Psychometric properties of the Chinese version of the attitude towards pressure ulcer prevention instrument: A cross-sectional survey

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Abstract
To carry out the translation and cultural adaptation of the attitude towards pressure ulcer prevention instrument for use in Chinese and to analyse the validity and reliability of the adapted version of the questionnaire. In this quantitative, descriptive, cross-sectional study, after translation of the questionnaire from English to Chinese, back-translation, and assessment of equivalence between the original and back-translated version by an expert panel, the Chinese version instrument was assessed by a convenience sample of registered nurses in several hospitals in cities of China. The internal consistency and content validity of the instrument was tested, and a confirmatory factor analysis was also performed. Confirmatory factor analysis showed that the goodness of fit of the five-factor model after the scale localization was not ideal. Therefore, confirmatory factor analysis is performed to obtain the three-factor solution of comparative fit index, goodness-of-fit index, and adjusted goodness-of-fit index reaching the acceptable standard. The instrument score of nurses with wound care certification was significantly higher than that of nurses without wound care special certification. The adapted version of the instrument for Chinese nurses can be used as a tool to measure attitudes towards pressure injury prevention.

Keywords
attitude, nurses, pressure ulcer, prevention, scale development

Key Messages
- based on the attitude towards pressure ulcer prevention (APuP) instrument developed by Beeckman and his colleagues, this study developed a Chinese version of the instrument to provide tool support for the survey of pressure ulcer prevention attitudes among Chinese nurses

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1 | INTRODUCTION

Pressure injury (PI), also known as pressure ulcer (PU), is defined as harm caused to the skin and/or underlying soft tissues. It usually occurs over bony prominence or is related to the use of medical device or other artefacts. Age, multiple comorbidities, and poor health status usually predicted the prevalence of pressure injury. Recent studies have shown that pain, infectious complications, long-term and expensive hospitalisation, persistent open wounds, increased risk of death, and decreased health-related quality of life are associated with pressure injuries. PI prevention is critical as they lead to longer hospital stays, reduced quality of life for patients, and increased workload of care, drawing global attention for their health consequences and significant economic burden.

2 | BACKGROUND

The latest comprehensive global evidence shows that the prevalence and hospital access rates of PI in adult patients are 12.8% and 8.4%, respectively. PI is considered as an international adverse event on patients and a negative indicator of health care quality because nurses are principally responsible for assessment of patient risk of PU and management of skin integrity. In China, PI prevalence rates were reported at 0.63% to 6.6%. There is no doubt that PUs are still a common health care problem, but they can be avoided if proper precautions are taken.

Attitudes affect people’s thinking, actions, and interests, so a positive attitude towards PUs prevention means an increased willingness to take action. Ajzen believes that planned behaviour theory can motivate people who are not inclined to perform targeted behaviours and help them identify beliefs that must change in order to produce behavioural intentions. Attitudes predict individual behaviour by controlling “behavioural beliefs” about the outcomes of participating in certain activities and perceived behaviours. It is very important to change the attitude of PU prevention in the practice of PU prevention and intervention, for that the attitude of nurses to pressure ulcers prevention will affect the behaviour of pressure ulcers intervention. Therefore, the instruments of nurses’ attitude towards preventing pressure ulcers can effectively help nursing managers understand the work of nurses and reasonably avoid the risk of pressure ulcers from another perspective. Globally, More and Price, Kallman and Beeckman et al currently exist to develop instruments to assess nurses’ attitudes to pressure ulcer prevention. Unfortunately, instruments to assess nurses’ attitudes to pressure injuries are scarce in Mainland China. The results of studies conducted in other countries cannot be generalised to China because of some cultural and health system differences. In view of the above, there is a need to acculturate and validate the use of the attitude pressure ulcer prevention instrument in China, considering the need to provide updated questionnaires to assess nurses’ attitudes towards the prevention of pressure injury/pressure ulcers.

3 | METHODS

3.1 | Instrument

The validated attitude towards pressure ulcer prevention instrument (APuP) was developed by Beeckman and colleagues. It was used to study the attitudes of the nurses towards PU prevention. The instrument includes 13 items and reflects five subscale domains: “personal competency to prevent pressure ulcers,” “priority of pressure ulcer prevention,” “impact of pressure ulcers,” “responsibility in pressure ulcer prevention,” and “confidence in the effectiveness of prevention.” A 4-point Likert-type scale was designed to collect the data (1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree). Sum scores were calculated to obtain the total attitude score. Scores on the negatively worded items were reversed to obtain a total score. Higher scores indicated more positive attitudes. A mean attitude score of ≥75% was considered to be satisfactory in this study. Previous validation research indicated that the content validity index of the items in the APuP was between 0.87 and 1.00 and Cronbach’s α ranged from 0.76 to 0.82.
3.2 | Translation and adaptation and psychometric testing procedure

The English version of the APuP was translated into Chinese according to Brislin’s translation model. The steps for translation and adaptation of the test are shown in Figure 1. The STROBE guidelines for the reporting of observational studies were followed (see File S1).

3.2.1 | Forward translation

Two bilingual researchers interpreted the original APuP into Chinese independently. One majored in Nursing and studied in an English-speaking country for 5 years; the other majored in Medicine and worked and studied in an English-speaking country for 8 years. They are fluent in English and Chinese and have experience in translating health documents. The purpose of this step is to verify whether the translation of the questionnaire reflects the content contained in the original text. After that, all members of the research team reviewed and discussed any incongruity in the two copies until consensus was reached.

3.2.2 | Back-translation

The translated version was then back-translated blindly into English by two experts. One is a professional English translator graduated from Beijing Foreign Studies University; the other has been teaching Medical English for more than 20 years in Nursing School of Jilin University. Then, the two back-translation versions were compared, verified, and revised by the research team again, from which a final Chinese translation was obtained.

3.2.3 | Evaluation of translation equivalence

Translation equivalence of the versions was evaluated by the translation validity index (TVI). A total of nine experts were recruited to compare the original English version of the APuP and the Chinese version. The TVI assessment was performed using a 4-point Likert scale (1 = not relevant, 2 = needs major item modification to be equivalent, 3 = equivalent but needs minor modification, and 4 = equivalent). Each item was revised until a translation equivalence score of 4 was achieved.

3.2.4 | Evaluation of the content validity

An expert panel involving nine experts was asked for evaluating each item on a 4-point Likert scale (from irrelevant to absolutely relevant) to determine the content validity and confirm whether the items were designed properly. The expert panel included three specialists in wound care, two nursing managers, two nursing...
professors, and two advanced-practice nurses specialising in wound care. The items were evaluated individually. Ambiguous and/or complex terms were removed or rephrased until no changes to the Chinese translation were deemed necessary. After two rounds of consultation, some cultural adjustments were made to the presentation of certain items based on suggestions from experts. These items were evaluated respectively through the online Delphi technique. Ambiguous and/or complex terms were removed or rephrased successively by consensus until no changes to the Chinese translation had been considered. At the end of each round, the independent reviewers receive feedback on the analysis of responses and suggestions made by other experts. The process was completed after participants reached at least 80% consensus. Certain cultural adjustments were made to the expression of certain items on the basis of the experts’ advice after two rounds of consultation.

3.2.5 | Pilot testing

The revised version of the APuP was pilot tested to evaluate whether the APuP was easy to understand and answer with a convenience sample of 15 nurses in the First Hospital of Jilin University.

3.2.6 | Evaluation of the internal consistency

Cronbach’s alpha was calculated to test the internal consistency of the adapted questionnaire. These values range from zero to one. The higher the value, the higher the measure’s internal consistency, and values over 0.70 are considered acceptable for reliability.

3.2.7 | Evaluation of the construct validity

The construct validity of the APuP was determined by performing a confirmatory factor analysis of the five-factor model by Beeckman et al. The maximum likelihood method was used as estimation method. Furthermore, an exploratory factor analysis was conducted using the principal axis factoring extraction method with Promax with Kaiser normalisation rotation.

3.3 | Data collection

A professional platform called SO JUMP (Changsha Ranxing Information Technology Co Ltd, Changsha, China) was used for the data collection. First, the content of the questionnaire was entered into a computer. Secondly, the electronic questionnaire was sent to individual nurses over WeChat application (Tencent, Shenzhen China) (a total of 15 nurses) and 7 WeChat groups of seven hospitals with relatively fixed quantity of nurses (a total of 735 nurses). Four among those groups were established for this research, while the other two had been previously used for the information about continuing education and nursing management. The number of nurses in each group was 246, 53, 161, 93, 47, 74, and 61 for the groups 1 to 7, respectively. Six hundred and eighty-one nurses responded to the questionnaires between June and July 2019. Participation was voluntary and anonymous, and consent to participate was implied by completion and submission of the survey. No compensation or remuneration was received for study participation. The responses were performed independently without communicating to other WeChat participants.

3.4 | Data analysis

Statistical analyses were performed using the SPSS Statistics 22.0 and SPSS Amos 23.0 for Windows. Descriptive statistics were used to describe the sample, and non-parametric inferential statistics (Kruskal-Wallis \( H \), Mann–Whitney \( U \)) were used to analyse within-sample differences in scores. A significance level of <0.05 (two side) was selected for all tests.

In the confirmatory factor analysis, criteria used for determining goodness of fit were the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The value regarded as a good fit for the GFI and AGFI was >0.90, CFI >0.95, and RMSEA <0.06. A model with a poor fit will score >0.10 on the RMSEA. Two methods were used for confirmatory factor analysis, namely maximum likelihood method and the generalised least square method. The sensitivity of the maximum likelihood to the violation of normality and the robustness of the generalised least square to the violation of hypothesis were used to improve the reliability of the analysis results.

An exploratory factor analysis (EFA) was performed by exploring the main components in the correlation matrix of every item, with a Promax with Kaiser normalisation rotation and the Kaiser criterion to test the construct validity of the APuP if the correlation coefficient between the factors was greater than 0.3. Prior to performing EFA, Kaiser-Meyer-Olkin (KMO) and Bartlett’s sphericity test were used to test the sampling adequacy and the suitability of the data for factor analysis. The criterion for factor extraction was an eigenvalue...
1.0 because these values could explain a higher percentage of the total variability and a factor loading of >0.40.

3.5 | Ethical aspects

The study was approved by the Institute Review Board of College of Nursing, Jilin University (access number: 2019061201). All the participants were given verbal and written information about the nature of the study and those who agreed to participate signed an informed consent form. Permission to conduct the cultural adaptation process and psychometric studies of the APuP was obtained from the author, D.Beeckman of the Ghent University in Belgium.

4 | RESULTS

4.1 | Translation process and cross-culture validation

The item-level CVI (I-CVI) of all items was 0.78 to 1.00. Nine items were rated as 3 or 4 points (absolutely relevant or relevant) by all experts and the scale-level CVI(S-CVI) was 0.96, which is considered acceptable for content validity. In the pilot testing phase, nurses express no difficulties in understanding the phrases and sentences in the Chinese version of APuP. Table 1 demonstrates the rating status of experts during cultural debugging.

| TABLE 1 | Evaluation of the attitude pressure ulcer prevention content validity |
|---------|-------------------------------------------------------------|
| Item    | Number of experts with a rating of 3 or 4 | I-CVI |
| 1       | 9                                            | 1     |
| 2       | 9                                            | 1     |
| 3       | 9                                            | 1     |
| 4       | 7                                            | 0.78  |
| 5       | 8                                            | 0.89  |
| 6       | 9                                            | 1     |
| 7       | 9                                            | 1     |
| 8       | 8                                            | 0.89  |
| 9       | 9                                            | 1     |
| 10      | 9                                            | 1     |
| 11      | 8                                            | 0.89  |
| 12      | 9                                            | 1     |
| 13      | 9                                            | 1     |

Note: A total of nine experts participated in the evaluation; I-CVI: The number of experts with an I-CVI rating of 3 or 4 divided by the total number of experts; S-CVI = (1*9 + 0.89*3 + 0.78)/13 = 0.958.

4.2 | Sample characteristics

The characteristics of the participants are enumerated in Table 2. Of the 681 valid questionnaires, 93% of the participants were female and mostly aged 25 to 35. At the same time, 50% of nurses were nurse practitioners. Among all the nurses surveyed, the age group was concentrated in 25 to 35 years old, accounting for 73.4% of the total number. Meanwhile, nearly half of nurses have worked for 5 to 10 years, and only 3.5% have worked for...
a year or less. The nurses surveyed in this study were all from tertiary hospitals in Mainland China, and most of them have a bachelor’s degree, which was consistent with previous reports. This information indicated that most nurses have some clinical experience and have accumulated relevant knowledge and skills. And more than one-fifth of the nurses had specialised certification, while only nine of them had wounds care certification.

### 4.3 Internal consistency of the Chinese version APuP

The analysis of 13 items in Chinese version of APuP showed that item-total correlation scores were between 0.362 and 0.639 (Table 3), which is considered there were moderate to high correlation between items and total. Relevant experts and studies have confirmed that correlations between 0.10 and 0.30 are considered “small,” those between 0.30 and 0.50 are considered “moderate,” and those greater than 0.50 are considered “large.” Therefore, there was no necessity to delete items of the scale after translation process and cross-culture validation. The value of Cronbach’s α for the whole scale was 0.837, accounting for its reliability. Item values were from 0.710 to 0.724 (Table 3). Cronbach’s α evaluated reliability and considered satisfactory if ≥0.7.31,32

### 4.4 Confirmatory analysis

The results of five-factor confirmatory factor analysis (CFA) indicated that the goodness of fit of the model was not sufficient. The values of CFI and AGFI except GFI analysed by the maximum likelihood method were too low to meet the acceptance criteria (Table 5). Meanwhile, the value of RMSEA was 0.126, which was much higher than the generally accepted standard. Although the analysis results of generalised least square method were slightly better than that of maximum likelihood method, it was still not quite close to the recommended levels. Based on the above findings, the five-factor model proposed for the APuP instrument could not be confirmed in the Chinese sample included in this study. Because of the poor fitting between the model and data, exploratory factor analysis (EFA) was continued for factor structure analysis.

#### TABLE 3 Factors and items in the instrument—attitude towards pressure ulcer prevention (APuP)

| Factors     | Items                                                                 | Item-total correlation | Cronbach’s α |
|-------------|-----------------------------------------------------------------------|------------------------|--------------|
| Competence  | 1. I feel confident in my ability to prevent pressure ulcers           | 0.400                  | 0.723        |
|             | 2. I am well trained to prevent pressure ulcer                         | 0.362                  | 0.724        |
|             | 3. Pressure ulcer prevention is too difficult. Others are better than I am | 0.391                  | 0.723        |
| Priority    | 4. Too much attention goes to prevention of pressure ulcer             | 0.384                  | 0.722        |
|             | 5. Pressure ulcer prevention is not that important                     | 0.639                  | 0.710        |
|             | 6. Pressure ulcer prevention should be a priority                      | 0.450                  | 0.718        |
| Impact      | 7. A pressure ulcer almost never causes discomfort for a patient      | 0.593                  | 0.711        |
|             | 8. The impact of pressure ulcer on a patient should not be exaggerated | 0.494                  | 0.714        |
|             | 9. The financial impact of pressure ulcers on society is high          | 0.376                  | 0.723        |
| Responsibility | 10. I am not responsible if a pressure ulcer develops in my patient    | 0.590                  | 0.712        |
|             | 11. I have an important task in pressure ulcer prevention            | 0.575                  | 0.716        |
| Effectiveness | 12. Pressure ulcers are preventable in high-task patients            | 0.402                  | 0.723        |
|             | 13. Pressure ulcers are almost never preventable                      | 0.567                  | 0.714        |
| Overall     |                                                                       |                         | 0.837        |

*aNegatively worded item.
4.5 | Exploratory factor analysis

EFA extracted three-factor solutions with eigenvalues ≥1, which accounted for 54% of the total variance. The KMO measure of sampling adequacy for this group of variables was 0.814, indicating sufficient sample size. Bartlett’s test of sphericity ($\chi^2 = 2381.470$, df = 78, $P < .001$) in this study was significant and showed sufficient correlation between items. Three specific dimensions were obtained through EFA: (a) Incapability and Negative Cognitive (five items); (b) Capability and Confidence (six items); (c) Stress and Concern (two items). The rotated component matrices of the three-factor solution are listed in Table 4.

CFA shows that the goodness of fit of the three-factor model was better than that of the five-factor model. Values for CFI, GFI, and AGFI in the maximum likelihood method all met the acceptance standard, while RMSEA was close to the standard but still not satisfactory (Table 5). All the values of the generalised square method reached a satisfactory degree of goodness of fit.

4.6 | Attitude scores towards pressure ulcer prevention

In the sample of nurses from the seven hospitals, the APuP score had a mean of 41.45 (SD = 4.81). The score reached 79.7% of the highest of the APuP, which is considered a positive attitude according to that proposed by Beeckman. Table 6 demonstrated the mean scores for each item.

In order to further explore whether attitude score was correlated with other characteristics, correlation analysis was conducted in this study (Table 7). The average total score of the APuP of male nurses was lower than that of female nurses, with statistical difference ($P < .05$). But none of the factors was statistically significant. Age, 

| Item (number from original instrument in brackets) | Factor 1 | Factor 2 | Factor 3 |
|--------------------------------------------------|----------|----------|----------|
| (5) Pressure ulcer prevention is not that important.\(^b\) | 0.762 | 0.171 | 0.168 |
| (7) A pressure ulcer almost never causes discomfort for a patient.\(^b\) | 0.790 | 0.086 | 0.116 |
| (8) The impact of pressure ulcer on a patient should not be exaggerated.\(^b\) | 0.740 | 0.020 | −0.036 |
| (10) I am not responsible if a pressure ulcer develops in my patient.\(^b\) | 0.734 | 0.123 | 0.135 |
| (13) Pressure ulcers are almost never preventable.\(^b\) | 0.635 | 0.151 | 0.260 |
| (1) I feel confident in my ability to prevent pressure ulcers. | −0.003 | 0.774 | −0.809 |
| (2) I am well trained to prevent pressure ulcer. | −0.022 | 0.749 | −0.130 |
| (6) Pressure ulcer prevention should be a priority. | 0.181 | 0.578 | 0.079 |
| (9) The financial impact of pressure ulcers on society is high. | 0.065 | 0.595 | 0.045 |
| (11) I have an important task in pressure ulcer prevention. | 0.265 | 0.651 | 0.122 |
| (12) Pressure ulcers are preventable in high-task patients. | 0.100 | 0.572 | 0.097 |
| (3) Pressure ulcer prevention is too difficult. Others are better than I am.\(^b\) | 0.113 | 0.077 | 0.825 |
| (4) Too much attention goes to prevention of pressure ulcer.\(^b\) | 0.253 | −0.032 | 0.785 |

\(^a\)Factor 1, Incapability and Negative Cognitive; Factor 2, Capability and Confidence; Factor 3, Stress and Concern.

\(^b\)Negatively worded item.
professional category, and number of years in practice were irrelevant to the attitude towards PUs. Highest educational level, nursing specialist certifications, and even wound care certifications did not make a significant difference in attitude total scores. The highest educational level affects the score of factor 3 to some extent. Nurses with the highest educational level of master’s degree have the highest average score of factor 3, making the score of this dimension statistically different \( (P < .05) \). There was also a statistical difference \( (P < .05) \) in the mean scores of nurses with special qualifications in factor 2. Meanwhile, having a wound care certification made a significant difference between the mean score of factor 2 \( (P < .000) \) and factor 3 \( (P < .000) \).

### 5 DISCUSSION

The purpose of this study was to develop a Chinese version of attitude towards pressure ulcer instrument (APuP) and test its reliability, validity, and goodness of fit. Meanwhile, to explore whether there was a correlation between PU prevention attitude and other factors, it provides Chinese clinical nurses with tools to determine if there is an attitude problem in pressure ulcers management. Crucially, the study participants were recruited from seven hospitals in different regions of Mainland China, potentially representing nurses from a wide range of backgrounds.

The internal consistency of the Chinese version of APuP is satisfactory, with an overall test value for Cronbach’s \( \alpha \) of 0.837, which is higher than the reliability value of 0.79 in the English version.\(^{19} \) The values of Cronbach’s \( \alpha \) of each item in the Chinese version are higher than 0.7, which are acceptable.\(^{34,35} \) However, when the original five-factor model is used for the analysis of five subscales, the results of Cronbach’s \( \alpha \) are obviously lower than the reliability value of the original English model (0.380-0.502 for the five subscales). However, Cronbach’s \( \alpha \) was 0.65 in the Spanish version of the first analysis. Item 4 ("Too much attention goes to the prevention of pressure ulcer")—the overall correlation was poor and the value increased slightly to 0.7 after deletion.\(^{12} \) According to the relevant research of Shadi Sohrabi Akhkand et al.,\(^{20} \) the Cronbach’s \( \alpha \) of the Persian version of pressure ulcer attitude questionnaire is 0.891.

Some questions in the APuP instrument are not in line with Chinese reading and expression habits after being directly translated into Chinese. For example, “I have an important task in pressure ulcers prevention” in item 11 of the original scale was adjusted to “Preventing

| Item                                                                 | Mean  | SD (Standard Deviation) |
|----------------------------------------------------------------------|-------|-------------------------|
| (5) Pressure ulcer prevention is not that important.                 | 3.54  | 0.672                   |
| (7) A pressure ulcer almost never causes discomfort for a patient.  | 3.56  | 0.713                   |
| (8) The impact of pressure ulcer on a patient should not be exaggerated. | 3.12  | 0.831                   |
| (10) I am not responsible if a pressure ulcer develops in my patient. | 3.29  | 0.689                   |
| (13) Pressure ulcers are almost never preventable.                  | 3.26  | 0.646                   |
| (1) I feel confident in my ability to prevent pressure ulcers.      | 3.09  | 0.643                   |
| (2) I am well trained to prevent pressure ulcer.                    | 3.05  | 0.670                   |
| (6) Pressure ulcer prevention should be a priority.                 | 3.29  | 0.760                   |
| (9) The financial impact of pressure ulcers on society is high.     | 3.08  | 0.700                   |
| (11) I have an important task in pressure ulcer prevention.         | 3.40  | 0.618                   |
| (12) Pressure ulcers are preventable in high-task patients.         | 3.08  | 0.638                   |
| (3) Pressure ulcer prevention is too difficult. Others are better than I am. | 2.86  | 0.678                   |
| (4) Too much attention goes to prevention of pressure ulcer.        | 2.86  | 0.754                   |

### TABLE 6

Descriptive values of the items of the attitude towards pressure ulcer prevention instrument (APuP)
pressure injuries is an important task of mine according to expert opinions in order to avoid ambiguity caused by unclear expression. In other versions of the localization process, experts carefully read each item in the original version to check its cultural suitability and make minor changes to the wording if necessary. Most participants in the study were young female nurses with bachelor's degrees, similar to the sample that initially tested the English version of APuP. The difference is that Beeckman et al also looked at a number of nursing students who were not involved in this study. The level of attitude scores (79.7%) reported here was

| Sub-groups | Mean score (SD) | Factor 1 (SD) | Factor 2 (SD) | Factor 3 (SD) |
|------------|----------------|---------------|---------------|---------------|
| Gender     |                |               |               |               |
| Male       | 39.91 (5.04)   | 16.53 (3.32)  | 19.16 (2.98)  | 5.69 (1.39)   |
| Female     | 41.67 (4.80)   | 16.83 (2.59)  | 19.00 (2.68)  | 5.70 (1.20)   |
| p-Value    | .042           | .441          | .705          | .344          |
| Age        |                |               |               |               |
| ≤25        | 41.71 (5.16)   | 17.02 (2.99)  | 19.22 (2.19)  | 5.78 (1.29)   |
| >25 to 35  | 41.40 (4.86)   | 16.82 (2.62)  | 18.92 (2.74)  | 5.71 (1.16)   |
| >35 to 45  | 42.23 (4.63)   | 16.70 (2.41)  | 19.21 (2.50)  | 5.85 (1.30)   |
| >45 years  | 41.80 (4.40)   | 16.46 (3.22)  | 19.65 (3.67)  | 5.77 (1.50)   |
| p-Value    | .529           | .804          | .399          | .748          |
| Professional category |            |               |               |               |
| Primary nurse | 41.30 (5.15)   | 16.98 (2.51)  | 18.76 (2.68)  | 5.80 (1.11)   |
| Nurse practitioner | 41.68 (4.75)  | 16.80 (2.62)  | 19.12 (2.48)  | 5.67 (1.18)   |
| Nurse-in-charge | 41.47 (4.59)  | 16.67 (2.93)  | 19.12 (3.13)  | 5.88 (1.41)   |
| Deputy director nurse | 42.15 (4.53) | 16.31 (2.74)  | 19.08 (3.34)  | 5.74 (1.40)   |
| p-Value    | .758           | .497          | .490          | .327          |
| Number of years in practice |        |               |               |               |
| ≤1         | 41.69 (5.00)   | 17.33 (2.56)  | 18.67 (1.80)  | 5.91 (1.24)   |
| >1 to 5    | 41.49 (4.67)   | 17.03 (2.67)  | 19.22 (2.71)  | 5.73 (1.07)   |
| >5 to 10   | 41.28 (5.09)   | 16.64 (2.68)  | 18.80 (2.70)  | 5.64 (1.20)   |
| >10 to 15  | 41.97 (4.41)   | 16.87 (2.54)  | 19.36 (2.62)  | 5.96 (1.42)   |
| >15 years  | 42.46 (4.32)   | 16.64 (2.59)  | 19.42 (3.13)  | 5.90 (1.32)   |
| p-Value    | .446           | .328          | .159          | .161          |
| Highest degree held |            |               |               |               |
| Technical secondary school | 43.00 (6.06)   | 15.00 (4.16)  | 19.00 (1.41)  | 4.25 (1.71)   |
| Associates | 42.32 (4.77)   | 17.01 (2.65)  | 18.68 (2.84)  | 5.79 (1.22)   |
| Baccalaureate | 41.45 (4.83)  | 16.79 (2.67)  | 19.12 (2.60)  | 5.73 (1.21)   |
| Master     | 41.65 (4.96)   | 16.66 (1.97)  | 18.00 (3.83)  | 6.14 (1.13)   |
| p-Value    | .508           | .478          | .094          | .024          |
| Any certification |          |               |               |               |
| Yes        | 41.42 (4.31)   | 16.72 (2.72)  | 19.51 (2.83)  | 5.89 (1.35)   |
| No         | 41.60 (4.96)   | 16.82 (2.63)  | 18.89 (2.65)  | 5.70 (1.17)   |
| p-Value    | .715           | .677          | .016          | .101          |
| Wound care certification |        |               |               |               |
| Yes        | 42.00 (4.30)   | 19.22 (1.09)  | 23.33 (1.00)  | 7.78 (0.067)  |
| No         | 41.56 (4.84)   | 16.77 (2.65)  | 18.96 (2.67)  | 5.72 (1.20)   |
| p-Value    | .788           | .006          | <.0001        | <.0001        |
similar to those found (62%-78%) in previous surveys. In one Swedish study, the attitude score was as high as 89%, which may be related to the deletion of one item in the Swedish version of the APuP scale and the corresponding change in the total score.

Confirmatory analysis showed that the five-factor structure proposed by APuP could not be supported and the structure validity was poor. Further EFA and CFA showed that the three-factor solution fit the data. Differences in sample characteristics may be one of the reasons why the original five-factor model is not suitable for Chinese samples. Beeckman et al’s study included 29% of nursing students, while 7% of nurses had no experience. Neither of these two groups existed in this study, and only nurses working in hospitals were included. There may be cultural differences in health care systems and policies between China, Belgium, and the Netherlands that influence nurses’ attitudes and ways of thinking about stress injury prevention.

No attitudinal difference was found in the overall score level among nurses of different professional title categories, which supported the previous research results of Strand et al in the intensive care unit. However, this contradicts the results of Demarre et al, whose survey showed that nurses scored significantly higher on PUs prevention (78.3%) than nursing assistants (72.3%). According to the results of the study, gender, age, number of years in practice, and educational level were not the factors to distinguish the stress injury attitude score. Clinical experience as a nurse does not seem to affect our population’s attitude towards PI prevention; nurses with less than 1 year of experience had roughly the same APuP scores as nurses with more than 15 years of experience. Another study in Turkey reported the same thing, but the more recent study found that experienced nurses (10-14 years) had higher attitude scores than less experienced nurses (5-9 years). These differences may be strongly related to the medical care environment in China. If a patient in charge of the nurse experiences a PU during hospitalisation, it will be considered a medical error. This will increase the attention of nurses to PU to a certain extent. Meanwhile, health care managers also attach great importance to the occurrence of PUs and regard it as an indicator of individual or group care quality. Thus, it is all the more compelling for nurses to focus on prevention. There was no significant difference in the attitude of the specialist nurses to preventing PUs compared with those receiving regular education nurses. Overall score and factor 1 (Incapability and Negative Cognitive) among nurses with wound care certification are quite the same. However, there are significant differences between factor 2 (Capability and Confidence) and factor 3 (Stress and Concern). Nurses with wound care certification showed more positive attitude. This may be because of the fact that nurses with wound care certification are more comfortable with specialised training in dealing with stress injuries.

5.1 Limitations

This study has the following limitations. First, the results of this study may not represent the attitudes of all nurses in China towards PU prevention, as this study was conducted in a convenient sample of tertiary hospitals in Beijing, Changchun, Shenyang, and Jilin. It has been confirmed that nurses working in tertiary hospitals have a better attitude and ability to prevent pressure ulcers than nurses working in non-tertiary and community hospitals. Secondly, the three-factor structure analysed in this study is quite different from the original five-factor model, and the rationality of each dimension summary still needs to be verified by larger samples. In addition, although the use of online questionnaire can effectively reduce the problems caused by questionnaire input (such as lack of answers, etc), there will be errors caused by people unfamiliar with online questionnaire, which will also affect the quality of the questionnaire.

6 CONCLUSION

This study suggests that the original APuP instrument is not appropriate to represent the attitude of Chinese nurses towards pressure ulcer prevention. The five-factor model does not fit the data well, and then the three-factor solution is obtained from the factor analysis. In this study, the internal consistency of the questionnaire in translation and analysis was satisfactory. In addition, nurses with wound care certifications showed more ability and confidence in the attitude of pressure ulcers prevention.

This study provides researchers with a validated instrument to measure nurses’ and other health care providers’ attitudes towards pressure ulcer prevention and look for correlations with other factors or post-intervention changes. The instrument can also be used to conduct rapid surveys to assess attitudes towards pressure ulcer prevention in clinical settings, as well as to assess the effectiveness of intervention plans. In addition, the instrument can help nursing managers identify nurses with less positive attitudes and develop targeted interventions for improvement, thereby improving the quality of care. More importantly, this study provides the world with data on pressure ulcers prevention among Chinese nurses, enriching the results in related fields.
Nevertheless, it is recommended that further research and development of an effective and reliable instrument be used to assess nurses’ attitudes towards PI prevention in different health care environment to improve the usefulness of the scale.

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CONFLICT OF INTEREST
No authors have any conflicts of interest to declare for the publication of this manuscript.

AUTHOR CONTRIBUTIONS
Xuemiao Huang, Tao Zan, Jing Tang, Dan Zhang, Wanting Zu, Taiwei Wang, Lisheng Wang, Wenbo Nie: Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; Xuemiao Huang, Tao Zan, Jing Tang, Dan Zhang, Wanting Zu, Taiwei Wang, Lisheng Wang, Wenbo Nie: Involved in drafting the manuscript or revising it critically for important intellectual content; Xuemiao Huang, Tao Zan, Jing Tang, Dan Zhang, Wanting Zu, Taiwei Wang, Lisheng Wang, Wenbo Nie: Given final approval of the version to be published. Each author has participated sufficiently in the work to take public responsibility for appropriate portions of the content; Xuemiao Huang, Tao Zan, Jing Tang, Dan Zhang, Wanting Zu, Taiwei Wang, Lisheng Wang, Wenbo Nie: Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

ETHICS STATEMENT
The study was approved by the Institute Review Board of College of Nursing, Jilin University (access number: 2019061201).

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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