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Professional nurses' knowledge of prevention and management of peritonitis in renal units

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Background: Peritoneal dialysis–associated peritonitis remains a serious complication contributing to morbidity, mortality, and treatment failure among patients with end-stage kidney disease. Despite evidence-based guidelines, rising infection rates highlight the need to strengthen professional nurses' knowledge to improve prevention based on evidence-based guidelines.

Aim: To develop, implement and evaluate an educational intervention to enhance professional nurses' knowledge regarding the prevention and management of peritonitis in renal units in Nelson Mandela Bay.

Setting: Three renal units in private and public hospitals in Nelson Mandela Bay.

Methods: A quantitative, quasi-experimental one-group pre-test and post-test design was employed. A census sample of $n = 37$ professional nurses was included. Baseline and post-intervention knowledge were assessed using a structured questionnaire. An educational intervention aligning with the 2022 International Society for Peritoneal Dialysis peritonitis guidelines was implemented. Data were analysed using descriptive and inferential statistics with the assistance of a statistician. Validity and reliability were assessed, and ethical considerations were upheld.

Results: Post-intervention knowledge scores improved across all domains. Statistically significant improvements were observed in knowledge related to the definition and measurement of peritonitis ($p = 0.011$), prevention strategies ($p = 0.029$), and overall knowledge ($p = 0.007$), with moderate effect sizes.

Conclusion: A guideline-based educational intervention significantly improved professional nurses' knowledge of key aspects of peritonitis prevention and recognition. Integrating structured, evidence-based education into renal nursing practice may enhance patient outcomes and promote safer peritoneal dialysis care.

Contribution: This study provides evidence supporting targeted educational interventions to strengthen renal nursing practice and improve adherence to international peritoneal dialysis guidelines.

Keywords: educational intervention; professional nurses; peritonitis; peritoneal dialysis; renal units; knowledge.

Introduction

Chronic kidney disease, the main precursor to end-stage kidney disease, is primarily caused by diabetes and hypertension and often goes undetected until significant nephron loss occurs, earning the label 'silent killer' (Kalantar-Zadeh et al. 2021; Thomas 2019). Globally, approximately 700 million people live with chronic kidney disease (Francis et al. 2024). Chronic kidney disease diagnosis relies on serum creatinine, urea, and estimated glomerular filtration rate; in advanced stages, progression to end-stage kidney disease (with an estimated glomerular filtration rate of < 15 mL/min/1.73 m^2) requires kidney replacement therapy (National Kidney Foundation 2023). Chronic kidney disease staging guides clinical decision-making and intervention, but access to kidney replacement therapy in public renal units is often limited by infrastructure, screening gaps, and systemic constraints, with the coronavirus disease 2019 pandemic exacerbating delays (Francis et al. 2024). In many countries, including South Africa, renal units provide outpatient dialysis for patients with end-stage kidney disease through haemodialysis or peritoneal dialysis (collectively known as kidney replacement therapy) (Karkar & Wilkie 2023). Peritoneal dialysis offers home-based treatment, improving quality of life and reducing infection exposure; after placement of a peritoneal catheter, patients receive training on aseptic techniques and dialysis

exchanges, which are performed by instilling dialysis fluid into the abdominal cavity and subsequently draining it to remove waste products and excess fluid (National Institute of Diabetes and Digestive and Kidney Diseases 2024). However, it carries the risk of peritonitis, a serious complication that can lead to sepsis, catheter loss, membrane damage, and mortality (Li et al. 2022; Thomas 2019). Peritonitis is a serious and potentially life-threatening complication among patients undergoing peritoneal dialysis. Peritoneal dialysis-associated peritonitis differs from general peritonitis, arising mainly from contamination during dialysis or infection via the catheter. Infection can occur through five primary pathways: intraluminal, periluminal, transmural, haematogenous, or vaginal (Thomas 2019). Risk factors include poor aseptic technique, touch contamination, exit-site or tunnel infections, catheter mishandling, and inflammatory reactions to dialysate, with common pathogens including *Staphylococcus aureus*, coagulase-negative staphylococci, *Pseudomonas aeruginosa*, and *Candida* (International Society for Peritoneal Dialysis 2022; Salzer 2018). Peritonitis incidence in peritoneal dialysis varies by geography, patient factors, and adherence to clinical protocols, with the International Society for Peritoneal Dialysis (ISPD) recommending fewer than 0.40 episodes per patient-year (Li et al. 2022; Moloi & Kalawo 2018). Key diagnostic criteria include abdominal pain, cloudy effluent, white cell count > 100, and positive effluent culture. Early recognition of symptoms such as fever, nausea, and abdominal discomfort is crucial, and severe cases may require hospitalisation (Wang, Sawyer & Shah 2023). Prevention strategies include comprehensive patient and caregiver health education, adherence to strict aseptic technique during dialysis exchanges, routine exit-site care, prophylactic antibiotics where indicated, and prompt recognition and management of early signs of infection; recurrent or refractory cases may require catheter removal (International Society for Peritoneal Dialysis 2022; Woodrow et al. 2017). Peritonitis also imposes financial burdens on patients and healthcare systems, including treatment costs, hospitalisation, loss of income, and transport expenses (Al Sahlawi, Bargman & Perl 2020). Professional nurses play a central role in preventing, diagnosing, and managing peritonitis. Their responsibilities include patient education, monitoring treatment response, administering medications, and recording peritonitis episode rates to ensure compliance with guidelines. Adherence to evidence-based practice and guideline implementation reduces delays in treatment, lowers peritoneal dialysis failure rates, and improves patient outcomes (Gray & Grove 2019; Li et al. 2022). Peritonitis remains a major complication of peritoneal dialysis in South Africa, with several centres reporting rates above ISPD targets. Strengthening nurses' knowledge through ongoing education and promoting guideline-based care are therefore critical for improving patient safety, reducing infection risk, and enhancing treatment outcomes (Li et al. 2022; Musoke et al. 2020). One of the guidelines commonly used to manage peritonitis includes the 2022 ISPD peritonitis guidelines (Li et al. 2022). These guidelines provide comprehensive, evidence-based recommendations to reduce the incidence and complications of peritonitis. However, the extent to which these guidelines are known, implemented and applied by professional nurses in renal units remains unclear. Rising peritonitis rates in Nelson Mandela Bay, increasing from 0.420 episodes per patient-year in 2020 to 0.674 and 0.85 at the time of the study (Lang, Ensor & Freercks 2026), together with the continued reliance on outdated practices observed by the first author, underscore the need for targeted educational interventions to strengthen nurses' knowledge and support adherence to guideline-based care.

Research methods and design

Study setting

The study was conducted in three renal units located within one public hospital and two private hospitals in Nelson Mandela Bay, Eastern Cape province, South Africa. These facilities were purposively selected because they were the only healthcare institutions in the study area that provided peritoneal dialysis services. The inclusion of sites in the Eastern Cape province is important, as it provides contextual relevance to a region with documented healthcare disparities and varying levels of access to specialised renal care. The selected renal units offer specialised nephrology services for patients undergoing peritoneal dialysis, including patient education, routine clinical monitoring, catheter care, prevention and management of dialysis-related complications, and the treatment of peritonitis. Importantly, these units actively manage patients receiving peritoneal dialysis and therefore play a central role in the prevention and management of peritonitis. As peritonitis remains a significant complication of peritoneal dialysis, these units provided an appropriate setting for exploring related clinical practices. Including both public and private hospitals was important to ensure representation of the different healthcare sectors within the region. These sectors differ in terms of service delivery models, patient populations, resource availability, and organisational structures. Incorporating both allowed for a more comprehensive understanding of peritoneal dialysis care across contexts and strengthened the transferability and richness of the study findings.

Study design

A quantitative, quasi-experimental one-group pre-test and post-test design was employed in this study to evaluate the effectiveness of an educational intervention aimed at enhancing nurses' knowledge regarding the prevention and management of peritonitis. Participants completed a pre-test questionnaire to assess their baseline knowledge, attended the educational intervention, and subsequently completed a post-test questionnaire to measure changes in knowledge following the intervention. This design was appropriate because it allowed the researcher to evaluate the effect of the intervention in a real-world clinical setting where random assignment to intervention and control groups was not feasible or practical. The pre-test and post-test enabled measurement of participants' knowledge before and after the intervention, thereby determining the extent of change

attributable to the educational programme. Furthermore, due to the small number of nurses working in the selected renal units, the inclusion of a separate control group was not feasible, making a one-group design approach the most suitable for this study (Gray & Grove 2019).

Population and sample

Because of the small population, a census sampling approach was used, including all professional nurses working in these units at the time of data collection. As the population size was limited, calculating a minimum sample size was not necessary. Instead, the study aimed to include as many participants as possible. A total of $n = 37$ nurses participated in the pre-test, while $n = 32$ nurses completed the post-test (see Figure 1).

The educational intervention

An educational intervention includes teaching strategies, such as structured training sessions and the provision of printed and electronic educational materials. The educational intervention was a structured programme designed to equip nurses with the necessary knowledge to make informed, evidence-based decisions about preventing and managing peritonitis in renal units (Polit & Beck 2014). An educational intervention was developed based on the 2022 ISPD peritonitis guidelines, adapted to the local context, and guided by the Knowledge-to-Action framework (Graham et al. 2006). The educational intervention was reviewed by experts, including a critical care specialist and two nephrology professionals. The intervention was subsequently piloted with four professional nurses from the emergency department at Hospital 1 who had expertise in peritoneal dialysis. To minimise potential bias, these nurses were requested not to discuss the intervention with nurses working in the renal unit at Hospital 1. Table 1 outlines the educational intervention.

As indicated in Table 1, the researcher implemented the educational intervention immediately after the pre-test, using a PowerPoint presentation delivered during a one-off 20-min contact session. The session was conducted by the researcher with the aid of a projector and a laptop, enabling visual demonstrations of key concepts and interactive engagement with the participants. Thereafter, the researcher gave hard copies and emailed electronic copies of the PowerPoint presentation, the 2022 ISPD peritonitis guidelines, and the screening tool developed using sections from the guidelines to respondents. In addition, the screening tool for peritonitis prevention and management was displayed in the units to support ongoing reference and implementation in practice. Details of the researcher were available to respondents should there be any concerns or questions during or after the implementation of the study. Furthermore, the researcher conducted bi-weekly monitoring visits to renal units in Nelson Mandela Bay to assess respondents' engagement with and adherence to interventions to prevent and manage peritonitis, in line with the 2022 ISPD peritonitis guidelines. The researcher provided ongoing support to reinforce the use of guidelines and screening tools, address challenges, and clarify educational content. All participants received the same training session, educational materials, and monitoring visits. The educational intervention was implemented over 3 months (early June 2025 to late August 2025).

Data collection

Written permission was obtained from the operational and unit managers of the relevant public and private renal units. Managers (gatekeepers) were informed about the study objectives, phases, recruitment procedures, and potential benefits through meetings, followed by telephonic and email communication, and were provided with copies of the ethical and institutional approval documents. After obtaining managerial approval, the first author attended morning staff meetings and scheduled in-person training sessions to conduct recruitment. During these sessions, the same study information that had been provided to the gatekeepers was shared with prospective participants. Interested nurses were screened for eligibility, and those who met the inclusion criteria were invited to provide written informed consent. Following recruitment and enrolment, suitable times for data collection were arranged telephonically with the unit managers. Data were collected using self-administered hardcopy pre-test and post-test questionnaires, each requiring approximately 15 min to complete. The questionnaires were distributed and collected in person by the researcher during scheduled data collection sessions. To ensure confidentiality, participants were assigned unique study codes, and no names or personal identifiers were recorded on the questionnaires. Participants were requested not to discuss the questionnaire items while completing them

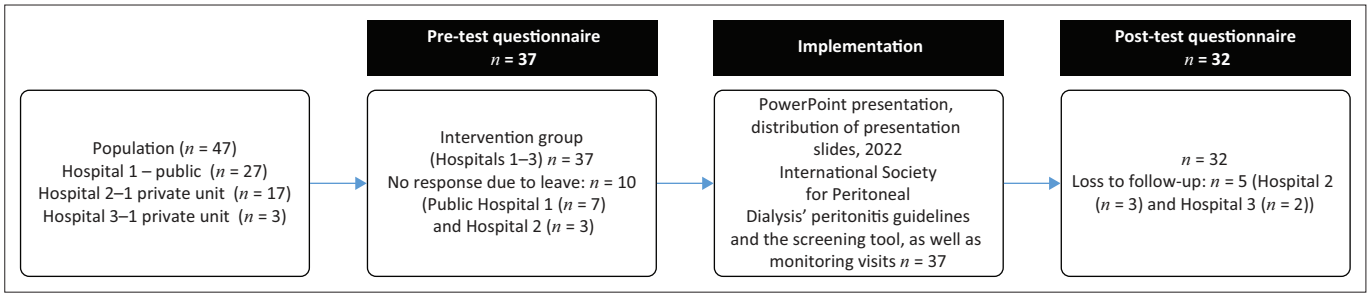

FIGURE 1: Sampling framework.

TABLE 1: Educational intervention for improving nurses' knowledge of preventing and managing peritonitis in renal units.

Tool	Content	Mode of delivery
34-Slide PowerPoint presentation based on the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines	• One slide listing the objectives of the session. • Information (1 step to 10 steps) based on key sections from the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines. Pictures and text, outlining the prevention and management of peritonitis.	20-min, face-to-face, interactive training session, using a projector and laptop
Educational materials	• PowerPoint presentation slides based on the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines. • The 2022 International Society for Peritoneal Dialysis' peritonitis guidelines. • Screening tool for peritonitis prevention and management.	Hard and electronic copies of the PowerPoint presentation slides, the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines, and the screening tool for the prevention and management of peritonitis in renal units were distributed to participants. In addition, the screening tool was displayed in each renal unit.
Monitoring visits	• Monitoring visits and observation of the use of the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines across all renal units involved in the study. • Purpose: • To assess respondents' engagement and adherence to the educational materials • To identify challenges with the implementation of the educational materials • To provide ongoing support, such as additional explanation of the educational materials, including the guidelines	Face-to-face, two weekly monitoring visits, and observation per renal unit over the 3-month implementation period

to minimise bias. The pre-test was administered immediately before the educational intervention during a 2-week period in May 2025, while the post-test was administered over a 2-week period in September 2025, following a 2-month interval after the intervention. Both questionnaires contained the same knowledge-related items, allowing for direct comparison of participants' knowledge before and after the intervention and enabling measurement of changes attributable to the educational programme. During Phase 1, participants completed a pre-test questionnaire designed to assess their baseline knowledge of peritonitis prevention and management. The questionnaire comprised two sections: Section A collected demographic data through nine multiple-choice items, while Section B assessed knowledge of the 2022 ISPD peritonitis guidelines using 25 items rated on a three-point Likert scale (agree, not sure, disagree). The pre-test results provided a baseline against which the effectiveness of the educational intervention could be evaluated. Both the educational intervention and the study questionnaires were developed in accordance with the 2022 ISPD peritonitis guidelines. Of the $n = 37$ nurses who completed the pre-test, $n = 32$ completed and returned the post-test questionnaire. The post-test questionnaire included the same demographic and knowledge sections as the pre-test, together with an additional Section C that evaluated participants' perceptions of the educational intervention. Section C comprised five items measured using four-point and three-point Likert scales, as well as one open-ended question. The findings from Section C are beyond the scope of this manuscript and are therefore not reported. The questionnaires were pilot tested among four professional nurses with expertise in peritoneal dialysis from the emergency department of Hospital 1, who were not part of the study population. Participants in the pilot study were asked not to share any information with nurses in the selected renal unit included in the main study, to minimise the risk of contamination. No major amendments were required following the pilot test. The data obtained during the pilot phase were not included in the main study.

Data analysis

Pre-test and post-test data were entered by the first author into Microsoft Excel, with each questionnaire assigned a distinct study code. The dataset was checked, cleaned, and organised according to biographical details and knowledge-related items. Data were then analysed using Microsoft Excel. Knowledge scores were calculated by summing correct responses, with a maximum possible score of 25, and were further converted into percentage scores for ease of interpretation. Because the same participants completed both the pre-test and post-test, the data were treated as paired (dependent) data, and this was accounted for in the analysis. Descriptive statistics, including frequencies, means, medians, and standard deviations, were used to summarise participant characteristics and knowledge scores. Inferential analysis was conducted using paired-samples t-tests to assess changes in knowledge before and after the intervention. In addition, repeated-measures analysis of variance (ANOVA) was used to further examine differences across the two time points where applicable. Statistical significance was set at $p < 0.05$, and Cohen's d was calculated to determine effect sizes, interpreted as small (0.2–0.5), medium (0.5–0.8), and large ($\geq$ 0.8). Missing data were minimal and handled using listwise deletion, in which incomplete paired responses were excluded from the inferential analysis. Because of the limited sample size, multivariate analysis of demographic associations was not performed.

Reliability and validity

In this study, reliability and validity were enhanced through multiple strategies. Face validity was established through expert review by the supervisor, co-supervisor, statisticians, a critical care specialist, and nephrology professionals, who evaluated whether the questionnaire appropriately measured nurses' knowledge of peritonitis prevention and management. Their input ensured clarity, relevance, and alignment of the items with the 2022 ISPD peritonitis guidelines. Content validity was strengthened by developing the questionnaire directly from the 2022 ISPD peritonitis guidelines, ensuring comprehensive coverage of key knowledge areas related to peritonitis prevention and management. A pilot study involving four nurses was conducted prior to the main data collection to test the clarity and feasibility of the questionnaire and educational intervention. Data obtained from the pilot study were

excluded from the final analysis to prevent contamination of results.

Data reliability was further supported through careful data recording, routine verification (spot checks), and independent statistical oversight.

Ethical considerations

Ethical clearance was obtained prior to data collection from the Department Research Committee, the Faculty Postgraduate Studies Committee, and the Research Ethics Committee for Health (REC-H) at the Nelson Mandela University (Ref. 1578). Additional permissions were granted by the Eastern Cape Department of Health, Life Healthcare in the Eastern Cape, and participating renal units in Nelson Mandela Bay. Participation was voluntary, and confidentiality and anonymity were ensured by using unique study codes instead of names, with no identifying information recorded. Participants were informed of their right to withdraw at any stage without penalty. To minimise coercion, especially given that participants were employees of the study sites, recruitment and data collection were conducted independently of management, and participation had no impact on employment. Data were stored securely in password-protected files and locked cabinets, accessible only to the researcher and supervisor. The study adhered to the ethical principles of autonomy, beneficence, non-maleficence, and justice, in line with the Belmont Report.

Results

A total of 37 professional nurses participated in the pre-test, representing a 100% response rate, while 32 nurses completed the post-test, yielding an 86.5% response rate.

Demographic data

Section A of the questionnaire collected respondents' demographic and professional information, including gender, age, experience in peritoneal dialysis, length of service in renal units, position within the unit, type of institution, highest qualification attained, frequency of use of the 2022 ISPD peritonitis guidelines, and sources of knowledge used in the care of patients on peritoneal dialysis. The participants' demographic characteristics are summarised in Table 2.

As outlined in Table 2, a total of 69 responses were analysed: Pre-test ($n = 37$) and post-test ($n = 32$). Most respondents were female (85.3%), aged 30–49 years (69.5%), professional nurses (94.1%), and worked almost equally in public and private sectors. Over half had prior peritoneal dialysis experience (56.5%), with the largest group having 10–19 years of renal unit experience, and most held a post-graduate diploma in nephrology nursing. Use of the 2022 ISPD peritonitis guidelines was low, with over half reporting no use and only 27.5% using them weekly or daily. Knowledge of peritoneal dialysis care was mainly obtained through in-service training, formal education, and clinical experience, while other sources were rarely used; slight increases in the use of these sources were noted post-test. Chi-square analysis showed no significant demographic differences between pre- and post-test groups ($p > 0.05$), indicating comparable samples.

Knowledge regarding prevention and management of peritonitis

Section B (Items B1–B25) evaluated respondents' knowledge. Each item required a single response of Agree, Not Sure, or Disagree. Table 3 presents the results, summarising the distribution of responses across all 25 knowledge items for the pre-test, post-test, and overall samples. The knowledge responses for the pre-and post-tests are outlined in Table 4.

As shown in Table 4, participants demonstrated high levels of agreement on key peritonitis diagnosis and monitoring indicators. For example, most nurses correctly identified that cloudy effluent with pain, white blood cell count > 100/µL, and a positive culture indicates peritoneal dialysis peritonitis (B1: 86% pre-test; 94% post-test), and that inspection of the exit site is essential (B20: 100% both phases). Slight post-test improvements were observed for several indicators, including cause-specific peritonitis diagnosis per culture (B3: 27% pre-test; 41% post-test) and antifungal prophylaxis co-prescription (B15: 66% pre-test; 91% post-test, $p = 0.006$), highlighting a statistically significant gain in knowledge in this area. Knowledge of prevention measures improved overall, particularly regarding topical antibiotic use for exit sites (B9: 81% pre-test; 94% post-test) and emptying the abdomen during gastrointestinal (GI)/gynaecological procedures (B11: 92% pre-test; 94% post-test). Strong understanding was also evident in the management of peritonitis and its complications, including refractory peritonitis leading to peritoneal dialysis failure (B25: 94% pre-test; 97% post-test). However, uncertainty persisted in certain areas. Knowledge gaps remained regarding minimum dwell time (B2: 49% pre-test; 56% post-test), organism-specific diagnosis (B3), antibiotic routes (B22, B23), and management of hypokalaemia (B14: 44% pre-test; 56% post-test).

Knowledge scores

Knowledge scores, assessed through pre- and post-test measures, are presented in Table 3.

As outlined in Table 3, participants showed improvements across all domains of peritonitis knowledge, including definition and measurement, monitoring and reporting, prevention, and management, with mean scores increasing from pre- to post-intervention. Statistically significant gains were observed in the Definition and Measurement of Peritonitis (Pre: 41.44 → Post: 54.17; $p = 0.011$, Cohen's $d = 0.63$, medium effect), Prevention of Peritonitis (Pre: 57.09 → Post: 66.02; $p = 0.029$, Cohen's $d = 0.54$, medium effect), and the Overall Knowledge Score (Pre: 52.71 → Post: 59.69; $p = 0.007$, Cohen's $d = 0.68$, medium effect).

TABLE 2: Demographic characteristics of participants (pre-test and post-test).

Variable	Category	Pre-test *n* = 37	%	Post-test *n* = 32	%	Total *n* = 69	%
A1 Gender	Female	32	86.5	26	81.3	58	85.3
	Male	5	13.5	5	15.6	10	14.7
	Total	37	100.0	31	100.0	68	100.0
A2 Age (years)	20–29	3	8.1	4	12.5	7	10.1
	30–39	12	32.4	11	34.4	23	33.3
	40–49	14	37.8	11	34.4	25	36.2
	50+	8	21.6	6	18.8	14	20.3
A3 Experience in peritoneal dialysis	Yes	18	48.6	21	65.6	39	56.5
	No	19	51.4	11	34.4	30	43.5
A4 Years in renal units	< 3	7	20.0	6	18.8	13	19.4
	3–4	4	11.4	8	25.0	12	17.9
	5–9	10	28.6	5	15.6	15	22.4
	10–19	13	37.1	12	37.5	25	37.3
	20+	1	2.9	1	3.1	2	3.0
A5 Position	Unit Manager	1	2.8	0	0.0	1	1.5
	Professional Nurse	33	91.7	31	96.9	64	94.1
	Community Service	2	5.6	1	3.1	3	4.4
A6 Institution type	Private	17	45.9	16	50.0	33	47.8
	Public	20	54.1	16	50.0	36	52.2
A7 Qualification	Diploma (Bridging)	8	22.9	8	25.0	16	23.9
	Diploma in Nursing Science	9	25.7	7	21.9	16	23.9
	BCur	4	11.4	0	0.0	4	6.0
	Bachelor of Nursing	1	2.9	4	12.5	5	7.5
	Post-Grad Nephrology	13	37.1	13	40.6	26	38.8
A8 Frequency using the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines	Daily	4	10.8	9	28.1	13	18.8
	Weekly	3	8.1	3	9.4	6	8.7
	Monthly	4	10.8	4	12.5	8	11.6
	Yearly	4	10.8	1	3.1	5	7.2
	Not at all	22	59.5	15	46.9	37	53.6
A9 Sources of knowledge	Own experience	9	24.3	9	28.1	22	31.9
	Undergraduate/post-grad studies	11	29.7	13	40.6	24	34.8
	In-service training	14	37.8	18	56.3	32	46.4
	Literature	1	2.7	6	18.8	7	10.1
	Workshops/courses	7	18.9	0	0.0	7	10.1
	Internet	3	8.1	0	0.0	3	4.3
	2022 ISPD guidelines	6	16.2	0	0.0	6	8.7
	Other	3	8.1	0	0.0	3	4.3

ISPD, International Society for Peritoneal Dialysis.

Note: χ^2 (df = 1, n = 68) = 0.09, p = 0.762 (Gender); χ^2 (df = 3, n = 69) = 0.47, p = 0.925 (Age); χ^2 (df = 1, n = 69) = 2.01, p = 0.156 (Experience in PD); χ^2 (df = 4, n = 67) = 2.99, p = 0.560 (Years working in renal units); χ^2 (df = 2, n = 68) = 1.16, p = 0.559 (Position in renal unit); χ^2 (df = 1, n = 69) = 0.11, p = 0.737 (Type of institution); χ^2 (df = 4, n = 67) = 5.93, p = 0.205 (Highest qualification); χ^2 (df = 4, n = 69) = 4.71, p = 0.318 (Frequency of using the 2022 International Society for Peritoneal Dialysis' peritonitis guidelines). For A9 items, statistical tests were conducted on yes/no responses, with continuity corrections where expected frequencies were low. No significant differences were found between pre-test and post-test groups.

TABLE 3: Knowledge scores.

Variable	Pre-test				Post-test				Mean difference	*t*	*p*-value	Cohen's *d*
	Sample size	Mean score	s.d.	95% CI	Sample size	Mean score	s.d.	95% CI				
Definition and measurement of peritonitis score	37	41.44	19.88	34.81–48.07	32	54.17	20.30	46.85–61.49	-12.73	-2.63	0.011	0.63 (Medium)
Measuring, monitoring, and reporting peritonitis score	37	45.27	12.96	40.95–49.59	32	47.66	11.64	43.46–51.86	-2.39	-0.80	0.427	n/a
Prevention of peritonitis score	37	57.09	18.76	50.84–63.34	32	66.02	13.56	61.13–70.91	-8.92	-2.23	0.029	0.54 (Medium)
Management of peritonitis score	37	67.03	18.98	60.70–73.36	32	70.94	21.31	63.26–78.62	-3.91	-0.81	0.423	n/a
Overall, knowledge score	37	52.71	10.31	49.27–56.15	32	59.69	10.38	55.95–63.43	-6.99	-2.80	0.007	0.68 (Medium)

CI, confidence interval; s.d., standard deviation.

Discussion

To develop, implement and evaluate an educational intervention to enhance professional nurses' knowledge regarding the prevention and management of peritonitis in renal units in Nelson Mandela Bay. The educational intervention led to significant improvements in peritonitis-related knowledge among renal nurses, demonstrating the effectiveness of structured, guideline-based education in peritoneal dialysis care. Knowledge scores increased across all domains – definition and measurement, monitoring and reporting, and prevention and management of peritonitis.

TABLE 4: Knowledge responses for pre-test and post-test (n = 69).

Item and correct answer	Agree n (%) pre/post				Not sure n (%) pre/post				Disagree n (%) pre/post				χ^2	p-value
Definition and measurement of peritonitis														
B1 Cloudy drainage + pain + white blood cells > 100/µL + positive culture = peritoneal dialysis peritonitis. Correct: Agree.	32	86	30	94	4	11	2	6	1	3	0	0	$\chi^2(1,69) = 0.99$	$p = 0.319$
B2 Minimum dwell time is 4 hrs. Correct: Disagree.	18	49	18	56	15	41	5	16	4	11	9	28	$\chi^2(1,69) = 3.36$	$p = 0.067$
B3 Cause-specific peritonitis is diagnosed per culture. Correct: Agree.	10	27	13	41	12	32	3	9	15	41	16	50	$\chi^2(1,69) = 1.43$	$p = 0.232$
Measuring, monitoring and reporting peritonitis														
B4 Monitor incidents monthly. Correct: Disagree.	33	89	29	91	4	11	3	9	0	-	0	-	χ^2 impossible	-
B5 CQI programme is essential. Correct: Agree.	36	97	31	97	1	3	1	3	0	-	0	-	$\chi^2(1,69) = 0.01$	$p = 0.917$
B6 Rate per patient-year. Correct: Agree.	30	83	28	88	5	14	4	13	1	3	0	-	$\chi^2(1,69) = 0.53$	$p = 0.468$
B7 Rate > 0.5 acceptable. Correct: Disagree.	17	46	22	69	19	51	8	25	1	3	2	6	$\chi^2(1,69) = 0.52$	$p = 0.471$
Prevention of peritonitis														
B8 Systemic prophylactic antibiotics post-catheter. Correct: Disagree.	27	73	26	81	6	16	4	13	4	11	2	6	$\chi^2(1,69) = 0.45$	$p = 0.503$
B9 Topical antibiotic for exit site. Correct: Agree.	30	81	30	94	4	11	1	3	3	8	1	3	$\chi^2(1,69) = 2.43$	$p = 0.119$
B10 No prophylaxis for wet contamination. Correct: Disagree.	11	31	15	47	17	47	6	19	8	22	11	34	$\chi^2(1,69) = 1.40$	$p = 0.237$
B11 Empty abdomen during gastrointestinal/gynae procedures. Correct: Agree.	33	92	30	94	2	6	1	3	1	3	1	3	$\chi^2(1,69) = 0.45$	$p = 0.503$
B12 Direct technique inspection. Correct: Agree.	34	94	30	94	2	6	2	6	0	-	0	-	$\chi^2(1,69) = 0.09$	$p = 0.767$
B13 Pets are insignificant. Correct: Disagree.	14	39	12	38	1	3	1	3	21	58	19	59	$\chi^2(1,69) = 0.05$	$p = 0.826$
B14 Avoiding hypokalaemia reduces risk. Correct: Agree.	16	44	18	56	7	19	8	25	13	36	6	19	$\chi^2(1,69) = 1.16$	$p = 0.281$
B15 Anti-fungal prophylaxis co-prescribed. Correct: Agree.	23	66	29	91	9	26	3	9	3	9	0	-	$\chi^2(1,69) = 7.49$	$p = 0.006$
Management of peritonitis														
B16 No need to test effluent. Correct: Disagree.	13	36	11	34	6	17	5	16	17	47	16	50	$\chi^2(1,69) = 0.11$	$p = 0.737$
B17 Cloudy effluent presumed peritonitis. Correct: Agree.	34	94	30	94	1	3	1	3	1	3	1	3	$\chi^2(1,69) = 0.09$	$p = 0.767$
B18 History must note contamination/disconnection. Correct: Agree.	35	97	32	100	1	3	0	-	0	-	0	-	$\chi^2(1,69) = 1.78$	$p = 0.182$
B19 Localised pain ≠ peritonitis. Correct: Disagree.	13	36	13	41	2	6	2	6	21	58	17	53	$\chi^2(1,69) = 0.09$	$p = 0.762$
B20 Inspect the exit site for infection. Correct: Agree.	36	100	32	100	0	-	0	0	-	-	0	-	$\chi^2(1,69) = 0.88$	$p = 0.349$
B21 Pain monitoring determines admission. Correct: Agree.	33	92	29	91	1	3	2	6	2	6	1	3	$\chi^2(1,69) = 0.04$	$p = 0.844$
B22 Only systemic route, gram-negative only. Correct: Disagree.	21	58	18	56	10	28	7	22	5	14	7	22	$\chi^2(1,69) = 0.84$	$p = 0.361$
B23 Oral route preferred. Correct: Disagree.	15	43	14	44	5	14	2	6	15	43	16	50	$\chi^2(1,69) = 0.62$	$p = 0.431$
B24 Cannot adjust antibiotics. Correct: Disagree.	14	40	14	44	3	9	1	3	18	51	17	53	$\chi^2(1,69) = 0.14$	$p = 0.711$
B25 Refractory peritonitis causes peritoneal dialysis failure. Correct: Agree.	34	94	31	97	1	3	1	3	1	3	0	-	$\chi^2(1,69) = 0.78$	$p = 0.377$

CQI, continuous quality improvement.

Statistically significant gains were observed in the domains of definition and measurement, prevention of peritonitis, and overall knowledge, all reflecting medium effect sizes. These results underscore the value of structured, guideline-aligned education in enhancing nurses' understanding of peritonitis – a common and potentially serious complication of peritoneal dialysis. Peritonitis remains a leading cause of technique failure, hospitalisation, and morbidity among patients undergoing peritoneal dialysis, emphasising the importance of knowledgeable nursing care in its prevention and early management (Akarkach et al. 2020; Li et al. 2022; Szeto et al. 2017). Consistent with prior research, targeted educational programmes grounded in internationally recognised guidelines, such as the 2022 ISPD peritonitis guidelines, can significantly improve nurses' knowledge and competency (Brown et al. 2021; Nopsopon et al. 2022). The greatest improvements in this study were observed in the domains of definition and measurement and prevention of peritonitis. Foundational concepts, such as diagnostic criteria, interpretation of effluent, and preventive strategies, appear particularly responsive to structured education (Figueiredo et al. 2016). For example, participants demonstrated improved recognition that cloudy effluent with pain, elevated white blood cells, and a positive culture indicates peritonitis, and that antifungal prophylaxis should be co-prescribed when indicated. Enhanced understanding of these core principles is crucial, as early recognition and accurate diagnosis of peritonitis are strongly associated with better clinical outcomes and reduced complications (Al Sahlawi et al. 2020; Piraino et al. 2020). In contrast, changes in monitoring and management knowledge were not statistically significant, suggesting that these areas were relatively well understood at baseline. This aligns with previous studies indicating that experienced renal nurses often demonstrate high baseline competence in routine monitoring and management tasks, which may result in smaller measurable gains following educational interventions: A potential ceiling effect (Wang et al. 2023). Nonetheless, reinforcing existing knowledge is important for maintaining consistency in monitoring practices and adherence to evidence-based management protocols (World Health Organization 2021). Improved knowledge of peritonitis is particularly important for renal nurses, who play a central role in infection prevention, patient education, and early intervention. Adequate knowledge of diagnostic criteria, exit-site care, aseptic technique, and guideline-recommended treatment enables nurses to identify early signs of infection, initiate timely interventions, and support adherence to best-practice

standards (Figueiredo et al. 2016). The literature consistently highlights nurse knowledge and competence as key determinants of patient safety, infection rates, and overall peritoneal dialysis outcomes (Perl et al. 2020). The study also suggests a potential influence of demographic factors, such as years of clinical experience, prior peritonitis training, and educational background, on baseline knowledge and learning outcomes. Although subgroup analyses were not performed, participants with lower baseline knowledge, particularly in foundational domains, appeared to benefit most from the intervention. This is consistent with prior research demonstrating that less experienced nurses or those with limited peritoneal dialysis exposure often exhibit greater knowledge gains following structured educational programmes (He et al. 2026; Nopsopon et al. 2022; Wang et al. 2023). Conversely, domains with higher baseline scores showed smaller improvements, reflecting trends observed in another nursing education study, potentially because of a ceiling effect that limits the scope for further improvement (Taylor et al. 2021). Overall, these findings highlight the value of structured, guideline-based educational interventions for renal nurses. Grounding education in the 2022 ISPD peritonitis guidelines not only improves knowledge but also supports the translation of evidence into clinical practice, in line with the Knowledge-To-Action framework. By strengthening their knowledge of peritonitis, nurses are better equipped to provide safe, effective, and consistent care, anticipate complications, and make informed clinical decisions. Evidence suggests that such interventions can enhance adherence to best-practice standards, reduce peritonitis rates, and ultimately improve patient outcomes and the quality of renal care.

Limitations and recommendations

Several limitations are reported. The study used a one-group design without a control group, limiting causal inference. The relatively small sample size and short follow-up period may have influenced the detection of changes in some knowledge domains. Methodological limitations included a brief intervention, potential recall bias due to identical pre- and post-tests, a lack of usability testing, and the absence of behavioural observation. The study assessed knowledge improvement but did not evaluate long-term retention or clinical outcomes. Future research should involve larger, multi-site samples, adopt more robust and flexible designs, extend intervention duration, include observational and outcome-based measures, and use longitudinal mixed-methods approaches to enhance generalisability and impact. Based on the results, this study recommends the development, implementation, and evaluation of structured, guideline-based educational interventions to enhance professional nurses' knowledge of peritonitis prevention and management in renal units in Nelson Mandela Bay. Education should be grounded in internationally recognised standards such as those of the ISPD and incorporated into ongoing in-service training and continuous professional development programmes. In addition, strengthening structured training is essential to improve knowledge of key areas such as diagnosis, effluent interpretation, aseptic technique, and preventive strategies, thereby supporting consistent, evidence-based practice in peritoneal dialysis care.

Contributions

This study provides empirical evidence that structured educational interventions significantly improve renal nurses' knowledge of peritonitis, particularly in foundational domains such as its definition, measurement, and prevention. It demonstrates that guideline-based education can produce meaningful knowledge gains, with medium effect sizes, reinforcing its effectiveness in clinical practice. The findings also support existing literature indicating that nurse competence is a key determinant of patient safety, infection prevention, and peritoneal dialysis outcomes. In addition, the study highlights that nurses with lower baseline exposure to peritoneal dialysis may benefit most from targeted educational interventions, underscoring the importance of continuous professional development in renal nursing.

Conclusion

An educational intervention grounded in the 2022 ISPD peritonitis guidelines significantly improved professional nurses' knowledge in key areas of peritonitis care. Incorporating regular, structured educational programmes into renal unit practice is recommended to support guideline implementation and improve patient outcomes.

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Competing interests

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CRediT authorship contribution

Candice C. Williams: Conceptualisation; Investigation; Methodology; Supervision; Writing – original draft. Wilma ten Ham-Baloyi: Conceptualisation; Methodology; Supervision; Writing – original draft. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication, and take responsibility for the integrity of its findings.

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Data availability

The data that support the findings of this study are available on request from the corresponding author, Wilma ten Ham-Baloyi, upon reasonable request.

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