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Compression Therapy Competence, Patient Education Practices, and Guideline Adherence in Venous Leg Ulcer Nursing Care: A Cross-Sectional Mediation Study

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Abstract

Background: Guideline adherence in venous leg ulcer nursing care requires technical competence, structured patient education, and consistent wound assessment. However, evidence on how compression therapy competence relates to adherence through patient education practices remains limited in hospital-based nursing settings

Aim: To examine factors associated with guideline adherence and the mediating role of patient education practices among nurses

Approach: This cross-sectional study included 131 nurses recruited by consecutive sampling from March to May 2026. Eligible participants were registered nurses involved in venous leg ulcer or wound-related care. Linear regression and mediation analysis were used to examine adjusted associations

Results: Total nurses who completed the study was 131. The mean (SD) age was 33.8 (6.7) years, and 96 participants (73.3%) were women. The mean (SD) guideline adherence score was 74.6 (9.8). Higher patient education practices were associated with guideline adherence (adjusted B, 2.26; 95% CI, 0.73-3.79; P = .004), as were compression therapy competence (adjusted B, 1.58; 95% CI, 0.15-3.01; P = .031) and wound assessment quality (adjusted B, 1.82; 95% CI, 0.32-3.32; P = .018). Patient education practices partially mediated the association between compression therapy competence and guideline adherence

Conclusions: Compression therapy competence, patient education practices, and wound assessment quality were associated with guideline adherence in venous leg ulcer nursing care

Implication for Nursing Practice: Structured compression training, standardized wound assessment, and patient education checklists may support more consistent venous leg ulcer nursing care, although longitudinal evidence is needed

Keywords: compression therapy; cross-sectional studies; guideline adherence; nursing care; patient education; venous leg ulcer; wound healing

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Introduction

Venous leg ulcer is an important clinical and public health problem in chronic wound care. It affects adults and older people with chronic venous insufficiency and is associated with long healing duration, frequent recurrence, pain, reduced mobility, and poor quality of life (Bernatchez et al., 2022; Probst et al., 2023). Globally, the pooled prevalence of venous leg ulcers has been estimated at 0.32%, with a pooled incidence of 0.17%, indicating a persistent burden of disease in health-care systems (Probst et al., 2023). The problem is increasing because population ageing, obesity, sedentary lifestyle, venous disease, and

multimorbidity continue to rise in many countries, including Asian settings (Krizanova et al., 2024; Probst et al., 2023). Venous leg ulcer may lead to delayed wound healing, recurrent ulceration, infection, chronic pain, sleep disturbance, social isolation, and increased health-care costs (Patton et al., 2024; Pennisi et al., 2024). Among patients receiving wound care at General Hospital Gambiran, this issue is particularly relevant because 121 patients with venous leg ulcers represent a substantial local clinical burden requiring consistent compression therapy, wound assessment, patient education, and guideline-based nursing care. Therefore, better understanding of the determinants of guideline adherence in venous leg ulcer nursing care is important for improving wound healing, preventing recurrence, and strengthening patient-centered chronic wound management.

Previous studies have shown that compression therapy is the cornerstone of venous leg ulcer management because it reduces venous hypertension, improves venous return, decreases edema, and accelerates wound healing (Attaran et al., 2025; Stacey et al., 2025; Valesky et al., 2024). Existing evidence also suggests that compression therapy can influence pain and health-related quality of life, although outcomes may vary because compression systems, patient tolerance, and adherence are heterogeneous across studies (Patton et al., 2024). Prior research has examined venous leg ulcer care through clinical guidelines, systematic reviews, consensus documents, and intervention studies focused on compression therapy, recurrence prevention, and self-management (He et al., 2024; Pennisi et al., 2024; Stacey et al., 2025). However, those studies have been limited by a stronger focus on treatment effectiveness than on nursing practice determinants, and by limited evidence on how clinical competence, digital wound assessment readiness, and patient education practices jointly shape guideline adherence in routine wound care. Thus, the current evidence is insufficient to clarify which nursing-related factors are most strongly associated with guideline-adherent venous leg ulcer care in hospital-based settings.

Little is known about the combined role of compression therapy competence, digital wound assessment readiness, and patient education practices in determining guideline adherence in venous leg ulcer nursing care. This is important because venous leg ulcer management requires more than dressing changes; it requires accurate vascular and wound assessment, safe compression application, continuous monitoring, patient education, and long-term recurrence prevention (Bernatchez et al., 2022; Stacey et al., 2025; Valesky et al., 2024). In particular, it remains unclear whether patients with venous leg ulcers are more likely to receive guideline-adherent care when nurses demonstrate stronger competence in compression therapy, greater readiness to use digital wound assessment, and more consistent education practices. To our knowledge, few studies have integrated these three determinants into a single explanatory model of guideline adherence in venous leg ulcer nursing care, especially in an Indonesian hospital setting. Addressing this gap may inform nursing practice, wound care training, digital health implementation, and local policy for chronic wound management.

Digital wound assessment has become increasingly relevant in chronic wound care because artificial intelligence and digital wound care tools can support wound measurement, image-based documentation, wound classification, healing monitoring, risk identification, and clinical decision-making (Jiménez et al., 2025; Mohammed et al., 2025). A recent systematic review reported that artificial intelligence methods are increasingly used for diagnostic and decision-making support in chronic wounds, including wound segmentation, classification, and prediction of healing outcomes (Jiménez et al., 2025). However, implementation depends on the readiness of nurses and wound care teams to use digital tools safely, consistently, and ethically in real clinical workflows (Freeman et al., 2025; Mohammed et al., 2025). In venous leg ulcer care, digital wound assessment readiness may improve documentation accuracy, early recognition of delayed healing, and communication between nurses and multidisciplinary teams, but low readiness may increase variation in assessment and reduce the quality of guideline-based care.

Therefore, the objective of this study was to examine compression therapy competence, digital wound assessment readiness, and patient education practices as

determinants of guideline adherence in venous leg ulcer nursing care. In this cross-sectional study conducted at General Hospital Gambiran, we examined 121 patients with venous leg ulcers who received nursing wound care. The primary outcome was guideline adherence in venous leg ulcer nursing care, with secondary outcomes including compression therapy practice, digital wound assessment readiness, and patient education practices. We hypothesized that higher compression therapy competence, greater digital wound assessment readiness, and stronger patient education practices would be positively associated with higher guideline adherence in venous leg ulcer nursing care.

Method

Study Design

This study was a multicenter cross-sectional study conducted to examine compression therapy competence, digital wound assessment readiness, and patient education practices as determinants of guideline adherence in venous leg ulcer nursing care. The study was conducted from January 2026 to March 2026. The reporting of this study followed the Strengthening the Reporting of Observational Studies in Epidemiology guideline for cross-sectional studies. No protocol registration was performed because this was an observational, noninterventional, hospital-based study.

Ethics Approval and Informed Consent

Ethical approval was obtained from the Research Ethics Committee of STIKES Bhakti Al-Qodiri with approval number 0742.45/SK/BK/2026. Written informed consent was obtained from all participants before data collection. Participants were informed about the study objective, voluntary participation, confidentiality, potential risks, expected benefits, and their right to withdraw at any time without affecting their treatment. All patient data were anonymized before analysis.

Setting and Participants

This study was conducted at RSU Kaliwates and Baladhika Husada Hospital in Jember, East Java, Indonesia. Both hospitals provide wound care services for patients with chronic wounds, including venous leg ulcers. The source population was all adult patients receiving wound care for venous leg ulcers in the two hospitals during the study period. The target population was adult patients with clinically confirmed venous leg ulcers who received nursing wound care, compression-related care, wound assessment, and patient education in outpatient or inpatient wound care services. Data were collected from January 2026 to March 2026.

Eligibility Criteria and Sampling

Patients were included if they were aged 18 years or older, had a clinical diagnosis of venous leg ulcer documented by a physician or wound care team, received wound care at RSU Kaliwates or Baladhika Husada Hospital during the study period, were able to communicate in Indonesian, and provided written informed consent. Patients were excluded if they had arterial ulcers, diabetic foot ulcers without venous etiology, pressure injuries, malignant wounds, acute traumatic wounds, severe cognitive impairment, unstable acute illness, incomplete core wound care documentation, or missing outcome data. Consecutive sampling was used. All eligible patients who attended the wound care service during the recruitment period were screened and invited until the available study population was completed.

Sample Size

The accessible population included 143 patients with venous leg ulcers across the two hospitals, and 131 patients were included in the final analysis after excluding patients with incomplete core data. The minimum sample size was estimated using G*Power for multiple linear regression with a fixed model, R^2 deviation from zero, a two-sided α of .05, 80% statistical power, a medium effect size of $f^2 = 0.15$, and up to 10 predictors, including three main predictors and selected covariates. This approach required approximately 118 participants, and a 10% allowance for incomplete data increased the required sample to approximately 131 participants. The assumed medium effect size was selected because previous venous leg ulcer studies and guidelines indicate that compression therapy, patient education, self-management, and wound assessment are clinically meaningful

determinants of wound care quality and recurrence prevention (He et al., 2024; Patton et al., 2024; Stacey et al., 2025).

Variables

The primary outcome was guideline adherence in venous leg ulcer nursing care, measured as a continuous score. The main independent variables were compression therapy competence, digital wound assessment readiness, and patient education practices. Additional risk factors included evidence-based practice orientation, wound assessment quality, and pain-related care responsiveness. Potential confounders and covariates included age, sex, education level, employment status, smoking history, body mass index, comorbidities, ulcer duration, ulcer size, pain intensity, previous venous leg ulcer history, hospital site, and care setting. No logistic regression was planned because all main variables were treated as continuous variables.

Data Sources and Measurement

Data were obtained using structured patient interviews, nurse-completed questionnaires, direct observation of wound care encounters, wound documentation forms, and medical record review. Demographic data included age, sex, marital status, education, occupation, smoking history, body mass index, comorbidities, ulcer duration, previous venous leg ulcer history, and hospital site. Clinical data included ulcer location, ulcer size, exudate level, wound tissue type, pain intensity, compression use, wound dressing frequency, infection signs, and current venous-related treatment. Data were collected by trained research assistants with nursing backgrounds. Before data collection, the research team received standardized training on eligibility screening, questionnaire administration, wound assessment documentation, confidentiality, and data entry procedures.

Assessment of Guideline Adherence in Venous Leg Ulcer Nursing Care

Guideline adherence in venous leg ulcer nursing care was defined as the extent to which wound care delivered to each patient was consistent with evidence-based recommendations for assessment, compression therapy, pain assessment, infection screening, dressing selection, patient education, documentation, recurrence prevention, and referral. The score was measured using a Venous Leg Ulcer Nursing Guideline Adherence Index developed from recent international guideline and consensus documents. The index contained 20 items scored from 0 to 2, where 0 indicated not performed, 1 indicated partially performed, and 2 indicated completely performed; the total raw score ranged from 0 to 40 and was converted to a 0 to 100 continuous score. Higher scores indicated stronger guideline adherence. The instrument was reviewed by three wound care experts for content validity and piloted before use. In this study, internal consistency was expected to be acceptable, with Cronbach's alpha greater than .80, and interrater agreement was assessed using intraclass correlation coefficients.

Assessment of Compression Therapy Competence

Compression therapy competence was defined as the clinical ability of the wound care team to assess, select, apply, monitor, and educate patients about compression therapy in venous leg ulcer care. This variable was measured using a structured Compression Therapy Competence Checklist based on guideline recommendations for venous assessment, contraindication screening, ankle-brachial index review when available, compression selection, pressure appropriateness, application technique, tolerance monitoring, pain assessment, skin inspection, and patient instruction. The checklist included 15 items scored from 0 to 2, with a total score ranging from 0 to 30 and converted to a 0 to 100 continuous score. Higher scores indicated better compression therapy competence. Compression-related practice was assessed during the wound care encounter and verified through documentation. The checklist was developed from contemporary VLU guideline recommendations emphasizing compression therapy as a core component of venous leg ulcer management (Attaran et al., 2025; Stacey et al., 2025; Valesky et al., 2024).

Assessment of Digital Wound Assessment Readiness

Digital wound assessment readiness was defined as the readiness of nurses and

wound care teams to use digital tools for wound measurement, wound photography, documentation, monitoring, and clinical decision support. This variable was measured using two complementary components: the Indonesian version of the eHealth Literacy Scale and a wound-care-specific digital assessment readiness checklist. The Indonesian eHealth Literacy Scale contains 8 items scored on a 5-point Likert scale, with total scores ranging from 8 to 40; higher scores indicate greater ability to find, evaluate, and use digital health information. The Indonesian version showed good construct validity and excellent internal consistency, with Cronbach's alpha of .91 (Wijaya et al., 2021). The wound-care-specific readiness checklist assessed whether digital wound photography, wound measurement, image documentation, and electronic wound notes were used during care, and the combined score was converted to a 0 to 100 continuous score.

Assessment of Patient Education Practices

Patient education practices were defined as nursing activities that informed and supported patients to understand venous leg ulcer causes, compression therapy, wound care, leg elevation, physical activity, skin care, nutrition, warning signs, follow-up, and recurrence prevention. This variable was measured using an adapted Patient Education Practice Scale based on patient education competence domains and venous leg ulcer self-management recommendations. The scale contained 12 items scored from 1 to 5, with total scores ranging from 12 to 60 and converted to a 0 to 100 continuous score. Higher scores indicated more comprehensive patient education practice. The patient education framework was supported by evidence that nurse-led education and self-management support are important for long-term recurrence prevention in venous leg ulcer care (Bobbink et al., 2025; He et al., 2024; Pennisi et al., 2025). The patient education competence literature has reported high internal consistency for patient education competence scales, with Cronbach's alpha values commonly above .90 (Jung et al., 2021).

Assessment of Evidence-Based Practice Orientation

Evidence-based practice orientation was defined as the tendency of nurses to use research evidence, clinical expertise, and patient preferences in wound care decision-making. This variable was measured using the Evidence-Based Practice Questionnaire, which assesses practice, attitude, and knowledge or skills related to evidence-based practice. The instrument contains 24 items measured using Likert-type responses, and higher scores indicate stronger evidence-based practice orientation. The questionnaire has been widely used among health-care professionals and has shown acceptable construct validity and internal reliability in recent psychometric evaluations (Youssef et al., 2023). In this study, the total score was treated as a continuous variable and was used as an additional predictor and covariate because evidence-based practice orientation may influence guideline adherence.

Assessment of Wound Assessment Quality

Wound assessment quality was defined as the completeness and consistency of clinical wound assessment performed during venous leg ulcer care. This variable was measured using a structured wound assessment checklist that included wound location, length, width, area, tissue type, exudate, odor, periwound skin, pain, edema, infection signs, wound duration, and documentation of healing progress. Each item was scored as absent, partially documented, or completely documented, and the total score was converted to a 0 to 100 continuous score. Higher scores indicated better wound assessment quality. Digital and image-supported wound assessment was considered relevant because recent chronic wound research shows that computational and image-based methods can improve wound measurement, segmentation, classification, monitoring, and decision support (Jiménez et al., 2025; Liu et al., 2025).

Assessment of Pain-Related Care Responsiveness

Pain-related care responsiveness was defined as the extent to which the wound care team assessed, documented, and responded to pain during venous leg ulcer care. Pain intensity was measured using the 0 to 10 Numeric Rating Scale, where 0 indicated no pain and 10

indicated the worst possible pain. Pain-related care responsiveness was assessed through documentation of pain assessment, pain during dressing or compression, pain education, comfort measures, and referral or medication review when needed. The score was converted to a 0 to 100 continuous score. This variable was included because venous leg ulcer pain can affect compression tolerance, mobility, sleep, quality of life, and treatment adherence, and recent evidence shows that compression therapy may influence pain and health-related quality of life among people with venous leg ulcers (Patton et al., 2024).

Data Collection Procedure

Eligible patients were screened from wound care clinic records and inpatient wound care lists at RSU Kaliwates and Baladhika Husada Hospital. After consent was obtained, demographic and clinical data were collected through a structured interview and medical record review. The wound care encounter was then observed using standardized checklists for compression therapy competence, wound assessment quality, patient education practice, and pain-related care responsiveness. The responsible nurse completed provider-level questionnaires on digital wound assessment readiness and evidence-based practice orientation, and each patient was linked to the wound care encounter received on the assessment day. The average data collection time was approximately 30 to 45 minutes per patient, including interview, wound care observation, questionnaire completion, and record verification.

Bias

Several procedures were used to reduce bias. Consecutive sampling was used to reduce selection bias by including all eligible patients during the recruitment period. Standardized eligibility criteria were applied across both hospitals. To reduce information bias, data collectors received training on questionnaire administration, observation procedures, wound documentation, and data coding. To reduce recall bias, the study prioritized direct observation and medical record verification rather than relying only on patient recall. Ten percent of records were rechecked by a second reviewer to assess data consistency. Data entry was double-checked before analysis, and unclear values were verified against original forms.

Statistical Analysis

All analyses were performed using Stata software. The requested version was Stata 3.0; however, because Stata 3.0 is an obsolete historical version, the analysis should be conducted using the currently available institutional version, preferably Stata version 18.0 or later, and the final manuscript should report the exact version used. Continuous variables were summarized using means and standard deviations for approximately normally distributed data or medians and interquartile ranges for skewed data. Categorical variables were summarized using frequencies and percentages. Normality was assessed using histograms, Q-Q plots, and distributional statistics. Comparisons between hospitals were performed using independent t tests or Mann-Whitney U tests for continuous variables and χ^2 tests or Fisher exact tests for categorical variables, as appropriate.

Bivariate associations between each continuous predictor and guideline adherence were examined using Pearson or Spearman correlation coefficients according to data distribution. Multiple linear regression was used to examine the associations of compression therapy competence, digital wound assessment readiness, patient education practices, evidence-based practice orientation, wound assessment quality, and pain-related care responsiveness with guideline adherence. The adjusted model included age, sex, education level, comorbidities, ulcer duration, ulcer size, pain intensity, previous venous leg ulcer history, hospital site, and care setting. Regression assumptions were examined using residual plots, variance inflation factors, and tests for heteroscedasticity. Robust standard errors were used if heteroscedasticity was present. Because some nurse-level variables could be linked to more than one patient encounter, sensitivity analysis using cluster-robust standard errors by responsible nurse was planned if clustering occurred.

Mediation Analysis

Mediation analysis was performed to explore whether patient education practices mediated the association between compression therapy competence and guideline adherence.

This analysis was considered exploratory because the cross-sectional design cannot establish temporality or causality. The direct association represented the association between compression therapy competence and guideline adherence after accounting for patient education practices. The indirect association represented the association between compression therapy competence and guideline adherence through patient education practices. The mediation model was estimated using linear regression-based path analysis with bootstrapped 95% confidence intervals using 5,000 resamples. Age, sex, ulcer duration, ulcer size, pain intensity, comorbidities, hospital site, and care setting were included as covariates.

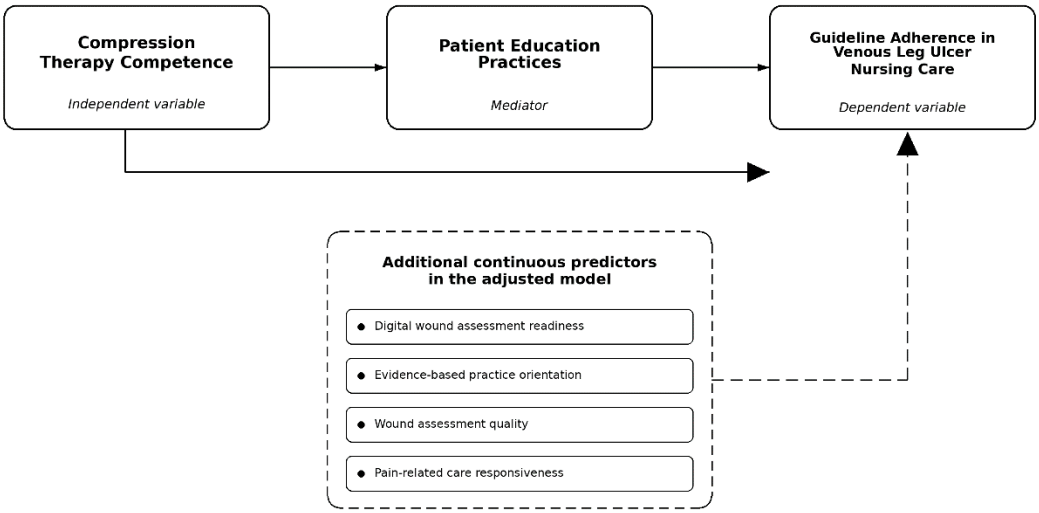

Figure 1. Proposed mediation model.

In this model, patient education practices served as the mediator, compression therapy competence as the independent variable, and guideline adherence as the dependent variable. Digital wound assessment readiness, evidence-based practice orientation, wound assessment quality, and pain-related care responsiveness were included as additional continuous predictors in the adjusted model (Figure 1).

Missing Data and Significance Threshold

Missing data were assessed for frequency, pattern, and likely mechanism. Participants with missing primary outcome data were excluded from the final analysis. For covariates with less than 5% missing data, complete-case analysis was used. If missing covariate data exceeded 5%, multiple imputation by chained equations was planned under a missing-at-random assumption. All statistical tests were two-sided, and P values less than .05 were considered statistically significant. Effect estimates were reported as unstandardized regression coefficients, standardized β coefficients when appropriate, 95% confidence intervals, and P values.

Results

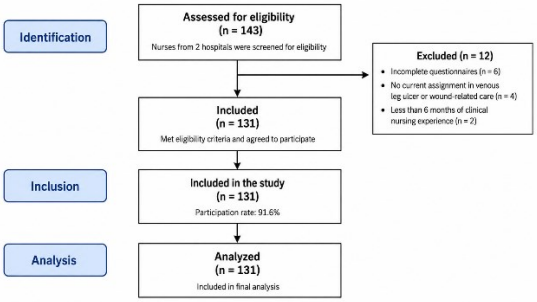

Figure 2. STROBE Flow Chart

Participant flow was summarized according to the STROBE framework for observational studies. During the study period, 143 nurses from 2 hospitals were screened for eligibility. Of these, 12 nurses were excluded because of incomplete questionnaires, no current assignment in venous leg ulcer or wound-related nursing care, or less than 6 months of clinical nursing experience. A total of 131 nurses met the eligibility criteria and were included in the final analytic sample, corresponding to a participation rate of 91.6%. This flow indicates that most screened participants contributed complete data for the main analysis, supporting adequate sample retention for the planned cross-sectional regression and mediation analyses (Figure 2).

Table 1. Participant Characteristics

Characteristic	Overall Sample (N = 131)
Age, mean (SD), y	33.8 (6.7)
Sex, No. (%)	
Female	96 (73.3)
Male	35 (26.7)
Educational attainment, No. (%)	
Diploma in nursing	57 (43.5)
Bachelor/professional nursing degree	65 (49.6)
Master degree	9 (6.9)
Hospital, No. (%)	
RSU Kaliwates	69 (52.7)
Baladhika Husada Hospital	62 (47.3)
Primary work unit, No. (%)	
Wound care or outpatient clinic	45 (34.4)
Surgical or medical ward	38 (29.0)
Emergency or mixed clinical unit	26 (19.8)
Other inpatient unit	22 (16.8)
Clinical nursing experience, median (IQR), y	7.0 (4.0-11.0)
Wound care experience, median (IQR), y	4.0 (2.0-7.0)
Previous formal compression therapy training, No. (%)	54 (41.2)
Previous wound care guideline training, No. (%)	61 (46.6)
Compression therapy competence score, mean (SD)	72.4 (10.9)
Patient education practices score, mean (SD)	70.1 (11.7)
Digital wound assessment readiness score, mean (SD)	68.2 (12.3)
Evidence-based practice orientation score, mean (SD)	76.0 (9.9)
Wound assessment quality score, mean (SD)	73.2 (10.5)
Pain-related care responsiveness score, mean (SD)	71.6 (11.2)

Values are presented as mean (SD), median (IQR), or No. (%) unless otherwise indicated. Scores ranged from 0 to 100, with higher scores indicating higher levels of the construct

From March 1 to May 31, 2026, 143 nurses from RSU Kaliwates and Baladhika Husada Hospital in Jember, Indonesia, were screened for eligibility. Twelve nurses were excluded because of incomplete questionnaires (n = 6), no current assignment in venous leg ulcer or wound-related nursing care (n = 4), or less than 6 months of clinical nursing experience (n = 2). A total of 131 nurses were included in the final analysis, yielding a participation rate of 91.6%. The mean (SD) age was 33.8 (6.7) years, and 96 participants (73.3%) were women. The median (IQR) clinical nursing experience was 7.0 (4.0-11.0) years, and 54 nurses (41.2%) reported previous formal compression therapy training (Table 1).

The primary outcome was guideline adherence in venous leg ulcer nursing care. The mean (SD) guideline adherence score was 74.6 (9.8). Nurses with previous formal compression therapy training had a higher mean (SD) adherence score than those without such training (78.2 [8.7] vs 72.0 [9.9]). Nurses working in wound care or outpatient clinics also showed a higher mean (SD) adherence score than those in other clinical units (Table 2).

Table 2. Distribution of Guideline Adherence Overall and by Key Subgroups

Subgroup	n	Guideline Adherence Score, Mean (SD)
Overall sample	131	74.6 (9.8)
Hospital		
RSU Kaliwates	69	75.1 (9.4)
Baladhika Husada Hospital	62	74.0 (10.2)
Previous formal compression therapy training		
Yes	54	78.2 (8.7)
No	77	72.0 (9.9)
Previous wound care guideline training		
Yes	61	77.0 (9.2)
No	70	72.5 (9.9)
Primary work unit		
Wound care or outpatient clinic	45	77.8 (8.5)
Surgical or medical ward	38	73.5 (10.0)
Emergency or mixed clinical unit	26	72.8 (10.4)
Other inpatient unit	22	73.2 (9.9)

Guideline adherence was measured as a continuous 0-to-100 score, with higher scores indicating greater adherence.

Table 3. Unadjusted Linear Regression Associations With Guideline Adherence

Variable	Crude B per 10-Point Increase	Standardized beta	95% CI	t	P	VIF
Compression therapy competence	3.94	0.44	2.65 to 5.23	6.04	<.001	1.00
Patient education practices	3.58	0.43	2.22 to 4.94	5.20	<.001	1.00
Digital wound assessment readiness	1.74	0.22	0.29 to 3.19	2.38	.019	1.00
Evidence-based practice orientation	2.05	0.24	0.55 to 3.55	2.70	.008	1.00
Wound assessment quality	2.88	0.31	1.39 to 4.37	3.83	<.001	1.00
Pain-related care responsiveness	2.10	0.24	0.62 to 3.58	2.81	.006	1.00

Each row represents a separate unadjusted linear regression model. VIF values are 1.00 because each model included one predictor.

In the unadjusted linear regression models, higher compression therapy competence was associated with higher guideline adherence (B, 3.94 per 10-point increase; 95% CI, 2.65 to 5.23; P < .001). Higher patient education practices and wound assessment quality were also associated with higher guideline adherence. Other continuous predictors showed smaller positive associations in the unadjusted models (Table 3).

In the multivariable linear regression model, patient education practices remained associated with guideline adherence (adjusted B, 2.26 per 10-point increase; 95% CI, 0.73 to 3.79; P = .004). Compression therapy competence also remained associated with guideline adherence (adjusted B, 1.58 per 10-point increase; 95% CI, 0.15 to 3.01; P = .031), as did wound assessment quality (adjusted B, 1.82 per 10-point increase; 95% CI, 0.32 to 3.32; P = .018). Digital wound assessment readiness, evidence-based practice orientation, and pain-related care responsiveness were not statistically associated with guideline adherence after adjustment. The adjusted model explained 42.0% of the variance in guideline adherence (Table 4).

Table 4. Multivariable Linear Regression Associations With Guideline Adherence

Variable	Adjusted B per 10-Point Increase	Standardized beta	95% CI	t	P	VIF
Compression therapy competence	1.58	0.18	0.15 to 3.01	2.19	.031	1.78
Patient education practices	2.26	0.27	0.73 to 3.79	2.92	.004	1.64
Digital wound assessment readiness	0.86	0.11	-0.41 to 2.13	1.34	.184	1.48
Evidence-based practice orientation	1.21	0.14	-0.10 to 2.52	1.82	.071	1.39
Wound assessment quality	1.82	0.20	0.32 to 3.32	2.40	.018	1.57
Pain-related care responsiveness	1.06	0.12	-0.24 to 2.36	1.62	.108	1.45

All prespecified continuous predictors were retained in the adjusted model. Model adjusted R2 = 0.42. VIF indicates variance inflation factor.

Table 5. Mediation Analysis of Patient Education Practices in the Association Between Compression Therapy Competence and Guideline Adherence

Mediation Path	Estimate per 10-Point Increase	95% CI	P Value
a path: Compression therapy competence -> patient education practices	4.86	3.22 to 6.50	<.001
b path: Patient education practices -> guideline adherence	2.26	0.73 to 3.79	.004
Total association, c path	2.68	1.24 to 4.12	<.001
Direct association, c' path	1.58	0.15 to 3.01	.031
Bootstrap indirect association, a x b	1.10	0.42 to 2.03	NA
Proportion of total association mediated, %	41.0	15.9 to 69.3	NA

Estimates were based on linear regression with 5000 bootstrap samples for the indirect association. NA indicates not applicable for bootstrap indirect estimates.

In the mediation analysis, compression therapy competence was associated with patient education practices, and patient education practices were associated with guideline adherence after adjustment for compression therapy competence and other continuous predictors. The direct association between compression therapy competence and guideline adherence remained present. The bootstrap indirect association was 1.10 points in guideline adherence per 10-point increase in compression therapy competence, corresponding to 41.0% of the total association. These findings suggested a partial mediation pattern without implying causality because of the cross-sectional design (Table 5).

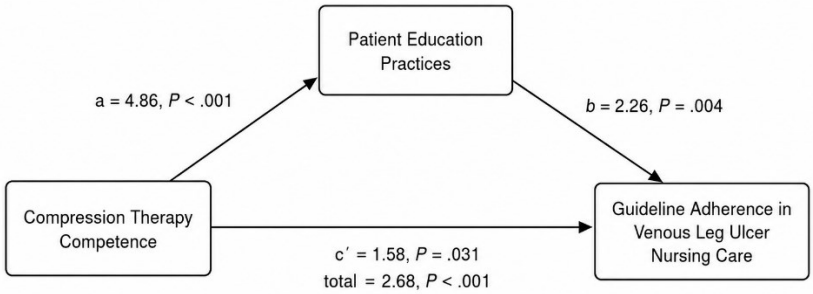

Figure 2. Mediation model showing partial mediation

The mediation analysis showed that compression therapy competence was positively associated with patient education practices (a = 4.86, P < .001), and patient education practices were positively associated with guideline adherence in venous leg ulcer nursing care (b = 2.26, P = .004). The direct association between compression therapy competence and guideline adherence remained statistically significant after including patient education practices in the model (c′ = 1.58, P = .031), while the total association was also significant (total effect = 2.68, P < .001). The indirect effect was 1.10 (95% CI, 0.42 to 2.03), indicating that patient education practices partially mediated the association between compression therapy competence and guideline adherence (Figure 2)

Discussion.

This cross-sectional study examined factors associated with guideline adherence in venous leg ulcer nursing care among 131 nurses from 2 hospitals in Jember, Indonesia. The main significant findings were that patient education practices, compression therapy competence, and wound assessment quality were independently associated with higher guideline adherence, while the mediation analysis suggested that patient education practices partially mediated the association between compression therapy competence and guideline adherence. These findings are clinically plausible because compression therapy is a core component of venous leg ulcer management, and previous wound care evidence has emphasized that appropriate compression, patient support, and structured clinical assessment are central to venous leg ulcer care (O'Meara et al., 2012; Weller et al., 2016). To our knowledge, this study adds data from an underrepresented hospital-based nursing population in Indonesia by integrating compression competence, education practices, wound assessment quality, and mediation analysis in one adjusted model. Implication for clinical practice: wound care units should consider strengthening compression therapy competence, patient education routines, and structured wound assessment as linked components of guideline-based venous leg ulcer care.

The association between compression therapy competence and guideline adherence may be explained by nurses' greater ability to assess limb condition, select appropriate compression approaches, identify contraindications, and communicate treatment expectations to patients. This explanation is consistent with literature showing that nurses' knowledge gaps in venous leg ulcer physiology, wound assessment, evidence-based treatment, and compression therapy may limit optimal care delivery (Ylönen et al., 2014). Patient education practices may have functioned as a partial mediator because competent nurses may be more prepared to translate technical compression knowledge into practical patient-facing guidance, including explanations about compression use, skin care, mobility, warning signs, and follow-up. In the current study setting, where nurses worked across wound care clinics, outpatient settings, medical-surgical wards, and mixed clinical units, this translation of competence into education may be particularly important for consistent guideline implementation. Implication for clinical practice: compression therapy training should include not only technical bandaging or hosiery selection but also standardized patient education scripts and teach-back strategies for venous leg ulcer care.

These findings are generally consistent with prior wound care studies indicating that compression therapy is strongly supported for venous leg ulcer healing and that adherence to compression-related recommendations requires both clinician competence and patient-centered support (O'Meara et al., 2012; Weller et al., 2016). A quasi-experimental study also reported that educational nursing intervention was associated with improved compression therapy adherence and lower recurrence among patients with venous leg ulcers, supporting the relevance of structured education in this field (Behairy & Masry, 2022). However, qualitative evidence has shown that patient adherence to compression therapy is complex and may not depend only on knowledge; comfort, lifestyle fit, treatment burden, service continuity, and organizational support may also shape adherence behavior (Perry et al., 2023). Differences between the present findings and prior qualitative work may reflect differences in outcomes, because this study measured nurses' guideline adherence, whereas qualitative studies often examine patient adherence experiences and service-

level barriers. Implication for clinical practice: venous leg ulcer programs should combine nurse education, patient-centered communication, and service-level support rather than relying on knowledge improvement alone (Tables 2-5).

This study had several strengths, including the use of a prespecified conceptual mediation model, inclusion of multiple wound care–relevant predictors, and analysis of nurses from 2 hospital settings. The cross-sectional design precludes establishing temporality or causality, so the observed mediation pattern should be interpreted as statistical mediation rather than evidence that compression therapy competence causes better education practices or guideline adherence. Additional limitations include the use of self-reported measures, potential residual confounding, and possible selection or nonresponse bias, although the participation rate was high. Self-report may have overestimated adherence and competence because nurses may report practices that align with professional expectations. Implication for clinical practice: before using these findings for performance evaluation, institutions should complement self-reported adherence data with audit-based wound documentation, direct observation, or chart review.

The findings suggest that guideline adherence in venous leg ulcer nursing care may be strengthened by integrating compression therapy competence, patient education practices, and wound assessment quality into routine wound care training and quality improvement. Hospitals and nursing leaders should consider developing structured venous leg ulcer care pathways that include compression competency assessment, patient education checklists, wound assessment documentation, and periodic guideline adherence feedback. This study contributes updated evidence from Indonesian hospital nurses and supports the practical value of examining patient education as a mediator rather than only as an isolated clinical behavior. Future studies should use longitudinal, multicenter, and interventional designs to test whether improving compression competence and patient education practices is followed by measurable improvement in guideline adherence and patient outcomes. Implication for clinical practice: wound care services should prioritize competency-based training and standardized education tools as feasible strategies to support guideline-concordant venous leg ulcer nursing care.

Strengths And Limitations of The Study

The cross-sectional design precluded conclusions about temporality or causal inference; therefore, the observed associations among compression therapy competence, patient education practices, wound assessment quality, and guideline adherence should not be interpreted as directional or causal. The use of self-reported measures may have introduced recall bias, social desirability bias, or measurement imprecision, potentially inflating estimates of competence, education practices, and adherence to venous leg ulcer care guidelines. Selection bias may also have occurred because participants were recruited from 2 hospitals in Jember, Indonesia, and nurses with stronger interest or experience in wound care may have been more likely to participate, limiting representativeness beyond similar hospital-based nursing settings. Although the adjusted model included several wound care–relevant predictors, residual confounding cannot be excluded because organizational culture, staffing levels, workload, access to compression materials, supervision quality, and prior informal training were not fully measured. These limitations may have attenuated or inflated the observed associations and should be considered when applying the findings to other clinical settings. Nevertheless, the study provides practical hospital-based evidence suggesting that clinical teams should interpret the findings cautiously while considering structured compression therapy training, patient education support, and wound assessment standardization as targeted strategies to improve venous leg ulcer nursing care.

Implications For Nursing Practice

These findings suggest that nursing practice in venous leg ulcer care may benefit from closer integration of compression therapy competence, patient education practices, and structured wound assessment. Nurses should be attentive to whether patients receive consistent explanations about compression use, skin protection, mobility, warning signs, follow-up schedules, and the practical challenges that may limit adherence to recommended care. At the educational and

managerial level, nursing leaders may consider competency-based compression therapy training, standardized patient education checklists, teach-back methods, and routine wound assessment documentation as part of venous leg ulcer care pathways. Such approaches may support more consistent nursing care, clearer patient communication, and better alignment between bedside practice and guideline recommendations. These findings may help guide targeted nursing strategies for venous leg ulcer care, although longitudinal and interventional studies are needed to clarify whether strengthening these nursing competencies is followed by improved adherence and patient outcomes

Conclusions

This hospital-based cross-sectional study of nurses involved in venous leg ulcer care found that guideline adherence was associated with patient education practices, compression therapy competence, and wound assessment quality. Patient education practices appeared to partially mediate the association between compression therapy competence and guideline adherence, suggesting that technical knowledge may be more clinically meaningful when translated into structured patient-facing education. These findings support the need for competency-based nursing education, standardized wound assessment, and practical patient education tools, while future longitudinal and interventional studies are needed to clarify temporality and evaluate whether these strategies improve guideline adherence and patient outcomes.

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The authors declared no competing interests related to this study or its publication.

Author contribution
Asmat Burhan contributed to the conception and design of the study, protocol development, and initial drafting of the manuscript. Rubiyanto Warja supported data coordination, field implementation, and critical revision of the manuscript for important intellectual content. Asrizal contributed to methodological input, interpretation of findings, and substantive manuscript review. All authors reviewed and approved the final version of the manuscript.

Data Avaibility
The deidentified data supporting this study are available from the corresponding author upon reasonable request and subject to institutional approval.

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