

Critical Care Nurses' Knowledge, Attitudes, and Practices Regarding Pressure Injury Treatment: A Nationwide Cross-Sectional Survey

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Background: Pressure injury is a common problem in intensive care units. Critical care nurses play an important role in multidisciplinary teams performing pressure injury treatment. Identifying the clinical status of pressure injury treatment may contribute to improving care quality.

Aim: To identify the knowledge, attitudes, and practices regarding pressure injury treatment in critical care nurses.

Design: A cross-sectional survey.

Methods: Secondary data were extracted from a multicenter clinical trial. Knowledge and attitudes toward pressure injury treatment were assessed through a self-administered eight-item questionnaire. The observed practices were recorded using a case report form. The report was in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement.

Results: A total of 950 critical care nurses in 15 hospitals from six provinces/municipalities of China were investigated. The mean knowledge score was 2.89 ± 1.16 (95% confidence interval: 2.82–2.97) out of a possible total of 5 points. The correct rates of selecting wound dressings and pain management were 34.4% and 45.6%, respectively. The mean attitude score was 9.07 ± 1.09 (95% confidence interval: 9.00–9.13) out of a possible total of 12 points. A total of 2092 patient days of pressure injury treatment practices were observed and recorded. Repositioning was the most commonly employed treatment measure (98.8%). Foam dressing was the common dressing for stage I (53.6%), stage II (47.5%), and more severe pressure injury (67.9%), including stage III, IV, unstageable, and suspected deep tissue injury.

Conclusion: Critical care nurses exhibited a generally low level of knowledge and moderate attitudes regarding pressure injury treatment. Practices of pressure injury treatment were generally acceptable.

Keywords: pressure injury, treatment, knowledge, attitude, practice, evidence implementation

Plain Language Summary

What is known about this topic

- Individuals in the critical care unit often have a higher prevalence and incidence rates of pressure injury than other patients.
- Nurses play important roles in multidisciplinary teams performing pressure injury treatment.
- There is a gap between evidence and practice regarding pressure injury therapy. Knowing what nurses know, think, and do about treating pressure injuries will be helpful for closing this gap.

What this study adds

- This is the first study to provide a systematic view of Chinese critical care nurses' knowledge, attitudes, and behaviors regarding the treatment of pressure injuries.
- Instead of self-report surveys, observation records were used to gather practices for treating pressure injuries.
- Critical care nurses demonstrated a generally low level of knowledge and moderate attitudes regarding pressure injury treatment. Practices of pressure injury treatment were generally acceptable.

Introduction

Hospital-acquired pressure injury (PI) is a common problem worldwide. According to a recent systematic review, the global pooled prevalence of hospital-acquired PI in adult patients was 8.4%.¹ PI is associated with negative effects on the health system and patients, including an increased risk of infection, pain and sadness,² prolonged hospitalization,³ reducing patient safety and quality of life,⁴ and causing a substantial economic burden for healthcare.⁵ Individuals in the intensive care unit (ICU) have a higher frequency and incidence rate of PI than other patients^{6,7} because of the complexity of their conditions, which often involve risk factors such as reduced mobility,⁸ the use of medical devices,^{9,10} hemodynamic compromise,¹¹ older age, and poor nutrition.^{12,13} According to a systematic review, in adult ICU patients, the prevalence and incidence of PI were 16.9–23.8% and 10.0%–25.9%, respectively.¹⁴ Furthermore, mortality was observed to gradually with the severity of PI in the ICU.⁷

PI treatment refers to the care of an existing condition or wound to facilitate PI healing. PI influences patient recovery, and PI treatment is a comprehensive procedure. It is necessary to tailor treatments to the characteristics of the wound and the patient's overall health status.⁸ Nurses come into contact with individuals with PI on a daily basis. Although some treatment methods, such as surgical treatment, are difficult for nurses to apply, nursing staff must be able to accurately assess the stage of injury and perform interventions, such as repositioning and using wound dressings, to facilitate PI healing.¹⁵ Therefore, nurses play a significant role in multidisciplinary teams regarding PI treatment.¹⁶

Several clinical practice guidelines have advised PI treatment recommendations.^{8,17,18} However, a previous study reported that a substantial number of nurses do not sufficiently comply with the guidelines.¹⁹ To close the gap between the recommendations of the guidelines and clinical practices, authorities and policy-makers in the field of nursing should acquire as much state information about what nurses know, think, and do regarding PI treatment as possible.

Several studies have been conducted to assess nurses' knowledge and clinical practice regarding PI treatment.^{19–21} However, these investigations have produced contradictory findings. In Jordan, a survey found that nurses had adequate PI treatment knowledge and implementation.²¹ Similarly, a survey in the Swedish showed that nurses displayed good knowledge of PI treatment.¹⁹ In contrast, the levels of PI knowledge and implementation in clinical practice were notably lower among Spanish nurses.²⁰ Furthermore, in these previous studies, nurses self-reported their PI treatment practices, which may have led to differences between self-reported outcomes and actual clinical practice. As a result, the goal of the current study was to determine ICU nurses' self-reported knowledge, attitudes, and observed PI treatment behaviors.

Methods

Design

The cross-sectional study was reported in compliance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement.²² This study used data collected during a national multicenter health program, which was designed to assess the efficacy of a nursing intervention in hospitalized immobile patients.^{23,24} This trial consisted of three stages. In stage I, a nationwide multicenter cross-sectional baseline investigation was conducted. In this stage, medical, surgery and ICU nurses were investigated. In stage II, a nursing intervention model was established. In stage III, the effectiveness of the nursing intervention model was examined. Data for this study were drawn from stage I of the clinical trial. Nurses in ICUs were the target population of this study. As a result, the phrase "ICU" was utilized to obtain relevant data from stage I of the clinical trial.

Study Setting and Population Sample

Six tertiary, twelve secondary, and seven community hospitals encompassing six provinces or municipality cities in eastern, southern, western, northern, and central China participated in stage I of the clinical trial. Hospitals were selected

using a convenience sampling method on the basis of the number of beds and nurses. The selection of nurses in each hospital similarly followed a method of convenience sampling. The inclusion criterion for the participants was full-time registered nurses with a minimum of 1 year of experience. Students or those undergoing nursing training were excluded from the list of candidates.

Data Collection Instrument

A self-administered structured questionnaire was used to gather information about nurses' knowledge of PI treatment and their subjective attitudes regarding it. Eight single-choice questions made up the survey: five were related to knowledge, and three were related to attitudes ([Supplementary File 1](#)). For questions about nurses' knowledge, correct answers were given a score of 1, while incorrect answers were given a score of 0. Scores for all knowledge items ranged from 0 to 5. In this study, we designated a mean score more than 4 as representing a satisfactory knowledge level; a mean score range of 3 to 4 as a moderate level; and a mean score below 3 as a poor level. On the basis of a 4-point Likert scale, attitudes were scored as follows: 1 for strongly disagree, 2 for disagree, 3 for agree, and 4 for strongly agree. The range of overall attitude ratings was 3–12. In this study, we designated a mean score of 10 greater as representing a positive attitude level; a mean score range of 6 to 10 as a moderate attitude level; and a mean score below 6 as a negative attitude level.

The PI management guideline served as the basis for the development of the questionnaire.²⁵ One enterostomal therapist, one clinical nursing expert, one academic, and two nurse managers with 20 years of clinical experience each evaluated the content validity of the questionnaire. Expert evaluations were performed for the scale-level content validity index (S-CVI) and item-level content validity index (I-CVI). With a score of 1.0 on the S-CVI and I-CVI, the modified final questionnaire was shown to be valid. Test-retest reliability and Cronbach's alpha were used to attain stability and internal consistency, respectively. Over the course of 14 days, 30 nurses participated in an evaluation of the questionnaire's test-retest reliability. The Cronbach's alpha value was 0.795, and the test-retest reliability score was 0.875.

Using a self-designed case report form (CRF), nurses' PI treatment practices were gathered. These practices comprised general PI treatment measures (repositioning, support surfaces), as well as the use of specific wound dressings for various stages of PI. The Landelijke Prevalentiemeting Zorgproblemen questionnaire²⁶ and the Minimum Data Set instrument²⁷ were the fundamental foundations on which the CRF was developed. The PI stage terminology used throughout this study was derived from the international PI categorization system (2014).²⁸ A 14-day pilot survey was conducted at the clinics to evaluate the applicability of the CRF, and adjustments were made in response to input from participating nurses. The CRF's final iteration was presented as an electronic data collection tool.

Data Collection Procedures

Between September and October 2015, nurses' self-reported knowledge of PI therapy, attitudes regarding PI treatment, and demographic data (gender, age, and education) were all investigated. From November 2015 to March 2016, nurses' PI treatment practices were observed and recorded.

In each participating hospital, a trained investigator was in charge of recruiting nurses and disseminating information on the questionnaire survey. Prior to the survey, it was made clear that the questionnaire would only be used for research purposes and would not have any bearing on how well nurses were performing. Nurses were not allowed to talk to other participants or look up material in the literature while completing the questionnaire. Under supervision by the investigators, participants were encouraged to sit alone and complete the paper questionnaire. The questionnaire took approximately 10 minutes to complete in total. The investigator went through each completed questionnaire to ensure that there were no missing items.

Each ICU ward of each participating hospital hired one data collector every 15 beds to collect information on nurses' practices. Wards with fewer than 15 beds also recruited two registered nurses. These data collectors received on-site education, including videos and manuals, before conducting the survey, along with guidelines about the electronic system, data collecting frequency, and scheduling. After the training, a test was given to ensure that the data collectors had appropriate knowledge and abilities. The data collectors were required to achieve at least 85% accuracy in the test. Data collectors watched and documented the nurses' treatment procedures using CRF every day until the PI patient transferred out of the ICU, wound healing, death, or observation for 90 days. Data collected may more than one time

about the work practices of an individual nurse. It was the responsibility of the head nurses in each unit to audit the data and further assess their quality. Once a week, the data were examined and verified by the project steering group (the authors of this study were in charge of surveillance at all participating hospitals), and comments were provided on any identified errors via email and teleconference.

Statistical Analysis

Version 25 of IBM's SPSS statistical software was used to analyze the gathered data. Frequency and percentage values were used to examine categorical variables, whereas mean and standard deviation (SD) were used to examine continuous variables. Bar graphs were used to display self-reported PI treatment knowledge and attitudes. Statistics were obtained using an Excel spreadsheet.

Results

Characteristics of Critical Care Nurses

A total of 950 critical care nurses from 15 hospitals (six tertiary and nine secondary) were extracted. The average age of the nurses was 28.5 ± 4.5 years. Of the respondents, 87.8% were female, 69.8% held a bachelor's degree or above, and 82.0% worked in tertiary hospitals. A total of 98.1% of nurses attended education courses in the ward, and 85.8% of nurses attended education courses at the hospital. The demographics of the critical care nurses are shown in Table 1.

Knowledge Regarding PI Treatment

Out of a possible score of 5 points, the mean knowledge score was 2.89 ± 1.16 (95% confidence interval [CI]: 2.82–2.97). The overall average correct rate for all five knowledge items was 57.9%. Figure 1 shows the correct rate of each item. Among the different areas of PI treatment knowledge, the highest percentage of correct answers was for repositioning, and almost all nurses knew about the importance of repositioning in the treatment of PI. The lowest percentage of correct answers was for selecting wound dressings, and few nurses were able to recognize the features of various wound

Table 1 Demographic Characteristics of the Critical Care 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)
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)

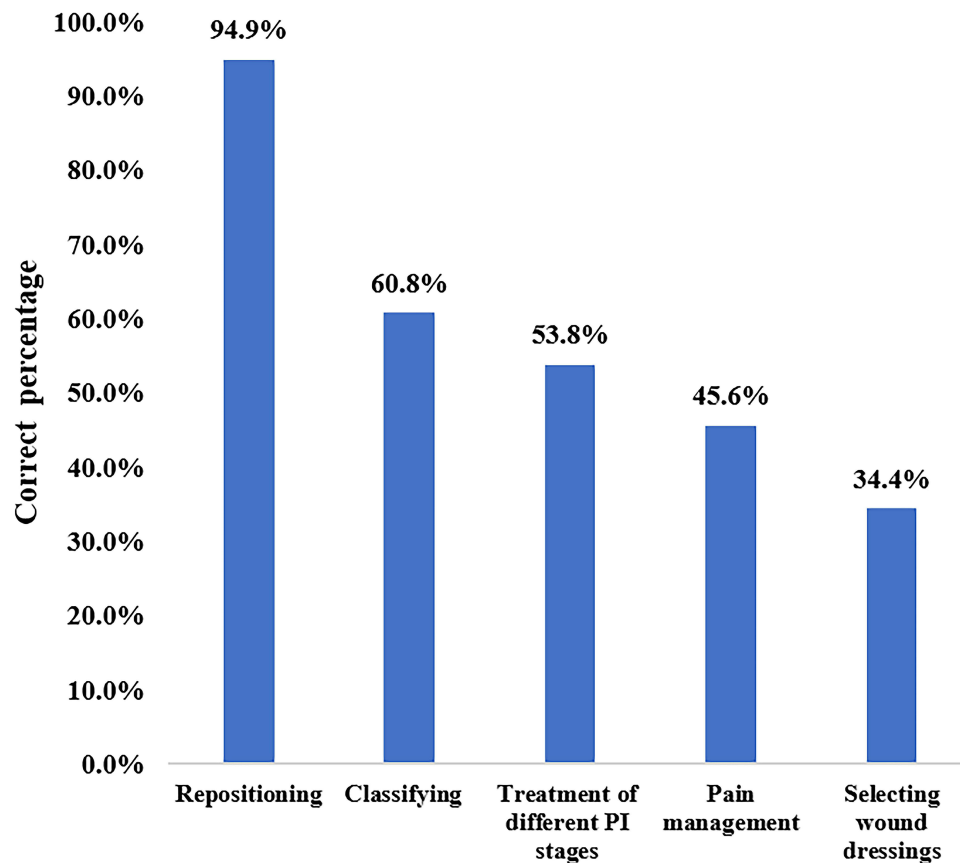


Figure 1 Critical care nurses' knowledge regarding PI treatment.

dressings and correctly select them for different types of PI wounds. In total, 53.8% of critical care nurses knew about the treatment of different PI stages and identified the correct method: “Stable and uninfected wounds at the heel should not be removed.” A total of 45.6% of critical care nurses knew about PI pain treatment methods, which included keeping the wound bed covered and moist, selecting a wound dressing that required less frequent changes, and using repositioning techniques and equipment to manage PI pain.

Attitudes Regarding PI Treatment

Out of a possible score of 12, the mean attitude score was 9.07 ± 1.09 (95% CI: 9.00–9.13). Over 98% of ICU nurses strongly or somewhat agreed that nursing is essential in the treatment of PI. More than 99% of participants strongly or somewhat agreed that they were willing to put the PI treatment recommendations into practice. 14% of the nurses strongly or somewhat agreed that taking care of PI patients adds to their burden. [Figure 2](#) shows these findings.

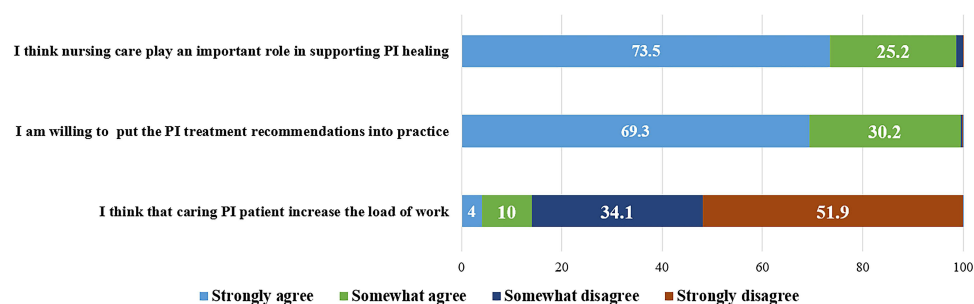


Figure 2 Critical care nurses' attitudes regarding PI treatment.

Table 2 The Critical Care Nurses Practices of Pressure Injury Treatment

General Treatment Measures (N=2092)	Repositioning=2066 (98.8%)
	Support Surface=2028 (96.9%)
Stage I (n=1208)	Foam dressing=647 (53.6%)
	Hydrocolloid dressing=549 (45.4%)
Stage II (n=446)	Foam dressing=212 (47.5%)
	Hydrocolloid dressing=178 (39.9%)
Stage III	Foam dressing=182 (67.9%)
Stage IV	Alginate dressing=18 (6.7%)
Unstageable	Hydrogel dressing=10 (3.7%)
Suspected deep tissue injury (n=268)	Silver ions dressing=5 (1.9%)

Practices Regarding PI Treatment

A total of 2092 patient days of PI treatment practice behavior were observed and recorded. Among them, 1208 patient days of stage I, 446 patient days of stage II, and 268 patient days of more severe stages, including stage III, IV, unstageable, and suspected deep tissue injury PI treatment practice behavior, were recorded.

The most commonly used general treatment measure was repositioning. The repositioning frequency was every 2 hours during daytime in 80.4% of cases and every 2 hours during night-time in 78.8% of cases. Alternating soft pillows/cushions and pressure air mattresses were the most common support surfaces, used in 92.1% and 90.5% of cases, respectively. The observed practices of PI treatment are shown in Table 2.

Discussion

The self-reported knowledge and attitudes of ICU nurses in eastern, southern, western, northern, and central China, as well as observed practices of PI therapy, were evaluated in this study. The findings demonstrated that nurses had generally poor knowledge in terms of PI treatment and showed moderate attitudes regarding this treatment area. The results revealed that nurses' PI treatment practices were generally acceptable.

On the basis of the knowledge survey questionnaire, the current study revealed that critical care nurses' level of knowledge of PI treatment was relatively low. Recommendations of guidelines for PI treatment were not widely disseminated, and only 57.9% of nurses had a basic understanding of them. This result was in accord with the findings of nursing staff survey studies in Canada²⁹ (n = 256) and Spain²⁰ (n = 740) but was inconsistent with the results of studies in Sweden¹⁹ (n = 154) and Jordan²¹ (n = 600). One possible reason is that the differences in questionnaires led to different results. Some questionnaires used "yes" or "no" options and relatively few treatment knowledge items. It may be desirable to develop an effective PI treatment questionnaire to facilitate a comprehensive understanding and comparison of nurses' PI treatment knowledge. Another possible reason for the difference between the current findings and those of some previous studies is that PI treatment knowledge has changed dynamically over time, and nurses may not be able to constantly update their knowledge and processes. ICU nurses would be expected to have more PI-related knowledge than other types of nurses because the ICU has a higher incidence of PI than other hospital departments.¹⁴ Unfortunately, ICU nurses did not exhibit a higher level of knowledge of PI treatment. This is an area in need of improvement.

ICU nurses appeared to be unfamiliar with stage classification methods. Only 60.8% of ICU nurses in China were able to identify PI stages on the basis of wound features, which was a lower proportion than that reported in other countries (79% in Sweden¹⁹ and 81% in the Midwestern United States).¹⁵ The classification of PI is important for

analyzing sores and determining the degree of harm. The classification forms the basis for deciding on treatment alternatives.³⁰ Critical care nurses generally work more closely with patients than other clinicians, so their ability to assess patients' skin condition is critical. One previous study reported that 92% of nurses realized the significance of assessing and managing pain related to PI development,²¹ but only 45.6% of nurses knew how to manage PI pain in our study. It is meaningful that nurses recognize the importance of PI pain therapy, but knowing how to treat pain is crucial. Using the principles of moist wound healing and repositioning techniques and equipment as essential nonpharmacological interventions to reduce PI pain has been recommended in PI management guidelines.⁸ The nurses in our study had a low level of awareness of this issue, in accord with Pancorbo et al's findings.²⁰ Although the majority of nurses mentioned that the type of dressing should be selected on the basis of the characteristics of the ulcer,²⁰ only 34.4% of nurses understood the features of various wound dressings and had an in-depth understanding of the correct use of wound dressings based on different types of PI wounds in our study. This result is inconsistent with the results among nurses working in primary care settings,³¹ which suggested that approximately 80% of those nurses knew about the correct usage of foam, alginate, hydrocolloid, and silver dressing.³¹ A possible reason for this finding is that nurses require more knowledge to give prescriptions. Legalization of prescription by nurses is increasing worldwide.³² To improve PI treatment, critical nurses must first gain sufficient knowledge.

The current findings revealed that most nurses approved of PI treatment education courses in wards or hospitals, but nurses' current knowledge level of PI treatment was relatively low. This might be a result of the nurses receiving outdated and insufficient PI treatment education. Only 53.8% of nurses identified the following updated intervention: "Stable and uninfected wounds at the heel should not be removed." Education content should be constantly updated following the evidence of PI treatment, particularly the methods of wound treatment, which are constantly updated and developed.⁸ Education programs should clearly explain why outdated interventions are ineffective so that nurses can quickly discard them. The existence of inadequate PI knowledge can be drawn from comparisons with other studies.^{20,21} Many nurses know they should treat PI but do not know how to perform specific treatment measures. Access to scientific research and adequate ongoing training is fundamental to recognizing the state of the art in wound care.³³ It is worth noting that rudimentary training cannot address all problems because knowledge is not automatically translated into practice. The place of healthcare and nurses' perception of their own knowledge are also essential factors to consider.²⁹ To improve nurses' understanding of PI therapy, nursing managers and policymakers should pay attention to current educational concerns and offer evidence-based and thorough education courses on the basis of particular clinical contexts.

According to the results of the attitude survey questionnaire, nurses generally held moderate attitudes regarding PI therapy. Wounds necessitate a wide variety of therapeutic interventions, and the presence of PI signals an increased workload for nursing staff. Continuous preventive methods are required to prevent PI from worsening or leading to complications.¹⁹ However, only 14% of nurses agreed that caring for PI patients increased their workload. There is a general view among nurses that PI treatment is a healthcare giver's duty. With the advent of enterostomal therapists, the scope of nurses' responsibility has expanded.³⁴ Nurses should further clarify their own role positioning, improve their awareness of active participation, and enhance their sense of responsibility. The importance of nurses in interdisciplinary collaboration for the treatment of PI warrants further investigation.

The findings of this investigation indicated that nurses' PI treatment practices are acceptable. The result of PI treatment practices may be related to the attitude of the nurses. For example, more than 99% of nurses strongly or somewhat agreed that they were willing to put the PI treatment recommendations into practice. Therefore, they are able to carry out measures of hospital requirements despite the level of knowledge of nurses being insufficient. The use of repositioning and support surfaces as a general treatment measure entailed better compliance. The current results revealed that approximately 80% of nurses performed repositioning with a frequency of every 2 hours. However, current guidelines advise repositioning patients on individualized schedules.⁸ Nurses may be able to tailor repositioning frequency in accordance with the conditions of each patient with the assistance of guidelines. Wound dressings are an important part of PI treatment. It is well acknowledged that wound healing is improved when the wound is maintained in a moist state rather than being air-dried.³⁵ In this study, nurses did not commit errors in the principles of wound dressing for treating different PI stages. Foam dressings were most frequently used at each stage

in this study. Foam dressings can reduce pressure in stage I PI. Additionally, foam dressings can be used for PI of stage II and above, with moderate/heavy effects for the management of periwounded skin, reduction in wound exudate, and improvement in PI healing.⁸ According to clinical practice guidelines, hydrocolloid dressings should be used for noninfected stage II PI, as revealed by the clinical condition of the PI.⁸ A total of 39.9% of stage II PIs were reported to accept hydrocolloid dressings. Hydrogel dressing has been recommended for noninfected stage II PI and noninfected stage III and IV PI with low exudate.⁸ Hydrogel dressing was not used for any stage II PI cases but was used in 3.7% of stage III or stage IV PI cases in the current study. Alginate dressing has been recommended for use in stage III and IV PI with moderate exudate.⁸ Approximately 6.7% of PI cases were deemed to be appropriate for alginate dressing. Nurses had a relatively low level of knowledge in selecting wound dressings, but there were no errors of treatment principles in the practice of wound dressings. A possible reason for this finding is that nurses had a basic understanding of the nature of wound dressing but were not sure what kind of dressing to use for different wound conditions at the same stage, such as exudation and infection. Neuberg et al³⁶ also found that more practical skills were needed in modern dressing applications. These results could inform the development of future educational content.

Limitations

The current study had some limitations. The data were extracted from a database containing information that was collected at an earlier time, and nurses' treatment knowledge and attitudes may have changed in the intervening years. Despite this limitation, this study has several notable advantages. The knowledge, attitudes, and practices of critical care nurses regarding PI therapy were examined using the first thorough multicenter study conducted in China. Practice behaviors over the course of 2092 days were carefully observed and documented, revealing important information about how PI treatment measures were put into practice.

Conclusion

This study is the first to provide a thorough overview of the knowledge, attitudes, and behaviors of Chinese critical care nurses regarding PI treatment. Nurses' level of knowledge regarding the selection of wound dressings and pain management was found to be relatively low. Nurses expressed moderate attitudes toward PI treatment and were not fully aware of their roles in PI treatment. Several attempts have been made to qualify PI treatment practices. However, there is a gap between clinical practice and evidence, which still needs to be improved. Nursing managers and policy-makers should provide comprehensive and evidence-based courses based on specific clinical settings to enhance nurses' PI treatment knowledge.

Ethics Approval and Informed Consent

The P College Hospital's Human Research Ethics Committee approved the study procedure (IRB 201502017). The nurses received a thorough explanation of the experiment in the cover letter. Before the research began, nurses were told that they had to give written informed permission and that they could leave the investigation at any time.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This work was supported by the National Health and Family Planning Commission (Beijing, China) [grant numbers 201502017].

Disclosure

The authors report no conflicts of interest in this work.

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