BRITISH JOURNAL OF HOSPITAL MEDICINE

ARTICLE

Latent Profile Analysis of Pressure Injury Knowledge Levels Among Nursing Staff in Tertiary General Hospitals

Li Zhang[1,†], Shu-Nan Hu[1,†], Xu-Mei Yan[1], Yan Zhang[1], Shen Wei[2,*], Ye-Fen Han[3,*]

[1]Department of Nursing, PengZhou People's Hospital, Chengdu, Sichuan, China
[2]Department of Gynecology, Ruikang Hospital Affiliated to Guangxi University of Chinese Medicine, Nanning, Guangxi, China
[3]School of Nursing, Guangxi University of Chinese Medicine, Nanning, Guangxi, China
*Correspondence: 2020t0595@pwu.edu.ph (Shen Wei); hanyf@gxtcmu.edu.cn (Ye-Fen Han)
[†]These authors contributed equally.

Abstract

Aims/Background The prevalence of pressure injuries (PIs) is a widely used clinical indicator of patient safety and quality of care. Nurses' understanding of pressure injury (PI) can significantly impact the treatment outcomes for patients. This study, based on latent profile analysis (LPA), reveals the characteristics associated with PI knowledge levels among clinical nurses in district and county tertiary medical institutions. We aim to help nursing managers formulate training plans accurately so that clinical nurses can provide high-level skin care services for patients.

Method In June 2023, 1482 nurse staff from 4 tertiary general hospitals at the district and county level in Chengdu were chosen as research subjects using the convenience sampling method. Responses to the general information questionnaire, the Chinese Version of Pressure Ulcer Knowledge Assessment Tool (C-PUKAT), and the Chinese Version of Attitude towards Pressure ulcer Prevention (C-APuP) were used to compare the population's characteristics based on LPA.

Results Three latent profiles of nurses' PI knowledge were identified: weak foundation type (46.3%), strengthening foundation type (42.7%), and special improvement type (11.0%). Subjects' departments, administrative positions, highest degrees and PI prevention attitude scores, as well as whether they have participated in the training, all differed significantly between latent profile groups ($p < 0.05$).

Conclusion The PI knowledge level of nursing staff at the district and county tertiary general hospitals requires urgent improvement. Nursing managers should prioritize the management level and quality of PI training among clinical nursing staff. Precise training programs can be developed based on different categories of nursing staff to enhance their PI knowledge, thereby effectively improving the quality of healthcare for inpatients.

Key words: pressure injury knowledge; healthcare services; nursing staff; latent profile analysis; clinical governance

Submitted: 29 April 2024 Revised: 10 July 2024 Accepted: 12 July 2024

How to cite this article:
Zhang L, Hu S, Yan X, Zhang Y, Wei S, Han Y. Latent Profile Analysis of Pressure Injury Knowledge Levels Among Nursing Staff in Tertiary General Hospitals. Br J Hosp Med. 2024. https://doi.org/10.12968/hmed.2024.0226

Introduction

The incidence of pressure injury (PI) is one of the sensitive quality monitoring indicators of nursing care (Nursing Center and National institute of Hospital Administration, 2016). In May 2023, the National Health Commission of the PRC and the National Administration of Traditional Chinese Medicine (NATCM) in China issued the Circular on the Action for Comprehensively Improving the Quality of

Medical Care (2023–2025), which proposes to improve the monitoring and feedback of the quality of nursing care, to carry out continuous improvement based on an evidence-based foundation and clinical needs, and to progressively reduce the incidence of in-hospital PI at stage 2 or above incurred by inpatients (National Administration of Traditional Chinese Medicine, 2023). The assessment and implementation of preventive measures for PI in inpatients are mainly undertaken by nursing staff. The PI knowledge of nursing staff is a key factor in preventing the occurrence of PI, and the level of PI knowledge they master directly affects the quality of PI care (Feng et al, 2017; Parisod et al, 2022). In the context of the fast-growing aging population in our country, district-level tertiary hospitals serve as a crucial platform for the government to provide basic medical and health services to residents within county-level regions. According to relevant PI nursing guidelines (Kottner et al, 2019), a scientific assessment of nurses' knowledge levels and prevention attitudes regarding PIs plays a critical role in their prevention and treatment. Therefore, it is imperative to pay close attention to the PI knowledge levels of nurses in district-level tertiary hospitals. Most of the current studies are based on scale scores that access the level of PI knowledge of nursing staff, and the main research targets are nursing staff in large grade A tertiary hospitals (Bjurbo et al, 2024; Dong and Meng, 2022; Zhang et al, 2021), however, there is a lack of research on the level of PI knowledge of nursing staff in level III general hospitals at the county level. Moreover, previous assessments also failed to pinpoint the specific areas of deficiency in nurses' knowledge of PI, and was unable to effectively address these deficiencies. The objective of this study is to identify the factors influencing the PI knowledge level of clinical nurses working in tertiary medical institutions. This will enable nursing managers in level III general hospitals at the county level to develop targeted training programs aimed at enhancing the knowledge level of clinical nurses dealing with PI, thereby improving their ability to manage patients with PI, and reducing its incidence.

Methods

Research Subjects

In June 2023, 1482 nurse staff from 4 district and county tertiary general hospitals in Chengdu were chosen as research subjects using the convenience sampling method. The inclusion process is shown in Fig. 1. Inclusion criteria: (1) Those who are $\geq$18 years old and have obtained a nurse practitioner qualification certificate; (2) Those who have been engaged in clinical nursing work for more than one year; (3) Those who voluntarily participate in the survey. Exclusion criteria: Nursing staff who are not employed or on duty in that research unit. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of PengZhou People's Hospital, with ethical code of No. (07) of the 2022 Review of Science Ethics.

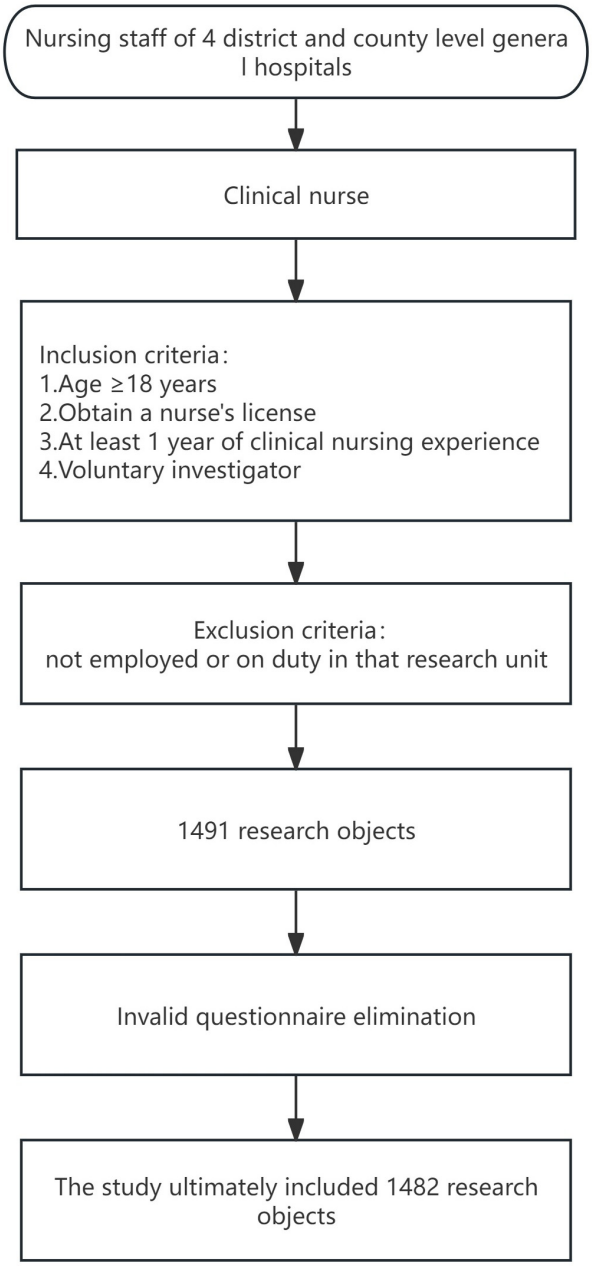

Fig. 1. Research subjects inclusion and exclusion flow chart.

Survey Instruments

General Information Questionnaire

After reading relevant literature (Wang, 2021; Wei et al, 2023; Zhang et al, 2021) and consulting experts, we designed a general information questionnaire that included gender, age, first academic degree, final academic degree, professional title, position, working years, whether they are specialist nurses, whether they have participated in PI-related training, and other information.

The Chinese Version of Pressure Ulcer Knowledge Assessment Tool (C-PUKAT)

This assessment tool was translated into Chinese by Wang (2021) in 2020 from the Pressure Injury Knowledge Assessment Tool 2.0 (PIKAT2.0) compiled by the

Beeckman research group. The scale has a total of 21 items which are divided into six dimensions: aetiology, classification and observation, risk factor assessment, nutrition items, PI prevention, and special patients. The scoring method is 1 point for the correct choice, 0 points for the wrong choice or do not know, and the total score is 0–21 points. The higher the score, the higher the PI knowledge score. Its reliability and validity have been tested in China. The KR-20 value is 0.713 and the test-retest reliability is 0.893, indicating that it can be used to assess the PI knowledge of Chinese nurses.

The Chinese Version of Attitude towards Pressure ulcer Prevention (C-APuP)

This scale was translated into Chinese by researcher Wang (2021) in 2018. The scale includes four dimensions: personal ability, priority, impact of pressure injuries (PIs), and confidence in preventing PIs. The Likert 4-level scoring method is used, in which items 3, 4, 5, 7, 8, 10, and 13 are reverse scored. The total possible score on the scale is 52 points. Higher scores indicate a more positive attitude towards the prevention of PIs. The Cronbach's α of this scale is 0.814.

Data Collection

The informed consent form and questionnaire were sent to the director of the nursing department of the surveyed hospital in the form of a questionnaire on Wen Juan Xing (https://www.wjx.cn), a popular Chinese online survey platform, manufactured by Changsha Ranxing Information Technology Co., Ltd. in Changsha, China. The director of the nursing department of each medical institution posted it to the nurses' WeChat work group. Before answering the questions, the participants needed to check the "Informed Consent Form" to confirm whether they agreed or not. In order to ensure the effectiveness of the electronic questionnaire, functions such as the number of times to fill in, required content, logic detection, and filling time requirements were all set up to avoid missed filling in and reduce invalid questionnaires.

Statistical Methods

IBM SPSS 23.0 Statistics (IBM, New York, NY, USA) and Mplus 8.3 (Muthen & Muthen, Los Angeles, CA, USA) were used for statistical analysis of data. Count data were described by frequency and percentage (%). χ^2 and Z tests were used to compare general characteristics across latent PI knowledge categories. Single-sample Kolmogorov-Smirnov tests were used to test continuous variables for normality. Continuous variables with a non-normal distribution were described as the median (interquartile range). The Kruskal-Wallis test was used to compare dimensions of the C-PUKAT scale between latent PI knowledge categories. Taking the strengthening foundation profile and the special improvement latent profile as dependent variables, we used multiple logistic regression to identify characteristics that were significant predictors of these profiles. LPA of PI knowledge was conducted based on responses to the C-PUKAT using Mplus 8.3. We assumed the initial model as a profile, and then gradually increased the number of profiles in the

Table 1. General information of the research subjects in the three PI knowledge categories.

Dimensions	Weak foundation type	Strengthening foundation type	Special improvement type	χ^2/Z	p
Sex				3.214	0.200
Male	28 (4.1%)	24 (3.8%)	2 (1.2%)		
Female	662 (95.9%)	602 (96.2%)	164 (98.8%)		
Professional title				47.377	0.000
Nurse	160 (23.2%)	138 (22.0%)	14 (8.4%)		
Senior nurse	266 (38.6%)	264 (42.2%)	60 (36.1%)		
Supervisor nurse	234 (33.9%)	204 (32.6%)	76 (45.8%)		
Co-chief nurse and above	30 (4.4%)	20 (3.2%)	16 (9.6%)		
First degree				41.996	0.000
Technical secondary school	148 (21.4%)	104 (16.6%)	44 (26.5%)		
Junior college	411 (59.6%)	358 (57.2%)	60 (36.1%)		
Bachelor degree or above	131 (19.0%)	164 (26.2%)	62 (37.3%)		
Highest degree				47.366	0.000
Junior college	212 (30.7%)	138 (22.0%)	10 (6.0%)		
Bachelor degree or above	478 (69.3%)	488 (78.0%)	156 (94.0%)		
Department				89.544	0.000
Other departments	73 (10.6%)	42 (6.7%)	6 (3.6%)		
Department of obstetrics, gynaecology and paediatrics	130 (18.8%)	88 (14.1%)	12 (7.2%)		
Emergency Department	65 (9.4%)	44 (7.0%)	6 (3.6%)		
Department of Internal Medicine	194 (28.1%)	206 (32.9%)	80 (48.2%)		
Department of Surgery	128 (18.6%)	176 (28.1%)	40 (24.1%)		
Operating room	72 (10.4%)	22 (3.5%)	12 (7.2%)		
Department of Critical Care Medicine	28 (4.1%)	48 (7.7%)	10 (6.0%)		

Table 1. Continued.

Dimensions	Weak foundation type	Strengthening foundation type	Special improvement type	χ^2/Z	p
Whether or not you participated in the PI training				19.203	0.000
Yes	606 (87.8%)	592 (94.6%)	154 (92.8%)		
No	84 (12.2%)	34 (5.4%)	12 (7.2%)		
Whether or not you specialized nurses				25.690	0.000
Yes	24 (3.5%)	32 (5.1%)	22 (13.3%)		
No	666 (96.5%)	594 (94.9%)	144 (86.7%)		
When was the last time you received PI training?				25.245	0.001
1–3 months	204 (29.6%)	240 (38.3%)	64 (38.6%)		
3–6 months	108 (15.7%)	98 (15.7%)	26 (15.7%)		
6–12 months	54 (7.8%)	54 (8.6%)	16 (9.6%)		
≥12 months	122 (17.7%)	64 (10.2%)	16 (9.6%)		
Your primary source of PI knowledge				52.664	0.000
Academic exchanges at all levels	8 (1.2%)	4 (0.6%)	2 (1.2%)		
Special training within the department	344 (49.9%)	310 (49.5%)	70 (42.2%)		
Special training in the hospital	316 (45.8%)	284 (45.4%)	72 (43.4%)		
Special training outside the hospital	6 (0.9%)	16 (2.6%)	18 (10.8%)		
Independent literature reading	16 (2.3%)	12 (1.9%)	4 (2.4%)		
Administrative position				61.655	0.000
Yes	28 (4.1%)	44 (7.0%)	36 (21.7%)		
No	662 (95.9%)	582 (93.0%)	130 (92.7%)		
Age (years)	31 (26, 36)	31 (26, 34)	32 (29, 38)	19.222	0.000
Working experience (years)	9 (4, 14)	8 (4, 11)	11 (6, 16)	18.237	0.000

PI, pressure injury.

model, and judged the best-fitting model based on model adaptation indicators: (1) the Akaike Information Criterion (AIC) was used to measure the fit of a statistical model based on the concept of entropy, and usually select the model with the lowest AIC; (2) the Baysian Information Criterion (BIC) and the adjusted Baysian Information Criterion (aBIC). Smaller values indicate a better model fit; (3) Entropy, which was used to measure how accurately the model classifies individuals, with a value between 0 and 1. The closer Entropy is to 1, the more accurately the model classifies individuals; and (4) the Lo-Mendell-Rubin Test (LMRT) and the Bootstrapped Likelihood Ratio Test (BLRT). Significant LMRT and BLRT values show that the model with K categories is superior to the model with K-1 categories.

Results

General Information about Research Subjects

A total of 1491 questionnaires were received. According to the questionnaire elimination standards, nine questionnaires were eliminated, and 1482 valid questionnaires were included, with an effective recovery rate of 99.396%. The count data were described by frequency and percentage (%); age and working experience information about research subjects were expressed as the median (interquartile range). Comparisons of the general information of the research subjects across the three PI knowledge categories are shown in Table 1.

Current Status of PI Knowledge among Nursing Staff

Pairwise differences in C-PUKAT dimensions between latent profile categories were significant ($p < 0.05$) for all comparisons except: There was no significant difference in the Prevention of PI dimension or the PI prevention in special patients dimension between the weak foundation and strengthening foundation latent profiles; there was no significant difference in the PI prevention in special patients dimension between the strengthening foundation and special improvement latent profiles. See Table 2 for details.

LPA Results of Nursing Staff's PI Knowledge

LPA was conducted on the nursing staff's PI knowledge based on responses to the C-PUKAT, and 1–4 latent profile models were established in sequence. The fitting index of each model is detailed in Table 3. According to the results of the model, the entropy value was >0.9 when the number of classifications was 3 or 4, indicating that the accuracy of classification was greater than 90%. The p values of the likelihood ratio (LR) indicators LMRT and BLRT were both <0.05 for all models. The AIC, BIC and aBIC values were relatively low and similar, but in model selection, the number of individuals in each profile should generally be $\geq$10% (Wang, 2020). Therefore, based on the comprehensive analysis results and theoretical considerations, the three-latent-profile model was finally selected. The average probabilities of nursing staff in each profile belonging to that model were 99.5%, 99.8%, and 97.4%. In terms of PI knowledge, 686 (46.3%) nurses in the first category obtained the lowest score. According to the results, this category of nurses, termed the weak foundation type, was the weakest in knowledge related to

Table 2. Nursing staff scores on C-PUKAT dimensions for each latent profile category.

Dimensions	Weak foundation type	Strengthening foundation type	Special improvement type	*Z*	*p*	Kruskal-Wallis	
						Pairwise comparison	*p*
Etiology score	2 (1, 2)	2 (1, 2)	2 (2, 3)	36.114	0.000	a-b a-c b-c	0.000 0.000 0.000
Classification and observation	1 (0, 1)	2 (2, 2)	3 (3, 3)	1382.824	0.000	a-b a-c b-c	0.000 0.000 0.000
Risk assessment	1 (0, 1)	1 (1, 2)	1 (1, 2)	70.846	0.000	a-b a-c b-c	0.000 0.000 0.003
Nutrition	1 (0, 1)	1 (0, 1)	1 (1, 2)	32.289	0.000	a-b a-c b-c	0.018 0.000 0.000
Prevention of PI	2 (2, 2)	2 (2, 2)	3 (2, 4)	10.969	0.004	a-b a-c b-c	1.000 0.004 0.007
PI prevention in special patients	1 (1, 2)	1 (1, 2)	1 (1, 2)	8.350	0.015	a-b a-c b-c	0.618 0.012 0.109
PI knowledge	8 (6, 9)	9 (8, 11)	12 (10, 14)	352.511	0.000	a-b a-c b-c	0.000 0.000 0.000

PI, pressure injury; C-PUKAT, the Chinese Version of Pressure Ulcer Knowledge Assessment Tool. Annotation: a indicates Weak foundation type, b indicates Strengthening foundation type, c indicates Special improvement type.

PI classification and observation, risk assessment, nutrition, and prevention. There were 633 nursing staff (42.7%) in the second category. This type of nursing staff has medium knowledge in all dimensions, so it was termed the strengthening foundation type. There were 163 nursing staff in the third category (11.0%). This type of nursing staff is at a high level in all dimensions but is relatively low in PI risk assessment, nutrition, and PI prevention dimensions for special patients, so it was termed the special improvement type (Fig. 2).

Multiple Regression Analysis for Predictors of PI Knowledge Category

A parallelism test revealed a p value < 0.05 ($p = 0.000$), indicating that multi-classification logistic regression was not appropriate. Therefore, multinomial logistic regression was used. The results are shown in Table 4. The regression analyses included latent PI knowledge categories (weak foundation type, strengthening foundation type, special improvement type) as dependent variables, with weak

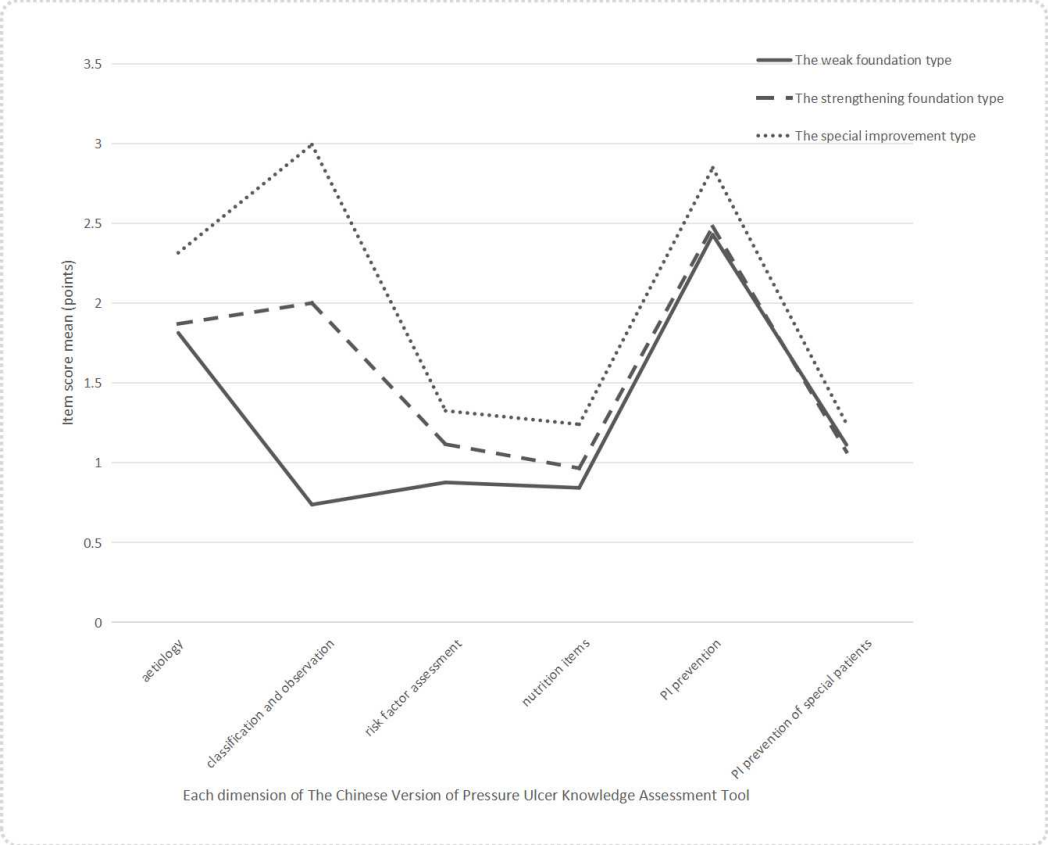

Fig. 2. Identified categories of nursing staff PI knowledge.

foundation type as the reference group). Sex, years of experience, title, position, department, source of knowledge acquisition, C-APuP score, first degree, highest academic qualification, whether or not they participated in the training, and the time of the most recent training were included as the independent variables. The regression results showed that having no administrative position, being in the operating room and Emergency Department, maternity and paediatrics, and other departments, having the title of nurse, not having participated in PI training, having the source of hospital-specific and department-specific training, and having lower C-APuP scores were significant predictors of the weak foundation type. Having attended IP training, attaining higher the highest degree and having higher C-APuP score were significant predictors of the strengthening foundation type. A high C-APuP score, having an administrative position, and attaining a higher level of education (both first degree and highest degree) were significant predictors of the characteristics of the special improvement type.

Discussion

PI Knowledge Level of Nursing Staff Needs to be Improved

Unfortunately, due to the constraints of the study, we were unable to fully assess the level of nurses' comprehension of PI in district and county specialized hospitals. The PUKAT 2.0 score rate for nurses in this study was 42.82%. A self-reporting

Table 3. Comparison of fitting indicators of latent profile models for PI knowledge.

Model	Akaike Information Criterion (AIC)	Baysian Information Criterion (BIC)	Adjusted Baysian Information Criterion (aBIC)	Entropy	*p*		Profile probability
					Lo-Mendell-Rubin Test (LMRT)	Bootstrapped Likelihood Ratio Test (BLRT)	
1	22,029.404	22,093.018	22,054.897				
2	21,826.471	21,927.193	21,866.835	0.707	0.0001	0.0001	0.889/0.111
3	21,651.684	21,789.514	21,706.919	0.971	0.0009	0.0000	0.463/0.427/0.110
4	21,625.789	21,800.727	21,695.896	0.909	0.0281	0.0000	0.463/0.373/0.109/0.054

Table 4. Multiple regression analysis for predictors of PI knowledge level categories.

Independent variable		Strengthening foundation type						Special improvement type					
		B	SE	*p*	OR	95% CI		B	SE	*p*	OR	95% CI	
						Lower limit	Upper limit					Lower limit	Upper limit
Intercept		–1.715	1.629	0.292				–3.042	2.704	0.261			
Working experience (years)		–0.011	0.029	0.698	0.989	0.934	1.047	0.013	0.042	0.756	1.013	0.933	1.109
C-APuP score		0.067	0.015	0.000	1.069	1.038	1.101	0.079	0.025	0.002	1.082	1.030	1.137
Administrative position		0.464	0.281	0.098	1.590	0.917	2.757	0.969	0.332	0.004	2.635	1.374	5.053
First degree		–0.125	0.111	0.262	0.883	0.710	1.098	0.170	0.170	0.013	0.655	0.469	0.915
Highest degree		–0.323	0.154	0.036	0.724	0.535	0.980	–1.390	0.372	0.000	0.249	0.120	0.516
Whether or not you participated in the PI training		0.832	0.243	0.001	2.298	1.428	3.697	0.141	0.389	0.717	1.152	0.537	2.471
When was the last time you received PI training?		–0.026	0.047	0.589	0.975	0.888	1.070	–0.073	0.079	0.359	0.930	0.796	1.086
Whether or not you specialized nurses		–0.101	0.312	0.746	0.904	0.491	1.665	0.273	0.425	0.521	1.314	0.571	3.020
Department	Other departments	–0.872	0.321	0.007	0.418	0.223	0.785	–1.330	0.590	0.024	0.265	0.083	0.841
	Department of Internal Medicine	–0.420	0.264	0.112	0.657	0.391	1.103	0.260	0.415	0.532	1296	0.575	2.924
	Department of Surgery	–0.131	0.272	0.629	0.877	0.515	1.493	–0.206	0.442	0.642	0.814	0.342	1.937
	Department of obstetrics, gynaecology and paediatrics	–0.797	0.283	0.005	0.451	0.259	0.785	–1.110	0.500	0.028	0.334	0.125	0.889
	Emergency Department	–0.760	0.317	0.017	0.468	0.251	0.871	–0.990	0.586	0.091	3.371	0.118	1.171
	Operating room	–1.685	0.352	0.000	0.185	0.093	0.369	–0.600	0.510	0.239	0.549	0.202	1.492
Primary source of PI knowledge	Academic exchanges at all levels	–1.143	0.830	0.168	0.319	0.063	1.621	–1.668	1.018	0.101	0.189	0.026	1.385
	Special training within the department	–1.107	0.518	0.033	0.331	0.120	0.912	–2.063	0.567	0.000	0.127	0.042	0.386
	Independent literature reading	–0.506	0.664	0.446	0.603	0.164	2.213	–1.500	0.835	0.072	0.223	0.043	1.146
	Special training in the hospital	–1.054	0.516	0.041	0.349	0.127	0.959	–1.977	0.564	0.000	0.138	0.046	0.418

C-APuP, the Chinese Version of Attitude towards Pressure ulcer Prevention.

approach was utilized for this survey, and it is possible that respondents sought online resources to enhance their scores. However, the scoring rate is still lower than those reported by Jin et al (2022) and Wei et al (2023), suggesting an urgent need to improve the level of PI knowledge of nursing staff in tertiary general hospitals in Chengdu city and county levels. The subjects of this study belonged to the tertiary general hospitals of the districts and counties, and the information regarding PI received by the nursing staff had a certain lag (De Meyer et al, 2019). Nurses with a weak theoretical foundation should enhance their knowledge of PI prevention through recognition and observation in virtual wards or teaching rounds. It is important to note that nurses in specialized departments such as obstetrics and gynecology, pediatrics, and the Emergency Department, have a greater need for this type of education; therefore, specialized PI education should be emphasized during training. The other types of nurses showed lower proficiency in risk factor assessment, nutrition management, and PI prevention for special patients. Nursing managers can organize group case studies led by nutritionists and wound care specialist nurses to address these specific areas for improvement. Nurses categorized under the special improvement type have a relatively high level of theoretical understanding and can benefit from learning alongside wound care specialist nurses. Additionally, nursing managers should regularly invite experts from superior hospitals to give lectures on cutting-edge information to promote nurses' understanding.

Characteristics of Nursing Staff with Different Latent PI Knowledge Profiles

Department

This study revealed that nursing staff in operating rooms, emergency departments, obstetrics and gynaecology, and paediatrics, and those with various professional titles, were more likely to have weak foundations. Patients in the above departments have special requirements and have greater requirements for nurses' PI knowledge. However, nursing managers often neglect to train them on PI knowledge, possibly due to their relatively high professional titles and longer working years (Chinese Nursing Association, 2023; Gao et al, 2023; He et al, 2021; Kulik et al, 2018). Therefore, it suggests that nursing managers should not use the level of nursing staff and working years of nursing staff as the basis for stratified PI training.

Professional Titles and Administrative Positions

Results of this study revealed that administration position was significantly related to latent PI knowledge. Due to the need for nursing management work, nursing managers have a high demand for nursing management-related knowledge (Ying et al, 2019) and participate in various types of training at all levels more frequently than nursing staff without positions. It is suggested that nursing managers should focus on the supply and distribution of resources for high-quality training of clinical nursing staff, which may be appropriately directed towards nursing staff without positions, increasing opportunities for learning.

Training Methods

This study shows that nurses who have not participated in PI training have the characteristics of a weak foundation type, which is similar to the conclusions of Zhang et al (2021). Previous surveys have shown that most nurses believe that clinical practice training is the best way to learn and that the length of training is the most critical influencing factor in attending training, but that clinical practice learning opportunities have decreased due to factors such as time and human resources (Qiao et al, 2022; Teo et al, 2019). Standardized training for nurses can help nurses to correctly formulate preventive measures (Jiang et al, 2020; Park et al, 2024). A previous study confirmed that wound specialist nurses can provide reliable support to clinical nurses in the decision-making process of identification and prevention of PI (Almalki et al, 2022). Therefore, nursing managers can build a wound specialist group responsible for PI knowledge training for nurses. The team members should be composed of nursing quality experts, international wound therapists, and wound specialist nurses. At the same time, the wound specialist nurses should carry out practical courses that include bedside teaching guidance and workshops, so as to combine practice and theory, and promote the transformation of theoretical knowledge into clinical practice by nurses.

Degree

In this study, the lower the highest education level of nurses, the higher the likelihood of being categorized into the weak foundation group, which is in line with the findings of previous studies, and may also align with the robust theoretical foundation of nurses with advanced education, along with their literature comprehension and evidence-based practice abilities. Learning through continuing professional education and research courses can allow clinical nurses to develop and apply existing evidence-based results (Gaspar et al, 2022). Therefore, nursing managers should prioritize nurses with college degrees and regularly provide them with professional development opportunities related to performance improvement theory.

PI Prevention Attitude

In this study, PI prevention attitude was identified as a significant predictor of PI knowledge profile among nursing staff at the district and county level. Existing studies have shown a significant positive correlation between knowledge and attitude. Thus, a more positive attitude towards prevention promotes PI knowledge level, but the practical difficulty lies in the inability of caregivers to translate positive preventive attitudes into practical preventive strategies (Şahan and Güler, 2024). Nurses know the importance of preventing PIs, but work overload hinders their ability to guarantee the implementation of diverse preventive measures (Albagawi and Jones, 2016). Therefore, nursing managers should find ways to enhance nurses' enthusiasm for PI prevention, which can include increasing human resources and applying advanced equipment (Stern and Roshan Fekr, 2023), thereby reducing the workload of nurses, and improving the enthusiasm of nurses' prevention attitude, and enhancing the level of nurses' PI knowledge.

Conclusion

In this study, three categories of the PI knowledge level of nursing staff in tertiary general hospitals at district and county levels were identified through latent profiling, namely, weak foundation type, strengthening foundation type, and special improvement type. Departments, professional titles and administrative positions, training methods, degrees, and PI prevention attitude are influential factors in the latent category classification of the PI knowledge of nursing staff. Nursing managers in tertiary general hospitals at the district and county levels should be aware of the factors affecting the PI knowledge when formulating the training program. At the same time, further exploration into intervention methods is necessary to enhance nurses' knowledge and management levels related to PI, while developing training programs tailored to different types of nurses based on their characteristics will improve the quality of PI management among nurses and enhance patient safety.

Key Points

- The profile characteristics of PI knowledge levels of clinical nurses in district and county tertiary medical institutions were investigated by LPA.
- In June 2023, 1482 nurse staff from 4 tertiary general hospitals at the district and county level in Chengdu were chosen as research subjects using the convenience sampling method.
- Subjects' departments, administrative positions, degrees and PI prevention attitude scores, as well as whether they have participated in the training, are all significantly associated with the PI knowledge level.
- The PI knowledge level of nursing staff in district and county tertiary general hospitals requires urgent improvement.

Availability of Data and Materials

All the data of this study are included in this article.

Author Contributions

LZ, SNH, SW and YFH designed the research study. LZ, SNH, XMY and YZ performed the research. SNH, LZ, SW, XMY and YZ analyzed the data. LZ, SNH, SW and YFH drafted the manuscript. All authors contributed to editorial changes of important content in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of PengZhou People's

Hospital, with ethical code of No. (07) of the 2022 Review of Science Ethics. Informed consent was obtained from all subjects involved in the study.

Acknowledgement

Not applicable.

Funding

This work is supported by Chengdu medical research project of Chengdu Health Commission (2022593).

Conflict of Interest

The authors declare no conflict of interest.

References

Albagawi BS, Jones LK. Quantitative exploration of the barriers and facilitators to nurse-patient communication in Saudia Arabia. Journal of Hospital Administration. 2016; 6: 16–24. http://doi.org/10.5430/jha.v6n1p16

Almalki MS, Kimpton A, Jones LK, Da Costa C. Nurses' Perceived Facilitators of Research Utilisation in a Multicultural Setting in Saudi Arabia: Observational Study. Nursing Reports. 2022; 12: 164–174. https://doi.org/10.3390/nursrep12010017

Bjurbo C, Wetzer E, Thunborg D, Zhang L, Hultin L. Knowledge and attitudes regarding pressure injuries among assistant nurses in a clinical context. International Wound Journal. 2024; 21: e14950. https://doi.org/10.1111/iwj.14950

Chinese Nursing Association. Prevention of intraoperative acquired stress injuries: T/CNAS29—2023. 2023. http://hltb.kxj.org.cn/uploads/admin/202301/63d8f48168bc3.pdf (Accessed: 31 January 2023).

De Meyer D, Verhaeghe S, Van Hecke A, Beeckman D. Knowledge of nurses and nursing assistants about pressure ulcer prevention: A survey in 16 Belgian hospitals using the PUKAT 2.0 tool. Journal of Tissue Viability. 2019; 28: 59–69. https://doi.org/10.1016/j.jtv.2019.03.002

Dong Q, Meng XJ. A convenient sampling survey of influencing factors of stress injury knowledge among nursing staff in operating room of Beijing Grade A Hospital. Chinese Journal of Health Statistics. 2022; 39: 772–775.

Feng CC, Zhao SZ, Hu AL. Investigation on prevention behavior and influencing factors of pressure ulcer in nurses. Chinese Journal of Practical Nursing. 2017; 33: 2294–2298.

Gao XL, Guo L, He L. Expert consensus on prevention of intraoperative acquired stress injury. Journal of Nursing Science. 2023; 38: 44–47.

Gaspar S, Botelho Guedes F, Vitoriano Budri AM, Ferreira C, Gaspar de Matos M. Hospital-acquired pressure ulcers prevention: What is needed for patient safety? The perceptions of nurse stakeholders. Scandinavian Journal of Caring Sciences. 2022; 36: 978–987. https://doi.org/10.1111/scs.12995

He LX, Yuan ZHF, Liu H, Liao DB, Ning N. Current status and prevention of stress injury in emergency patients. PLA Nursing Journal. 2021; 38: 65–68.

Jiang L, Li L, Lommel L. Nurses' knowledge, attitudes, and behaviours related to pressure injury prevention: A large-scale cross-sectional survey in mainland China. Journal of Clinical Nursing. 2020; 29: 3311–3324. https://doi.org/10.1111/jocn.15358

Jin LH, Chen YY, Zhou JH. Homogenization training of stress injury nursing for liaison nurses in the base hospital of the medical. Union. Journal of Nursing. 2022; 37: 65–68.

Kottner J, Cuddigan J, Carville K, Balzer K, Berlowitz D, Law S, et al. Prevention and treatment of pressure ulcers/injuries: The protocol for the second update of the international Clinical Practice Guideline 2019.

Journal of Tissue Viability. 2019; 28: 51–58. https://doi.org/10.1016/j.jtv.2019.01.001

Kulik LA, Connor JA, Graham DA, Hickey PA. Pressure injury prevention for paediatric cardiac surgical patients using a nurse-driven standardized clinical assessment and management plan. Cardiology in the Young. 2018; 28: 1151–1162. https://doi.org/10.1017/S1047951118000975

National Administration of Traditional Chinese Medicine. Notice regarding the implementation of a comprehensive Action Plan to enhance the standard of medical care (2023-2025). 2023. https://www.gov.cn/zhengce/zhengceku/202305/content_6883704.htm (Accessed: 26 May 2023).

Nursing Center, National institute of Hospital Administration. Handbook of Nursing-Sensitive Quality indicators. People's Medical Publishing House: China. 2016.

Parisod H, Holopainen A, Koivunen M, Puukka P, Haavisto E. Factors determining nurses' knowledge of evidence-based pressure ulcer prevention practices in Finland: a correlational cross-sectional study. Scandinavian Journal of Caring Sciences. 2022; 36: 150–161. https://doi.org/10.1111/scs.12972

Park S, Kim EJ, Lee SJ, Kim EJ, Lee JY, Hong JE. Knowledge and Visual Differentiation Ability of the Pressure Injury Classification System and Incontinence-Associated Dermatitis among Hospital Nurses: A Descriptive Study. Healthcare. 2024; 12: 145. https://doi.org/10.3390/healthcare12020145

Qiao Y, Xi BH, Zhang Y. Investigation on current situation and demand of stress injury knowledge training in Top three general hospitals. International Journal of Nursing. 2022; 41: 2515–2519.

Şahan S, Güler S. Evaluating the Knowledge Levels and Attitudes Regarding Pressure Injuries among Nurses in Turkey. Advances in Skin and Wound Care. 2024; 37: 1–8. https://doi.org/10.1097/ASW.0000000000000195

Stern L, Roshan Fekr A. Recent Advances and Applications of Textile Technology in Patient Monitoring. Healthcare. 2023; 11: 3066. https://doi.org/10.3390/healthcare11233066

Teo CSM, Claire CA, Lopez V, Shorey S. Pressure injury prevention and management practices among nurses: A realist case study. International Wound Journal. 2019; 16: 153–163. https://doi.org/10.1111/iwj.13006

Wang MC. Latent Variable Modeling and Mplus Application· Basic Part (pp. 276). Chongqing University Press: China. 2020.

Wang W. Development and application of the pressure ulcer knowledge assessment tools and attitude towards pressure ulcer prevention [master's thesis]. University of South China, China. 2021.

Wei S, Yang L, Zhao CS, Luo YT. Analysis on the knowledge level of stress injury and its influencing factors of nurses in the hospital of Stomatological wound Specialty Alliance. Guangxi Medicine. 2023; 45: 2416–2420.

Ying SJ, Liu XL, Wang L. Investigation on current situation of post competence and training demand of head nurses. Chinese Journal of Modern Nursing. 2019; 25: 2560–2564.

Zhang YB, He L, Gou L, Pei JH, Nan RL, Chen HX, et al. Knowledge, attitude, and practice of nurses in intensive care unit on preventing medical device-related pressure injury: A cross-sectional study in western China. International Wound Journal. 2021; 18: 777–786. https://doi.org/10.1111/iwj.13581