



Predictors of Pressure Injury Prevention Practices Among ICU Nurses in China

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ABSTRACT

OBJECTIVE: To explore the predictors of knowledge of pressure injury (PI) prevention, attitudes on PI prevention, organization support for PI prevention, and the influence of a healthy work environment (HWE) on PI prevention practices among ICU nurses in China.

METHODS: A descriptive, predictive, online survey was conducted among 510 ICU nurses in Guizhou province, China. A PI prevention knowledge questionnaire, PI prevention attitude questionnaire, organizational support for PI prevention questionnaire, HWE assessment tool, and PI prevention practice questionnaire were used for data collection. A hierarchical regression analysis was used to determine the influence of certain predictive factors.

RESULTS: An HWE, organizational support for PI prevention, and positive attitudes toward PI prevention were significant predictors of good practice regarding PI prevention. However, knowledge of PI prevention was not a significant predictor.

CONCLUSIONS: To achieve optimal nursing quality in terms of PI prevention, hospital and nursing administrators should develop strategies or interventions to create and sustain an HWE and supportive organizational culture for ICU nurses and enhance positive attitudes toward PI prevention.

KEYWORDS: attitudes, healthy work environment, ICU, intensive care unit, knowledge, nurses, organizational support, practice, pressure injury, prevention

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INTRODUCTION

A pressure injury (PI) is local damage of skin or tissue over a bony prominence or under medical devices as a result of prolonged pressure or pressure combined with shear.¹ These injuries continue to constitute a significant and complicated health problem worldwide. Globally, 6.34% of patients experienced PIs in hospital settings,² and the incidence of PIs among ICU patients is even higher, ranging from 6.60% to 36.80%.³ Patients in the ICU are more likely to develop PIs because of high acuity, immobility, medications such as sedatives and vaso-pressors, and reliance on medical devices.^{4,5} Coyer et al⁶ highlighted that ICU patients are 3.8 times more likely to develop a PI than non-ICU patients during hospitalization. Similarly, in China, the PI incidence among ICU patients is 4.48%, more than four times higher than in non-ICU settings.⁷

The development of PIs places a tremendous burden on patients and healthcare systems, prolonging the length of hospital stays, increasing the cost of treatment, and even leading to death.⁸⁻¹⁰ It has been reported that 2% of preventable deaths were caused by PIs.¹¹ Accordingly, PIs have been established as a patient care quality indicator, and they typically can be prevented. Nurses play a vital role in prevention as direct care providers. Many guidelines have been issued in recent years to guide clinical nursing practice regarding PI prevention.^{12,13} However, nurses' compliance with these guidelines is often sub-optimal.¹⁴⁻¹⁹ Moreover, Vanderwee et al²⁰ reported that only 10.8% of patients at risk of PI received fully adequate prevention.

Several factors are associated with PI prevention practices among nurses; these include knowledge,^{11,17,21,22} attitudes,^{23,24} organizational support (including the presence of wound specialist nurses),²¹ formal training on PI prevention,²¹ the availability of PI guidelines and relevant equipment/devices,^{11,16,21} and a healthy work environment (HWE).²⁵ However, previous studies have

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been mostly conducted among general nurses, and few studies explore predictors of ICU nurses' practices regarding PI prevention.²⁶ Further, these previous studies were mostly conducted outside of China. Based on a current literature review, no published studies have explored predictors of ICU nurses' PI prevention practices in China.

Accordingly, the study objective was to determine the predictive power of knowledge, attitudes, organizational support, and HWE on PI prevention practices among ICU nurses in China. The findings of this study provide a starting point for improving nursing care and PI prevention specifically for ICU patients.

METHODS

A web-based cross-sectional predictive study was conducted among ICU nurses in Guizhou province, China, from March 31 to April 30, 2020. This study included nurses who are responsible for direct care in adult ICUs of 25 secondary and 29 tertiary care hospitals. A convenience sampling technique was used to recruit participants, who were invited to join by the ICU head nurses in each identified hospital. The head nurses disseminated a link for an online survey to ICU nurses who were willing to participate.

Instruments

Six instruments for data collection were used as follows:

Part 1: Demographic Questionnaire. A demographic questionnaire was developed by the authors after a review of relevant literature including sex, age, final education level, grade level of the hospital, working experience in ICUs, training on PI prevention last year, and the need for training on PI prevention.

Part 2: Pressure Injury Prevention Knowledge Questionnaire. This questionnaire was developed and modified based on the Pressure Ulcer Knowledge Assessment Tool 2.0 (PUKAT 2.0) to measure nurses' knowledge of PI prevention.²⁷ The modified tool is a 22-item questionnaire covering six themes associated with PI prevention including etiology, classification and observation, risk assessment, nutrition, prevention of PIs, and specific patient group. Each item uses a true/false/do not know format. The total score ranges from 0 to 22; a higher score indicates a higher level of knowledge.

Part 3: Pressure Injury Prevention Attitude Questionnaire. The Attitudes toward Pressure Ulcer Prevention (APUP) instrument developed and validated by Beeckman et al²⁸ was used to measure nurses' attitudes toward PI prevention. The questionnaire covers five aspects: personal competency to prevent PIs, the priority of PI prevention, the impact of PIs, personal responsibility in PI prevention, and confidence in the effectiveness of prevention.²⁸ The tool consists of 13 items using a 4-point Likert-type

scale, where 1 indicates strong disagreement and 4 indicates strong agreement. The total score ranges from 13 to 52; higher scores indicate a more positive attitude towards PI prevention.

Part 4: Organizational Support for PI Prevention Questionnaire. This questionnaire was developed by the researchers according to the evidence obtained from the literature review. The tool examines four aspects: the availability of PI guidelines, formal training on PI prevention, the presence of wound specialist nurses, and the availability of equipment. Each item is answered using a 5-point Likert-type scale (1, strongly disagree; 5, strongly agree). Higher scores indicate greater support from the hospital for PI prevention.

Part 5: HWE Assessment Tool. The HWE assessment tool, developed by the American Association of Critical Nursing,²⁹ was used to assess workplace atmosphere. The tool consists of 18 items that cover six standards of appropriate staffing, authentic leadership, effective decision-making, true collaboration, skilled communication, and meaningful recognition. Each item was rated by a 5-point Likert-type scale (1, strongly disagree; 5, strongly agree). The higher the score, the healthier the work environment.

Part 6: PI Prevention Practice Questionnaire. Nurses' practices regarding PI prevention were measured by a questionnaire evaluating compliance with recommendations for preventing PIs (called QARPPU).³⁰ The QARPPU was modified by the researchers to make it more specific and suitable for the Chinese setting and ICU nurses. The modified QARPPU is a 17-item questionnaire covering five themes: use of a risk prediction instrument, skin care, postural change, force and pressure relief, and nutrition for PI prevention. Each item is answered using a 5-point Likert-type scale (1, never; 5, always). The summed score ranges from 17 to 85. Higher scores indicate better practices regarding PI prevention.

Before data collection, permission to use and modify these instruments was obtained from the relevant authors. Three bilingual translators with a nursing background were invited to separately use the back-translation technique;³¹ final versions were compared and discussed to ensure the equivalence of the instruments. Three wound care experts were invited to validate the questionnaires. The scale content valid index values were 0.97, 0.92, 1, 0.95, and 0.98 for the knowledge, attitude, organizational support, HWE assessment, and PI prevention practice questionnaires, respectively. The reliability of the questionnaires was tested with 20 ICU nurses. The intraclass correlation coefficient for the knowledge questionnaire was 0.72, and the Cronbach α values were .70, .87, .96, and .85 for the attitude, organizational support, HWE assessment, and PI prevention practices questionnaires, respectively.



Data Collection

Data were collected from March 31, 2020, to April 30, 2020, via an online questionnaire platform. The survey consisted of two consecutive stages: the preparation phase and implementation phase. In the preparation phase, the authors created a list of secondary and tertiary care hospitals with ICU departments. Next, the researchers contacted the ICU head nurses to help announce the survey and recruit participants.

In the implementation phase, the researchers sent the link for the survey to the ICU head nurses and asked them to send the link to the study population. Participants were asked to complete the anonymous survey online voluntarily in their spare time. An introductory text was provided alongside the questionnaire informing participants about the objectives of the study, the confidentiality of personal information, and included a request for consent to participate. Participants who were willing to participate in the survey selected "I agree to participate in the study" by way of consent.

Ethics

Ethical approval was obtained from the Center for Social and Behavioral Sciences Institutional Review Board, Prince of Songkla University, Thailand (2020 Nst-Qn 001), and Guizhou Medical University, China (2019-162).

Statistical Analyses

Sample size was determined by Yamane formula $N/1 + N \cdot e^2$.³² For this study, the total population of adult ICU nurses was estimated to be 2,586 in Guizhou province, and the confidence interval was set at 95%. Therefore, the minimum sample size required was 347 ICU nurses. Considering the low response rate for online surveys,³³ the researchers added an extra 50% to the number of participants and increased the desired sample size to 520 participants.

SPSS version 23 (IBM Corp, Armonk, New York) was used for data analysis. The statistical significance level was set at $P < .05$. Descriptive statistics of frequency, percentage, and mean \pm SD were computed to describe participant characteristics. A hierarchical multiple regression analysis was conducted to determine the predictive power of each variable in practice. Assumptions including normality, linearity, homoscedasticity, autocorrelation, and multicollinearity were tested, revealing that all were met.

RESULTS

A total of 510 ICU nurses who completed the online survey were included in the study. The majority of participants were women (84.9%), with the mean age of 30.42 ± 5.32 years, with a bachelor's degree or above (71.4%). Most of the participants were from tertiary care hospitals (65.5%). The length of their work experience in

the ICU ranged from 1 month to 21.58 years. Approximately half of the participants (50.8%) had more than 5 years' experience working in the ICU, and 12.4% of them had less than 1 year. Regarding PI prevention training, 66.9% of participants had received training in the last year, but 95.3% of participants reported that they needed more (Table 1).

The average score for PI prevention practice was 70.85 ± 11.52 . Descriptive statistics for PI prevention knowledge, attitudes, organizational support, and HWE are presented in Table 2. Pearson correlation analysis demonstrated a significant and positive relationship between PI prevention practice and knowledge ($r = 0.18$, $P < .01$), attitudes ($r = .39$, $P < .01$), organizational support ($r = 0.46$, $P < .01$), and HWE ($r = .48$, $P < .01$). Therefore, these factors were subsequently entered into four blocks of the regression model. The HWE (most significantly correlated to PI prevention practice) was entered into the first block. Then, organizational support, attitudes, and knowledge were entered into the second, third, and fourth blocks, respectively.

Table 1. PARTICIPANT CHARACTERISTICS (N = 510)

Variables	n (%) Unless Otherwise Noted
Age, mean \pm SD (minimum-maximum), y	30.42 \pm 5.32 (21-50)
21-30	280 (54.9)
31-40	209 (41)
41-50	21 (4.1)
Sex	
Female	433 (84.9)
Male	77 (15.1)
Final education level	
Diploma	146 (28.6)
Bachelor and above	364 (71.4)
Hospital type	
Tertiary	334 (65.5)
Secondary	176 (34.5)
Working experience in ICUs, y (minimum-maximum)	1 mo to 21.58 y
<5	251 (49.2)
5-10	187 (36.7)
>10	72 (14.1)
Previous PI prevention training	
Yes	341 (66.9)
No	169 (33.1)
Need for PI prevention training	
Yes	486 (95.3)
No	24 (4.7)

Abbreviation: PI, pressure injury.

**Table 2. PARTICIPANT VARIABLES (N = 510)**

Variables	Mean ± SD	Possible Score
Pressure injury prevention knowledge	14.48 ± 2.04	0–22
Attitudes on pressure injury prevention	39.86 ± 4.48	13–52
Organizational support	28.84 ± 5.89	6–40
Healthy work environment	67.88 ± 11.97	18–90

Table 3 displays the summary of the hierarchical multiple regression analysis. It revealed that HWE accounted for 23.2% of the variance in PI prevention practices ($R^2_{\text{adjusted}} = 0.232, P < .001$). The addition of organizational support for PI prevention increased the variance to 24.8% ($R^2_{\text{adjusted}} = 0.248, P < .001$), with a change of 1.8% ($R^2_{\text{change}} = 0.018, P < .001$). The PI prevention attitudes in block 3 could explain the additional 7% ($R^2_{\text{change}} = 0.07, P < .001$) of the variance in practice, increasing the total R^2 to 31.7% ($R^2_{\text{adjusted}} = 0.317, P < .001$). The addition of the knowledge variable into block 4 contributed to an additional 0.4% variance in PI prevention practice; however, this finding was not significant ($R^2_{\text{change}} = 0.004, P = .07$). Overall, the full regression model could explain 31.7% of the variance in practice regarding PI prevention. An HWE ($\beta = .29, P < .001$) and attitudes ($\beta = .26, P < .001$) toward and organizational support for PI prevention ($\beta = .16, P < .01$) were significant predictors for PI prevention practices.

DISCUSSION

This study revealed that HWE, organizational support for PI prevention, and PI prevention attitudes were significant predictors for practice among ICU nurses in China. By contrast, PI prevention knowledge did not appear to influence PI prevention practices significantly.

Although 66.9% of participants reported receiving training on PI prevention in the previous year, 95.3% of them attested that they needed further training on PI prevention. This phenomenon may be correlated with several factors. First, the amount of PI prevention training provided for ICU nurses may be insufficient. Unfortunately, this study

did not quantify training on PI prevention. In addition, the training provided may not have been high-quality or effective. Accordingly, these authors recommend that nursing managers provide more learning opportunities for ICU nurses regarding PI prevention and ensure high quality and effectiveness of said training.

An HWE was a significant predictor of PI prevention practice among ICU nurses in China. This finding indicates that the healthier the work environment, the better the nursing practices. To the best of the researchers' knowledge, the present study was the first to explore the predictive power of HWE in determining nursing practice regarding PI prevention. Skilled communication, true collaboration, effective and appropriate decision-making, meaningful recognition, and authentic leadership ensure a healthy professional environment in which nurses can make optimal contributions to ensure optimal patient outcomes.³⁴ A poor work environment associated with low job satisfaction, high intent to leave, and emotional burnout is related to hospital accidents such as medical errors.^{35–37} This finding was also supported by Shrestha,²⁵ who found that an HWE positively correlated with ICU nurses' practice regarding PI prevention.

Organizational support for PI prevention was a significant predictor for PI prevention practice among ICU nurses in China. This finding revealed that participants who received greater support from their facility had a higher level of PI prevention practice. Organizational support refers to providing updated PI guidelines, the presence of wound specialist nurses in the unit, the availability of adequate equipment for PI prevention, and training on PI prevention to promote optimal care.

This finding was consistent with that of previous studies, in which the availability of PI guidelines,^{11,21} presence of a wound specialist,²¹ adequate equipment,¹⁶ and training on PI prevention²¹ were significant predictors for PI prevention practices. The availability of guidelines provides nurses with existing evidence, promoting nurse-level selection of evidence-driven preventive measures over nursing care based on personal experience.²¹ Wound specialists receive good training on PI

Table 3. HIERARCHICAL REGRESSION ANALYSES PREDICTING PRACTICE

Independent Variables	Block 1		Block 2		Block 3		Block 4		95% Confidence Interval
	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	
Healthy working environment	.483	<.001	.316	<.001	.283	<.001	.288	<.001	.17 to .39
Organizational support			.214	.001	.166	.005	.159	.007	.08 to .54
Attitudes					.276	.000	.258	<.001	.47 to .86
Knowledge							.068	.074	-.04 to .81
R^2_{adjusted}	.232		.248		.317		.320		
R^2_{change}			.018 ^a		.07 ^a		.004		

^a < .01.

prevention and can function as educators and advisors to empower and help nurses adhere to evidence-based practice regarding PI prevention.^{21,38} It is not surprising that adequate PI prevention equipment can support practice; pillows, cushions, skin barrier products, and support surfaces are often required to support recommended interventions.^{12,13} The lack of this equipment might impede nurses' motivation and/or ability to implement preventive measures.¹⁶ Finally, training nurses on PI prevention can improve practice because it affords opportunities for nurses to obtain firsthand information concerning PI prevention, thus increasing their knowledge and capability to prevent PIs.³⁸

Consistent with previous studies, attitudes toward PI prevention are a significant predictor of PI prevention practices.^{23,24} Theoretically, participants with more positive attitudes toward an issue are more likely to show a positive behavior regarding the issue.³⁹ An increase in positive attitudes may correlate with a higher interest in PI prevention, motivating nurses to carry out positive practices regarding PI prevention. This finding was supported by Kim et al,²¹ who stated that nurse interest in PI care was a significant predictor of PI care practices.

That said, knowledge was not a significant predictor of PI prevention practice among ICU nurses in China. This finding differs from a previous study by Tallier et al,²² who reported that PI knowledge was a significant predictor of PI prevention practices. Tallier et al²² found that nurses' PI prevention knowledge corrected score was 72%, higher than the 65.82% in the current study (14.48/22, Table 2). They also revealed that with each point increase in knowledge percentage score, nurses were 1.14 times more likely to perform better in PI prevention.²² There are several possible reasons for this difference, including different sample (perioperative nurses), different study tools, different definition of PI prevention practices, and different training for or participation in PI continuing education. The dependent variable measured in the present study was actual PI preventive practices, not a comparison of expected PI preventive behaviors to actual practice. Further, the PI knowledge questionnaire used by investigators modified some subscales and the response format from the original version,²⁹ and the unit of analysis was a total knowledge score, not a corrected score. Accordingly, the studies are difficult to directly compare.

Another reason knowledge did not play as large a role as the other factors identified might be that the knowledge questionnaire in this study focused on pathophysiology, such as etiology and classification of PIs, which was not mirrored in the PI prevention practice questionnaire. Moreover, this may be attributed to the gap between theory and practice.⁴⁰ There is no doubt that knowledge is a prerequisite for nurses to identify patients at risk for

PIs, to select appropriate preventive measures, and to perform interventions in correct ways. However, the integration of knowledge into practice is multifactorial. Staff shortages, heavy workload, and lack of time, equipment, and resources may be barriers for PI prevention by nurses.^{38,40} Consequently, it is possible that participants with more knowledge cannot evince a higher level of PI prevention practice. This finding was supported by Demarre et al²³ and Beekman et al,²⁴ who also reported that knowledge was not a significant predictor for nurses' adherence to PI prevention recommendations.

Limitations

The sample of this study consisted of ICU nurses in only one province of China, so it may not be possible to generalize the results to other countries or populations. Further, self-reported questionnaires were used in this study; participants may have overstated actual preventive practices, resulting in inflated scores and skewing of results. A future observational study is recommended to examine actual PI prevention practices among ICU nurses. Finally, this study was conducted using convenience sampling, which could introduce selection bias.

CONCLUSIONS

These results indicated that HWE, organizational support for PI prevention, and attitudes on PI prevention were significant predictors of PI prevention practices. Therefore, to enhance ICU nurses' practice regarding PI prevention, it is particularly important for hospital and nursing administrators to establish an HWE, as well as a supportive workplace for ICU nurses, and to cultivate nurses' positive attitudes toward PI prevention. ●

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