

The Effect of Nursing Intervention on Knowledge and Prevention of Recurrent Urinary Tract Infections among the Elderly

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Abstract

Background: Urinary tract infections (UTIs) are common in the elderly individual and frequently result in more serious and sometimes fatal consequences. Poor knowledge is a risk factor for urinary tract infections recurrent among elderly individual.

Purpose: This study aimed to evaluate the effect of nursing intervention on knowledge and prevention of recurrent urinary tract infections among the elderly.

Design & Setting: The quasi-experimental study was conducted in the urology outpatient clinics at Zagazig University Hospitals.

Sample: A purposive sample of 150 elderly individuals with UTIs was divided into a study group (n=75), which received both standard care and nursing intervention about self-care practices for preventing recurrent urinary tract infections, and a control group (n=75), which received only the standard care protocol.

Tools: Two tools were used; A Structured Interview Questionnaire on Demographic Characteristic, and Knowledge, and Risk Assessment and Manifestation of Recurrent Urinary Tract Infection.

Results: The study findings showed statistically significant improvements, with 6.7% having total satisfactory knowledge pre-intervention, and an impressive 85.3% and 82.7% achieving total satisfactory knowledge in the post-test and follow-up, respectively. In comparison, the control group had only 5.3% with total satisfactory knowledge pre-intervention, and only 6.7%

and 5.3% with total satisfactory knowledge in the post-test and follow-up, respectively. In addition, after the posttest, 6.7% of the study group had a total high risk, 13.3% had a total moderate risk, and 80% had a total low risk. In contrast, 50.7% of the control group had a total high risk, 33.3% had a total moderate risk, and 16% had a total low risk.

Conclusion: Both the study and control groups exhibited an overall deficiency in knowledge levels and an increase in associated risks and manifestations related to recurrent urinary tract infections (RUTIs) during the pre-intervention phase. However, post-intervention results provide evidence confirming the effectiveness of the nursing intervention in significantly enhancing overall knowledge, and reducing associated risks and manifestations among the elderly in the study group.

Recommendations: Periodically assess nursing interventions and monitor high-risk groups for recurring urinary tract infection through feedback, surveys, and follow-up screenings. Design and distribute educational materials about UTI prevention to high-risk patients in urology departments, including printed handouts and colored brochures.

Keywords: Nursing intervention, knowledge, Elderly, Recurrent urinary tract infection.

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Introduction

The aging of the global population is developing rapidly (Shen et al., 2023). According to the World Health Organization, by 2050, the world's elderly population will have doubled (Brojeni et al., 2019). Urinary tract infections (UTIs) are the most common type of infection among the elderly population worldwide and the most common cause of hospitalization due to bacterial infections (Akhtar et al., 2021).

The elderly are more susceptible to infections due to dehydration, incontinence, limited activity, impaired cognitive function, and uncontrolled diabetes mellitus. Bacterial growth in urine without signs of urinary tract infection is the most frequent form of the symbiotic colony, known as asymptomatic bacteriuria (Alamri et al., 2022). In elderly patients, UTIs are a major cause of functional deterioration, leading to increased vulnerability, frailty, and decreased chances of recovering basic independent activities (Garcia-Bustos et al., 2021).

Recurrent urinary tract infections (RUTIs) are associated with significant morbidity and a decrease in quality of life, which subsequently impacts healthcare economically (Kwok et al., 2022). Preventing RUTIs, particularly in an aging demographic, is important. Prevention strategies have included evaluating and managing predisposing conditions to UTI—such as pelvic organ prolapse, bladder lesions, or kidney stones—liberalizing fluid intake, post-coital

voiding, vaginal estrogen therapy, and long-term low-dose antibiotic prophylaxis for six months in women (Mody&Juthani-Mehta, 2019).

Elderly who understand their condition are better able to take control of their health (Sayed et al., 2022). Gerontological nurses play a key role in educating the elderly to increase their knowledge and recognize the early signs and symptoms of urinary tract infections, thus encouraging prevention, early detection, and treatment of potential infections (El-Bana& Ali, 2020). Nursing intervention is critical as it can increase knowledge and decrease the risk of RUTIs. Therefore, this study aimed to evaluate the effect of nursing intervention on knowledge and prevention of recurrent urinary tract infections among the elderly.

Method

Study Design and Setting

A quasi- experimental design was used to conduct the current study in the urology outpatient clinic at ZagazigUniversity Hospitals, Egypt.

Sample size calculation

Sample size calculated using open epi is 150 who will receive self-care practice intervention. Percent of urinary tract infection among elderly with intervention program was (7.2%), whereas percent of urinary tract infection among elderly on routine care was (18%) (Sorbye et al., 2016). Confidence level is 95% with power of study 80%, therefore the sample was 150 patients (75 patients in study group &75 patients in control group).

Sampling Technique

A purposive sample of 150 elderly individuals with UTIs was divided into a study group (n=75), which received both standard care and nursing intervention about self-care practices for preventing recurrent urinary tract infections, and a control group (n=75), which received only the standard care protocol.All participants had been diagnosed with urinary tract infection and met the specified criteria outlined below:

Inclusion Criteria:

- The ability to independently perform all self-care activities.
- Inclusion of both sexes.
- Willingness to actively participate in the study.
- Able to communicate.

Exclusion Criteria:

- Individuals with diagnosed mental disorders.

Tool of data collection

Two tools were used for collection of data include:

Tool 1: A structured interview questionnaire it was consist of two parts:

Part 1: Demographic characteristics of the elderly participants:

To assess the elderly characteristics, which included age, residence, gender, and marital status, level of education, working before retirement, current working, monthly income, and living with.

Part 2: Patient's Knowledge Questionnaire (pre/post/ and follow up intervention):

It was developed by the researchers based on reviewing related literatures (Cox et al., 2022; Alshahrani et al., 2022) to assess knowledge about urinary tract infection, and its measures to prevent UTI. It included parts of the urinary system and function of its parts, UTI definition, causes, UTI classifications, symptoms of lower and upper UTIs, complications, factors that contribute to the occurrence of urinary tract infection, practices that reduce urinary tract infection recurrent, measures that can relieve the symptoms of urinary tract infection, treatment of urinary tract infection, and protocol for taking antibiotics.

- **Scoring system:** For each item, a score of one was given for the correct answer, and zero for the wrong answer or "don't know." The sum of the participants' grades for each question was used to calculate their total knowledge scores. Twenty-three (23) grades were used to calculate the total grade, and knowledge was categorized as follows: Satisfactory, if the score was 60% or more; Unsatisfactory, if the score was less than 60%.

Tool 2: Urinary Tract Infection Assessment Tool: This tool used to assess the Risk Factors, and Manifestations of RUTI. It contained two parts:

Part 1: Risk Assessment of Recurrent Urinary Tract Infection (pre/post/ and follow up intervention):

It was adapted from (Abed Al-Aziz, 2005) to determine the risk factors for recurrent urinary tract infection which will be classified to (a) **Non-modifiable risk factors** such as anatomical malformations, diseases that weaken the immune system and neurological issues pertaining to the urinary system. (b) **Modifiable risk factors** such as presence of stone, enlarged prostate, delay of micturition, reduced daily fluid intake, excessive consumption of cola, tea, and coffee, personal hygiene practices, improper hygiene post sexual activity, wiping from back to front after urination

& defecation, using strong soap for the perineal area, constipation, diarrhea, obesity, smoking, engaging in sports (walking), and take antibiotics.

-Scoring system: Each item received a score of one for "Yes" and zero for "No." Risk assessment of recurrent urinary tract infection (RUTI) was considered as follows: **High risk**, if the score was 70% or more; **Moderate risk**, if the score was 50% to less than 70%; **Low risk**, if the score was less than 50%.

Part 2: Urinary Tract Infection Manifestation Checklist (pre/post/ and follow up intervention):

It was adapted from (Gomaa, 2013) to assess urinary tract infection manifestations. Which will be contained (a) **General manifestations** of urinary tract infection such as Frequency, Urgency, dysuria or painful urination, fever, chills, malaise, tachycardia, nausea, vomiting, urinary incontinence, and urinary retention. Also, (b) **Local manifestation** such as pain, purulent urethral discharge, urethral irritation, inflammation of the perineal area, and change in the character of urine.

The Nursing Intervention

Assessment phase:

During the assessment phase, pre-nursing intervention data collection for baseline assessment was carried out using Patient's Knowledge Questionnaire (for both the study and control groups). The researcher initiated this phase by introducing herself, explaining the study's purpose, and seeking participants' informed consent. Confidentiality was assured, and participants were informed that their information would solely be utilized for research purposes. The researcher methodically explained and discussed each item in the study tools with the elderly participants, documenting their responses. Data from this phase was preliminarily analyzed to inform the subsequent program development.

Planning phase:

Drawing upon the needs identified during the pre-test assessment and in alignment with study objectives, the researcher formulated nursing intervention on knowledge aimed at preventing recurrent urinary tract infections among the elderly. This phase included the translation of needs, deficits, and requirements into the intervention's goals and objectives.

Implementation phase:

During the implementation phase, the nursing intervention was exclusively administered to the study group. The study group was divided into 15 smaller groups, each comprising 5 elderly participants, fostering interaction and discussions. The instructional sessions were organized into 4 theoretical components, each lasting 30 to 45 minutes. In total, 60 theoretical sessions were

conducted on Saturdays, Monday, Wednesday, and Thursdays from 10 am to 1 pm. The session breakdown is as follows:

- **Sessions 1:**

This session aimed to illustrate the goals and objectives of the program. The researcher then enhanced comprehension of recurrent urinary tract infections (RUTIs) by covering the components of the urinary system and their respective functions.

- **Sessions 2:**

The main objective of this session was to deepen the elderly participants' knowledge of urinary tract infections by discussing their definition, classification, causes, and associated risk factors.

- **Sessions 3:**

This session focused on enhancing the elderly participants' understanding of the signs and symptoms of recurrent UTIs, the methods used for diagnosis, and the practices that can reduce the recurrence of infections.

- **Sessions 4:**

The main objective of this session was to educate the elderly about the measures that can relieve symptoms of recurrent UTIs, the potential complications if left untreated, and the available treatment options.

Participants engaged actively, gaining skills and autonomy to protect their urinary health. A PowerPoint presentation and group discussions reinforced comprehension. Feedback from the elderly was encouraged, and visually appealing brochures containing concise information were distributed for post-intervention reference.

Evaluation phase:

Evaluation of the intervention's efficacy involved following up with all patients in both study and control groups. Patient's Knowledge Questionnaire was utilized after one week to assess improvements in knowledge. A subsequent follow-up was conducted three months later for both groups, utilizing the same tools to assess knowledge, and recurrence of urinary tract infections.

Ethical Considerations

The study proposal was subjected to thorough scrutiny and received approval from the Research Ethics Committee (REC) as well as the Postgraduate Committee of the Faculty of Nursing at Zagazig University, with the approval granted in November 2022. The ethical principles adhered to were as follows:

Informed Consent:Each elderly was provided with a verbal explanation of the study's objectives, along with the rights to non-participation or withdrawal at any point without needing to provide any reasons. Participants were informed that their involvement in the study was completely voluntary.

Confidentiality:Participants were assured that all data collected from them would remain confidential and would be used exclusively for research purposes.

Statistical analysis

Data collected from the studied sample was revised, coded and entered using Personal Computer (PC). Computerized data entry and statistical analysis were fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages and Mean SD. A correlation coefficient "Pearson correlation" is a numerical measure of some type of correlation, meaning a statistical relationship between two variables. Chi-square is a statistical test that examines the differences between qualitative data (study and control). McNemar test is a statistical test that examines the differences between qualitative data (pre, post and follow-up). ANOVA, which stands for Analysis of Variance, is a statistical test used to analyze the difference between the means (pre, post and follow-up). T-test, which stands for Analysis of Variance, is a statistical test used to analyze the difference between the means (study and control). Linear regression analysis is used to predict the value of a variable based on the value of another variable.

Results

Elderly participants' characteristics in the intervention and control groups

Table 1 indicates that the mean age of the study and control groups was 72.66 ± 8.97 years & 72.93 ± 9.2 years respectively. Regarding residence and marital status, 94.7% of the study group and 96% of the control group belonged to rural areas, 60% of the study group and 62.7% of the control group were married. There were no significant differences in terms of demographic characteristics across all domains between the study and control groups.

Effects of nursing intervention on elderly knowledge

Table 2 reveals that there were remarkable and highly statistically significant differences ($P < 0.01$) between pre, post, and follow-up intervention in the study group's knowledge across all domains. Moreover, a highly significant difference ($P < 0.01$) is observed between the study and control groups concerning their knowledge domains during the post-test and follow-up assessments.

Table 2b highlights a highly significant differences in knowledge levels within the study group across all domains ($P < 0.01$). In contrast, within the control group, no statistically

significant difference was observed in knowledge levels before, after, and during the follow-up period of the intervention ($P > 0.05$). Additionally, a pronounced distinction was noted between the knowledge levels of the study and control groups at post-test and follow-up, and this difference was highly statistically significant.

Figure 1 illustrates that the study group exhibited remarkable improvement, with 6.7% having total satisfactory knowledge pre-intervention, and an impressive 85.3% and 82.7% achieving total satisfactory knowledge in the post-test and follow-up, respectively. In comparison, the control group had only 5.3% with total satisfactory knowledge pre-intervention, and only 6.7% and 5.3% with total satisfactory knowledge in the post-test and follow-up, respectively.

Total risk assessment of recurrent urinary tract infection in the intervention and control groups

Figure 2 illustrates that after the posttest, 6.7% of the study group had a total high risk, 13.3% had a total moderate risk, and 80% had a total low risk. In contrast, 50.7% of the control group had a total high risk, 33.3% had a total moderate risk, and 16% had a total low risk.

Manifestation of recurrent urinary tract infection in the intervention and control groups

Table 3 indicates that the study group experienced significant decreases in the percentage of all general manifestation domains of recurrent urinary tract infection. These results demonstrate a highly statistically significant difference between pre, post, and follow-up intervention in the study group's general manifestation of recurrent urinary tract infection, encompassing frequency, urgency, dysuria, fever, chills, malaise, tachycardia, nausea, vomiting, and urinary incontinence ($P < 0.01$). Additionally, there was a statistically significant difference between pre, post, and follow-up in the control group regarding urinary retention ($P < 0.05$).

In contrast, there was a statistically significant difference between pre, post, and follow-up in the control group regarding the presence of tachycardia, nausea, and vomiting ($P < 0.05$). Moreover, a highly statistically significant difference is observed between the study and control groups in the general manifestation of urinary tract infection at post-test and follow-up ($P < 0.01$).

Table 4a illustrates a highly statistically significant difference between pre, post, and follow-up intervention in the study group regarding various recurrent urinary tract infection symptoms, including suprapubic pain, flank pain, urethral pain, perineal pain, purulent urethral discharge, urethral irritation, and inflammation of the perineal area ($P < 0.01$). Moreover, there was a highly statistically significant difference between the study and control groups across all domains of present local manifestation of urinary tract infection at post-test and follow-up ($P < 0.01$).

Table 4b clarifies that there was a highly statistically significant difference between pre, post, and follow-up intervention in the study group regarding changes in urine color, odor, and

consistency ($P < 0.01$). Meanwhile, the control group exhibited no statistically significant difference between pre, post, and follow-up in all domains of changes in the character of urine.

Predictors of total knowledge improvement post-intervention in the study group

Regarding predictors of total knowledge improvement, Table 5 shows that a highly significant model was detected through an F-test ($F = 8.560$, $p\text{-value} = 0.004$). This model explains 37% of the variation in total knowledge post-intervention in the study group, as indicated by the coefficient of determination ($r^2 = 0.37$). Furthermore, the table declares that factors such as age (80 or more), previous work experience (housewife), and education level (illiterate) have a significantly positive effect on total knowledge post-intervention with p -values of 0.008, 0.026, and 0.003, respectively.

Discussion

Urinary tract infection (UTI) is one of the most common infections in older adults. It constitutes approximately 25% of all infections in older adults (Godbole et al., 2020). People need to be knowledgeable of what a UTI is, its risk factors, its manifestation, and preventive measures. People can use their knowledge to prevent UTIs if they have sufficient knowledge (Metwally et al., 2021). Thus, the current study was conducted to evaluate the effect of nursing intervention on knowledge and prevention of recurrent urinary tract infections among the elderly.

I. Assessment of Knowledge Levels in Preventing Recurrent Urinary Tract Infections among Elderly

The existing study results clarified that in the pre-intervention phase, the study's findings revealed an overall deficiency in knowledge concerning the prevention of RUTIs in both the study and control groups. Several factors contributed to this deficiency, including the absence of prior nursing interventions focusing on self-care practices for preventing RUTIs among the elderly. Additionally, many participants possessed only basic literacy skills, and a significant number resided in rural areas with restricted access to medical services and a low socioeconomic status.

In the post-test and follow-up assessments, the study group demonstrated accurate knowledge on various aspects, including the anatomy and function of the urinary system, the definition and causes of urinary tract infections, classifications of urinary tract infections, symptoms of lower and upper urinary tract infections, and complications associated with urinary tract infections. Furthermore, there was a statistically significant overall improvement in the level of knowledge, shifting from a minority to a majority following the nursing intervention, with a slight decrease in follow-up. This enhancement, post-implementation of the nursing intervention, could be attributed to the content of the nursing intervention, which focused on delivering practical

knowledge in a simple, straightforward, and understandable manner, thereby enhancing awareness, behavioral changes, and preventive measures related to self-care practices for preventing recurrent urinary tract infections among the elderly.

In contrast, the knowledge level of the control group either exhibited minimal improvement or did not show significant enhancement, despite receiving the protocol treatment for the prevention of RUTIs. This might have been due to several factors. One possibility was that the protocol treatment itself may not have been sufficiently effective in enhancing knowledge levels among participants in the control group. Additionally, individual differences in learning abilities, motivation, or prior knowledge about UTI prevention could have influenced the outcomes.

These findings were consistent with a study conducted by **Cooper et al. (2017)** in the **United Kingdom**, which concluded that older adults demonstrated knowledge improvement from 49% in the pre-intervention to 73% in the post-intervention periods, but decreased slightly to 63% in follow-up. Additionally, a study in **Alexandria, Egypt**, by **Harby et al. (2023)**, reported that knowledge scores before the nursing intervention were 4.50 ± 0.51 , potentially linked to their low educational level and socioeconomic status. However, following the nursing intervention, a significant improvement was observed in the knowledge scores (7.50 ± 1.41) after two weeks and (10.60 ± 1.71) after three weeks.

This was consistent with a previous study in **Alexandria, Egypt**, conducted by **Abd-Elwahab et al. (2021)**, which found significant improvements in knowledge levels across all areas of urinary tract infections after the implementation of the nursing intervention. The study reported statistically significant increases from 50% to 90% after the educational nursing program. In agreement with this, a study conducted by **Metwally et al. (2021)** in **Tanta, Egypt**, also reported that the study group exhibited a shift from a poor to a good level of overall knowledge in 92.5% of participants after the program, compared to the control group.

This aligned with a study conducted in **Saudi Arabia** by **Ahmed and Khresheh (2016)**, which concluded that 70% of the studied women had a good level of knowledge related to UTI immediately after the educational program. Similarly, a study conducted in **India** by **Kharadi (2019)** in **Rajasthan** displayed that all respondents had adequate knowledge (91.03%) post-program implementation. In the same context, the results of a study conducted in **the United States** by **Jena et al. (2021)** mentioned that nursing education had a greater impact on older adults' knowledge level regarding UTI prevention.

II: Risk Assessment and Manifestations of Recurrent Urinary Tract Infections

➤ Risk Assessment of Recurrent Urinary Tract Infections:

A. Non-modifiable Risk Factors:

The existing study results clarified that the highest non-modifiable risk factor in the study group was polycystic kidney disease, while the control group had ureter stricture as the highest risk factor. Conversely, the lowest risk factors in both study and control groups were the use of immunosuppressive drugs and spinal cord injury. The prominence of polycystic kidney disease as a high-risk factor aligned with existing knowledge of its association with chronic kidney disease (CKD) and its impact on immune responses. Polycystic kidney disease, often hereditary, was linked to CKD, which could compromise the immune system and increase susceptibility to infections.

This finding resonated with research in **Taiwan** by **Chao et al. (2021)**, which demonstrated a progressively higher risk of UTIs in individuals with CKD and frailty. Also, a study in **England** by **Ahmed et al. (2018)** highlighted an increased risk of UTI-related hospitalization and mortality in older patients with renal impairment. These studies collectively emphasized the intricate relationship between kidney health, immunity, and the risk of UTIs in the elderly.

B. Modifiable Risk Factors:

The assessment of modifiable risk factors for urinary tract infections (UTIs) among the elderly provided valuable insights into the influence of behavior and lifestyle on infection susceptibility. In the study group, the most prevalent **pre-intervention** modifiable risk factors were delayed micturition, followed by decreased daily fluid intake, and improper hygienic measures related to sexual activity. The control group exhibited similar risk factors, with variations likely stemming from individual characteristics and habits. The prevalence of delayed micturition in both groups aligned with findings from a study in **Ethiopia** by **Seifu&Gebissa (2018)**, which identified holding urine for extended periods as a significant risk factor for UTIs. Similar findings were reported by **Jagtap et al. (2022)** in **India**, emphasizing the withholding of urine as a significant risk factor for UTIs in women.

In the post-intervention phase, the study group demonstrated significant improvements in modifiable risk factors, indicating the efficacy of nursing interventions in promoting behavioral changes. Despite these improvements, obesity remained unchanged. The lack of significant improvement in obesity underscored the complexity of addressing lifestyle factors and the need for targeted strategies. Contrastingly, the control group did not show significant improvements in modifiable risk factors, highlighting the impact of the structured nursing intervention and the role of healthcare professionals in facilitating behavioral changes.

Total Risk Assessment of Recurrent UTIs:

Before implementing the nursing intervention, the current study revealed that more than half of the elderly participants were categorized as having a total high risk, with over one-third falling into the total moderate risk category. This pattern was consistent with the control group. The

association of higher risk levels with aging and chronic conditions aligned with the existing vulnerability of the elderly to UTIs. The aging process could compromise the immune system's ability to respond effectively to infections, making elderly individuals more susceptible to RUTIs. Chronic conditions, especially diabetes mellitus, further contributed to the overall risk by impacting immune function and increasing the likelihood of urinary tract complications.

After implementing the nursing intervention, the study group exhibited a significant improvement in total risk assessment, with a majority transitioning to the low-risk category. In contrast, the control group remained unchanged in their risk categorization. This substantial improvement in risk assessment in the study group indicated the effectiveness of the nursing intervention in enhancing knowledge, altering behavior, and reducing the overall risk of recurrent UTIs among the elderly participants.

These findings aligned with studies conducted in various locations, including Egypt (Selim et al., 2018; Metwally et al., 2021; Harby et al., 2023), Saudi Arabia (Ahmed & Khresheh, 2016), the United Kingdom (Cooper et al., 2017), and the United States (Haley et al., 2023). These studies collectively demonstrated the positive impact of nursing interventions on UTI-related outcomes, emphasizing the significance of tailored healthcare strategies in improving risk assessments and preventing recurrent urinary tract infections in the elderly.

➤ Manifestations of Recurrent Urinary Tract Infections:

A. General Manifestations of RUTIs:

In the pre-intervention phase, the existing study results clarified that dysuria emerged as the most common general manifestation in both the study and control groups, followed by fever in the study group and frequency in the control group. These findings aligned with the common clinical symptoms associated with UTIs. In agreement with this, Seifu & Gebissa (2018) in Ethiopia reported fever, dysuria, urgency, frequency, flank pain, and suprapubic pain as common clinical symptoms of UTIs. This aligned with the findings of Gharbi et al. (2019) in England, Shankar et al. (2021), Jagtap et al. (2022) in India, and Gama et al. (2020) in Brazil, which highlighted dysuria, frequency, incontinence, hematuria, fever, and abdominal pain as prevalent symptoms of UTIs.

In the post-intervention phase, the study group exhibited a significant decrease in the percentage of all domains of general UTI manifestations. This reduction in symptom prevalence underscored the positive impact of nursing interventions in ameliorating UTI symptoms and improving the overall well-being of elderly individuals. These findings were consistent with a study conducted in Brazil by Gama et al. (2020), which emphasized the effectiveness of nursing interventions in improving UTI symptoms.

B. Local Manifestations of RUTIs:

In the pre-intervention phase, the present study results illustrated that urethral irritation emerged as the most common local manifestation in both the study and control groups, with flank pain being the least reported. The observed results were influenced by factors such as the predominance of female participants, improper hygienic practices, and delayed micturition. The predominance of urethral irritation aligned with the common clinical presentation of UTIs, especially in females. Improper hygienic practices and delayed micturition contributed to the local manifestations observed, emphasizing the importance of addressing behavioral factors in preventing and managing UTIs.

After the implementation of the nursing intervention, the study group demonstrated a marked improvement and decrease in all local manifestations, highlighting the effectiveness of nursing interventions in alleviating UTI symptoms, including avoiding certain beverages, taking prescribed antibiotics, and emphasizing proper hygiene. These findings were consistent with studies conducted in Spain (Smithson et al., 2019) and Hong Kong (Choi et al., 2015).

Regarding the predictors for elderly total knowledge and total risk assessment in the study group post-intervention, the findings revealed that age, education level, and previous working experience had a significant positive effect on total knowledge and risk assessment. Specifically, elderly individuals aged between 60 and 70, with an educational level of reading and writing, and previous work experience, particularly as housewives, exhibited satisfactory knowledge and lower risk assessments post-intervention. This could have been due to the physiological changes and accumulation of comorbidities that come with aging, making urinary tract infections (UTIs) prevalent among the elderly (Shih et al., 2019). Furthermore, over two-thirds of the elderly participants were housewives with low educational levels, which hindered their ability to interact effectively with healthcare providers and understand nursing intervention messages. Without assistance, they struggled to read health-related information and comprehend medical instructions, impacting their ability to follow treatment regimens and reduce the risk of recurrent UTIs.

Similarly, a study in Benha, Egypt, by Said & Elbana (2019) found highly significant relationships between women's total knowledge scores and their education level, as well as their working conditions before intervention. However, no significant differences were observed between women's total knowledge scores and their age before and after the intervention. This aligned with Xu et al. (2022) in China, who identified age as an independent risk factor for postoperative urine-derived pathogenic infections in benign prostatic hyperplasia patients. Zhu et al. (2020) also reported that older age was an independent risk factor for UTIs. In contrast, Sabra et al. (2022) in Lebanon found no significant association between knowledge scores and educational level, possibly due to Lebanese pharmacists' frequent participation in continuing education activities enhancing their knowledge.

Conclusion

The study results revealed that both the study and control groups exhibited an overall deficiency in knowledge levels and an increase in associated risks and manifestations related to recurrent urinary tract infections (RUTIs) during the pre-intervention phase. However, post-intervention results provide evidence confirming the effectiveness of the nursing intervention in significantly enhancing overall knowledge, and reducing associated risks and manifestations among the elderly in the study group.

Additionally, there was a slight decrease in knowledge levels during the follow-up period, with sustained improvements evident compared to the control group.

Recommendations

Periodically assess nursing interventions and monitor high-risk groups for recurring urinary tract infection through feedback, surveys, and follow-up screenings. Design and distribute educational materials about UTI prevention to high-risk patients in urology departments, including printed handouts and colored brochures.

Declaration of Conflicting Interests

The Author(s) declare(s) that there is no conflict of interest.

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Table (1): Distribution of Elderly Participants Based on Their Demographic Characteristics in the Study and Control Groups (n=150)

Demographic Characteristics	Study group (n=75)		Control group (n=75)		Test P value
	No	%	No	%	
Age (years)					T test
60-<70	28	37.3	27	36	>0.05
70-<80	26	34.7	25	33.3	
80 or more	21	28	23	30.7	
Mean± SD	72.66±8.97		72.93±9.2		

Residence					Chi-square
Rural	71	94.7	72	96	0.531
Urban	4	5.3	3	4	>0.05
Gender					
Male	30	40	28	37.3	0.916
Female	45	60	47	62.7	>0.05
Marital status					Chi-square
Married	45	60	47	62.7	1.009
Unmarried	2	2.7	1	1.3	>0.05
Divorced	0	0	0	0	
Widow	28	37.3	27	36	
Educational level					Chi-square
Illiterate	31	41.3	32	42.6	1.081
Read & write	38	50.7	38	50.7	>0.05
Primary education	3	4	2	2.7	
Secondary education	3	4	2	2.7	
University education	0	0	1	1.3	
Working before retirement					Chi-square
Employee	2	2.7	4	5.3	1.346
Housewife	50	66.7	48	64	>0.05
Farmer/Laborer	18	24	19	25.3	
Free business	5	6.7	4	5.4	
Current working					Chi-square
Working	6	8	8	10.7	0.781
Not working	69	92	67	89.3	>0.05

Monthly income					Chi-square
Insufficient	48	64	47	62.7	>0.05
Sufficient	27	36	28	37.3	
Sufficient and save	0	0	0	0	
Living with					Chi-square
Alone	14	18.7	14	18.7	>0.05
Spouse	45	60	47	62.6	
Sons /relatives	16	21.3	14	18.7	

*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$

Table(2a):Distribution of Elderly Participants' Based on Correct Knowledge Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

Knowledge	Group	Pre-test		Post-test (After 1 week)		Follow-up (After 3months)		McNemar Test	P
		N	%	N	%	N	%		
The parts of the urinary system	Study	26	34.7	68	90.7	66	88.0	8.750	<0.01**
	Control	27	36.0	28	37.3	26	34.7	0.064	>0.05
	Chi-square Test	0.403 >0.05		6.999 <0.01**		7.088 <0.01**			
The function of the urinary system	Study	28	37.3	72	96.0	70	93.3	9.114	<0.01**
	Control	30	40.0	30	40	28	37.3	1.100	>0.05
	Test	1.024 >0.05		7.002 <0.01**		7.135 <0.01**			
Definition of a urinary tract	Study	16	21.3	60	80.0	56	74.7	8.909	<0.01**
	Control	14	18.7	15	20.0	13	17.3	1.024	>0.05

infection	Test	1.150 >0.05		9.888 <0.01**		9.014 <0.01**			
Causes of urinary tract infection	Study	7	9.3	54	72.0	50	66.7	10.442	<0.01**
	Control	7	9.3	6	8.0	6	8.0	1.209	>0.05
	Test	----		9.237 <0.01**		8.672 <0.01**			
Classifications of urinary tract infections	Study	5	6.7	55	73.3	52	69.3	9.654	<0.01**
	Control	6	8	6	8.0	7	9.3	1.003	>0.05
	Test	0.056 >0.05		8.777 <0.01**		9.013 <0.01**			
Lower UTI include	Study	5	6.7	62	82.7	60	80	8.472	<0.01**
	Control	6	8.0	7	9.3	6	8	0.612	>0.05
	Test	0.030 >0.05		9.700 <0.01**		9.542 <0.01**			
Symptoms of lower urinary tract infection	Study	4	5.3	60	80.0	55	73.3	7.698	<0.01**
	Control	5	6.7	6	8.0	6	8.0	0.503	>0.05
	Test	0.461 >0.05		9.333 <0.01**		8.645 <0.01**			
Symptoms of upper urinary tract infection	Study	5	6.7	63	84	61	81.3	10.146	<0.01**
	Control	7	9.3	6	8	7	9.3	0.825	>0.05
	Test	0.578 >0.05		9.788 <0.01**		10.482 <0.01**			
Complications of urinary tract infection	Study	6	8.0	64	85.3	62	82.7	10.681	<0.01**
	Control	7	9.3	8	10.7	7	9.3	0.775	>0.05
	Test	0.436		8.671		9.761			

		>0.05	<0.01**	<0.01**		
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*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$

Table (2b): Distribution of Elderly Participants' Based on Correct Knowledge Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

Knowledge	Group	Pre-test		Post-test (After 1 week)		Follow-up (After 3 months)		McNemar Test	P
		N	%	N	%	N	%		
Factors that contribute to the occurrence of urinary tract infection	Study	5	6.7	50	66.7	50	66.7	7.682	<0.01**
	Control	3	4	2	2.7	2	2.7	0.830	>0.05
	Chi-square Test	1.103 >0.05		8.766 <0.01**		8.766 <0.01**			
Practices that reduce urinary tract infection recurrent	Study	4	5.3	56	74.7	53	70.7	7.532	<0.01**
	Control	4	5.3	3	4	3	4	0.640	>0.05
	Test	-----		9.140 <0.01**		8.650 <0.01**			
Measures that can relieve the symptoms of urinary tract infection	Study	3	4.0	59	78.7	58	77.3	10.277	<0.01**
	Control	2	2.7	3	4.0	3	4.0	0.675	>0.05
	Test	0.861 >0.05		9.661 <0.01**		9.755 <0.01**			
Treatment of urinary tract infection	Study	4	5.3	61	81.3	60	80.0	9.701	<0.01**
	Control	3	4	4	5.3	3	4.0	1.003	>0.05
	Test	0.861 >0.05		9.661 <0.01**		9.755 <0.01**			
Protocol for	Study	2	2.7	53	70.7	51	68.0	9.200	<0.01**

taking antibiotics	Control	3	4	2	2.7	2	2.7	0.765	>0.05
	Test	0.632		9.880		9.616			
		>0.05		<0.01**		<0.01**			

*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$

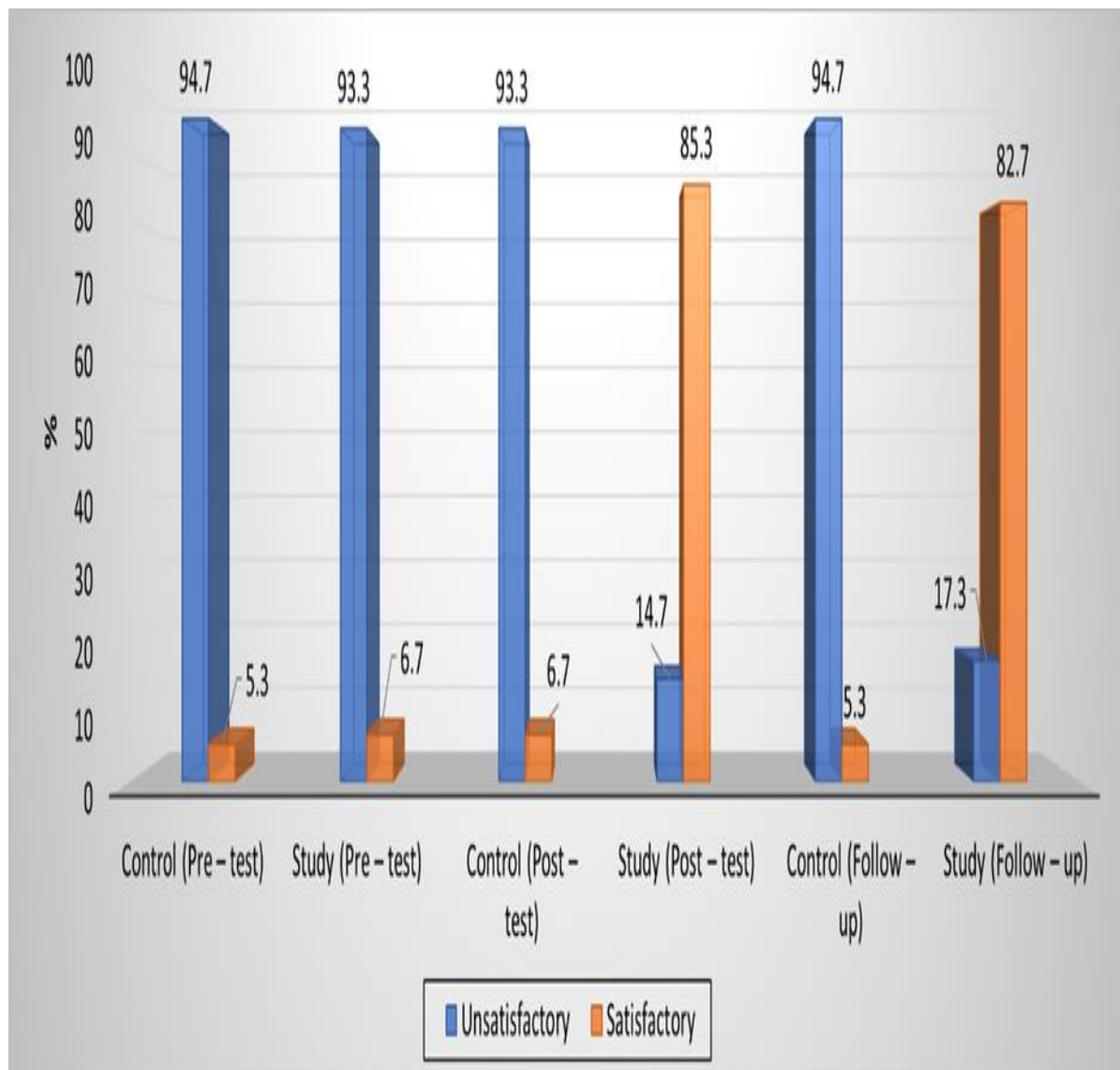


Figure 1. Distribution of Elderly Participants Based on Their Total Knowledge Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

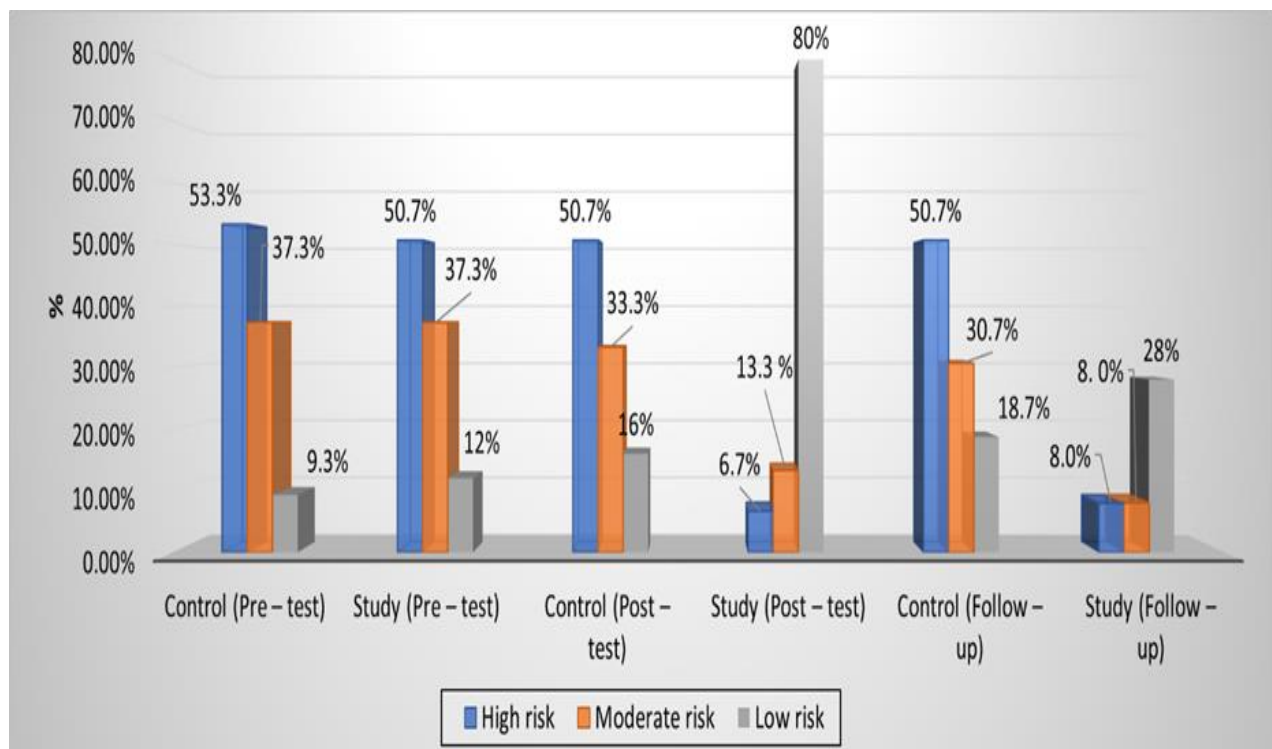


Figure 2. Distribution of Elderly Participants Based on Their Total Risk Assessment Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

Table (3): Distribution of Elderly Participants Based on General Manifestation of Recurrent Urinary Tract Infection Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

General Manifestation	Group	Pre-test (After 1 week)		Post-test (After 3 months)		Follow-up		McNemar test	P
		N	%	N	%	N	%		
Frequency	Study	63	84.0	8	10.7	6	8.0	9.108	<0.01**
	Control	62	82.7	57	76.0	54	72.0	1.209	>0.05
	Chi-square Test	1.02 >0.05		7.999 <0.01**		7.823 <0.01**			
Urgency	Study	60	80.0	5	6.7	3	4.0	9.116	<0.01**

	Control	58	77.3	56	74.7	53	70.7	1.624	>0.05
	Test	0.98		8.234		8.690			
		>0.05		<0.01**		<0.01**			
Dysuria	Study	67	89.3	11	14.7	7	9.3	8.912	<0.01**
	Control	69	92.0	65	86.7	62	82.7	1.700	>0.05
	Test	1.001		6.999		6.823			
		>0.05		<0.01**		<0.01**			
Fever	Study	65	86.7	10	13.3	3	4.0	10.701	<0.01**
	Control	61	81.3	50	66.7	56	74.7	1.447	>0.05
	Test	1.278		7.014		7.222			
		>0.05		<0.01**		<0.01**			
Chills	Study	46	61.3	10	13.3	2	2.7	10.320	<0.01**
	Control	43	57.3	41	54.7	42	56.0	1.309	>0.05
	Test	1.190		7.123		7.823			
		>0.05		<0.01**		<0.01**			
Malaise	Study	44	58.7	11	14.7	4	5.3	9.980	<0.01**
	Control	40	53.3	39	52.0	37	49.3	1.012	>0.05
	Test	1.807		6.543		6.490			
		>0.05		<0.01**		<0.01**			
Tachycardia	Study	61	81.3	3	4.0	0	0.0	10.562	<0.01**
	Control	58	77.3	47	62.7	40	53.3	2.998	<0.05*
	Test	1.713		7.900		8.823			
		>0.05		<0.01**		<0.01**			
Nausea	Study	42	56.0	7	9.3	1	1.3	8.776	<0.01**
	Control	41	54.7	39	52.0	37	49.3	1.034	<0.05*

	Test	0.467 >0.05	6.540 <0.01**	6.800 <0.01**		
Vomiting	Study	37 49.3	8 10.7	2 2.7	9.662	<0.01**
	Control	34 45.3	31 41.3	29 38.7	1.402	<0.05*
	Test	1.029 >0.05	6.570 <0.01**	5.999 <0.01**		
Urinary incontinence	Study	43 57.3	8 10.7	3 4.0	8.999	<0.01**
	Control	39 52.0	35 46.7	31 41.3	1.023	>0.05
	Chi-square Test	1.879 >0.05	6.338 <0.01**	6.800 <0.01**		
Urinary retention	Study	34 45.3	7 9.3	2 2.7	7.602	<0.05*
	Control	31 41.3	28 37.3	25 33.3	1.624	>0.05
	Test	1.172 >0.05	5.990 <0.01**	6.107 <0.01**		

*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$

Table (4a): Distribution of Elderly Participants Based on Local Manifestation of Recurrent Urinary Tract Infection Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

Local Manifestation	Group	Pre-test		Post-test (After 1 week)		Follow-up (After 3 months)		McNemar Test	P
		N	%	N	%	N	%		
Pain									
Suprapubic	Study	37	49.3	9	12.0	3	4.0	8.712	<0.01**

	Control	34	45.3	31	41.3	30	40.0	1.534	>0.05
	Test	1.178		8.351		7.820			
		>0.05		<0.01**		<0.01**			
Flank	Study	31	41.3	8	10.7	4	5.3	6.701	<0.01**
	Control	28	37.3	26	34.7	24	32.0	1.503	>0.05
	Test	1.300		5.980		6.023			
		>0.05		<0.01**		<0.01**			
Urethral	Study	33	44.0	9	12.0	2	2.7	7.800	<0.01**
	Control	32	42.7	29	38.7	27	36.0	1.290	>0.05
	Test	0.765		6.900		6.823			
		>0.05		<0.01**		<0.01**			
Perineal	Study	34	45.3	8	10.7	1	1.3	6.790	<0.01**
	Control	32	42.7	30	40.0	24	32.0	1.029	>0.05
	Test	0.916		6.356		6.821			
		>0.05		<0.01**		<0.01**			
Purulent urethral discharge	Study	45	60.0	12	16.0	6	8.0	7.690	<0.01**
	Control	43	57.3	40	53.3	38	50.7	1.008	>0.05
	Test	1.777		5.986		6.237			
		>0.05		<0.01**		<0.01**			
Urethral irritation	Study	61	81.3	13	17.3	4	5.3	9.134	<0.01**
	Control	57	76.0	53	70.7	49	65.3	1.035	>0.05
	Test	2.012		8.356		7.823			
		>0.05		<0.01**		<0.01**			
Inflammation of the	Study	54	72.0	15	20.0	5	6.7	8.765	<0.01**
	Control	52	69.3	49	65.3	47	62.7	1.003	>0.05

perineal area	Test	1.000	7.019	7.667		
		>0.05	<0.01**	<0.01**		

*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$

Table (4b): Distribution of Elderly Participants Based on Change in the Character of Urine Across Pre, Post, and Follow-Up Intervention in the Study and Control Groups (n=150)

Change in the Character of Urine	Group	Pre-test		Post-test (After 1 week)		Follow-up (After 3 months)		McNemar Test	P
		N	%	N	%	N	%		
Change at color	Study	67	89.3	14	18.	8	10.7	8.102	<0.01**
	Control	69	92.0	60	80.0	62	82.7	0.034	>0.05
	Chi-square Test	0.876 >0.05		7.014 <0.01**		7.222 <0.01**			
Change in odor	Study	43	57.3	9	12.0	4	5.3	7.652	<0.01**
	Control	40	53.3	38	50.7	37	49.3	1.524	>0.05
	Test	0.927 >0.05		7.111 <0.01**		7.208 <0.01**			
Changes in consistency	Study	38	50.7	10	13.3	3	4.0	8.712	<0.01**
	Control	36	48.0	33	44.0	30	40.0	1.534	>0.05
	Test	0.456 >0.05		5.990 <0.01**		6.088 <0.01**			

*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$

Table (5): Best fitting multiple linear regression model for the total knowledge post intervention among the study group.

Items	Unstandardized Coefficients <i>B</i>	standardized Coefficients <i>B</i>	T test	P. value
Age (80 or more)	-.267	.203	5.754	.008**
Previous work (Housewife)	-.190	.137	3.570	.026*
Education level (Illiterate)	.301	.240	6.700	.003**

Model	R ²	Df.	F	P. value
Regression	0.37	2	8.560	.004**

a. Dependent Variable: total knowledge

b. Predictors: (constant): age (80 or more), Previous work (Housewife), Education level (Illiterate)

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