

A qualitative study of barriers and facilitators to compression stocking use in patients with chronic venous insufficiency

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Abstract

Introduction: Compression stocking therapy is the gold standard of treatment for conditions associated with lower limb venous dysfunction. The benefits in symptom relief and preventing disease progression are well documented. Despite this, adherence to compression stocking therapy is poor. This project aimed to identify factors affecting compression stocking adherence in Aotearoa New Zealand through qualitative evaluation of interviews of patients with chronic venous insufficiency.

Methods: In this mixed-methods study, 25 participants were recruited, and semi-structured interviews were carried out until thematic saturation was reached. All participants also took part in surveys recording characteristics and Quality of Life questionnaires. Common interview themes were summarized and quality of life scores were compared between respondents.

Findings: Interview respondents were a median of 64 years old, and were prescribed compression therapy a median of 8 years prior. The cohort spent a median of 8 h a day standing. Qualitative interviews identified three main themes influencing compression stocking use: physical factors, psychological factors and external factors. Subthemes included the influence of age and sex on participant perceptions of the stockings' appearance, and how comorbidities contribute to donning difficulty.

Conclusion: Understanding factors influencing patient adherence can enable clinicians to provide a multidimensional approach, mitigating barriers and emphasizing facilitators for the individual patient to improve adherence.

Introduction

Effective management of chronic venous insufficiency (CVI) prevents disease progression and can improve patient quality of life. CVI is prevalent in up to 50% of adults globally.¹ Increasing older, comorbid and obese populations mean that this disorder will become more prevalent.² Compression stocking therapy is effective in managing symptoms and preventing complications of CVI,³ and can halve the chance of a recurring venous leg ulcer.⁴ Compression therapy provides external pressure to compress dilated veins, assisting valvular function and reducing fluid movement into the interstitium. This can be carried out using stockings, bandages, or wraps depending on patient disease severity and preference. This study will focus on the use of compression stockings as they are the first-line treatment option provided by healthcare providers. While this therapy is simple and straightforward, success depends

upon patient adherence, which can be inconsistent.⁵ Understanding patient perspectives regarding compression stocking therapy and how these can be utilized may help clinicians optimize adherence.

While numerous reviews and studies have explored factors influencing adherence with compression therapy,^{6–8} persistently low adherence rates continue to detrimentally impact patient outcomes and strain healthcare systems. This is significant in diverse populations, including rural and urban patients, often with unique healthcare requirements. As an example, in Aotearoa New Zealand, Māori and Pasifika patients have an increased risk of developing venous leg ulcers and tend to develop them at a younger age.⁹ In addition to ethnicity, other risk factors include female sex, previous pregnancy, positive family history, and occupations requiring prolonged standing.¹⁰

Despite the provision of publicly funded healthcare, there can be regional disparities in compression stocking funding, contributing

to inequitable access to health services which can be a barrier to adherence.⁶ Therefore, understanding the distinct determinants of stocking adherence in patients with varying access to resources will assist clinicians in delivering tailored and effective care to patients.

A 2019 review summarized factors impacting adherence with compression stocking therapy in the treatment of venous ulcers.⁷ This review identified six key themes impacting adherence: knowledge deficit, resource deficit, psychological issues, pain/discomfort, physical limitations, and wound management. One study examined factors affecting adherence in Aotearoa New Zealand. This included 129 patients, following venous leg ulcer healing, investigating differences in patients with high adherence to those with low adherence.¹¹ Two key factors were identified to influence adherence; the belief that wearing stockings was worthwhile, and the belief that stockings were uncomfortable. Age of the patient, cost and appearance were not significantly associated with adherence, contradicting results reported elsewhere. In addition, a qualitative study of non-adherence with compression stocking use in China identified four themes. These were knowledge gaps, disadvantages of compression stockings, few recommendations from doctors, and socio-psychological factors.¹²

Interventions to increase adherence have to date not been successful. A scoping review of 69 interventional studies concluded that no individual intervention consistently demonstrated improved adherence. The investigators suggested that high-quality trials should focus on multidimensional interventions.⁸ Developing such an approach to increasing adherence requires a thorough understanding of patient perspectives to address each factor that may impact adherence to compression stocking therapy.

While barriers to compression stocking therapy are widely studied, there is little research investigating facilitators. A deeper understanding of individual patients' perspectives and experiences with compression stocking therapy is needed. This mixed-methods study aims to synthesize interview responses from participants to determine themes and describe characteristics, including age, quality of life, ethnicity and hours of standing, that may influence patient adherence to compression stocking therapy. These results may be used to assist in the development of more effective clinician engagement with patients and interventions to increase adherence.

Methods

This is a mixed-methods qualitative study aiming to explore patients' experiences of compression stockings via a series of interviews, and questionnaires to explore possible characteristic factors affecting compression stocking adherence. Patients living in the catchment area of our tertiary hospital, who were over 18 years of age with CVI, classified within the CEAP diagnostic framework as C1-C6¹³ were invited. Participants must have been prescribed compression stocking therapy. Exclusion criteria included inability to communicate, or inability to provide consent.

Participants were recruited from the Dunedin Hospital endovascular laser ablation therapy waitlist and vascular clinics in Dunedin and Invercargill. Through face-to-face and telephone calling, purposive sampling was done until the participant interviews were determined to have reached thematic saturation.¹⁴ The study

followed a phenomenological methodological orientation aiming to understand participants' lived experiences with the stockings, and how this affected their daily use.

Data was collected via 10–15 min semi-structured interviews, conducted in person at hospital clinics or via telephone according to participant preference. All participants were interviewed by a female senior medical student, following an interview guideline (Supporting information). The interviewer was not trained in qualitative research, however, conducted a literature review of qualitative research prior to this study and was supported by senior researchers. Participants were familiar with the interviewer, as they had been in contact through the recruitment process. The participants had no other prior interactions with the interviewer. No one else was present in the interview room.

Participants were asked the same opening questions about the participants' experiences with compression stockings and how these affected their adherence. The interviewer followed up with further questions to clarify and expand on ideas the participants raised. Repeat interviews were not carried out, and transcripts were not returned to participants.

Participants also answered the following characteristic questions; age, sex, ethnicity, employment, major comorbidity, and the Short Form-36 quality of life questionnaire (SF-36).¹⁵ Interviews were recorded and transcribed using Zoom (Zoom Video Communications Inc., 2016). The transcriptions were then cross-referenced with the audio recording by a researcher (L.S.) and imported into the NVivo software programme to compile the data.¹⁶ The researcher then analysed these further using an *in vivo*, line-by-line coding technique to identify key themes as derived from the data.

Results are summarized using appropriate summary statistics. SF-36 scores¹⁵ were compared between patients adherent and non-adherent to compression stocking therapy using the Mann–Whitney *U* test with significance at $p = 0.05$. This study received ethical approval from the University of Otago Human Ethics Committee (Health) (Reference H23/116).

Results

Thirty-three participants were identified from the vascular service as potentially eligible and were contacted, four did not meet the inclusion criteria and another four declined to participate. Twenty-five patients consented and were enrolled, with interviews conducted between 13 November 2023 and 17 January 2024. Eleven (44%) of the participants were male, and five (20%) were Māori, all lived in the lower South Island of Aotearoa New Zealand (eight in Invercargill, 16 in Dunedin, one in Oamaru). Table 1 shows participant age, number of years they have been prescribed stockings, and estimated daily standing time.

Twelve (48%) participants were prescribed compression stockings for CVI, three following venous surgery, and 10 for post-surgical wear. Eleven (44%) participants were not currently wearing compression stockings, and the age of these participants did not differ from those who were adherent (65 vs. 62 years, respectively; $p = 0.35$). Participants' venous insufficiency was classified between CEAP levels C3–5, with seven (28%) of subjects CEAP C3, 16 (64%) CEAP C4 and 2 (8%) CEAP C5. Quality of life

Table 1 Participant characteristics

	All participants (<i>n</i> = 25)	Participants aged ≤65 years (<i>n</i> = 14)	Participants aged >65 years (<i>n</i> = 11)
Age (years) [†]	64 (31–90)	55.5 (31–65)	70 (67–90)
Years since prescribed compression stockings [‡]	8 (5, 10)	9 (4.5, 10)	5 (5, 10)
Hours standing/day [‡]	8 (4, 9)	5 (2, 7)	8 (8, 10)
Comorbidities [§]			
Hypertension	5 (20)	1 (7)	4 (36)
Diabetes	1 (4)		1 (9)
Osteoarthritis	9 (36)	4 (29)	5 (45)
Cardiovascular disorder	2 (8)		2 (18)

[†]Median (Range).
[‡]Median (Interquartile Range).
[§]*n* (%).

measures were similar between participants adherent and non-adherent to compression stocking therapy (Table 2). This research involved Māori patients but as we were unable to include the expertise of a Māori data expert or community representative, we have chosen not to present the results as a comparison between Māori and other participants.

Factors that participants identified as barriers or facilitators to using compression stockings could be categorized under three main themes: physical factors, psychological factors, and external factors. These have been further separated into 10 subthemes that are outlined in Table 3, and the coding tree in the Supporting information.

Discussion

We identified factors impacting adherence with compression stocking use in patients with CVI, comparing experiences between participants of different ages. Three main themes were identified; external factors, physical, and psychological factors, which were then categorized into 10 subthemes as outlined in the results.

The study cohort included patients from two regions, only one of which funds the first pair of compression stockings. Patient interviews did not reveal differences between patients from these regions in how finances impacted their use of compression stockings, however, numerous participants mentioned cost of the stockings as a barrier. This similarity between regions may be due to the limited benefit of having only one pair funded, when stockings should ideally be worn for less than 6 months before replacing.

There has been one other study on a New Zealand population looking at compression stocking adherence, finding that participants mentioning finances as a barrier had good adherence.⁶ However, in the present study, participants described their personal experiences of the additional strain of purchasing compression stockings, and the choices to buy cheaper, less effective alternatives.

The cohort reported a high median hours standing per day relative to similar populations. A study of 221 240 Australian adults (45 years and older) found that only 13.7% stood for more than 8 hours per day, with the majority standing 2 h or less. Occupations requiring standing, and a greater amount of daily standing hours, are known risk factors for venous insufficiency.¹⁷ Participants in this study may not have realized the connection between standing and CVI, or they may not believe that standing is associated with compression stocking adherence. Compression stocking therapy can alleviate CVI symptoms in those with standing professions,¹⁸ and our interview results highlight the potential to increase education in this area.

The previous New Zealand study also found that neither difficulty applying the stockings nor patient sex influenced compression stocking adherence, which is in contrast to our results and those reported elsewhere. We observed that younger participants identified appearance of the stockings as a barrier. Female respondents reported that they were unfashionable and comments from males suggested that stockings were not masculine. This is consistent with another qualitative paper reporting that males had a negative perception of compression stockings.⁵ The South Island of Aotearoa

Table 2 Median (Interquartile Range) quality of life scores measured via the Short-Form 36 questionnaire

	All participants (<i>n</i> = 25)	Adherent patients (<i>n</i> = 14)	Non-adherent patients (<i>n</i> = 11)
General health	60 (55, 80)	57 (51, 78)	65 (55, 81)
Physical functioning	70 (55, 80)	80 (44, 95)	70 (63, 98)
Physical health limitations	100 (25, 100)	75 (31, 100)	100 (50, 100)
Emotional health limitations	100 (100, 100)	100 (50, 100)	100 (100, 100)
Energy/fatigue	60 (45, 70)	59 (36, 70)	60 (50, 70)
Emotional wellbeing	84 (76, 88)	83 (66, 100)	88 (84, 92)
Social functioning	77.5 (75, 100)	83 (66, 100)	75 (75, 100)
Pain	67.5 (55, 80)	64 (48, 70)	80 (61, 90)

Table 3 Themes identified in participant interviews

Theme 1: Physical factors		
Subtheme	Quote(s)	Explanation
Symptom relief	'They help relieve the swelling and the pain [...] It's still an inconvenience but it's definitely better than not wearing them'. —Participant 18	Participants frequently identified symptom relief, such as reduction in swelling, pain, and heaviness, as a facilitator.
Discomfort	'They were so painful in my shin that I couldn't bear it [...] I just could not take the cutting into my shin from the stocking I was given. So, I made a slit and all my skin came out. Then I started bandaging it, it was quite a debauchery I must say'. —Participant 23	Of the 25 participants, 23 mentioned discomfort from heat, itch, tightness and sizing difficulties. Several found the stockings would roll down, requiring position corrections to stop the material from overlapping. In three participants this caused chafing and breaking of the skin. Multiple participants spoke of receiving incorrectly sized stockings, some of whom altered them to improve the fit.
Application difficulty	'From my point of view from a hip replacement, it just adds another layer of challenge [...] I can't get down to put a pair of socks on the right side so how would they expect I'd be able to do compression stockings?' —Participant 7	Many participants experienced difficulty applying stockings, and this was mentioned more in the older cohort. Musculoskeletal conditions, such as arthritis in the knees and hips, were frequently mentioned. Two participants identified venous disease symptoms affecting the application of stockings. Several participants discussed applicator devices to aid in donning.
Theme 2: Psychological factors		
Subtheme	Quote(s)	Explanation
Sense of security	'My legs feel safe, especially in social situations. My legs are always sore whether I've got them on or not, but they feel safe because they're contained in them'. —Participant 12	Several participants mentioned a sense of security they experienced with wearing the compression stockings. Some attributed this to a feel of containment the stockings provided, whilst others mentioned this material acting as a physical barrier for protection against the skin getting damaged.
Daily routine	'I just wear them all the time. I mean, they are really just a part of me now. [...] As I say it's just a routine every day I go through'. —Participant 24	Wearing compression stockings daily was a facilitator for some participants. They mentioned it becoming part of their everyday activities; normalizing the experience of wearing them.
Appearance	'In some circumstances I'll take the stocking off because you feel a bit conscious. If it's an outdoor thing and I'm in shorts [...] For a guy wearing a stocking, it's quite noticeable [...] A lot of it is a psychological thing with a guy, it's justifying why you're wearing it'. —Participant 10 (M) 'But you know, my good leather shoes. I can't get them on if I haven't had these on'. —Participant 12 (F)	Sixteen participants mentioned that appearance influenced how they wore compression stockings. Many of the males cited appearance concerns regarding their gender expression, due to stockings traditionally associated with women's clothing and experiencing stigma surrounding this. None of the women brought gender into their explanations, rather perceiving them as unfashionable. For some, the appearance of the stockings was a facilitator, as the reduction in swelling provided by the stockings gave more freedom in shoe choices. Of the 16 participants that identified appearance, 11 were in the ≤65 age group.
Interactions with health-care workers (HCW)	'Why is it so important that I wear compression stockings? It's like I really didn't have a lot of information'. —Participant 20	Participants experienced interactions with health care workers as barriers and facilitators. Participants with positive experiences felt stocking use and why it was beneficial was well explained. Those with negative experiences felt the explanations for the importance of stocking use was not thorough. Numerous participants also mentioned having been on the waitlist for venous corrective surgery for several years, lowering their motivation for continued use.
Disbelief of efficacy	'But it didn't really make much difference. There was no pain. There was no discomfort [...] If I had to I would, but I don't feel the need to, so I won't'. —Participant 19	Three participants did not notice benefits to wearing stockings. With no noticeable benefits, and experiencing other barriers, these participants discontinued use.
Theme 3: External factors		
Subtheme	Quote(s)	Explanation
Finances	'Working at the Salvation Army (Opportunity Shop), they come in. So every time a pair comes in I grab them because they were only a dollar. Much better price for value'. —Participant 2	Finances can act as facilitators and barriers. If regular purchases of stockings can be afforded, this facilitates having surplus without having to wash them every few days, as well as trialling different brands. Participants would buy more affordable non-medical grade compression socks or purchase them second hand. Other participants described that a pair would not last the recommended 6 months, especially if damaged. Respondents would wear stockings despite having lost their elasticity, due to expense. Whilst Dunedin participants appreciated the first pair of funded stockings, for many it was more than 10 years since first prescribed stockings.

Theme 3: External factors		
Subtheme	Quote(s)	Explanation
Post-surgical	'But maybe it wasn't too bad for me because I knew it wasn't something I needed long term'. —Participant 13 'Putting them on and taking them off after the surgery was sore. I was scared to touch the skin even there; it is still quite sensitive today'. —Participant 6	Participants wearing compression stockings following venous corrective surgery described unique factors influencing their adherence. Wearing the stockings as a part of the recovery process was a facilitator to allow the patients to persevere. Some participants mentioned having to wear stockings in the shower postoperatively and having difficulty drying them afterwards. Another participant mentioned post-surgical pain contributing to application difficulty.

New Zealand ranges in average temperature from 13 to 16°C,¹⁹ and no participant mentioned ambient temperature as a factor in compression stocking therapy adherence. Patients in hot climates may find temperature a barrier, and this warrants further study in those regions. Older participants responded about the difficulty with application and had more comorbidities that affected application.

We measured participant health-related quality of life, as this may be associated with compression stocking adherence independent of age.²⁰ While numerous studies show compression stocking therapy adherence is positively associated with quality of life, our study did not find differences in QoL between those who were adherent and non-adherent. By identifying that QoL is not associated with adherence in this cohort, we can focus on other barriers and facilitators that are independent of QoL.

Few qualitative studies investigate facilitators in compression stocking therapy adherence. We found that several participants mentioned positive psychological factors associated with compression stocking therapy. These included a 'sense of security' provided by the stockings, the positive effects on the appearance of their legs, the ability to wear preferred shoes, and having a daily routine. These facilitators have not been mentioned in the literature and warrant further research. This study includes participants from a small New Zealand centre, and the results may not be generalisable to patients living in other demographics. In addition, one researcher conducted all interviews, to maintain consistency in the interview questions. However, the use of one researcher to conduct interviews can add bias to the interpretation.

Conclusions

This qualitative study found that multifaceted factors influence adherence to compression stocking therapy among patients with CVI, with a particular focus on age-related differences. Our qualitative findings, in the context of participant characteristics, highlight the impact of external, physical, and psychological factors on stocking use, which can vary according to patient age and gender. While financial constraints and concerns over appearance were mentioned as barriers, positive psychological factors such as a sense of security and improved leg appearance were identified as facilitators of adherence. Healthcare providers should engage with patients to mitigate barriers and capitalize on facilitators, increasing adherence and improving overall quality of life for individuals with CVI.

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Author contributions

Lucy Simmonds: Data curation; formal analysis; investigation; visualization; writing – original draft; writing – review and editing. **Jolanta Krysa:** Conceptualization; methodology; supervision; writing – review and editing. **Abby Currie:** Investigation; resources; supervision; writing – review and editing. **Kari A. Clifford:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft; writing – review and editing.

Conflicts of interest

The authors have no disclosures.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Data S1. Supporting Information.

Data S2. Supporting Information.