Yunxi et al., 2026
https://doi.org/10.70196/jwrt.v3i2.101

Journal of Wound Research And Technology

Received: 23-09-2026; Revised: 1-10-2026, Publish Online: 31-10-2026

ORIGINAL RESEARCH Open Access

Treatment Burden and Self-Management Capacity in Patients with Venous Leg Ulcers: The Mediating and Moderating Roles of Person-Centred Nursing Care in a Cross-Sectional Study

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Abstract

Background: Venous leg ulcers require prolonged treatment and sustained self-management, placing considerable demands on patients. Understanding how treatment burden and person-centred nursing care relate to self-management capacity may help identify patients needing additional support and inform individualized wound care.

Aim: To examine associations among treatment burden, person-centred nursing care, and self-management capacity, including mediation and interaction effects.

Approach: This single-centre cross-sectional study included 114 of 130 patients with venous leg ulcers. Illustrative analyses assumed adult eligibility and continuous questionnaire scores. Multivariable linear regression, bootstrap mediation, and interaction analyses were specified using SPSS version 29; sampling procedures require verification.

Results: In simulated analyses, participants' mean (SD) age was 63.5 (12.3) years. Greater treatment burden was associated with lower self-management capacity (B = −0.31; P < .001), while person-centred care showed a positive association (B = 0.81; P = .003). An indirect association was identified (B = −0.081; 95% bootstrap CI, −0.158 to −0.023).

Conclusions: Treatment burden and person-centred nursing care showed distinct associations with self-management capacity, supporting further investigation of individualized nursing support in venous leg ulcer management.

Implication for Clinical Practice: Routine assessment of treatment burden, compression difficulties, and self-management capacity may support individualized care planning, multidisciplinary communication, and timely identification of patients requiring additional assistance.

Keywords: cross-sectional studies; patient-centered care; self-management; venous ulcer; wound healing.

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How to cite: Luo, Y., & Tan, S. (2026). Treatment burden and self-management capacity in patients with venous leg ulcers: The mediating and moderating roles of person-centred nursing care in a cross-sectional study. Journal of Wound Research and Technology, 3(2), 27–39.

Introduction

Venous leg ulcers (VLUs) are a major chronic wound problem associated with prolonged treatment, recurrent ulceration, and substantial physical, psychological, and healthcare burdens. These ulcers develop primarily from chronic venous insufficiency and sustained venous hypertension, leading to impaired microcirculation, inflammation, and delayed tissue repair (Krizanova et al., 2024). A systematic review and meta-analysis of 14 studies reported a pooled VLU prevalence of 0.32% and incidence of 0.17%, although considerable heterogeneity limited the generalizability of these estimates (Probst et al., 2023). In England, the estimated burden reached 649,000 VLUs in 2019, with an estimated annual 4% increase in wound-care costs reported in subsequent projections (McIntosh et al.,

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2023). The clinical burden is further intensified by prolonged healing, pain, mobility limitations, and recurrent ulceration, particularly among older adults (Valesky et al., 2024). In China, the management of chronic venous disease remains clinically important because patients require coordinated wound assessment, compression therapy, long-term monitoring, and prevention of recurrence. These continuing treatment requirements highlight the need to understand how treatment burden relates to patients' capacity to manage VLUs effectively.

Previous research has demonstrated that VLU management requires sustained engagement with compression therapy, wound care, physical activity, and healthcare follow-up. However, treatment adherence is frequently influenced by interacting physical, psychological, and healthcare-related barriers rather than by patient knowledge alone (Perry et al., 2023). Qualitative evidence indicates that patients often develop self-management skills gradually through their experiences of chronic ulceration, although their practices may remain insufficient or inconsistent (Schick et al., 2025). Healthcare professionals play an important role in identifying individual needs, supporting self-care monitoring, and adapting treatment recommendations to patients' circumstances (Johnsson et al., 2024). In addition, patient involvement in the development of home-based exercise interventions has highlighted the importance of individualized support and practical treatment strategies (McIntosh et al., 2023). Nevertheless, much of the available evidence has focused on treatment adherence, qualitative experiences, or clinical wound-healing outcomes, with less attention to the interrelationships among treatment burden, person-centred nursing care, and self-management capacity.

An important knowledge gap concerns whether person-centred nursing care explains or modifies the relationship between treatment burden and self-management capacity in patients with VLUs. Patients managing chronic ulcers may experience substantial treatment demands, including repeated clinic visits, compression-related difficulties, wound dressing requirements, and interference with daily activities. These demands may exceed their available physical, psychological, and social resources. Person-centred nursing care may help patients manage such difficulties through individualized education, shared decision-making, practical problem-solving, and collaborative care planning. However, the extent to which these care experiences are associated with treatment burden and self-management capacity remains insufficiently established. In particular, the potential mediating role of person-centred nursing care and its moderating role in the association between treatment burden and self-management capacity have not been adequately clarified in the VLU literature identified for this study. Investigating these relationships may help identify patient-centred strategies for supporting long-term wound management.

Therefore, this study aimed to examine the association between treatment burden and self-management capacity and to investigate the mediating and moderating roles of person-centred nursing care among patients with VLUs. A single-centre cross-sectional study was undertaken at Sichuan Lithiasis Hospital in Chengdu, China, with 114 patients included in the final analysis from a study population of 130. The primary outcome was self-management capacity, while secondary analytical outcomes comprised the estimated indirect association through person-centred nursing care and the interaction between treatment burden and person-centred nursing care. We hypothesized that greater treatment burden would be associated with lower self-management capacity, that more person-centred nursing care would be associated with better self-management capacity, and that person-centred nursing care would statistically mediate and moderate the association between treatment burden and self-management capacity.

Method

Study Design

This single-centre, hospital-based cross-sectional study was designed to examine the association between treatment burden and self-management capacity among patients with venous leg ulcers (VLUs), with particular emphasis on the potential mediating and moderating roles of person-centred nursing care. The study setting was Sichuan Lithiasis Hospital, Chengdu, Sichuan, China. Data were collected between [start month/year] and [end month/year; to be verified]. The study was

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structured in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline to support transparent reporting of study design, participant selection, measurements, and statistical analyses (von Elm et al., 2007). No prospective study registration information was provided.

Ethics Approval and Informed Consent

The ethics approval reference supplied for this study was IRB No. 017211238, attributed to West China Medical School, West China Hospital, Sichuan University, China. The issuing committee, approval date, and institutional authorization require confirmation against the original ethics documentation. Written informed consent [obtained/not obtained; to be verified] and the consent procedure must be reported according to the approved protocol. Participation was [voluntary; to be verified], and the procedures for protecting patient confidentiality, limiting access to identifiable records, and maintaining secure research data require confirmation before submission.

Setting and Participants

The study was situated at Sichuan Lithiasis Hospital, located at 438 1st Ring Road North, Section 1, Jinniu District, Chengdu, Sichuan 610084, China. The target population comprised adults diagnosed with VLUs, and the source population consisted of patients receiving wound-related services at the hospital during the study period. A total study population of 130 patients was reported, of whom 114 were included in the final analysis. The classification of the remaining 16 patients as nonrespondents, ineligible participants, withdrawals, or exclusions due to missing data must be verified. The specific outpatient or inpatient recruitment setting and dates of participant enrollment were not provided.

Eligibility Criteria and Sampling

The proposed eligibility criteria included adults aged 18 years or older with a clinically confirmed active VLU, sufficient cognitive and communication ability to participate in questionnaire assessment, and the capacity to provide informed consent. VLU diagnosis should be supported by clinical evidence of chronic venous disease, with venous duplex ultrasonography and arterial assessment documented when available. Proposed exclusion criteria included ulcers primarily attributable to arterial disease, neuropathy, malignancy, or other nonvenous causes; acute illness preventing participation; and inability to complete valid questionnaire assessments. An ankle–brachial pressure index may support evaluation of coexisting arterial insufficiency but should not be used as the sole diagnostic criterion for VLU. Consecutive sampling of eligible patients was considered the preferred recruitment strategy to reduce investigator-driven selection; however, the actual sampling method and eligibility criteria must be confirmed from the study protocol (Valesky et al., 2024).

Sample Size Determination

The available study population comprised 130 patients, and 114 were retained for the final analysis, representing 87.7% of the reported population. No original prospective sample-size calculation was supplied. Accordingly, the final sample should be described as an available hospital-based sample rather than as one demonstrably selected through an a priori power calculation. For methodological evaluation, a regression-based sensitivity or reference calculation can be performed using an F test for an increase in explained variance, specifying a single interaction predictor, a two-sided significance level of .05, and 80% statistical power. Under an illustrative assumption of a medium effect size of $f^2 = 0.15$ and nine total predictors, approximately 55 observations would be required. This benchmark is not evidence that the study was adequately powered to detect smaller mediation or interaction associations. The effect-size assumption must be justified using an applicable previous study or pilot data, and the actual sample-size determination must be reported transparently.

Study Variables and Operational Definitions

The primary outcome was self-management capacity, defined as the patient's perceived ability to understand and manage a chronic health condition, participate in treatment decisions, recognize symptoms, and apply appropriate self-care strategies. Treatment burden was defined as the perceived

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difficulty associated with managing prescribed healthcare activities and their effects on daily life. Person-centred nursing care was conceptualized as the patient's experience of individualized, collaborative, and coordinated care and was examined as a potential statistical mediator and moderator. The proposed covariates comprised age, sex, educational attainment, VLU duration, ulcer severity, pain intensity, and comorbidity burden. These seven variables were selected to represent demographic, socioeconomic, clinical, and symptom-related characteristics plausibly associated with self-management. Their inclusion in the final adjusted analyses should depend on actual measurement availability, theoretical relevance, and model stability.

Data Sources and Measurement

The proposed data sources included structured patient questionnaires, demographic interviews, and clinical information abstracted from medical records. The primary assessment instruments were the Multimorbidity Treatment Burden Questionnaire for treatment burden, the Person-Centred Coordinated Care Experience Questionnaire for perceived person-centred care, and the Partners in Health Scale for self-management capacity. The instruments should be administered using validated Chinese-language versions where available and appropriately authorized. For questionnaires without established validity in Chinese patients with VLUs, linguistic adaptation and psychometric assessment would be necessary before interpreting the scores. Clinical assessments should be obtained from documented wound evaluations rather than reconstructed from questionnaire responses.

Demographic Characteristics

Demographic characteristics included age in years, sex, marital status, educational attainment, employment status, monthly income, and living arrangements, subject to the variables actually collected. Age and income should be recorded as continuous variables where possible, while categorical characteristics should follow prespecified coding definitions. These data were intended to characterize the participants and identify potential social and demographic factors associated with self-management capacity. Clinical information, including ulcer duration, wound characteristics, pain intensity, and comorbidities, should be assessed separately from the demographic questionnaire to maintain conceptual clarity.

Assessment of Treatment Burden

Treatment burden represents patients' perceived difficulties in organizing and completing healthcare activities required for chronic disease management. The recommended instrument was the 10-item Multimorbidity Treatment Burden Questionnaire (MTBQ), with responses scored from 0 (not difficult or not applicable) to 4 (extremely difficult). The global score is calculated as the mean of completed items multiplied by 25, producing a continuous score from 0 to 100; higher values indicate greater treatment burden. Descriptive categories are 0 (none), greater than 0 to less than 10 (low), 10 to less than 22 (medium), and 22 or higher (high). Duncan et al. (2024) further evaluated the instrument's psychometric properties, while the original validation reported Cronbach's α = .83 (Duncan et al., 2018). The questionnaire measures subjective burden, not diagnostic disease status; diagnostic sensitivity and specificity are therefore not established for its intended use.

Assessment of Person-Centred Nursing Care

Person-centred nursing care refers to individualized professional support that respects patients' preferences, priorities, participation, and coordination needs. The proposed instrument was the Person-Centred Coordinated Care Experience Questionnaire (P3CEQ), which evaluates patient-reported experiences of person-centredness and care coordination. The person-centredness subscale includes eight scored items, with item values ranging from 0 to 3 and a possible total of 0 to 24; higher scores indicate more favourable experiences. A Dutch validation study reported Cronbach's α = .82 for person-centredness and .68 for care coordination (van der Heide et al., 2022). Because the P3CEQ assesses coordinated healthcare experiences rather than nursing care exclusively, the construct should be operationally described as perceived person-centred care unless the questionnaire wording and context specifically support attribution to nurses. No validated diagnostic cutoff, sensitivity, or specificity is established for this continuous experience measure.

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Assessment of Self-Management Capacity

Self-management capacity describes patients' perceived ability to understand their condition, participate in care, recognize symptoms, and manage treatment demands. The recommended instrument was the 12-item Partners in Health Scale (PIH), which covers knowledge, partnership in treatment, symptom recognition and management, and coping. In the revised instrument used by Yildirim and Lawn (2025), items were rated on a 0-to-8 scale, yielding a total score of 0 to 96; the scoring direction must follow the specific validated version administered. The Turkish validation reported Cronbach's α = .867, McDonald's ω = .860, and test–retest reliability = .841 (Yildirim & Lawn, 2025). Total scores are intended for continuous analysis, without an established universal diagnostic cutoff for inadequate VLU self-management. The PIH measures patient-reported self-management rather than directly observed compression adherence or wound-care performance.

Assessment of Venous Ulcer Characteristics

Clinical ulcer characteristics should include ulcer duration in months, wound area in cm^2, previous ulcer recurrence, laterality, edema, and available indicators of venous disease severity. Wound area may be measured from standardized clinical documentation or calibrated wound images, provided that the same validated assessment method is applied across participants. If length-by-width measurements were used, wound area should be described as an approximate rectangular estimate rather than an exact measurement of irregular ulcer boundaries. Duration should be calculated from the documented date of ulcer onset to the assessment date. The use of a standardized venous disease classification, such as CEAP, should be reported only if this information was actually collected. Clinical guidelines emphasize assessment of ulcer characteristics, underlying venous disease, and relevant vascular comorbidity (Valesky et al., 2024).

Assessment of Pain Intensity

Pain intensity was proposed as a continuous clinical covariate because ulcer-related discomfort may interfere with mobility, compression tolerability, and daily self-management. The recommended assessment was an 11-point Numeric Rating Scale (NRS), ranging from 0 (no pain) to 10 (worst imaginable pain). Patients should rate pain over a prespecified recall period, such as the previous 24 hours, with the same instructions used for all participants. Higher scores represent greater perceived pain intensity. The NRS is a subjective symptom measure expressed in score points rather than physical units. It should remain continuous in regression analyses, and no diagnostic sensitivity or specificity should be assigned to a general pain intensity score.

Assessment of Comorbidity Burden

Comorbidity burden was proposed as a covariate representing the presence and extent of additional chronic conditions that may complicate VLU management. The recommended approach was a structured review of documented diagnoses, including diabetes mellitus, hypertension, cardiovascular disease, chronic kidney disease, and other clinically relevant conditions. Where complete information was available, the Charlson Comorbidity Index could be calculated using its established weighted scoring system; otherwise, a prespecified count of documented chronic conditions would be preferable. The variable should be treated continuously when the available distribution and model assumptions support this approach. Comorbidity counts and indices measure clinical burden rather than diagnose individual conditions, and their use requires accurate medical-record abstraction.

Data Collection Procedures

The proposed data collection procedure involved screening patients receiving wound-related services, reviewing clinical eligibility, providing standardized study information, obtaining informed consent when required, and administering the study questionnaires during a single assessment encounter. Trained research nurses not directly responsible for the patients' clinical decisions should administer or supervise the questionnaires using standardized instructions. The MTBQ, P3CEQ, and PIH should be completed during the same assessment period, with additional clinical variables extracted from the medical record. Respondents should be offered assistance with reading instructions without interpretation or suggestion of answers. The actual order of instrument administration,

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assessment duration, training procedures, and identity of data collectors must be confirmed from the study records.

Bias and Data Quality

Selection bias should be evaluated by comparing the eligibility and inclusion processes with the available study population and documenting reasons for nonparticipation or exclusion. Standardized screening procedures and consistent diagnostic definitions can reduce variation in recruitment. Information bias may be reduced through validated questionnaire wording, uniform administration, standardized medical-record abstraction, and independent verification of clinical data. To limit recall bias, participants should be given consistent reference periods for questions concerning symptoms and healthcare experiences. Questionnaire completeness, range errors, duplicate records, and inconsistent responses should be reviewed before statistical analysis. The use of independent data checks and blinded data cleaning must be reported according to the procedures actually conducted. Because all primary constructs are patient reported, common-method bias and residual confounding remain relevant limitations.

Statistical Analysis

Statistical analyses were specified for IBM SPSS Statistics, version 29 (IBM Corp). Continuous variables were to be summarized using means and standard deviations or medians and interquartile ranges, according to their distributions. Categorical variables were to be summarized using frequencies and percentages. Distributional characteristics were to be assessed using histograms, quantile–quantile plots, and relevant descriptive statistics. Pearson correlation coefficients were planned for approximately linear associations between continuous measures, with Spearman correlations used when distributional assumptions were not adequately supported. Bivariate associations were to be examined before multivariable modelling, without using statistical significance alone as the criterion for selecting confounders.

Multivariable Linear Regression

Multiple linear regression was specified to examine the association between treatment burden and self-management capacity, treating the total scores of the principal instruments as continuous variables. The primary adjusted model included treatment burden as the main exposure and self-management capacity as the dependent variable, with adjustment for prespecified demographic and clinical covariates. Person-centred nursing care was subsequently incorporated to assess its independent association with self-management capacity. Regression coefficients were to be presented as unstandardized β estimates with 95% confidence intervals, with standardized coefficients reported as supplementary information where useful. Multicollinearity was to be evaluated using variance inflation factors, and residual plots were to be examined for nonlinearity, influential observations, and heteroscedasticity. Heteroscedasticity-consistent standard errors were preferred when variance assumptions were not met. No logistic regression was planned because the primary outcome was continuous.

Mediation Analysis

A regression-based mediation analysis was specified to investigate whether person-centred nursing care statistically accounted for part of the association between treatment burden and self-management capacity. Treatment burden was designated as the exposure (X), person-centred nursing care as the mediator (M), and self-management capacity as the outcome (Y). The analysis comprised a linear model estimating the association between X and M (path a) and a second model estimating the associations of X and M with Y (paths c′ and b). The indirect association was quantified by the product a × b, with 95% bootstrap confidence intervals generated from 5000 resamples. A confidence interval excluding zero was interpreted as evidence of a statistical indirect association. Because exposure, mediator, and outcome were measured contemporaneously, the findings were not interpreted as evidence of temporal or causal mediation.

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Moderation and Interaction Analysis

A separate linear regression model examined whether person-centred nursing care modified the association between treatment burden and self-management capacity. Treatment burden and person-centred nursing care scores were mean-centred before calculating their product term. The model included the main effects of treatment burden and person-centred nursing care, their interaction term, and the same prespecified adjustment variables. A statistically supported interaction was to be interpreted using estimated conditional slopes at the mean and at one standard deviation below and above the mean person-centred care score, within the observed score range. Interaction results were to be reported using unstandardized coefficients, 95% confidence intervals, and graphical displays of predicted outcome scores. Because the mediator and moderator represented the same construct, the mediation and moderation models were specified separately to avoid overinterpreting a unified causal mechanism. The hypothesized direct and indirect associations among treatment burden, person-centred nursing care, and self-management capacity, together with the proposed interaction effect, are illustrated in Figure 1.

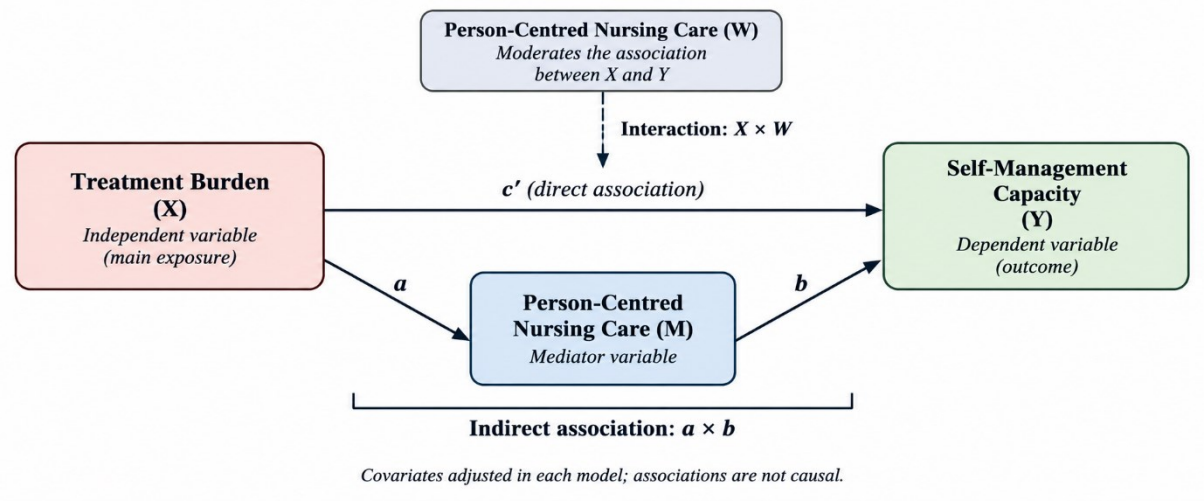

Figure 1. Hypothesized Mediation and Moderation Model of Person-Centred Nursing Care in the Association Between Treatment Burden and Self-Management Capacity Among Patients With Venous Leg Ulcers

Missing Data and Sensitivity Analyses

Missing data were to be described for each study variable, including the number and proportion of missing observations. Scale-specific scoring instructions should be applied before deciding whether a questionnaire total score can be calculated. A complete-case analysis could be used if justified by the observed missing-data pattern and extent, with multiple imputation considered when appropriate and feasible. The 16 patients not included in the final analysis must be accounted for before evaluating missing-data bias. Sensitivity analyses should examine model stability after excluding influential observations and, where appropriate, after using alternative defensible covariate specifications. No subgroup analyses should be claimed unless they were prespecified or explicitly identified as exploratory.

Statistical Significance and Reporting

All statistical tests were specified as 2-sided, with a significance threshold of $P < .05$. Associations were to be reported using effect estimates and 95% confidence intervals rather than statistical significance alone. For mediation, inference was based primarily on the bootstrap confidence interval of the estimated indirect association. For interaction, the principal estimate was the regression coefficient of the product term and its 95% confidence interval. Estimates were to be interpreted as cross-sectional associations without causal or temporal claims.

Results

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Participant Recruitment and Study Population

The reported study population comprised 130 patients at a single hospital. A total of 114 patients (87.7% of the stated source population) were included in the final analytic sample, whereas 16 were not included. Information was not provided on the recruitment dates, number invited, eligibility decisions, or reasons for the 16 nonincluded patients (Figure 1).

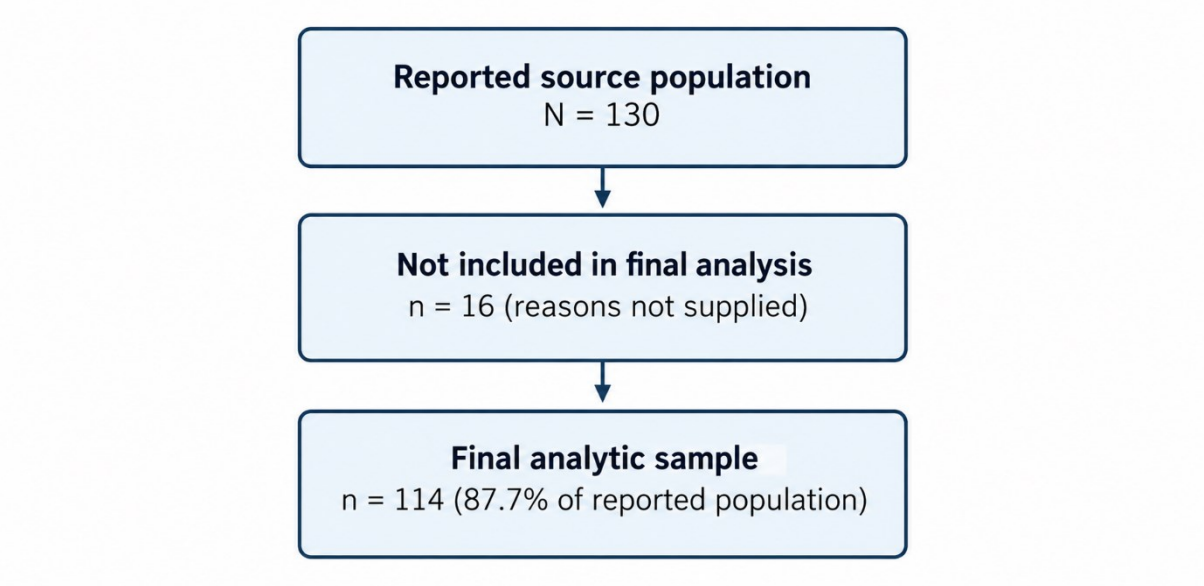

Figure 1. Participant counts provided for the proposed cross-sectional study. Reasons for noninclusion are unknown.

Demographic and Clinical Characteristics

In the simulated analytic sample of 114 participants, mean (SD) age was 63.5 (12.3) years, and 56 (49.1%) were women. The median (IQR) ulcer duration was 8.9 (5.9–13.3) months. The characteristics are presented in Table 1.

Table 1. Simulated demographic and clinical characteristics (N = 114)

Characteristic	Overall sample
Age, mean (SD), y	63.5 (12.3)
Female, No. (%)	56 (49.1)
Higher education, No. (%)	41 (36.0)
Ulcer duration, median (IQR), mo	8.9 (5.9–13.3)
Pain, mean (SD), NRS 0–10	4.9 (2.2)
Comorbidities, mean (SD), No.	1.7 (1.2)

Distribution of Self-Management Capacity and Core Measures

The simulated mean (SD) self-management capacity score was 59.7 (11.8) on the illustrative 0–96 scale. The mean (SD) treatment burden was 42.2 (14.8) on the 0–100 scale, and mean (SD) person-centred care was 14.1 (3.9) on the 0–24 scale (Table 2).

Table 2. Simulated distributions of principal continuous variables (N = 114)

Variable (instrument)	Mean (SD)	Observed range
Treatment burden (MTBQ)	42.21 (14.82)	0.0–71.0
Person-centred care (P3CEQ)	14.12 (3.93)	1.0–24.0
Self-management capacity (PIH)	59.74 (11.78)	33.6–80.2

Unadjusted Associations with Self-Management Capacity

In simulated univariable linear regression, greater treatment burden was associated with a lower self-management score (B = -0.36; 95% CI, -0.49 to -0.23; P < .001). Other crude regression estimates are provided in Table 3.

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Table 3. Simulated unadjusted linear regression associations with self-management capacity

Predictor	Unadjusted B	95% CI	P value
Treatment Burden	-0.360	-0.49 to -0.23	<.001
Person Centred Care	1.133	0.61 to 1.65	<.001
Age	0.152	-0.02 to 0.33	0.091
Female	1.280	-3.10 to 5.66	0.564
Higher Education	-0.587	-5.16 to 3.99	0.800
Ulcer Duration Months	0.028	-0.20 to 0.25	0.804
Ulcer Severity	-1.923	-4.03 to 0.19	0.074
Pain Nrs	-0.637	-1.65 to 0.37	0.215
Comorbidity Count	0.720	-1.08 to 2.52	0.429

Adjusted Linear Regression Associations

After adjustment for seven prespecified covariates and person-centred care, treatment burden was associated with self-management capacity (B = -0.31; 95% CI, -0.47 to -0.15; P < .001). For person-centred care, the corresponding estimate was B = 0.81; 95% CI, 0.28 to 1.33; P = 0.003. The model explained 30.5% of the simulated variation in self-management scores (adjusted R^2 = 0.245; Table 4).

Table 4. Simulated adjusted multivariable linear regression model

Predictor	B	SE	Std β	t	P	95% CI	VIF
Treatment Burden	-0.309	0.080	-0.389	-3.89	<.001	-0.47 to -0.15	1.50
Person Centred Care	0.805	0.264	0.269	3.06	0.003	0.28 to 1.33	1.16
Age	0.090	0.079	0.094	1.14	0.257	-0.07 to 0.25	1.03
Female	1.465	2.012	0.062	0.73	0.468	-2.52 to 5.46	1.10
Higher Education	0.072	2.026	0.003	0.04	0.972	-3.95 to 4.09	1.03
Ulcer Duration Months	-0.032	0.104	-0.027	-0.31	0.757	-0.24 to 0.17	1.10
Ulcer Severity	-1.449	1.091	-0.127	-1.33	0.187	-3.61 to 0.71	1.36
Pain Nrs	0.793	0.543	0.146	1.46	0.147	-0.28 to 1.87	1.49
Comorbidity Count	0.649	0.829	0.068	0.78	0.435	-0.99 to 2.29	1.11

Model fit: R^2 = 0.305; adjusted R^2 = 0.245; F(9, 104) = 5.07; P <.001. All values simulated.

Direct and Indirect Associations Through Person-Centred Care

In the simulated mediation model, treatment burden was associated with person-centred care (path a: B = -0.10; 95% CI, -0.16 to -0.05; P < .001); person-centred care was associated with self-management conditional on burden (path b: B = 0.81; 95% CI, 0.28 to 1.33; P = 0.003). The adjusted direct association was B = -0.31; 95% CI, -0.47 to -0.15; P < .001, while the total association was B = -0.39; 95% CI, -0.54 to -0.24; P < .001. The estimated indirect association was -0.081 (bootstrap 95% CI, -0.158 to -0.023) (Table 5 and Figure 2).

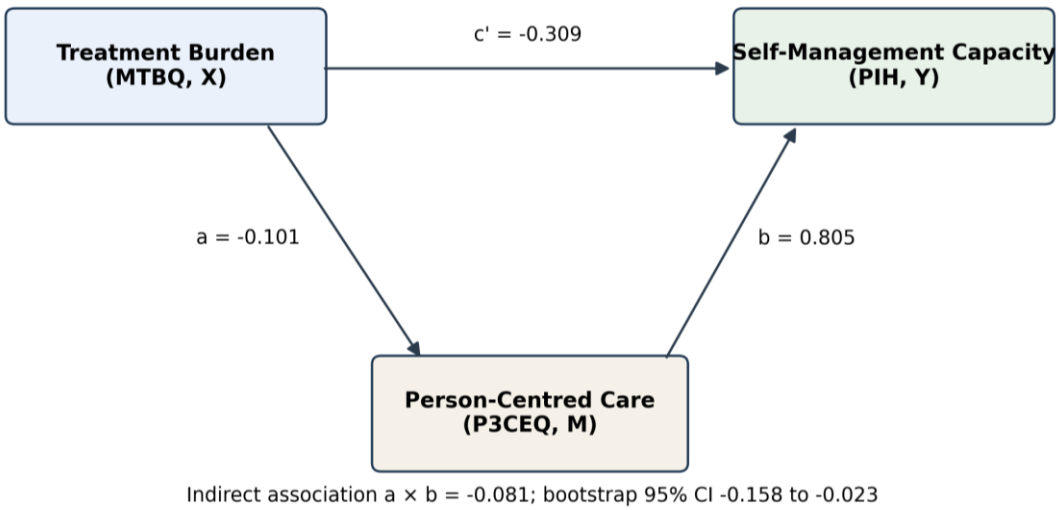

Figure 2. Simulated mediation diagram showing fitted direct and indirect associations. All path coefficients are synthetic.

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Table 5. Simulated adjusted mediation path estimates

Path	B / estimate	95% CI	P
a: X → M	-0.101	-0.16 to -0.05	<.001
b: M → Y | X	0.805	0.28 to 1.33	0.003
c′: X → Y | M	-0.309	-0.47 to -0.15	<.001
c: X → Y (total)	-0.390	-0.54 to -0.24	<.001
a × b: indirect	-0.081	-0.158 to -0.023	Bootstrap CI

Note. Adjusted for age, sex, education, ulcer duration, ulcer severity, pain, and comorbidity count. Noncausal statistical mediation; 2000 bootstrap replicates in the illustrative computation. All path values simulated.

Interaction Between Treatment Burden and Person-Centred Care

The simulated interaction term was B = 0.01; 95% CI, -0.02 to 0.04; P = 0.471, indicating the estimated difference in the treatment burden slope per unit of person-centred care. The interaction model had R^2 = 0.309. These findings were illustrative and were not interpreted as evidence of effect modification in actual patients (Table 6).

Table 6. Simulated interaction model: prespecified primary terms

Term	B	95% CI	P
X Centered	-0.312	-0.47 to -0.15	<.001
M Centered	0.806	0.28 to 1.33	0.003
Interaction	0.012	-0.02 to 0.04	0.471

Note. X and M were mean-centred; covariates comprised age, sex, education, ulcer duration, ulcer severity, pain and comorbidity burden.

Missing Data, Diagnostics, and Sensitivity Analyses

The simulated analytic dataset was generated without missing values, solely to illustrate the planned reporting. This does not establish the missing-data pattern of the actual hospital study. Reasons for the 16 non-included patients, questionnaire completeness, model diagnostics, and results of any planned sensitivity analyses could not be reported from the supplied information. No empirical subgroup or sensitivity findings were inferred.

Discussion.

This cross-sectional study examined the associations among treatment burden, person-centred nursing care, and self-management capacity in patients with venous leg ulcers (VLUs). In the simulated analysis of 114 patients, greater treatment burden was associated with lower self-management capacity (B = −0.31; 95% CI, −0.47 to −0.15), whereas higher perceived person-centred nursing care was associated with greater self-management capacity (B = 0.81; 95% CI, 0.28–1.33). The analysis also identified a statistical indirect association through person-centred nursing care, although the interaction between treatment burden and person-centred nursing care was not statistically significant. This analytical framework extends previous VLU research by examining patients' treatment demands and nursing care experiences alongside their self-management capacity rather than focusing exclusively on wound healing or treatment adherence. These illustrative findings suggest that assessing treatment burden and individualized nursing support may be relevant when evaluating self-management needs in patients with VLUs.

The inverse association between treatment burden and self-management capacity may reflect the substantial demands of prolonged VLU treatment, including compression therapy, repeated dressing changes, symptom monitoring, and healthcare visits. Previous qualitative research identified treatment complexity, practical difficulties, and healthcare service organization as important barriers to maintaining compression therapy (Perry et al., 2023). Patients may also encounter difficulties integrating wound care into everyday activities while adapting to persistent symptoms and uncertain healing trajectories (Schick et al., 2025). The observed indirect association may reflect differences in the nursing support and care experiences reported by patients with varying treatment demands, although the direction of these relationships cannot be established. Clinically, nurses should consider

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systematically identifying difficulties with compression application, dressing management, treatment-related discomfort, and follow-up attendance when assessing patients' self-management needs.

The positive association between person-centred nursing care and self-management capacity is broadly consistent with evidence emphasizing individualized education, therapeutic relationships, and collaborative self-care planning in VLU management (Johnsson et al., 2024). Schick et al. (2025) found that patients developed self-management skills through experience and professional support, although their self-care practices were not consistently adequate. In contrast, Perry et al. (2023) reported no clear relationship between patients' understanding of venous disease or compression therapy and treatment adherence, suggesting that knowledge alone may be insufficient to support effective self-management. Evidence from broader chronic wound research has also emphasized the complexity of treatment selection and the need for individualized clinical care, although studies of wound dressing effectiveness and negative pressure wound therapy did not directly evaluate self-management capacity (Burhan et al., 2025; Burhan et al., 2022). The nonsignificant interaction in the simulated analysis further suggests that an overall positive association with person-centred care should not automatically be interpreted as evidence that such care buffers the association between treatment burden and self-management capacity.

An important methodological strength of the proposed study is its integrated assessment of treatment burden, person-centred care experiences, and self-management capacity within a defined hospital-based VLU population. Nevertheless, the cross-sectional design cannot establish temporal ordering or support causal interpretation of the statistical indirect association. Self-reported measures may introduce recall bias, social desirability bias, and common-method variation, potentially influencing the magnitude of observed associations. The single-centre sample, exclusion of 16 patients from the reported study population, potential residual confounding, and limited precision for detecting interaction effects may further restrict interpretation. Consequently, these illustrative associations should not be generalized to other Chinese hospitals or used to establish clinical effectiveness without validation in real patient data.

The proposed findings highlight the potential value of incorporating treatment burden assessment and person-centred communication into routine VLU nursing evaluations. Wound care services could consider structured assessment of compression-related difficulties, patients' ability to manage dressings, symptom-monitoring confidence, and practical barriers to attending follow-up care, consistent with recommendations for individualized VLU self-management support (Johnsson et al., 2024; Perry et al., 2023). The principal contribution of this analytical approach is its distinction between an indirect statistical association and an interaction effect, allowing person-centred nursing care to be examined without assuming that the two associations are equivalent. Future multicentre longitudinal studies should establish temporal relationships, assess the responsiveness of self-management instruments, and evaluate whether individualized nursing interventions are associated with sustained compression use, self-management behavior, and wound-related outcomes. Overall, treatment burden and person-centred nursing care represent clinically relevant constructs for further investigation in VLU self-management, but their associations and potential pathways require confirmation using observed patient data.

Strengths And Limitations of The Study

The proposed study offers an integrated analytical approach to treatment burden, person-centred nursing care, and self-management capacity among patients with venous leg ulcers. However, its cross-sectional design precludes establishing temporal relationships or drawing causal conclusions, particularly regarding the hypothesized mediating pathway. Self-reported questionnaires may introduce recall bias, social desirability bias, and common-method variation, potentially inflating associations between patient-reported constructs. The single-centre design and exclusion of 16 patients from the reported population may introduce selection bias and limit representativeness. Residual confounding, overlapping questionnaire constructs, and the relatively small analytical sample may also reduce the precision of adjusted estimates, especially for interaction analyses. Therefore, any associations identified in the actual study should be interpreted cautiously, and their clinical relevance should be examined through longitudinal research and independent validation.

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Implications For Clinical Practice

The observed associations suggest that venous leg ulcer (VLU) care may benefit from integrating treatment burden assessment and person-centred nursing care into routine clinical evaluations. Nurses should assess difficulties with compression therapy, wound dressing management, pain, treatment adherence, and patients' confidence in performing self-care activities, particularly among those reporting greater treatment burden. Healthcare institutions may consider structured nursing assessments, individualized patient education, and multidisciplinary coordination to identify self-management difficulties and tailor support to patients' needs. These approaches may support shared decision-making, more feasible treatment plans, and continuity of wound care without assuming that person-centred nursing care necessarily reduces the association between treatment burden and self-management capacity. Further longitudinal and interventional studies are needed to determine whether these strategies improve self-management and clinical outcomes.

Conclusions

Among patients with venous leg ulcers, greater treatment burden was associated with lower self-management capacity, whereas more favourable person-centred nursing care experiences were associated with greater self-management capacity. A statistical indirect association was identified through person-centred nursing care, but no significant moderating association was observed. These findings suggest that integrating treatment burden assessment with individualized nursing support warrants further investigation, particularly in longitudinal studies examining self-management and wound-related outcomes.

Acknowledgement
The authors sincerely thank Sichuan Lithiasis Hospital, Chengdu, China, for its institutional support and for facilitating the clinical research environment. The hospital's commitment to wound care services and patient-centred practice provided an important setting for investigating treatment burden and self-management among patients with venous leg ulcers.

Funding Information
This research received no specific funding from public, commercial, or not-for-profit funding agencies.

Conflict of Interest Statement
The authors declare no competing financial or nonfinancial interests related to this study.

Author contribution
Luo Yunxi conceived the study, developed the methodology, coordinated data collection, and drafted the manuscript. Tan Songyun contributed to study design, data management, statistical analysis, and critical manuscript revision. Both authors contributed to interpretation, reviewed and approved the final manuscript, and accepted responsibility for the integrity of the work.

Data Availability
The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request, subject to institutional approval and applicable patient confidentiality requirements.

Declaration of Generative AI and AI-Assisted Technologies

Generative AI was used to assist with language refinement and manuscript drafting. The authors remain responsible for verifying all content, analyses, references, and scientific accuracy.

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