

Factors that impact compression hosiery concordance post healing

KEY WORDS

- ▶ Adherence
- ▶ Compression hosiery
- ▶ Concordance
- ▶ Lower limb ulcer
- ▶ Venous leg ulcer

Background: Low concordance with compression hosiery following healing of venous leg ulcers leads to high rates of venous leg ulceration recurrence. **Aims:** To determine what factors impact concordance and what actions can be undertaken to limit recurrence rates. **Methods:** Medline, CINAHL, AMED, TRIP and Joanna Briggs Institute databases were explored from 2007–2017. Studies concerning concordance/adherence with compression hosiery post venous leg ulcer (VLU) healing were reviewed. Seven studies were included in the final literature review. **Results:** Discomfort/pain, application difficulties, lack of patient education regarding compression hosiery use and aesthetic factors were all reported to influence hosiery concordance. These factors contributed to increased VLU recurrence rates, affecting patients' quality of life (QoL) and providing an avoidable burden on healthcare services. **Conclusion:** Current practice provides limited support to patients. The implementation of a compression clinic would provide assessment of leg condition, hosiery efficacy, advice and support to patients to increase hosiery concordance and thus reduce VLU recurrence.

Leg ulcers are a common problem that have a prevalence of 0.1% to 0.3% in the adult population in the United Kingdom (Scottish Intercollegiate Guidelines Network [SIGN], 2010) with 60–85% being of venous origin (Vasudevan, 2014), making venous leg ulcers (VLUs) the most common form of leg ulceration.

VLUs are caused by chronic venous insufficiency (CVI) where damage occurs to the valves within the veins that direct blood flow towards the heart (Bainbridge, 2013). Once these valves become damaged, backflow can occur and blood pools within the blood vessels leading to venous hypertension. This can lead to damage of the surrounding tissues increasing the likelihood of an ulcer forming (Harding et al, 2015). As the damage to the venous valves is usually irreparable, VLUs are a chronic health condition that require long term management post healing, usually by the application of compression hosiery (Anderson, 2012). By utilising compression hosiery as a long-term intervention in the management of CVI the risk of ulceration recurrence is reduced (Cullum et al, 2009).

The primary setting for VLU treatment is the community, with approximately 67–80% VLU patients treated at home or within clinic environments (Nazrarko, 2016). Leg ulcer treatments and management consumes approximately 25–50% of community nurses clinical work hours (Chamanga et al, 2014), thus VLUs are huge consumers of nursing time and healthcare resources. Once healed, patients are advised to wear compression hosiery on a long-term basis to manage their CVI, however, many patients do not concord with hosiery treatment, leading to high rates of ulceration recurrence estimated at 26–69% (Harding et al, 2015). This lack of patient concordance with treatment post VLU healing has been repeatedly identified as an issue in practice (Anderson, 2012).

The current estimated yearly cost of VLU treatment to the National Health Service is £630 million (Guest et al, 2016). Whilst VLU treatment is a significant financial burden, it is also very time consuming to treat and manage and has a substantial impact on the quality of life of patients (Green and Jester, 2010). If the rates of recurrence were reduced

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Table 1. Search Terms

1	Venous ulcer/s
2	Varicose ulcer/s
3	Leg ulcer/s
4	Lower limb ulcer/s
5	Chronic wound/s
6	OR 1–5
7	Compression hosiery
8	Compression stocking/s
9	Compression therapy
10	Compression garment/s
11	OR 7–10
12	Compliance
13	Concordance
14	Adherence
15	OR 12-14
16	Combine 6 AND 11 AND 15

by effective management, the financial, time and quality of life (QoL) burden would be minimised and resources could be redirected.

This literature review will evaluate the current literature exploring the factors that affect patient concordance with compression hosiery following healing of VLU. A systematic search revealed appropriate literature that was evaluated and the key themes drawn. This will be discussed and analysed to discover the current knowledge base of non-concordance factors.

METHODS

A search of five databases was undertaken: Medline, Joanna Briggs Institute, CINAHL, AMED and TRIP. The databases were all searched individually by utilising line by line search terms (*Table 1*). Following completion of the search, reference lists of the literature were hand reviewed in line with the gold standard search method (Hopewell et al, 2007). Hand searching can retrieve studies that can be lost through database searching alone, identifying potentially relevant articles. All study methodologies were considered for inclusion in the review, as limiting to specific study methodologies can exclude useful papers and apply bias to the studies collected (McDonagh et al, 2013). English language only studies were included, as the scope and the funding of the project would not allow translation services. Translation services available online cannot effectively translate complex ideas easily and the impact of the literature can be lost once translated into English (Root-Bernstein and Ladle, 2014).

Studies published within the last ten years (2007) were included in the study due to changes in treatments and treatment pathways in the management of VLUs. Selecting studies from the last ten years ensured the relevance of the data found.

By combining all search terms and searching the various databases individually, a range of applicable literature was sourced that required further screening to fully assess their suitability.

SEARCH RESULTS

After the initial search, a total of 341 articles were found, applying the specific search criteria required for this study, 7 were deemed suitable for inclusion in the review and were reviewed.

DATA EXTRACTION

Following a full review of the seven papers selected, the data they contained was extracted and organised on data extraction sheets, grouping them into qualitative, quantitative and cohort studies. This was undertaken to allow the key points of each study to be accessible for the review. The selected studies were summarised, including details of methodology, sample size, subject characteristics and the outcomes of those studies were noted in order to identify recurrent themes.

To thoroughly analyse the quality, validity and relevance of the selected articles Critical Appraisal Skills Programme (CASP, 2017) tool was applied to the seven selected articles. The CASP tool is validated and allows studies to be critically analysed by using a logical and systematic methodology (Oxman, 1993). The CASP tool (2017) has numerous versions that can be applied to a range of different study types including qualitative, quantitative and cohort studies.

ANALYSIS

In order to effectively identify the key findings within the studies, a process of thematic analysis was applied. Thematic analysis is the most common method of interpreting findings in evidence reviews (Pope et al, 2007). It identifies the key, reoccurring evidence from the wide range of data available and codes this information which can then be grouped into distinct themes that can be analysed (Walker, 2014) Thematic analysis was used because it has a number of strengths allowing data to be summarised from both qualitative and quantitative studies. This allows multiple complex findings to be derived from a large varied body of data despite varied methodologies (Guest et al, 2012). Its versatility in data analysis allows a detailed and thorough view of the data to be formed and allows the reviewer to come to a clear and well organised summary (Nowell et al, 2017).

RESULTS

The four primary identified themes were:

- ▶▶ Discomfort/Pain
- ▶▶ Application
- ▶▶ Education
- ▶▶ Aesthetic (*Figure 1*)

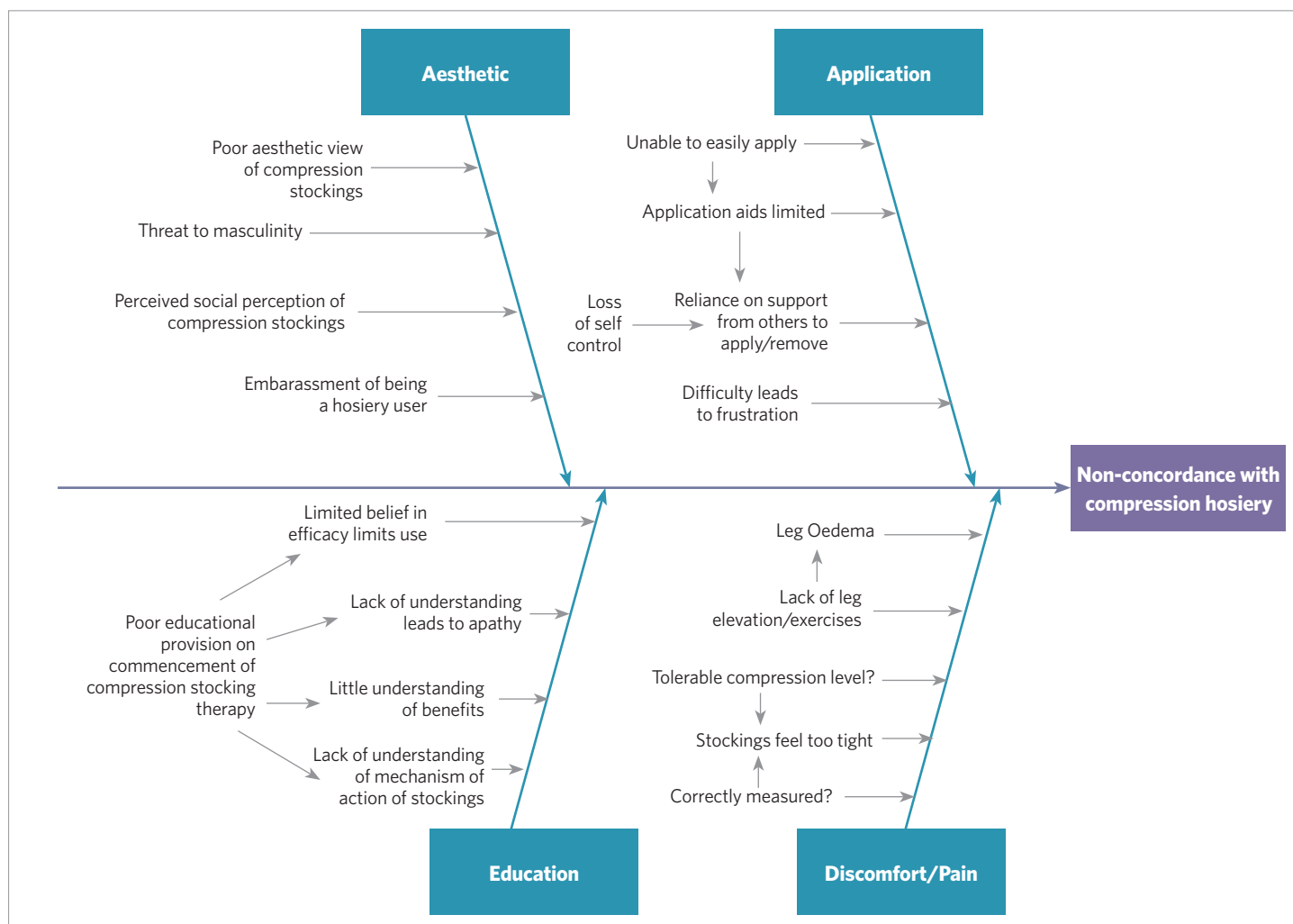


Figure 1. The topics leading to the four primary themes

DISCOMFORT/PAIN

Of the seven studies included within the review, four studies identified discomfort/pain as one of the primary barriers to concordance with wearing compression hosiery (Table 2). Of the multiple studies only Raju et al's (2007) quantitative study identified discomfort/pain as the singular finding of the study. The other three studies identified at least two primary contributory factors. Raju et al's (2007) study was the largest study within this literature review with a sample size of 3,144 participants. This large sample increases the confidence level of the data gathered (Wilcox, 2010). However, the methodology of the study was limited, consisting of a single interview with each participant asking them to self-grade their own concordance level. This methodology provides poor quality data as individuals often attempt to portray themselves in a favourable light or give extreme answers to questions

(McDonald, 2008). Within the results of the study, 63% of participants did not comply with compression hosiery treatment and of this 63%, 55% stated non-concordance due to non-specific reasons/medical advice. The study states the primary reason for non-concordance was discomfort/pain factors, however, only 25% of the total sample cited this to be the causative issue casting doubt upon the reliability of the study's results.

Clarke-Moloney et al (2007) also had a robust sample size (n=100) and utilised a more developed methodology than Raju et al (2007), utilising a randomised control trial method with a purposefully selected sample. The subjects undertook prior education sessions regarding stocking usage, a questionnaire regarding hosiery use and an assessment of a subject's ability to apply/remove stockings and how stockings affect their lifestyle. This study included regular

Table 2. Thematic analysis table modified from Aveyard (2014)

Discomfort/Pain	Application	Education	Aesthetics
Van Hecke et al, 2010	Van Hecke et al, 2010	Jul et al, 2004	
Raju et al, 2007	Finlayson et al, 2011	Finlayson et al, 2011	
Clarke-Moloney et al, 2012	Clarke-Moloney et al, 2012	Clarke-Moloney et al, 2012	
Tandler, 2016	Tandler, 2016		
	Madden, 2015		Madden, 2015.

three-monthly follow ups until twelve months. The results of the study identified 11% of the participants did not comply with treatment. In total 5% of the total sample did not comply with treatment due to discomfort/pain issues, 4% due to application difficulties and 2% due to aesthetic reasoning. Compliance within this study was extremely high, with 75% of participants fully compliant at 3 months and 65% fully compliant at twelve months. The high concordance levels throughout the study were attributed by the authors to regular follow ups with the researchers. Higher concordance rate with other treatments has been identified in other studies where regular supportive follow ups were undertaken (Owens, 2015; Ou, 2017).

The remaining two studies that identified discomfort/pain as primary reasons for non-concordance were Tandler's (2016) study and Van Hecke et al's (2010) study that researched the opinions of TV nurses on the reasoning for patient non-concordance. Tandler's (2016) methodology consisted of 26 TV nurses completing a self-reporting questionnaire. With its small sample size and the limited closed question questionnaire methodology, data validity of this study is limited (Parahoo, 2014). Similarly, Van Hecke et al, (2010) had 26 participants and utilised semi-structured interviews (with open ended questions), observations and consultations with patients and TV nurses. Whilst the sample size was again small, the multi method information collection and triangulation of the data by cross referencing the data gathered from the differing methodologies ensured validity of the data collected (Carter et al, 2014). This triangulation of data ensured this study's findings were the more robust of these two studies that surveyed TV nurses' opinions.

APPLICATION

Difficulty in stocking application, and the general ineffectiveness of aids to assist application has been identified in limiting concordance in five studies (Figure 3). Three of the studies (Van Hecke et al 2010; Clarke-Moloney et al 2012; Tandler, 2016) identified discomfort/pain as well as application difficulties in affecting concordance with compression hosiery.

Two studies which identified application difficulties amongst one of the themes and did not identify discomfort/pain were Finlayson et al's (2011) prospective longitudinal study and Maddens (2015) qualitative study. Finlayson, Edwards and Courtney's (2011) study recruited 80 selected participants post VLU healing. Data was collected three-monthly for a period of one year utilising a questionnaire methodology. Questions surveyed adherence to wearing compression hosiery, lower leg exercises and leg elevation. There was a marked reduction in all three measured outcomes every three months. The study suggests physical restriction limits adherence to all measured outcomes as the population sample was older (mean age of 75) with multiple co-morbidities, comparable to the general demographic that require compression hosiery following VLU healing. This contradicts the findings of Raju et al's (2007) and Jull et al's (2004) that state comorbidities have little effect upon concordance. The reduced leg elevation and exercise lead to increased oedema to the legs thus increasing the feelings of discomfort/pain and difficulty in application. This cyclical process reduced full concordance from 71% at the commencement of the study to 49% by the end of the study. The study noted that regular follow up visits of at least twice per year did lead to improved concordance with compression hosiery ($p < 0.05$) as did the use of preventative strategies (leg exercises/elevation), which are rarely reported in studies investigating leg ulcer recurrence.

Maddens (2015) study also identified difficulty in application as a key theme, however the primary findings of this study were aesthetic issues and this will be discussed fully below. The application issue affecting concordance was the ineffectiveness of application aids, with the aids being described as cumbersome and making subjects feel self-conscious when applying stockings in the presence of others. Subjects also stated that they often required assistance of a carer or family member to

put stockings on resulting in issues of self-doubt reduced independence.

EDUCATION

Three studies identified a lack of patient education and a lack of understanding of the importance of compression hosiery. Of these, two identified at least one other factor and have been discussed previously. Jull et al's (2004) quantitative study identified a lack of patient understanding as its primary finding. The study consisted of 129 participants interviewed mostly by telephone utilising a closed questionnaire methodology, which is a good methodology for identifying specific demographic data (Griffith, 1999), and data analysis via univariate analysis. This analysis method is a weakness of the study, as it is the simplest method of analysing and describing data with no investigation into the possible causality (Wang and Jain, 2003). The paper was beyond the ten-year inclusion criteria intended for the scope of this study, but it was found via manual searching and the findings warranted inclusion in this review.

The findings of the study identified where there was appreciation of the benefits of stockings in the prevention of ulcer recurrence, then there was an increased level of concordance. This study found no links to application difficulty reducing concordance, at odds with the majority of studies within this review. Similarly, no relationship was found between the aesthetic quality of stockings and concordance, again at odds with the results of Madden's (2015) study. Jull's study has its limitations and with the methodology relying on self-report, the potential for exaggerated results is high (McDonald, 2008). The 95% confidence interval of the results of Jull et al's (2004) study is also very wide (C.I = 3.60-212; $p=00001$), bringing into doubt the accuracy of the results and indicating the sample size may have been too small (Prel et al, 2009).

Jull et al's (2004) findings state that concordance is aided by fostering and supporting patients in the understanding of the benefits of compression stockings via the provision of both written and verbal education. The presentation of the risks of non-concordance prior to the benefits of concordance appears to foster patients' belief in their worth however further research is required

to confirm this. Finlayson, Edwards and Courtney's (2011) study also suggested health professionals may be required to reinforce and reaffirm education upon compression use and prevention strategies through regular follow up visits. Clarke-Moloney et al (2012) found high levels of concordance with hosiery and lower levels of VLU recurrence with regular support via three monthly follow ups. The study speculated the regular contact reaffirmed stocking importance to the patient and provided support with any issues they may have.

AESTHETIC

One study identified aesthetic issues of hosiery affecting concordance. Maddens (2015) study provided an adequate sample size (n-19) for a qualitative study design. However, six of the participants were aged between 21-45 years old and had developed leg ulcers due to intravenous drug use, these six subjects did not fit the patient demographics of the other studies and thus inclusion of their data may have altered the study's findings. Interviews were conducted utilising topic guides, providing the researcher with a vast range of data that was analysed thematically allowing recurrent themes to be identified from the data. The findings of the study found a reluctance to wear compression stockings particularly in males due to a loss of masculinity as subjects stated, "stockings are for women" and that they make subjects "feel like I'm wearing women's tights" leading to doubt and ambivalence as to their effectiveness and thus decreased use. These issues of perceived self-image regarding hosiery is a little researched area and the study indicates patient's non-concordance may be due to preservation of social presentation of one's self. The study was limited in its demographic scope with the study sample of white, working-class subjects limiting its wider impact. Whilst the study is limited, it does raise pertinent issues regarding the perception of stockings and patient's self-presentation concerns regarding their use.

DISCUSSION

This review identified multiple factors limiting concordance following VLU healing, with the four primary themes discussed above being the most prominent reasons. This literature review has identified the four primary factors that

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impact upon patient concordance. These barriers to concordance include the feeling of discomfort/pain, difficulty in applying stockings, a lack of understanding of the importance of stockings and the perceived negative effect of wearing stockings on self-image. There appears to be overlapping of factors throughout the multiple studies reviewed, indicating non-concordance is a multifaceted issue that requires the provision of holistic care to improve concordance rates. This review identifies that no single intervention or approach is suitable to increase concordance, and a holistic and supportive approach is required to meet the needs of patients and increase stocking use post VLU healing to reduce the risk of future ulceration (Nelson and Bell-Syer, 2014)

The current body of evidence suggests compression hosiery and graduated compression hosiery is the recommended approach by SIGN (2010) to prevent VLU recurrence. Studies identify compression hosiery concordance rates post VLU healing range from 98% (Jünger et al., 2004) to 20% (McGuckin et al, 2002). Concordance rates vary wildly and as a result the range of recurrent ulceration following healing is estimated between 26% and 69% in the twelve months post healing (Abbate et al, 2005; Nelson and Bell-Syer, 2014). These high recurrence rates result in a huge strain both financially and upon resources of healthcare services and limits the quality of life (QoL) of patients who undergo cyclical stages of healing and ulceration (Green et al, 2015).

Low stocking concordance correlates with increased VLU recurrence. This causes detrimental effects to the QoL of patients who undertake cyclical phases of healing and ulceration. This results in a burden to the healthcare economy in terms of staffing, financial and material resources that could have otherwise been utilised elsewhere if the ulceration did not recur.

The current support to patients is limited and does not follow National Institute for Health and Care Excellence (2014) and SIGN (2010) recommendations in regular reassessment of patients utilising compression hosiery. The proposed service improvement of compression clinics, providing holistic, psychosocial care and educational support to patients can ensure they feel supported in their hosiery use and are regularly assessed reducing the likelihood of VLU's recurring. The implementation

of the compression clinics has numerous benefits. Organisationally, healthcare providers will be providing an efficient and proactive service, and financial savings are generated reducing VLU recurrence and therefore the associated costs. Most importantly, patient outcomes are improved through an increase in QoL and improved health outcomes.

To meet the individual needs of patients, a “wrap-around” service, education, support and best practice in compression hosiery utilisation is needed to increase concordance and thus reduce the potential for VLU's reoccurrence. The clinic would invite patients who utilise compression hosiery to attend a compression clinic twice a month, with qualified nurses and support staff present. These staff would educate patients regarding supportive interventions such as leg exercises, assess patients leg condition, re-Doppler patients as required, provide skin care with leg washing and application of cream, and check stockings to see if they continue to exert the correct pressures (mmHg) as originally prescribed. Manufacturers state that stocking elasticity diminishes over time through regular use and washing, thus becoming ineffective (Activa, 2017; Jobst, 2018). The clinic would provide a social occasion where patients gain peer support from other users and share ideas and tips, such as stocking application, similar to the Lindsey Leg Club® model of social care (Lindsey, 2004). By involving voluntary agencies such as Age UK, who provide information, and advice (Age UK, 2018) within the clinics, individuals can be supported holistically, with signposting services to relevant agencies and other supportive measures available.

CONCLUSION

This study reviewed data from a specific time period focusing on compression hosiery as the primary management tool in preventing further ulceration. More recent evidence indicates surgical treatment of the underlying causes of venous hypertension, such as venous ablation or venous sclerotherapy, may lead to lower rates of ulcer reoccurrence when used in conjunction with compression hosiery, when compared to utilising compression hosiery alone (Gohel et al, 2018). This approach is predicated on the person being well enough to undergo this procedure. Further research is required in the area of combining

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- surgical intervention with hosiery management in improving patient outcomes and QoL.
- As evidenced in this study, concordance with compression hosiery is low. What can be done to improve this? The utilisation of compression hosiery kits as the first line treatment may improve concordance rates post healing, however the evidence is mixed, with little difference demonstrated between 4-layer bandaging and hosiery kits in healing rates or post healing hosiery concordance rates (Tickle et al, 2017). The development of adjustable compression wraps, such as Juxta Wraps, allow patients to apply graduated compression more easily than compression hosiery by utilising velcro straps; this approach is becoming increasingly prevalent, but again the efficacy of these devices is yet to be fully determined (Stather, Petty and Howard, 2019).
- The development of the suggested compression clinic could provide a holistic means of caring for patients with compression hosiery in a situation where there is currently no service supporting these patients. The Leg Club® model, developed by Ellie Lindsay, provides this model of support to individuals, on an informal, voluntary basis. The proposed service would similarly support individuals long term with their compression hosiery usage, post healing, under the direct care of a healthcare team. However, there are some significant barriers to the implementation of such a service and its sustainability and, as a result, the service may not be deemed value for money by funders. Clinics deliver a proactive, health promotion approach to care, supporting patients with long term issues; if widely implemented, could save the NHS an estimated £81.5–141.5 million a year if VLU recurrence rates were halved (Guest et al, 2015).
- By providing a service that proactively meets the needs of patients utilising compression hosiery, healthcare providers can increase patient's health outcomes and their QoL. By providing patient support VLU recurrence can be reduced, thus limiting the financial, material, time burden placed upon healthcare services when patients undergo cyclical processes of healing and ulceration. **WUK**
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