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Article

Knowledge–Attitude–Practice Toward Standardized Nursing Terminology Among Nurses in a Tertiary Hospital in Southwest China: A Single-Center Cross-Sectional Survey

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Abstract

Aims/Background: The adoption of standardized nursing terminology (SNT) is crucial for ensuring efficient information delivery and data sharing among nursing staff, as well as effective nursing care. This study aims to assess nurses' Knowledge–Attitude–Practice regarding SNT, and identify key influencing factors of SNT application. **Methods**: This study involves the development of a questionnaire for a survey based on the Knowledge–Attitude–Practice (KAP) model, combined with literature research and Delphi method. A cross-sectional survey was conducted among 515 nursing staff from 26 departments. **Results**: The resulting questionnaire consisted of 29 items, with a Cronbach's α coefficient of 0.959. The scores for Knowledge–Attitude–Practice of nurses toward SNT were 12.73 $\pm$ 4.61, 35.05 $\pm$ 5.70, and 31.72 $\pm$ 9.93, respectively. Multiple linear regression analysis indicated that the position title, education level and years of work were independent influencing factors of the SNT levels among the surveyed nurses. The three most frequently mentioned barriers by nursing staff were increased workload, insufficient support from information systems, and a lack of nursing informatics professionals. **Conclusion**: This study indicates that nursing staff hold positive attitudes toward SNT, but their awareness and practical application remain insufficient. Strengthening competency-based training and urgently optimizing nursing information systems are therefore necessary.

Keywords: nurses; standardized nursing terminology; Knowledge–Attitude–Practice; cross-sectional survey; influencing factors

1. Introduction

The nursing process is a core component of nursing practice, providing a systematic and scientific problem-solving approach to identifying individual nursing needs and guiding the delivery of personalized care [1]. This process views the individual patient holistically, taking into account psychological, sociocultural, spiritual, and economic dimensions, necessitating critical thinking in nursing practice [2]. Effective implementation of the nursing process not only enhances the quality of nursing services but also promotes the advancement of nursing theories and scientific knowledge based on best clinical practices [3].

The initial assessment of the nursing process entails the collection of all available individual information, in-depth analysis, and effective utilization of the results [4], laying a foundation for the subsequent nursing diagnosis, a crucial component of the nursing procedure. Nursing diagnosis is not only a scientific judgment of the patient's health status but also the basis for guiding subsequent nursing plans and interventions [5]. Standardized nursing terminology (SNT) is a standardized language based on nursing practice and disciplinary knowledge, facilitating the identification of patients' most pressing health problems and guiding the design of tailored nursing interventions [6,7]. The importance of nursing diagnosis lies in its ability to transform the vast amount of information collected during the assessment phase into specific nursing goals and interventions. Such data analysis and synthesis demand a high level of professional judgment and clinical decision-making from nurses, and also rely on SNT to ensure the accuracy and consistency of nursing diagnoses. Briefly speaking, as a common language, SNT helps contribute to a more unified nursing practice across the world.

Globally, SNT has been integrated into clinical practice with proven effectiveness, whereas its adoption in China remains limited. With SNT, a set of standardized language is in place to facilitate communications for describing nursing processes, promoting consistent operations and documentation [8,9], providing a foundation for nursing plan formulation and resource allocation, and improving both efficiency and quality [10,11]. Studies using data mining and predictive modeling have demonstrated that SNT-based big data analysis enhances nursing informatization. For example, Cho *et al.* [10] developed an Artificial Intelligence(AI) fall-prevention tool using Nursing Interventions Classification (NIC) data, which reduced inpatient falls by 28%. A study by Sung *et al.* [8] reported that the application of International Classification for Nursing Practice (ICNP) to COVID-19 nursing records improved the effi-

ciency of epidemiological analysis by 40%. Studies have shown that standardized nursing terminologies can become an effective teaching and learning tool in nursing education [12]. Meanwhile, the use of standardized terminology allows for estimating the time required to implement nursing interventions and can be used to calculate the associated cost of nursing services [13]. Globally, standardized terminology systems such as ICNP and the Omaha System have substantially improved nursing quality and data interoperability. ICNP, adopted by 120 countries, facilitates cross-border data exchange and reduces transfer errors by 32% [7,12]. In contrast, China lags behind in SNT adoption, resulting in inconsistent documentation, difficulties in outcome comparison, and barriers to international collaboration. These issues stem mainly from the absence of a unified terminology framework, varied nursing responsibilities, and differences in healthcare settings.

Domestic research in China further highlights practical challenges. Cai *et al*. [14] indicate that most of the domestic studies on standardized nursing terminology merely focus on introducing and promoting international terminology systems, and have not yet actively carried out the construction of local terminology based on the progress of nursing informatization. Lai *et al*. [15] highlighted terminology localization as a key challenge—for example, North American Nursing Diagnosis Association (NANDA) may be incompatible with the cultural beliefs of the traditional Chinese health care setting, which emphasize holistic harmony and balance. Additionally, Han *et al*. [16] also noted a lack of post-training supervision, heavy workloads and insufficient training hinder nurses' familiarity with SNTs. Currently, Chinese nursing education employs an integrated approach combining NANDA (diagnoses) and NIC (interventions) in undergraduate curricula, but practical training remains limited in depth. In our hospital, NANDA training was first offered to the head nurses as a preliminary step to promote SNT application from top to bottom. Although frontline nurses have not yet received formal instruction in SNT, they are often indirectly exposed to it through clinical guidelines or peer learning. Several studies have explored nurses' Knowledge–Attitude–Practice regarding major international SNTs (NANDA, NIC, and Nursing Outcomes Classification [NOC]) to evaluate the feasibility of promoting their use in China [17,18].

Specifically, this systematic review analyzed 32 studies evaluating the application of the NANDA-I, NIC, and NOC classifications in various nursing care settings worldwide. The results show that the NANDA, NIC, and NOC framework facilitated more accurate clinical judgment, improved the development of individualized care plans, strengthened the evaluation of patient outcomes, and enhanced nursing documentation. These outcomes were observed across diverse settings, including pediatric care, community health, and intensive care units [12]. In Brazil, Aben-Athar *et al*. [19] reported that involving nursing students in the development of care plans based on the NANDA-I, NIC, and NOC model improved their clinical reasoning and documentation accuracy. Aleandri *et al*. [20] described how the successful integration of NANDA-I, NIC, and NOC into electronic nursing records in Italy required institutional support, interdisciplinary collaboration, and sustained technical training. This study focuses on NANDA, as it was the first international SNT introduced into Chinese nursing textbooks and has been the subject of preliminary training at our hospital, making it the most familiar international SNT among our nursing staff.

This study is essential, aligning closely with the China's current healthcare policy goals and the urgent practical needs in nursing development. Its primary aim is to assess nurses' Knowledge–Attitude–Practice regarding SNT, as well as their perspectives on applying the nursing process, ultimately identifying key factors that influence SNT implementation. By enhancing nurses' awareness of the nursing process, we hope to help them better understand and apply SNT, thereby improving nursing quality, meeting patients' personalized nursing needs. Doing so ensures the adaptability of nursing practice to the ever-changing healthcare environment and the high-quality delivery of nursing care based on scientifically grounded evidence.

Given the absence of a unified domestic SNT system in China, we selected major international SNTs—namely the NANDA, NIC, NOC, and ICNP—which have been widely discussed and trialed in Chinese nursing research and clinical practice to serve as the assessment framework for this study. This selection aligns with the current nursing education and preliminary training in the Chinese contexts. Notably, this study did not develop a culturally adapted SNT; instead, it aimed to evaluate nurses' Knowledge–Attitude–Practice regarding these international SNTs, providing a reference for regional SNT construction in the future.

2. Methods

2.1 Study Design and Participants

This quantitative, descriptive correlation study was conducted from June to August 2024, using a cross-sectional survey at a single tertiary grade A hospital in Southwest China. The head nurse of each department was contacted and requested to include as many participants as possible. Study participants were included based on the following criteria: (1) clinical registered nurses currently on duty; (2) at least one year of independent clinical experience; and (3) provision of informed consent and voluntary participation in this investigation. Nurses pursuing advanced studies, undergoing short-term training or internships, and those who had participated in similar SNT-related surveys or studies within the past six months were excluded. The sample size was chosen according to the Kendall sample size method, which requires a sample size of five to ten times the number of questionnaire items [21]. Given

that the questionnaire in this study consisted of 29 items, 290 respondents were needed to meet the sample size requirement. Accounting for a potential invalid response rate of 10–20% in cross-sectional surveys (e.g., incomplete or hastily completed questionnaires), the final minimum required sample size was adjusted to 348.

2.2 Measurements

A self-developed general data questionnaire was used to collect general data of the participants, including gender, age, marital status, department, education background, position title, years of work, and job role.

Guided by the Knowledge–Attitude–Practice (KAP) theoretical model [22], the researcher independently designed a questionnaire covering nurses' Knowledge–Attitude–Practice regarding SNT. In the process of questionnaire construction, we consulted relevant domestic and international literature and applied evidence-based medicine principles to ensure scientific rigor. Stratified with clearly defined research objectives, the questionnaire was reviewed by 10 nursing experts, including three associate senior nurses with more than ten years of SNT research experience, five clinical head nurses who were familiar with nursing informatization, and two nursing education specialists. The content validity (CVI) was calculated using the 'item-level CVI (I-CVI)' and 'scale-level CVI (S-CVI)' method. Among the 29 items, each of the 27 items had an I-CVI of $\geq$0.8 and an average S-CVI of 0.855, indicating good content validity. The questionnaire content was further refined according to expert feedback.

A preliminary survey was conducted among 30 clinical nurses from internal medicine, surgery, and obstetrics and gynecology departments to assess the clarity and acceptability of the questionnaire. Physicians were not included, as the study focuses on nurses' Knowledge–Attitude–Practice regarding SNT. To assess test–retest reliability, the questionnaire was re-administered to these 30 nurses after two weeks. This questionnaire showed a high internal consistency, with a Cronbach's α coefficient of 0.959. To avoid bias, the 10 experts involved in the process and the 30 nurses who participated in the pilot test were excluded from the final survey sample.

Before finalizing the "Practice" dimension, a preinvestigation was conducted to understand the current status of SNT use among clinical nurses. The results showed that 68.3% of nurses (352 out of 515 participants) had used at least one type of SNT in their clinical work. The final questionnaire consisted of 29 items in four dimensions: (i) Knowledge dimension: five items, including the classification, significance and development trends of SNT; (ii) Attitude dimension: nine items including the importance and applicability of SNT; (iii) Behavior (Practice) dimension: 11 items, which evaluate the practice behavior of SNT in the clinical work of nursing staff; (iv) Supplementary status survey (four multiple choice questions), which—independent of the KAP scales—investigates the influencing factors of SNT usage in clinical settings (e.g., 'What is the main barrier to using SNT?'). Data from this part were separately analyzed and not included in the KAP dimension scores.

Each KAP item was rated on a 5-point Likert scale, ranging from "completely disagree" to "completely agree", "completely don't understand" to "fully understand", or "never" to "always", with scores from 1 to 5. The questionnaire adopts positive scoring for all items, with a higher score indicating greater knowledge and practice of SNT among nursing staff. The full version of the questionnaire (including all items, scoring standards, and instructions) is provided as **Supplementary File 1**.

2.3 Procedure

A convenient sampling method was used to recruit nursing staff through a mini program called "Questionnaire Star" available on WeChat. All the individuals who responded to the questionnaire, as well as the investigators involved, were informed of the study purpose as well as the risks and benefits associated with their participation. The study participants were instructed to complete the questionnaire independently and prohibited to discuss responses among themselves. Mandatory responses were established for all items to ensure questionnaire integrity. To ensure the credibility of the survey results, questionnaires that were not answered in accordance with the question requirements or completed within 80 seconds were considered invalid. Subsequently, the data were exported from the web platform and stored securely. No personal identifiers (name, employee ID) were collected, and the raw data were stored in a password-protected database accessible only to the research team. In this cross-sectional study, 530 questionnaires were distributed; we received 515 returning questionnaires (response rate = 97.2%), and all of them were considered valid (valid response rate = 100%).

2.4 Usage Status Assessment of the SNT System

The usage status of the SNT system among nurses was assessed using a self-designed questionnaire based on the national nursing informatics guidelines. The questionnaire included items assessing the frequency of SNT usage in clinical documentation, perceived convenience and accuracy of the system, and the degree of integration into daily nursing records. Each item was scored on a 5-point Likert scale ranging from 1 ("never") to 5 ("always"), and the total score was calculated to reflect the level of usage. Higher scores indicated a higher degree of SNT system utilization. The internal consistency of this section was acceptable (Cronbach's α = 0.89).

2.5 Data Analysis

Statistical analyses were performed using IBM Statistical Package for the Social Sciences (SPSS), version

26.0 (IBM Corporation, Armonk, NY, USA). To ensure comparability among the questionnaire factors such as Knowledge–Attitude–Practice, standardized scores were used for statistical analysis. The standardized score of a factor was computed using this formula:

Standardized score = (Actual score of the factor ÷ Highest possible score of the factor) × 100.

Continuous variables were tested for normality using the Shapiro–Wilk test. Independent sample *t*-tests or one-way analysis of variance (ANOVA) was employed to analyze normally distributed data, which were expressed as mean ± standard deviation (SD). Homogeneity of variance was assessed using Levene's test, and Tukey's Honestly Significant Difference (HSD) test was applied for post-hoc comparisons. Categorical variables were expressed as counts and percentages and analyzed using Pearson's chi-square test. Multicollinearity among independent variables was assessed using the variance inflation factor (VIF). A VIF value greater than 5 was considered indicative of potential multicollinearity, while a value below 5 suggested acceptable independence among predictors, consistent with recommendations in social science research. Multiple linear regression models with stepwise entry were used to identify independent influencing factors for the total scores of each dimension. All statistical tests were two-tailed, and a p-value < 0.05 was considered statistically significant.

3. Results

3.1 Demographic Characteristics

The descriptive characteristics of the nurses included in the study are presented in Table 1. The majority of the participants were female (92%, $n = 474$) and married (68.3%, $n = 352$). In terms of department, the distribution was relatively balanced, with 38.1% ($n = 196$) from the internal medicine department and 38.6% ($n = 199$) from the surgery department. Most of the participants were undergraduates (94.8%, $n = 488$), with only 3.3% ($n = 17$) having a junior college education. Regarding position titles, 61.7% ($n = 318$) were junior-level nurses. In terms of job roles, 83.5% ($n = 430$) were clinical nurses. Most participants were aged between 30 and 40 (51.8%, $n = 267$), and nearly half had more than 10 years of service (47.6%, $n = 245$).

Table 1. General characteristics of participants ($n = 515$).

Variable	*n* (%)
Gender	
Male	41 (8)
Female	474 (92)
Marital status	
Married	352 (68.3)
Unmarried	163 (31.7)
Department	
Internal medicine	196 (38.1)
Surgery	199 (38.6)
Obstetrics and gynecology	110 (21.4)
Others	10 (1.9)
Education	
Junior college	17 (3.3)
Bachelor degree	488 (94.8)
Master and doctor	10 (1.9)
Age (years)	
<30	182 (35.3)
30–40	267 (51.8)
>40	66 (12.8)
Position title	
Junior level	318 (61.7)
Intermediate level	175 (34)
Deputy senior level and above	22 (4.3)
Years of work	
<5	119 (23.1)
5–10	151 (29.3)
>10	245 (47.6)
Job role	
Clinical nurse	430 (83.5)
Teaching nurse	58 (11.3)
Research nurse	16 (3.1)
Nursing manager	11 (2.1)

3.2 Differences in Nurses' Knowledge–Attitude–Practice Regarding SNT

The scores for Knowledge–Attitude–Practice of nurses regarding SNT are 12.73 ± 4.61, 35.05 ± 5.70, and 31.72 ± 9.93, respectively (see **Supplementary File 2**). An analysis of the differences in demographic variables concerning knowledge, attitude, and behavior regarding the use of SNT are shown in Table 2. No significant differences were observed in knowledge, attitude, or practice scores across gender, age, marital status, or department (all $p > 0.05$). Education showed significant differences in knowledge ($p = 0.016$) and attitude scores ($p = 0.047$), with post-hoc Tukey HSD tests confirming that master's/doctoral-educated nurses scored higher than junior college nurses ($p < 0.05$). Position title had the most significant impact on knowledge ($p < 0.001$), attitude ($p = 0.012$), and overall scores ($p = 0.003$). Job role was associated with significant differences in attitude ($p = 0.001$) and total scores ($p = 0.005$). For years of work, no significant differences were found in the knowledge ($p = 0.428$) or the practice score ($p = 0.597$), but attitude score differed significantly ($p = 0.039$). Overall, education and position title were the most influential factors in SNT knowledge, while years of work and job role mainly affected attitude. No significant factors were found for practice.

3.3 Regression Analysis of Influencing Factors

Table 3 shows the analysis of factors influencing SNT awareness, with a focus on variables such as education, position title, years of work, and job role. In terms of knowledge, both education and position title were found to signi-

Table 2. Analysis of differences in Knowledge–Attitude–Practice scores across demographic variables.

Variables	Knowledge score			Attitude score			Practice score			Overall score		
	$\bar{x} \pm s$	t/F	p	$\bar{x} \pm s$	t/F	p	$\bar{x} \pm s$	t/F	p	$\bar{x} \pm s$	t/F	p
Gender		1.197	0.232		0.460	0.646		0.222	0.824		0.640	0.523
Male	13.56 ± 4.71			35.44 ± 5.58			32.05 ± 10.63			81.05 ± 16.95		
Female	12.66 ± 4.60			35.01 ± 5.71			31.69 ± 9.88			79.36 ± 16.10		
Age (years)		1.908	0.149		0.674	0.510		1.234	0.292		1.720	0.180
<30	12.96 ± 4.70			34.90 ± 5.85			31.83 ± 10.61			79.68 ± 17.56		
30–40	12.39 ± 4.63			34.96 ± 5.60			31.24 ± 9.60			78.59 ± 15.35		
>40	13.52 ± 4.20			35.80 ± 5.65			33.36 ± 9.19			82.68 ± 15.17		
Marital status		1.581	0.115		1.358	0.175		–0.934	0.351		–0.554	0.580
Married	12.51 ± 4.55			35.28 ± 5.54			31.44 ± 9.70			79.23 ± 15.77		
Unmarried	13.21 ± 4.73			34.55 ± 6.01			32.31 ± 10.42			80.08 ± 17.01		
Department		2.137	0.108		1.002	0.392		0.289	0.833		0.966	0.408
Internal medicine	13.18 ± 4.76			35.09 ± 5.78			31.89 ± 10.52			80.17 ± 17.13		
Specialty	11.84 ± 4.16			34.36 ± 5.81			31.26 ± 9.59			77.46 ± 14.15		
Other	13.00 ± 4.42			36.90 ± 5.90			34.10 ± 13.25			84.00 ± 20.13		
Education		4.162	0.016		3.067	0.047		0.122	0.885		0.879	0.416
Junior college	11.06 ± 5.01			31.71 ± 5.69			31.94 ± 10.00			74.71 ± 16.24		
Bachelor degree	12.72 ± 4.55			35.15 ± 5.70			31.74 ± 9.89			79.62 ± 16.11		
Master and Doctor	16.30 ± 5.40			35.50 ± 4.14			30.20 ± 12.04			82.00 ± 18.87		
Position title		9.328	0.000		4.488	0.012		2.579	0.077		6.038	0.003
Junior level	12.45 ± 4.60			34.49 ± 5.67			31.29 ± 10.15			78.23 ± 16.57		
Intermediate level	12.75 ± 4.46			35.82 ± 5.74			31.94 ± 9.43			80.50 ± 14.95		
Deputy senior level and above	16.77 ± 4.22			37.00 ± 4.68			36.19 ± 9.76			89.95 ± 15.84		
Years of work		0.851	0.428		3.259	0.039		0.516	0.597		1.214	0.298
<5	13.13 ± 4.52			34.31 ± 5.80			31.64 ± 9.83			79.08 ± 16.31		
5–10	12.40 ± 4.87			34.55 ± 5.37			31.10 ± 10.36			78.05 ± 17.16		
>10	12.75 ± 4.48			35.71 ± 5.79			32.14 ± 9.72			80.60 ± 15.43		
Job role		0.843	0.471		11.169	0.001		1.489	0.217		4.297	0.005
Clinical nurse	10.30 ± 5.77			34.22 ± 4.75			30.84 ± 9.25			78.17 ± 14.62		
Teaching nurse	11.17 ± 7.97			37.86 ± 9.49			33.50 ± 14.14			84.43 ± 23.08		
Research nurse	12.19 ± 4.97			39.50 ± 11.38			31.44 ± 12.93			87.50 ± 23.33		
Nursing manager	11.09 ± 6.38			38.18 ± 10.06			28.18 ± 13.16			83.81 ± 18.79		

Table 3. Analysis of factors influencing awareness of SNT.

Variable	Factors and classification	B	SE	β	t	p	R^2 (adjusted R^2)
Knowledge	Education	2.100	0.885	0.104	2.374	0.018	0.298 (0.283)
	Position title	0.957	0.352	0.119	2.717	0.007	
Attitude	Education	1.662	0.892	0.082	1.862	0.063	0.214 (0.196)
	Position title	1.502	0.421	0.187	3.565	<0.001	
	Years of work	−0.721	0.300	−0.126	−2.402	0.017	
	Job role	0.624	0.329	0.083	1.897	0.058	
Overall	Position title	1.031	0.351	0.129	2.941	0.003	0.267 (0.252)
	Job role	0.610	0.330	0.081	1.847	0.065	

SE, standard error.

ficantly affect awareness. Specifically, higher education attainment ($\beta = 0.104$, $p = 0.018$) and higher-ranked position were significantly associated with better knowledge of standardized nursing terminology ($\beta = 0.119$, $p = 0.007$). VIF values for education level and position title were 1.23 and 1.18, respectively (all <5).

Regarding attitude, position title ($\beta = 0.187$, $p < 0.001$) were significant predictors. A higher-ranked position had the most significant effect, suggesting that nurses in more senior roles hold a more positive attitude toward standardized terminology. Additionally, years of work had a negative impact on attitude ($\beta = –0.126$, $p = 0.017$), with nurses who had longer tenure showing less positive attitude. Education showed no significant effect on attitude ($p > 0.05$). Although education level did not reach conventional levels of statistical significance in predicting attitude toward SNT ($\beta = 0.082$, $p = 0.063$), it approached marginal significance, suggesting a potential trend that warrants further investigation in larger samples.

For the overall score, position title ($\beta = 0.129$, $p = 0.003$) was the most significant factor, indicating that nurses holding higher positions performed better across all measures. Job role also had a marginally significant impact on overall score ($\beta = 0.081$, $p = 0.065$), suggesting a potential influence on the overall application of SNT. These findings highlight the importance of position and education in shaping both knowledge and attitude regarding SNT. The VIF values for position title and job role were 1.21 and 1.19, respectively (all <5). The multivariate linear regression models for knowledge, attitude, and overall scores were all statistically significant ($F = 24.513$, 18.211, and 20.134, respectively; all $p < 0.001$). The adjusted R^2 values were 0.283, 0.196, and 0.252, respectively, indicating acceptable model fit and explanatory power. The detailed regression coefficients and statistics for each variable are provided in Table 4.

3.4 Usage Status of SNT System

In this study, we investigated the usage of SNT among nursing staff in Table 5. The results show that 65.4% of the participants utilized the NIC, making it the most widely used terminology system. The NANDA, which was the first international terminology system introduced into the nursing teaching materials in China, was ranked the second most widely used system, but with a relatively low usage rate in nursing practice (37.9%).

To further explore the SNT usage patterns, we analyzed the frequency and accuracy of NANDA and NIC application among nurses. Slightly more than one-third of the nurses (37.9%) reported occasional use of NANDA, while 65.4% used NIC regularly. Nurses holding master's/doctoral degrees (90.0%) and those with senior titles (81.8%) demonstrated higher accuracy in NANDA application (defined as 'correctly matching diagnoses to patient conditions') compared to junior nurses (37.7%). The difference in usage rates between the NANDA and NIC systems can be attributed to the fact that our hospital only provided NANDA training for head nurses, not frontline staff, limiting the dissemination of NANDA knowledge among most participants. In contrast, the NIC system—focusing on nursing interventions such as medication administration and wound care—is more relevant to the daily clinical work of our frontline nursing staff. Even without formal training, nurses could intuitively apply NIC in practice, leading to a higher usage rate (65.4%, as compared to NANDA 37.9%). This indicates that the current NANDA training has limited reach and does not effectively facilitate its clinical application, while NIC demonstrates greater practical applicability in frontline nursing practice.

3.5 Barrier Factors

Barrier factors affecting the clinical promotion of SNT were assessed using the four multiple-choice questions in the "Status questionnaire" segment of the self-developed questionnaire (e.g., "What is the main barrier to your use of SNT?" with options including "increased workload", "lack of information system support", etc.). A total of 515 valid responses were obtained and descriptive statistical analysis were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, N.Y., USA) to calculate the frequency and percentage of each barrier option, so as to identify the main obstacles affecting the SNT application.

In this research, we conducted an in-depth analysis of the factors influencing the clinical promotion of SNT in Table 6. Increased workload (22.1%) was identified as the

Table 4. Analysis of factors influencing awareness of SNT.

Variable	Factors and classification	B	SE	β	t	p	R^2 (adjusted R^2)
Knowledge	Education (ref: College)						0.298 (0.283)
	Bachelor vs College	1.87	0.72	0.109	2.59	0.010	
	Master vs College	2.93	1.02	0.085	2.27	0.024	
	Position title (ref: Junior)						
	Intermediate vs Junior	0.72	0.36	0.096	2.02	0.044	
	Senior vs Junior	1.64	0.61	0.118	2.69	0.008	
Attitude	Education (ref: College)						0.214 (0.196)
	Bachelor vs College	1.56	0.68	0.091	2.29	0.023	
	Master vs College	2.31	0.93	0.077	2.48	0.014	
	Position title (ref: Junior)						
	Intermediate vs Junior	1.01	0.37	0.128	2.74	0.007	
	Senior vs Junior	1.74	0.49	0.172	3.55	<0.001	
	Years of work (ref: <5)						
	5–10 vs <5	–0.52	0.28	–0.104	–1.85	0.065	
	>10 vs <5	–0.86	0.32	–0.137	–2.70	0.007	
	Job role (ref: Clinical nurse)						
	Teaching vs Clinical	1.88	0.79	0.102	2.38	0.018	
	Research vs Clinical	2.34	0.88	0.083	2.65	0.009	
	Manager vs Clinical	1.95	0.90	0.067	2.17	0.031	
Overall	Position title (ref: Junior)						0.267 (0.252)
	Intermediate vs Junior	0.82	0.35	0.107	2.36	0.019	
	Senior vs Junior	1.72	0.58	0.121	2.97	0.003	
	Job role (ref: Clinical nurse)						
	Teaching vs Clinical	1.46	0.73	0.091	2.00	0.047	
	Research vs Clinical	1.89	0.81	0.078	2.34	0.020	
	Manager vs Clinical	1.75	0.84	0.066	2.08	0.039	

SNT, standardized nursing terminology.

most significant barrier, highlighting the challenge nurses face in managing additional documentation in a busy clinical setting. Lack of information system support (21.7%) and shortage of nursing informatics professionals (19.2%) were also cited as major obstacles, reflecting the constraints of limited technological and human resources. In addition, insufficient departmental attention (7.9%), unfamiliarity with SNTs (7.4%), lack of training (6.8%), and difficulty in localization (7.0%) were reported as secondary barriers. Collectively, these factors exerted a combined impact on the effective promotion of standardized nursing terminologies, pointing to the necessity of making improvements in aspects such as training, resource allocation, and management support in the days to come.

4. Discussion

In this survey of 515 nursing staff across 26 departments, women were found to comprise the majority of the workforce, with ages ranging from 22 to 53 years. Distribution of their duration of tenure presents a normal trend. Regarding position titles, most nurses held primary or intermediate positions, while the majority of staff had an undergraduate degree as their highest level of education. These data reflect the demographic characteristics, cultural backgrounds, department distributions, job role and so on of the nursing staff in our hospital, and also provide data support for further analyzing the factors influencing the nurses' Knowledge–Attitude–Practice regarding SNT.

4.1 Differences in SNT Knowledge–Attitude–Practice: Correlations With Demographic and Professional Factors

The present study elucidates the current state of Knowledge–Attitude–Practice regarding SNT among nursing staff. The findings revealed a limited understanding of SNT, despite a positive attitude toward their use, accompanied by a low tendency for actual application. The total knowledge score for SNT was 12.73 $\pm$ 4.61, indicating a low level of mastery. Notably, the relatively low level of SNT knowledge among nurses in this study cannot be attributed solely to the distribution of educational backgrounds; instead, it is supported by evidence from domestic research. A survey of 50 undergraduate nursing programs revealed that only 12% of these programs offer specialized courses titled "standardized nursing terminology", and among the programs that do include such content, 87% allocate fewer than 16 hours of teaching time, which is insufficient to support in-depth learning of the SNT concepts and application methods.

Table 5. Ranking of SNT systems and their usage distributions.

Term	*n* (%)	Rank
Nursing Interventions Classification (NIC)	337 (65.4)	1
North American Nursing Diagnosis Association (NANDA)	195 (37.9)	2
Clinical Care Classification (CCC)	108 (21.0)	3
International Classification for Nursing Practice (ICNP)	98 (19.0)	4
Nursing Outcomes Classification (NOC)	93 (18.1)	5
European Nursing care Pathways (ENP)	61 (11.8)	6
Omaha System (OS)	54 (10.5)	7
None of the above has been used	34 (6.6)	8

Table 6. Barriers to clinical promotion of SNT system.

Barrier Factor Frequency	*n* (%)	Rank
Increased workload	114 (22.1)	1
Lack of information system support and funding	112 (21.7)	2
Shortage of nursing informatics professionals	99 (19.2)	3
Insufficient departmental attention and requirements	41 (7.9)	4
Other barriers (e.g., unfamiliarity with SNT)	149 (28.9)	5

In the practice dimension, the total score was 31.72 $\pm$ 9.93, with generally low scores for its item, particularly for "Paying attention to the development dynamics of SNT", "Proactively learning knowledge related to SNT", and "Fully utilizing standardized language to describe the nursing process". Although some research on SNT exists in the country, it largely remains at the stage of recognition, introduction, translation, and limited application, with a lack of a unified SNT framework [23]. Additionally, nursing information systems are generally semi-informative and lack a structured design, with nursing records still manually entered as free text and poorly integrated with SNT [23].

The total attitude score was 35.05 $\pm$ 5.70, indicating that, despite low levels of SNT knowledge and practice among hospital nursing staff, they maintained a positive attitude toward the application of SNT in clinical practice, teaching, and research. Han *et al*. [16] found significant deficiencies in the cognition and application of North American International Nursing Diagnoses among 335 nursing staff in 15 top-tier hospitals across 10 provinces and cities in China, particularly in terms of their awareness and practice, while attitude scores were relatively higher, consistent with the results of this study.

Nurses' attitudes, knowledge, and behaviors are influenced by factors such as their education level, title, and job role. Clinical nurses, due to heavy workloads, tend to have lower mastery and application tendencies of nursing terminologies. Nurses in research positions, benefiting from more training and resources, have a deeper understanding of SNT. Nursing managers play an active role in promoting the application of SNT in the hospital's informatization construction. As nurses age and attain higher position titles, their recognition of the importance of SNT increases. In this survey, 96.7% of nurses at the research hospital held an undergraduate degree or higher, while only 1.9% had postgraduate qualifications, reflecting the lack of nursing information terminology courses in domestic nursing education and the resulting limited understanding of SNT among nurses. Experts recommend incorporating SNT into nursing education and in-service training to enhance nurses' information literacy [24].

The findings of the current study are consistent with domestic studies on nursing informatization, highlighting low SNT knowledge due to training deficiency. For example, Cai *et al*. [14] surveyed 1200 nurses across 15 tertiary hospitals in China and found that only 28.5% had received SNT training, comparable to the 23.1% in our study, where only head nurses received NANDA training. This confirms that insufficient SNT training is a nationwide issue, not limited to the research hospital.

4.2 Strengthening Nurses' SNT Awareness Through Practical Training Strategies

As one of the earliest SNT system introduced and promoted in China, the NANDA plays an indispensable role in improving the quality of nursing services and advancing the development of the nursing profession [25]. Despite targeted NANDA training for head nurses, overall awareness among nurses remained low at only 19.9%. This gap stems not only from individual factors but also from shortcomings in the training process. Specifically, two key reasons underlie this conclusion: First, the training process had obvious flaws, as only 26 head nurses—one per department—received NANDA training, and hospital records showed no mandate for these nurses to disseminate the training content to frontline staff. As a result, a striking 83.7% of frontline nurses reported in the status survey that they had "never heard of NANDA training", highlighting a significant gap in knowledge dissemination. Second, the greater independent learning advantage observed among nurses with higher

position titles and education further underscores the impact of training dissemination gap. This advantage likely stems from more systematic exposure to NANDA training during their academic and professional development, fostering a deeper understanding of SNT. Conversely, nurses with lower educational levels and titles may have fewer training opportunities and thus inadequate awareness and comprehension of SNT.

Although the head nurses received NANDA training, their awareness rate was only 27.3%, suggesting that the training content may not be comprehensive enough and the delivery methods potentially ineffective. This implies that a failure to cover the core elements of SNTs in the training content or to foster interactivity and practicality, achieving profound learning outcomes and a favorable awareness rate would remain challenging. Scenario-based leadership theory training [26], as an emerging method, has been shown to effectively enhance head nurses' management capabilities, indicating that adopting more interactive and practical training methods could similarly improve SNT awareness.

To enhance the dissemination and application of SNTs, it is imperative to broaden the hierarchical coverage of training, providing customized training content for frontline nurses at different levels and with varying learning needs. Such a personalized training strategy not only improves the head nurses' mastery of SNTs but also ensures that frontline clinical nurses can fully master and apply SNT, thereby enhancing the quality of nursing services in practice. Therefore, we need to re-examine and optimize existing training programs to ensure the comprehensiveness of training content, the effectiveness of methods, and the extensive coverage of training levels, in order to promote the application of SNTs in clinical nursing practice and enhance the quality of nursing services.

4.3 Broadening SNT Usage at Clinical Settings Through Information Construction

The rapid advancement of information technologies, such as cloud computing, mobile internet, and big data, has accelerated the adoption of electronic medical records and electronic health records within China's healthcare information systems. Alongside this technological advancement, the demand for SNT has increased, with their role in enhancing nursing documentation quality, increasing the visibility of nursing work, and elevating the quality of nursing practice widely acknowledged. A scoping review demonstrates that the adoption of SNT significantly improves the quality of health records, achieved by increasing the standardization of nursing documentation and promoting the transparency of nursing work [27]. Table 6 shows that NIC was the most commonly used SNT system (65.4%), followed by NANDA (37.9%). This aligns with China's nursing education model, which integrates both the NANDA (diagnoses) and NIC systems (interventions); however, the higher usage rate of NIC may be attributed to its higher practical relevance with daily clinical interventions (e.g., wound care, medication administration) that are part of the routine nursing work. However, the research also highlights key limitations in the application of SNTs, particularly the insufficient evidence regarding the correlation between nurses' knowledge levels and the practical application of SNTs, as well as unclear impacts on patient outcomes, workflow efficiency, or communication. Another study examined the use and impact of SNTs in the informatization practice of nursing and midwifery, finding that SNTs hold great potential for enhancing data interoperability, supporting clinical decision-making, and improving documentation quality; however, their effectiveness is influenced by factors such as nurses' competencies, the practice environment, technological infrastructure, and the quality of education [28].

In China, the adoption of SNTs remains at an early stage. Nursing staff are primarily encouraged to apply the international terminology systems, while research on developing localized terminologies aligned with the domestic nursing informatization construction process is lacking [14]. Existing research has pointed out that the sole application of an SNT system in China is not feasible, due to the differences between existing international terminology systems as well as the distinct nursing practice content and documentation habits in China [28]. Zhang *et al*. [6] suggested that future research on SNTs should be based on China's clinical development and actual needs, summarizing ideas from existing application experiences to expedite the exploration of a localized system construction applicable at the national level. Following the introduction of health informatization construction policies by China's health department, hospital nursing informatization has expanded rapidly, but most systems remain confined to closed-loop operation and management, hindering the integration of heterogeneous nursing data and thus limiting their potential in guiding practice at a larger scale [29]. Nursing informatics, as an emerging interdisciplinary field that integrates nursing, computer science [30], and information science, has a unique professional advantage in solving data barrier issues, and thus, there is a significant demand for the development of nursing informatics in China. Therefore, ongoing support from nursing informatics is essential for the standardization of nursing terminologies in the future.

Other recommendations include developing subsets of specialized terms based on domestic nursing practice, embedding these term items into nursing information systems after structured coding, establishing association rules between modules, developing a knowledge base that covers complete nursing procedures, and refining the structure and quantifiability of the nursing records. Meanwhile, targeted training should be offered to nursing staff to familiarize themselves with the newly added SNTs and their usage within the system, including term searching, selection and

entry, as well as interpreting the information and functions generated by the system based on these terms. Strengthening the informatization construction of SNTs is not only an inevitable requirement for improving the quality of nursing services but also a key step in achieving nursing data integration, enhancing nursing decision-making efficiency, and promoting the development of nursing research and education.

4.4 Limitations

This study has several key limitations. First, it used a cross-sectional self-reported survey design, which potentially introduces biases, such as recall bias, that affect response accuracy. Second, quantitative research variables were limited, and no significant influencing factors were identified in the practice dimension. This may be related to the questionnaire design—focusing only on SNT application frequency, without exploring driving/hindering factors such as institutional support or workflow compatibility—and the inherent sample characteristics like the single-center setting that leads to homogeneous nursing behaviors and insufficient data variability. Future studies will optimize questionnaire items and expand sample sources. Additionally, the current study was conducted in one tertiary hospital in Southwest China. Head nurse training (e.g., NANDA training) and baseline data (e.g., nursing informatization level, SNT awareness) here may differ from other local hospitals, limiting the result generalizability. Thus, findings of this single-center study are not generalizable to all other hospitals in Southwest China, underscoring the need for future multicenter studies.

5. Conclusion

In this study, we found that nurses in general hold a positive attitude toward SNT but demonstrate knowledge gaps and low practice levels. Position title, education level, and job role are key influencing factors of SNT usage, while increased workload, a lack of information system support, and a shortage of nursing informatics professionals were identified as major barriers.

Key Points

• Nurses in a tertiary hospital in Southwest China showed a positive attitude toward standardized nursing terminology (SNT), but their knowledge and practice levels were suboptimal.

• Higher education level, position title, and years of work were independent influencing factors of SNT usage.

• The most frequently reported barriers included increased workload, a lack of information system support, and a shortage of nursing informatics professionals.

• Institutional training programs and integration of SNT into electronic health records are urgently needed to promote its implementation.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

HF: Conceptualization, Methodology, Investigation, Writing—original draft. SP: Data curation, Formal analysis. LLC: Software, Visualization. YS: Supervision, Conceptualization, Methodology, Hypothesis formulation, Experimental design justification. All authors contributed to revising the manuscript critically for important intellectual content. 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 research project was conducted in accordance with the principles of the Declaration of Helsinki regarding medical research in humans, as well as local regulations. The study was approved by the Medical Ethical Committee of The Second Affiliated Hospital of Army Medical University (Approval Date: 28 December 2022; Approval Number: 2022-515-01) and informed consent was obtained from the participants.

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/BJHM50395.

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