


# Risk Factors for Recurrent Pressure Ulcers: Insights from a Retrospective Study in Vietnam



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## Abstract:

**Background:** Recurrent pressure ulcers (RPU) are common among patients with limited mobility, leading to prolonged treatment and reduced quality of life. However, data on prognostic factors for RPU remain limited, especially in Vietnam. Objective: This study aims to identify prognostic factors influencing RPU among patients admitted to the Vietnam National Burn Hospital (VNBH) in Hanoi, the capital of Vietnam.

**Methods:** A retrospective cohort study was conducted on 583 patients diagnosed with pressure ulcers at VNBH from May 2019 to May 2024. Data were extracted from the VNBH electronic database, including demographic characteristics, comorbidities, wound severity, treatment history, and preventive measures. Univariate and multivariate logistic regression analyses were applied to determine independent predictors of RPU.

**Results:** The study sample included 463 men (79.4%) and 120 women (20.6%), with a mean age of  $51.7 \pm 35.9$  years. A total of 108 (18.5%) patients experienced RPU. Multivariate analysis identified age  $>31$  years (OR=2.3), presence of comorbidities (OR=2.7), mobility impairment (OR=3.8), incontinence (OR=6.3), stage III ulcers (OR=4.2), stage IV ulcers (OR=6.7), absence of combined therapy (OR=3.2), and lack of rehabilitation (OR=3.0) as significant independent predictors of RPU ( $p < 0.05$ ).

**Conclusion:** RPU are a significant healthcare challenge, particularly among older individuals with comorbidities, mobility impairments, and incontinence. Advanced ulcer stages and wound care that is not consistent with the current standard of care further increase the risk.

**Keywords:** Recurrent pressure ulcer, Prognostic factors, Multivariate analysis, Nursing, VNBH electronic database, Mobility impairments.

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## 1. INTRODUCTION

Pressure ulcers (PUs), also known as pressure injuries or bedsores, are localized injuries to the skin and underlying tissue caused by prolonged pressure, shear, or friction [1]. PUs are common in patients with limited mobility, such as those who are bedridden or use wheelchairs, and are associated with significant morbidity, prolonged hospital stays, decreased quality of life, and increased healthcare costs [2, 3]. Globally, the prevalence of PUs ranges from 4% to 23% among hospitalized patients, with rates reaching up to 39% in long-term care facilities [4, 5]. Among patients with PUs, RPUs represent a particularly persistent and costly complication. Despite advancements in wound care, RPUs remain a major healthcare concern, with recurrence rates reported between 21% and 60%, depending on patient populations and care settings [6].

RPUs are defined as ulcerations that reappear at the same anatomical site within 12 months of the initial wound's complete closure [7]. Multiple factors contribute to PU recurrence, including patient-related aspects (such as advanced age, comorbidities, immobility, and incontinence) and healthcare-related limitations (such as sub-optimal wound management, inadequate rehabilitation, and lack of proper nutrition) [8]. Previous studies have emphasized that individuals with spinal cord injuries, diabetes, and cardiovascular diseases are at higher risk for RPUs due to impaired tissue perfusion and delayed wound healing [9, 10]. Gaps in clinical care often compound these risks, for example, failure to implement regular turning schedules, lack of rehabilitation services, and poor nutritional support, all of which have been associated with higher recurrence rates [11, 12].

The economic and social burden of PUs and RPUs is considerable. Treating recurrent or severe PUs is often multiple times more costly than preventing them and/or managing an initial wound [13, 14]. Beyond the financial costs, PUs significantly diminish patients' quality of life, contributing to pain, restricted mobility, psychological distress, and social isolation [7, 8].

In Vietnam, research on PU recurrence is limited. The Vietnam National Burn Hospital (VNBH) serves as a referral center for patients with chronic wounds across the Northern and Central regions of the country, managing a large volume of PU cases annually. Identifying recurrence predictors in this population is crucial to improve clinical outcomes and develop targeted, patient-specific, and resource-appropriate prevention strategies. Importantly, while PU management typically involves multidisciplinary collaboration, nursing professionals are at the forefront of prevention and daily wound care [15]. Nurses are responsible for performing skin assessments, ensuring timely repositioning, managing moisture and hygiene, providing nutritional support, and educating patients and caregivers regarding. These empirically-based interventions play a central role in mitigating recurrence risk. Yet, limited attention has been given to the direct impact of nursing-specific practices on PU recurrence, particularly in resource-constrained healthcare settings such as Vietnam.

This study, therefore, aims to identify prognostic factors associated with RPU at a national referral center and to offer evidence-based recommendations with particular emphasis on nursing roles in PU recurrence prevention.

## 2. METHODS

### 2.1. Study Design

This retrospective cohort study was conducted using patient records from the Vietnam National Burn Hospital (VNBH) between May 1, 2019, and May 31, 2024. Participants were included if they were aged 18 years or older, diagnosed with pressure ulcers (any stage), and had complete electronic medical records available in the VNBH database. These records had to contain data on demographics, comorbidities, ulcer characteristics, and treatment history. Eligible patients included those whose pressure ulcers developed either before admission (as the primary reason for hospitalization) or during hospitalization. For recurrent pressure ulcer (RPU) cases, only those with documented recurrence at the same anatomical location within 12 months of wound closure were included.

Exclusion criteria were incomplete or missing essential clinical data (*e.g.*, ulcer location, stage, or outcome), diagnosis of non-pressure ulcer etiologies (such as diabetic foot ulcers, venous or arterial ulcers), age under 18 years, or transfer from another hospital without sufficient pre-transfer documentation or follow-up data.

The VNBH, located in Hanoi, serves as a referral center for burn patients and individuals with chronic wounds transferred from hospitals across Northern and Central Vietnam. The VNBH database contains electronic patient records for over 800 patients with chronic wounds annually. All patient information, including demographics, medical conditions, care procedures, and treatment outcomes, is recorded in the VNBH database by wound care specialist doctors and the nurses who care for the patients from five clinical departments during the patients' hospital stays. Permission to access and use anonymized patient data was granted to the research team by the hospital's leadership and the Ethics Committee in Biomedical Research of the VNBH. Only authorized members of the research team ( $n=5$ ) had access to the electronic medical records. All data were handled in compliance with institutional confidentiality regulations and national data protection policies, ensuring full respect for patient privacy.

### 2.2. Participants

In total, data were collected from 583 patients (463 men (79.4%) and 120 women (20.6%)). The participants' mean age was  $51.7 \pm 35.9$  years (with the highest frequency in patients aged 31-60 years ( $n=374$ , 64.1%)). They had all been admitted to the Wound Healing Center, VNBH, from May 1, 2019, to May 31, 2024. Most participants lived in rural regions ( $n=336$ , 57.6%), were farmers ( $n=216$ , 37%), and 108 (18.5%) had RPUs (Table 1).

**Table 1. Demographic of studying patients (n=583).**

Variables	Frequency	Percentage
	Mean±SD (min-max): 51.7±35.9 (16-95)	
<b>Age (years)</b>	-	-
≤30	93	15.9
31-60	374	64.2
≥61	116	19.9
<b>Gender</b>	-	-
Male	463	79.4
Female	120	20.6
<b>Place of residence</b>	-	-
Urban	247	42.4
Rural	336	57.6
<b>Socio-professional categories</b>	-	-
Worker	71	12.2
Farmer	216	37
Retired	189	32.4
Other (freelancer, student)	107	18.4
<b>Recurrence pressure ulcer (RPU)</b>	-	-
Yes	108	18.5
No	475	81.5

**Note:** SD, Standard Deviation.

### 2.3. Data Collection

The research team consisted of five members (2 doctors and 3 nurses) who all had ≥ 5 years of experience in the field of wound care. Before data collection began, the questionnaire was developed and tested on 10 patients with PUs (admitted to VNBH in 2024 and randomly selected from the VNBH database). Following the pilot, the questionnaire was edited and revised by experts from VNBH.

Data collected on the questionnaire consisted of demographic data, including gender, age, place of residence, socio-professional category, and presence of RPUs during the study period. RPUs were defined as ulcerations occurring at the same anatomical site as a previous ulcer within 12 months of complete closure of the initial wound [7]. Health conditions, such as comorbidities (spinal cord injury, traumatic brain injury, stroke, diabetes, and cardiovascular diseases), mobility status (normal ambulation, weakness, or paralysis/loss of mobility), and/or urination and defecation issues, were also extracted. For patients with RPUs, wound characteristics and treatment history, and information from the most recent hospitalization before ulcer recurrence were recorded. This included the number of ulcers, ulcer location, ulcer stage, combined

therapy during treatment (negative pressure therapy, hyperbaric oxygen therapy), and interventional methods used to heal ulcers (self-healing wounds, skin grafts, or flap reconstruction). Pre-hospital care regimens, such as rehabilitation and turning patients every 2-4 hours to prevent PUs in patients with limited mobility, were also recorded.

### 2.4. Statistical Analysis

Data analysis was conducted using SPSS software version 24.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. To identify prognostic factors associated with RPUs, comparisons were made between patients with RPUs and others based on demographic characteristics, overall patient condition, wound characteristics, treatment history, and pre-hospital care regimens upon hospital admission. Continuous variables were analyzed using the Student's t-test, while categorical variables were compared using the Chi-square test. A multiple logistic regression model was developed to estimate odds ratios (ORs) with 95% confidence intervals (CIs) for RPU-related factors. Variables with a  $p$ -value < 0.2 in univariate analysis, following the Hosmer-Lemeshow criterion, were selected for multivariate analysis. The final multivariate model retained only independent predictors of RPUs with statistical significance ( $p < 0.05$ ).

### 2.5. Ethical Clearance

This study followed the ethical principles outlined in the Declaration of Helsinki. The research protocol was reviewed and approved by the Ethics Committee in biomedical research (ECBR) of the Vietnam National Burn Hospital (Approval No: 08/CNChT-HDDD). Since this was a retrospective study using anonymized patient data from the hospital's electronic database, the requirement for informed consent was waived by the ECBR. All patient data were handled with strict confidentiality, and no personally identifiable information was disclosed. The research team ensured compliance with ethical guidelines to protect patient rights and privacy throughout the study.

## 3. RESULTS

A total of 583 patients had 681 PUs. In the two groups of patients with RPU and Primary PU (PPU), no statistically significant differences were observed regarding place of residence and occupation. Six variables, age, gender, comorbidities, mobility status, and urination and defecation status, with  $p < 0.05$ , were selected for inclusion in the multivariate analysis (Table 2).

Patients without combined therapies (negative pressure wound therapy, hyperbaric oxygen therapy, or both) and those with stage III or IV ulcers had a significantly higher risk of RPUs compared to those who received combined therapies and had only stage II ulcers ( $p = 0.02$  and  $0.04$ , respectively). Other variables, such as the number of ulcers, ulcer location, and surgical treatment with flap reconstruction, did not show statistically significant differences between the RPU and PPU groups ( $p > 0.05$ ).

However, surgical treatment with flap reconstruction ( $p < 0.2$ ) was retained for inclusion in the multivariate analysis (Table 3). Among 506 patients with mobility impairment, those who received rehabilitation and were turned every

2-4 hours had a statistically significantly lower rate of RPU compared to those who did not receive these care services ( $p < 0.05$ ) (Table 4).

**Table 2. Patient's overall condition and RPU.**

Variables	RPU (n=108)	PPU (n=475)	OR (95% CI)	p-value
	N (%)	N (%)		
<b>Age (years)<sup>(*)</sup></b>	-	-	-	-
≤30	12 (11.1)	81 (17.1)	Ref	-
31-60	65 (59.2)	309 (65.1)	1.4 (1.2-2.5)	0.03
≥61	31 (28.7)	85 (17.8)	2.1 (1.8-3.4)	-
<b>Gender<sup>(*)</sup></b>	-	-	-	-
Male	85 (78.7)	378 (79.6)	2.6 (1.8-4.5)	0.02
Female	23 (21.3)	97 (20.4)	Ref	-
<b>Place of residence</b>	-	-	-	-
Urban	49 (45.4)	198 (41.7)	0.9 (0.3-1.7) Ref	0.27
Rural	59 (54.6)	277 (58.3)	-	-
<b>Socio-professional categories</b>	-	-	-	-
Worker	29 (26.8)	42 (8.8)	Ref	-
Farmer	35 (32.4)	181 (38.1)	0.9 (0.5-2.1)	0.35
Retired	22 (20.4)	167 (35.2)	1.2 (0.6-1.9)	-
Other (freelancer, student)	22 (20.4)	85 (17.9)	1.5 (0.8-2.6)	-
<b>Co-morbidities<sup>(*)</sup></b>	-	-	-	-
Yes <sup>(**)</sup>	100 (92.6)	397 (83.6)	5.9 (4.2-9.8)	<0.001
None	8 (7.4)	78 (16.4)	Ref	-
<b>Mobility status<sup>(*)</sup></b>	-	-	-	-
Normal ambulation	9 (8.3)	68 (14.3)	Ref	-
Weakness	34 (31.5)	129 (27.2)	3.2 (2.5-6.6) 5.7 (2.9-8.3)	<0.001
Paralysis/ loss of mobility	65 (60.2)	278 (58.5)	-	-
<b>Urination<sup>(*)</sup></b>	-	-	-	-
Continent	26 (24.1)	172 (36.2)	Ref	0.02
Incontinent	82 (75.9)	303 (63.8)	3.8 (1.9-5.2)	-
<b>Defecation<sup>(*)</sup></b>	15 (13.9)	-	-	-
Continent	93 (86.1)	157 (33.1)	Ref	0.01
<b>Incontinent</b>	-	318 (66.9)	4.3 (2.2-6.5)	-

**Note:** N, Frequency; %, Percentage; OR, Odds Ratio; CI, Confidence interval; p-value, Probability value.

\*The selected variable for multivariate analysis.

\*\*Including one or more of the following diseases: Spinal cord injury, Traumatic brain injury, Stroke, Diabetes, Cardiovascular diseases.

**Table 3. Wound characteristics and treatment history of RPUs (n=681 ulcers).**

Variables	RPU (n=137)	PPU (n=544)	OR (95% CI)	p-value
	N (%)	N (%)		
<b>Number of Ulcers</b>	Total: 108 patients	Total: 475 patients	-	-
1	86 (79.6)	425 (89.5)	Ref	-
2	15 (13.9)	31 (6.5)	1.2 (0.7-3.6)	0.29
3	7 (6.5)	19 (4.0)	1.7 (0.5-4.7)	-
<b>Ulcer location</b>	-	-	-	-
Sacrum	55 (40.1)	163 (29.9)	Ref	-
Trochanter	32 (23.4)	101 (18.6)	0.8 (0.4-1.8)	0.25
Ischium	24 (17.5)	132 (24.3)	1.2 (0.5-2.1)	-
Others	26 (19.0)	148 (27.2)	0.7 (0.4-1.9)	-
<b>Ulcer stage<sup>(*)</sup></b>	-	-	-	-
II	25 (18.2)	288 (52.9)	Ref	-

(Table 3) contd....

Variables	RPU (n=137)	PPU (n=544)	OR (95% CI)	p-value
	N (%)	N (%)		
III	62 (45.3)	172 (31.6)	1.9 (1.4-3.2)	0.04
IV	50 (36.5)	84 (15.4)	2.5 (1.5-3.6)	-
<b>Combined therapy<sup>(*)</sup></b>	Total: 108 patients	Total: 475 patients	-	-
Yes <sup>(**)</sup>	39 (12.5)	254 (53.5)	Ref	-
No	69 (87.5)	221 (46.5)	2.8 (1.8-4.9)	0.02
<b>Surgical treatment with flap reconstruction<sup>(*)</sup></b>	-	-	-	-
Yes	44 (32.1)	312 (57.4)	Ref	-
No <sup>(***)</sup>	93 (67.9)	232 (42.6)	1.8 (1.2-4.1)	0.12

**Note:** N, Frequency; %, Percentage; OR, Odds Ratio; CI, Confidence interval; p-value, Probability value.

\*The selected variables for multivariate analysis.

\*\*Including patients who received negative pressure therapy, hyperbaric oxygen therapy, or both.

\*\*\*Including patients with self-healing wounds, those receiving skin grafts, or those undergoing a combination of skin graft and flap reconstruction.

**Table 4. Pre-hospital care and RPU (n=506).**

Variables	RPU (n=99)	PPU (n=407)	OR (95% CI)	p-value
	N (%)	N (%)		
<b>Rehabilitation<sup>(*)</sup></b>	-	-	-	-
Yes	23 (23.2)	222 (54.5)	Ref	-
No	76 (76.7)	185 (45.5)	2.4 (1.2-4.1)	0.02
<b>Turning patients every 2-4 hours</b>	-	-	-	-
Yes	8 (8.1)	247 (60.7)	Ref	-
No <sup>(**)</sup>	91 (91.9)	160 (39.3)	4.7 (2.5-6.9)	0.01

**Note:** N, Frequency; %, Percentage; OR, Odds Ratio; CI, Confidence interval; p-value, Probability value.

\*The selected variables for multivariate analysis.

\*\*Patients who did not receive regular repositioning every 2-4 hours.

### 3.1. Multivariate Analysis

Patients with pressure ulcers who were older than 31 years, had comorbidities, limited mobility, stage III ulcers, did not receive combined therapy, or did not participate in rehabilitation had a significantly higher risk of ulcer recurrence. The risk increased by 2.3-fold for patients over 31 years, 2.7-fold for those with comorbidities, 3.8-fold for those with limited mobility, 4.2-fold for those with stage III ulcers, 3.2-fold for patients who did not receive combined therapy, and 3.0-fold for those who did not undergo rehabilitation ( $p < 0.05$  for all). Additionally, incontinence, defecation issues, paralysis or loss of mobility, stage IV ulcers, and failure to be repositioned every 2-4 hours were associated with higher risks of PU recurrence, 6.3, 7.1, 5.4, 6.7, and 6.2 times higher, respectively ( $p < 0.001$ ) (Table 5).

## 4. DISCUSSION

The results indicate that patients over 31 years had a significantly higher risk of RPUs than younger patients. This finding aligns with prior research showing that aging leads to reduced skin elasticity, impaired tissue regeneration, and a decline in immune function, all contributing to delayed wound healing and increased recurrence rates [15, 2]. Although our analysis did not identify specific comorbidities such as diabetes, spinal cord injuries, or cardiovascular diseases as significant predictors of recurrence,

previous studies have shown that complications commonly associated with these conditions, such as impaired circulation and peripheral neuropathy, can severely compromise tissue repair [16]. In particular, diabetic neuropathy contributes to RPU risk by reducing protective sensation and impairing microvascular function, which delays wound recognition and healing [17]. Additionally, malnutrition, particularly deficiencies in protein and micronutrients, has been increasingly recognized as a key contributor to delayed wound healing and higher RPU risk, making it a critical target for nutritional interventions [18]. Sarcopenia, often accompanying malnutrition, reduces the muscle mass essential for mobility and effective pressure redistribution, thereby complicating wound healing and elevating the risk of RPUs [19].

Limited mobility was a significant factor associated with RPU risk. The literature indicates that patients with paralysis or prolonged immobility, such as those confined to bed, have nearly a fourfold increased risk of developing PUs due to sustained pressure on bony prominences and compromised tissue perfusion [20]. Impaired microcirculation and localized ischemia are central pathophysiological mechanisms in PU formation [21]. In addition, incontinence, particularly dual urinary and fecal incontinence, has been strongly associated with skin breakdown and PU development, with nearly half of hospital-acquired patients with PUs affected by this condition [22].

**Table 5. Predictive factors in patients with RPUs.**

Variables	OR	95% CI		p-value
		Lower	Upper	
<b>Age (years)</b>	-	-	-	-
≤30	Ref	-	-	-
31-60	2.3	1.8	2.1	0.03
≥61	3.6	2.5	5.7	0.01
<b>Gender</b>	-	-	-	-
Male	1.6	0.8	2.1	0.07
Female	Ref	-	-	-
<b>Co-morbidities</b>	-	-	-	-
Yes	2.7	1.9	4.5	0.04
None	Ref	-	-	-
<b>Mobility status</b>	-	-	-	-
Normal ambulation	Ref	-	-	-
Weakness	3.8	2.4	5.1	0.01
Paralysis/ loss of mobility	5.4	3.3	7.2	0.001
<b>Urination</b>	-	-	-	-
Continent	Ref	-	-	-
Incontinent	6.3	5.2	10.5	<0.001
<b>Defecation</b>	-	-	-	-
Continent	Ref	-	-	-
Incontinent	7.1	5.8	12.6	<0.001
<b>Ulcer stage <sup>(*)</sup></b>	-	-	-	-
II	Ref	-	-	-
III	4.2	3.7	8.3	0.01
IV	6.7	4.6	10.8	<0.001
<b>Combined therapy</b>	-	-	-	-
Yes	Ref	-	-	-
No	3.2	1.9	4.5	0.02
<b>Surgical treatment with flap reconstruction</b>	-	-	-	-
Yes	Ref	-	-	-
No	1.1	0.5	2.1	0.08
<b>Rehabilitation</b>	-	-	-	-
Yes	Ref	-	-	-
No	3	1.5	6	0.03
<b>Turning patients every 2-4 hours</b>	-	-	-	-
Yes	Ref	-	-	-
No	6.2	4.7	9.5	0.001

**Note:** OR, Odds Ratio; CI, Confidence interval; p-value, Probability value.

The results indicated that ulcer severity was a major determinant of recurrence, with patients with stage III and IV ulcers exhibiting a significantly higher risk of RPUs than those with stage II ulcers. This aligns with observations by Meier *et al.* (2019), who reported that deep-tissue (stage III/IV) pressure injuries require prolonged healing and are more prone to secondary infections, thereby increasing recurrence risk [23]. Moreover, Kabir *et al.* (2025) demonstrated that biofilm-driven infection delays wound closure in PUs, substantially increasing the risk of recurrence [24]. In addition, Yang *et al.* (2024)

described how chronic wounds, especially in the elderly, are characterized by cellular senescence and unresolved inflammation, which hinder tissue repair through sustained cytokine signaling and oxidative stress [25]. These mechanisms may also contribute to delayed healing and increased recurrence in PUs.

The results also found that the use of combined therapies, including negative pressure wound therapy (NPWT) and hyperbaric oxygen therapy (HBOT), was associated with a decreased risk of RPUs. A recent meta-analysis con-



firmed that adjunctive HBOT with NPWT significantly enhances tissue perfusion and granulation tissue formation [26], while HBOT improves oxygen delivery to ischemic tissues, facilitates angiogenesis, and increases collagen synthesis, thereby enhancing wound healing [27]. In our study, HBOT was part of a combined therapy regimen and showed an association with reduced recurrence (OR = 0.31,  $p < 0.05$ ). While its primary benefit lies in accelerating initial healing, HBOT may also enhance tissue quality post-recovery, potentially lowering susceptibility to future breakdown. However, we acknowledge a potential for selection bias. Patients who received HBOT may have had better baseline conditions, such as mobility, caregiver support, or access to advanced medical care. Although several confounders (*e.g.*, mobility status, ulcer stage, comorbidities, and rehabilitation) were adjusted for in our multivariate analysis, residual confounding related to socioeconomic status or healthcare access cannot be entirely ruled out. This limitation, inherent in our retrospective design, underscores the need for future prospective studies with Rehabilitation strategies, such as structured physical therapy, mobility enhancement, and scheduled repositioning, were found to play a crucial role in reducing the occurrence of RPUs. Patients who received structured rehabilitation programs and were repositioned every 2–4 hours exhibited a significantly lower risk of PU recurrence. These findings are in line with recent evidence from a systematic review and meta-analysis by Avsar *et al.* (2020), which demonstrated that frequent repositioning at intervals of 2 to 4 hours effectively reduces the incidence of PUs by alleviating prolonged pressure on bony prominences and improving local blood circulation [28]. In addition, there is evidence that the use of advanced pressure-redistribution surfaces, including dynamic air mattresses, is effective in preventing RPUs [29]. Moreover, the importance of education for both professional caregivers, particularly nurses, and informal caregivers, such as family members, has been increasingly recognized in improving PU outcomes. Structured wound care training programs, including those focusing on early detection, repositioning techniques, and dressing protocols, have been shown to significantly enhance care quality and reduce recurrence rates. While earlier studies, such as that by Latimer *et al.*, highlighted the positive impact of caregiver education [30], more recent literature also supports these findings. For instance, Deakin *et al.* emphasized that structured educational interventions for hospitalized patients significantly improved their knowledge of pressure injury prevention strategies, including repositioning, skin inspection, and nutritional care. This patient-centered approach empowers individuals to participate actively in their care, thereby potentially reducing the risk of PU development and recurrence [31].

## 5. STUDY LIMITATION

While this study offers valuable insights related to the risk factors associated with RPUs, it has several limitations. First, its retrospective design may introduce bias due to incomplete data recording by healthcare providers. Second, the study was conducted at a single institution,

limiting the generalizability of findings to other settings. Third, factors such as nutritional status and psychological well-being, which may also influence PU recurrence, were not assessed. Future studies incorporating these variables and employing prospective designs could provide a more comprehensive understanding of RPU risk factors.

## 5.1. Nursing Implications

The findings of this study reinforce the critical role of nursing in the prevention and management of RPUs. Key nursing interventions, such as routine repositioning of patients every 2–4 hours, monitoring skin integrity, assisting with hygiene in incontinent patients, and providing nutritional and mobility support, were shown to significantly reduce recurrence rates [32, 33]. Nurses are uniquely positioned to implement and monitor these preventive strategies, particularly in settings with limited resources [34]. To maximize impact, structured training programs focused on PU prevention should be widely implemented among nursing staff [35]. Moreover, incorporating PU risk assessment tools into daily nursing workflows and fostering interdisciplinary collaboration can enhance early detection and optimize patient outcomes [36, 37]. These implications underscore the need for nursing leadership to be actively involved in pressure injury prevention programs and policies at both the institutional and national levels [34, 36].

Proper skin hygiene, including gentle cleansing with pH-balanced products and the application of moisturisers or barrier preparations to manage skin moisture, has been shown to significantly reduce PU incidence among high-risk populations, with one cohort study reporting a drop from approximately 50% to 13% in PU occurrence [37]. This consideration highlights the importance of a holistic, multidisciplinary approach to RPU prevention, one that goes beyond wound healing technologies and addresses equitable access to long-term preventive care. In addition, emerging regenerative therapies, such as bioengineered skin substitutes and platelet-rich plasma applications, have demonstrated promising results in promoting healing and preventing recurrence [38, 39]. Nevertheless, their limited availability in low-resource settings remains a challenge, underscoring the need for broader implementation within Vietnam's healthcare infrastructure

## CONCLUSION

This study identified key risk factors for RPUs, including older age, comorbidities, limited mobility, incontinence, and advanced ulcer stages. The absence of combined therapies and the lack of rehabilitation were also associated with higher recurrence risk. These findings highlight the importance of the role nurses play in early risk assessment and implementation of targeted prevention strategies [32, 34]. Enhancing nursing care practices, particularly repositioning, skin monitoring, and patient education, can play a vital role in reducing RPU rates and improving patient outcomes [32, 33, 35].

## AUTHORS' CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: N.D., C.T.: Study conception and design; B.D., N.L.: Data collection; P.T.: Analysis and interpretation of results; P.Y.: Draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

## LIST OF ABBREVIATIONS

VNBH	= Vietnam National Burn Hospital
PU	= Pressure ulcer
RPU	= Recurrent PU
NPWT	= Negative Pressure Wound Therapy
HBOT	= Hyperbaric Oxygen Therapy
OR	= Odds Ratio
CI	= Confidence Interval
SD	= Standard Deviation
ECBR	= Ethics Committee in Biomedical Research
SPSS	= Statistical Package for the Social Sciences
WHO	= World Health Organization
PPU	= Primary PU.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research protocol was reviewed and approved by the ethics committee in biomedical research (ECBR) of the Vietnam National Burn Hospital (Approval No: 08/CNChT-HDDD)

## HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were under the ethical standards of the institutional and/or research committee, and with the 1975 Declaration of Helsinki, as revised in 2013.

## CONSENT FOR PUBLICATION

The requirement for informed consent was waived by the ECBR

## STANDARDS OF REPORTING

STROBE guidelines were followed.

## AVAILABILITY OF DATA AND MATERIALS

The data supporting the article's findings is available in the secured data repository of the National Burn Hospital at web [<http://vienbongquocgia.vn>], reference number [2372 - confidential].

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None.

## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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