Faculty of Natural and Applied Sciences Journal of Mathematical and Statistical Computing
Print ISSN: 3026-8605
www.fnasjournals.com
Volume 1; Issue 1; December 2023; Page No. 19-28.

Modelling the Associated Risk Factors of Urinary Tract Infections (UTI) Using Logistic Regression

[1]Victor-Edema, U.A., [1]Njigwum, A.S., & [2]Amadi-Wali, O.
[1]Department of Mathematics/Statistics, Ignatius Ajuru University of Education, Port Harcourt, Nigeria.
[2]Department of Medical Microbiology and Parasitology, Rivers State University, Port Harcourt, Nigeria

***Corresponding author email**: uyodhu.victor-edema@iaue.edu.ng

Abstract
The lack of knowledge and improper awareness of the potential risks of urinary tract infection (UTI) is one of the major factors accounting for its high prevalence rates in Nigeria. This study aims to identify risk factors associated with urinary tract infections using logistic regression in tertiary health facilities in Rivers State. The study adopted a case-control observational design using retrospective data. The study population included the data of patients visiting Rivers State University Teaching Hospital from 2021 to 2023. The sample size was determined by using the 43.7% prevalence rate of UTI in the country with the aid of the Scalex SP calculator. A sample size of 592 patients was utilized for the study, and a purposive sampling technique was used to draw data from the records of patients screened for UTI. Data collected was analyzed using univariate (descriptive), bivariate (Chi-square) and multivariate (binary logistic regression) statistics. The SPSS version 27 was utilized for the statistical analysis. The result showed that urinary tract infections had an overall prevalence of 24.8%. Also, it was revealed that age is significantly associated with urinary tract infections, while gender is not. Finally, the sociodemographic factors (age and sex) significantly predict urinary tract infections among patients. Specifically, middle-aged persons (50-59yrs) were 7.6 times more likely to have UTI compared to children and teens (0-17yrs) (95% CI 2.12, 27.27). Finally, it was recommended that special care should be given to age groups who are at higher risk of contracting urinary tract infections.

Keywords: Urinary Tract Infection, Risk Factor, Logistic Regression

Introduction

With about 150 million cases each year (Ngong et al. 2021), the urinary tract is the second most prevalent site for bacterial infections after the respiratory tract (Ossai et al. 2014 in Kone et al., 2023). UTIs are the most prevalent outpatient infections, with a lifetime incidence of 50-60% in adult women, and recurrence within 6 months is common (Medina & Castillo-Pino, 2019). Glover et al. (2014) in Kone et al. (2023) discovered that 25 to 35% of women experience a recurrence of UTI within 3-6 months. The presence of considerable bacteria in the urine causes urinary tract infections (UTIs). Urinary tract infections (UTIs) are inflammatory illnesses of the urinary system or tract caused by the unusual growth of pathogens (Amali et al 2009 in Odoki et al 2019). Urinary tract infections are known to produce short-term morbidity in the form of fever, dysuria, and lower abdominal pain (LAP), as well as irreversible kidney scarring. Urinary tract infections can be acquired in the community or the hospital. Community-acquired urinary tract infections (CA-UTIs) are defined as infections of the urinary system that occur in a person's life in the community or a hospital setting within 48 hours after admission. Community-acquired UTI is the second most frequent microbiological infection found in the community. Nosocomial urinary tract infections (N-UTIs) are infections of the urinary tract that emerge after 48 hours of hospitalization and in which the patient was not incubating at the time of admission or within three days after release (Lacovelli et al 2014). Urinary tract infections can be asymptomatic, acute, chronic, complicated, or uncomplicated, and the clinical manifestations of UTIs are determined by the portion of the urinary tract involved, the etiologic organisms, the severity of the infection, and the patient's ability to mount an immune response. Asymptomatic and symptomatic UTIs both constitute a severe hazard to public health care, lowering the quality of life and increasing work absenteeism (Olowe et al., 2015) The signs and symptoms of UTIs such as fever, burning feelings while urinating, LAP, itching, blister and ulcer formation in the genital area, genital and suprapubic pain, and pyuria are mainly determined by the age of the person affected and the location of the

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infected urinary tract (Amali et al 2009 in Odoki et al 2021). There are several factors predisposing patients to UTI, and they are called risk factors.

Risk factors are biological, psychological, family, community, or cultural qualities that precede and are associated with a greater risk of poor outcomes (Substance Abuse and Mental Health Services Administration- SAMHSA, 2019). In epidemiology, a risk factor or determinant is a variable that is associated with a greater probability or chance of disease or infection (Parritz, 2017). Because correlation does not show causation, risk variables or determinants are correlational rather than causal. Risk factors associated with urinary tract infection may differ by country and geographical area, and some include poor personal hygiene, prostate issues, weakened immunity, sex, diabetes, and the use of spermicidal contraception. Similarly, it is believed that women's genital urinary anatomy, particularly the short urethra with proximity to the perianal area, increases the likelihood of UTI more than men's (Vasudevan, 2014 in Mwang'onde & Mchami, 2022). Consequently, for this study, binary logistic regression was used to determine risk factors associated with urinary tract infections.

The binary Logistic Regression model was first introduced by David Cox in 1958 and it is used not only to identify risk factors but also to predict the probability of success or failure of an event (Cox, 1958; Kleinbaum & Klein, 2010 in Ogonu, 2021). This type of logistic model is used primarily to predict an event with binary outcomes. For example, 'presence or absence', 'yes or no'. The predictor variables can either be metric or non-metric or a combination of both in the model. The effect of individual predictor variables can be measured while adjusting for the predictive ability of other factors in the mode. The binary logistic model was used in this study to examine and predict the likelihood of there is presence or absence of Urinary Tract Infection in patients visiting the Rivers State University Teaching Hospital. The regression model enabled the estimation of the presence of UTI sociodemographic factors (sex and age) in patients. In the model, the outcome variable was dichotomized to take the value of "1" if the event occurs (i.e., presence of UTI), and "0" if the event does not occur (i.e., absence of UTI). Since the probability of occurrence or non-occurrence of an event cannot be less than 0 or greater than 1, the event probability distribution is restricted between 0 and 1. It is important to underscore that the use of the binary logistic regression method for data analysis is in line with related empirical reviews of the study.

Reports from various studies affirmed that gender, age, race, circumcision, diabetes, urinary catheter, genitourinary tract abnormalities, pregnancy, newborns, elderly and hospitalization status are all associated with an increased risk of recurrent UTIs. (Odoki et al., 2019). *E. coli* is the most commonly isolated pathogenic organism in UTI, followed by *K. pneumoniae*, *Staphylococcus*, *Proteus*, *Pseudomonas*, *Enterococcus*, and *Enterobacter* (Marami et al., 2019; Odoki et al., 2019). A urine sample containing more than 10^5 colonies/ml of urine in pure culture is considered significant bacteriuria (Kehinde et al. 2011 in Kone et al., 2023). Also, urinary tract symptoms and a positive midstream urine culture result (growth of bacteria > 105 colony-forming units/mL and no more than two microbial species) were considered UTIs (Li et al., 2020). Even with improvements in diagnosis and treatment, UTIs continue to have high incidence and fatality rates, particularly in medical settings. For instance, UTIs are linked to a 2.3% attributable death rate in hospitalized patients and an estimated $340–$450 million yearly cost in the US (Zeng et al., 2022). Until now, there is a dearth of existing published studies from River or Bayelsa states that model the risk factors associated with urinary tract infections. The purpose of this study is to use logistic regression to model the associated risk factors of urinary tract infection in health institutions in Rivers State, Nigeria.

Statement of the Problem

Despite improvements in diagnosis and treatment, UTIs continue to be associated with high incidence and fatality rates, particularly in healthcare settings. Literature reports that the economic cost of UTI is enormous in developed countries like the United States. Similarly, the high prevalence of UTI in sub-Saharan Africa is a major cause of concern with an overall average prevalence of 32.12% according to a meta-analysis study (Mwang'onde & Mchami, 2022). Also, the study revealed that Nigeria ranks the second highest in the prevalence of UTI with an average of 43.65%. This prevalence rate may be higher in developing countries because a lot of UTI cases are unreported and are treated through self-medication and the use of herbal medicine. Despite the increasing prevalence within the country, not so much has been done to fully understand the spread of UTI and predict its associated risk factors. The scarcity of studies within the study area (Rivers and Bayelsa State) has prompted this study. Therefore, the purpose of this study is to use logistic regression to model the associated risk factors of urinary tract infection in health facilities institutions in Rivers State, Nigeria.

Aim and Objectives of the Study

This study aims to model the risk factors of urinary tract infections (UTI) using logistic regression in selected tertiary health facilities in Rivers State. In specific terms, the objectives of the study include the following, to:

1. Determine the level of urinary tract infections among patients from selected tertiary health facilities in Rivers State.
2. Determine the association between selected sociodemographic factors (age and sex) and urinary tract infections among patients from selected tertiary health facilities in Rivers State.
3. Ascertain the extent to which selected sociodemographic factors (age and sex) predict urinary tract infections among patients from selected tertiary health facilities in Rivers state.

Research Questions

The following research questions guided the study:

1. What is the prevalence of urinary tract infections among patients from selected tertiary health facilities in Rivers State?
2. To what extent are selected sociodemographic factors (age, and sex) associated with urinary tract infections among patients from selected tertiary health facilities in Rivers State?
3. To what extent do select sociodemographic factors (age and sex) predict urinary tract infections among patients from selected tertiary health facilities in Rivers State?

Hypotheses

The following null hypotheses were tested at a 0.05 level of significance.

1. Sociodemographic factors (age and sex) are not significantly associated with urinary tract infections among patients from selected tertiary health facilities in Rivers State.
2. Sociodemographic factors (age and sex) do not predict urinary tract infections among patients from selected tertiary health facilities in Rivers State.

Materials and Method

The study adopted a case-control analytical design using retrospective data. Unlike the cross-sectional descriptive observational design which is prospective or in the future, the case-control or retrospective design is a type of non-experimental or observational study utilized in epidemiological research where cases and controls with and without the outcome of interest are identified, and their previous exposure to a certain variable (risk factor) is gathered and analyzed to establish a relationship (Talari & Goyal, 2020). Rivers State is home to three universities and two tertiary health facilities- the University of Port Harcourt Teaching Hospital and the Rivers State University Teaching Hospital. The study population include the data of patients who were tested for urinary tract infection at Rivers State University Teaching Hospital in 2022. A sample of 592 patients' data was drawn for the study. The sample size is calculated using the Scalex SP calculator (Naing, et. al., 2022). For the expected prevalence of 43.65% (Onde & Mchami, 2022), the required minimum sample size is 398 for the margin of error or absolute precision of ±5% in estimating the prevalence with 95% confidence and considering the potential loss/attrition of 5%. With this sample size, the anticipated 95% CI is (38.65%, 48.65%). The formula is stated mathematically thus;

$$n = \frac{Z^2 P(1-P)}{d^2}$$

where n = Sample size

Z = Z statistic for a level of confidence

P = Expected prevalence or proportion

(If the expected prevalence is 20%, then P = 0.2), and

d = Precision (If the precision is 5%, then d = 0.05).

A purposive sampling technique was used to draw retrospective data from 592 patients who were tested for urinary tract infection in Rivers State University Teaching Hospital between 2021 to 2023.

The data for the study is retrospective data of patients' Urinary test results for three months (from June to August 2022), and the data was collected from patient's records from the Rivers State University Teaching Hospital

Ethical Consideration

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The investigation was conducted in compliance with international ethical norms and the study protocol was approved by the Research Ethics Committee of the Rivers of the State University Teaching Hospital **(RSUTH/REC/2023401).**

Mathematical Formulation

The mathematical formulation for the following statistics was discussed, namely: prevalence, Chi-square and binary logistic regression.

Prevalence of UTI

In the field of epidemiology, the percentage of a given population affected by a disease, risk factor, or other result under investigation is referred to as prevalence, or prevalence rate (Nedea, 2020). This can either be measured at a particular time or over a specified period of time.

Prevalence Rate (%) =

$$\frac{\text{New and pre-existing cases of disease during the same time period}}{\text{Population size during the same time period}} \times 100$$

Chi-square test of Independence

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where:

χ^2 = Chi Square obtained
$\sum$ = the sum of
O = observed score
E = expected score

Description of Binary Logistic Regression Model

$$\textbf{Log}\left(\frac{p}{1-p}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \text{----} + \beta_k X_n \quad \textbf{(1)}$$

The model shows the odds of UTI. In this study, P is the probability of UTI occurring, and (1-P) is the probability of UTI not occurring. While X_1 ….. X_n represents the independent variables and β_1 …… β are the regression parameters; a is a constant that gives the value of UTI when all the independent variables are absent in the model, and μ is the residual or random error term Log $\left(\frac{p}{1-p}\right)$ is referred to as the logic transformation of the probability of an event (i.e., UTI) occurring. A binary regression model was used in this study to predict the odds of occurrence of UTI in Rivers State using Rivers State University Teaching Hospital as a case study as influenced by the socio-demographic risk factors.

Model Specification

The implicit function of the model can be specified thus:

$y = f(S)$ (2)

where y is the outcome variable representing UTI

S: represent the selected socio-demographic factors used in the study

The socio-demographic factors are

S: *{AGE, SEX}* (3)

where,

AGE: The age of the patient measured in years

SEX: Biological sex measured as male or female

Hence,

y = *({AGE, SEX*) (4)

The regression model was developed to examine the association between socio-demographic factors (age and sex) and UTI in health facilities in Rivers.

Statistical Models for Testing Relationships

One statistical model will be set up to test the main hypothesis of the study and it is stated below in a null form:

1. Sociodemographic factors (age and sex) do not predict urinary tract infections among patients from selected tertiary health facilities in Rivers.

Model 1

The Implicit function of the relationship is denoted as:

$y = f(S)$ (5)

The Explicit function is denoted as:

$y = \beta_0 + \beta_1 AGE + \beta_2 SEX + \mu$ (6)

In model 1 above, y is the outcome variable and it refers to the logistic transformation of the probability of UTI occurring. β_0 is the intercept representing the probability of occurrence of the UTI in the absence of all the explanatory socio-demographic factors. β_1 to β_3 will be the odds ratios of UTI occurring, while each letter in the model represents the dummy variables derived from the maternal factors. The "μ" is the error term.

If the estimated odd ratio of any of the dummy variables is greater than 1, it signifies that the probability of occurrence of the outcome event (i.e. UTI) given that category of the variable is higher than the probability of the event occurring in the presence of the reference category of that variable. However, if the estimated odd ratio is less than 1, then the probability of the event occurring given that variable category, is less than the event occurring given the reference category for that variable. The test statistic for this model as well as for other similar logistic models in this study was the Chi-square statistic. The degree of freedom was the number of parameters estimated. The significant level was set at 5% (i.e., $P < 0.05$).

Method of Data Analysis

Data collected was analyzed using univariate (descriptive), bivariate (Chi-square) and multivariate (binary logistic regression) statistics. All statistical inferences of significance were made when the obtained p-value of the computed statistics fell below 0.05. The SPSS version 27 was utilized for the statistical analysis.

Results

Prevalence of urinary tract infections among patients from selected tertiary health facilities in Rivers state

For prevalence statistics, descriptive statistics of frequency counts and simple percentages were employed for its estimation.

Table 4.2: Prevalence of urinary tract infections among patients

UTI	**N**	**%**
Absence of UTI	445	75.20
Presence of UTI	147	24.80
Total	**592**	

Prevalence of common Pathogens of UTI

Pathogens	**N**	**%**
Escherichia coli	65	11.00
Klebsiella pneumonia	14	2.40
Proteus mirabilis	8	1.40
Staphylococcus aureus	46	7.80
Candida Spp	14	2.40
	147	**24.80**

The finding showed that urinary tract infections had an overall prevalence of 24.8% among patients from a tertiary health facility in Rivers State. Similarly, *Escherichia coli* had the highest prevalence of 11%, followed by *Staphylococcus aureus* (7.8%), while *Klebsiella pneumonia* and *Candida* spp (2.4%) had an equal prevalence and the least occurring is *Proteus mirabilis* (1.4%). Again, the findings showed the percentage of isolated pathogens that cause urinary tract infections (UTIs) among patients. The bar graph in Fig. 4.1 reveals that *Escherichia coli* is the most common pathogen that causes UTI, having a percentage occurrence of 44%, followed by *Staphylococcus aureus* (31%). *klebsiella pneumonia* and *Candida* spp jointly made up 20% while, *Proteus mirabilis* had the lowest prevalence making up 10% of the isolated organisms.

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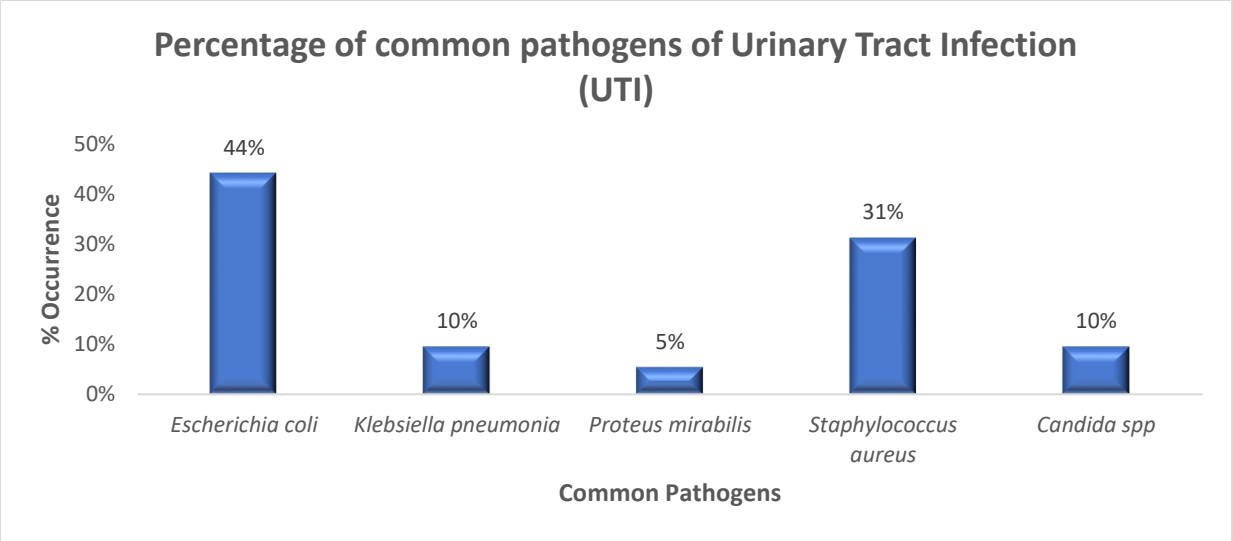

Fig.4.1: Percentage of common pathogens that cause Urinary Tract Infection (UTI)

The association between sociodemographic factors (age and sex) and urinary tract infections

The bivariate Chi-square analysis was employed to test the association between sociodemographic factors (age and sex) and urinary tract infections. Specifically, the hypothesis for the bivariate association for sex is stated below:

H_{o1}: Sex is not significantly associated with urinary tract infections among patients from selected tertiary health facilities in Rivers State.

H_1: Sex is significantly associated with urinary tract infections among patients from selected tertiary health facilities in Rivers State.

Table 4.3: Bivariate association between Gender and Urinary Tract Infection

		UTI						
Gender		**No**	**Yes**	**Total**	**X^2**	**Df**	**P-value**	**Cramer's V**
Male	Count	181	66	247	0.811	1	0.368	0.037
	Expected Count	185.7	61.3					
	% within Gender	73.30	26.70					
Female	Count	264	81	345				
	Expected Count	259.3	85.7					
	% within Gender	76.50	23.50					
Total	**Count**	**445**	**147**	**592**				
	% within Gender	75.2	24.8	100.0				

The bivariate Chi-square analysis was used to determine the association between gender and urinary tract infection among patients (Table 4.3). The result of the association between gender and the presence of urinary tract infection revealed that the obtained p-value of the computed Chi-square statistic falls above 0.05 and thus, the null hypothesis is not rejected ($X^2(1) = .081$, p = .368, Cramer's V= .037). Although males showed a higher prevalence of UTI (26.7%) than females (23.5%) the difference is negligible. Conclusively, this implies that gender is not significantly associated with the presence of urinary tract infections.

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The association between Age and Urinary Tract Infections

H_{o2}: Age is not significantly associated with urinary tract infections among patients from selected tertiary health facilities in Rivers state.

H_2: Age is significantly associated with urinary tract infections among patients from selected tertiary health facilities in Rivers State.

Table 4.4: Bivariate association between Age and Urinary Tract Infection

		UTI						
Age		**No**	**Yes**	**Total**	**X^2**	**Df**	**P-value**	**Cramer's V**
0-17yrs	Count	38	3	41	21.07	5	0.001	0.189
	Expected Count	30.8	10.2					
	% within Age	92.70	7.30					
18-29yrs	Count	74	27	101				
	Expected Count	75.9	25.1					
	% within Age	73.30	26.70					
30-39yrs	Count	116	27	143				
	Expected Count	107.5	35.5					
	% within Age	81.10	18.90					
40-49yrs	Count	73	17	90				
	Expected Count	67.7	22.3					
	% within Age	81.10	18.90					
50-59yrs	Count	42	25	67				
	Expected Count	50.4	16.6					
	% within Age	62.70	37.30					
≥ 60yrs	Count	102	48	150				
	Expected Count	112.8	37.2					
	% within Age	68.00	32.00					
Total	**Count**	**445**	**147**	**592**				
	% within Age	75.2	24.8	100.0				

The bivariate Chi-square analysis was used to determine the association between age and urinary tract infection among patients (Table 4.4). The result of the association between age and the presence of age and urinary tract infection revealed that the obtained p-value of the computed Chi-square statistic falls below 0.05 and thus, the null hypothesis is rejected ($X^2(5) = 213.07$, p = .001, Cramer's V= .189). Conclusively, this implies that age is significantly associated with the presence of urinary tract infections. The Cramer's V coefficients indicated that age is moderately associated with the presence of urinary tract infection (Cramer's V at df=5, small effect = .04, moderate = .13, Large/strong = .22 Cohen 1988 in Kim, 2017)

Socio-demographic factors (age and sex) predicting presence of urinary tract infections

The binary logistic regression analysis was employed to model the relationship between sociodemographic factors (age and sex) and urinary tract infections. Specifically, the hypothesis for the logistic model is stated below:

H_{o1}: Sociodemographic factors (age and sex) do not predict urinary tract infections among patients from selected tertiary health facilities in Rivers State.

H_1: Sociodemographic factors (age and sex) predict urinary tract infections among patients from selected tertiary health facilities in Rivers state

Table 4.5: Gender and age predicting presence of Urinary tract infection (UTI)

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Parameters	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. EXP(B)	
							Lower	Upper
Gender(1) (Female = 1, Male =Ref)	0.037	0.211	0.031	1	0.86	1.038	0.686	1.57
Age (0-17yrs = Ref)			18.647	5	0.002			
Age (1) (18-29yrs)	1.526	0.641	5.663	1	**0.017**	4.598	1.309	16.155
Age (2) (30-39yrs)	1.076	0.637	2.852	1	0.091	2.934	0.841	10.229
Age (3) (40-49yrs)	1.084	0.658	2.717	1	0.099	2.956	0.815	10.725
Age (4) (50-59yrs)	2.028	0.652	9.666	1	**0.002**	7.597	2.116	27.277
Age (5) (≥ 60yrs)	1.796	0.628	8.182	1	**0.004**	6.028	1.76	20.644
Constant	-2.563	0.615	17.373	1	0	0.077		
Omnibus test (X^2 =22.51)	0.001							
Hosmer and Lemeshow Test	0.943							
-2 Log likelihood	641.08							
Nagelkerke R Square	0.055							
Overall predicted percentage	75.2%							

The results from the logistic regression employed to determine if sociodemographic factors (age and gender) could predict the presence of UTI showed that the Omnibus logistic regression model was statistically significant ($p < .05$). This implies that at least one of the explanatory factors is significant and as such the omnibus null hypothesis is rejected. Therefore, Sociodemographic factors (age and sex) significantly predict urinary tract infections among patients from selected tertiary health facilities in Rivers State. The large value of the Hosmer and Lemshow test ($p = 0.943 > .05$) indicates that the model provides a good fit for the prediction of UTI. The Nagelkerke R^2 showed that the model accounts for 5.5% of the variance in having UTI and the model correctly classified 75.2% of UTI cases. From the model, it was revealed that age was a significant predictor of UTI among the participants. As such the following significant outcomes were shown: young adults (18-29yrs) were 4.6 times more likely to have UTI compared to children and teens (0-17yrs) (95% CI 1.31, 16.16). Similarly, middle-aged persons (50-59yrs) were 7.6 times more likely to have UTI compared to children and teens (0-17yrs) (95% CI 2.12, 27.27). More so, aged persons (≥ 60 years) were 6.03 times more likely to have UTI compared to younger persons (0-17 years) (95% CI 1.76, 20.64). However, it was revealed that gender is not a significant predictor of UTI, although, the inclusion of gender provided a better fit for the model. The regression equation is: $UTI = -2.563 + 0.037_{Sex} + 1.526_{Age(18\text{-}29yrs)} + 2.028_{Age(50\text{-}59yrs)} + 1.796_{Age(\geq 60yrs)} + \mu$ ($y = \beta_0 + \beta_1 AGE + \beta_2 SEX + \mu$). Therefore, with this model, it would be feasible to make further studies and interventions.

Discussion

The first result of the study showed that urinary tract infections had an overall prevalence of 24.8% among patients from a tertiary health facility in Rivers State. Similarly, *Escherichia coli* is the most common pathogen that causes UTI, having a percentage occurrence of 44%, followed by *Staphylococcus aureus* (31%). klebsiella mirabilis and *Candida* spp. jointly made up 20% while, *Proteus mirabilis* had the lowest prevalence making up 10% of the isolated organisms. Kone et al. (2023) investigated the risk factors for urinary urinary tract infections and reported a in several communities in Ondo State, Nigeria. The study utilized 509 participants and reported an occurrence rate of 20.43%. Li et al. (2020) reported a prevalence of 19%. Marami et al. (2019) reported an overall prevalence of 18% (95% confidence interval (CI): 15.34-22.63). Ojezele (2020) reported that the most commonly isolated organism was *E. coli*, which was identified from 120 (40%) of the patients. Also, Odoki et al. (2019) found that *Escherichia coli* was the most prevalent bacterial uropathogenic with 41.9% followed by *Staphylococcus aureus* 27/86 (31.4%), *Klebsiella pneumoniae* 11.6%, *Proteus mirabilis* 3.5%. However, Iwuafor et al. (2016), Odoki et al. (2019) and Mwang'onde and Mchami (2022) reported a higher prevalence of 35.6%, 32.2% and 43.65% respectively. Although, they all affirmed that *Escherichia coli* was the most prevalent causal agent of UTI.

Next, the second result showed that age is significantly associated with the presence of urinary tract infection, while, gender is not significantly associated with the presence of urinary tract infection. Furthermore, the sociodemographic factors (age and sex) significantly predict urinary tract infections among patients from selected tertiary health facilities in Rivers State. Specifically, young adults (18-29yrs) were 4.6 times more likely to have UTI compared to children and teens (0-17yrs) (95% CI 1.31, 16.16). Similarly, middle-aged persons (50-59yrs) were 7.6 times more likely to have UTI compared to children and teens (0-17yrs) (95% CI 2.12, 27.27). More so, aged persons (≥ 60 years) were 6.03 times more likely to have UTI compared to younger persons (0-17 years) (95% CI 1.76, 20.64). However, it was revealed that gender is not a significant predictor of UTI. The present study is similar to Marami et al. (2019) who found that urinary tract infection risk increases with age 35-44 years. Ojezele (2020) reported that UTIs were most common between the ages of 21 and 30 (23%). Also, Zhu et al. (2022) reported that female sex and increased age are predictors of UTI. Li et al. (2020) reported sex as a predictor of urinary tract infection in stroke patients. However, Iwuafor et al. (2016) reported that neither age nor gender was predictive of infection among patients in the intensive care unit.

Conclusion

The finding of the study affirmed that urinary tract infections had an overall prevalence of 24.8% among patients from a tertiary health facility in Rivers State. Similarly, *Escherichia coli* had the highest prevalence of 11%, followed by *Staphylococcus aureus* (7.8%), while *Klebsiella pneumonia* and *Candida* spp (2.4%) had an equal prevalence and the least occurring is *Proteus mirabilis* (1.4%). Also, it was found that age is significantly associated with the presence of urinary tract infections, while, gender is not. Finally, the sociodemographic factors (age and sex) significantly predict urinary tract infections among patients from selected tertiary health facilities in Rivers State. Specifically, age is a significant risk factor for urinary tract infection. Therefore, government policies and interventions should target patients within the age bracket who are highly at risk of UTI.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. The hospital management should prioritize awareness of urinary tract infections and the associated risk factors.
2. The state ministry of health should make policies and interventions which target patients within the age bracket that are highly at risk of UTI.
3. The state health ministry should pay more attention to health research about funding key epidemiological studies.

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