

Assessing the healthcare costs associated with venous leg ulcer compression bandages – A scoping review

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ABSTRACT

Aim: To determine the monetary costs identified in economic evaluations of treatment with compression bandages among adults with venous leg ulcers (VLU).

Method: A scoping review of existing publications was conducted in February 2023. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used.

Results: Ten studies met the inclusion criteria. To place the costs of treatment into context, these are reported in conjunction with the healing rates. Three comparisons were made: **1.4 layer compression versus no compression** (3 studies). One study reported that 4 layer compression was more expensive than usual care (£804.03 vs £681.04, respectively), while the 2 other studies reported the converse (£145 vs £162, respectively) and all costs (£116.87 vs £240.28 respectively). Within the three studies, the odds of healing were statistically significantly greater with 4 layer bandaging (OR: 2.20; 95% CI: 1.54–3.15; $p = 0.001$).; **2.4 layer compression versus other compression** (6 studies). For the three studies reporting the mean costs per patient associated with treatment (bandages alone), over the treatment period, analysis identified a mean difference (MD) in costs for 4 layer vs comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) of −41.60 (95% CI: 91.40 to 8.20; $p = 0.10$). The OR of healing for 4 layer compression vs comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) is: 0.70 (95% CI: 0.57–0.85; $p = 0.004$). For 4 layer vs comparator 2 (2 layer compression) the MD is: 14.00 (95% CI: 53.66 to −25.66; $p < 0.49$). The OR of healing for 4 layer compression vs comparator 2 (2 layer compression) is: 3.26 (95% CI: 2.54–4.18; $p < 0.00001$). For comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) vs comparator 2 (2 layer compression) the MD in costs is: 55.60 (95% CI: 95.26 to −15.94; $p = 0.006$). The OR of healing with Comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) is: 5.03 (95% CI: 4.10–6.17; $p <$

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0.00001). Three studies presented the mean annual costs per patient associated with treatment (all costs). The MD is 172 (150–194; $p = 0.401$), indicating no statistically significant difference in costs between the groups. All studies showed faster healing rates in the 4 layer study groups. **3. Compression wrap versus inelastic bandage** (one study). Compression wrap was less expensive than inelastic bandage (£201 vs £335, respectively) with more wounds healing in the compression wrap group (78.8%, $n = 26/33$; 69.7%, $n = 23/33$).

Conclusion: The results for the analysis of costs varied across the included studies. As with the primary outcome, the results indicated that the costs of compression therapy are inconsistent. Given the methodological heterogeneity among studies, future studies in this area are needed and these should use specific methodological guidelines to generate high-quality health economic studies.

1. Introduction

Venous Leg Ulcers (VLU) are defined as an open skin lesion of the leg or foot that occurs in an area affected by venous hypertension. These wounds, which represent up to 80% of all leg ulcers have a significant impact on patient health and quality of life [1]. Clinical practice guidelines for VLU management have been developed internationally, providing clear guidance for practitioners on how to prevent and manage patients with these debilitating wounds [2,3]. Compression therapy, a system of elastic or non-elastic garments or modified devices that provide specific range of graduated compression pressure, is a key best practice recommendation for the treatment of VLUs [4]. Compression therapy is directed at lowering venous hypertension, decreasing venous stasis and inflammation and further enhancing tissue vascularization [4].

VLUs are considered a significant health problem in many countries and regions [5], with statistics suggesting that they affect approximately 1%–3% of people globally [6,7] with prevalence increasing to 1 in 50 people aged over 80 years. VLUs also have a major financial and socioeconomic impact due to the cost and duration of care [5]. A retrospective cohort study using THIN data (The Health Improvement Network) reported that in the UK, 53% of all venous leg ulcers healed within 12 months, with a mean healing time of three months [8]. The mean NHS cost of wound care over 12 months was an estimated £7600 per VLU. However, the cost of managing an unhealed VLU was 4–5 times more than that of managing a healed VLU (£3000 per healed VLU and £13,500 per unhealed VLU) [8]. After taking into consideration all aspects of caring for patients with VLU, including doctors' visit, nursing care, and direct treatment related costs the budget becomes exponentially elevated [5]. Much of the direct cost of treatment is associated with the supply of dressings, including multilayer bandages, and community nurse visits [9]. Poor adherence to prevention and treatment strategies contributes to the significant financial outlay and associated implications [10]. For example, in Australia, it is estimated that the cost of healing a VLU could be reduced 2.7 times per patient if compression stockings were used as prescribed [11].

Research shows that a VLU profoundly impacts a person's quality of life (QoL) because a person has to cope with an open wound that can take years to heal [12]. To heal the wound, patients must endure the application of compression bandages and dressing changes once or twice weekly, a time-intensive process. Research has identified VLU pain as a significant burden on other areas of a person's life [13,14]. For example, VLU related pain can affect a person's sleep and ability to mobilise [15]. The duration and intensity of the pain and the lack of sleep could lead to people feeling down and depressed [16]. A clear interconnectedness exists between the physical, social, and psychological aspects of enduring a VLU and its treatment [17].

The VLU cost burden is expected to rise dramatically over the coming years due to the aging population and an increasing prevalence of obesity and of chronic venous circulatory problems [18,19]. Given the importance of VLU for the individual, the health service and society as a whole, and the fact that compression therapy is the gold standard of treatment, this scoping review aimed to provide an overview of monetary costs in economic evaluations of treatment with compression

bandages among adults with VLU.

2. Review question

This scoping review used the PICOS Framework [20] as a guide, to aid in the development of the questions for exploration in the review. The components of the PICOS were:

- Population: Adult patients (aged >18 years) in treatment of VLU
- Intervention: VLU compression treatment as determined by the authors
- Control: All other treatments or none
- Outcome: Cost of VLU compression bandages
- Setting: All settings.

The primary question of this scoping review was:

“The aim of this study is to determine the costs associated with the treatment of venous leg ulcers (VLU) using compression bandages.”

The secondary questions were

- What type of study design was used to evaluate costs?
- Which cost perspectives were used?

3. Methods

Scoping reviews are used to present a broad overview of the evidence pertaining to a topic, irrespective of study quality, and are useful when examining areas that are emerging, to clarify key concepts and identify gaps [21,22]. Scoping reviews are therefore, particularly useful when a body of literature has not yet been comprehensively reviewed or exhibits a complex or heterogeneous nature not amenable to a more precise systematic review of the evidence [23]. Nonetheless, scoping reviews still require rigorous and transparent methods in their conduct to ensure that the results are trustworthy [24].

The author team followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to guide the conduct and reporting of the review [25].

3.1. Search strategy

The search explored for papers published in scientific journals published in English, no limits applied initially on type of methodology, jurisdiction, patient group, treatment type or patient demographic. The following electronic databases were used to identify relevant literature: MEDLINE (Ovid), EMBASE (Ovid), EBM Reviews and Cochrane Library (Ovid), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science. To identify further published papers, this search included a search of the reference lists of all identified papers and the grey literature using OpenGrey (www.opengrey.eu).

The keywords used in the search were:

- #1: Chronic Venous Leg Ulcer OR Venous Leg Ulcer, OR Ulcers, leg ulcers

- #2: Healing OR heal* OR wound healing OR VLU healing
- #3: Cost OR Monetary cost OR Financial cost OR Cost effectiveness OR Cost utility OR Cost minimization OR Cost burden OR Financial burden
- #4: Compression Therapy OR Compression therapies OR dressing, bandage OR Dressings, Bandages OR wraps OR stockings
- #5: Venous Leg ulcer recurrence OR ulcer recurrence
- #6: #1 AND (#2 OR #3 OR #4) OR #5
- #7: Time OR Staff time
- #8: #3 AND #6 AND #7
- #9: Wound care
- #10: #8 AND #9

3.2. Inclusion criteria

The following criteria were used for inclusion of articles in the review

- Published primary research papers
- Papers written in English
- Costs included as primary or secondary outcome
- Adults (aged over 18 years)
- Clinical setting of any type
- VLU treatment with bandages

3.3. Exclusion criteria

- Papers written in non-English language
- Case studies
- Papers utilized any model estimated in economic evaluation, such as cost-effectiveness analysis, cost-utility analysis, or cost-benefit analysis

3.4. Screening

Identified references were included in the Rayyan Platform. Article titles and abstracts were independently assessed by three different team members and coded as relevant, potentially relevant, or not relevant, according to the inclusion and exclusion criteria. The full-text versions of potentially relevant studies were obtained and screened against the inclusion criteria. Following screening of the full text articles, consensus between reviewers in relation to the studies to be included was then obtained.

3.5. Data extraction

Descriptive data were extracted from the full-text versions and charted onto a pre-designed data extraction table recording author and year, country, setting, design, population, sample, intervention, comparator, follow-up, data collection, currency, intervention cost, and comparator cost.

4. Results

4.1. Results of the search

Fig. 1 outlines the flow of articles through the screening process that led to the inclusion of ten articles [26–34].

4.2. Description of included studies

Table 1 provides an overview of the included studies.

4.3. Study design

Most of the included studies were randomised controlled trials (RCTs) (80%; n = 8) except for the two studies of [26,33]; where a retrospective analysis of the case record extracted from The Health

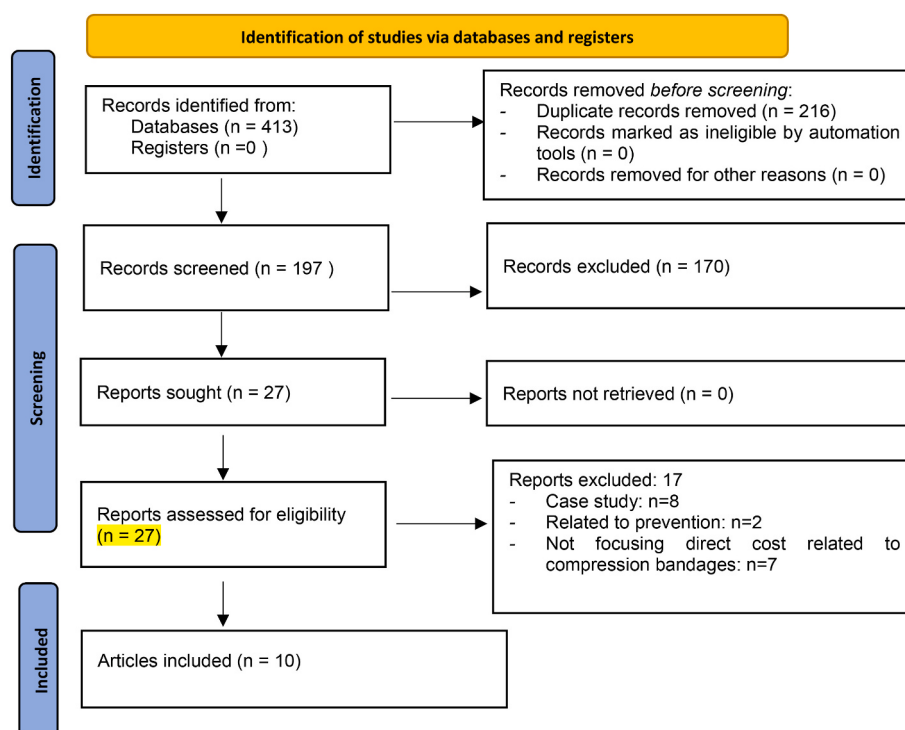


Fig. 1. PRISMA 2020 flow diagram for study selection [25].

Table 1
Overview of the included studies.

Author & year	Country	Setting	Design	Pop	Sample	Intervention	Comparator 1	Comparator 2	Follow up	Data Collection
Morrell 1998	UK	Eight community based research clinics	RCT	Patients with VLU	233	4 layer bandage	Usual care (may or may not have included compression)		52 weeks	Direct costs of treatment for leg ulcers (staff time, materials, transport, and overheads); mean per patient over the treatment period
[28]	UK	Community based leg ulcer services	RCT	Patients with VLU	112	4 layer bandage	2 layer compression		24 weeks	Direct costs (bandage alone); mean per patient over the treatment period
[30]	Ireland	Community based leg ulcer services	RCT	Patients with VLU	200	4 layer bandage	Usual care (no compression)		12 weeks	Direct costs (bandage alone); mean per patient over the treatment period
[27]	UK	primary care and hospital outpatients	RCT	Patients with VLU	378	4 layer bandage	short-stretch compression		52 weeks	Direct costs (nurse visits, doctor visits, hospital visits and bandages); mean annual costs per patient
[34]	Canada	community based leg ulcer services	RCT	Patients with VLU	424	4 layer bandage	short-stretch compression		52 weeks	Direct costs (Nurse visits, Compression bandages; Health services used; Out-of-pocket expenses; lost work due to leg ulcers) mean annual costs per patient
[32]	UK	Community nurse teams or services, family doctor practices, leg ulcer clinics, tissue viability clinics or services, & wound clinics	RCT	Patients with VLU	457	4 layer bandage	2 layer compression hosiery		52 weeks	Direct costs (bandages alone); Mean annual cost per patient
[33]	UK	UK NHS	Retrospective analysis of the case record	Patients with VLU	675	4 layer bandage	2 layer cohesive compression	2 layer compression	26 weeks	Direct cost (bandages alone); Mean per patient over the treatment period
Taylor 2016	UK	Hospital and community leg ulcer services	RCT	Patients with VLU	36	4 layer bandage	Usual care (no compression)		12 weeks	Direct costs (nurse visits, medications & consumables & bandages); Median per patient over treatment period
[26]	UK	UK NHS	Retrospective analysis of case record	Patients with VLU	600	4 layer bandage	2 layer cohesive compression	2 layer compression	26 weeks	Direct cost (bandages alone); Mean per patient over treatment period
Mosti 2019	Italy	Multicentre leg ulcer services	RCT	Patients with VLU	66	Compression wrap	Inelastic bandage		12 weeks	Direct cost (bandages alone); Mean per patient over the treatment period

Improvement Network (THIN) database (a nationally representative database of clinical practice among patients registered with general practitioners in the UK) was employed to obtain the study data.

4.4. Geographical location

Most studies were conducted in the UK (70%; $n = 7$) (Morrell et al., 1998, [27,28,32,33]; Taylor et al., 2016 [26], while one study was conducted in Ireland [30], one in Canada [34], and one in Italy (Mosti et al., 2019).

4.5. Study settings

Four studies were conducted in community based leg ulcer services

(Morrell et al., 1998 [28,30,34]. [27], included both primary care and hospital outpatients settings, while [32] had a broader inclusion criteria of community nurse teams or services, family doctor practices, leg ulcer clinics, tissue viability clinics or services, and wound clinics. Taylor et al. (2016) included hospital and community leg ulcer services, and [26,33] included patients randomly selected from the THIN database. Finally, Mosti et al. (2019) described their study as multicentric.

4.6. Population

All studies included patients with venous leg ulcers.

4.7. Sample size

The studies included a total sample of 3181 participants (mean 318; SD: ± 223 ; min 66 [Mosti et al., 2019]; max 675 [[33]]).

4.8. Study follow up

The mean follow up time across all studies was 32 weeks (SD: 18 weeks). Follow up was 52 weeks in Morell et al. (1998) [27,34], and Ashby et al. (2013). In Refs. [26,33] follow up was 26 weeks, while [28] followed up for 24 weeks. Finally, in Ref. [30]; Taylor et al. (2016) and Mosti et al. (2019) follow up was 12 weeks.

5. Results for the primary outcome

5.1. The monetary costs of treatment

Table 4 provides the results for the analysis of costs associated either with the compression alone, or costs associated with the full treatment, including, for example, nurse visits, GP visits and other associated costs.

Comparison 1: 4 layer compression versus no compression

Three studies are included in this comparison (Morrell 1998, [30]; Taylor 2016). Morrell et al. (1998) presented data as the mean costs per patient associated with treatment (all costs), over the treatment period, identifying that 4 layer compression was more expensive than usual care (£804.03 vs £681.04, respectively) [30]. also presented mean costs per patient over the treatment period, however, these were for bandages alone over the treatment period, and the authors identified that 4 layer compression was less expensive than usual care (£145 vs £162, respectively). Taylor et al. (2016) presented the median costs per patient associated with treatment (all costs), over the treatment period, at £116.87 for the 4 layer bandage group versus £240.28 for the usual care group. As with [30]; treatment was more expensive in the usual care group. Furthermore, within the three studies, overall, the odds of healing were statistically significantly greater with 4 layer bandaging compared to usual care (OR: 2.20; 95% CI: 1.54–3.15; $p = 0.001$).

Comparison 2: 4 layer compression versus other compression (comparator 1 and comparator 2)

Three studies [26,28,33] presented mean costs per patient associated with treatment (bandages alone), over the treatment period. Overall, the cost in Great Britain Pounds (GBP) in the 4 layer group was £1308 (mean: £436; SD: £381). In the comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) group the overall cost was £1433 (mean: £477.6; SD: £381), and for the comparator 2 (2 layer compression) group ($n = 450$) the cost was £844 (mean: £422; SD: 212). Further analysis identified a mean difference (MD) for 4 layer vs Comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) of -41.60 (95% CI: 91.40 to 8.20; $p = 0.10$), suggesting no statistically significant MD in costs between the two study groups. The MD in cost for 4 layer vs Comparator 2 (2 layer compression) is: 14.00 (95% CI: 53.66 to -25.66 ; $p < 0.49$), also suggesting no statistically significant MD in costs between the two study groups. The MD in costs for Comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) vs Comparator 2 (2 layer compression) is: 55.60 (95% CI: 95.26 to -15.94 ; $p = 0.006$). This indicates that Comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) is less expensive than comparator 2 (2 layer compression), further, there is a greater odds of healing with Comparator 1 (2 layer compression, short-stretch compression, 2 layer

compression hosiery, 2 layer cohesive compression, 2 layer compression) (OR: 5.03; 95% CI: 4.10–6.17; $p < 0.00001$).

Three studies [27,32,34] presented data as the mean annual costs per patient associated with treatment (all costs). In total for the 4 layer group this cost was £4742 (mean: £1581, SD: £255). For the comparator group the total cost was £4227 (mean: £1409; SD: £175). The MD is 172 (150–194; $p = 0.401$), indicating no statistically significant difference in costs between the groups. All studies showed faster healing rates in the 4 layer study groups.

Comparison 3: Compression wrap versus inelastic bandage

Mosti (2019) identified that compression wrap was less expensive than inelastic bandage (£201 vs £335, respectively). Furthermore, more wounds healed in the compression wrap group (78.8%, $n = 26/33$; 69.7%, $n = 23/33$).

5.2. Healing rates

Table 2 provides an overview of the results of the types of compression employed in the studies, healing rates and costs, while Table 3 provides a more detailed analysis of the results for healing.

Comparison 1: 4 layer compression versus no compression

Three studies are presented in this comparison (Morrell 1998, [30]; Taylor 2016). In total 48% ($n = 158/331$) healed in the 4 layer group compared to 28% ($n = 64/227$) in the no compression group. The Odds Ratio (OR) of healing in the 4 layer group is 2.20 (95% CI: 1.54–3.15; $p = 0.001$), indicating that those treated with 4 layer compression are more than twice as likely to heal, and this finding is statistically significant.

Comparison 2: 4 layer compression versus other compression (comparator 1 and comparator 2)

5.2.1. Percentage healed in each group

Five studies are included in this comparison [26,28,32–34]. In total 64% ($n = 536/837$) healed in the 4 layer group, while 72% ($n = 660/918$) healed in the comparator 1 group (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) and 53% ($n = 240/450$) healed in the comparator 2 group (2 layer compression). The OR of healing for 4 layer compression vs comparator 1 group (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) is: 0.70 (95% CI: 0.57–0.85; $p = 0.004$) indicating statistically significantly greater odds of healing in the comparator 1 group (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) group. The OR of healing for 4 layer compression vs comparator 2 group (2 layer compression) is: 3.26 (95% CI: 2.54–4.18; $p < 0.00001$) indicating statistically significantly greater odds of healing in the 4 layer compression group. Finally, the OR of healing for comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) vs Comparator 2 (2 layer compression) is: 5.03 (95% CI: 4.10–6.17; $p < 0.00001$) indicating a statistically significantly greater odds of healing in the comparator 1 (2 layer compression, short-stretch compression, 2 layer compression hosiery, 2 layer cohesive compression, 2 layer compression) group.

5.2.2. Time to healing

The three studies included in this comparison presented time to healing data [27,32,34]. [27]; presented the data as the mean days to healing, which were 96.7 (95% CI: 85.3, 111.6) in the 4 layer group and

Table 2

Results: Healing and costs.

Author & year	Currency	Intervention healing rate	Intervention cost	Comparator 1 Healing Rate	Comparator 1 cost	Comparator 2 Healing Rate	Comparator 2 Cost
Morrell 1998	GBP	4 layer bandage (n = 120) Healed: 34% (n = 41)	Mean: 804.03	Usual care (may or may not have included compression) (n = 113) Healed: 24% (n = 27)	Mean: 681.04	n/a	n/a
[28]	GBP	4 layer bandage (n = 57) Healed: 88% (n = 50)	Mean: 876	2 layer compression (n = 52) Healed: 77% (n = 40)	Mean: 916	n/a	n/a
[30]	Euro	4 layer bandage (n = 195) Healed: 54% (n = 105)	Mean; 210	Usual care (no compression) (n = 100) Healed: 34% (n = 34)	Mean: 234	n/a	n/a
[27]	GBP	4 layer bandage (n = 195) Mean time to heal: Days: 96.7 (85.3, 111.6)	Mean & 95% CI: 1298.41 (1187.83, 1471.90)	Short stretch bandage (n = 192) Mean time to heal: Days: 107.6 (95.9, 122.2)	Mean & 95% CI: 1525.73 (1373.92, 1716.66)	n/a	n/a
[34]	Canadian Dollars (2009–2010)	4 layer bandage (n = 215) Healed: 83% (n = 178) Median time to heal: Days: 62 (51, 73)	Mean (95% CI): 1570 (1448, 1870)	Short stretch bandage (n = 219) Healed: 92% (n = 201) Median time to heal: Days: 77 (63, 91)	Mean (95% CI): 1150 (1014, 1297)	n/a	n/a
[32]	GBP	4 layer bandage (n = 223) Healed: 70.4% (n = 157) Median time to heal Days: 98 days (85,112)	Mean: 1795.3 (1559.7 to 2185.0)	2 layer compression hosiery (n = 230) Healed: 70.9% (n = 163) Median time to heal Days: 99 days (84,126)	Mean: 1492.9 (1187.3 to 1954.3)	n/a	n/a
[33]	GBP	4 layer bandage (n = 175) Healed: 28% (n = 49)	Mean: 204.85	2 layer cohesive compression bandage (n = 250) Healed: 51% (n = 127)	Mean: 227.73	2 layer compression bandage (n = 250) Healed: 40% (n = 100)	Mean: 272.25
Taylor 2016	GBP	4 layer bandage (n = 16) Healed: 75% (n = 12)	Median (range); 116.87 (52.63–261.74)	Usual care (no compression) (n = 14) Healed: 21% (n = 3)	Median (range); 240.28 (74.65–588.05)	n/a	n/a
[26]	GBP	4 layer bandage (n = 200) Healed: 64% (n = 128)	Mean: 227.11	2 layer cohesive compression bandage (n = 200) Healed: 76% (n = 152)	Mean: 293.54	2 layer compression bandage (n = 200) Healed: 70% (n = 140)	Mean: 571.44
Mosti 2019	Euro	Compression wrap (n = 33) Healed: 78.8% (n = 26)	Mean: 228	Inelastic bandage (n = 33) Healed: 69.7% (n = 23)	Mean: 381	n/a	n/a

107.6 (95% CI: 95.9, 122.2) in the other compression group. In Refs. [32,34] data are presented as the median days to healing. These were 62 (95% CI: 51, 73) in the 4 layer group and 77 (95% CI: 63, 91) in the other compression group [34] and 98 days (95% CI: 85, 112) in the 4 layer group and 99 days (95% CI: 84, 126) in the other compression group [32].

Comparison 3: Compression wrap versus inelastic bandage

One study was included in this comparison (Mosti 2019). In terms of healing rates for compression wrap versus inelastic bandage, 78.8% (n = 26/33) healed in the compression wrap group compared to 69.7% (n = 23/33) in the inelastic bandage.

6. Results for the secondary outcomes

6.1. Type of design used for cost evaluation

Table 5 provides an overview of the cost data collected in the studies.

The authors [26,28,30,32,33], and Mosti et al., 2019, all collected costs perspectives related to the direct costs of the bandage alone. For [32]; costs were the mean annual cost per patient. For all the remaining authors the costs were calculated as the mean per patient over the treatment period.

For Morrell et al. (1998) [27,34], and Taylor et al. (2016) the costs were calculated as the total direct costs per patient (including staff time, materials, transport, and overheads) [27,34]. calculated the data as the mean annual cost, whereas Morrell et al. (1998) used the treatment period. For Taylor et al. (2016) costs were calculated as the median per patient over the treatment period.

7. Discussion

This scoping review set out to determine the monetary costs identified within economic evaluations of treatment with compression bandages among adults with VLU. Ten studies met the inclusion criteria. The type of compression therapy varied between the studies and results also varied with different follow up periods and calculation of the costs in all

Table 3

Healing rates and time to healing.

Healing rates: 4 layer versus no compression			
Author & year	4 layer compression	No Compression	
Morrell 1998	34% (n = 41/123)	24% (n = 27/113)	
[30]	54% (n = 105/195)	34% (n = 34/100)	
Taylor 2016	75% (n = 12/16)	21% (n = 3/14)	
Total OR	48%; n = 158/331	28%; n = 64/227 2.20 (95% CI: 1.54–3.15; <i>p</i> = 0.001)	
Healing rates: 4 layer versus other compression			
Author & year	Intervention	Comparator 1	Comparator 2
[28]	4 layer 88% (n = 50/57)	2 layer compression 77% (n = 40/52)	n/a
[34]	4 layer	short-stretch compression	n/a
[32]	83% (n = 178/215) 4 layer	92% (n = 201/219) 2 layer compression hosiery	n/a
[33]	70.4% (n = 157/223) 4 layer	70.9% (n = 163/230) 2 layer cohesive compression	2 layer compression 40% (n = 100/250)
[26]	28% (n = 49/175) 4 layer	51% (n = 127/250) 2 layer cohesive compression	70% (n = 140/200) 2 layer compression
Total	64%; n = 536/837	72%; n = 660/918	53%; n = 240/450
OR: 4 layer vs Comparator 1		0.70 (95% CI: 0.57–0.85; <i>p</i> = 0.004)	
OR: 4 layer vs Comparator 2		3.26 (95% CI: 2.54–4.18; <i>p</i> <0.00001)	
OR: Comparator 1 vs Comparator 2		5.03 (95% CI:4.10–6.17; <i>p</i> <0.00001)	
Time to heal (days) 4 layer versus other compression			
Author & year	4 layer	Inelastic bandage	
[27]	Mean: 96.7 (95% CI: 85.3, 111.6)	Mean: 107.6 (95% CI: 95.9, 122.2)	
[34]	Median: 62 (95% CI: 51, 73)	Median: 77 (95% CI: 63, 91)	
[32]	Median: 98 days (95% CI: 85, 112)	Median: 99 days (95% CI: 84, 126)	
Healing rates: Compression wrap versus inelastic bandage			
Author & year	Compression wrap	Other compression	
Mosti 2019	78.8% (n = 26/33)	69.7% (n = 23/33)	

included papers.

Three comparisons were made in this scoping review: 1.4 layer compression versus no compression; 2.4 layer compression versus other compression; 3. Compression wrap versus inelastic bandage. Compression therapy represents the gold standard for VLU management. The goal of any system is to deliver therapeutic compression during mobility and rest [35]. The key finding to emerge from the review is that there is an effect of 4 layer compression bandages on the healing of VLU when compared with no compression or other compression.

The analysis of costs presented varied findings across the included studies, particularly regarding the cost of compression therapy. Several factors may contribute to these inconsistent results. Tables 4 and 5 highlight that the variations in costs can be attributed to the expenses associated with treatment and data collection across different studies. Notably, the reported costs per patient associated with treatment differ among studies. While some studies focus on mean costs per patient using bandages alone, others encompass all costs and provide mean annual costs per patient associated with treatment. Furthermore, variations exist in the duration of the treatment period considered. Moreover, differences in study design, evaluation perspective, time period, and methods of cost estimation further complicate the comparability and interpretation of these results. This presents a challenge for researchers

Table 4

Costs associated with treatment.

4 layer vs no compression: Costs per patient associated with treatment				
Author & year	Currency; costs included and time period	4 layer	No compression	
Morrell 1998	GBP; all costs over the treatment period	Mean: £804.03	Mean: £681.04	
[30]	Euro converted to GBP at exchange rate for 2003 (0.69); bandages alone over the treatment period	Mean: £145	Mean: £162	
Taylor 2016	GBP; all costs over the treatment period	Median: £116.87	Median £240.28	
4 layer vs other compression: Mean costs per patient associated with treatment (bandages alone), over the treatment period				
Author & year	Currency	Intervention	Comparator 1	Comparator 2
[28]	GBP	4-layer	2 layer compression	n/a
		£876	£916	
[33]	GBP	4-layer	2 layer cohesive compression	2 layer compression
		£205	£223	£272.25
[26]	GBP	4-layer	2 layer cohesive compression	2 layer compression
		£227	£294	£571.44
Total	Participants	N = 432	N = 469	N = 450
	Cost: GBP	£1308	£1433	£844
		Mean: £436 (SD: £381)	Mean: £477.6 (SD: £381)	Mean: £422 (SD: £212)
MD: 4 layer vs Comparator 1		-41.60 (95% CI: 91.40 to 8.20; <i>p</i> = 0.10)		
MD: 4 layer vs Comparator 2		-14.00 (95% CI: 53.66 to -25.66; <i>p</i> <0.49)		
MD: Comparator 1 vs Comparator 2		-55.60 (95% CI: 95.26 to -15.94; <i>p</i> = 0.006)		
4 layer vs other compression: Mean annual costs per patient associated with treatment (all costs)				
Author & year	Currency	4 layer	Comparator 1	
[27]	GBP	4 layer 1298	short-stretch compression 1526	
[34]	Canadian Dollars converted to GBP at exchange rate for 2009 (1.05)	4 layer 1649	short-stretch compression 1208	
[32]	GBP	4 layer 1795	2 layer compression hosiery 1493	
Total	Participants	N = 633	N = 641	
	GBP	4742	4227	
		Mean: 1581 SD: 255	Mean: 1409 SD: 175	
MD		172 (150-194; <i>p</i> = 0.401)		
Mean costs per patient associated with treatment (bandages alone), over the treatment period				
Author & year	Currency	Compression wrap	Inelastic bandage	
Mosti 2019	Euro converted to GBP at exchange rate for 2019 (0.88)	201	335	

Table 5
Cost data collected in the studies.

Author & year	Data Collection
Morrell 1998	Direct costs of treatment for leg ulcers (staff time, materials, transport, and overheads); mean per patient over the treatment period
[28]	Direct costs (bandage alone); mean per patient over the treatment period
[30]	Direct costs (bandage alone); mean per patient over the treatment period
[27]	Direct costs (nurse visits, doctor visits, hospital visits and bandages); mean annual costs per patient
[34]	Direct costs (Nurse visits, Compression bandages; Health services used; Out-of-pocket expenses; lost work due to leg ulcers) mean annual costs per patient
[32]	Direct costs (bandages alone); mean annual cost per patient
[33]	Direct cost (bandages alone); mean per patient over the treatment period
Taylor 2016	Direct costs (nurse visits, medications & consumables & bandages); Median per patient over treatment period
[26]	Direct cost (bandages alone); mean per patient over treatment period
Mosti 2019	Direct cost (bandages alone); mean per patient over the treatment period

aiming to accurately evaluate these costs and inform healthcare organizations about the importance of prevention strategies for venous leg ulcers (VLU). To address this issue, it is imperative to adopt study design-specific methodological guidelines to conduct high-quality health economic studies. By doing so, we can effectively differentiate between the treatment costs of VLU, allowing for the implementation of targeted prevention strategies to alleviate these expenses.

7.1. Limitations

This review was undertaken within agreed recommendations for the conduct of a scoping reviews. A comprehensive literature search was performed, coupled with a clearly defined inclusion of data from relevant study designs. However, there are some limitations of this review, which may have affected the results. The study selection only included published articles available in full text in English, meaning potentially relevant studies would have been omitted. Also, this scoping review faces the same challenges as other reviews with regard to the heterogeneity of included studies. In addition, cost-effectiveness of compression therapy is difficult to assess due to the lack of uniformity in reported findings, including the incremental cost-effectiveness ratio and other outcome measures, such as quality-adjusted life-years (QALYs) [36].

8. Recommendations

Based on the findings of this scoping review, there are recommendations for both practice and further research. Healthcare practitioners should consider the costs associated with VLU treatment, including not only the cost of bandages but also factors such as nursing time costs, to inform decision-making regarding treatment options. Regular evaluation of interventions for VLU management is essential, taking into account both healing rates and associated costs, to make informed and cost-effective choices. For further research, conducting systematic reviews or meta-analyses to assess the quality and reliability of included studies is recommended to enhance confidence in the evidence. Additionally, economic evaluations should be conducted to determine the cost-effectiveness of different interventions for VLU treatment, shedding light on the value for money associated with each option. Exploring the long-term cost savings and patient outcomes linked to early intervention and prevention strategies for VLU is also crucial to reduce the burden of the disease and improve overall outcomes. Implementing these practice and research recommendations will contribute to optimizing VLU treatment, enhancing patient outcomes, and maximizing healthcare

resource utilization.

9. Conclusion

This scoping review aimed to appraise existing papers that assessed the monetary costs in economic evaluations of treatment with compression bandages among adults with VLU and 10 studies met the inclusion criteria. The type of compression therapy employed varied and results also varied with different follow up periods and calculation of the costs in all included papers. This is problematic as it becomes difficult to accurately evaluate costs from the existing literature, thereby inhibiting the usefulness of the data to inform practice. Thus, there remains uncertainty regarding monetary costs in economic evaluations of treatment with compression bandages among adults with VLU. To provide a more exact cost analysis of VLU care a larger prospective study could be using the specific methodological guidelines to generate high-quality health economic studies.

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