Article

PREVALENCE OF URINARY TRACT INFECTION AMONG NON-MUSLIM INDIGENOUS PEOPLE IN THE SOUTHERN PHILIPPINES (LUMAD): A COMMUNITY-BASED PARTICIPATORY RESEARCH

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Abstract: Urinary tract infection (UTI) is a common bacterial disease caused by certain pathogens such as *Escherichia coli*, affecting the urinary tract. In the Philippines, UTI ranks 4th in the 10 leading causes of morbidity. While there have been articles that discusses the different issues being faced by the Lumad ethnic group, only a few studies discuss their health conditions. Thus, this study has aimed to provide information on the positivity rate of urinary tract infection among the Lumad ethnic group and to further provide additional data on the scarce literature on their health conditions. A community-based project was conducted in a university wherein it catered laboratory services, such as urinalysis, complete blood count, fasting blood sugar, lipid profile and blood typing. The participants in this activity included the Lumad ethnic group and the janitorial staff of the university. A total of 43 urine samples were tested for urinalysis, in which 22 (female:18, male:4) of the total samples had elevated results. These findings were most prevalent among the female participants. These results suggest that there is high prevalence rate of UTI among the ethnic group included in the study. Additionally, an accidental finding of *Ascaris lumbricoides* ova was seen in one of the female participants. Hence, for future studies, the researchers recommend that fecal analysis must be added to the panel of laboratory services and to correlate the results to hematology and chemistry laboratory test for a more accurate diagnosis. The researchers also suggest to add more participants for better representation of the ethnic group.

INTRODUCTION

Urinary tract infection (UTI) is a common bacterial disease caused by the invasion of pathogenic bacteria, which leads to inflammatory responses (Sundaran, et al., 2018). It infects anywhere within the urinary tract such as in the urethra, bladder, ureters or kidneys (Foxman, 2014). According to the Department of Health in 2014, the top 10 leading causes of morbidity in the Philippines includes, (1) acute respiratory infection, (2) acute lower respiratory tract infection (ALRTI) and pneumonia, (3) hypertension, (4) urinary tract infection, (5) bronchitis, (6) influenza, (7) acute watery diarrhea, (8) respiratory tuberculosis (TB), (9) dengue fever, and (10) other forms of tuberculosis (TB). In this data, urinary tract infection ranks the 4th leading cause of morbidity in the country. UTI may be caused by Gram-negative and Gram-positive bacteria, as well as certain fungi. The most common cause of urinary tract infection is the uropathogenic *Escherichia coli*, followed by *Klebsiella pneumoniae*, *Staphyloccocus saprophyticus*, *Enterococcus faecalis,* group B *Streptococcus* (GBS), *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Candida* spp

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(Flores-Mireles et al., 2015). The most common laboratory test performed to diagnose UTI is urinalysis, occasionally accompanied by culture and sensitivity for confirmatory. During diagnosis, clinicians should consider the age, race, temperature and circumcision in male patients (Balighian, 2018).

Urinalysis is the examination of urine by observation of its physical and chemical properties, and performing microscopic examination on its sediments. Since urinalysis is practical and efficient, it is usually recommended by physicians as part of the initial examination of patients and is usually repeated as clinically warranted. The current standard for UTI diagnosis has limitations and a concept has been disproven that humans have a sterile urinary bladder (Price, 2018). Antibiotics such as trimethoprim sulfamethoxazole, ciprofloxacin and ampicillin are the most common recommended therapeutics for urinary tract infections (Flore-Mireles et al., 2015). However, the treatment is often difficult when there are no symptoms and there is antibiotic-resistance of the causative agent (Patros, 2017).

The Lumad ethnic group is a minority in the southern Philippines, distinct from the majority Moro Islam people of Mindanao. It is a non-sectarian group which mainly controls the majority of the provinces in Mindanao in the 20th century and later on became a minority due to the migration of the people to other areas, especially to Visayas, with the support from the government-funded resettlement programs. There are 18 Lumad ethnolinguistic groups namely, Atta, Bagobo, B'laan, Bukidnon, Dibabawon, Higaonon, Mamanwa, Mandaya, Manguwangan, Manobo, Mansaka, Subanon, Tagakaolo, Tasaday, Tboli, Teduray, and Ubo.

Currently, they are referred as cultural minorities. Due to urbanization, they were pushed by the lowlanders to the mountains and forest. As a consequence of forest destruction, they are still fighting to protect their culture and ancestral domain, despite the lowlanders coercing them to adapt Christianity. Majority of the Lumad are widely discriminated which makes them hard to adapt to the mainstream society. They also do not possess money or private property. In this study, majority of the urine specimens tested were from the Lumad ethnic group, and minority were from the janitorial staff of the university.

Significance of the Study

While there have been articles about the different issues being faced by the Lumad, there is still a paucity in the literature about their health conditions. This study aims to provide information on the positivity rate of possible urinary tract infection among the Lumad ethnic group and a few among the janitorial staff. Furthermore, this study may serve as an additional data with regards to the health condition of this ethnic group, to provide awareness, and to impose the proper health education and preventive measures to avoid such infection.

METHODOLOGY

A community-based project was conducted in a university in Manila, Philippines. A total of 43 urine samples were collected during the activity. The participants were given a 50 mL wide-mouth specimen container and were instructed to collect the specimen through mid-stream catch method. They were also instructed to submit the specimen immediately to avoid contamination. The samples were brought to a clinical laboratory for urine analysis performed by registered medical technologists. Physical examination was done by observing the color and turbidity of the urine samples. For the chemical examination, a 4-parameter chemstrip (pH, specific gravity, protein and glucose) was used. The protein analysis was based on the yellow to greenish-blue color change of the tetrabromophenol blue indicator with a minimum sensitivity of 10 mg/dL of protein in the sample. Highly buffered alkaline urines (pH 8.5) may yield false negative results. Turbid urine specimens were also a limiting factor. The specific gravity was based on the pKa change of certain pretreated polyelectrolytes in relation to the ionic concentration of the sample. In the presence of an indicator, a deep blue color may be observed in urine samples with low ionic concentration. Elevated specific gravity indicates the presence of moderate quantities of protein (100- 700 mg/dl), as well as the presence of glucose. In contrast, highly buffered alkaline urine may result to low specific gravity. Glucose testing was based on a sequential enzyme reaction. First, glucose oxidase catalyzed the formation of gluconic acid and hydrogen peroxide from the oxidation of glucose. Peroxidase, a second enzyme, then catalyzed the reaction of hydrogen peroxide with potassium iodide chromogen to oxidize the chromogen. Color changes from blue, greenish-brown, brown to dark-brown was observed. For pH, the test used a double indicator system composed of methyl red and bromothymol blue. Methyl red produced a color change from red to yellow in pH levels of 4 to

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6 and bromothymol blue changed from yellow to blue between pH 6 and 9. In pH levels of 5 to 9, a color change of the strip from yellow, green to dark blue was observed. The manner of reporting for chemical examination of urine is shown in Figure 1.

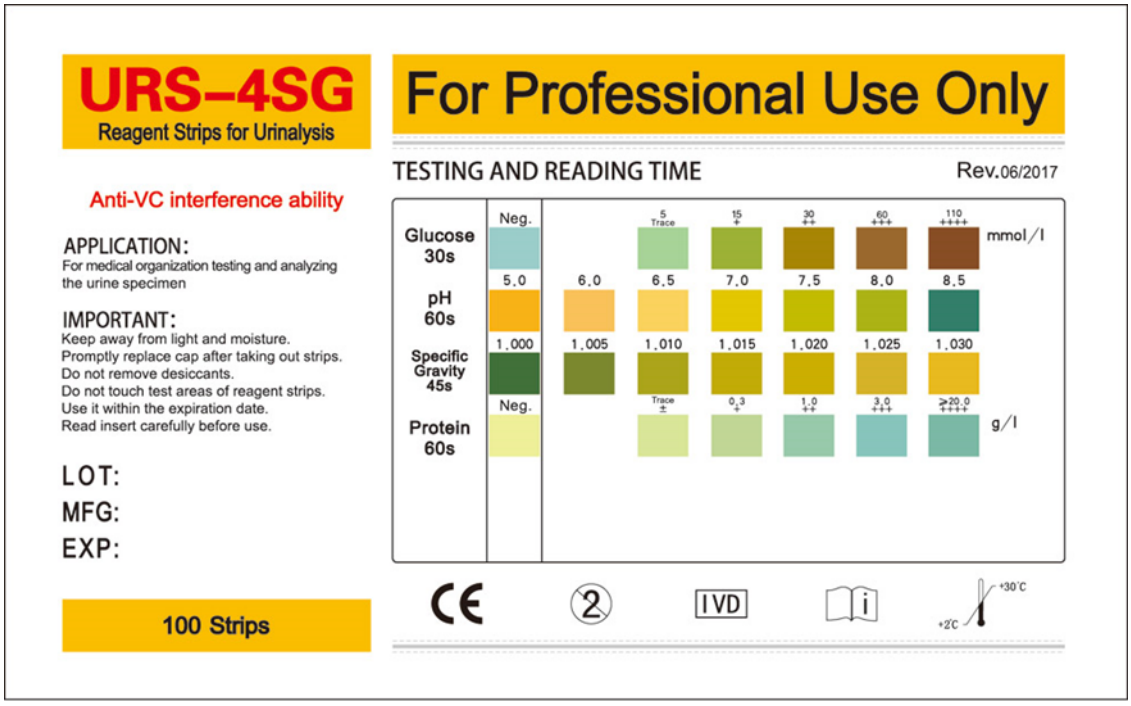

Figure 1. 4-Parameter Reagent Strip Test for Urinalysis

Each urine sample was centrifuged at 2000 rpm for 5 minutes. The supernatant was decanted and the sediments were resuspended in the remaining urine sample. A single drop was transferred to a clean glass slide, and was overlaid with a cover slip. Identification of casts, cells, crystals, bacteria, and others were done using a compound microscope under low- and high-power magnification.

Data were coded and analyzed using PHStat2, version 12.0 (Macrovision Corporation, USA) and Microsoft Excel. The mean, mode, standard deviation, class intervals, frequency and percentages of the patient demographics and results were determined.

Limitation of the Study

This study only included participants who voluntarily submitted themselves. Originally, 49 participants volunteered to collect their urine samples, however, 2 participants were not able to submit their samples and 4 of them did not state their age. Therefore, only a total of 43 urine samples were included and analyzed. The demographic profile was limited to the age and sex of the patients. Lifestyle, family history of diseases and employment status were not included due to the absence of survey.

Urinalysis was done using a 4-parameter chemstrip. Only pH, specific gravity, protein, and glucose were included in the strip and tested. Macroscopic and microscopic examination for urine were performed to provide better correlation of results.

Ethical Considerations

The nature and purpose of the study were disclosed to the participants. An informed consent was also provided. They were also informed that the activity was purely voluntary and that they had the right refuse with the interview. Participants were allowed to terminate their involvement or pull out their urine samples, at any time without the need of explanation. All information obtained were kept confidential and were not disclosed, divulged, or used whether directly or indirectly, to any other person or entity not involved during the entire duration of this study and will remain confidential at any time thereafter. The data gathered will only be used for this research. The researchers will abide by the genuineness and veracity of the data.

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RESULTS

A total of 43 participants (female: 21, male: 22) submitted their urine samples for this study (Table 1). The age group among the participants were classified into 6 classes with a 14-year interval. Majority of the participants (61%) belonged to the 10-23 years old age group. A wide range of age (mode=16) was observed among the participants, with 10 years old being the youngest, and 86 years old being the oldest participant (Table 2).

Table 1. Demographic Profile of Participants by Gender

GENDER		
	FREQUENCY	**PERCENTAGE**
MALE	22	51.2%
FEMALE	21	48.2%
TOTAL	N=43	

Table 2. Demographic Profile of Participants by Age Group

AGE GROUP		
AGE GROUP	**FREQUENCY**	**PERCENTAGE**
10-23 YEARS OLD	26	61%
24-37 YEARS OLD	7	16%
38-51YEARS OLD	8	19%
52-65 YEARS OLD	1	2%
66-79 YEARS OLD	0	0
80-93 YEARS OLD	1	2%
TOTAL	N=43	

Table 3 shows the tabulated urinalysis results of the participants. Fifty one percent (n=22) of the total population had elevated results. These findings were most prevalent among the female participants. Normal findings were observed in 49% of the total population, in which majority were male participants.

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URINALYSIS RESULT								
AGE/ SEX	PROTEIN	SUGAR	WBC	RBC	BACTERIA	EPITHELIAL CELLS	MUCUS THREADS	OTHER FINDINGS
30/M	TRACE	-	1-4/HPF	0-1/HPF	OCCASIONAL	OCCASIONAL	FEW	
86/F	-	-	0-3/HPF	5-8/HPF	FEW	FEW	MODERATE	
47/F	-	-	5-10/HPF	0-2/HPF	MANY	ABUNDANT	MODERATE	
43/M	-	-	0-2/HPF	NONE	OCCASIONAL	OCCASIONAL	FEW	
16/F	-	-	2-3/HPF	1-2/HPF	MODERATE	MANY	MANY	
15/F	-	-	4-5/HPF	2-3/HPF	FEW	MANY	FEW	
16/M	-	-	0-2/HPF	0-1/HPF	RARE	FEW	NONE SEEN	
18/F	TRACE	-	2-5/HPF	1-2/HPF	MANY	MANY	FEW	
10/M	-	-	0-2/HPF	NONE	OCCASIONAL	OCCASIONAL	FEW	
7/M	-	-	0-2/HPF	0-1/HPF	RARE	NONE SEEN	RARE	
16/F	-	-	0-2/HPF	0-1/HPF	RARE	FEW	NONE SEEN	
20/M	-	-	0-2/HPF	0-1/HPF	RARE	RARE	FEW	
16/F	-	-	0-2/HPF	0-1/HPF	RARE	MANY	MANY	
17/M	-	-	2-5/HPF	NONE	RARE	RARE	NONE SEEN	
16/M	-	-	0-2/HPF	0-1/HPF	RARE	RARE	RARE	
37/M	-	-	1-2/HPF	1-2/HPF	FEW	RARE	MODERATE	
48/M	TRACE	3+	1-3/HPF	0-2/HPF	RARE	NONE SEEN	MODERATE	
43/M	-	-	0-1/HPF	NONE	FEW	RARE	RARE	
60/M	-	-	0-1/HPF	0-1/HPF	RARE	RARE	MODERATE	
33/F	-	-	6-10/HPF	1-2/HPF	MANY	ABUNDANT	FEW	
34/F	-	-	0-3/HPF	0-1/HPF	FEW	MANY	FEW	
16/F	-	-	2-5/HPF	NONE	FEW	MODERATE	RARE	
16/F	-	-	2-4/HPF	TNTC	FEW	FEW	FEW	*Ascaris lumbricoides ova seen*
12/F	-	-	0-1/HPF	0-1/HPF	FEW	FEW	FEW	
14/F	-	-	2-5/HPF	NONE	RARE	MANY	MODERATE	

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14/M	-	-	2-5/HPF	1-2/HPF	RARE	FEW	RARE	
18/F	-	-	2-3/HPF	1-3/HPF	MANY	MANY	NONE SEEN	
48/F	-	-	5-10/HPF	2-4/HPF	MANY	MANY	NONE SEEN	
23/M	-	-	0-2/HPF	0-1/HPF	FEW	NONE SEEN	NONE SEEN	
15/F	-	-	0-2/HPF	0-2/HPF	NONE SEEN	FEW	NONE SEEN	
16/M	-	-	0-2/HPF	0-1/HPF	RARE	FEW	FEW	
22/F	-	-	0-2/HPF	0-1/HPF	RARE	FEW	MANY	
19/M	-	-	0-1/HPF	NONE	NONE SEEN	RARE	NONE SEEN	
18/F	-	-	0-1/HPF	NONE	FEW	MANY	RARE	
17/M	-	-	1-3/HPF	0-2/HPF	FEW	MANY	RARE	
19/M	-	-	0-2/HPF	0-1/HPF	RARE	RARE	RARE	
16/M	-	-	0-3/HPF	0-1/HPF	RARE	FEW	FEW	
49/M	-	-	3-5/HPF	2-5/HPF	RARE	RARE	MODERATE	
27/M	-	-	0-1/HPF	0-1/HPF	RARE	RARE	NONE SEEN	
21/M	-	-	0-1/HPF	0-1/HPF	RARE	RARE	NONE SEEN	
35/F	-	-	0-1/HPF	0-2/HPF	FEW	MODERATE	FEW	
42/F	-	-	2-4/HPF	0-1/HPF	RARE	MODERATE	FEW	
25/F	-	-	0-1/HPF	0-1/HPF	RARE	MODERATE	NONE SEEN	

Table 3. Urinalysis Result (Highlighted: Participants with Elevated Results)
Highlighted Cells – Participants with Elevated Results
(-) – Negative
N/S – None Seen

Elevated results among female participants were classified based on their results. A total of 5 female participants had moderately increased mucus threads, 3 had many epithelial cells, and 3 had increased pus cells accompanied by many bacteria and epithelial cells. Furthermore, there were female participants with many mucus threads (n=1), many epithelial cells accompanied by moderate mucus threads (n=1) , many epithelial cells with many mucus threads (n=1), trace protein accompanied by many bacteria and epithelial cells (n=1), moderately increased bacteria accompanied by many epithelial cells and mucus threads (n=1), increased pus cells accompanied by many bacteria, epithelial cells and moderately increased mucus threads (n=1). Additionally, one of the female participants had an increased red blood cells with accidental finding of *Ascaris lumbricoides* ova. Since A. l*umbricoides* eggs are usually passed in the feces at its embryonated state (O'lorcain et al, 2000), this was immediately noted as this may be considered as urine specimen contaminated with fecal matter.

Among the 4 male participants with elevated results, 2 of them had moderately increased mucus threads, 1 had a trace of protein with 3+ glucose accompanied by moderately increased mucus threads, and 1 case of increased red blood cells with moderately increased mucus threads.

DISCUSSION

According to history, routine urine examination began during 400 B.C. and since then, it has been considered as the most important diagnostic test. Urine analysis is a group of manual and/or automated qualitative and semi-quantitative tests performed on a urine sample. A routine urine analysis includes physical examination: color, transparency and specific gravity; chemical examination: pH, protein, glucose, ketones, blood, bilirubin, nitrite, urobilinogen, and leukocyte esterase; and microscopic examination. The dipstick analysis (± microscopy) is the most common form of urine analysis, and has been evaluated as the most cost-effective screening for urinary tract infection (Shaw et al, 1998). In a study conducted by Carl and colleagues in 1987, a total of 2,100 participants were tested by using the dipstick analysis. This study showed that at least 10% of the participants had a single urinary tract devia-

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tion. Through the help of urinalysis, early detection and treatment of diseases may prevent them from getting worse. This is also essential in monitoring the renal health of geriatric patients, as well as those who are immuno-compromised.

In healthy individuals, the urine normally has a few cell count and a few formed elements such as casts, epithelial cells, mucous threads and occasionally spermatozoa in male patients. A few erythrocytes and leukocytes apparently reach the urine by diapedesis from any part of the urinary tract.

Urinary tract infection (UTI) refers to any infection involving any part of the urinary tract, specifically the kidneys, ureters, bladder and urethra. The urinary tract is divided into two, the upper tract (kidneys and ureters) and lower tract (bladder and urethra). Urinary tract infections are a severe public health problem and are the most common outpatient infections, affecting 50-60% of adult women (Medina et al, 2019)

At a ratio of 8:1, UTIs occur more often in women than in men (Rahn, DD.,2008). The incidence of UTIs in adult males aged under 50 years is low, while adult women are 30 times more prone than men to develop UTI (Seifu, 2018). One in three women are most likely to develop UTI that requires antibiotic treatment. Additionally, 50% of women experience urinary tract infection at least once during their lifetime (Dielubanza et al, 2011). In this study, 22 out of the 43 participants had elevated results, in which 18 were female participants.

While there are no studies to associate the increased incidence of urinary tract infection, specifically among female Lumad, prevalence among adult women in general is explained by a few factors. This includes, anatomical structure, altered vaginal biota, pregnancy, menopause and intercourse-related issues (Minardi et al, 2011). According to the National Institute of Diabetes and Digestive and Kidney Diseases, women are more prone to UTIs because unlike men, they have shorter urethra which makes them anatomically predisposed to bacterial colonization. Pathogens from the vaginal flora colonize the external third of the short urethra. Due to urethral massage, urethral meatus trauma and probable changes in vaginal flora, sexual intercourse also increases the risk of urinary tract infection (Sheffield et al, 2005).

The most common bacterial cause of uncomplicated community-acquired UTI is the uropathogenic Escherichia coli (UPEC). This represents >80% of the total reported infections (Dielubanza et al, 2011). These bacteria inhabit the lower intestinal tract of warm-blooded vertebrates where they lead a seemingly innocuous existence until they gain access to a niche, such as the urinary tract, where they can cause disease. Other pathogens that causes urinary tract infection include Klebsiella *pneumoniae, Proteus mirabilis, Enterococcus faecalis and Staphylococcus saprophyticus* (Ronald, 2002). Uncomplicated lower UTI remains one of the most commonly treated infections in primary care. The urinary tract is a common source of infection in children and infants and is the most common bacterial infection in children < 2 years of age, both in the community and hospital setting (Hannah-Wakim et al, 2015).

Regardless of age, gender or ethnic group, urinary tract infection must be immediately managed and treated. A urinary tract infection that is left untreated, may lead to pyelonephritis, preterm labor among pregnant women and Group B Streptococcal infection among newborn (Haider et al, 2010). There must also be an immediate treatment after the proper investigation of the infection to avoid recurrent urinary tract infection (Ramzan et al, 2004). To avoid antimicrobial resistance, medications should be started with prescription, and several factors should be noted such as route of administration, frequency of dosing, side effects, and antimicrobial resistance of the pathogen of interest (Fluit et al, 2000).

CONCLUSION AND RECOMMENDATIONS

The community outreach program organized by the researchers provided a platform whereby important laboratory testing was made available to the individuals who have limited access to healthcare facilities and financial constraints. The results of this study show that urinary tract infection was observed among 22 out of 43 participants. The researchers suggest that there is a high prevalence rate (51.2%) of UTI among the group. Furthermore, 18 participants who had an elevated result were females, thus, suggesting that female, regardless of age, gender or ethnicity, are more prone to urinary tract infection than males. The most common risk factor to this incident is the anatomical structure of a female's genital area.

However, in this study, an accidental finding of Ascaris lumbricoides ova was seen in one of the female participants. This is suggestive that the urine sample submitted by the participant was contaminated with fecal matter, thus, the researchers recommends that fecal analysis may be added to the laboratory services to be offered during future community outreach program. The researchers also recommend to conduct further studies including more participants for better representation of the ethnic group and to correlate the results to hematology and chemistry laboratory tests for better diagnosis. Additionally, further studies on this topic may also be conducted to raise awareness that these people are also in need of medical assistance.

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REFERENCES

Balighian, E. D. (2018). Urinary tract infections in children. Pediatrics in Review, 3-12. doi:10.1542/pir.2017-0007

Dielubanza EJ, Schaeffer AJ. Urinary tract infections in women, Med Clin North Am , 2011, vol. 95 (pg. 27-41)

Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ (2015). Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nature Reviews Microbiology Vol 1 269-284 doi:10.1038/nrmicro3432

Fluit, A.C., Jones, M.E., Schmitz, F. et al. Antimicrobial resistance among urinary tract infection (UTI) isolates in Europe: results from the SENTRY Antimicrobial Surveillance Program 1997. Antonie Van Leeuwenhoek 77, 147–152 (2000). https://doi.org/10.1023/A:1002003123629

Foxman, Betsy (2014) Urinary Tract Infection Syndromes: Occurrence, Recurrence, Bacteriology, Risk Factors and Disease Burden. Infect Dis Clin N Am 2014:1-13 http://dx.doi.org/10.1016/j.idc.2013.09.003

Haider, G., Zehra, N., Munir, A. A., & Haider, A. (2010). Risk factors of urinary tract infection in pregnancy. JPMA. The Journal of the Pakistan Medical Association, 60(3), 213.

Hanna-Wakim RH, Ghanem ST, El Helou MW, et al. Epidemiology and characteristics of urinary tract infections in children and adolescents. Front Cell Infect Microbiol. 2015;5:45.

K.N. Shaw, K.L. McGowan, M.H. Gorelick, J.S. Schwartz, Screening for urinary tract infection in infants in the emergency department, which test is best? Pediatrics 1998, 10-11.

Kulchavenya, E. &. (2018). Urogenital tuberculosis, the cause of ineffective antibacterial therapy for urinary tract infections. Therapeutic Advances in Urology, 95–101. doi:10.1177/1756287217745772

Medina, M., Castillo-Pino, Edgardo (2019). An introduction to the epidemiology and burden of urinary tract infections, Ther Adv Urol. 11: 1756287219832172. doi: 10.1177/1756287219832172

Minardi, D., d'Anzeo, G., Cantoro, D., Conti, A., Muzzonigro, G., (2011). Urinary tract infections in women: etiology and treatment options, Int J Gen Med. 2011 4: 333–343 doi: 10.2147/IJGM.S11767

O'lorcain, P., & Holland, C. V. (2000). The public health importance of Ascaris lumbricoides. Parasitology, 121(S1), S51-S71.

Patros, C. S. (2017). Implementation and evaluation of an algorithm-based order set for the outpatient treatment of urinary tract infections in the spinal cord injury population in a VA Medical Center. Journal of Spinal Cord Medicine, 192-198. doi:10.1080/10790268.2017.1324355

Price, T. H. (2018). Urine trouble: should we think differently about UTI? Int Urogynecology, 29. doi:10.1007/s00192-017-3528-8

Rahn DD. Urinary tract infections: contemporary management. Urol Nurs. 20 08;28:333–41.

Ramzan, M., Bakhsh, S., Salam, A., Khan, Mustafa, G. Risk Factors of Urinary Tract infection. Gomal

Journal of Medical Sciences Jan–June, 2004, Vol. 2, No. 1

Ronald A. The etiology of urinary tract infection: traditional and emerging pathogens, Am J Med, 2002, vol. 113 suppl 1A (pg. 14S-9S)

R.S. Carl, D.S. Silverberg, R. Kaminsky, A. Aviram, routine urinalysis (dipstick) findings in mass screening of health adults, Clin chem., 33(21) 1987, 6-8.

ISSN 2651-6837

Seifu WD, Gebissa AD. BMC Infectious Diseases. 2018 Jan 10; 18: 30

Sheffield, Jeanne S. MD; Cunningham, F Gary MD Urinary Tract Infection in Women, Obstetrics & Gynecology: November 2005 - Volume 106 - Issue 5 Part 1 - p 1085-1092
doi:10.1097/01.AOG.0000185257.52328.a2

Sundaran, S., Reghu, A., Janardhanan, A., Das, C., Raju, T., & Hassan, U. (2018). Study on Antibiotic Utilization Pattern for Urinary Tract Infection at a Tertiary Care Hospital in Calicut. World Journal of Pharmacy and Pharmaceutical Sciences, 1147-1154.

http://www.doh.gov.ph/node/6390

http://globalecco.org/the-lumads

https://intercontinetalcry.org/indigenous-peoples/lumad/

https://www.filipinaslibrary.org.ph/articles/the-lumad-of-mindanao/

https://www.festalpagdiriwang.com/lumad-cultures-of-mindanao#:~:text=Lumad%20culture%20is%20rich%20and,indigenous%20cultures%20throughout%20the%20Philippines.

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