


ORIGINAL ARTICLE

Critical care nurses' knowledge, attitudes, and practices of pressure injury prevention in China: A multicentric cross-sectional survey

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Abstract

Pressure injury is a serious and preventable problem in intensive care units. Translating guidelines into clinical practice can reduce the incidence of pressure injury. Identifying clinical status, barriers and facilitators contribute to guideline implementation. To identify the knowledge, attitudes, and practices of pressure injury prevention in Chinese critical care nurses. Secondary data were extracted from a multicentric clinical trial. Knowledge and attitudes toward pressure injury prevention were assessed by a fourteen-item questionnaire. The observed practices were recorded using a case report form. The report complies with the STROBE statement. A total of 950 critical care nurses in 15 hospitals from six provinces of China were investigated. A total of 53.1% of nurses received a median score of 6 points or less. Knowledge regarding the repositioning procedure, risk assessment, and heel pressure injury prevention was insufficient. Over 99% of nurses strongly or somewhat agreed that pressure injury prevention was very important and that they were willing to take measures to prevent pressure injury. A total of 27 781 patient days of pressure injury prevention practice were recorded. Repositioning was the most commonly used prevention measure, followed by support surfaces and prophylactic dressings. A combination of repositioning, support surface, and prophylactic dressing was lacking. Chinese critical nurses showed a low level of knowledge and a positive attitude toward pressure injury prevention. Practices of pressure injury prevention were unsatisfactory. There is a clear gap between the guidelines and clinical practices. The barrier (low-level knowledge) and facilitator (positive attitude) were identified in this study. According to these findings, strategies need to be developed to promote guideline implementation.

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KEYWORDS

attitude, knowledge, practice, pressure injury, prevention

Key Messages

- this study is the first to provide a comprehensive map of Chinese critical care nurses' knowledge, attitudes, and practices in pressure injury prevention
- practices of pressure injury prevention were obtained from observation records rather than self-report questionnaires
- a total of 27 781 patient days of pressure injury prevention practice were used to analyze the gap between clinical practice and guidelines. Barriers and facilitators were identified by 950 critical care nurses' knowledge and attitude outcomes
- this survey presents further quality improvements in pressure injury prevention for critical care

1 | INTRODUCTION

Although there have been a variety of studies and quality improvements focusing on pressure injury (PI) prevention, hospital-acquired PI remains a frequently occurring problem throughout the world.¹ Worldwide, the prevalence of hospital-acquired PI varies from 0.2% to 26.3%,²⁻⁴ with significant heterogeneity observed among different geographic locations and healthcare institutions. The global pooled prevalence of hospital-acquired PI and PI in adult patients was 8.4% and 12.8%, respectively, according to a recent systematic review.¹ PI is related to adverse effects on the health system and patients, posing an increasing infection risk, pain and sadness,⁵ and prolonged hospitalization,⁶ reducing patients' safety and quality of life⁷ and resulting in a high financial burden for healthcare.⁸

The prevalence and incidence rates of individuals in the intensive care unit (ICU) are normally higher than those of other patients.^{9,10} According to a systematic review, the combined prevalence and incidence of PI in adult ICU patients had 95% confidence intervals (CI) of 16.9% to 23.8% and 10.0% to 25.9%, respectively.¹¹ Patients in the ICU are especially vulnerable to PI due to the complex conditions. The most prominent of many causative and confusing conditions is reduced mobility.¹² Devices employed in the ICU, including respiratory devices, urinary/fecal collection devices, nasogastric and feeding tubes, vein and arterial lines, blood pressure cuffs, and compression stockings, also increase the risk of PI.^{13,14} A total of 34.5% of hospital-acquired PI in ICU patients was assessed to be medical device-related. When an individual used a medical device, they were 2.4 times more likely to have a PI.¹⁵ ICU patients who have frequently hemodynamically compromised are also at risk of deep tissue injury due to hypotension, shock, or

dehydration.¹⁶ Other risk factors for PI involve age, nutrition, skin status, and vasopressor administration.^{17,18} A study of 13 254 patients in 1117 ICUs among 90 countries illustrated that steadily increasing connections with mortality were recognized for the increased severity of PI.⁹ With the rising aging population and recent advances in medical technologies, the demand for critical care is on an upward trajectory. A China multicenter survey showed that 19.23% of 23 985 patients had ICU stays during hospitalization.¹⁹ A systematic review found that the ICU PI prevalence was the highest in China.²⁰ Therefore, it is desirable to focus on PI in the ICU in the Chinese population.

PI is preventable.¹² PI prevention is a comprehensive procedure that includes essential elements: repositioning, prophylactic dressings, support surfaces, and general care (risk and skin assessment, nutrition). These prophylactic measures have been recommended by several clinical practice guidelines.^{12,21,22} The effectiveness of translating clinical practice guidelines into practice for the reduction of PI incidence has been examined.^{23,24}

Nurses come in contact with individuals who are at a higher risk of having PI daily. Therefore, they play a key part in multidisciplinary teams regarding PI prevention.²⁵ However, previous studies have shown that nurses do not sufficiently comply with the guidelines of PI prevention.^{26,27} One of the barriers to the implementation of PI prevention clinical practice guidelines can be a lack of knowledge.^{28,29} Knowing that nurses' knowledge and attitudes toward PI prevention are related to the quality of their care,³⁰ a study on nurses' attitudes, and knowledge toward PI prevention is capable of enhancing prevention behaviors.³¹ To remove barriers, close the gap between practices and guidelines, and improve care quality, authorities and policymakers in the nursing field

should gain as much about nurses' knowledge, attitudes, and practices associated with PI prevention.

Several studies have investigated the knowledge, attitudes, and practices of ICU nurses about PI prevention.³²⁻³⁶ The studies suggest that the result of knowledge, attitudes, and practices is contradictory. It is difficult to compare due to different sample and cutoff scores. Moreover, PI prevention practices were obtained by nurses self-reported in most studies. There may be inconsistencies between self-reported results and actual clinical practices. Although a study has investigated ICU nurses' knowledge, attitudes, and behaviors in western China,³² there is a scarcity of data that are multicentric with more geographic regions. Before we conducted a before and after clinical trial intended at assessing the efficacy of a standardized nurse intervention in preventing significant immobility problems in hospitalized immobile patients.^{19,37} This trial was performed in different China's geological areas (eastern, southern, western, northern, and central). In this study, secondary data analysis was used. Therefore, the objective of this study was to identify ICU nurses' self-reported knowledge and attitudes and observed and recorded practices of PI prevention.

2 | MATERIALS AND METHODS

This study was reported in compliance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement³⁸ (Supplementary file 1). Nurses working in the ICU are the target population of this secondary data analysis. Therefore, the word "ICU" was used to look for and retrieve relevant data from before and after the clinical trial. To avoid the influence of intervention, these secondary data are only drawn from the baseline phase of the clinical trial (Supplementary file 2).

2.1 | Sampling strategy

This clinical trial was carried out at 25 hospitals (6 tertiary, 12 secondary, and 7 community hospitals) covering six provinces or municipality cities. To choose hospitals, a convenience sampling strategy depending on the number of nurses and beds per hospital was used. The following were the nurse participants' inclusion criteria: (a) registered nurses; (b) with at least one year of experience; and (c) who understood the study's objectives and signed the permission form. The exclusion criteria were as follows: nurses worked part-time, either refreshed or in-training individuals.

2.2 | Data collection

The investigation of nurses' self-reported knowledge, subjective attitudes toward PI prevention, and demographic information (gender, age, location, and education) was conducted from September 2015 to October 2015. Nurses' PI prevention practices were observed and recorded from November 2015 to March 2016.

2.2.1 | Nurses' knowledge and attitude

Nurses' knowledge and subjective attitudes regarding PI prevention were collected using a self-administered structured questionnaire. The questionnaire consisted of 14 single-choice questions: knowledge (9 items) and attitude (5 items) (Supplementary file 3). Correct answers concerning knowledge questions received a score of 1, while incorrect responses received a score of 0. Total knowledge scores ranged from 0 to 9. Attitudinal scores were based on a 4-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree). Total attitude scores ranged from 5 to 20.

The questionnaire was developed based on the Association for the Advancement of Wound Care Pressure Injuries Guidelines.³⁹ The questionnaire's content validity was appraised by five professionals with 20 years of clinical experience (one enterostomal therapist, one expert in clinical nursing, one academic, and two nurse managers). The scale-level content validity index (S-CVI) and item-level content validity index (I-CVI) were computed through expert ratings. The final questionnaire was demonstrated to be valid after modifications, with an S-CVI and an I-CVI score of 1.0. Stability and internal consistency were achieved through test-retest reliability and Cronbach's α , respectively. With 30 nurses participating, the questionnaire's test-retest reliability was evaluated during fourteen days period. The test-retest reliability score was 0.875, and the Cronbach's α score was 0.795.

A trained investigator was in charge of recruiting nurses and giving information about the study aims to potential participants in each participating hospital. Before the survey, it was emphasized to possible respondents that the questionnaire would only be used for study goals and would have no impact on their performance evaluation. While answering the questionnaire, nurses were not permitted to communicate with one another, examine the literature or obtain any information on the relevant issue. Participants were instructed to sit alone and finish the paper questionnaire under the investigators' supervision. The amount of time needed to complete the questionnaire was approximately 10 minutes. The investigator checked all questionnaires to ensure that there were no missing

items after the completion and delivery of the questionnaire.

2.2.2 | Nurses' practices

Nurses' practices of PI prevention were collected using a self-designed case report form (CRF), which included PI prevention measures (repositioning, prophylactic dressings, and support surfaces). The development of the CRF was mainly based on the Minimum Data Set instrument^{40,41} and Landelijke Prevalentiemeting Zorgproblemen questionnaire.⁴² The CRF has gone through three rounds of expert consultation and revision. A fourteen-day pilot survey was performed in the clinics to assess the CRF's applicability, and changes were made based on feedback from participating nurses. The CRF can be employed and understood clearly and accurately in its final version. The CRF is presented as an electronic data capture system.

Data collectors were recruited in each ICU ward with a ratio of one investigator per fifteen beds. Two registered nurses were recruited in a ward with fewer than fifteen beds. Before the survey, these data collectors received the onsite training, video, and handbook, which included the instruction on the electronic system, data collection frequency, and timing. A quiz was given to ensure that the data collectors acquired the necessary knowledge and skills after the training. For the quiz, the data collectors were required to achieve at least 85% accuracy. The PI prevention practices were observed and recorded by data collectors daily. Head nurses in units were responsible for auditing the data every day to further ensure the quality of the data. The project steering group (the authors of this study were responsible for surveillance at all participating hospitals) monitored and audited the data recorded once a week and returned feedback on errors identified via e-mail and teleconference.

2.3 | Ethical considerations

The study protocol was approved by the Human Research Ethics Committee of the P Hospital (IRB No blind for peer review). A full presentation of the trial on the covering letter was delivered to nurses. Nurses were informed that they could withdraw from the trial at any time and that they needed to write informed consent before the study.

2.4 | Data analysis

SPSS statistical software IBM version 25 was used to analyze the collected data. Categorical variables are described

TABLE 1 Demographic characteristics of the ICU nurses (n = 950)

Variables	n (%) / mean \pm SD
Age (year)	28.5 \pm 4.5
Experience in nursing work (year)	6.4 \pm 5.1
Gender	
Male	116 (12.2)
Female	834 (87.8)
Education	
Diploma or below	287 (30.2)
Bachelor or above	663 (69.8)
Professional title (n = 948)	
Primary	816 (86.1)
Medium	127 (13.4)
Senior	5 (0.5)
Clinical nurse leaders	
No	875 (92.1)
Yes	75 (7.9)
Hospital level	
Secondary hospital	171 (18.0)
Tertiary hospital	779 (82.0)
Province/municipality	
Hubei	71 (7.5)
Beijing	108 (11.4)
Zhejiang	123 (12.9)
Guangdong	187 (19.7)
Sichuan	190 (20.0)
Henan	271 (28.5)
Economic region	
West	190 (20.0)
Middle	342 (36.0)
East	418 (44.0)
PI prevention training history	
Education courses in the ward	932 (98.1)
Education courses in the hospital	815 (85.8)
Education courses outside the hospital	219 (23.1)
Attended conferences abroad	20 (2.1)
Searched the guidelines and literature	515 (54.2)
Interactions with colleagues	655 (68.9)

Abbreviation: SD, standard deviation.

as the frequency and percentages, while continuous variables are described as the mean \pm SD (standard deviation). Bar graphs were adopted to show self-reported PI prevention attitudes. To show the relative proportions of PI prevention practices, pie charts were employed. An Excel spreadsheet was used to obtain the figures.

3 | RESULTS

3.1 | Characteristics of the ICU nurses

Overall, the baseline survey contained 3903 nurses from 25 hospitals. Some nurses work in non-ICU wards, so a total of 950 ICU nurses in 15 hospitals (6 tertiary, 9 secondary) were extracted from the baseline survey. The nurses' mean age was 28.5 ± 4.5 years. Most respondents were female (87.8%) and held a bachelor's degree or higher (69.8%). Most respondents worked in tertiary hospitals (82.0%) and received PI prevention education courses on the ward (98.1%). Table 1 shows the ICU nurses' demographic characteristics.

3.2 | ICU nurses' knowledge regarding PI prevention

The mean score of knowledge was 6.27 ± 1.37 (95% CI: 6.19–6.36) out of a maximum score of 9 points. For all 9 knowledge items, the total average correctness rate was $69.7\% \pm 21.5\%$ (95% CI: 55.4–82.1). A total of 53.1% of nurses ($n = 504$) received a median score of 6 points or less, with an overall average accuracy rate of 58.0%. The percentage of ICU nurses who could identify the correct repositioning procedure was 42.4%; identification of risk factors and high-risk populations of PI was 47.1%; identification of proper measures to prevent heel PI was 67.5%; identification of PI predilection areas for immobile patients was 74.7%.

3.3 | ICU nurses' attitude regarding PI prevention

Over 99% of participants strongly or somewhat agreed that PI prevention was very important; they were willing to prevent PI by observing the corresponding measures; they should initiatively perform a periodic assessment to evaluate the risk of PI. Over 98% of the nurses strongly or somewhat agreed that PI prevention is one of the important aspects of nursing care. Approximately 16% of the nurses strongly or somewhat disagreed with the strong associations between PI and low-quality nursing care. Figure 1 illustrates these findings.

3.4 | ICU nurses' practice regarding PI prevention

The administration of repositioning, prophylactic dressings, and support surfaces were recorded daily during the

survey. A total of 27 781 patient days of PI prevention practice behavior were observed and recorded. Repositioning was the most commonly used method (85.1%), followed by support surfaces (80.4%) and prophylactic dressings (13.1%). Figure 2 shows the observed and recorded practice of PI prevention. The most frequently used repositioning was every two hours (q2h). The 89.3% and 75.1% repositioning frequently used was q2h during daytime and nighttime, respectively. The more commonly used support surface was alternating soft pillows/cushions and pressure air mattresses. The most frequently employed prophylactic dressing was foam dressing.

4 | DISCUSSION

In this study, eastern, southern, western, northern, and central China ICU nurses' self-reported knowledge and attitudes and observed and recorded practices of PI prevention were investigated. The findings demonstrated that their knowledge was low, their attitude was generally positive, and their practices were unsatisfactory.

4.1 | ICU nurses' knowledge and attitudes of PI prevention

Based on the results of the knowledge survey questionnaire, this study found that the knowledge level of PI prevention in ICU nurses ($n = 950$) was low. The mean knowledge score was 6.27 ± 1.37 (in a whole range of 0–9). This finding was consistent with the findings of past ICU nurses' survey studies from Guizhou Province, China ($n = 510$),³² Iran ($n = 308$),³³ Turkey ($n = 390$),³⁴ and Cyprus ($n = 102$)³⁵ but inconsistent with the results in Iran ($n = 183$).³⁶ The reason may be the differences in sample size, region, and cutoff point for classifying satisfactory knowledge. For all nine knowledge items, the total average accuracy rate was 69.7%. Knowledge accuracy is higher than the national average of 64.07% in China.³⁷ This may be due to ICU patients having susceptibility and tolerance to the individual risk factors for PI and mechanical boundary conditions.¹² As a result, ICU nurses need more PI knowledge than other nurses.

A total of 42.4% of nurses identified the correct repositioning procedure, mainly since they are not sure that the side 90° or 30° lateral position is more effective. A study³² also reported that 61.8% of nurses mistakenly considered that the side 90° lateral position is much more beneficial than the side 30° lateral position. A total of 47.1% of nurses identified risk factors for PI in this study. The accuracy rate is lower than that of Iranians (80.9%)³⁶ and Ethiopia (92.6%).⁴³ The reason may be that managers did

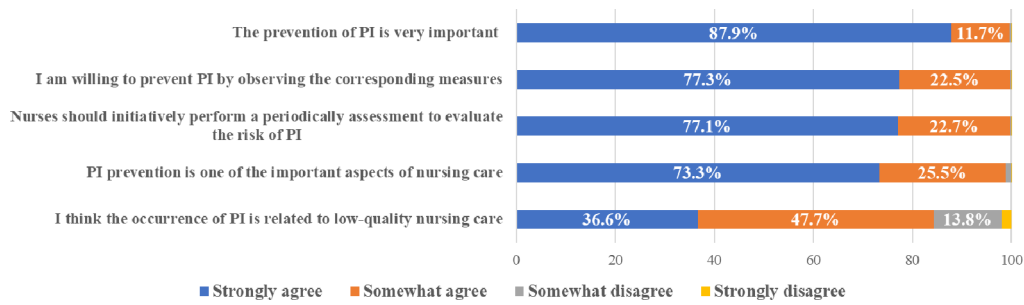


FIGURE 1 Nurses' attitudes regarding PI prevention

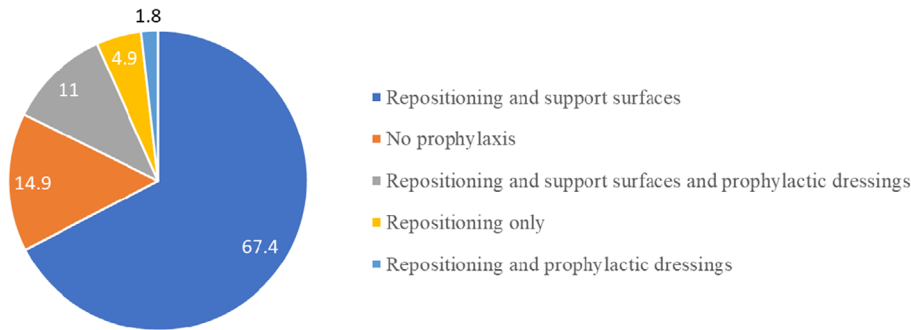


FIGURE 2 The overall use rate of prevention measures

not focus on the training of relevant knowledge, or nurses rely largely on risk assessment tools and lack comprehensive knowledge of risk factors. A total of 67.5% of nurses identified proper measures to prevent heel PI, which is in agreement with the findings of an early study.³⁶ However, ICU patients are more vulnerable to heel PI.⁴⁴ In clinical practice guidelines, reducing heel PI is also an essential consideration.¹²

Although 98.1% of nurses accepted PI prevention education courses in wards in this study, the nurses' knowledge level of PI prevention was low. This may be related to outdated and inadequate PI prevention education provided for nurses. Outdated education content may have not been updated with the latest evidence. Evidence-based practice must be included in nursing education courses.⁴⁵ For example, many nurses do not know the repositioning angle of the slide lying position; however, the clinical practice guideline has given clear recommendations.¹² The existence of inadequate PI knowledge was also founded on a content analysis, which showed that only a quarter of the PI chapters had sufficient content in the textbooks.⁴⁶ Nurses may have spent time acquiring PI prevention knowledge, but knowledge has not been improved due to insufficient information in textbooks or training contents. Nursing managers and policymakers should pay attention to current education issues and provide evidence-based and comprehensive textbooks and education courses to enhance nurses' PI prevention knowledge.

Nurses showed a generally positive attitude toward PI prevention according to the findings of the attitude

survey questionnaire. A similar finding was found among ICU nurses from Guizhou Province, China.³² In general, descriptive studies that assess attitudes regarding PI prevention in ICU nurses yield inconsistent discoveries. The reported attitude level is divided into three types: positive,^{35,36,47} moderate,⁴⁸ and negative.^{33,49} The difference in results might be attributed to nurses' knowledge level, healthcare policy, and data collection tools.

For the attitude item "I think the occurrence of PI is related to low-quality nursing care," most nurses strongly or somewhat agree with it, and approximately 16% of nurses expressed the opposite attitude. This may be related to the presence of unavoidable PI. In an environment where numerous competing and life-saving duties sometimes take precedence, ICU nurses must be able to successfully balance PI prevention. PI does occur in ICU patients despite prevention efforts.⁵⁰ However, nurses should still be active in PI prevention since avoidable PI takes place when preventive strategies are not appropriately implemented.⁵¹ In fact, PI is not a clinical issue prevented by nurses alone, especially in the ICU. Another aspect worth investigating is the importance of interdisciplinary collaboration in PI prevention measures.

4.2 | ICU nurses' practice of PI prevention

The results of the study suggest that PI prevention practices are unsatisfactory according to observed and

recorded data. Of the prevention measures, repositioning was the most common in PI prevention clinical practice (85.1%). Similar results were indicated in a past study.²⁶ This research showed that the most frequent repositioning was every 2 hours (q2h). The frequency of repositioning at q2h was also the highest in Ethiopia.⁴³ A turning regimen of q2h also seems to be routine in southwest Virginia.⁵² However, “choosing wisely Canada” recommended that individuals not employ a q2h turning routine unless it is part of the older person's care plan.⁵³ In fact, the evidence conflicts with potential differences between different turning frequencies.^{54,55} According to certain research, more frequent repositioning was not related to a substantial reduction in the incidence of PI.^{40,41,56} Other studies have the opposite conclusion.^{57,58} Guidelines recommend repositioning all individuals on individualized schedules.¹² Moreover, it may not be safe to turn a person for restricted medical disorders. For patients who are unable to maintain a periodical repositioning routine, nurses should initiate frequent small shifts and supplement regular repositioning.¹² The implementation of guidelines may be able to help nurses personalize the frequency and method of repositioning according to each patient's needs. More research is required to be conducted on effective decision support tools or pressure mapping that help nurses make decisions regarding the frequency of repositioning.

Prophylactic dressings were the relatively rarely used PI prevention practice among clinical practices (13.1%), suggesting that prophylactic dressing practices were insufficient. A Saudi Arabian study reported the same findings.⁵⁹ Previous studies have shown a link between a lower incidence of PI and preventive dressings among the immobile population in the ICU.^{60,61} Under normal conditions, ICU patients have respiratory devices, urinary/fecal collection devices, and other devices. The annual medical device-related pressure injury (MDRPI) prevalence was high.¹⁴ Studies have found that in a number of individuals, the administration of prevention dressings at the device-skin surface reduces the occurrence of MDRPI.⁶² Guidelines also recommend that prophylactic dressing beneath a medical device is capable of reducing the risk of MDRPI.¹²

The guideline did not recommend a single use of support surface or prophylactic dressing.¹² In this study, the support surface or prophylactic dressings were not used alone. However, a combination of repositioning, support surface, and prophylactic dressing was only 11% in this study. This finding agreed with the results of an earlier study before the intervention phase.⁶³ Studies have shown that multicomponent PI prevention measures are more effective than a single measure.^{64,65} Thus, clinical practice guidelines offer an overview of useful

approaches to consider by ICU nurses when conducting PI prevention practices.

ICU nurses should be conscious of PI prevention measures and can implement them. Education and experience influence nurses' knowledge and attitudes, which have a heavy impact on behaviors. Following an in-depth discussion that combined clinical practice guidelines with China's clinical status in China, the following factors should be considered in efforts to enhance PI prevention in the ICU. First, the effectiveness and quality of PI prevention training content should be enhanced. Education content should be evidence-based and adequate. Face-to-face, video, and virtual training means should be developed further. Second, repositioning on individualized schedules is difficult to carry out compared to q2h. Nurses need to establish and document individual pressure relief schedules based on an individual's physiological, mental, and psychological characteristics and the type of prophylactic dressings and support surfaces in use. If the individual does not respond to the regimen as predicted, the technique and frequency of repositioning should be reconsidered. Third, as an effective intervention to prevent MDRPI, prophylactic dressings are desirable for ICU nurses. Finally, the organization's barriers and facilitators are different. To build guideline implementation strategies that fit the facility's demands, a local assessment is needed.

4.3 | Limitations

There is a limitation associated with this study. The data were derived from a database from a previous data collection time, which might have led to results that do not accurately represent the current context. Despite this limitation, this study has remarkable advantages. A total of 950 ICU nurses in 15 hospitals (eastern, southern, western, northern, and central China) were surveyed. This is the first comprehensive multicenter study of PI prevention knowledge, attitudes, and practices among Chinese ICU nurses. A total of 27 781 days of practice behaviors were carefully observed and recorded, providing new insights into the real implementation of PI prevention measures.

5 | CONCLUSION

PI is a significant cause of morbidity and mortality in the ICU. This study is the first to present a comprehensive map of ICU nurses' knowledge, attitudes, and practices of PI prevention in China. Despite the positive attitudes toward PI prevention, nurses' knowledge regarding the

repositioning procedure, risk assessment, and heel PI prevention were insufficient. There is a clear gap between the evidence and clinical practices of PI prevention. The implementation of evidence-based guidelines is an effective measure to reduce the gap. The barrier (low-level knowledge) and facilitator (positive attitudes) for the implementation of the guidelines were identified in this study. Policymakers and nurse managers need to develop strategies focusing on barriers and facilitators to promoting guideline implementation.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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