestimate the true costs in routine clinical practice.

The costs of treating patients with a leg ulcer were estimated for patients being treated in 31 specialist wound centres across Germany.[47] In total, 218 patients (mean age 69.8 years, median age 71 years) were investigated. Average cost per patient ranged from €9900 to €10,800.

Costs to the UK NHS were estimated from resource use collected as part of a randomised clinical trial of patients with a venous leg ulcer treated with two types of compression bandaging. Mean annual treatment costs for patients treated with four-layer compression (the gold standard) were estimated to be €2459 (95% CI €2251–2789) at 2005–2006 UK sterling prices converted to Euros at €1=£0.638.[45]

The annual costs of treating patients with venous leg ulcers in Sweden and the UK were estimated to be €1332–2585 in Sweden and €814–1994 in the UK at 2002 prices. Costs were highest for larger ulcers and ulcers with a long duration.[48]

Assuming best practice treatment, the total cost to the NHS of treating venous leg ulcers has been estimated as €266–314 million at 2005–2006 prices.[45]

Data from the French national DRG database recorded 14,762 hospital episodes in 2005 with a primary diagnosis of lower-limb ulcer (ICD-10 code: L97). The average cost per episode was €5744–7304 (inpatient) and €543 (outpatient). The approximate cost of hospitalisations alone in France in 2005 was €58 million.[49] The total national cost of treating patients with a leg ulcer in France was estimated in 2002 to be €126–882 million.[46]

In Germany, in 2005 the average length of stay for an inpatient with a venous leg ulcer was 15.8 days and the total hospital cost was €1.02 billion (inpatient) and €0.61 billion (outpatient): €1.63 billion in total, excluding costs incurred in treating patients in the community.[50]

References

1 Mahe, E., Langlois, G., Baron, G. et al. Results of a comprehensive hospital-based wound survey. J Wound Care 2006; 15: 9, 381-384.

2 O'Keeffe, M. An evaluation of wound care provision in one community care area in Ireland. Poster (P060) presented at EWMA annual meeting in Prague, May 2006. Available at http://ewma.org/english/conferences/conference-abstracts/2006/2006-poster-abstracts.html

3 Drew, P., Posnett, J., Rusling, L. on behalf of the Wound Care Audit Team. The cost of wound care for a local population in England. Int Wound J 2007; 4: 149-155.

Discussion

Any sustainable improvement in wound-care provision requires commitment from senior management. Where the true impact of wounds on an organisation is not visible, this commitment is likely to be lacking. This review of the available evidence suggests that information on the direct resource impact of wounds on hospital or community health-care providers in Europe is limited. Most of the literature focuses on particular wound types, rather than on the health-care organisations providing wound care.

Studies of wound epidemiology are of limited value in estimating the costs of wound care to local health-care providers because they typically consider only patients with one particular type of wound. Evidence on the total number of patients receiving wound treatment in a local population is limited.

Two population-based studies in the UK reported point prevalence rates of 3.70 and 3.55 patients per 1000 covered population with at least one wound under treatment.[3,4] Most of these patients (70–80%) were being treated by nurses in the community.

A similar study, undertaken in Sweden, found a point prevalence of patients with a chronic wound of 2.4 per 1000 population.[5]

Evidence of the prevalence of wounds among inpatients in European hospitals is also limited, and the range of estimates is wide: from 27% (in one UK hospital)[3] to 52% (in a Parisian hospital).[1] The higher estimates are consistent with evidence from a national survey of hospitals in Western Australia (mean prevalence 49% in 85 public hospitals).[51]

The only study to estimate the proportion of community nurse time spent on wound care is an unpublished study of community nurse resource use in Dublin.[2]

Two UK studies[3,4] have provided estimates of the annual cost of wound care to local health-care providers based on information about dressing costs, frequency of dressing changes and nurse time per dressing change. However, we did not find any studies that have carried out a detailed, prospective costing of local wound-care provision.

A number of studies report the prevalence of pressure ulcers among hospital inpatients. Most studies of European hospitals suggest that 20–25% of inpatients have a pressure ulcer at any one time, although the range of estimates is wide.[20] Several studies suggest that most pressure ulcers in hospitalised patients are hospital acquired (estimates range from 51%[24] to 80%.[27] However, we did not find any studies of the incidence of pressure ulceration, which may be regarded as a better measure of patient risk, or of the annual number of patients treated, which is a better reflection of the potential costs.

Evidence of the costs of pressure ulcer treatment is very limited. We identified one study that carried out a detailed costing of patients admitted to a hospital in Florence, Italy, with a primary diagnosis of pressure ulceration,[28] and one study that reported a costing of a patient with several severe pressure ulcers.[29] No studies estimated the total annual cost of pressure ulcer treatment to an individual hospital or community health-care provider.

All major European countries operate a form of regional or national surveillance of surgical wound infection designed to record the incidence of infection for a range of surgical procedures. National rates range from 1.7% to 3.6%,[10,14] although it is difficult to make comparisons because of differences in the procedures included and the periods covered by the surveillance. However, national estimates of the incidence of surgical infection are of limited value in understanding the costs to a particular hospital. National surveillance does not involve all hospitals or all surgical procedures, and the incidence of surgical infection is still not routinely recorded. The impact of wound infection on patient morbidity, extended length of hospital stay, readmission and re-operation is well understood, but in the absence of hospital-level data on the number of infections, it is difficult to estimate the true resource impact.

More research needs to be done in individual hospitals or by community health-care providers to identify the number of patients with wounds under treatment, the number of avoidable wounds or wound complications, and the annual resource costs of wound care to the organisation. This type of baseline audit highlights the opportunities for improvement and lays a foundation on which outcomes of specific interventions can be evaluated.

Limitations

Only articles with an abstract in English were included. In view of the European perspective, this may mean we have missed important sources. Since our main purpose was to identify the types of information available, rather than attempting an exhaustive summary of the results, we have not undertaken a critical review of the quality of published studies.

Conclusion

Wounds are a major source of morbidity to patients and a major cost to hospital and community health-care providers. The true extent of this cost is not recognised because local evidence is lacking. As a consequence, the vital importance of good wound care may be underestimated.

Improving the evidence base at an organisational level should be a priority. There are opportunties here for collaboration between wound-care professionals to facilitate local studies (using standard methods and data-collection instruments) which could be compared internationally. ■

4 Vowden, K., Vowden, P., Posnett, J. The resource costs of wound care in Bradford and Airedale primary care trust in the UK. J Wound Care 2009; 18: 3, 93-102.

5 Lindholm, C., Bergsten, A., Berglund, E. Chronic wounds and nursing care. J Wound Care 1999; 8: 1, 5-10.

6 Pina, E. Epidemiology of wounds treated in community services in Portugal. EWMA J 2007; 7: 2, 21-27.

7 Lindholm, C., Andersson, H., Fossum, B., Jorbeck, H. Wounds scrutiny in a Swedish hospital: prevalence, nursing care and bacteriology, including MRSA. J Wound Care 2005; 14: 7, 313-319.

8 Hospitals in Europe Link for Infection Control through Surveillance (HELICS). Principal Surveillance Networks in the EU Member States (About Helics, Helics III). Available at http://www.ecdc.europa.eu/IPSE/helicshome.htm

9 Hospital in Europe Link for Infection Control through Surveillance (HELICS). Surveillance of Surgical Site Infections, SSI Statistical Report, Surgical Site Infections 2004. Published March 2006. Available at http://ipse.univ-lyon1.fr

10 Surgical site infection surveillance in England (1997–2003). CDR Weekly 2004; 14: 21, 1-5. Available at http://www.hpa.org.uk/CDR/archives/2004/hcai_2104.pdf

11 Astagneau, P., Rioux, C., Golliot, F., Brucker, G. for the INCISO Network Study Group. Morbidity and mortality associated with surgical site infections: results from the 1997–1999 INCISO surveillance. J Hospital Infection 2001; 48: 267-274.

12 Rioux, C., Grandbastien, B., Astagneau, P. Impact of a six-year control programme on surgical site infections in France: results of the INCISO surveillance. J Hospital Infection 2007; 66: 217-223.

13 Moro, M.L., Morsillo, F., Tangenti, M. et al and the ICN Regional Group. Rates of surgical-site infection: an international comparison. Infect Control Hosp Epidemiol 2005; 26: 442-448.

14 Brandt, C., Sohr, D., Behnke, M. et al. Reduction of surgical site infection rates associated with active surveillance. Infect Control Hosp Epidemiol 2006; 27: 1347-1351.

15 Coello, R., Charlett, A., Wilson, J. et al. Adverse impact of surgical site infections in English hospitals. J Hosp Infect 2005; 60: 93-103.

16 Hopmans, T.E.M., Blok, H.E.M., Troelstra, A., Bonten, M.J.M. Prevalence of hospital-acquired infections during successive surveillance surveys conducted at a university hospital in the Netherlands. Infect Control Hosp Epidemiol 2007; 28: 4, 459-465.

17 Monge Jodra, V., Sainz de Los Terreros Soler, L., Diaz-Agero Perez, C. et al. Excess length of stay attributable to surgical site infection following hip replacement: a nested case-control study. Infect Control Hosp Epidemiol 2006; 27: 1299-1303.

18 Defez, C., Fabbro-Peray, P., Cazaban, M. et al. Additional direct medical costs of nosocomial infections: an estimation from a cohort of patients in a French university hospital. J Hosp Infect 2008; 68: 130-136.

19 Hospital Episode Statistics for England. Available at http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=192

20 Vanderwee, K., Clark, M., Dealey, C. et al. Pressure ulcer prevalence in Europe: a pilot study. J Evaluation in Clinical Practice 2007; 13; 227-235.

21 Barrois, B., Labalette, C., Rousseau, P. et al. A national prevalence study of pressure ulcers in French hospital inpatients. J Wound Care 2008; 17: 9, 373-379.

22 Wann-Hansson, C., Hagell, P., Willman, A. Risk factors and prevention among patients with hospital-acquired and pre-existing pressure ulcers in an acute care hospital. J Clin Nurs 2008; 17: 13, 18-27.

23 Gunningberg, L. Risk, prevalence and prevention of pressure ulcers in three Swedish health-care settings. J Wound Care 2004; 13: 7, 286-290.

24 Lahmann Nils, A., Halfens Ruud, J.G., Dassen, T. Pressure ulcers in German nursing homes and acute care hospitals: prevalence, frequency, and ulcer characteristics. Ostomy/Wound Management 2006; 52: 2, 20-33.

25 Bermark, S., Zimmerdahl, V., Muller, K. Prevalence investigation of pressure ulcers. EWMA J 2004; 4: 1, 7-11.

26 Gallagher, P., Barry, P., Hartigan, I. et al. Prevalence of pressure ulcers in three university teaching hospitals in Ireland. J Tissue Viability 2008; 17: 4, 103-109.

27 Barbut, F., Parzybut, B., Boelle, P.Y. et al. Pressure sores in a university hospital (in French). Presse Med 2006; 35: 5 Pt 1, 769-778

28 Vannozzi, D., Baggiani, L., Gori, E. et al. Analysis of costs attributable to cutaneous sores in the territory of the local health unit of Florence. Oral presentation (no. 22) at EWMA annual meeting in Lisbon, May 2008. Available at http://www.ewma.org/ewma2008/downloads/Abstractbog_ENG_LOW_oral%20abs%201-100.pdf

29 Gethin, G., Jordan-O'Brien, J., Moore, Z. Estimating costs of pressure area management based on a survey of ulcer care in one Irish hospital. J Wound Care 2005; 14: 4, 162-165.

30 Bennett, G., Dealey, C., Posnett, J. The cost of pressure ulcers in the UK. Age Ageing 2004; 33: 230-235.

31 Soldevilla Agreda, J.J., Torra i Bou, J.E., Posnett, J. et al. The burden of pressure ulcers in Spain. Wounds 2007; 19: 7, 201-206.

32 Reiber, G.E., Boyko, E.J., Smith, D.G. Lower extremity foot ulcers and amputations in diabetes. In: National Diabetes Data Group, National Institutes of Health. Diabetes in America (2nd edn). US Government Printing Office (NIH pub. no. 95-1468), 1995.

33 Scottish Intercollegiate Guidelines Network (SIGN). Management of Diabetes: A national clinical guideline. SIGN, 2001.

34 Wild, S., Roglic, G., Green, A. et al. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004; 27: 1047-1053.

35 Smith, D., Cullen, M.J., Nolan, J.J. The cost of managing diabetic foot ulceration in an Irish hospital. Ir J Med Sci 2004; 173: 2, 89-92.

36 Martinez, D.A., Aguayo, J.L., Morales, G. et al. Impact of a clinical pathway for the diabetic foot in a general hospital (in Spanish). Anales de Medicina Interna 2004; 21: 9, 420-424.

37 Calle-Pascual, A.L., Redondo, M.J., Ballesteros, M. et al Non-traumatic lower extremity amputations in diabetic and non-diabetic subjects in Madrid, Spain. Diabetes Metabolism 1997; 23: 519-523.

38 Prompers, L., Huijberts, M., Schaper, N. et al. resource utilisation and costs associated with the treatment of diabetic foot ulcers. Prospective data from the Eurodiale study. Diabetologia 2005; 51: 1826-1834.

39 Apelqvist, J., Ragnarson-Tennvall, G., Larsson, J., Persson, U. Long-term costs for foot ulcers in diabetic patients in a multidisciplinary setting. Foot Ankle Int 1995; 16: 7, 388-394.

40 Graham, I.D., Harrison, M.B., Nelson, E.A. et al. Prevalence of lower-limb ulceration: a systematic review of prevalence studies. Adv Skin Wound Care 2003; 16: 6, 305-316.

41 US Census Bureau, International Database. Available at http://www.census.gov/ipc/www/idb. Accessed August 2008.

42 Soldevilla, J., Torra, J.E., Verdu, J. et al. Epidemiology of chronic wounds in Spain: results of the first national studies on pressure ulcer and leg ulcer prevalence. Wounds 2006; 18: 8, 213-226.

43 Clarke-Moloney, M., Keane, N., Kavanagh, E. An exploration of current leg ulcer management practices in an Irish community setting. J Wound Care 2006; 15: 9, 407-410.

44 Moffatt, C., Franks, P., Doherty, D. et al. Prevalence of leg ulceration in a London population. Quarterly J Med 2004; 97: 7, 431-437.

45 Posnett, J., Franks, P. The costs of skin breakdown and ulceration in the UK. In: Pownall, M. (ed.). Skin Breakdown: The silent epidemic. Smith & Nephew Foundation, 2007. Available at www.snfoundation.org.uk

46 Begaud, B. Epidemiology of leg ulcers (in French). Ann Dermatol Venereol 2002; 129: 10 Pt 2, 1225-1226.

47 Augustin, M., Herberger, K., Purwins, S., Debus, E.S. Cost-of-illness of venous leg ulcers in Germany: a nationwide cross-sectional study. Oral presentation (no. 24) at EWMA annual meeting in Lisbon, May 2008. Available at http://ewma.org/ewma2008/downloads/Abstractbog_ENG_LOW_oral%20abs%201-100.pdf

48 Tennvall, G.R., Hjelmgren, J. Annual costs of treatment for venous leg ulcers in Sweden and the United Kingdom. Wound Rep Reg 2005; 13: 13-18.

49 Agence Technique de l'information sur l'Hospitalisation. http://www.ewma.org/ewma2008/downloads/Abstractbog_ENG_LOW_oral%20abs%201-100.pdf

50 Rabe, E., Pannier-Fischer, F., Bromen, K. et al. Bonner Venenstudie der Deutschen Gesellschaft für Phlebologie Epidemiologische Untersuchung zur Frage der Häufigkeit und Ausprägung von chronischen Venenkrankheiten in der städtischen und ländlichen Wohnbevölkerung , Phlebologie 2003; 32: 1, 1-14.

51 Strachan, V., Prentice, J., Newall, N. et al. WoundsWest Wound Prevalence Survey 2006: State-wide Report Overview. Ambulatory Care Servivces, Department of Health, Perth, Western Australia 2007.

52 Margolis, D.J., Bilker, W., Santanna, Baumgarten M. Venous leg ulcer: incidence and prevalence in the elderly. J Am Acad Dermatol 2002; 46: 381-386.

Ameer Ally (ConvaTec), Luc Gryson (EWMA), David Hibbitt (Covidien), Kristina Jensen (Coloplast A/S), Laurent Metz (Ethicon) and Achim Vogel (Paul Hartmann) provided invaluable assistance in identifying and reviewing information and commenting on drafts of the paper