

# Prevalence and Associated Factors of Urinary Tract Infections among Diabetes Mellitus Patients at KIU-TH from January to December 2022

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## ABSTRACT

Globally, an estimated 150 million individuals are affected by urinary tract infections (UTIs) every year, with a significant number of those affected being diabetics. The International Diabetes Federation (IDF) reported that in the year 2019, there were about 60 million cases of patients suffering from diabetes who developed UTIs. The study assessed the prevalence and associated factors of urinary tract infections among diabetic mellitus patients in the medical ward at KIUTH. The objectives were to find out the prevalence and the factors associated with urinary tract infections among diabetic patients in the medical ward of KIU-TH. The study was descriptive, and it involved 87 patient files selected by purposive sampling, in which a checklist was the main tool of data collection. The study showed that female gender was significantly associated with the occurrence of urinary tract infection in diabetic patients at OR 0.17 (0.05–4.29) and PV 0.01. The study also shows that having other disease comorbidities was significantly associated with the occurrence of UTI among diabetic patients at OR 0.58 (0.35–8.07) and PV 0.002. The study also shows that having late diabetic disease among diabetic patients was also significantly associated with the occurrence of UTI among diabetic patients at OR 0.69 (0.35–8.19) and PV 0.004. The study concluded that 48 (55.2%) of diabetic patients had had a urinary tract infection, and therefore the study recommends that diabetic patients should be health educated on the causes and control of UTI so as to prevent their occurrences. The study also recommends that the government increase service provisions like treatments to reduce the occurrence of opportunistic conditions in UTIs, and the patients should be encouraged to seek regular medical checkups so that they monitor disease progression.

**Keywords:** Diabetics, UTIs, Patients, Diabetes mellitus.

## INTRODUCTION

Diabetes mellitus (DM) is a disorder that is characterized by varying degrees of insulin resistance, high blood glucose levels, and defective insulin secretion [1–5]. Due to impairment of the immune system because of decreased cellular responses, urinary tract infections (UTI) are commonly found in patients with diabetes mellitus [6, 7]. Annually, it is estimated that about 150 million individuals are affected by UTI globally, with a significant number of those affected being diabetics [8]. The 2015 WHO report has shown that there is a marked increase in the number of people affected by diabetes, and this trend is scheduled to grow in geometric proportions in the next couple of decades. In sub-Saharan Africa, many people suffering from DM are prone to contracting UTI due to a lack of proper management protocols, given that their weakened immune systems perform poorly in the

elimination of pathogens that cause UTI [9]. Poor metabolic control has also been found to be another reason why patients with DM are prone to UTI [10, 11]. A study in Algeria by Hannington et al. [12] on the national prevalence survey of infections in hospitals found that 26% of the total number of women who were over 60 years old had a UTI and diabetes mellitus. In East Africa, a study by Jonathan et al. [13] on the diagnosis and treatment of UTIs found that the pathogens causing UTI in diabetic patients had been found to differ from those causing UTI in nondiabetic patients, in which pathogens causing UTI in 79% of all diabetic patients were more resistant to administered antibiotics than pathogens causing UTI in nondiabetic patients. In a Ugandan study by Tumuhimbise et al. [14] on the microbial etiology and sensitivity of asymptomatic bacteriuria among diabetic mothers in Mulago, they found that

*Escherichia coli* was the predominant organism that causes UTI both in diabetic and non-diabetic patients. In this study, 6% of all the diabetic patients admitted were also diagnosed with a UTI. Because UTI is the leading cause of morbidity among diabetics, a high prevalence of diabetes is likely to translate to a high prevalence of UTI [15, 16]. A study on diabetic prognosis by the CDC in Uganda in 2019 showed that high glucose production in urine encouraged the growth of pathogenic bacteria in 54% of all the patients, which caused UTI in this category of patients. Considering the already weak immune systems of the patients, the pathogens that cause

UTIs can thrive and colonize the urinary tracts. The government of Uganda, through the Ministry of Health, has put measures in place to curb complications associated with diabetes, but that has not been enough. This study will therefore emphasize factors associated with UTIs among diabetic patients so that an intervention can be done. More so, a lot of studies have been done regarding diabetes, but no study has been done to ascertain the factors associated with urinary tract infections in diabetic patients, so this study will bridge the communication gap.

## METHODOLOGY

### Study Design

The study was a retrospective in which data was accessed from patient files who had been admitted at

KIU-TH with diabetes for one year from January to December 2022.

### Area of Study

The study was carried out at Kampala International University Teaching Hospital in Ishaka-Bushenyi District, Western Uganda. KIU-TH is a private hospital with specialized clinics including the ANC/MCH among others. It also comprises inpatient departments like the surgical, medical, paediatrics and private wards. It is located approximately 100 m north of the junction of the Ntungamo-Kasese Road with the Mbarara-Ishaka

Road. Its location is approximately 77 kilometres (48 miles), by road, west of Mbarara, the largest city in the sub-region. This location lies approximately 360 kilometres (224 miles), by road, southwest of Kampala, the capital of Uganda and the largest city in that country. The coordinates of Ishaka Bushenyi Municipality are 0° 32' 40.00"N, 30° 8' 16.00" E (Latitude 0.544445; Longitude: 30.137778

### Study Population

The study population was diabetes mellitus patients who attended KIU-TH from January to December 2022.

### Inclusion Criteria

All files of diabetic mellitus patients who attended KIU-TH from January to December 2022.

### Exclusion Criteria

- ❖ Files whose patients were suspected of diabetes mellitus but not confirmed by diagnosis.
- ❖ Files whose patients died.

### Sample Size Determination

The incidence rate of UTI was estimated to be 6% [14] and a total of 87 files of diabetic patients were accessed for data. Determined using the formula for simple random sampling using single proportions given by: (Kish Leslie, [17])

$$n = \frac{z^2 p q}{d^2}$$

Where n = Sample size

z = z value corresponding to a 95% level of significance = 1.96

p = expected proportion of population 6% = 0.6 [14].

q = (1 - p) = (1-0.06) = 0.94

d = absolute precision (6%)

Therefore, the above sample size is:

$$n = \frac{1.96^2 \times 0.035 \times 0.965}{0.05 \times 0.05}$$

n = 87

= 87 respondents

### Sampling procedure

A purposive sampling procedure was used to select patient files, where all the patient files of those diagnosed and managed with diabetes from January

to December 2022 were sampled until 87 files were reached.

### Study Instruments

A pre-coded checklist was used to collect data from patient files, the checklist was designed in order of specific objectives which were to assess the prevalence of urinary tract infections among diabetic patients as

well as factors associated with UTIs among the diabetic. The checklist was first pretested in the study before beginning the actual study.

### Data Collection

Patient files were obtained from the records store and checked for other clinical information such as patient had been managed for UTI or not, attached laboratory findings were also used to confirm if the

diabetic patient had a UTI or not. Confidentiality of information was ensured. The information obtained was only used for purposes of research.

### Pre-testing

A data collection checklist was pretested for quality before the study to ensure the validity of the data. Evaluation was made based on understanding of the

quest; clarity of questions; and embarrassments provided by questions and proposed additives and amendments were made where necessary.

### Data Management, Presentation and Analysis

The checklists were stored in a lockable cabinet. The data was then entered into an MS Access database. The patient names were omitted so as not to compromise on confidentiality. Each file was assigned a unique identification number. The data was

analyzed by tallying the information with percentages being derived. Demographic & clinical characteristics were displayed in the form of tables and graphs.

### Ethical Considerations

The report was presented to the faculty administrator of clinical medicine and dentistry for approval prior to beginning the study. Permission was obtained from the medical executive director of KIU-Teaching Hospital for the study. The study was carried out by existing ethical guidelines. Informed consent was sought from every patient before the questionnaire

was administered. Then permission to collect data from different files was helpful. Confidentiality was held at all costs; no information was divulged to any persons other than the researchers. All the information that was obtained from the study was treated with the utmost confidentiality and was used only for the intended purpose.

## RESULTS

**Table 1: Prevalence of UTI among diabetic mellitus patient**

Prevalence of UTI among diabetic patients	Frequency	Per cent
UTI among diabetic patients	48	55.2
No UTI among diabetic patients	39	44.8

From table 1 above showing the prevalence of UTI among diabetic mellitus patients in which the majority 48(55.2%) patients had urinary tract

infections while 39(44.8%) of the patients did not have Urinary tract infections.

**Table 2: Social demographic factors associated with UTI among diabetic patients**

Social demographics	UTI in diabetic patients		No UTI in diabetic p		Odds ratio 95% CI	p-value < 0.05 sg
	Freq.(48)	Per cent	Freq.(39)	Per cent		
Gender						
Female	35	64.6	19	48.7	Ref	
Male	17	35.4	20	51.3	0.17(0.5-4.29)	0.015
Immunosuppression						
Disease commodities	26	54.2	16	41.0	Ref	
No disease commodities	22	45.8	23	59.0	0.58(0.35-8.07)	0.002
Employment status						
Formerly employed	13	27.1	11	28.2	Ref	
Peasant	35	72.9	28	71.8	0.23(0.05-4.06)	0.202

**Sg , significance less than 0.05; confidence interval 95%; UTI urinary tract infection**

Table two above shows the association between social demographic factors and UTI among diabetic patients in which the majority 35(64.65) of the patients who had UTI were females while 20(51.3%) of the patients who had no UTI were males. The study showed that the female gender was significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.17(0.5-4.29) and p-value of 0.015. The study also assessed for immune suppression in which the majority 26(54.2%) of the patients with UTI said they experienced other associated while 23(59.0%) of those who had no UTI said they did not experience opportunistic diseases

the study showed that existence of disease commodities among diabetic patients was significantly associated with occurrence of UTI among diabetic patients at odds ratio of 0.58(0.35-8.07) and p- value of 0.002. The study also assessed employment status in which the majority 35(72.9%) of the patients with UTI as well as 28(71.8%) of the patients without UTI said that they were peasants the study showed that peasant employment status was not significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.23(0.05-4.06) and p- the value of 0.202.

**Table 3: Health-related factors associated with UTI among patients**

Health-related factors	UTI in diabetic patients		No UTI in diabetic patients		Odds ratio 95% CI	p-value < 0.05 sg
	Freq.(48)	Per cent	Freq.(39)	Per cent		
Late diabetic disease						
Yes	28	58.3	15	38.5	Ref	0.004
No	20	41.7	24	61.5	0.69(0.35-8.19)	
Catheterization						
Yes	07	14.6	03	7.7	Ref	0.823
No	41	75.4	36	92.3	0.40(0.25-5.15)	
Urine relation						
Yes	11	22.9	01	2.6	Ref	0.524
No	37	77.1	38	97.4	0.37(0.07-9.06)	

**Sg, significance less than 0.05; confidence interval 95%; UTI urinary tract infection**

Table three above shows the association between health-related factors and UTI among patients in which the majority 28(58.3%) of the patients with UTI said that they had the late diabetic disease while at least 24(61.5%) of the patients without UTI said they had no late diabetic disease the study showed that existence of late diabetic disease was significantly associated with occurrence of UTI among diabetic patients at odds ratio of 0.69(0.35-8.19) and p-value 0.004. The study also assessed for catheterization in which the majority 41(75.4%) of the patients with UTI as well as 36(92.3%) of the patients without UTI

said that they had no catheterization the study showed that catheterization was not significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.40(0.25-5.15) and p-value of 0.823. The study also assessed for urine relation in which the majority 37(77.1%) of the patients with UTI as well as 38(97.4%) of the patients without UTI said that they had no urine relation the study showed that having no urine relation was not significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.37(0.07-9.06) and p-value of 0.524.

## DISCUSSION

### Prevalence of UTI among diabetic mellitus patients

The study showed that the majority of 48 (55.2%) patients had urinary tract infections, while 39 (44.8%) of the patients did not have urinary tract infections. This could be a result of immunosuppression, which exposes patients to UTIs. When compared with other studies, a similar study carried out in Sudan showed the magnitude of asymptomatic urinary tract infections among diabetic patients. Among the 200

diabetic patients involved in the study, it was found that 20.9% had asymptomatic bacteriuria [18]. A study carried out on the profile of Ugandans with diabetes mellitus found that 7.1% of women with diabetes were found to have relapsing UTI and 15.9% had reinfection of the urinary tract compared to women without diabetes, who had 2.0% and 4.1% relapse and reinfection, respectively [19].

### Factors associated with UTI among diabetic patients

From the study, the majority of 35 (64.65) of the patients who had UTI were females, while 20 (51.3%) of the patients who had no UTI were males. The study showed that female gender was significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.17 (0.5–4.29) and a p-value of 0.015. When compared with other studies, Leonard et al. [16] also showed that the female anatomy also has the urethra closer to the anus, consequently making it easier for bacteria from the rectum to find their way to the urethra [16]. Women who use spermicidal agents as a form of birth control are also known to be at a higher risk of contracting an UTI. The normal flora in the vagina is greatly reduced by spermicides, and this leaves the pathogenic bacteria, which survive the effect of the spermicidal agents, to cause an infection [20]. The study also assessed immune suppression, in which the majority of 26 (54.2%) of the patients with UTI said they experienced disease commodities, while 23 (59.0%) of those who had no UTI said they did not experience opportunistic diseases. The study showed that the existence of disease commodities among diabetic patients is significantly associated with the occurrence of UTI among diabetic patients, with an odds ratio of 0.58 (0.35–8.07) and a p-value of 0.002. This could result from the synergistic action of polymicrobes. When this study is compared with other studies, Turpin et al. [21] also showed that, depending on the risk factors and pathogenesis of the pathogen infecting an individual, UTIs differ in terms of severity. Another study showed that the role played by the host defense also determines whether there was a successful UTI or not. An infection will only occur when there is an imbalance between the host defenses and the pathogenesis of the organism infecting the urinary tract [22]. Diabetes mellitus is one of the diseases that interferes with the immune response of the body, consequently allowing UTIs to develop [23–30]. The study also assessed the employment status, in which the majority of 35 (72.9%) of the patients with UTI as well as 28 (71.8%) of the patients without UTI said that they were peasants. The study showed that being a peasant as an employment status was not significantly associated with the occurrence of UTIs among diabetic patients at an odds ratio of 0.23 (0.05–4.06) and a p-value of 0.202. This is usually because peasants have poor health-seeking behavior that puts them at a disadvantage to suffering from UTIs when their immunity is already compromised by diabetes. The multi-level model analysis also indicates that household income is a key factor in maternal health service utilization because some mothers are unable

to pay, and some may choose not to seek modern ANC services when they fall sick. In the study, the majority of 28 (58.3%) of the patients with UTI said that they had late diabetic disease, while at least 24 (61.5%) of the patients without UTI said they had no late diabetic disease. The study showed that the existence of late diabetic disease was significantly associated with the occurrence of UTI among diabetic patients, with an odds ratio of 0.69 (0.35–8.19) and a p-value 0.004 [31–37]. Late disease diagnosis means delayed initiation of treatment, which gives other pathogens an opportunity for cross-infection. According to Jonathan et al. [13], some factors may facilitate the progression of an infection faster than others may. These factors may be associated with the host or the pathogen. Host factors that predispose an individual to UTI include gender, kidney stones, and an enlarged prostate. It is projected that up to half of women will have at least one episode of UTI in their lifetime. Women have a shorter urethra, making it easier for bacteria to travel up to the bladder and cause an infection there [25]. The study also assessed for catheterization, in which the majority (41,75.4%) of the patients with UTI as well as 36 (92.3%) of the patients without UTI said that they had no catheterization. The study showed that failure to have catheterization was not significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.40 (0.25–5.15) and a p-value of 0.823. These external devices can introduce infections into the body if maximum care is not taken. When compared with other studies, Ojede et al. [18] noted that, when foreign instruments, like catheters, are introduced into an individual, they provide a route for foreign organisms to find their way into the body. Pathogens invading the urinary tract also find it easy to access the organs in the region through the in-dwelling catheter, and individuals with in-dwelling catheters are more likely to get UTIs compared to those with no catheters [26]. The study also assessed the urine relationship, in which the majority (37, or 77.1%) of the patients with UTI as well as 38 (97.4%) of the patients without UTI said that they had no urine retention. The study showed that having no urine retention was not significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.37 (0.07–9.06) and a p-value of 0.524. This encourages the growth of pathogens that eventually become UTIs. When compared with other studies, Mangeni et al. [27] also showed that catheter use means that voiding of urine does not completely occur, and retention of urine in the bladder encourages colonization of bacteria and a potential UTI.

## CONCLUSION

The study concludes that 48 (55.2%) of diabetic patients had a urinary tract infection. The study also concludes that the female gender was significantly associated with the occurrence of urinary tract infection in diabetic patients at an odds ratio of 0.17 (0.05–4.29) and a p-value of 0.015. The study also concludes that having other disease comorbidities was significantly associated with the occurrence of

UTI among diabetic patients at an odds ratio of 0.58 (0.35–8.07) and a p-value of 0.002. The study also concludes that having late diabetic disease among diabetic patients was also significantly associated with the occurrence of UTI among diabetic patients at an odds ratio of 0.69 (0.35–8.19) and a p-value of 0.004.

## Recommendation

The study recommends that diabetic patients should be healthily educated on the causes and control of UTIs so as to prevent their occurrences. The study also recommends that the government increase service provisions like treatments to reduce the

occurrence of opportunistic conditions in UTIs. The patients should be encouraged to seek regular medical checkups so that they can monitor disease progression.

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