Received: 25 November 2019 | Revised: 4 March 2020 | Accepted: 23 March 2020

DOI: 10.1111/iwj.13366

ORIGINAL ARTICLE

IWJ WILEY

Cost of managing patients with venous leg ulcers

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Abstract

The aim of this study was to estimate costs associated with the management of patients with venous leg ulcers (VLUs) from the perspective of the UK National Health Service (NHS). The analysis was undertaken through the Secure Anonymised Information Linkage Databank which brings together and anonymously links a wide range of person-based data from around 75% of general practitioner (GP) practices within Wales (population coverage ~2.5 million). The data covered an 11-year period from 2007 to 2017. All patients linked to the relevant codes were tracked through primary care settings, recording the number of GP practice visits (number of days with an event recorded), and wound treatment utilisation (eg, dressings, bandages, etc.) Resources were valued in monetary terms (£ sterling) and the costs were determined from national published sources of unit costs. This is the first attempt to estimate the costs of managing of VLUs using routine data sources. The direct costs to the Welsh NHS are considerable and represent 1.2% of the annual budget. Nurse visits are the main cost driver with annual estimates of £67.8 million. At a UK level, these costs amount to £1.98 billion. Dressings and compression bandages are also major cost drivers with annual Welsh estimates of £828 790. The direct cost of managing patients with VLUs is £7706 per patient per annum, which translates to an annual cost of over £2 billion, when extrapolated to the UK population. The primary cost driver is the number of district nurse visits. Initiatives to reduce healing times through improving accuracy of initial diagnosis, and improved evidence-based treatment pathways would result in major financial savings.

KEYWORDS

chronic wounds, economic burden, linked routine data, VLUs

1 | INTRODUCTION AND BACKGROUND

Chronic venous insufficiency is the most common cause of leg ulceration, in the community.[1,2] Major implicating factors for venous leg ulcers (VLUs) include family history, obesity, deep venous thrombosis, and increasing age.[3] It is estimated that VLUs affect up to 3% of the adult population worldwide[4] and are a major cause of morbidity and decreased health-related quality of life.[5] Chronic venous insufficiency is often not diagnosed until LUs develop, at which stage its treatment can be difficult and often leads to patients experiencing a repeated pattern of ulceration, healing and recurrence. The main stay of treatment for venous insufficiency includes the use of compression bandages to apply external pressure to the lower limbs with the aim of improving venous function.[6,7] Despite appropriate treatment, the majority of VLUs take several weeks, even months to heal,[3-8] are frequently painful, and patients can have often high levels of exudate and odour. This can impact severely on the patients' quality of life and also lead to other psychological issues such as anxiety, depression, and social exclusion.[9,10] The current health-related burden of VLUs is imprecise and has been the subject of several studies that have attempted to estimate, not only the health impact on the patient, but also the economic burden. Guest et al estimated the annual cost of treating patients with LU in the UK to be £1.94 billion.[11] A second study estimated the cost of managing an unhealed VLU to be four to five times more than that of managing a healed VLU (£3000 per healed VLU vs £13,500 per unhealed VLU).[12] Finally, the latest study by Guest et al reported the annual predicted cost of VLU to be £1.3 billion in the first 12 months from onset.[12] The approach taken by this study differs in the methodology used by Guest et al.[12] The Secure Anonymised Information Linkage (SAIL) Databank was interrogated (~2.5 million people) over a period of 11 years, whereas the previous study used a total of 505 patients with VLUs evaluated over a 12- month period.

Key Messages

- the current health-related burden of venous leg ulcers (VLUs) is imprecise and has been the subject of several studies that have attempted to estimate, not only the health impact on the patient, but also the economic burden. Annual costs of treating patients with leg ulcers (LU) in the UK have been estimated to be £1938 million
- this is the first attempt to estimate the costs of managing of VLUs using routine data sources. The direct costs to the Welsh NHS are considerable and represent 1.2% of the annual budget. Nurse visits are the main cost driver with annual estimates of £67,751 424. At a UK level, these costs amount to £1,987 375 104. Dressings and compression bandages are also major cost drivers with annual Welsh estimates of £9,116 689
- the direct cost of managing patients with VLUs is £7706 per patient per annum, which translates to an annual cost of over £2 billion, when extrapolated to the UK population. The primary cost driver is the number of district nurse visits. Initiatives to reduce healing times through improving accuracy of initial diagnosis, and improved evidence-based treatment pathways would result in major financial savings

1.1 | Aims and objectives

The aim of this study was therefore to estimate the costs associated with the management of patients with VLUs from the perspective of the UK National Health Service (NHS) using routine data as provided in the SAIL database.Specific objectives of the study were to:

- Establish a profile of patients with VLUs, based on clinical coding.
- Interrogate routine data to catalogue health services resource utilisation by this cohort of patients.
- Identify various wound treatments used and their impact on resource utilisation.
- Estimate the overall costs of managing patients with VLUs.
- Identify the major cost drivers in the management of patients with VLUs.

1.2 | Methods

The analysis was undertaken through the SAIL Databank,[13] which brings together, and anonymously links, a wide range of person-based data from around 75% of general practitioner (GP) practices within Wales (population coverage ~2.5 million people).[14,15] It includes GP records, outpatient (OP) clinical data, inpatient

(IP) episodes, and accident and emergency (A&E) Department data, to create an encrypted anonymised linking field for each individual. This linkage allows the patient pathway to be tracked through the NHS Wales system both retrospectively and prospectively from a specific reference point. The patient cohort was identified through relevant clinical codes, and the resource implications of their management were collected and estimated using published sources.[16,17]

This approach provided an in-depth inventory of the contacts, consultations, and resources utilised in the current management of such patients, enabling the potential implications of adjustments to these management approaches.

1.3 | Data analysis

The SAIL database was interrogated to catalogue health service resource utilisation by this cohort of patients. We used the GP Data to identify and quantify all events in order to measure service usage.

The Welsh Demographic Service Data[18] was utilised to gather basic demographics, information on follow-up time (residency in Wales and GP registrations), and Welsh Index of Multiple Deprivation[19] score to measure deprivation.

1.4 | Resource use

All patients linked to the relevant codes were tracked through primary care settings, recording their level of GP practice visits (number of days with an event recorded) and wound treatment utilisation (eg, dressings, bandages, etc.). District nurse visits were not available in the data, so the extent of district nurse time involved in the management of the VLU wounds was estimated as two visits per week. This estimate was based on detailed discussions with several clinicians and a tissue viability nurse.

TABLE 1 Unit costs used in the analysis

Health service resource	Unit cost (£)	Source
GP surgery visit (per surgery consultation lasting 9.22 min)	£38	PSSRU 2018
GP home visit	£120	PSSRU 2013 (inflated to 2018 prices using BOE calculator)
Practice nurse	£42	PSSRU 2018
GP telephone triage	£14.80	PSSRU 2018
Practice nurse telephone triage	£7.70	PSSRU 2018
District nurse	£78	PSSRU 2015 (inflated to 2018 prices using BOE calculator)
Dressings, bandages, medication, etc.		
Various	£	BNF (2018)

Abbreviations: BNF, British National Formulary; BOE, Bank of England; PSSRU, Personal and Social Services Research Unit.

1.5 | Cost data

Resources were valued in monetary terms (£ sterling) and the costs determined from national published sources of unit costs including the British National Formulary (BNF)[16] and Personal and Social Services Research Unit (PSSRU) unit costs,[17] where costs were unavailable and/or local costs were utilised (eg, from local financial records or NHS Wales formulary); these were provided by other sources. The currency year was 2018, while an inflation calculator (Bank of England) was used to convert previous years' costs to current prices (Table 1).

1.6 | Perspective

The perspective taken was that of the UK NHS.

1.7 | Statistical analysis

Statistical analysis was undertaken in SPSS Version 25 for Windows. Furthermore, basic descriptive demographic statistics were also collected alongside the resource use and cost data. Survival analysis of treatment duration was conducted using R 3.5.

2 | RESULTS

The report utilised primary care data from the SAIL Databank, covering approximately 75% of GP practices in Wales. The study period was between 2007 and 2017.

A VLU was defined as either a specific code that implies a VLU, or the combination of a non-specific ulcer code with a code for either compression stockings or varicose veins. Non-specific codes included codes such as "recurrent LU" (M274.), "non-healing LU" (M273.), and "traumatic LU" (M2716), where a combination of codes was used:

- For the combination of ulcer code and varicose veins, there was no time restriction: each code could appear anywhere within the study period.

- For the combination of an ulcer code and a stocking, the ulcer diagnosis code was required to come first.

The date of diagnosis with VLU was the first occurrence of a VLU code (either specific or non-specific) (Table 2).

2.1 | Cohort demographics

Of the cohort of 8352, 56% (n = 4,648) were female and 44% male (n = 3,704). The average age of females was 74.8 and 68.4 years for males.

2.2 | Treatment

Read codes in the GP data only show the occurrence of a prescription. They do not show the quantity or dose, so the counts shown represent number of prescriptions (each of which may be for multiple items).

The cost of all the treatments (dressings, bandages, compression stockings, etc.) over the 11 years linked to the VLU-related codes (n = 8352) was costed (taking into account multiple items) using the BNF and GP Prescription data from Primary Services Wales,[20] where the average number of items per prescription per patient was estimated (Table 3).

Table 4 summarises the costs of all the treatment types. The main cost drivers were "Compression Other" (£1,754,951) and "Dressing" (£6,157,949).

2.3 | Cost of GP event days

Not all days with an event represent consultations with a GP. Some are prescription renewals, receipt of letters from hospital, and other activities. There is no reliable way from the data held in SAIL to identify the number of patient consultations. The assumption was made that 33% of all days with an event recorded represented a consultation. This estimate was based on discussions with several clinicians and a GP. This is probably a conservative assumption, because it results in consultation rates per person-year that are lower than previously published rates for the UK[21] while the cohort in this study is older and is known to have health issues requiring a high level of care. Therefore, a pragmatic approach to defining and costing a GP contact was

TABLE 2 Cohort characteristics

Read code	n
A specific venous leg ulcer (VLU) code (M2714 and M2715)	1828
A non-specific VLU code combined with compression stocking	3104
A non-specific VLU code combined with varicose veins	3420
Total	8352

TABLE 3 Events by treatment type (2007-2017)

Treatment	Patients	Event/prescription count	Avg. per patient	Sum (£)
Hydrocellular foam	107	277	2.6	£19 932
Hydrofiber Ribbon	365	1269	3.5	£25 856
Barrier Cream	874	4393	5.0	£15 100
Barrier Spray	540	1824	3.4	£17 071
Compression Applicator	1047	1267	1.2	£35 355
Compression Other	3906	61 693	15.8	£1 754 951
Compression Stocking	3607	14 741	4.1	£585 803
Autolytic hydrogels	1104	3782	3.4	£134 663
Autolytic Manuka Honey	1107	3037	2.7	£64 606
Dressing	7002	193 161	27.6	£6 157 950
Gauze	1306	7306	5.6	£27 320
Line	2827	23 211	8.2	£83 757
Swab	180	573	3.2	£21 645
Swab	363	1909	5.3	£9306
Elasticated tubular support bandage	1457	9414	6.5	£17 851
Total	25 792	327 857	12.7	£8 971 166

TABLE 4 Summary of all treatment types by group (2007-2017)

Group	N	Mean (SD)	Sum
Hydrocellular foam	7	£2847 (£5002)	£19 932
Hydrofiber Ribbon	4	£6464 (£6309)	£25 856
Barrier Cream	9	£1678 (£3329)	£15 100
Barrier Spray	2	£8536 (£11 646)	£17 072
Compression Applicator	3	£11 785 (£16 616)	£35 355
Compression Other	116	£15 129 (£94 110)	£1 754 951
Compression Stocking	93	£6299 (£23 228)	£585 803
Autolytic Hydrogels	21	£6413 (£16 106)	£134 663
Autolytic Manuka Honey	30	£2154 (£4982)	£64 606
Mechanical Debridement	2	£48 708 (£68 031)	£97 415
Passive Debridement	7	£5923 (£12 085)	£41 461
Sharp Debridement	11	£604 (£925)	£6647
Dressing	912	£6752 (£33 333)	£6 157 949
Gauze	5	£5464 (£5649)	£27 320
Line	54	£1551 (£4321)	£83 757
Swab type one	2	£10 823 (£10 448)	£21 645
Swab type two	2	£4653 (£1700)	£9306
Elasticated tubular support bandage	12	£1488 (£2436)	£17 850
Total	1292	£6136 (£23 350)	£9 116 690

TABLE 5 Estimated consultations and costs by year

Year	Days with an event	Estimated consultations	Patient count	Avg. per patient	GP cost	Nurse cost	Total cost
2007	12 357	4119	1021	4.0	£94 439	£59 705	£154 144
2008	23 572	7857	1709	4.6	£180 150	£113 893	£294 043
2009	29 279	9760	2204	4.4	£223 766	£141 467	£365 233
2010	34 716	11 572	2506	4.6	£265 318	£167 737	£433 055
2011	38 903	12 968	2760	4.7	£297 317	£187 968	£485 285
2012	37 227	12 409	2929	4.2	£284 509	£179 870	£464 378
2013	38 201	12 734	3173	4.0	£291 952	£184 576	£476 528
2014	40 952	13 651	3283	4.2	£312 977	£197 868	£510 845
2015	40 047	13 349	3405	3.9	£306 061	£193 495	£499 556
2016	34 783	11 594	3326	3.5	£265 830	£168 061	£433 891
2017	28 207	9402	3186	3.0	£215 573	£136 288	£351 861
Total	358 244	119 415	29 502	4.0	£2 737 892	£1 730 928	£4 468 819

taken, assuming that 82% of consultations were conducted at the surgery, 12% of consultations were over the telephone, and 3% were either home visits or conducted at other locations.[22] For ease of analysis and to combat the unknown quantity of "other locations," the 3% conducted at other locations were added into the telephone consultations to make them 15% of the 82%.

Additionally, the study disaggregated the numbers further, by assuming that 62% of the above-mentioned consultations were undertaken by GPs. Thirty-four percentage were undertaken by practice nurses and 4% by other clinicians. Again, for ease of analysis and the unknown quantity of "other clinicians," the 4% other clinicians were classed as being undertaken by practice nurses (Table 5).

TABLE 6 Summary table of all treatment and visit costs

Overall summary of VLU-related treatment and resource use costs	
SAIL observed	
8352	No. of patients
£4 468 819	GP events/contacts
£9,116 689	Treatments
£745 265 664	DN visits (based on 2 per week)
£758 851 172	Total over 11 years
£68 986 470	Estimated annual cost of treatment (n = 8352)
Wales	
11 136	No. of patients
£5 586 024	GP events/contacts
£11 395 861	Treatments
£993 687 552	DN visits (based on 2 per week)
£1 010 669 437	Total over 11 years
£91 879 040	Estimated annual cost of treatment (n = 11 136)
UK	
244 992	No. of patients
£10 892 747	GP events/contacts
£16 412 092	Treatments
£21 861 126 144	DN visits (based on 2 per week)
£21 888 430 983	Total over 11 years
£1 989 857 362	Estimated annual cost of treatment (n = 244 992)

Abbreviations: DN, district nurse; GP, general practitioner; SAIL, Secure Anonymised Information Linkage.

The unit costs for health care utilisation were obtained from a number of PSSRU sources[17,23] and are shown in Table 1.

2.4 | Total resource utilisation

Table 6 summarises all the costs relating to VLU treatment observed via the GP data within the SAIL Databank over the 11 years. Furthermore, the "observed" data has been extrapolated to all-Wales and UK populations. This results in an estimated annual cost of treating VLUs of £68,986,470 for the "observed" data or £8,260 per patient annually for the cohort based on UK prevalence.

When resource use is compared with prescription use, there were 2.7 times as many prescriptions as there were estimated consultations—that is, 321,038/119,415. The cost of prescribed treatments was roughly twice the cost of consultations—that is, £9,116,690/£4,468,819.

3 | DISCUSSION

This is the first to attempt to estimate the economic burden of VLUs using the SAIL Databank. The direct costs to the Welsh NHS are considerable and represent 1.2% of the annual budget. District Nurse visits are the main cost driver, with annual estimates of £67,751,424. At a UK level, these costs amount to £1,987,375,104.Dressings and compression bandages are also significant cost drivers with annual Welsh estimates of £8,771,897. In terms of the SAIL estimates, this represents 12.6% of the total treatment budget. An earlier study using the SAIL data base showed that 3% of spend for all wounds in primary care was directed at the costs of dressings.[24] This difference could be due to the increase in SAIL Databank coverage since the publication of that study (45% Vs 75%), and also the use in this study of a more sophisticated and sensitive linkage algorithm. When resource use is compared with prescription use, the percentage use of prescriptions per resource used (ie, GP or nurse consultation) is 2.7 prescriptions per patient—that is, 321,038/119,415. When the costs are compared, the average prescription cost is £2 per patient—that is, £9,116,690/£4,468,819.

The estimates presented in this study are generally comparable to Guest et al's 2017 paper[11] where annual English NHS costs are estimated to be £1.3 billion.

The results confirm other findings associated with the cost of wound care. It is mistakenly believed that the use of wound management materials per se is the major cost driver in treatment costs, whereas in reality, nursing time and hospital costs are together responsible for the around 80% and 85% of the total cost.[25] Healing times, frequency of dressing changes, and complications are three important drivers of cost.

Previous authors have also demonstrated that the management and treatment of chronic venous ulcers add substantial costs to global health care systems, as well as having a negative impact on patient's quality of life.[12] The results of this study have also demonstrated that treating VLUs consumes large amounts of medical products, drugs, and compression bandaging. In terms of health care clinical practitioners treating this condition, the application of compression bandaging, an essential component of treatment, is known to be variable.[26] Furthermore, the plethora of available wound dressings, with varying evidence relating to their effectiveness, also pose challenges in developing individual care pathways.

There is increasing evidence that there is significant sub-optimal service delivery in relation to wound management, and which is not based on notions of best practice. These include inadequate diagnosis, failure to identify the wound type, not using best practice for managing the underlying pathology, and the lack of adequate health professional education and training.[27]

Possibly, the best way of attacking these particular challenges is looking at reducing waste, harm, and variation in practice and ensuring that there are local, regional, national, and international guidelines, protocols, algorithms, and care pathways that should be followed, wherever possible, for the vast majority of patients. In addition, the continued creation of local, regional, and national centres of excellence, where patients with complex LUs could be assessed and their wounds resolved would be of great benefit.

Innovative medical approaches are evolving that will provide additional alternatives and additions to current practices to heal VLUs faster, and have the potential to significantly reduce the total cost of treatment of such wounds. Two illustrative examples will be discussed. Although compression therapy improves venous ulcer healing, it does not treat the underlying causes of venous hypertension. Treatment of superficial venous reflux has been shown to reduce the rate of ulcer recurrence, but the effect of early endovenous ablation of superficial venous reflux on ulcer healing remains unclear. In a large randomised study, 450 patients undergoing early endovenous ablation of superficial venous reflux with compression resulted in faster healing of venous ulcers and more time free from ulcers than ulcers treated with compression and deferred venous ablation.[28] A second example of innovation that could potentially help to speed up ulcer healing is the use of topical multimodal anaesthesia combined with adrenaline and an antimicrobial prior to and post-wound debridement. Ensuring confidence in the attending clinician to debride and giving the patient a pain-free experience while optimising wound bed preparation will lead to successful outcomes. If wound bed preparation is optimised early in the treatment pathway faster healing may occur. The potential clinical and economic benefits of topical multi- modal anaesthesia as part of achieving pain relief during debridement have been summarised in a recent publication.[29] It is recommended that better education of debridement types in the curriculum for nurses at University undergraduate level would also help tackle the issue of choosing the appropriate debridement techniques in practice. This would also help address the issue of whether the right professionals are debriding at the right time, in the right manner, and in the right context.

3.1 | Strengths and limitations

SAIL data base that covers nearly 70% to 80% of welsh population was used and extrapolations made from this represent a more realistic estimate of the problem.

Although clinical coding may be an issue, we have tried to improve the quality of data using the more accurate prescription data to qualify the picked up clinical codes.

The results of the study provide an important reference point for policy makers in concerting resources and strategies in tackling the main cost drivers for this condition. While it is the ideal in aiming complete healing of ulcers, this is not always possible. To improve resource efficiency, strategies/treatments that effectively reduce clinician/district visits should be used.

Secondary care data have not been included due to the difficulty in identifying what care is driven by VLUs. The national out-patient data in Wales do not contain information on diagnoses and treatments. Further research is needed to investigate the coding structure of these events within SAIL and how best to tackle the issues without having to make too many assumptions. Inpatient stays are also missing from this analysis due to a similar coding problem. However, as the treatment of VLUs is likely to take place in primary community care by practice nurses and district nurses, the assumption was made that there would be an insignificant level of VLU-related inpatient activity.

The coding issues relating to GP events/contacts are another limitation which were addressed in the assumptions made. However, by using the existing evidence laid out by Hippisley-Cox (2009),[22] a reasonable assumption was made of the types of contact that patients would have with either the GP or the practice nurse.

The estimate of two district nurse visits per week may be an underestimate of the actual "real-world" frequency of visits by these practitioners to change dressings, bandages, etc. If the average number of district nurse visits were increased to three, then the observed SAIL estimate of annual costs would be £102,862,182 or £12,316 per patient. Being able to accurately identify district nurse visits within the SAIL databank would be advantageous for future wound-related routine data research.

We recognise that the relatively narrow perspective of the Welsh NHS is a limitation. However, we believe it still to be reflective of the UK NHS as a whole.

Additionally, we have not costed other health-related costs, such as the use of other medications such as pain killers, antibiotics, etc.

Finally, the relatively narrow perspective of Welsh NHS costs shows just one picture of the economic burden VLUs have on the UK health care system. A wider, more societal perspective would shed light on further substantial costs relating to caregivers, loss of productivity, and health-related quality of life.

4 | CONCLUSION

The direct Welsh NHS costs of relating to the managing patients with treatment of VLUs is £7,706 per patient per annum, which translates to an annual cost of over £2 billion, when extrapolated to the UK population. The primary cost driver is the number of district nurse visits. Future initiatives to reduce healing times, through improving accuracy of initial diagnosis, and improved evidence-based treatment pathways would result in major financial savings.

ACKNOWLEDGEMENTS

The authors would also like to acknowledge the help of Trudi Young and Dr Melanie Thomas in the development of this analysis and Medical Ethics Pty, Melbourne, Australia, for the provision of a research grant to allow this work to be completed. This study was commissioned and funded by the Medical Ethics Pty, Melbourne, Australia.

CONFLICT OF INTEREST

The study's sponsors had no involvement in the study design; the collection, analysis, and interpretation of the data and methodology; the writing of this manuscript; and the decision to submit this article for publication. The views expressed in this article are those of the authors and not necessarily those of the sponsors. The authors have no conflicts of interest with this study.

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How to cite this article: Phillips CJ, Humphreys I, Thayer D, et al. Cost of managing patients with venous leg ulcers. *Int Wound J*. 2020; 17:1074–1082. https://doi.org/10.1111/iwj.13366