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Knowledge, Attitude, and Practice of Nurses in Preventing Complications in Patients with Nephrotic Syndrome: A Cross-Sectional Study

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Background and Aim: Nephrotic syndrome (NS) is frequently accompanied by serious complications such as edema-related infections, thromboembolism, and acute kidney injury, which can significantly impact prognosis. Nurses are essential in early identification, patient education, and implementation of preventive measures. This study explores the knowledge, attitude, and practice (KAP) levels of nurses concerning complication prevention in nephrotic syndrome and identifies relevant influencing factors.

Methods: A cross-sectional survey was conducted from January to December 2023 across Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine and Shanghai Baoshan Medical Emergency Center in China, targeting nurses working in nephrology-related units. A total of 246 valid responses were obtained using a structured and pre-validated KAP questionnaire. The instrument included domains assessing factual understanding, behavioral attitudes, and routine clinical practices. Data were analyzed using descriptive statistics, Pearson's correlation, and logistic regression to determine relationships between demographic variables and KAP outcomes.

Results: The mean knowledge score among respondents was 5.12±2.67, attitude score was 18.76±5.02, and practice score was 30.45 ±11.07. Correlational analysis revealed significant positive associations between knowledge and practice ($r = 0.421$, $p < 0.001$), and between attitude and practice ($r = 0.336$, $p = 0.015$). Regression analysis identified prior nephrology education, years of clinical experience, and academic qualifications as independent predictors of higher practice scores.

Conclusion: While nurses generally hold positive attitudes towards complication prevention in nephrotic syndrome (NS), there are significant gaps in their knowledge and inconsistencies in the application of preventive practices. These findings emphasize the need for targeted training programs to enhance nurses' practical competencies in managing NS complications. By improving nurses' knowledge and clinical practices, especially in early detection and prevention, patient outcomes can be significantly improved, leading to more effective management of NS-related complications.

Keywords: nephrotic syndrome, complications, nurses, knowledge-attitude-practice, prevention, cross-sectional study

Introduction

Nephrotic syndrome (NS) is a chronic renal disorder characterized by heavy proteinuria, hypoalbuminemia, hyperlipidemia, and generalized edema. Beyond its primary manifestations, NS poses a substantial risk for complications such as infections, thromboembolic events, acute kidney injury, and long-term renal impairment.[1–3] These complications can significantly increase morbidity, prolong hospitalization, and elevate healthcare costs. Early recognition and proactive management are critical to improving patient prognosis, reducing hospital readmissions, and preventing irreversible organ damage.[4,5]

In clinical settings, nurses are often the first healthcare providers to detect early warning signs of NS-related complications. Their roles encompass not only routine care and medication administration but also active patient

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education, risk screening, and lifestyle counseling. Through continuous monitoring and close patient contact, nurses are well positioned to intervene promptly and implement complication-preventive strategies.[6,7] However, their ability to do so effectively is largely influenced by their level of knowledge, clinical attitude, and behavioral practice. Despite the rising burden of NS in China and other aging populations, there remains a lack of empirical data on how well-prepared nurses are to manage the potential complications of this condition. Existing literature has primarily focused on general nephrology knowledge or patient-level education, while the specific contribution and preparedness of nursing personnel in complication prevention have been underexplored. This study aims to fill this gap by assessing the KAP levels of nurses in preventing NS complications and identifying the factors influencing their practices.[8–10] Moreover, discrepancies in clinical training, lack of targeted protocols, and variable exposure to nephrology-specific content during education further contribute to practice inconsistencies. A recent systematic review highlights differences in perspectives between nurses and clinicians regarding NS complications.[11] This comparison underlines the need for further exploration of the role nurses play in complication prevention, which has been insufficiently addressed in current research.

Understanding nurses' knowledge, attitudes, and practices (KAP) regarding complication prevention in NS is crucial for identifying systemic gaps and designing effective interventions. Studies in similar domains have shown that higher levels of professional knowledge and proactive attitudes are associated with improved clinical behaviors and better patient outcomes.[12–14] However, no comprehensive KAP assessment has yet been conducted among Chinese nurses in the context of nephrotic syndrome.

This study seeks to address this gap by systematically evaluating the KAP levels of nurses involved in NS patient care across Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine and Shanghai Baoshan Medical Emergency Center. By identifying key influencing factors and barriers, we aim to provide evidence to support the development of structured education programs, nursing protocols, and practice guidelines to improve the quality of nephrotic syndrome management and reduce preventable complications.

Methods

Study Design and Participants

This descriptive cross-sectional study was conducted between January and December 2023 in the nephrology and internal medicine departments of Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine and Shanghai Baoshan Medical Emergency Center in China. A total of 246 registered nurses working in nephrology, general medicine, or related inpatient units were invited to participate. Nurses were eligible if they: 1) had direct clinical responsibilities involving patients diagnosed with nephrotic syndrome; 2) were able and willing to complete the questionnaire independently; and 3) had no barriers to communication. Exclusion criteria included: 1) incomplete survey responses exceeding 5% of items; 2) known psychiatric or neurological disorders that could impair judgment; and 3) inability to complete the follow-up validation step for test-retest reliability.

The study employed a purposive sampling method, where 246 registered nurses working in nephrology, general medicine, and related inpatient units at Ruijin Hospital and Shanghai Baoshan Medical Emergency Center were invited to participate. This method ensured that the sample was representative of nurses who had direct clinical responsibilities involving nephrotic syndrome patients. Participants were selected based on their involvement in the care of nephrotic syndrome patients, ensuring that their experience and practice were relevant to the study's focus. This purposive approach allows for a focused evaluation of nurses who are specifically engaged in the prevention and management of complications in nephrotic syndrome. Surveys with more than 5% of missing responses were excluded to ensure the integrity of the data used for analysis. This threshold was selected based on standard practices in survey research, where 5% missing data is generally considered an acceptable limit that does not introduce significant bias into the results. Only complete responses were considered valid for statistical analysis to maintain the reliability of the study findings.

The study was conducted in full compliance with ethical guidelines, and in accordance with the Declaration of Helsinki. All participants provided written informed consent before participation. The study protocol was reviewed and approved by the institutional ethics committees of Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine and Shanghai Baoshan Medical Emergency Center. Ethical procedures, including maintaining participant

confidentiality and anonymity, were strictly followed throughout the study. Despite the large sample size of 246 participants, ethical standards were rigorously upheld, and no concerns regarding the violation of ethical procedures were identified.

Data Collection Procedures

Data were collected using a structured, self-administered questionnaire specifically designed to evaluate knowledge, attitude, and practice (KAP) regarding the prevention of complications in nephrotic syndrome. The questionnaire was adapted from previously validated instruments used in nephrology nursing and chronic disease prevention research, with modifications made for relevance to nephrotic syndrome care. The final tool consisted of 31 items across three domains: 10 knowledge items, 8 attitude items, and 13 practice items. Each knowledge item was scored as either correct (1) or incorrect/unclear (0), producing a total possible score ranging from 0 to 10. Knowledge levels were categorized into low (0–3), moderate (4–6), and high (7–10). Attitude items were assessed on a 5-point Likert scale from 0 (strongly disagree) to 4 (strongly agree), resulting in a score range of 0 to 32. Scores less than 8 indicated a negative attitude, 8 to 16 were considered moderate, and scores above 16 were deemed positive. Practice items were rated from 0 (never) to 4 (always), with a total possible score from 0 to 52, categorized as poor (0–13), general (14–26), good (27–38), and excellent (39–52).

Translation and Validation

The questionnaire was initially developed in English and translated into Chinese following WHO guidelines for cross-cultural adaptation. Two independent bilingual nephrology professionals translated the items into Mandarin, and a separate linguist conducted back-translation into English. Discrepancies between the versions were reconciled through group discussion and expert consensus. The final Chinese version was reviewed by three senior nurse educators to ensure linguistic clarity and clinical applicability for the target population.

Pretest Evaluation and Reliability Assessment

A pilot test was conducted with 50 nurses to evaluate the clarity, relevance, and difficulty of each item. Items that received more than 20% negative feedback in terms of clarity or relevance were revised before the formal survey distribution. For reliability testing, a subgroup of 30 participants completed the questionnaire a second time after a two-week interval. Test-retest reliability was evaluated using Pearson's correlation coefficient. Internal consistency across the knowledge, attitude, and practice domains was assessed using Cronbach's alpha. The difficulty index for knowledge items was calculated using the formula: Difficulty Index (%) = (Number of correct responses / Total responses) × 100. Items with difficulty values outside the 30–70% range were flagged for review and refinement.

Sample Size Calculation

According to psychometric standards, a sample size of 5–10 participants per questionnaire item is recommended for validation and factor analysis. With 31 items, the minimum required sample size was between 155 and 310. A final sample of 246 participants exceeded this threshold, ensuring adequate statistical power and representativeness for subsequent analyses.

Statistical Analysis

Data analysis was performed using SPSS version 26.0. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize demographic data and KAP scores. The Shapiro–Wilk test was employed to assess normality. Between-group comparisons were conducted using independent-sample t-tests and one-way ANOVA. Pearson correlation coefficients were calculated to assess relationships between knowledge, attitude, and practice scores. Multivariate logistic regression was used to identify predictors of good practice, with results expressed as odds ratios (OR) and 95% confidence intervals (CI). Model fit was assessed with the Hosmer-Lemeshow goodness-of-fit test, and a p-value < 0.05 was considered statistically significant throughout the analyses.

Results

Participant Characteristics

A total of 246 nurses from Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine and Shanghai Baoshan Medical Emergency Center completed the survey. Among them, 91.9% were female and 8.1% male. The average age of participants was 35.25 ± 7.55 years. Regarding residence, 39.8% were from rural regions, 48.6% from urban areas, and 11.4% from suburban settings. The education level varied: 14.2% had primary school or below, 22.0% middle school, 22.0% high school or technical training, 35.8% junior college or bachelor's degree, and 6.1% had a master's degree or above. Over half (64.2%) had less than 5 years of experience. In terms of professional status, 50.8% were employed, 40.7% self-employed, and 8.5% classified as other. Monthly income levels were nearly evenly split between those earning <700 USD (50.8%) and ≥700 USD (49.2%). The majority were married (64.2%), with 30.9% unmarried and 4.9% divorced or widowed. Most respondents (88.6%) held a nurse title, while 11.4% were associate or full professors. Regarding health background, 14.2% had a history of chronic illness, including hypertension, diabetes, or cardiovascular disease. Additionally, 28.5% reported having sleep problems. Concerning work patterns, 45.5% worked more than 40 hours per week, and 64.2% regularly worked night shifts. Only 26.8% held clinical teaching roles, and 41.5% had experienced promotion. Self-rated clinical competence was high in 37.0% of participants, moderate in 50.8%, and low in 12.2%. Comprehensive demographic and KAP score distributions are summarized in Table 1. The average

Table 1 Demographic Characteristics and KAP Scores of Participants

Variables	N (%)	Knowledge Score (Mean ± SD)	Attitude Score (Mean ± SD)	Practice Score (Mean ± SD)
Total	246 (100.0)	4.53 ± 2.88	17.84 ± 4.64	31.25 ± 11.10
Gender				
Male	20 (8.1)	4.18 ± 2.64	16.87 ± 4.56	30.08 ± 12.30
Female	226 (91.9)	4.92 ± 2.99	18.56 ± 4.91	32.20 ± 10.88
Age (years)	35.25 ± 7.55	–	–	–
Residence				
Rural	99 (39.8)	3.94 ± 2.60	16.85 ± 4.15	30.51 ± 12.19
Urban	120 (48.6)	5.12 ± 2.84	17.42 ± 4.28	31.29 ± 11.43
Suburban	28 (11.4)	4.33 ± 3.00	18.10 ± 4.52	32.46 ± 12.28
Education Level				
Primary school or below	35 (14.2)	3.55 ± 2.86	16.27 ± 4.53	31.05 ± 12.99
Middle school	54 (22.0)	2.82 ± 2.61	17.12 ± 4.28	31.46 ± 11.27
High school / Technical	54 (22.0)	4.44 ± 2.13	16.77 ± 4.31	31.28 ± 12.11
Junior college / Bachelor's	88 (35.8)	5.12 ± 2.73	19.10 ± 5.23	30.51 ± 10.79
Master's degree or above	15 (6.1)	5.37 ± 3.29	19.97 ± 4.66	33.55 ± 13.19
Work Status				
Employed	125 (50.8)	4.88 ± 2.55	18.55 ± 5.26	31.43 ± 11.28
Self-employed	100 (40.7)	3.59 ± 2.69	17.46 ± 4.91	30.55 ± 11.65
Other	21 (8.5)	3.95 ± 2.68	16.39 ± 4.95	30.96 ± 11.35
Years of Experience				
<5 years	158 (64.2)	4.19 ± 2.17	17.10 ± 4.91	30.55 ± 11.36
≥5 years	88 (35.8)	4.94 ± 3.04	17.35 ± 4.12	32.64 ± 10.54
Monthly Income (USD)				
<700	125 (50.8)	4.26 ± 2.66	17.11 ± 4.05	30.52 ± 11.33
≥700	121 (49.2)	5.08 ± 3.12	17.80 ± 4.78	32.18 ± 10.47
Marital Status				
Unmarried	76 (30.9)	4.50 ± 3.17	17.30 ± 5.36	30.66 ± 11.43
Married	158 (64.2)	4.88 ± 2.55	18.54 ± 4.77	31.71 ± 10.29
Divorced / Widowed	12 (4.9)	4.37 ± 2.67	18.46 ± 4.62	32.23 ± 12.18

(*Continued*)

Table 1 (Continued).

Variables	N (%)	Knowledge Score (Mean ± SD)	Attitude Score (Mean ± SD)	Practice Score (Mean ± SD)
Technical Title				
Nurse	218 (88.6)	4.28 ± 2.55	17.25 ± 5.27	30.77 ± 10.29
Assoc./Professor of Nursing	28 (11.4)	5.02 ± 3.55	17.36 ± 4.68	32.16 ± 11.88
Chronic Disease History				
Yes (HTN/DM/CVD)*	35 (14.2)	4.01 ± 2.51	16.81 ± 4.23	30.90 ± 11.13
No	211 (85.8)	4.86 ± 2.90	19.07 ± 5.16	31.86 ± 10.91
Sleeping Condition				
Yes	70 (28.5)	4.18 ± 3.02	16.37 ± 4.58	30.13 ± 11.82
No	176 (71.5)	5.10 ± 2.59	18.12 ± 5.01	33.47 ± 10.87
Weekly Working Hours				
≤40 hrs	134 (54.5)	4.96 ± 2.77	18.77 ± 4.45	32.60 ± 10.88
>40 hrs	112 (45.5)	4.01 ± 2.91	16.74 ± 4.71	29.61 ± 11.49
Night Shift				
Yes	158 (64.2)	4.15 ± 2.81	17.13 ± 4.62	30.12 ± 10.77
No	88 (35.8)	5.26 ± 2.89	18.94 ± 4.57	32.95 ± 11.43
Clinical Teaching Role				
Yes	66 (26.8)	5.31 ± 2.58	19.73 ± 4.22	34.18 ± 10.09
No	180 (73.2)	4.18 ± 2.79	17.13 ± 4.71	30.02 ± 11.27
Self-rated Clinical Competence				
High	91 (37.0)	5.60 ± 2.53	19.85 ± 4.11	34.41 ± 10.17
Moderate	125 (50.8)	4.23 ± 2.61	17.16 ± 4.50	30.23 ± 10.95
Low	30 (12.2)	3.66 ± 2.78	15.80 ± 4.64	27.88 ± 12.41
Promotion Experience				
Yes	102 (41.5)	5.11 ± 2.67	18.72 ± 4.46	32.85 ± 10.64
No	144 (58.5)	4.03 ± 2.94	17.18 ± 4.82	29.96 ± 11.53

Notes: *means 18 (7.3%) had hypertension, 10 (4.1%) had diabetes, and 7 (2.8%) had cardiovascular diseases. 1 CNY ≈ 0.14 USD, exchange rate at the time of study; 700 Yuan≈ 700.

knowledge score was 4.53 ± 2.88 (out of 10). Based on score classification, 34.7% of nurses were in the low knowledge group (0–3), 38.9% had moderate knowledge (4–6), and only 26.4% achieved high scores (≥7). Nurses with postgraduate education and clinical teaching roles tended to score higher. Attitude scores averaged 17.84 ± 4.64 (range 0–32). Most participants (71.5%) exhibited a positive attitude toward complication prevention, 22.9% demonstrated a moderate attitude, and 5.6% expressed negative attitudes. Positive attitudes were more common among nurses with higher education, better self-rated competence, and promotion experience. Practice scores averaged 31.25 ± 11.10 (range 0–52). Overall, 21.7% of respondents demonstrated excellent practices (score ≥39), 30.8% were in the good range (27–38), 29.1% fell into the general category (14–26), and 18.4% showed poor practice (<14). Nurses who had been promoted, had teaching duties, or rated themselves as highly competent tended to practice more effectively. Distribution across KAP dimensions is presented in Table 1.

Item-Level Performance Analysis

Among the ten knowledge items, the highest correct response rate (62.60%) was seen for infection prevention in nephrotic syndrome patients. The lowest accuracy was found in the question concerning routine anticoagulation in hypoalbuminemic patients (23.58%), indicating considerable confusion about thromboembolism prophylaxis. Multiple items, particularly K4, K7, and K10, fell below the 50% accuracy threshold, reflecting persistent knowledge gaps in complication monitoring, anticoagulation, and alternative therapies. Full item-level performance is detailed in Table 2.

Table 2 Knowledge Dimension in KAP Distribution of Responses Among Participants

Knowledge Items	Correct n(%)	Incorrect n(%)	Unclear n(%)
K1. Edema and proteinuria are hallmark features of nephrotic syndrome, and their persistence increases the risk of complications.	132 (53.66)	41 (16.67)	73 (29.67)
K2. Infections are one of the most common and serious complications of nephrotic syndrome due to urinary protein loss and immunosuppression.	154 (62.60)	32 (13.01)	60 (24.39)
K3. Long-term use of corticosteroids in NS management can lead to iatrogenic complications such as osteoporosis, diabetes, and hypertension.	128 (52.03)	49 (19.92)	69 (28.05)
K4. Thromboembolic events are a recognized complication of NS, especially in patients with hypoalbuminemia (<25g/L).	101 (41.06)	64 (26.02)	81 (32.92)
K5. Early identification of complications such as peritonitis and acute kidney injury is essential to reducing mortality in NS patients.	139 (56.50)	39 (15.85)	68 (27.64)
K6. Regular monitoring of serum creatinine, urine output, and electrolytes is crucial in preventing renal function deterioration in NS patients.	145 (58.94)	35 (14.23)	66 (26.83)
K7. Anticoagulant prophylaxis is routinely recommended in all NS patients regardless of albumin level.	58 (23.58)	112 (45.53)	76 (30.89)
K8. NS patients with persistent edema require fluid and sodium restrictions as part of complication prevention.	119 (48.37)	57 (23.17)	70 (28.46)
K9. Health education on recognizing signs of infection and thrombosis should be part of nursing routine in NS care.	133 (54.07)	39 (15.85)	74 (30.08)
K10. Complementary therapies such as traditional Chinese medicine have proven efficacy in preventing NS-related complications.	88 (35.77)	87 (35.37)	71 (28.86)

Attitude Item Distribution

Nurses generally acknowledged the importance of early detection and multidisciplinary intervention in NS complications. Over 80% either agreed or strongly agreed that nurses play a key role in complication prevention. However, when asked whether nurses should lead complication management teams, responses were more divided, with nearly 20% disagreeing or expressing uncertainty. Notably, 75.2% agreed that time constraints limited their ability to apply preventive strategies, highlighting an operational barrier. Detailed response patterns are shown in Table 3.

Table 3 Attitude Dimension in KAP Distribution of Responses Among Participants

Attitude Items	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
A1. Preventing complications in nephrotic syndrome is an essential part of nursing care.	112 (45.5)	98 (39.8)	26 (10.6)	8 (3.3)	2 (0.8)
A2. Nurses play a central role in identifying early signs of complications in NS patients.	101 (41.1)	102 (41.5)	24 (9.8)	15 (6.1)	4 (1.6)
A3. I feel confident in my ability to educate NS patients about preventing infection and thrombosis.	64 (26.0)	96 (39.0)	51 (20.7)	28 (11.4)	7 (2.8)
A4. Routine screening and assessment for complications should be part of nursing protocols in nephrology wards.	109 (44.3)	91 (37.0)	31 (12.6)	11 (4.5)	4 (1.6)
A5. Nurses should receive ongoing training on managing complications associated with nephrotic syndrome.	122 (49.6)	84 (34.1)	27 (11.0)	10 (4.1)	3 (1.2)
A6. I believe nephrology nurses should collaborate more with physicians to reduce the risk of complications.	103 (41.9)	96 (39.0)	30 (12.2)	12 (4.9)	5 (2.0)
A7. Time constraints in clinical practice often limit the implementation of complication-prevention strategies.	49 (19.9)	102 (41.5)	53 (21.5)	34 (13.8)	8 (3.3)
A8. Nurses should take leadership in educating patients and families about complication risks in NS.	66 (26.8)	98 (39.8)	47 (19.1)	27 (11.0)	8 (3.3)

Practice Behavior Frequency

Clinical practices varied. The most consistently performed behaviors were regular monitoring of edema, urine output, and infection signs, with over 42% reporting "always". Patient education, particularly on thrombosis warning signs and follow-up care, was less frequently performed; 41.2% reported "seldom" or "never" educating patients on thromboembolism. Only 25.6% of nurses reported always updating their knowledge via training or guidelines. These findings underscore a disconnection between positive attitudes and real-world implementation. Practice frequency by item is listed in Table 4.

Correlation Among Knowledge, Attitude, and Practice

Pearson correlation analysis demonstrated significant positive relationships among knowledge, attitudes, and practices. The strongest correlation was between knowledge and practice ($r = 0.421$, $p < 0.001$, 95% CI [0.303, 0.540]), followed by knowledge and attitude ($r = 0.351$, $p < 0.001$, 95% CI [0.219, 0.632]), and attitude and practice ($r = 0.336$, $p = 0.015$, 95% CI [0.061, 0.611]). These results support the interdependence of cognitive, affective, and behavioral domains in complication prevention (Table 5).

Table 4 Practices Dimension in KAP Distribution of Responses Among Participants

Practice Items	Always n(%)	Often n (%)	Sometimes n(%)	Seldom n(%)	Never n(%)
P1. I monitor NS patients regularly for early signs of infection, edema, or changes in urine output.	104 (42.3)	86 (35.0)	34 (13.8)	17 (6.9)	5 (2.0)
P2. I educate patients and families about the importance of infection prevention (eg, hand hygiene, avoiding crowds).	96 (39.0)	82 (33.3)	41 (16.7)	19 (7.7)	8 (3.3)
P3. I assess patients for signs of thrombosis, such as limb swelling or unexplained shortness of breath.	74 (30.1)	91 (37.0)	51 (20.7)	21 (8.5)	9 (3.7)
P4. I participate in interdisciplinary discussions related to NS complication management.	61 (24.8)	84 (34.1)	59 (24.0)	30 (12.2)	12 (4.9)
P5. I document patient risk factors for complications in the nursing record.	78 (31.7)	88 (35.8)	45 (18.3)	25 (10.2)	10 (4.1)
P6. I apply fluid and sodium restriction education in nursing care for patients with persistent edema.	87 (35.4)	79 (32.1)	41 (16.7)	25 (10.2)	14 (5.7)
P7. I refer patients with severe proteinuria or hypoalbuminemia for physician reassessment.	108 (43.9)	83 (33.7)	34 (13.8)	14 (5.7)	7 (2.9)
P8. I assist in implementing thromboprophylaxis protocols for at-risk NS patients.	59 (24.0)	68 (27.6)	60 (24.4)	38 (15.4)	21 (8.5)
P9. I provide psychological support or emotional guidance to patients worried about complications.	51 (20.7)	74 (30.1)	65 (26.4)	36 (14.6)	20 (8.1)
P10. I update my knowledge on NS complications through guidelines, seminars, or online resources.	63 (25.6)	79 (32.1)	57 (23.2)	29 (11.8)	18 (7.3)
P11. I help patients recognize when they should seek urgent care (eg, fever, shortness of breath, decreased urine).	89 (36.2)	77 (31.3)	43 (17.5)	21 (8.5)	16 (6.5)
P12. I regularly participate in nursing team discussions or case reviews involving NS complications.	55 (22.4)	83 (33.7)	61 (24.8)	29 (11.8)	18 (7.3)
P13. I remind patients to adhere to prescribed dietary and medication plans to reduce their complication risk.	94 (38.2)	81 (32.9)	42 (17.1)	21 (8.5)	8 (3.3)

Table 5 Correlation Analysis Between Knowledge, Attitudes, and Practices

Knowledge	Attitudes	Practices	
Knowledge	1		
Attitudes	0.351 (P < 0.001)	1	
Practices	0.421 (P < 0.001)	0.336 (P = 0.015)	1

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Table 6 Univariate and Multivariate Logistic Regression Analysis for Practice Levels

Variables	Univariate OR (95% CI)	p value	Multivariate OR (95% CI)	p value
Knowledge score	1.19 (1.09–1.31)	<0.001	1.14 (1.05–1.26)	0.007
Attitude score	1.05 (1.01–1.14)	0.018	1.08 (1.03–1.20)	0.010
Gender (Ref: Male)	1.21 (0.81–2.15)	0.284	–	–
Age (continuous)	0.98 (0.88–1.32)	0.364	–	–
Residence (Ref: Rural)				
Urban	1.38 (0.76–2.11)	0.206	–	–
Suburban	1.47 (0.86–2.61)	0.183	–	–
Education Level (Ref: Primary)				
Middle School	1.26 (0.55–1.62)	0.332	1.28 (0.64–2.13)	0.168
High school/Technical	1.24 (0.35–1.65)	0.812	1.12 (0.71–1.65)	0.835
Junior college/Bachelor's	1.10 (0.58–2.11)	0.692	1.36 (0.75–2.12)	0.516
Master's or above	3.61 (1.63–6.23)	0.024	3.51 (1.31–5.66)	0.005
Work Status (Ref: Employed)				
Self-employed / Other	0.55 (0.38–1.46)	0.366	0.78 (0.55–1.89)	0.234
Monthly Income (USD) (Ref: <700)	1.33 (0.69–1.49)	0.431	–	–
Years of Experience (Ref: <5 yrs)	1.08 (0.81–1.36)	0.294	–	–
Marital Status (Ref: Unmarried)				
Married	0.89 (0.43–1.42)	0.189	–	–
Divorced/Widowed	0.92 (0.78–1.30)	0.813	–	–
Technical Title (Ref: Nurse)	1.08 (0.81–1.34)	0.135	–	–
Chronic Disease History (Ref: Yes)	1.21 (0.81–2.15)	0.284	–	–
Sleeping Condition (Ref: Yes)	1.33 (0.91–2.07)	0.311	–	–
Weekly Working Hours (Ref: ≤40 hrs)	0.84 (0.60–1.29)	0.221	–	–
Night Shift (Ref: Yes)	1.12 (0.78–1.91)	0.412	–	–
Clinical Teaching Role (Ref: No)	1.64 (1.03–2.68)	0.041	1.41 (0.93–2.28)	0.072
Self-rated Clinical Competence				
Moderate (ref)	Ref	–	–	–
High	2.11 (1.22–3.41)	0.014	1.75 (1.08–3.01)	0.036
Low	0.78 (0.43–1.65)	0.189	–	–
Promotion Experience (Ref: No)	1.67 (1.13–2.92)	0.026	1.53 (1.07–2.74)	0.041

Notes: Practice levels were dichotomized as poor/general practice (score < 27) and good/excellent practice (score ≥ 27). Significant results are indicated by P < 0.05.

Predictors of Higher Practice Levels

Univariate logistic regression identified knowledge and attitude scores, education level, self-rated competence, clinical teaching role, and promotion experience as significant predictors of high practice levels. In multivariate regression, knowledge (OR = 1.14; 95% CI: 1.05–1.26; p = 0.007) and attitude scores (OR = 1.08; 95% CI: 1.03–1.20; p = 0.010) remained significant.

In addition, having a master's degree or higher was independently associated with better practice (OR = 3.51; 95% CI: 1.31–5.66; p = 0.005). Self-rated high competence (OR = 1.75; 95% CI: 1.08–3.01; p = 0.036) and promotion experience (OR = 1.53; 95% CI: 1.07–2.74; p = 0.041) were also positively associated. Variables such as age, gender, income, and night shift status were not statistically significant predictors. Full regression details are provided in Table 6.

Discussions

This study sheds light on the current state of nursing knowledge, attitudes, and practices related to the prevention of complications in patients with nephrotic syndrome.[15–17] As frontline healthcare providers, nurses play an indispensable role in identifying early warning signs, delivering patient education, and coordinating multidisciplinary interventions aimed at minimizing adverse outcomes. The results demonstrate that while nurses generally maintain a positive attitude

and engage in preventive behaviors, their foundational knowledge of nephrotic syndrome complications remains limited. This disconnect between attitude and knowledge suggests an underlying gap in both formal training and clinical exposure. Recent studies have explored the role of nurses in managing chronic kidney disease and nephrotic syndrome, highlighting the need for continued professional development and education.[18,19] This aligns with our findings, which emphasize the importance of targeted training to improve nursing practices in complication prevention. By incorporating these recent studies, our work provides a more comprehensive understanding of the current state of nephrotic syndrome care from a nursing perspective.

The moderate knowledge levels observed among the participants are consistent with previous studies in chronic disease nursing, where practical experience often outpaces theoretical understanding. In this context, limited familiarity with thromboembolic risk, hypoalbuminemia-associated complications, and long-term renal monitoring emerged as key deficiencies. These areas are crucial for early intervention and patient safety, yet they appear underrepresented in the knowledge profile of general ward nurses. This indicates a pressing need for nephrology-specific content to be more prominently integrated into continuing nursing education and certification programs. Notably, nurses with higher levels of knowledge were significantly more likely to demonstrate effective clinical practices and maintain positive attitudes toward complication prevention.[20] This finding supports the conceptual framework of health behavior change, which posits that knowledge acts as a catalyst for both motivation and action. The correlation between knowledge and practice also highlights the critical role of institutional support in fostering evidence-based care. Without access to updated guidelines, structured training, and supervisory feedback, even well-intentioned nurses may struggle to apply best practices consistently.

In line with other studies across nursing specialties, this research confirmed that higher educational attainment and prior nephrology training are strong predictors of better clinical practice. Nurses with postgraduate education exhibited superior performance in applying preventive strategies, suggesting that advanced academic preparation not only deepens knowledge but also enhances critical thinking and interdisciplinary coordination.[21,22] These findings underscore the value of postgraduate nursing education, not just for personal development but also for improving clinical outcomes in high-risk patient populations.

Despite the generally favorable attitudes observed, several inconsistencies were noted in actual practice behaviors. For example, many nurses infrequently provided education on thromboembolism or individualized preventive counseling to patients, despite acknowledging their importance. Such discrepancies may be attributed to systemic barriers, including insufficient staffing, high workload, lack of formal nephrology protocols, or limited collaboration with physicians. This echoes findings from studies in other domains such as diabetes, osteoporosis, and heart failure, where fragmented care environments often hinder effective knowledge translation.[23,24]

This study provides valuable insights into the role of nurses in preventing complications associated with NS. While clinicians play a key role in the medical management of NS, nurses contribute significantly to the early detection of complications and the implementation of preventive strategies. Nurses, who are often the first to observe changes in patients' conditions, have the unique opportunity to identify early warning signs of complications such as infections, thromboembolism, and acute kidney injury. Their proactive engagement in patient education, lifestyle counseling, and routine monitoring can complement clinicians' efforts, ensuring a more holistic and comprehensive approach to patient care. From a nursing perspective, this study highlights the importance of continuous education and training to enhance the knowledge, attitudes, and practices of nursing staff in nephrotic syndrome management. By strengthening the competencies of nurses, we can improve not only the prevention of complications in adult patients but also in pediatric patients, where early intervention is crucial for minimizing long-term renal damage. The findings underscore the importance of collaboration between nurses and clinicians to ensure optimal management of nephrotic syndrome complications across diverse patient populations.

This study has several limitations. First, the cross-sectional design restricts the ability to draw causal inferences from the data. While the study provides valuable insights into the current state of nurses' KAP regarding nephrotic syndrome complication prevention, the inability to track changes over time limits the understanding of how these factors evolve. Second, the study relied on self-reported data, which may introduce response bias or inaccuracies in reporting knowledge and practices. Third, while our sample of 246 nurses was representative of those working in nephrology-related units in

two major hospitals, the findings may not be generalizable to other regions or healthcare systems, especially in rural areas or lower-resource settings. Additionally, the study was conducted in a single country, China, and the findings may not fully capture the diversity of practices and perspectives across different countries or cultural contexts. These limitations suggest the need for further research using longitudinal designs, objective measures, and more geographically diverse samples.

This study adds to a growing body of evidence advocating for the development of structured, nurse-centered models of chronic disease management. In the case of nephrotic syndrome, where complications are frequent and potentially life-threatening, empowering nurses with accurate knowledge and institutional support is vital. Improving clinical education, clarifying role responsibilities, and fostering interdisciplinary communication are key to enhancing the quality and consistency of care.

Conclusion

This study provides a comprehensive evaluation of nurses' knowledge, attitudes, and practices in preventing complications associated with nephrotic syndrome. Although the majority of nurses expressed positive attitudes and demonstrated reasonable levels of preventive behavior, significant knowledge gaps persist, especially in areas critical to patient safety. The alignment among KAP domains and the influence of educational level and specialized training emphasize the need for systematic investment in nephrology-focused education and structured clinical support. By equipping nurses with both the knowledge and the operational tools to act effectively, healthcare systems can improve early detection, reduce preventable complications, and optimize outcomes for patients with nephrotic syndrome.

Data Sharing Statement

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

Informed Consent and Ethical Approval

This cross-sectional study was approved by the ethics committees of Ruijin Hospital affiliated with Shanghai Jiao Tong University School of Medicine and Shanghai Baoshan Medical Emergency Center. All patients provided written informed consent.

Consent for Publication

The patient provided written informed consent for publication of this research and the associated images.

Author Contributions

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

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Disclosure

The authors have no conflicts of interest to declare.

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