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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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BACTERIAL PROFILE, ANTIMICROBIAL RESISTANCE, AND FACTORS ASSOCIATED WITH URINARY TRACT INFECTION AMONG PREGNANT WOMEN AT HOSANNA TOWN HEALTH FACILITIES, CENTRAL ETHIOPIA

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Abstract.

Introduction: Urinary tract infection in pregnancy is a common microbial infection. Antimicrobial resistance among uropathogens is becoming a major health problem worldwide. The antimicrobial agents used to manage urinary tract infections during pregnancy should be carefully chosen. Therefore, this study aimed to determine the bacterial profile, antibiotic susceptibility pattern, and factors associated with urinary tract infection among pregnant women at Hosanna town public health facilities.

Materials and Methods: A facility-based cross-sectional study was conducted from March to August 2022 on a total of 312 pregnant women who attended antenatal care at Hosanna Town public health facilities. Sociodemographic, clinical data, and related information were collected by using a pre-tested questionnaire. In addition, mid-stream urine specimens were collected from study participants. Bacterial pathogens were identified by standard bacteriological techniques. Antibiotic susceptibility testing was performed by using the Kirby Bauer disk diffusion method. The data were analyzed by using SPSS version 25. Chi-square and odds ratios were calculated and a P-value ≤ 0.05 at a 95% confidence interval was considered statistically significant. The results were presented with words and tables.

Results: Of a total of pregnant women, 59/312(18.9%) (95% CI: 14.7-23.7) were found to have significant bacteriuria. The predominant isolates were *Escherichia coli (E. coli)* 22(34.4%), followed by coagulase-negative *staphylococci* (CoNS) 10(15.6%), *Staphylococci aureus (S. aureus)* 7(10.9%), and *Klebsiella pneumoniae (K. pneumoniae)* 6(9.4%). Overall, 78.1% of these isolates were multidrug-resistant (MDR). Gram-negative bacteria were susceptible to meropenem (97.6%), gentamicin (85.7%), nitrofurantoin (82.1%), ciprofloxacin (73.8%), amoxicillin-clavulanic acid (73.8%) and ceftriaxone (71.8%), but highly resistant to ampicillin (95.5%), trimethoprim-sulfamethoxazole (74.4%), doxycycline (71.8%), cefuroxime (69.2%), and cephalexin (69.2%). The gram-positive bacteria were susceptible to gentamicin (86.4%), erythromycin (81.8%), and nitrofurantoin (77.3%): whereas they showed a high level of resistance to penicillin (72.7%), doxycycline (54.5%), trimethoprim-sulfamethoxazole (52.9%), and cefoxitin (52.9%). No formal education for the participant (AOR: 2.86, 95% CI: 1.03-7.98, p = 0.044), family monthly income <1500 birr (AOR: 3.19, 95% CI: 1.48-6.89, p = 0.003), and previous history of UTI (AOR: 4.52, 95% CI: 2.04-10.03, p = 0.001) were significantly associated with bacteriuria.

Conclusion and recommendations: This study revealed a high prevalence of bacterial urinary tract infection among pregnant women and low susceptibility to ampicillin, trimethoprim-sulfamethoxazole, cefuroxime, and cephalexin. Therefore, regularly, culture-based bacterial identification and antibiotic susceptibility testing should be performed. Alternatively, empiric antibiotic therapy should consider the prevalence of antibiotic-resistant uropathogens and the factor that may increase the urinary tract infection occurrence due to multi-drug resistant uropathogens.

Key words. Urinary tract infections, bacteriuria, antibacterial drug resistance, pregnant women, hosanna, Ethiopia.

Introduction.

Urinary tract infections (UTIs) are common human microbial diseases that can produce functional and/or morphological disorders in the urinary tract [1]. It is a common nosocomial and community-acquired infectious disease worldwide [2]. The UTIs distribution in the population changes depending on age, sex, catheterization, genitourinary tract abnormalities, hospitalization, immune status, and prolonged use of antimicrobials [3,4]. The clinical features of UTIs depend on the part of the urinary tract involved, the etiologic types, the severity of the infection, and the patient's immune status [3].

Urinary tract infections (UTIs) are the most common microbial infections during pregnancy [5]. Asymptomatic bacteriuria (ASB) is an important predisposing factor for UTI during pregnancy [6]. In addition, during pregnancy, there are many anatomical and hormonal changes that favor UTI. Approximately 20% of pregnant women have UTI which is the most common reason for hospital admission [7]. Without treatment, 20 to 30% of pregnant women with asymptomatic bacteriuria have the probability to develop UTI [6,8].

Bacteria are the main cause of UTIs, however, fungi, viruses, and parasites may be involved in this infection. Studies indicated that the most common cause of UTIs is *Escherichia coli (E. coli)*, which represents 65–90% of infections. Other uropathogens that cause UTIs include *S. aureus, Klebsiella pneumoniae (K. pneumoniae), Citrobacter species, Pseudomonas aeruginosa (P. aeruginosa), Enterococcus species, S. saprophyticus*, and *Staphylococcus* coagulase negative (CoNS)[9-11]. Moreover, evidence from recent studies suggests that fungi, particularly species of Candida, are increasingly responsible for urinary tract infections (UTIs), particularly in critically ill patients.

Current empirical management of UTIs is complicated by antimicrobial resistance. It is one of the health threats faced in modern medicine now day [10]. Unrestrained antibiotics usage habit in developing countries might be attributable to the emergence of multidrug resistant bugs/bacteria causing UTI. As a result, antimicrobial resistance is one of the major causes of treatment failure for UTIs [12,13].

Due to a lack of facilities for culture and antibiotic susceptibility testing (AST), urine cultures are not frequently conducted in Ethiopia, especially in our community, to treat UTIs in prenatal

pregnant women. Updated and specific understanding of the uropathogens and their antibiotic susceptibility pattern is required to ensure optimal treatment for UTI during pregnancy. To the best of our knowledge, however, there is a lack of data in this research area in our locality. Hence, this study aimed to identify the bacterial causes of UTIs as well as susceptibility patterns and other factors associated with them. This help clinicians, provide evidence-based care that may prevent the emergence of multidrug resistant uropathogens and UTI complications during pregnancy in our region.

Materials and Methods.

Study design and setting:

A facility-based cross-sectional study was undertaken at hosanna town health facilities from March to August 2022, which is 232km far from Addis Ababa the capital city of Ethiopia. The area's altitude ranges from 1,500 m to -3,500 meters above sea level. Day-time temperatures are typically between 20-30oC, with night-time temperatures falling close to freezing at higher altitudes. The town has one teaching referral Hospital, three health centers, and more than ten health posts. This Hospital provides inpatient and outpatient medical services to residents of the Hadiyya zone and nearby towns and villages in neighboring zones. It provides services to patients in different clinical disciplines including gynecology and obstetrics, pediatrics, internal medicine, surgery, and orthopedics.

Source population:

All pregnant women who visit antenatal care at Hosanna Town health facilities.

Study population:

All pregnant women who attended antenatal care and selected pregnant women at Nigist Eleni Mohammed memorial comprehensive specialized hospital and Hosanna town health center from March 1, 2022, to August 30, 2022

Eligibility criteria

Inclusion criteria:

All pregnant women agreed to the study and provided written informed consent.

Exclusion criteria:

The study excluded pregnant women who were seriously unwell, receiving antibiotic treatment, had a history of hospital admission in the previous two weeks, and those who were admitted to the hospital for at least 48 hours prior to data collection and were unable to provide a sample.

Study Variables

Independent variables:

Age, level of education, occupation, family income, gravidity, gestational age, history of underlying disease, past history of UTI, and history of antibiotic use

Dependent variables:

Bacterial isolate and antimicrobial susceptibility pattern of the isolate.

Operational definitions.

Symptomatic UTI: is a condition that is characterized by the presence of significant bacteriuria in clean-voided midstream urine specimens that yield positive cultures (≥105 cfu/ml) with accompanying symptoms such as dysuria, urgency, frequency, incontinence, suprapubic pain, flank pain or costovertebral angle pain and tenderness, fever (temp. ≥ 380C) and chills) [14].

Asymptomatic UTI: is a condition that is characterized by the presence of significant bacteriuria in clean-voided midstream urine specimens that yield positive cultures (≥105 cfu/ml), in a patient without typical symptoms of UTI [15].

Past history of UTI: having one or more physician-diagnosed cystitis or pyelonephritis.

Multi-drug resistant (MDR): is an acquired non-susceptibility to at least one agent in three or more antimicrobial categories [16].

Midstream urine: A specimen obtained from the middle part of urine flow.

Sample size and sampling technique.

A systematic random sampling technique was used and the sample size was determined using a single population proportion formula [$n = [(Z\alpha/2)^2 * P(1 - P)]/d^2$] by assuming a 95% confidence level of $Z\ \alpha/2 = 1.96$, absolute desired precision (d)=5%, and proportion of bacterial UTI infection of 23.9% among women at Bale Goba referral hospital [17]. By considering a non-response rate of 15%, the final sample size calculated based on the single population proportion formula was 322 participants.

Data and Specimen Collection:

Information concerning the socio-demographic characteristics of study participants (age, sex, educational status, etc.) and clinical data were collected by trained data collectors (one medical microbiologist, three medical laboratory technologists, and two BSc. midwives). A pre-test was done to validate the questionnaire and modification was done accordingly (S1 Protocol). After receiving the proper instructions from medical laboratory technicians, the pregnant women collected midstream urine samples using leak-proof sterile plastic containers. The urine specimen was transported immediately to the microbiology laboratory of Wachemo University using the cold box. Then, the urine sample was inoculated within one hour of collection.

Urine specimen culture, Isolation, and Identification of bacteria:

Using calibrated wire loop (0.001 ml) sample was inoculated on cysteine lactose electrolyte deficient medium (CLED, Oxoid), MacConkey (Himedia), and mannitol salt agar (MSA, Himedia). After incubation at 37°C for 18-24 hours colonies were counted to check for significant growth. Colony counts yielding bacterial growth of 10^5 colony-forming unit (CFU)/ml was regarded as substantial for bacteriuria [15]. Bacterial identification was performed based on colony morphology, appearance, color, gram staining, and different biochemical tests like the Catalase test, Indole test, Citrate utilization test, Urease production test, Hydrogen sulfide production test, Sugar fermentation test and Coagulase test following standard procedure [18].

Antibiotic Susceptibility Testing:

Antibiotic susceptibility testing was performed by using the Kirby-Bauer technique according to the criteria of the Clinical

Laboratory Standards Institute (CLSI) by disc diffusion method [19]. Standardized suspensions of the bacterial isolates were prepared by taking a pure culture of 3–5 pure colonies of bacteria transferred to a tube containing 5mL sterile normal saline. The turbidity was matched with the turbidity standard McFarland 0.5. The standardized suspension was streaked evenly over the entire surface of Mueller-Hinton agar using a sterile cotton swab. The plates were left at room temperature to dry for 3–5 minutes and antibiotic discs (Oxoid) with the recommended concentrations were placed on the surface of a Muller-Hinton agar plate according to CLSI guideline. Finally, the plates were incubated at 35–37°C for about 18–24 hours. Diameters of the zones of inhibition was measured using a caliper and interpreted as sensitive, intermediate, and resistant according to 2020 CLSI guideline (S2 Protocol). Isolates with intermediate resistance were classified as resistant for a better statistical analysis.

Quality Assurance.

The reliability of the study finding was guaranteed by implementing quality control (QC) measures throughout the whole process of the laboratory work. All materials, equipment, and procedures were adequately controlled, and each procedure was aseptically performed. The quality of the culture media, gram stain, and antimicrobial discs were checked using standardized reference strains of *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 25923) according to the CLSI guideline. To standardize the inoculum density of bacterial suspension for the susceptibility test, a turbidity standard, equivalent to a 0.5 McFarland standard, was used [19].

Statistical Analysis.

Data were entered into EpiData, cleaned, and exported to Excel and SPSS software version 25 for analysis. Descriptive statistics (frequency tables and cross-tabulations) were used in the analysis. Categorical variables were expressed in percentages and the chi-square test was used to determine the association between independent and dependent variables. A multivariable logistic regression model was used to identify UTI-associated factors. The findings were presented using an adjusted odd ratio (OR) and their 95% confidence interval. P value <0.05 was considered as a cut-off point for the significant association.

Ethical considerations.

This study was conducted after approval by the Research Review Committee of Wachemo University, with reference number WCU-IRB 003/28. Then permission was obtained from the health facilities' responsible bodies. Written informed consent was also obtained from study participants. The aim of the study, its significance, confidentiality, their rights of participation, the procedure, and associated risks were explained through an information sheet. For each confirmed infection by the laboratory analysis, the responsible clinician of the study subjects was informed for better patient care.

Results.

Demographic and clinical characteristics:

A total of 312 pregnant women were enrolled, with a response rate of approximately 97%. Of which 128 (41.0%) and 184 (59.0%) study subjects were clinically symptomatic and asymptomatic for UTI, respectively. The mean age of study participants was 26.0 (±5.2 SD) years within the age range of 16-43. The 98.1% (n=306) of participants were married and more than three-fourth of them 79.5% (n=248) were urban residents. Besides, nearly 36.2% (n=113) of the study participants had no formal education and 52.7% (n=164) were housewives (Table 1).

Table 1. *Socio-demographic characteristics and clinical data of pregnant women at Hosanna Town health facilities, South Ethiopia, 2022 (n=312).*

Characteristics		**Frequency (%)**
Age	16–25	106 (34)
	26–35	149 (47.7)
	36–45	57 (18.3)
Marriage	Married	306 (98.1)
	Separated/widowed	6 (1.9)
Residence	Urban	248 (79.5)
	Rural	64 (20.5)
Education	No formal education	113 (36.2)
	Primary school	81 (26.0)
	High school	69 (22.1)
	Above high school	49 (15.7)
Occupation	Civil servant	26 (8.3)
	Merchant	42 (13.5)
	Daily laborer	20 (6.4)
	Farmer	48 (15.4)
	Student	12(3.8)
	Housewife	164(52.7)
Monthly income (birr)	<1500	54 (17.3)
	≥1500 and <3000	95(30.4)
	≥3000	163(52.2)
Gravidity	1st	92(29.5)
	2nd	109(34.9)
	>3rd	111(35.6)
Gestational stage	1st trimester	92(29.5)
	2nd trimester	105(33.7)
	3rd trimester	115(36.8)
Underlying disease	DM	8(2.6)
	Kidney problem	21(6.7)
	Other illness	12(3.8)
	None	276(88.5)
Symptom of UTI	Asymptomatic	184(59.0)
	Symptomatic	128(41.0)
History of catheterization	No	305(97.8)
	Yes	7(2.2)
History of UTI before	No	273(87.5)
	Yes	39(12.5)
History of antibiotics use within previous two weeks	No	307(98.4)
	Yes	5(1.6)
Abbreviations: UTI: Urinary Tract Infection; **DM:** Diabetes Mellitus, Other illness: Hepatitis + HIV		

The Prevalence of bacterial isolates among pregnant women:

Overall prevalence of bacterial UTI/significant bacteriuria was 18.9 % (59/312) (95% CI: 14.7-23.7). The prevalence of bacterial UTI among symptomatic and asymptomatic women were 20.3% and 17.9%, respectively. Of 59 culture positive

cases, a total of 64 bacterial isolates were identified with 11 different types of bacteria. Both gram-positive and gram-negative bacterial isolates were recovered with a 34.4% (n = 22) and a 65.6% (n = 42) prevalence, respectively. Mixed infections were observed among (1.6%, n = 5) pregnant women. Among the isolates the predominant bacteria were *E. coli* 22(34.4%), followed by Coagulase negative *staphylococcus* (CoNS) 10(15.6%), and *S. aureus* 7(10.9 (Figure 1).

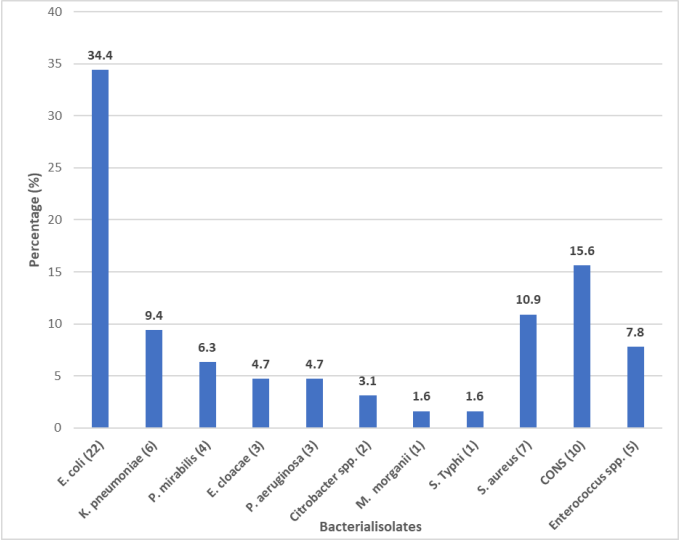

Figure 1. *Profile of bacterial isolates among pregnant women with bacterial urinary tract infection at Hosanna Town health facilities, South Ethiopia, 2022.*

Antibiotics susceptibility patterns of the bacterial isolates:

The antibiotics susceptibility profile of isolates has been presented in (Tables 2 and 3). The recovered gram-positive bacterial isolates showed a high level of susceptibility to some of the tested antibiotics. For instance, 86.4%, 81.8%, and 77.3% of them were sensitive to gentamicin, erythromycin, and nitrofurantoin respectively, followed by clindamycin (70.6%), chloramphenicol (70.6%), and ciprofloxacin (68.6%). However, they showed a high level of resistance to penicillin (72.7%), doxycycline (54.5%), trimethoprim–sulfamethoxazole (52.9%), and cefoxitine (52.9%) (Table 2). CoNS, the second most common isolate was sensitive to erythromycin, gentamicin, ciprofloxacin, nitrofurantoin, chloramphenicol, and clindamycin were 100%, 100%, 90%, 90%, 80%, and 80%, respectively. However, CoNS was resistant to penicillin and doxycycline 70% and 50% respectively. In addition, 71.4% and 40% of *S. aureus* and CoNS were resistant to methicillin (oxacillin), respectively (Table 2).

In this study, gram-negative isolates were sensitive to meropenem (97.6%), gentamicin (85.7%) and nitrofurantoin (82.1%), and gram-positive bacteria were sensitive to gentamicin (86.4%), erythromycin (81.8%) and nitrofurantoin (77.3%). The most common, *E. coli* were sensitive to meropenem (95.5%), gentamicin (90.9%) and nitrofurantoin (86.4%) however resistant to ampicillin (95.5%), doxycycline (77.3%), and trimethoprim–sulfamethoxazole (68.2%) (Table 3).

Multi-drug resistance patterns of bacterial isolates:

Overall, 78.1% (n = 50) of bacterial isolates were multi-drug resistant (MDR; resistance to at least one antibiotic from three or more classes). Among the total MDR, (90.9%, n = 20) was *E. coli*, (85.7%, n = 6) was *S. aureus*, (70%, n = 7) was CoNS, (66.7%, n = 4) was *K. pneumoniae*, (100%, n = 5) was *Enterococcus spp.*, and (100%, n = 4) was *P. mirabilis* (Table 4).

Factors associated with bacteriuria among pregnant women at Hosanna Town health facilities, South Ethiopia, 2022.

In multivariable analysis, the bacteriuria had a significant association with no formal education (AOR: 2.86, 95% CI: 1.03-7.98, p = 0.044), low family monthly income, <1500 birr (AOR: 3.19, 95% CI: 1.48-6.89, p = 0.003), and previous history of UTI (AOR: 4.52, 95% CI: 2.04-10.03, p = 0.001) (Table 5).

Discussion.

Bacterial urinary tract infection (UTI) is one of the common infections in clinical practice in pregnant women, and the increased antimicrobial resistance has become a serious public health concern worldwide [12,13]. In this study, the overall prevalence of significant bacteriuria among pregnant women was 18.9% (95% CI: 14.7–23.7). This finding is comparable with previous Ethiopian studies in Ambo (18.7%) [11], Dessie (15.5%) [20], Addis Ababa (16.9%) [21], Gonder (15.9%) [22], Adigrat (21.2%) [23] and findings from Somaliland (16.4%) [24] and Kenya (15.7%) [25]. However, this study finding is lower than other findings reported in Bale, Ethiopia (26%) [26], Mogadishu Somalia (78.6%.) [27], Uganda (35%) [28] and Nigeria (33.5%) [5]. There was also some documented evidence in Hawassa (7.8%) [29], Jigjiga (13.2%.) [30], and Bangladesh (8.9%) [31], which was lower than the current study finding. This disparity in prevalence of significant bacteriuria across different studies from one country to another and among regions of the same country might be attributed to the difference in associated factors, sample size, geographical variations, social habits of the community, and health education practice.

The prevalence of significant bacteriuria among symptomatic and asymptomatic pregnant women in our study were 26 (20.3%) and 33 (17.9%), respectively, which was lower than studies done in Bale, Ethiopia, symptomatic UTI (35.3%) and asymptomatic bacteriuria (22%) [26] and higher than studies done in Hawassa, Ethiopia (8.9%) symptomatic UTI and (7.0%) asymptomatic bacteriuria [29] and Bangladesh, (4.4%) symptomatic UTI and (4.5%) asymptomatic bacteriuria [31], and comparable with study reported in Addis Ababa, prevalence of asymptomatic bacteriuria was (16.9%) [21].

Gram-negative and gram-positive bacterial isolates were recovered with a 65.6% and a 34.4% prevalence, indicating the predominance of gram-negative bacteria in causing UTIs among pregnant women. Other studies reported comparable findings [17,21,29,31,32]. This could be due to the existence of distinctive virulence factors harbored by gram-negative bacteria, which support colonization of the urinary epithelium and invasion of the urinary tract, and the difficulty of maintaining personal hygiene during pregnancy [33].

In this study, the most frequent etiologic agent isolated from pregnant women was *E. coli* (34.4%). Similarly, *E. coli* was

Table 2. *Antibiotics resistance patterns of the gram-positive bacterial isolates of bacterial urinary tract infection among pregnant women at Hosanna Town health facilities, South Ethiopia, 2022.*

Antibiotics (%)	**Bacterial isolates (%)**				
	Pattern	**CoNS (n = 10)**	***S. aureus* (n = 7)**	***Enterococcus* spp. (n = 5)**	**Total (n = 22)**
CAF	R	2 (20)	3(42.9)	NT	5 (29.4)
CPR	R	1(10)	2 (28.6)	4(80)	7 (31.8)
FM	R	1(10)	2 (28.6)	2(40)	5 (22.7)
SXT	R	3(30)	6 (85.7)	NT	9 (52.9)
DOX	R	5 (50)	3(42.9)	4(80)	12 (54.5)
CLD	R	2 (20)	3(42.9)	NT	5 (29.4)
E	R	0	2 (28.6)	2(40)	4 (18.2)
P	R	7 (70)	6 (85.7)	3(60)	16 (72.7)
AMP	R	NT	NT	4(80)	4 (80)
FOX	R	4 (40)	5 (71.4)	NT	9 (52.9)
GEN	R	0	1(14.3)	1(20)	3 (13.6)

Where: CoNS-Coagulase negative *staphylococcus,* GEN-Gentamycin, CAF-Chloramphenicol, DOX-Doxycycline, SXT-Trimethoprim-sulfamethoxazole, CRP-Ciprofloxacin, FM-Nitrofurantoin, FOX-Cefoxitin, P-Penicillin, AMP-Ampicillin, CLD-Clindamycin, and E-Erythromycin, NT-Not Tested, R-Resistant.

Table 3. *Antibiotics resistance patterns of the gram-negative bacterial isolates of bacterial urinary tract infection among pregnant women at Hosanna Town health facilities, South Ethiopia, 2022.*

Drugs (%)	**Bacterial isolates (%)**									
	Pattern	***E. coli* (n = 22)**	***K. pneumoniae* (n = 6)**	***P. mirabilis* (n = 4)**	***Enterobacter spp.* (n = 3)**	***P. aeruginosa* (n = 3)**	***Citrobacter* spp. (n = 2)**	***Morganella morganii* (n = 1)**	***Salmonella* Typhi (n = 1)**	**Total (n = 42)**
AMP	R	21(95.5)	6(100)	4 (100)	3(100)	NT	2(100)	1(100)	1(100)	21(97.4)
SXT	R	15(68.2)	4 (67.7()	3(75)	3(100)	NT	2(100)	1(100)	1(100)	29 (74.4)
DOX	R	17(77.3)	4 (67.7)	2 (50)	2 (66.7)	NT	1 (50)	1(100)	1(100)	28 (71.8)
CXM	R	12 (54.5)	5(83.3)	3 (75)	3(100)	NT	2(100)	1(100)	1(100)	27 (69.2)
CEP	R	12 (54.5)	5(83.3)	3 (75)	3(100)	NT	2(100)	1(100)	1(100)	27 (69.2)
CRO	R	3(13.6)	2 (33.3)	2 (50)	1 (33.3)	NT	2(100)	0	1(100)	11 (28.2)
CAZ	R	3 (13.6)	2 (33.3)	2 (50)	1 (33.3)	2 (66.7)	0	0	1(100)	13 (26.2)
AMC	R	3(13.6)	2 (33.3)	2 (50)	1 (33.3)	2 (66.7)	1 (50)	0	0	13 (26.2)
CPR	R	4(18.2)	2 (33.3)	2 (50)	1 (33.3)	2 (66.7)	0	0	0	11 (26.2)
FM	R	3(13.6)	1(16.7)	2 (50)	1 (33.3)	NT	0	0	0	7 (17.9)
GEN	R	2 (9.1)	0	3 (75)	1 (33.3)	0	0	0	0	6 (14.3)
MERO	R	1(4.5)	0	0	0	0	0	0	0	1 (2.4)

Where: AMP-Ampicillin, SXT- sulfamethoxazole-trimethoprim, DOX-Doxycycline, CXM-Cefuroxime, CEP-Cephalexin, GEN - Gentamycin, CAZ-Ceftazidime, CRO - Ceftriaxone, AMC-Amoxicillin-clavulanate, CIP-Ciprofloxacin, FM-Nitrofurantoin, MERO–Meropenem, NT-Not Tested, R-Resistant

Table 4. *Multi-drug resistance patterns of bacterial isolates of bacterial urinary tract infection among pregnant women at Hosanna Town health facilities, South Ethiopia, 2022.*

Bacterial isolates	**Level of resistance (number (%))**									**Total MDR isolates ≥R3**
	R0 (%)	R1 (%)	R2 (%)	R3 (%)	R4 (%)	R5 (%)	R6 (%)	R7 (%)	≥ R8 (%)	
E. coli (n = 22)	1(4.5)	_	1(4.5)	4 (18.2)	8 (36.4)	4(18.2)	3 (7.7)	_	1 (4.5)	20 (90.9)
CoNS (n = 10)	_	_	5 (50)	3 (30)	-	1(10)	1(10)	_	_	5 (50)
S. aureus (n = 7)	_	_	1 (14.3)	_	3(42.8)	_	_	2(28.6)	1(14.3)	6 (85.7)
K. pneumoniae (n = 6)	_	_	2(33.3)	_	2(33.3)	1 (16.7)	1 (16.7)	_	_	4 (66.7)
Enterococcus spp. (n = 5)	_	_	_	_	_	2 (40)	_	2 (40)	1(20)	5 (100)
P. mirabilis (n = 4)	_	_	1(25)	_	2(50)	_	_	1(25)	_	3(75)
E. cloacae (n = 3)	_	_	2 (66.7)	_	_	1(33.3)	_	_	_	1(33.3)
P. aeruginosa (n = 3)	_	_	_	_	1(33.3)	_	2(66.7)	_	_	3 (100)
Citrobacter spp. (n = 2)	_	_	1(50.0)	_	_	1(50.0)	_	_	_	1(50.0)
M. morganii (n = 1)	_	_	_	_	1(100)	_	_	_	_	1(100)
S. Typhi (n = 1)	_	_	_	_	1(100)	_	_	_	-	1(100)
Total (n = 64)	1 (1.6)	_	13 (20.3)	7 (10.9)	18 (28.1)	10 (15.6)	7 (10.9)	5(7.8)	3 (4.7)	50 (78.1)

Where. CoNS-Coagulase negative *staphylococcus*, R0: susceptible to all antibiotics, R1–R8: resistance to 1, 2, 3, 4, 5, 6, 7, and 8 classes of antibiotics, respectively, ≥R3: resistance to 3 or more classes of antibiotics (S3 Dataset), MDR: multi-drug resistance

Table 5. *Bivariable and multivariable analysis of factors associated with bacteriuria among pregnant women at Hosanna Town health facilities, South Ethiopia, 2022.*

Characteristics		Culture result		Bivariable Analysis	Multivariable Analysis	
		Positive (%)	Negative (%)	COR (95% CI)	AOR (95% CI)	p-value
Age	16–25	21 (35.6)	112 (44.3)	0.63 (0.23-1.75)	0.77(0.23-2.17)	0.544
	26–35	32 (54.2)	122 (48.2)	0.79 (0.29-2.17)	0.71(0.25-2.32)	0.639
	36–45	6 (10.2)	19 (7.5)	1		
Residence	Urban	43 (72.9)	210 (83.0)	1		
	Rural	58 (70.4)	16 (27.1)	1.82 (0.94-3.52)		
Marriage	Married	58 (98.3)	248 (98.0)	1.17 (0.13-10.20)		
	Separated/widowed	1 (1.7)	5 (2.0)	1	1	
Education	No formal education	31 (52.5)	82 (32.4)	2.271 (1.05-6.99)	**2.86 (1.03-7.98)**	**0.044**
	Primary school	11 (18.6)	70 (27.7)	1.13 (0.39-3.27)	0.99 (0.32-2.3.11)	0.993
	Secondary school	11 (18.6)	58 (22.9)	1.36 (0.47-3.96)	1.18 (0.37-3.72)	0.781
	College and above	6 (10.2)	43 (17.0)	**1**	1	
Family monthly income (birr)	<15000	19 (98.4)	35 (13.8)	3.14(1.55-6.38)	**3.19(1.48-6.89)**	**0.003**
	≥15000 and <3000	16 (37.3)	79 (31.2)	1.17(0.59-2.34)	1.11(0.54-2.84)	0.786
	≥3000	24 (33.9)	139 (54.9)	1	1	
Gestational stage	1st trimester	23 (39)s	69 (27.3)	1.92(0.956-3.864)	2.10(0.953-4.610)	0.066
	2nd trimester	19 (32.2)	86 (40.0)	1.27(0.623-2.605)	1.19(0.492-2.875)	0.700
	3rd trimester	17 (28.8)	98 (38.7)	1	1	
Gravidity	1ST	17 (28.8)	75 (29.6)	1		
	2ND	22 (37.3)	87 (34.4)	1.11(0.55-2.25)		
	≥3	20 (33.9)	91 (36.0)	0.97(0.47-1.98)		
History of catheterization	No	56 (94.9)	249 (98.4)	1		
	Yes	3 (5.1)	4 (1.6)	3.33(0.73-15.32)		
History of UTI before	No	44 (74.6)	229 (90.5)	1	1	
	Yes	15 (25.4)	24 (9.5)	3.25 (1.58-6.69)	**4.52(2.04-10.03)**	**0.001***
Symptom of UTU	Asymptomatic	33 (55.9)	151 (59.7)	1		
	Symptomatic	26 (54.1)	102 (40.3)	0.86(0.48-1.52)		

Where: COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval, Other illness: Hepatitis + HIV, *: statically significant

the most commonly isolated bacteria from previous studies in Gonder (49.2% %) [22], Hawassa (47.8%) [29], Dessie (33.3%) [32], Kenya (44.5%) [25], Somaliland (43.5%) [24], and Bangladesh (38%) [31]. Our study finding is lower compared to studies reported in Gonder (49.2% %) [22], Hawassa (47.8%) [29], Kenya (44.5%) [25], and Somaliland (43.5%) [24]. But it is comparable with study findings reported in Dessie (33.3%) [32] and Bangladesh (38%) [31].

Coagulase-negative *staphylococci* (CoNS) and *S. aureus* were the second and third most frequently isolated bacteria, accounting for 15.6% and 10.9% of the isolates, respectively. This result is comparable with other studies conducted elsewhere [17,24,34,35]. *Klebsiella kneumoniae, Proteus mirbalis, Enterobacter clocae, pseudomonas aeruginosa, Citrobacter species*, and *Enterococcus species* were also causative agents of UTI.

In this study, the antimicrobial susceptibility patterns of the recovered bacterial isolates were assessed, and the predominant isolate, *E. coli*, was 95.5% and 77.3% resistant to ampicillin and doxycycline, respectively. This finding is comparable with local studies conducted in Dire Dawa [34], Gonder [22] and abroad in Kenya [25], Uganda [28] and Somaliland [24]. However, meropenem (97.6%), gentamicin (90.9%), ceftriaxone (86.4%), ceftazidim (86.4%), augmentin (86.4%) and nitrofurantoin (86.4%), were relatively effective antibiotics against *E. coli*. This is consistent with studies conducted in Ethiopia and elsewhere [21-24,28]. In the present study, higher resistance by Gram-negative uropathogens was observed against ampicillin (97.4%), sulfamethoxazole-trimethoprim (74.4%), doxycycline (71.8%), and cefuroxime (69.2%). This is comparable with studies conducted in Ethiopia [22,34], Kenya [25], and Uganda [28]. However, this finding is in contrast to other studies conducted in Ethiopia [21,29]. Moreover, we also found that most of the isolates were sensitive to nitrofurantoin (85.7%), gentamicin (85.7%), and ceftriaxone (71.8%) (84.6%), which is comparable with studies conducted in Ethiopia [21,22,29]. On the other hand, gram-positive bacterial isolates showed a high level of susceptibility to some of the tested antibiotics. However, they showed a high level of resistance to penicillin (72.7%), doxycycline (54.5%), trimethoprim–sulfamethoxazole (52.9%), and cefoxitine (52.9%). Which is comparable with a study reported in Ethiopia [22,32,34] and Uganda [28]. Inappropriate usage of antibiotics and the prescribing rate prior to pregnancy could be the cause of this. Another possibility could be the transfer of antibiotic-resistant bacteria from person to person in the community.

According to this study's findings, most widely prescribed antibiotics are not effective against uropathogens. In this study, MDR prevalence found to be 78.1%, which is comparable to the studies in Dessie [20], and higher than studies in Addis Ababa

[21], Gonder [22] and lower than studies in Somaliland [24] and Uganda [28]. This variation may be due to the difference in drug-resistant bacterial strains in the local community and the magnitude of the isolated bacteria in studies [36]. The high resistance to these frequently given antibiotics may be caused by antibiotic abuse and self-medication in public locations like hospitals and communities [12,13]. Also, this result demonstrates that the study region in particular lacks effective infection control strategies and antimicrobial stewardship practices. However, there are evidence that antibiotics are being abused in Ethiopia in both hospital and non-hospital settings [37-39]. This, along with the rapid spread of bacteria with resistance and a poor surveillance system, were all factors that contributed to the AMR problem [13,36,37]. Antibiotic resistance should be a major clinical concern in our nation, especially the current research field, therefore we must work tirelessly to justify antibiotic use both inside and outside of hospitals.

In the present study, the result of multivariable analysis revealed that socio-demographic factors such as no formal education (AOR: 2.86, 95% CI: 1.03–7.98, p = 0.044) and family monthly income less than 1500 Ethiopian birr (AOR: 3.19, 95% CI: 1.48–6.89, p = 0.003) were statistically association with bacterial UTI among pregnant women. The non-formal education was another variable agreed with a study done in Bale [26] and Somaliland [24] which reported as factor associated with bacteriuria in pregnant women. Family monthly income less than 1500 was another factor that was associated with significant bacteriuria among pregnant women. A similar finding was reported in other studies on pregnant women in Ethiopia [11,34,40,41], Somaliland [24] and Pakistan [42]. This could be due to the negative influence of low socioeconomic status on the nutrition and immune status of pregnant women. In addition, a woman with less formal education and a low family income may also be unhygienic. During pregnancy, urinary tract infections are significantly increased by poor personal cleanliness [43].

Furthermore, pregnant women with a history of UTI had a significantly higher AOR than those without a history of UTI (AOR: 4.52, 95% CI: 2.04-10.03, p = 0.001). This was comparable to other studies reported elsewhere [20,24,27,28,32,34,35]. Recurrent infections are prevalent in UTIs, and having had a prior UTI increases the likelihood of getting another one. This could be due to the presence of resistant bacterial strains in those who had a previous history of UTI [22].

Limitation of the study.

Due to limited funding and laboratory resources, other microbes like *Chlamydia* and *Mycoplasma* species were not investigated. Also, species-level identifications for microorganisms like CoNS were not completed. Furthermore, the existence of isolated uropathogens that produce ESBL and/or cabapenamase has not been demonstrated. The results might not be representative and replicable in other health institutions due to differences in bacterial profiles and susceptibility rates. Notwithstanding these drawbacks, this study offers enough current information on UTIs in pregnant women, antibiotic susceptibility profiles, and their related characteristics in the context of the current investigation.

Conclusions and recommendations.

E. coli, followed by CoNS and *S. aureus*, was the most common bacterial causes of bacterial urinary tract infection in pregnant women. In addition, this study revealed limited susceptibility to ampicillin, sulfamethoxazole-trimethoprim, cephalexin, and doxycycline and good susceptibility to meropenem, gentamicin, nitrofurantoin, and third generation cephalosporins. Furthermore, this study found that, among pregnant women, bacterial isolates that cause UTI frequently exhibit multidrug resistance. There was a statistically significant association between bacteriuria and lack of formal education, low family income, and prior history of UTI. Thus, culture and antibiotic susceptibility tests are essential for the appropriate treatment of urinary tract infections in pregnant women in the research area. Otherwise, the presence of antibiotic-resistant bacteria and other potential risk factors for UTIs should be considered when prescribing empirical antibiotic therapy.

Abbreviations.

ABU: Asymptomatic Bacteriuria; **AST:** antimicrobial susceptibility test; **CFU:** Colony Forming Unit; **CLSI:** Clinical and Laboratory Standards Institute; **CoNS:** Coagulase Negative *Staphylococcus*; **MDR**: Multi-Drug Resistant; **UTI:** Urinary Tract Infection.

Supporting information.

S1 Protocol. Laboratory data collection form.

S2 Protocol. The AST interpretation chart.

S3 Dataset. Distribution of antibiotic resistance of isolates to different class of antibiotics.

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Availability of data and materials.

The data used and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate.

The protocol was approved by the institutional review committee of Wachemo University, College of medicine and health sciences with reference number 1049/13. Comprehensive information about the aim and objectives of the study was given for all study participants. Written informed consent was obtained from all study participants. For each confirmed infection by the laboratory analysis, the responsible clinician of the study subjects was informed for better patient care.

Consent for publication.

Not applicable

Competing interests.

All the authors declare that they have no competing conflict of interest.

Authors' contributions.

AM, DA, and SG designed the study. AM and AMS performed the study and collected data. AM, DA, SG, RAA and AMS analyzed the data and wrote the manuscript. All authors critically reviewed and approved the manuscript in its form.

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