

The health economic burden that acute and chronic wounds impose on an average clinical commissioning group/health board in the UK

Objective: To estimate the patterns of care and related resource use attributable to managing acute and chronic wounds among a catchment population of a typical clinical commissioning group (CCG)/health board and corresponding National Health Service (NHS) costs in the UK.

Method: This was a sub-analysis of a retrospective cohort analysis of the records of 2000 patients in The Health Improvement Network (THIN) database. Patients' characteristics, wound-related health outcomes and health-care resource use were quantified for an average CCG/health board with a catchment population of 250,000 adults ≥ 18 years of age, and the corresponding NHS cost of patient management was estimated at 2013/2014 prices.

Results: An average CCG/health board was estimated to be managing 11,200 wounds in 2012/2013. Of these, 40% were considered to be acute wounds, 48% chronic and 12% lacking any specific diagnosis. The prevalence of acute, chronic and unspecified wounds was estimated to be growing at the rate of 9%, 12% and 13% per annum respectively. Our

analysis indicated that the current rate of wound healing must increase by an average of at least 1% per annum across all wound types in order to slow down the increasing prevalence. Otherwise, an average CCG/health board is predicted to manage ~23,200 wounds per annum by 2019/2020 and is predicted to spend a discounted (the process of determining the present value of a payment that is to be received in the future) £50 million on managing these wounds and associated comorbidities.

Conclusion: Real-world evidence highlights the substantial burden that acute and chronic wounds impose on an average CCG/health board. Strategies are required to improve the accuracy of diagnosis and healing rates.

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burden • clinical commissioning group • health board • cost • wounds • ulcers

We previously reported the patterns of care and annual levels of resource use attributable to the National Health Service (NHS) managing an estimated 2.2 million patients with a wound during 2012/2013.^{1,2} The annual cost incurred by the NHS in managing these wounds and associated comorbidities was estimated to be £5.3 billion.¹ This equated to 4% of total expenditure by the publicly-funded NHS in the UK in 2013.¹ After adjustment for comorbidities, the annual NHS cost of managing these 2.2 million wounds was estimated to be £4.5–5.1 billion.¹ However, the annual NHS cost of managing a specific wound and associated comorbidities ranged from £1.94 billion for managing 731,000 leg

ulcers to £89.6 million for managing 87,000 burns.² Patients were predominantly managed in the community by general practitioners (GPs) and nurses. Hence, two-thirds of the annual cost was incurred in the community and the rest in secondary care.^{1,2} Of all wounds, 61% were shown to heal in an average year, and the annual cost of managing these wounds was estimated to be £2.1 billion compared with £3.2 billion for the 39% of wounds that did not heal within the study year.^{1,2} The patient care cost of an unhealed wound was a mean 135% more than that of a wound that heals (ranging from £698 to £3998 per patient for a healed wound versus £1719 to £5976 per patient for an unhealed wound).²

In England, clinical commissioning groups (CCGs) are clinically led statutory NHS bodies responsible for the planning and commissioning of health-care services for their local area. They are responsible for about 60% of the NHS budget, commission most secondary care services, and they also play a part in the commissioning of GP services.³ Health boards in Wales and Scotland are responsible for delivering all NHS services within a

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geographical area.^{4,5} Clinical commissioners need to plan for the health-care needs of their catchment population by delivering frontline services to achieve the best possible health outcomes. Accordingly, the aim of this article is to report the patterns of care and related resource use attributable to managing acute and chronic wounds among a catchment population of a typical CCG/health board and the corresponding NHS costs.

Methods

Study design

This was a sub-analysis of a retrospective cohort analysis of the records of a cohort of patients in The Health Improvement Network (THIN) database, as previously described.^{1,2}

Study population

The study population comprised the anonymised case records of a randomly selected cohort of 1000 patients from the THIN database who had a wound between 1 May 2012 and 30 April 2013 (cases) and a randomly selected cohort of 1000 control patients (controls) from the database, who were matched with the cases according to age, gender and the patient's general practice.¹ The inclusion and exclusion criteria have been previously described.^{1,2} In summary, cases had to be aged 18 years or above and have a read code for a wound in their medical history during the study year. Patients were excluded if they had a surgical wound that healed within four weeks of the surgical procedure and so too were patients with a dermatological tumour. The control patients had no mention of a wound anywhere in their medical history. The cases were age- and sex-matched with control patients as previously described.^{1,2} The authors obtained the complete medical records of the 2000 patients in the dataset, which enabled the analysis of data within and outside of the study period.

Study variables and statistical analyses

Information was systematically extracted from the patients' records over the study period as previously described.^{1,2} Wound type was documented in the patients' records, and the authors categorised them as being either acute (i.e. abscess, burn, open wound, unhealed surgical wound, trauma) or chronic (i.e. diabetic foot ulcer, arterial leg ulcer, mixed leg ulcer, venous leg ulcer, pressure ulcer).

Patients' characteristics, comorbidities (defined as a non-acute condition that patients were suffering from in the year before the start of their wound and not necessarily the year before the start of the study period), wound-related health outcomes and all community-based and secondary care resource use were extracted from the electronic records. This included a manual review of scanned documents and letters. All the data were quantified for cases and controls and stratified according to wound type. Differences between cases and controls were considered to be attributable to wound care and associated comorbidities. Differences

between acute and chronic wounds were tested for statistical significance using either a Mann-Whitney U test or a chi-squared test.

Logistic regression was used to investigate relationships between baseline variables and clinical outcomes. Multiple linear regression was also used to assess the impact of patients' baseline variables on resource use and clinical outcomes. All statistical analyses were performed using IBM SPSS Statistics (V.22.0; IBM Corporation (IBM United Kingdom Limited, Portsmouth)).

Health economic modelling

Using the THIN dataset, a computer-based model was constructed^{1,2} depicting the treatment pathways and associated management of the 2000 patients in the data set. The model spans the 12-month period from 1 May 2012 to 30 April 2013.

Unit costs at 2013/2014 prices⁶⁻⁸ were applied to the resource use in the model to estimate the total NHS cost of patient management from the time a patient entered the dataset (i.e. from 1 May 2012 or the start time of their wound if it occurred later) up to the time their wound healed or the end of the study period, whichever came first.

The THIN database contained an estimated 135,000 patients with a wound that matched the study protocol's inclusion and exclusion criteria, drawn from a base population of 3.9 million active patients. The catchment population of an average CCG was estimated to be 210,000 adults ≥ 18 years of age.⁹ The catchment population of an average health board in Scotland and Wales was estimated to be 310,000 and 350,000 adults ≥ 18 years of age, respectively.^{10,11} The average of all CCGs/health boards was 220,000 adults ≥ 18 years of age. Hence, the outputs of the modelling were extrapolated to the adult population of an average CCG/health board with a catchment population of 250,000 adults ≥ 18 years of age.

Sensitivity and scenario analyses

To assess whether any variable had a significant impact on the total cost of patient management, one-way sensitivity analyses were performed on all model inputs. This included adjusting the cost of patient management to exclude the cost of managing patients' comorbidities. Scenario analyses were performed to assess:

- The effect of changing the size of the catchment population in an average CCG/health board
- The impact of healing rates on the annual prevalence of wounds
- The impact of restricting product availability based on cost alone within a local or national wound care formulary.

Results

Patients' characteristics

Patients with acute wounds were significantly younger than those with chronic wounds (64.1 versus 72.3 years;

$p < 0.001$). However, there were no gender differences between the two groups (54% and 56% were females in the acute and chronic groups, respectively). Additionally, there was no significant difference in the percentage of smokers. In the acute group, 20% were smokers, 39% were non-smokers and 39% were ex-smokers. In the chronic group, 16% were smokers, 39% were non-smokers and 41% were ex-smokers.

The percentage of patients with acute and chronic wounds with different comorbidities in the year before the start of their wound (and not necessarily the year before the start of the study) is summarised in Table 1. Patients with chronic wounds had significantly more comorbidities than those with acute wounds. Consequently, the mean number of comorbid conditions in the acute group was 3.5 per patient compared with 4.2 per patient in the chronic group ($p < 0.001$).

Prevalence of wounds in the UK

We previously reported that the NHS managed an estimated 2.2 million adults ≥ 18 years of age with a wound in 2012/2013.¹ This equated to 11,200 wounds in an average CCG/health board with a catchment population of 250,000 adults ≥ 18 years of age. Of these wounds, 40% were considered to be acute, 48% chronic and 12% lacking any diagnosis. Furthermore, 89% of acute wounds, 58% of chronic wounds and 87% of unspecified wounds were a new wound in the study year. Additionally, 79% of acute wounds, 43% of chronic wounds and 71% of unspecified wounds healed in the study year and 1%, 3% and 3% of patients died, respectively. This suggests that the annual prevalence of acute, chronic and unspecified wounds is growing at the rate of 9%, 12% and 13%, respectively (i.e. the difference between the number of new wounds per annum and the number of healed wounds and deaths per annum being added to the number of existing wounds per annum, and assuming no demographic changes). Hence, in 2015/2016 it was estimated that an average CCG/health board with a catchment population of 250,000 adults ≥ 18 years of age would be managing 15,300 wounds (5900 acute, 7400 chronic and 2000 unspecified wounds). This equates to the annual prevalence of all wounds growing at the rate of 11%.

Logistic regression was performed on patients' age, gender, smoking status and all comorbidities. Those variables that yielded a p -value ≥ 0.05 were omitted from the analysis, resulting in the prior presence of cardiovascular disease, dermatological symptoms, nutritional deficiency and respiratory disease being considered to increase the relative risk of developing a chronic versus an acute wound or vice versa:

- Cardiovascular disease, a risk factor for developing a chronic rather than an acute wound (odds ratio: 2.10 [95% CI: 1.48; 2.99]; $p < 0.001$)
- Dermatological symptoms, a risk factor for developing a chronic rather than an acute wound (odds ratio: 1.58 [95% CI: 1.17; 2.11]; $p = 0.002$)
- Nutritional deficiency, a risk factor for developing a

Table 1. Percentage of patients with a comorbidity in the year before the start of their wound

Comorbidity	Acute	Chronic	p-value
Cardiovascular	61%	81%	<0.001
Dermatological	52%	63%	<0.001
Endocrinological	38%	49%	<0.001
Gastroenterological	43%	43%	ns
Musculoskeletal	35%	39%	ns
Nutritional deficiency	26%	38%	<0.001
Psychiatric	31%	30%	ns
Respiratory	31%	27%	ns
Neurological	21%	24%	ns
Other	11%	17%	ns
Immunological	4%	3%	ns
None	6%	5%	ns
ns—not significant			

chronic rather than an acute wound (odds ratio: 1.57 [95% CI: 1.15; 2.13]; $p = 0.004$)

- Respiratory disease, a risk factor for developing an acute rather than a chronic wound (odds ratio: 1.61 [95% CI: 1.17; 2.20]; $p = 0.003$).

Clinical outcomes

During the study period, 79% of acute wounds and 43% of chronic wounds healed. Nutritional deficiency had a greater impact on the healing of acute wounds compared with chronic wounds. Logistic regression suggested that during the study period nutritional deficiency was an independent risk factor for non-healing with:

- An odds ratio of 0.40 [95% CI: 0.23; 0.69]; $p = 0.001$ for acute wounds
- An odds ratio of 0.59 [95% CI: 0.39; 0.89]; $p = 0.01$ for chronic wounds.

Health-care resource use associated with patient management

As previously reported, patients were predominantly managed in the community by GPs and nurses (Table 2). Management of chronic wounds used significantly more resources than acute wounds, ranging from 162% more community nurse visits, to 47% more GP visits, 100% more drug prescriptions and 178% more wound care products per patient (Table 3). There was also a substantial, but non-significant increase in the use of other resources, including 70% more practice nurse visits, 260% more specialist nurse visits and 28% more hospital outpatient visits per patient. Hence, an average CCG/health board with a catchment population of 250,000 adults ≥ 18 years of age is estimated to have managed 11,200 wounds in

Table 2. Mean annual amount of NHS resource use attributable to managing different wound types in an average clinical commissioning group/health board with a catchment population of 250,000 adults. (Percentage of total amount of resource use is in parentheses)

Mean amount of resource use in an average CCG/health board with a catchment population of 250,000 adults attributable to managing:							
	Acute wounds		Chronic wounds		Unspecified wounds		All wounds
Number of wounds	4516	(40%)	5298	(48%)	1364	(12%)	11,178
GP visits	13,088	(34%)	22,589	(58%)	3018	(8%)	38,695
Practice nurse visits	28,870	(31%)	57,515	(62%)	6997	(7%)	93,382
Community nurse visits	12,351	(23%)	37,980	(70%)	4281	(8%)	54,612
Specialist nurse visits	45	(19%)	190	(81%)	0	(0%)	235
Allied health-care visits	682	(30%)	1330	(57%)	302	(13%)	2314
Hospital outpatient visits	6147	(36%)	9243	(53%)	1956	(11%)	17,346
Hospital admissions and day cases	2984	(61%)	1621	(33%)	268	(6%)	4873
Diagnostic tests	53,080	(29%)	113,525	(62%)	15,570	(9%)	182,175
Devices	396,348	(29%)	834,845	(61%)	140,702	(10%)	1,371,895
Wound care products	388,144	(22%)	1,267,306	(71%)	130,033	(7%)	1,785,483
Drug prescriptions	131,207	(27%)	307,223	(63%)	49,950	(10%)	488,380

Table 3. Mean annual amount of NHS resource use per patient attributable to managing different wound types

Mean amount of resource use per patient attributable to managing:					
	Acute wounds	Chronic wounds	Unspecified wounds	All wounds	Percentage difference between chronic and acute wounds
GP visits*	2.90	4.26	2.21	3.46	47%
Practice nurse visits	6.39	10.86	5.13	8.35	70%
Community nurse visits*	2.73	7.17	3.14	4.89	162%
Specialist nurse visits	0.01	0.04	0.00	0.02	260%
Allied health-care visits	0.15	0.25	0.22	0.21	66%
Hospital outpatient visits	1.36	1.74	1.43	1.55	28%
Hospital admissions and day cases	0.66	0.31	0.20	0.44	-54%
Diagnostic tests*	11.75	21.43	11.41	16.30	82%
Devices*	87.77	157.58	103.15	122.73	80%
Wound care products*	85.95	239.20	95.33	159.73	178%
Drug prescriptions*	29.05	57.99	36.62	43.69	100%

*Difference between acute and chronic wounds was significant; p=0.001

2012/2013 with 54,612 community nurse visits, 93,382 practice nurse visits, 38,695 GP visits, 17,346 hospital outpatient visits, 0.49 million drug prescriptions and 1.8 million dressings and bandages (Table 2).

NHS cost of patient management

In 2012/13 an average CCG/health board was estimated to have spent £26.7 million on managing 11,200 wounds

and associated comorbidities (£9.7 million on acute wounds, £15.2 million on chronic wounds and £1.8 million on managing unspecified wounds, each with associated comorbidities (Table 4). The primary cost driver of managing acute wounds was found to be hospital admissions and day cases, accounting for 42% of the total cost. In contrast, the primary cost driver of managing chronic wounds was drug prescriptions,

Table 4. Mean annual cost of NHS resource use attributable to managing different wound types in an average clinical commissioning group/health board with a catchment population of 250,000 adults. (Percentage of total cost is in parentheses)

Mean NHS cost attributable to managing:								
	Acute wounds		Chronic wounds		Unspecified wounds		All wounds	
GP visits	£587,397	(6%)	£1,131,003	(7%)	£137,947	(8%)	£1,856,347	(7%)
Practice nurse visits	£375,447	(4%)	£747,698	(5%)	£90,959	(5%)	£1,214,104	(5%)
Community nurse visits	£790,260	(8%)	£2,340,110	(15%)	£286,914	(16%)	£3,417,284	(13%)
Specialist nurse visits	£2750	(<1%)	£13,994	(<1%)	£0	(0%)	£16,744	(<1%)
Allied health-care visits	£37,387	(<1%)	£83,425	(1%)	£28,043	(2%)	£148,855	(1%)
Hospital outpatient visits	£718,984	(7%)	£1,138,748	(7%)	£230,068	(13%)	£2,087,800	(8%)
Hospital admissions and day cases	£4,098,613	(42%)	£1,681,292	(11%)	£251,394	(14%)	£6,031,299	(23%)
Diagnostic tests	£211,100	(2%)	£550,596	(4%)	£90,456	(5%)	£852,152	(3%)
Devices	£318,579	(3%)	£979,984	(6%)	£33,110	(2%)	£1,331,674	(5%)
Wound care products	£1,203,896	(12%)	£2,307,146	(15%)	£224,892	(12%)	£3,735,935	(14%)
Drug prescriptions	£1,366,539	(14%)	£4,227,384	(28%)	£452,713	(25%)	£6,046,636	(23%)
Other	£2012	(<1%)	£5700	(<1%)	£2571	(<1%)	£10,283	(<1%)
TOTAL	£9,712,964	(100%)	£15,207,080	(100%)	£1,829,067	(100%)	£26,749,113	(100%)
Mean cost per patient	£2151		£2870		£1341		£2393	

accounting for 28% of the total cost. Wound care products accounted for 12–15% of the total cost, while total community staff costs accounted for up to a further 28% of the overall costs. The distribution of costs between the community and secondary care varied according to wound type. Some 48% and 78% of the total annual NHS cost of managing acute and chronic wounds, respectively, was incurred in the community, with the remainder being incurred in secondary care.

Sensitivity analyses

The estimated amounts of individual resource use were individually reduced and increased by 25%. However,

this only affected the total annual NHS cost of wound management by 6% or less.

The analysis was based on an average CCG/health board with a catchment population of 250,000 adults ≥18 years of age. Fig 1 shows how the costs incurred by an average CCG/health board change in accordance with different numbers of adults in the catchment population. Table 5 shows the impact of the predicted annual prevalence of all wounds not growing at the rate of 11%.

On the basis that the annual prevalence of acute, chronic and unspecified wounds is growing at the rate of 9%, 12% and 13% respectively, it was predicted that

Table 5. Predicted annual number of wounds managed in an average clinical commissioning group/health board with a catchment population of 250,000 adults in accordance with different annual prevalence rates and associated NHS costs of wound management

Year	Predicted annual number of wounds if the annual prevalence grows at:					Predicted discounted annual NHS cost (£ million) of wound management if the annual prevalence grows at:				
	5.5%	8.3%	11.0%	13.8%	16.5%	5.5%	8.3%	11.0%	13.8%	16.5%
2015/2016	13,100	14,200	15,300	16,400	17,600	31.4	33.9	36.6	39.4	42.3
2016/2017	13,800	15,300	16,900	18,700	20,500	33.1	36.7	40.6	44.8	49.3
2017/2018	14,600	16,600	18,800	21,200	23,900	33.7	38.4	43.5	49.2	55.5
2018/2019	15,400	18,000	20,900	24,200	27,900	34.4	40.1	46.7	54.1	62.5
2019/2020	16,200	19,400	23,200	27,500	32,600	35.0	41.9	50.1	59.5	70.4

Discounting—the process of determining the present value of a payment that is to be received in the future

an average CCG/health board with a catchment population of 250,000 adults ≥18 years of age would be managing 6900 acute, 9400 chronic and 2500 unspecified wounds (18,800 wounds in total) in 2017/2018 (Fig 2), at a discounted (the process of determining the present value of a payment that is to be received in the future) cost of £14.4 million, £25.9 million and £3.3 million, respectively (i.e. £43.5 million in total; Fig 3). Fig 2 also indicates that the annual wound healing rate must increase by a minimum of 1% in order to slow down the year-on-year increase in the annual prevalence of wounds. However, if the rate of wound healing increases by an additional 1% per annum, the annual prevalence would start to decrease by 2019/2020, assuming no demographic changes. Failing that, an average CCG/health board is predicted to spend more than £55 million (equal to a discounted value of £50 million) on managing ~23,200 wounds and associated comorbidities in 2019/2020 (Figs 2 and 3).

Another scenario was constructed in which it was assumed that a local or national restricted wound care formulary with restricted product availability was introduced in 2016, which resulted in a decrease in the item cost of wound care products by 15%. Accordingly, it was predicted that an average CCG/health board with a catchment population of 250,000 adults would be managing 18,800 wounds in 2017/2018 and 23,200 wounds by 2019/2020 at a discounted cost of £42.7 million and £49.0 million respectively. However, if the healing rate decreases by 3% as a result of a formulary or other system change, it was predicted that an average CCG/health board with a catchment population of 250,000 adults would be managing 19,800 wounds in 2017/2018 and 25,800 wounds by 2019/2020 at a discounted cost of £45.0 million and £54.5 million respectively. This represents a prevalence increase of 5% and 11% and a corresponding cost increase of 5% and 11% in 2017/2018 and 2019/2020, respectively when compared with no introduction of a restricted formulary (Fig 3). This scenario emphasises the importance of carefully analysing the impact of change on the overall system performance.

When the NHS cost of managing patients was adjusted for their comorbidities, as previously described,^{1,2} the total annual NHS cost of:

- Managing 4500 acute wounds in 2012/2013 was reduced from £9.7 million to £7.9–9.3 million
- Managing 5300 chronic wounds in 2012/2013 was reduced from £15.2 million to £14.0–14.5 million
- Managing 1400 unspecified wounds in 2012/2013 was reduced from £1.8 million to £0.9–1.7 million.

Discussion

CCGs and health boards are responsible for planning, agreeing and monitoring services for their respective catchment population.^{3–5} However, wound care delivery appears to be patchy and disparate, with some individual CCGs having developed their own wound management

Fig 1. Relationship between the annual NHS cost of wound management in an average clinical commissioning group (CCG)/health board and the size of the catchment population

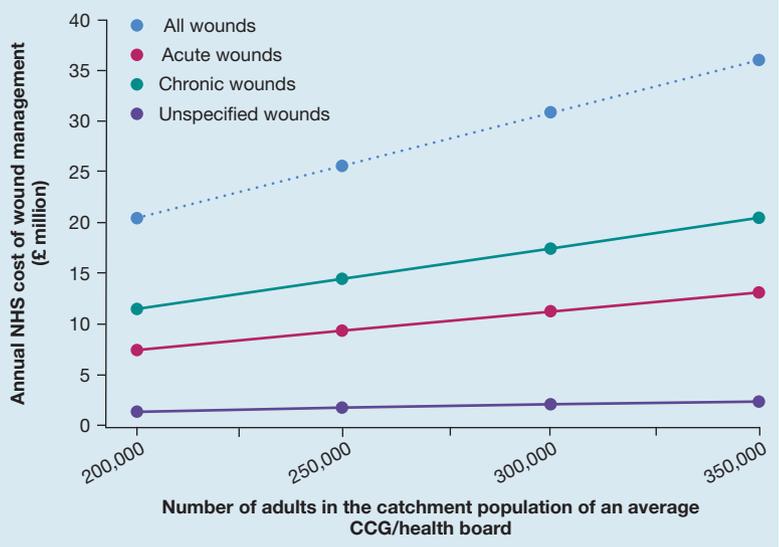
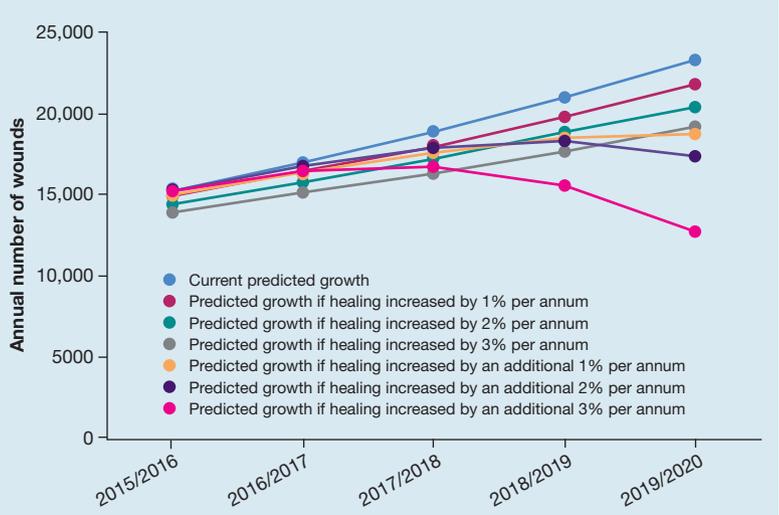


Fig 2. Predicted annual number of wounds managed in an average clinical commissioning group (CCG)/health board with a catchment population of 250,000 adults in accordance with different healing rates



types.^{12,13} However, there is clearly variance in wound care delivery between individual CCGs/health boards. While the role of CCGs and health boards is to address local health needs, the national health economic burden imposed by wounds requires that a nationally agreed strategy be established and implemented if unwarranted variation is to be reduced, outcomes improved and costs reduced equitably.

This present analysis found that an average CCG/health board with a catchment population of 250,000 adults ≥18 years of age managed 11,200 wounds in 2012/2013 (4500 acute, 5300 chronic and 1400 unspecified wounds). However, the annual prevalence of wounds was estimated to be growing at the rate of

9% for acute, 12% for chronic and 13% for unspecified wounds. This implies that unless healing rates improve, an average CCG/health board with a catchment population of 250,000 adults is predicted to manage 18,800 wounds in 2017/2018 and 23,200 wounds by 2019/2020. However, if a system change, such as the introduction of a restricted local or national formulary, reduces the cost of wound care products by 15%, but as a consequence leads to a 3% reduction in healing rates, the annual number of wounds managed by an average CCG/health board with a catchment population of 250,000 adults is predicted to increase by 5% in 2017/2018 and 11% in 2019/2020. This would lead to a cost increase in wound management in those two periods of 3% and 9%, respectively, when compared with no introduction of a restricted formulary, and reflects the point raised by Harrington:

‘One of the things I think we need to be careful about is not trying to save money by being overly restrictive, when in fact we might have fairly limited evidence about comparative effectiveness.’¹⁵

These predictions do not take into account any demographic changes in the population. However, Fig 1 indicates how the cost of wound management might change as a result of changes in the size of a catchment population of an average CCG/health board. Notwithstanding the above, the historical percentage increase in the prevalence of wounds year on year is unknown. Most clinicians involved in wound care say their clinics are getting larger year on year, but they could not quantify this. While this analysis is based on a uniform predictive increase in the prevalence of wounds across the UK, it is likely to be increasing at different rates in different parts of the country. Also, industrial market analyses for likely product demand all

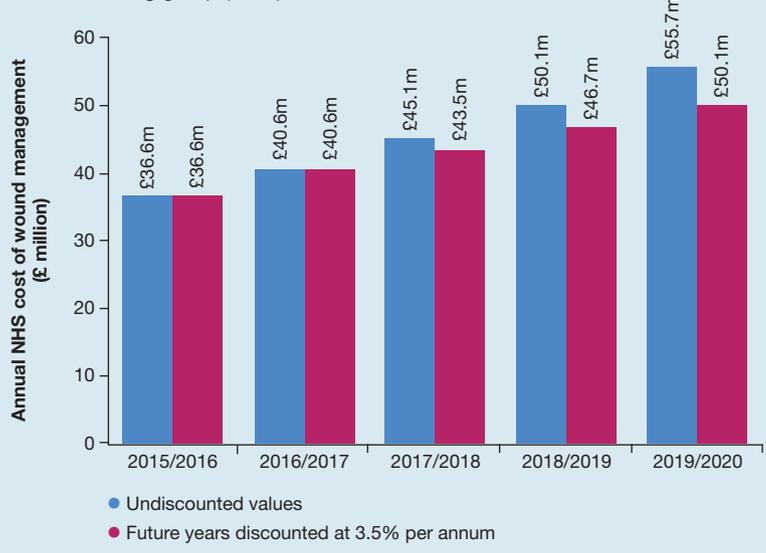
predict increasing markets for both conventional and advanced wound care products.^{16,17}

Optimal care delivery and timely wound healing requires a careful and detailed initial holistic assessment and an accurate wound diagnosis. The increasing annual prevalence of wounds is partially due to delayed wound healing, which is often associated with increased rates of wound complications, such as infection.^{18,19} Although healing is not achievable in all wounds, it is the primary desirable outcome for all wound types. We previously reported that in 2012/2013 only 47% of venous leg ulcers (VLUs) healed, which is very different from the healing rates reported by others, who found at least 70% of VLUs healed by 24 weeks after the start of treatment.²⁰⁻²² Additionally, fewer than 50% of other ulcers of the lower limb healed within the study period.^{1,2} In contrast, more than 70% of open wounds and surgical wounds (that failed to heal within four weeks of surgery) healed during the study period. Notwithstanding this, healing rates have to be increased by at least 1% in order to slow down the rate of increase in the annual prevalence of wounds. In order to improve wound healing rates, CCGs/health boards may wish to instigate outcomes data being reported as part of clinical governance in order to reduce variance. Moreover, clinicians should be more aware of published healing rates and assess the effectiveness of the care that is being provided against these standards. The clinical, economic and health-related quality-of-life impact of non-healing wounds on both patients and the NHS should be recognised and referral pathways developed to optimise care and reduce costs. We previously reported that resource use associated with managing unhealed wounds is substantially greater than that of managing wounds that healed² and that the patient care cost of an unhealed wound is a mean 135% more than that of a healed wound.²

In addition to our burden of wound study,^{1,2} we have previously highlighted inconsistencies in wound care, staff involvement and dressing choice, with an apparent lack of a patient-specific treatment plan in many instances.²³⁻²⁵ Wound care products account for only 12–15% of the cost of wound management with non-healing being a major driver for increased product costs.² Additionally, while there is a range of nursing staff (practice/community/specialist) involved in the delivery of wound care, there appears to be an increasing involvement of practice nurses. Accordingly, we recommend that each patient has a monitored care plan in line with national guidelines based on appropriate dressing selection, which may involve the use of advanced wound care products, targeting early cost-effective wound healing as the primary outcome. In addition, the ongoing changes in staff involvement in wound care need to be recognised and supported with appropriate resources and educational provision.

Our study has also highlighted the lack of senior involvement (both tissue viability teams and other

Fig 3. Predicted annual cost of wound care incurred by an average commissioning group (CCG)/health board



specialist health-care professionals) in clinical wound care. Additionally, there appears to be no correlation between wound complexity, wound duration and senior involvement,^{23–25} although chronic wounds use substantially more resources than acute wounds. The lack of senior engagement in wound care may have had a detrimental impact on outcomes, and thereby contributed to the increasing prevalence and cost of wound management. The changing role of tissue viability nurses in line with the ongoing target requirements related to pressure ulcer prevention²⁶ may partly explain their reduced involvement in front-line wound care.^{1,2}

Based on several studies assessing wound care in clinical practice,^{23–25} it has become difficult to define who is responsible for the care of an individual patient's wound and the management of any associated comorbidities. Moreover, the role of the GP and other community-based medical staff is inconsistent.^{1,2,23–25} Communication between practitioners appears to be poor, with no clear role allocation. Accordingly, the role of health-care professionals including practice nurses, community nurses, tissue viability nurses, podiatrists, GPs and other medical professionals needs to be clearly defined within the patient care pathway. Moreover, the responsibility for transforming the delivery of wound care needs to be assigned to an individual practitioner in order to achieve an optimum outcome for a patient. There should also be a clearly defined clinical role for senior staff, which is linked closely to an 'escalation of care ladder' for patients with both acute and chronic wounds, with clearly defined referral criteria.

The strengths and weaknesses of using the THIN database have been previously discussed.^{1,2} In summary, use of the THIN database enabled an estimation of the annual burden that wounds impose on the NHS based on real-world evidence derived from clinical practice. The analyses were based on clinicians' entries into their patients' records and inevitably subject to a certain amount of imprecision. Moreover, the computerised information in the THIN database is primarily collected by GPs for clinical care purposes and not for research. Prescriptions issued by GPs and nurse prescribers (both practice and community) are recorded in the database, but it does not specify whether the prescriptions were dispensed or detail patient compliance with the product. Despite these limitations, it is the authors' opinion that the THIN database affords one of the best sources of real-world evidence for clinical practice in the UK. Moreover, the analysis indicates how a real-world evidence database, such as THIN, can be used to predict epidemiological changes and consequential costs in patient management.

The analysis does not consider the potential impact of those wounds that remained unhealed beyond the study period. Furthermore, once healed, the wound itself, other than in areas of scar management, does not incur any 'treatment' costs. For some wounds, patients may enter a wound recurrence prevention phase. For VLU this may be ongoing treatment to manage chronic

venous disease, such as hosiery. These costs are not addressed in this analysis and neither is the ongoing provision of pressure-relieving equipment for pressure ulceration, or diabetic foot ulcers. No assumptions were made regarding missing data, and there were no interpolations. The THIN database may have under-recorded the use of some health-care resources outside the GP's surgery if not documented in the GP records, and the impact of this was addressed in the sensitivity analyses. The analysis excluded hospital-based prescribing, but this should have minimal impact on the results as most prescribing is undertaken by GPs and nurses in the community. Also excluded is the potential impact of managing patients with wounds being cared for in nursing/residential homes. The analysis only considered the annual cost of NHS resource use for the 'average adult patient', and no attempt was made to stratify resource use and costs according to age, gender, comorbidities, wound size, wound severity and other disease-related factors. Also excluded were the costs incurred by patients and indirect costs incurred by society, such as a result of patients taking time off work.

Notwithstanding the study's limitations, failure to improve the accuracy of diagnosis and wound-healing rates has the potential to increase expenditure on wound care by more than 50% for an average CCG/health board over the next five years. Where will this money come from? What services will an average CCG/health board have to forego in order to meet the increasing demand for wound care? **JWC**

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Reflective questions

- Is there sufficient monitoring of treatment plans and outcomes?
- Do we need to assess the effectiveness of wound care products in the real world and not simply rely on clinical trial data?
- What can be done to improve wound healing rates?
- How can the efficiency of health-care delivery be improved?
- Is palliative wound care an acceptable outcome for patients?

References

- 1 Guest JF, Ayoub N, Mollwraith T et al. Health economic burden that wounds impose on the National Health Service in the UK. *BMJ Open* 2015; 5(12):e009283. <https://doi.org/10.1136/bmjopen-2015-009283>
- 2 Guest JF, Ayoub N, Mollwraith T, et al. Health economic burden that different wound types impose on the UK's National Health Service. *Int Wound J* 2016; 14(2):322–330 <https://doi.org/10.1111/iwj.12603>
- 3 NHS choices. The NHS in England. 2016. <https://tinyurl.com/yghvdmq> (accessed 18 May 2017).
- 4 Wales NH. NHS Direct Wales. Health Boards. 2016. <https://tinyurl.com/7j3xnx6> (accessed 18 May 2017).
- 5 Scottish Government. Scottish Government NHS Boards. 2016. <https://tinyurl.com/mx65s6s> (accessed 18 May 2017).
- 6 Department of Health. NHS reference costs 2013 to 2014. <https://tinyurl.com/n3toxlr> (accessed 15 May 2017).
- 7 Curtis L. Unit Costs of Health and Social Care 2014. Personal Social Services Research Unit, 2014. <https://tinyurl.com/kuuopqb> (accessed 15 May 2017).
- 8 Drug Tariff. 2014. <https://tinyurl.com/mtynl2t> (accessed 15 May 2017).
- 9 Office for National Statistics. Clinical Commissioning Group Mid-Year Population Estimates. 2016. <https://tinyurl.com/lsokztj> (accessed 15 May 2017).
- 10 Scotland IS. Geography, Population and Deprivation (GPD) Support. 2016. <https://tinyurl.com/kbjhmeo> (accessed 15 May 2017).
- 11 Stats Wales. Population estimates by local health boards and age. 2016. <https://tinyurl.com/my4tkh2> (accessed 18 May 2017).
- 12 Herefordshire Clinical Commissioning Group. Herefordshire CCG. 2015. <https://tinyurl.com/mqq24d2> (accessed 18 May 2017).
- 13 Somerset Clinical Commissioning Group. Somerset CCG. 2015. <https://tinyurl.com/mssban5> (accessed 24 May 2017).
- 14 Cambridgeshire and Peterborough Clinical Commissioning Group. Cambridgeshire and Peterborough CCG. 2015. <https://tinyurl.com/k569rfd> (accessed 18 May 2017).
- 15 Harrington S. When do the costs outweigh the benefits? <http://knowledge.wharton.upenn.edu/article/medical-innovation-costs-outweigh-benefits/> (accessed 18 Nov 2016).
- 16 Wound Care Market by Product (Advanced (Foam, Alginate, NPWT, Active), Surgical, Traditional), Wound Type (Chronic (DFU, Pressure Ulcer), Acute (Burn)), End User (Hospital (Inpatient, Outpatient), Long-Term Care, Home Healthcare) - Global Forecast to 2021. (May 2016) <http://tinyurl.com/6par468> (accessed 25 May 2017).
- 17 Wound Dressings Market by Type (Advanced Wound Dressings, Traditional Wound Dressings), Application (Surgical Wounds, Ulcers, Burns), End User (Inpatient Facilities, Outpatient Facilities) - Global Forecast to 2021 (June 2016) <http://tinyurl.com/kssurn3> (accessed 25 May 2017).
- 18 Vowden P, Vowden K. The economic impact of hard-to-heal wounds: promoting practice change to address passivity in wound management. *Wounds International*. 2016; 7(2):10–15.
- 19 Dowsett C. Breaking the cycle of hard-to-heal wounds: balancing cost and care. *Wounds International*. 2015; 6(2):7–21.
- 20 Moffatt CJ, Mccullagh L, O'Connor T et al. Randomized trial of four-layer and two-layer bandage systems in the management of chronic venous ulceration. *Wound Repair Regen* 2003; 11(3):166–171. <https://doi.org/10.1046/j.1524-475X.2003.11303.x>
- 21 Franks PJ, Moody M, Moffatt CJ, et al.; Wound Healing Nursing Research Group. Randomized trial of cohesive short-stretch versus four-layer bandaging in the management of venous ulceration. *Wound Repair Regen* 2004; 12(2):157–162. <https://doi.org/10.1111/j.1067-1927.2004.012206.x>
- 22 Vowden KR, Mason A, Wilkinson D, Vowden P. Comparison of the healing rates and complications of three four-layer bandage regimens. *J Wound Care* 2000; 9(6):269–272. <https://doi.org/10.12968/jowc.2000.9.6.25992>
- 23 Guest JF, Gerrish A, Ayoub N, et al. Clinical outcomes and cost-effectiveness of three alternative compression systems used in the management of venous leg ulcers. *J Wound Care*. 2015; 24(7):300–310. <https://doi.org/10.12968/jowc.2015.24.7.300>.
- 24 Panca M, Cutting K, Guest JF. Clinical and cost-effectiveness of absorbent dressings in the treatment of highly exuding VLU's. *J Wound Care*. 2013; 22(3):109–118. doi:10.12968/jowc.2013.22.3.109.
- 25 Guest JF, Taylor RR, Vowden K, Vowden P. Relative cost-effectiveness of a skin protectant in managing venous leg ulcers in the UK. *J Wound Care*. 2012; 21(8):389–398. <http://dx.doi.org/10.12968/jowc.2012.21.8.389>
- 26 Pagnamenta F. The role of the tissue viability nurse. *Wound Essentials*. 2014; 9:65–67.

Trends in Wound Care *Volume V*

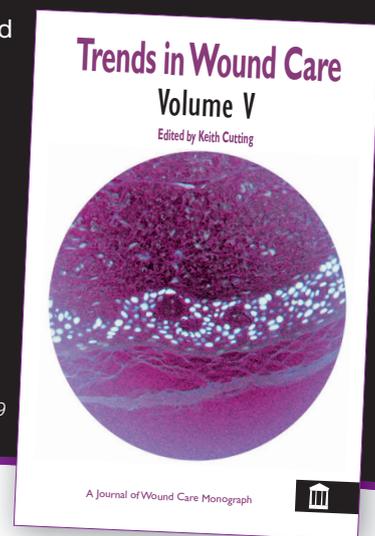
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