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Associated Factors with Nursing Skills in Management of Urinary Tract Infections during Pregnancy in Two Healthcare Facilities Selected in Bujumbura-Burundi

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Abstract

Background: Urinary tract infection is defined as, a bacterial infection that affects urinary tract, which can present as cystitis (bladder infection) or pyelonephritis (kidney infection). This study is of great importance in ensuring optimal management of urinary tract infections during pregnancy, which contributes to reducing complications and improving maternal and neonatal health, particularly at Van Norman Clinic and District Hospital of Kabezi. It helped to fill existing gaps in nursing practices, while strengthening collaboration between the different stakeholders in the health system. This study promoted the development of nursing skills, particularly in the area of management of urinary tract infections in pregnant, which should have a significant impact on the quality of care provided. It should be noted that the skills of nurses in the management of urinary tract infections in pregnant are influenced by several factors including: level of training, professional experience, and the availability of care protocols. These factors also directly condition the quality of care and the prevention of complications related to urinary tract infections during pregnancy. **Methodology**: This is a descriptive and analytical study conducted in October 2024 among 60 obstetrics-gynecological nurses using guided interviews and statistical analysis with STATA 17.0. Associations were assessed using bivariate and multivariate analysis. The validity of the results was ensured by rigorous sampling and adherence to ethical considerations. **Results**: The findings show a higher level of experience ($p = 0.010$), a high level of education ($p = 0.026$), and specific training ($p = 0.000$) significantly improve nursing skills. Regular application of standardized protocols also improves performance ($p = 0.001$). In contrast, an age between 34 and 41 years ($p \leq 0.021$) and

a low level of education are associated with a low level of competence ($p < 0.001$), also a big number of nurses did not participate in specific training on urinary tract infections during pregnancy ($p = 0.032$). **Conclusion**: Nursing skills are influenced by age, level of education, experience, specific training ($p = 0.000$), and the application of standardized protocols ($p = 0.001$). Longer experience and a high level of education significantly improve competence, while an age between 34 and 41 years is associated with a low level of competence ($p = 0.021$). Therefore, nurses may face challenges such as a lack of continuing education, limited access to diagnostic resources, or care protocols that are sometimes unsuitable for specific contexts (Gaitanakis *et al*., 2018). Strengthening skills through specialized training and integrating nurses into clinical decision-making appear to be essential levers for optimizing the management of UTIs during pregnancy.

Keywords

Nursing Skills, Urinary Tract Infection, Pregnancy, Associated Factors, Health

1. Introduction

Urinary tract infections (UTIs) are one of the most common bacterial infections in pregnant women, with significant implications for maternal and fetal health. The effective management of these infections relies heavily on the skills of healthcare professionals, particularly nurses, who play a key role in the screening, treatment, and prevention of associated complications. These skills are influenced by various contextual, structural, and individual factors that vary across the world [1].

In developed countries such as the United States and Europe, nursing management is influenced by factors such as accessibility to care, the cultural diversity of patients, and social inequalities [2]. Nurses often face language or cultural barriers that can hinder communication with patients, and therefore the effectiveness of care (Hooton & Gupta, 2020) [3]. Quality of care also depends on institutional support, the availability of clinical guidelines, and collaboration with other healthcare professionals. In developing countries such as Mali and Cameroon, nursing skills are often limited by insufficient specialized training, a lack of diagnostic equipment, and weak supervision systems [4] [5]. Folefack Tsafack *et al*. (2016) highlighted that the lack of clear protocols and continuing education constitutes a major obstacle to effective care. Furthermore, therapeutic decisions are often hampered by antibiotic resistance and the lack of suitable drugs (Cissé, 2021) [6].

This research is motivated by the desire to understand the factors associated with the management of urinary tract infections during pregnancy in order to strengthen nursing skills, improve clinical practices, and reduce complications related to urinary tract infections during pregnancy. By identifying training gaps,

organizational barriers, and resource needs, this study will contribute to the development of concrete recommendations to improve the quality of maternal care at the local level. Furthermore, this research aims to leverage the role of nursing and improve health outcomes for pregnant women by aligning practices with international standards for the management of urinary tract infections [7] [8].

Globally, the management of UTIs in pregnancy highlights the importance of adequate nurse training, the availability of medical resources, and adherence to care protocols. According to Hooton and Gupta (2020) [9], continuing education in obstetric and infectious disease care allows for better symptom detection, timely treatment administration, and a reduction in complications [10]. However, challenges remain, such as a lack of interdisciplinary coordination and nursing staff overload.

2. Literature Review

Urinary tract infection is a bacterial infection that affects the urinary tract, which can present as cystitis (bladder infection) or pyelonephritis (kidney infection). In pregnant women, it can lead to serious complications for both the mother and the fetus if not properly treated [11]. The epidemiology and pathophysiology of urinary tract infections (UTIs) during pregnancy highlight the importance of systematic screening and early management [12]. Identifying risk factors and common pathogens helps better guide treatment strategies and prevent maternal-fetal complications [13]. UTIs are the most common bacterial infections in pregnant women, with a prevalence ranging from 2% to 10% (Cissé, 2021). Hormonal and anatomical changes during pregnancy promote urinary stasis, increasing the risk of infection. Escherichia coli is the most commonly implicated organism, accounting for 70% to 95% of cases (Foxman, 2014) [14] [15].

Urinary tract infections affect approximately 2% to 10% of pregnant women worldwide, with variations depending on region and socioeconomic conditions (Foxman, 2014) [16]. A study conducted in developing countries revealed a prevalence ranging from 16% to 43%, with high rates of antibiotic resistance (Cissé, 2021; Folefack Tsafack *et al*., 2016) [17]. In a study conducted in the United States, asymptomatic urinary tract infections were shown to occur in 2% to 7% of pregnancies, while symptomatic cystitis and pyelonephritis affected approximately 1% to 2% of pregnant women (Gupta *et al*., 2019) [18].

During pregnancy, several factors contribute to an increased risk of UTIs. Anatomical and hormonal changes play a key role, including increased progesterone levels, which cause smooth muscle relaxation in the urinary tract, promoting urinary stasis that is conducive to bacterial proliferation (Delzell & Lefevre, 2000) [19]. Furthermore, the physiological immunosuppression specific to pregnancy impairs cellular immunity, reducing the body's ability to eliminate bacterial infections (Kass, 1960) [20]. Finally, a history of UTIs also increases the susceptibility of pregnant women to developing new UTIs (Schaeffer & Nicolle, 2016) [21].

Escherichia coli is the main causative agent of urinary tract infections during

pregnancy, accounting for 70% - 95% of cases (Foxman, 2014), we can add other pathogens agents which conduct in UTIs, as well as: Staphylococcus saprophyticus, Klebsiella pneumoniae, Proteus mirabilis. However, the emergence of antibiotic resistance is a major concern, particularly in the face of bacteria resistant to beta-lactams and fluoroquinolones (Gupta *et al*., 2019) [22] [23].

Untreated UTIs during pregnancy can lead to serious complications. Approximately 20% - 40% of pregnant women with asymptomatic UTIs develop acute pyelonephritis if left untreated, which can worsen the condition and pose additional health risks to both the mother and child (Gupta *et al*., 2019). Furthermore, these infections are associated with an increased risk of premature rupture of membranes and preterm delivery, which can have serious consequences for the infant's health (Smaill & Vazquez, 2019) [24]. Finally, severe maternal infection can affect fetal growth, leading to intrauterine growth restriction, and increase the risk of neonatal mortality due to infection-related complications (Delzell & Lefevre, 2000). These risks underscore the importance of appropriate treatment to prevent serious complications of UTIs during pregnancy.

Drawing on Orem's self-care theory, nurses can educate patients on essential preventive behaviors: adequate hydration, regular bladder emptying, and proper personal hygiene (Delzell & Lefevre, 2000) [25]. These educational interventions are crucial for preventing UTIs and reducing the risk of maternal-fetal complications. Using Leininger's model of care, which emphasizes cultural sensitivity, nurses can adapt their discourse and practices to better reflect patients' beliefs and habits, thereby increasing adherence to preventive measures (Leininger, 2002) [26] [27].

Early detection of UTIs relies on the clinical vigilance of nurses who, using simple tools (urine dipsticks, laboratory tests), can quickly detect signs of infection (Schneeberger *et al*., 2014) [28]. Peplau's theory of the caring relationship highlights the importance of therapeutic communication, allowing nurses to effectively collect symptoms reported by patients and direct them toward appropriate care. Nurses also follow patients throughout the antibiotic treatment, monitoring side effects, treatment tolerance, and performing follow-up tests to ensure the infection has cleared (Gaitanakis *et al*., 2018) [29] [30]. Jean Watson's theory of caring emphasizes the importance of the human dimension of care, emphasizing the creation of an empathic bond that promotes the patient's overall well-being.

3. Methodology

This is a cross-sectional study with a descriptive and analytical aim which took place over a period of one month; October 2024 at the CVN and District Hospital of Kabezi. The inclusion criteria were to be a part time or fulltime nurse in those two institutions; while, to be not a nurse or to work without a diploma was a crucial exclusion criterion.

The sample size was defined using Yamane's formula: $n = N/1 + N(e)^2$, where sig-

nification is; n: sample size, N: population size, e: 95% accuracy level (p = 0.05). We only performed bivariate and multivariate analysis to identify trends and relationships between variables using statistical methods to analyze quantitative data and employ thematic analysis for qualitative data, also identifying recurring themes.

A multiple logistic regression was performed by calculating the adjusted odds ratio of 95% confidence interval between dependent variable and the independent variables whose p-value was $p < 0.20$ in bivariate analysis. Only variables whose $p < 0.05$ at this level was considered significantly associated with the skills of nurses in the management of urinary tract infection during pregnancy in obstetrical service of VNC (Van Norman Clinic) and Kabezi DH. The discriminatory power of the final model will be tested to assess its reliability using the ROC curve.

For qualitative variables, the number and frequency (%) of the different modalities were calculated. Second, each independent variable is cross-referenced with the dependent variable using a bivariate analysis by simple logistic regression, with a risk of error α of 5% (p = 0.05), to analyze the relationship between the dependent variable and the different independent variables, calculating the crude odds ratio (ORB) with its 95% confidence interval. Variables with a $p < 0.10$ were considered significantly associated with "nursing skills in the management of urinary tract infections during pregnancy." Stata data analysis software.

4. Results

Findings of our research show that 48% of nurses in two health structures had a baccalaureate level of education; Nurses who had received training in maternal health were 62% of cases; 87% of cases did not receive training on urinary tract infections during pregnancy; 45% of nurses had 6 - 11 years of work experience in the two selected HCFs (VNC & Kabezi DH). Inadequate hygiene is the most cited cause of urinary tract infections during pregnancy (95%). The symptoms most recognized by nurses are burning during urination (88.33%). Urinalysis (96.67%) is clearly identified as a key diagnostic test. A history of urinary tract infections is a major risk factor (73.33%). Finally, poor hygiene habits (95%) and urinary retention (50%) are aggravating factors, while frequent sexual intercourse (55%) is also mentioned. The results also showed that 63.33% of nurses were familiar with the common causes of urinary tract infections during pregnancy in both health facilities. 63.33% of nurses received more useful training in the management of urinary tract infection.

Findings of our study show that a high number of nurses has been trained on urinary tract infections (53.33%), a big number of nurses was able to establish one treatment of that disease (63.33%); low number of nurses knew one to three practices (25%); only 25% of interviewed had a behavior of integration in management of urinary tract infections; a low number of nurses was able to describe one to three associated factors (11.67%); also among sixty interviewed, a significant number of nurses knew one exam to diagnosing urinary tract infections (41.67%); and among a tested number of nurses, some of them were able to tell one to four

symptoms of urinary tract infections (13.33%); and then a small number of nurses has been able to describe one to three causes of that disease higher talked (3.33%). Those results showed that nurses in Health Care Facilities were not competent in knowledge and skills to combatting urinary tract infections fluently as it is presented in Figure 1.

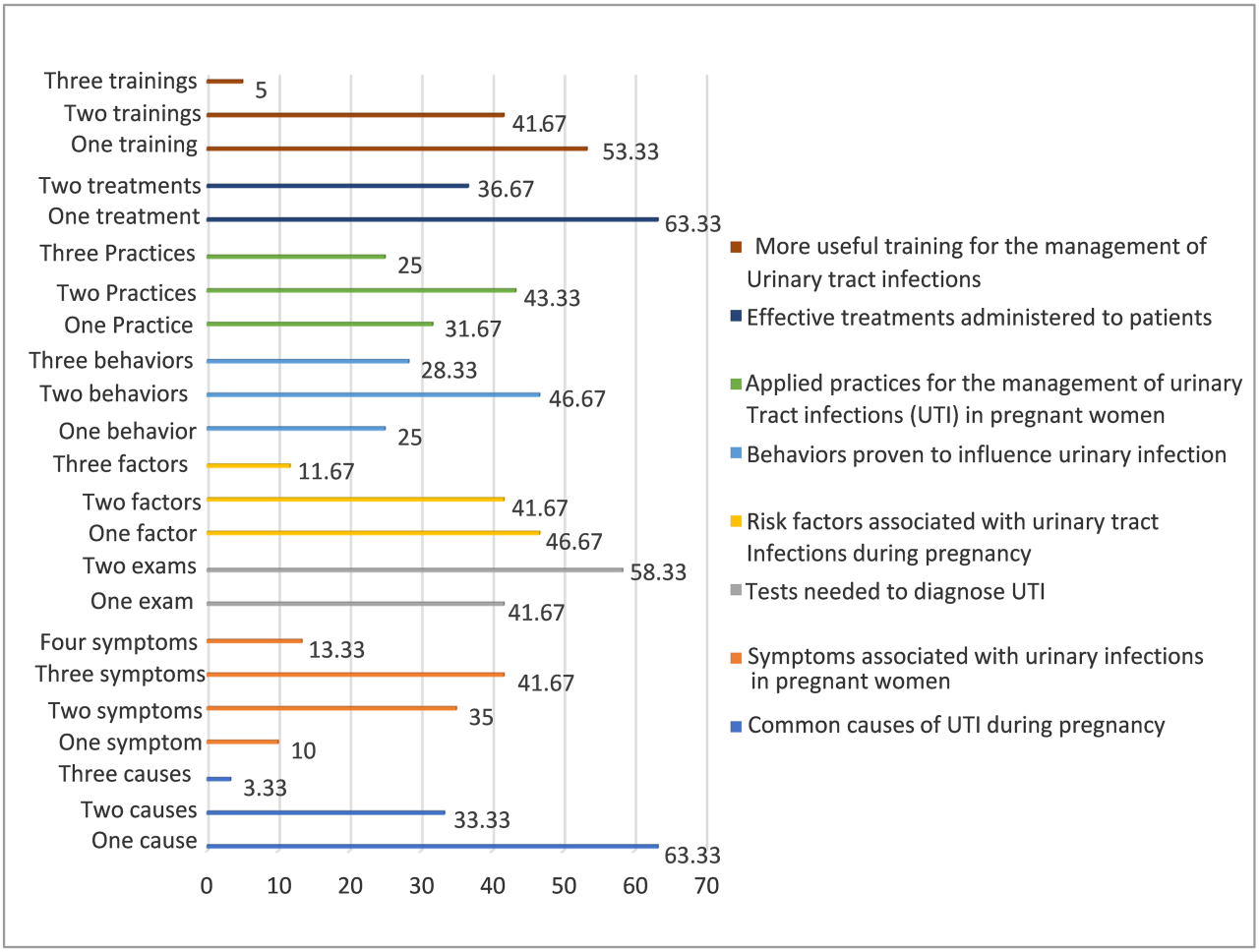

Figure 1. Distribution of nurses according to their knowledge of the pathophysiology, symptoms and complications of urinary tract infections during pregnancy.

Bivariate analysis shows that professional experience and training significantly influence the level of nursing competence in the management of urinary tract infections during pregnancy. Nurses with more experience ($p < 0.05$) and those with a higher level of education, including a Masters degree ($p = 0.026$), show greater competence. Frequent use of standardized treatment protocols is also a key factor, with a progressive improvement in skills depending on the frequency of application ($p < 0.05$). On the other hand, participation in specific training on urinary tract infections does not show a significant association with the level of competence ($p = 0.001$). Finally, neither marital status nor the possession of educational resources seem to significantly influence nursing competence.

Table 1. Analysis of the association between the level of nursing competence in the management of urinary tract infections during pregnancy and each independent variable in CVN and Kabezi DH (Bivariate analysis).

	Nurses' skill level in the management of urinary tract infections during pregnancy			
Explanatory variables	**Number**	**%**	**Crude OR 95%**	**p-value**
Age group				
18 - 25 years	4	6.6	1	
26 - 33 years	30	50	1.061 [0.003 - 1.171]	0.064
34 - 41 years	22	36.7	1.219 [0.009 - 4.988]	0.034
Over 41years	4	6.6	1.016 [0.0002 - 1.194]	0.060
Marital status				
Single	19	31.6	1	
Married	40	66.7	0.989 [0.125 - 7.804]	0.092
Widower	1	1.7	3.448 [0.006 - 18.154]	0.077
Education Level				
A2	28	46.7	1	
Bac	29	48.3	1.178 [0.026 - 1.191]	0.057
Masters	3	5	1.210 [0.002 - 0.589]	0.026
Experience				
Less than one year	6	10	1	
1 - 5 years	27	45	1.12 [0.031 - 0.534]	0.015
6 - 11 years	19	31.7	1.20 [0.031 - 1.495]	0.012
Over 11 years	8	13.3	1.32 [0.012 - 10.47]	0.002
Participate in maternal health training				
No	37	61.7	1.00 [0.001 - 6.06]	0.099
Yes	23	38.3	0.513 [1.05 - 17.41]	0.031
Participate in a specific training on urinary tract infections during pregnancy				
No	52	86.7	1.22 [0.23 - 3.212]	0.032
Yes	8	13.3	1.46 [0.33 - 2.908]	0.041
Identify potential complications of untreated urinary tract infections				
No	16	26.7	1	
Yes	44	73.3	0.61 [0.16 - 2.132]	0.073
Possession of tools or resources to assist in patient education				
No	46	76.7	1	0.066
Yes	14	23.3	1.3 [0.059 - 1.61]	0.051
Frequency of implementing standardized treatment protocols for urinary tract infections				
Never	45	75	1	
Rarely	6	10	1.90 [0.031 - 0.904]	0.050
Often	7	11.7	2.20 [0.031 - 0.904]	0.030
Always	2	3.3	3.10 [0.031 - 0.904]	0.019
Access to standardized treatment protocols for urinary tract infections				
Yes	37	61.7	1	
No	23	38.3	1.23 [0.031 - 0.904]	0.008

Table 1 shows that many interviewed (nurses) had an age range of 26 to 33 years, or 50% (p = 0.064); a big number of nurses was married, or 66.7% (p = 0.092); low number had masters' degree, or 5% (only 3; or p = 0.026); only eight interviewed had an experience of over eleven years, or 13.3% (p = 0.002); a significant number had not participate in maternal health training, or 61.7% (p = 0.099); a low number of nurses accepted that it didn't participate in specific training on urinary tract infections during pregnancy, or 86.7% (p = 0.032); however, a significant number of interviewed was able to identify potential complications of untreated urinary tract infections, 73.3% (p = 0.073); in addition, a big number of nurses had not tools or resources to assist and compains in patient education, 76.7% (p = 0.066); only two nurses implemented a standardized treatment protocol for urinary tract infections, 3.3% (p = 0.01); and then, a significant number nurses accessed to standardized treatment protocols for urinary tract infections, 61.7% (p = 0.008).

Multivariate analysis reveals that several factors significantly influence the level of competence of nurses in the management of urinary tract infections during pregnancy. Older nurses (34 - 41 years, p = 0.021) and those with a Masters degree (p = 0.026) show better competence. Professional experience of more than one year also significantly improves competence (p ≤ 0.010). Specific training (p = 0.000) and frequent application of standardized protocols (p ≤ 0.045) are positive predictors of high level of competence.

5. Discussions

Bivariate analysis confirms the significant influence of professional experience and educational level (p = 0.026) on nursing skills, in agreement with Benner (1984) and Aiken *et al*. (2014), who highlight the impact of experience and advanced training on the quality of care. Frequent application of standardized treatment protocols also improves skills (p < 0.05), as demonstrated by Cabana *et al*. (1999). However, specific training on urinary tract infections does not show a significant association (p = 0.001), concurring with the findings of Forsetlund *et al*. (2009) on the importance of post-training follow-up. In addition, marital status and access to educational resources do not significantly influence skills, corroborating the results of McHugh and Lake (2010) [30] [31].

Multivariate analysis revealed a significant association between educational attainment and nursing skill level, with a notable improvement among nurses with a master's degree (p = 0.026). These results confirm the findings of Aiken *et al*. (2014), who demonstrated that nurses with an advanced university degree are better prepared to apply evidence-based best practices. Indeed, a study conducted by Tourangeau *et al*. (2007) in Canada showed that nurses with a university degree had better critical analysis skills and a higher rate of compliance with care protocols. Furthermore, research such as that of Blegen *et al*. (2013) has highlighted that educational attainment is correlated with better clinical outcomes, due to greater mastery of therapeutic protocols and better decision-making in complex

clinical situations [32].

The study highlights that regular application of standardized protocols significantly improves nursing competence ($p \leq 0.045$). Nurses who apply these protocols "often" ($p = 0.020$) or "always" ($p = 0.001$) demonstrate significantly higher competence than those who rarely or never use them. This finding is consistent with the work of Cabana *et al*. (1999), who demonstrated that adherence to clinical guidelines reduces practice variability and improves the quality of care. In a study conducted in France by Vincent *et al*. (2018), it was observed that healthcare facilities that had implemented standardized treatment protocols for urinary tract infections in obstetrics had better clinical outcomes and a reduction in maternal-fetal complications. Reason why results highlight the importance of integrating protocols into nursing training and encouraging their systematic application [33] [34].

6. Conclusion

Nurses are key players in maternal care, intervening at multiple levels to ensure the health of pregnant women. In the management of urinary tract infections (UTIs) during pregnancy, they play a critical role in prevention, early detection, and patient follow-up to avoid serious maternal-fetal complications (Schneeberger *et al*., 2014). This section explores these different roles in depth, drawing on recent research and evidence-based recommendations. Despite their central role, nurses may face challenges such as a lack of continuing education, limited access to diagnostic resources, or care protocols that are sometimes unsuitable for specific contexts (Gaitanakis *et al*., 2018). Strengthening skills through specialized training and integrating nurses into clinical decision-making appear to be essential levers for optimizing the management of UTIs during pregnancy.

7. Recommendations

Recommendations are addressed to the following stakeholders:

Ministry of Public Health and the Fight against AIDS: Strengthening continuing education; Integrating standardized protocols; Encouraging academic training; Supervision and evaluation.

Authorities in Northen District of Bujumbura and all Head of District Hospitals of Burundi: to enhance an organization of local training; a logistical and material support; training nurses in urinary tract infections and other phenomenon, Supervision and mentoring and Performance evaluation.

Authorities of HCFs (Health Care Facilities) from Burundi: Capacity building; Implementation of standardized protocols; Availability of resources; Staff motivation.

Nurses who worked in the obstetrics' department: Self-training and updating of knowledge; Rigorous application of protocols; Collaboration and sharing of experience; Case monitoring and documentation.

Study Limitations

This study provides the associated factors to urinary tract infections during pregnancy in two health district of Bujumbura province including CVN and Kabezi DH. It does not represent the entire Burundian population and could not be generalized. Moreover, this study was conducted in short term of two months (October to November 2024). Authors did not test the reliability and validity of the questionnaire.

Conflicts of Interest

No conflicts of interest regarding the publication of this paper.

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