

ANALYSIS OF MICROBIOLOGICAL TESTS IN URINARY SYSTEM INFECTIONS

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ABSTRACT: Urinary tract infections account for about 40% of overall hospital system infections and are a serious economic burden and problem for public health system in any country. This is primarily expressed through absence from work. Urinary infection analysis needs to provide better results in this field by improved and better quality prevention, better education, and also higher quality hospitalisation. Using the method of urine analysis, i.e. through its results, we come to understand what the most common causes of urinary infections are. The study shows that the bladder inflammation (N30) is the most common admitting diagnosis in subjects whose urine culture was positive. Among the subjects with positive urine culture, *Escherichia coli* was found in 43.4% of patients. A statistically significant association was found between admitting diagnoses and the age group of respondents aged 35 to 50.

Keywords: Urinary tract infection, urine culture, *Escherichia coli*, immunity.

INTRODUCTION

The urinary system (lat. *Organa urinaria*) (US) is a group of human organs that have a task and role in:

- regulating the volume and composition of bodily fluids
- elimination of excess water, electrolytes and toxic substances (urea and creatinine) from the body
- cleansing the blood plasma of unwanted substances.

With the entry of pathogenic microorganisms into the human body, a biological process occurs which we call infection or contagion. Infection in most cases is caused by microorganisms after their entering the human body, and the most common are: bacteria, viruses, fungi and parasites. Since the human body neutralizes microorganisms with its immune system, every infectious process does not turn into a disease.

The most important factors for the development of infections are: the way microorganisms enter the body, the number of microorganisms and their power.

The most common infection, which occurs three or more times a year, and which occurs more often in women than in men, is urinary system infection (USI).

The main cause of cystitis and pyelonephritis is *Escherichia coli*. It is a type of bacteria that lives in the intestines of the human body, and under normal conditions does not lead to infections. It causes infection by creating various symptoms (discomfort and pain). Among other bacteria that also cause urinary tract infections, we note: *proteus mirabilis*, *klebsiella*, *streptococcus agalactie*, *pseudomonas aeruginosa*, *enterococcus faecalis*.

By the method of urine analysis, we find out what the state of a person's metabolism is, as well as the state of their urinary system. In addition to being a basic laboratory analysis, urine examination is an important diagnostic method.

The aim of the research was to determine the frequency of individual causes of urinary system infections, and to examine the interrelationships of respondents' demographic characteristics, as well as the relations between family physicians' admitting diagnoses and the results of laboratory analysis.

MATERIALS AND METHODS

The study included women of reproductive age from 18 to 50 from the Posavina County, who, in the period from January 1, 2021 to June 30, 2021, due to suspected urinary system infections, were referred to the Institute for Public Health Care for microbiological analysis by family doctors. The data indicated on each referral to the laboratory were used in this research, namely: age, place of residence and admitting diagnosis.

In the Public Health Institute of the Posavska County in Orašje, a microbiological examination of 249 urine samples taken from women from the Posavska County with suspected urinary system infection was performed.

Urine was processed according to the regulations related to microbiological analysis in such a way that the urine passed an automatic device that works on the principle of incubation of urine and has a reader of positive cultures.

Isolation of all urine cultures that were positive in the device and that contained more than or equal to 104 CFU/ml of microorganisms was performed. Positive urine samples were inoculated on CPSE nutrient medium at 37 degrees Celsius for about 24 hours.

After the incubation, the reading from the nutrient medium was performed, and the causes of urinary system infections and their sensitivity to antibiotics were determined.

RESULTS

Based on admitting diagnoses with suspected urinary system infection, microbiological examination of urine was negative in 58% of subjects, while in 42% of subjects urine culture was positive.

Table 1. Respondents whose urine cultures were positive by the place of residence

Place of Residence	Number	%
Orašje	64	60.38
Odžak	28	26.0
Domaljevac-Šamac	14	13.22
Overall:	106	100

Among the respondents with positive urine culture, there were 46 subjects or 43.4% of those with *Escherichia coli*, 23 subjects or 21.7% with *Enterococcus faecalis*, and *Staphylococcus saprophyticus* was

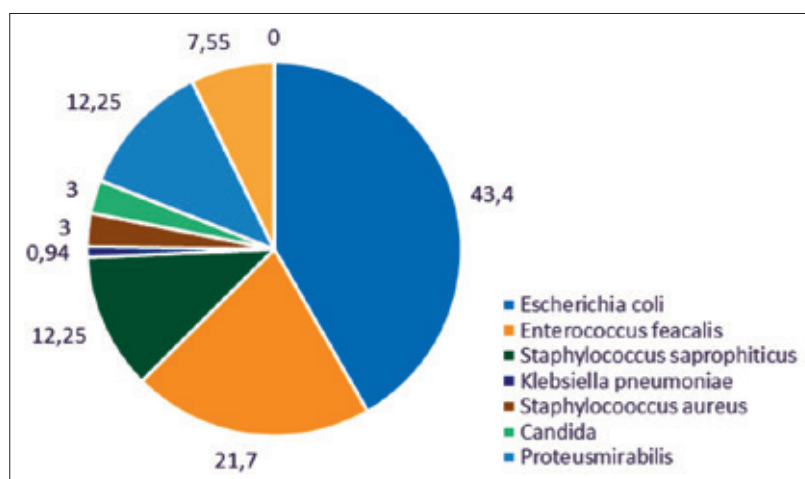


Figure 1. Incidence of individual causes of USI in subjects with positive urine culture

found in 13 subjects or 12.25%. *Klebsiella pneumoniae* was found in 1 subject or 0.94%, *Staphylococcus aureus* and *Candida* were found in 3% of subjects, *Proteus mirabilis* in 13 subjects or 12.25% and *Pseudomonas aeruginosa* in 8 subjects or 7.55% of respondents (Figure 1).

The study shows that inflammation of the bladder (N30) is the most common admitting diagnosis in subjects whose urine culture was positive. It occurred in as many as 50.5% of respondents. Urinary tract infection with unmarked location (N39.0) occurred in 26.7% of subjects, followed by acute cystitis (N30.0) in 6.9% of subjects. 5.9% of subjects were diagnosed with cystitis, unspecified (N30.9), 5% of subjects were referred with a diagnosis of second chronic cystitis (N30.2), while 4% of subjects reported interstitial cystitis (N30.1) and in 1% of subjects the admitting diagnosis there was second cystitis (N30.8) (Figure 2).

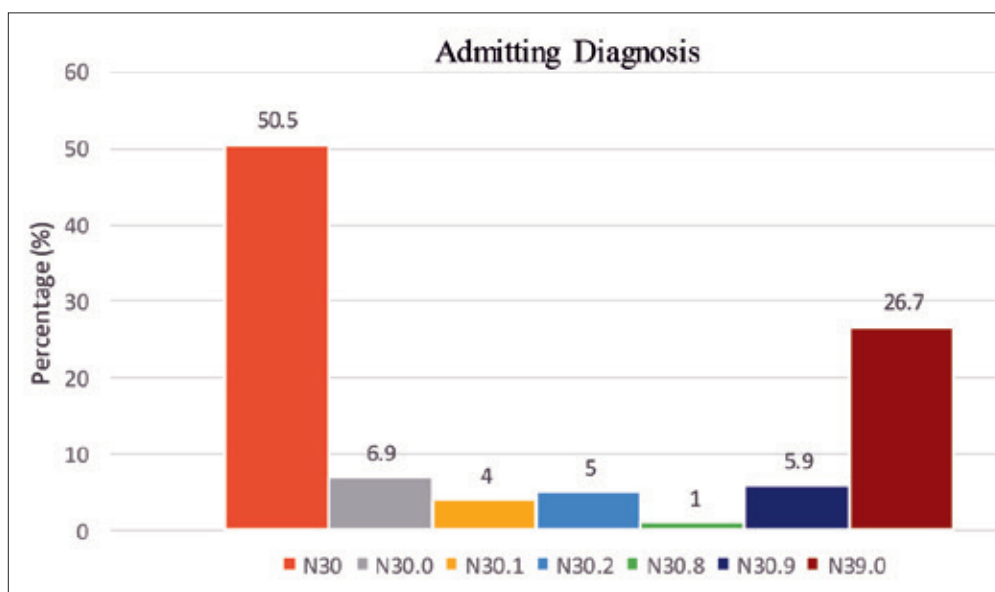


Figure 2. Frequency of Individual Admitting Diagnoses of Patients in Relation to Incidence

The subjects were divided into two groups, based on their age, and the analysis showed the association of the groups with individual causes of urinary system infection. (Table 2)

Table 2. Frequency distribution of causes in relation to the age of the respondents

Cause	Age of Respondents	
	Number of Respondents (%)	
	18-34 yr.	35-50 yr.
Escherichiacoli	19 (41.30)	27 (58.70)
Enterococcusfaecalis	14 (60.87)	9 (39.13)
Klebsiella pneumoniae	0	1 (100.00)
Proteusmirabilis	7 (53.8)	6 (46.2)
Pseudomonas aeruginosa	4 (50.0)	4 (50.0)
Staphylococcus aureus	1 (100.0)	0
Staphylococcus saprophyticus	5 (38.40)	8 (61.60)
Candida	0	1 (100.0)

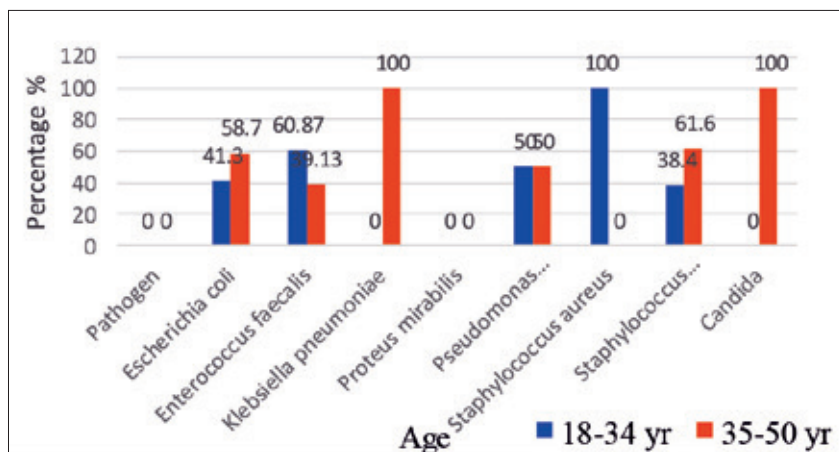


Figure 3. Frequency of Pathogens in Relation to the Respondents' Age

Table 3. Frequency of Positive Urine Culture Based on the Respondents' Age

Urine Culture Test	Age of Respondents Number of Respondents (%)	
	18-34	35-50
Positive	50 (47.15)	56 (52.85)
Negative	56 (39.40)	87 (60.60)

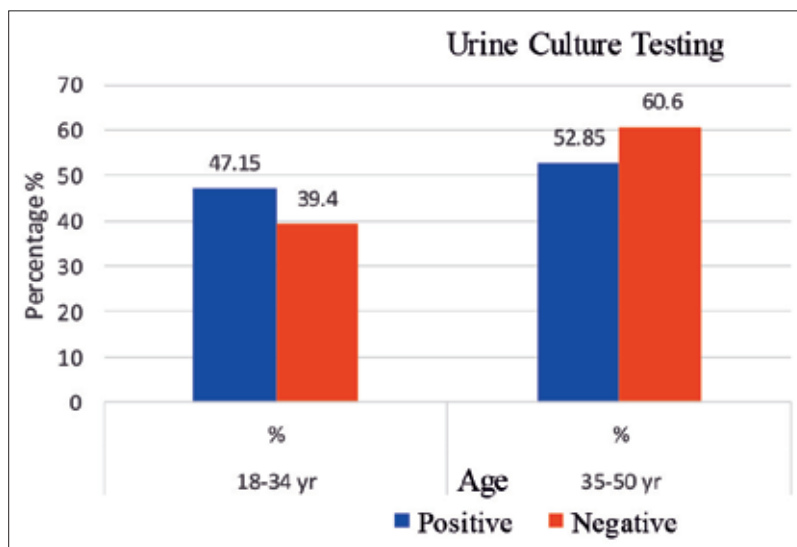


Figure 4. Frequency of Positive Urine Culture in Relation to Age

Table 4. Admitting Diagnoses in Relation to Age

Admitting Diagnosis	Age of Respondents Number of Respondents (%)	
	18-34 yr.	35-50 yr.
Inflammation of the bladder (N30) - 53.80%	78 (58.10)	56 (41.90)
Acute cystitis (N30.0) 4.40%	2 (18.20)	9 (81.80)
Interstitial cystitis (N30.1) 4.40%	4 (40.00)	6 (60.00)
Second chronic cystitis (N30.2) 4.40%	1 (10.00)	9 (90.00)
Second cystitis (N30.8)	0	1 (100.00)
Cystitis, unspecified (N30.9) 4.40%	2 (20.00)	8 (80.00)
Urinary tract infection, location unmarked (N39.0) 29.40%	19 (26.50)	54 (73.50)

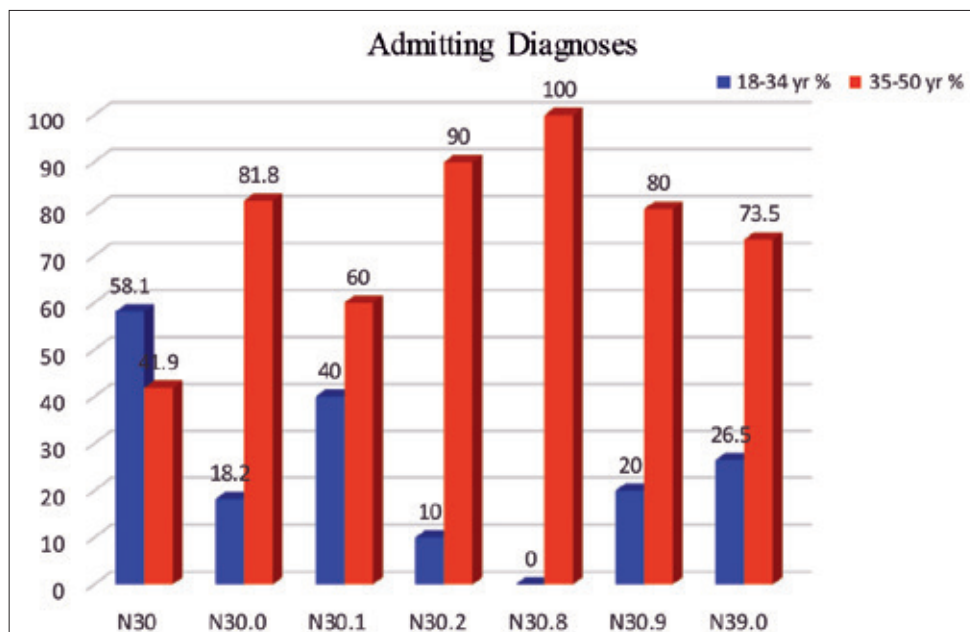


Figure 5. Admitting Diagnoses in Relation to Age

Table 5. Incidence of Individual Pathogens Depending on the Place of Residence.

Pathogen	Orašje (Number and %)	Odžak (Number and %)	Domaljevac -Šamac (Number and %)
Escherichia coli	28 (60.9)	13 (28.3)	5 (10.8)
Enterococcus faecalis	13 (56.6)	5 (21.7)	5 (21.7)
Klebsiella pneumoniae	1 (100.0)	0	0
Pseudomonas aeruginosa	4 (50.0)	4 (50.0)	0
Proteus mirabilis	6 (46.1)	5 (38.5)	2 (15.4)
Staphylococcus aureus	1 (100.0)	0	0
Staphylococcus saprophyticus	11 (84.6)	0	2 (15.4)
Candida	0	1 (100.0)	0

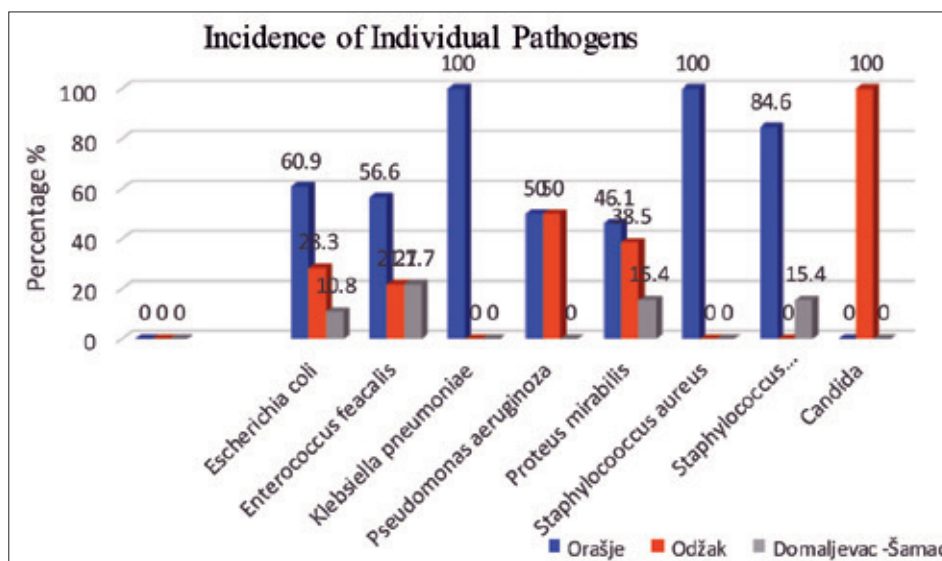
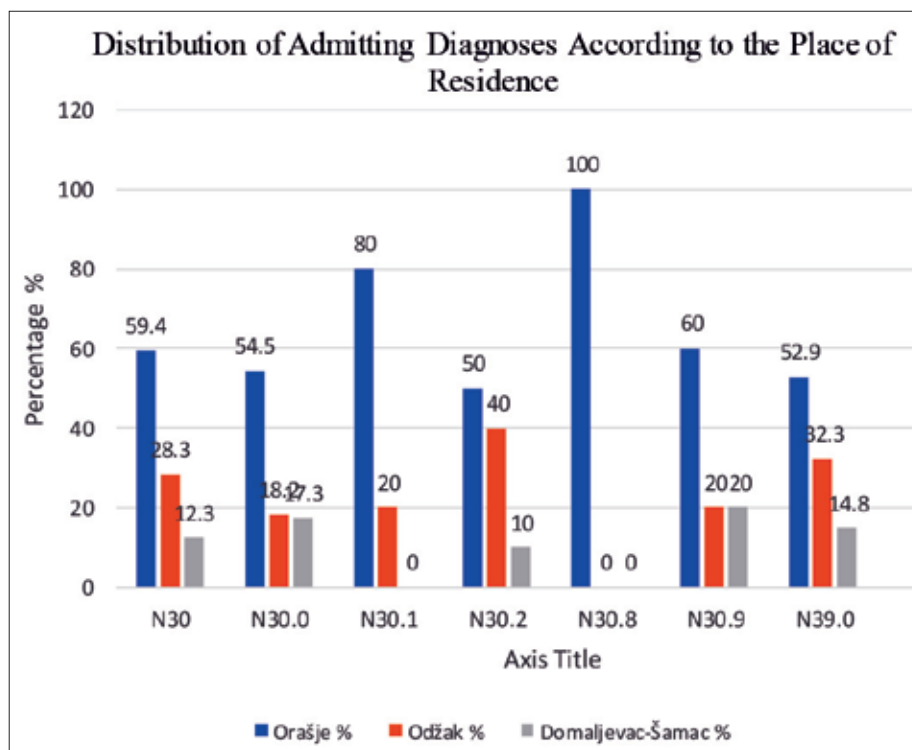


Figure 6. Incidence of Individual Pathogens Depending on the Place of Residence

Table 6. Distribution of Admitting Diagnoses Depending on the Place of Residence

Admitting Diagnosis	Orašje (Number and %)	Odžak (Number and %)	Domaljevac-Šamac (Number and %)
Inflammation of the bladder	79 (59.4)	38 (28.3)	17 (12.3)
Acute cystitis (N 30.0)	6 (54.5)	2 (18.2)	3 (17.3)
Interstitial cystitis (N 30.1)	8 (80.0)	2 (20.0)	0
Second chronic cystitis (N30.2)	5 (50.0)	4 (40.0)	1 (10.0)
Second cystitis (N30.8)	1 (100.0)	0	0
Cystitis, unspecified (N30.9)	6 (60.0)	2 (20.0)	2 (20.0)
Urinary tract infection, location unmarked (N39.0)	38 (52.9)	24 (32.3)	11(14.8)

**Figure 7.** Distribution of Admitting Diagnosis According to the Place of Residence**Table 7.** Frequency of Confirmed USIs Based on the Respondents' Place of Residence.

Urine Culture Test	Orašje (Number and %)	Odžak (Number and %)	Domaljevac-Šamac (Number and %)
Positive	64 (60.4)	28 (26.4)	14 (13.2)
Negative	87 (60.8)	39 (27.2)	17 (12.0)

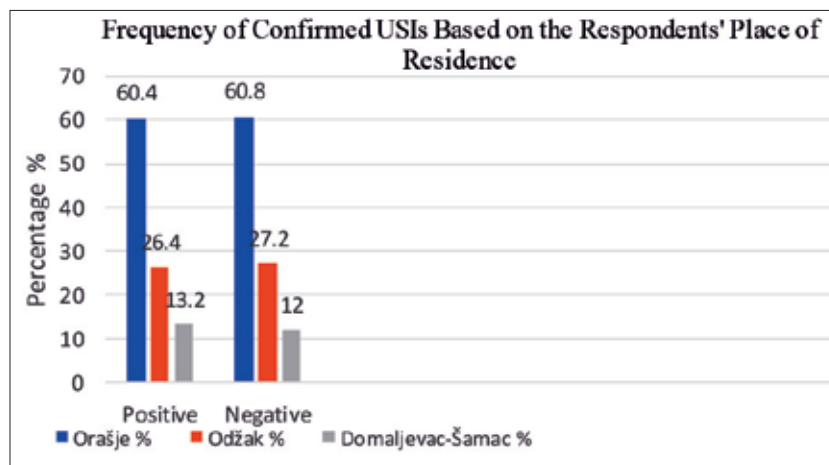


Figure 8. Frequency of Confirmed USIs Based on the Respondents' Place of Residence

DISCUSSION

Previous research and observations have shown that urinary system infections are more prevalent or more common in females. Some research has shown that due to hormonal status as well as evident anatomical differences compared to men, women are up to 30 times more likely to have urinary system infections.

For this reason, our research included female population. Microbiological analysis of urine showed that 42.57% of urine cultures were positive, while in 57.43% of respondents the test result was negative.

Also, scientific research shows that the development of urinary system infections increases by 7% in older women compared to women aged 18 to 50. Considering that in the research we divided women of reproductive age into two groups according to age: respondents aged 18 to 34 and respondents aged 35 to 50. The results confirmed that the respondents from the older group were more often referred for microbiological examination, thus making up a total of 52.85% of respondents with positive tests.

This result was in line with previously published results and conclusions in the literature, which showed that the risk of urinary tract infection increases with age. A study was conducted in France (Francis et al.) during 2016, in which a significant susceptibility of women to urinary system infections was found.

Our research found *Escherichia coli* in 43.4% of positive tests or out of a total of 106 respondents with positive tests, in 46 subjects this bacteria was present; therefore it is by far the most common cause. This result coincides with the results of research published in the literature. In 2018, Schreiber et al found that *Escherichia coli* is the most common pathogen causing URI in the United States and Europe. Furthermore, a study conducted in France in 2016 showed that the most common bacteria that causes urinary tract infections are: *E. coli*, *Enterococcus faecalis*, *Staphylococcus saprophyticus*, *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Pseudomonas aeruginosa*.

According to independent research, the most common diagnosis of urinary tract infections is cystitis. These statements agree with the results obtained in our study, in which of all the observed diagnoses observed, the most common is bladder inflammation or cystitis (N30), in 53.80% or in 134 of the 249 surveyed.

In addition to the fact that individual age groups were associated with infectious agents, each age group was also associated with admitting diagnoses. In this case, a statistically significant association was found between admitting diagnoses and the age group of respondents aged 35 to 50. Furthermore, this study showed that infections were more prevalent in older subjects, aged 35 to 50, compared to younger subjects.

This analysis can serve as a good basis for new research.

CONCLUSIONS

- The frequency of urinary system infections in women of reproductive age from the area of the three municipalities of Posavina County (Orašje, Odžak and Domaljevac-Šamac) is 42.57%. The sample included 249 women, 106 of whom had a positive urine culture.
- In the observed sample, it is evident that the most common cause of urinary tract infections is *Escherichia coli*, which is present in 43.4% of total positive urine cultures, or 46 cases of *Escherichia coli* infections out of a total of 106 positive urine cultures.
- Reviewing referrals from family doctors, it was established that the most common admitting diagnosis was cystitis - inflammation of the bladder (N30) - 53.80%.
- The subjects of the older age group (35 to 50 year olds) were proven to be more susceptible to urinary tract infections.

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Received: May 23, 2022

Accepted: June 27, 2022

