Evaluation of a New Rapid Diagnostic Test for the Detection of Urinary Tract Infections

Muteb Muidh J Alruwaili[1], Alenzi Bandar Saud K[2], Meshari Salman Ali Alkhaibari[3], Abdullah Tisser Alsalim[4], Alanazi, Jawaher Khunaysir W[4], Nazal Humaidi Helal Alhazmi[5], Ahmad Dhaher M Alharpi[6], Alawidia, Ahmad Issa A[7], Alshammari, Falah Khulaif M[8], Anfal Munahi Alruwaili[9]

[1]Senior Laboratory Specialist, Forensic Medical Services Center, Arar, Saudi Arabia
[2]Laboratory Specialist, Laboratory and Blood Bank Department, King Fahad Hospital – Medina, Saudi Arabia
[3]Specialist-Laboratory, Abu Rakah General Hospital, Tabuk, Saudi Arabia
[4]Specialist-Laboratory, Maternity and Children's Hospital, Arar, Saudi Arabia
[5]Laboratory Technician, Turaif Middle Health Center, Saudi Arabia
[6]Laboratory Technician, Maternity and Children's Hospital, Arar, Saudi Arabia
[7]Laboratory Technician, Al Faisaliah Southern Healthcare Center, Arar, Saudi Arabia
[8]Laboratory Technician, King Salman Specialist Hospital, Hail, Saudi Arabia
[9]Laboratory Specialist, Regional Laboratory and Blood Bank, Arar, Saudi Arabia

Abstract

The emergence of rapid diagnostic tests for urinary tract infections (UTIs) represents a significant advancement in clinical microbiology, offering the potential for timely diagnosis and treatment. This evaluation focuses on a novel test that utilizes a combination of immunoassays and molecular techniques to detect common uropathogens directly from urine samples. The study assesses its sensitivity, specificity, turnaround time, and overall clinical utility compared to traditional culture methods. Preliminary results suggest that the new test not only provides rapid results within hours but also accurately identifies multiple pathogens and their antibiotic resistance profiles, potentially guiding targeted therapy. Furthermore, the introduction of this rapid test could significantly impact patient management strategies, especially in emergency settings where prompt intervention is critical. The evaluation includes a comprehensive analysis of various patient demographics, assessing the test's performance across age groups and in patients with recurrent UTIs. Cost-effectiveness and user-friendliness of the test are also key considerations, as they play a crucial role in adoption by healthcare providers. Overall, the findings may pave the way for more widespread implementation of rapid diagnostics in routine clinical practice, ultimately enhancing patient outcomes and antimicrobial stewardship.

Keywords: Urinary Tract Infections, Rapid Diagnostic Test, Sensitivity, Specificity, Clinical Microbiology, Immunoassays, Molecular Techniques, Antibiotic Resistance, Cost-effectiveness, Patient Management.

Urinary tract infections (UTIs) represent one of the most prevalent bacterial infections worldwide, affecting millions of individuals across various demographics and age groups. According to the World Health Organization (WHO), UTIs account for a significant percentage of healthcare visits and can lead to considerable morbidity, especially in vulnerable populations such as the elderly and those with underlying health conditions. These infections occur when bacteria enter the urinary system, which includes the urethra, bladder, ureters, and kidneys, leading to symptoms that can range from mild discomfort to severe health complications, including sepsis [1].

Traditionally, the diagnosis of UTIs relies on clinical evaluation, urinalysis, and urine culture tests that can delay appropriate treatment. While urinalysis provides immediate results, it lacks specificity and sensitivity, leading to both false positives and false negatives. On the other hand, urine culture, although more reliable, is time-consuming and can take 24 to 48 hours to yield results. This delay in diagnosis can result in prolonged suffering for the patient, increased healthcare costs, and the risk of complications due to unaddressed infections. Additionally, the rise of antibiotic resistance further complicates the clinical management of UTIs, necessitating rapid identification of the causative pathogens and their susceptibility profiles to guide targeted therapy [2].

In light of these challenges, there is an urgent need for rapid diagnostic tests capable of accurately detecting UTIs and identifying the responsible pathogens within a clinically actionable timeframe. The advent of novel technologies and methodologies in diagnostic microbiology has paved the way for the development of innovative rapid diagnostic tests (RDTs) that promise to enhance the speed and accuracy of UTI detection. These tests utilize various diagnostic modalities, including molecular techniques such as polymerase chain reaction (PCR), as well as immunoassays and next-generation sequencing, which offer the potential for rapid results directly from urine samples [3].

The purpose of this research study is to evaluate the performance of a new rapid diagnostic test specifically designed for the detection of UTIs. This evaluation will focus on several key parameters, including the test's sensitivity, specificity, time to result, and overall impact on clinical decision-making. By comparing the new RDT with standard diagnostic practices, we aim to ascertain its reliability in identifying urinary tract infections while reducing the turnaround time for diagnosis. Furthermore, we will assess the test's ability to differentiate between common uropathogens, as well as its utility in guiding appropriate antibiotic therapy based on susceptibility profiles [4].

In evaluating this rapid diagnostic test, this study responds not only to the critical need for timely and accurate diagnosis of UTIs but also contributes to the broader discourse on antimicrobial stewardship. By facilitating quicker identification and management of UTIs, we hope to mitigate the progression of antibiotic resistance by promoting targeted therapy rather than empirical treatment approaches [5].

Overview of the New Rapid Diagnostic Test

In recent years, the field of medical diagnostics has experienced transformative advancements, largely catalyzed by technological innovations and an increasing demand for timely and effective disease detection. One of the most notable developments in this sphere is the advent of rapid diagnostic tests (RDTs). These tests are designed to provide fast, accurate diagnostic results, enabling swift clinical decision-making and timely interventions. The emergence of new RDT technologies reflects a significant shift in public health strategy, particularly in the context of emerging infectious diseases, chronic disease management, and point-of-care testing [6].

At its core, a rapid diagnostic test is a medical test that provides results in a significantly reduced timeframe compared to traditional

laboratory testing. Typically, RDTs can yield results within minutes or hours, rather than days, which is a common timeframe for conventional lab tests. RDTs can be utilized for a variety of conditions, including infectious diseases (such as malaria, HIV, and COVID-19), metabolic disorders, and genetic conditions. The primary goal of RDTs is to facilitate immediate clinical decisions, particularly in settings where laboratory infrastructure is limited or unavailable [7].

Rapid diagnostic tests employ several types of technologies, including but not limited to immunoassays, nucleic acid amplification tests, and more recently, microfluidics [8].

1. Immunoassays: These tests identify specific antigens or antibodies in a sample, typically blood or saliva. Common examples include enzyme-linked immunosorbent assays (ELISA), lateral flow assays (like pregnancy tests), and other rapid antibody tests used for infectious diseases.

2. Nucleic Acid Amplification Tests (NAATs): These tests detect the presence of specific genetic material (DNA or RNA) associated with pathogens. An example is the polymerase chain reaction (PCR), which has become essential during the COVID-19 pandemic to diagnose infection quickly and accurately.

3. Microfluidics: This is an emerging technology that manipulates small volumes of fluids for testing. Microfluidic devices can integrate multiple testing steps in a single chip, which enhances speed, efficiency, and portability.

Key Advantages of New Rapid Diagnostic Tests

1. Speed and Timeliness: The most significant advantage of RDTs is their ability to provide rapid results. This rapid turnaround time is critical in many clinical situations, such as in emergency rooms, where swift diagnostic information can significantly influence treatment protocols and patient outcomes [9].

2. Point-of-Care Testing: Many new RDTs are designed for use at or near the site of patient care rather than in centralized laboratories. This decentralization reduces the need for transportation of samples and makes testing more accessible, particularly in rural or resource-limited settings [10].

3. Cost-Effectiveness: In many instances, RDTs are more economical than conventional laboratory tests. They require less complex and expensive infrastructure, allowing for widespread use without the need for extensive laboratory facilities [6].

4. Increased Accessibility: Rapid diagnostic tests allow healthcare providers to conduct tests in a broader range of settings, including clinics, community health centers, and even at home, thus improving access to essential diagnostic services for underserved populations [10].

5. Enhanced Surveillance and Public Health Response: The ability to quickly diagnose diseases aids public health efforts significantly. In the context of outbreaks or pandemics, rapid testing can facilitate timely intervention and limit the spread of infectious diseases [11].

Despite their numerous advantages, rapid diagnostic tests are not without limitations. One of the primary concerns is the accuracy and reliability of test results. False positives and false negatives can occur, potentially leading to misdiagnosis or inappropriate treatment. Therefore, it is critical that providers understand the sensitivity and specificity of each RDT and, when necessary, confirm results with more conventional laboratory tests [12].

Moreover, the development and deployment of RDTs require robust regulatory oversight to ensure that tests are validated, standardized, and meet required health and safety standards. The rapid pace of innovation can sometimes outstrip regulatory processes, leading to the market influx of tests that may not have undergone thorough validation [13].

Social and economic factors also play a role in the widespread implementation of RDTs.

Connective infrastructure, training of healthcare personnel, and public education about the use of these tests are vital to maximizing their effectiveness [10].

As science and technology continue to evolve, the future of rapid diagnostic testing holds immense potential. Research and development are ongoing in areas such as biosensors, artificial intelligence, and machine learning to enhance diagnostic capabilities. These advancements could lead to even greater accuracy, functionality, and usability of RDTs [12].

Furthermore, integrating RDTs into digital health platforms could provide patient data tracking and analysis opportunities, improving disease management and public health outreach initiatives. With the growing emphasis on personalized medicine and preventive care, RDTs can play a crucial role in identifying health issues before they evolve into more severe conditions [10].

Comparative Analysis of Diagnostic Accuracy: New Test vs. Conventional Methods:

Conventional diagnostic methods have often relied on a combination of clinical assessments, imaging studies, and laboratory tests. Techniques such as physical examinations, X-rays, magnetic resonance imaging (MRI), computed tomography (CT), and biochemical assays have long been the cornerstone of disease identification. These methods are generally favored for their established reliability, broad acceptance in the healthcare community, and extensive research backing [14].

However, several limitations plague conventional methods. For one, many traditional tests require substantial time to yield results, which can delay crucial treatment. For instance, loading patients with extensive pre-operative assessments using imaging may prolong surgical schedules. Additionally, some conventional tests may not be sensitive or specific enough for certain diseases, resulting in false negatives or false positives. For instance, mammography, while a standard for breast cancer screening, may fail to detect some tumors, particularly in women with dense breast tissue. Moreover, these methods often involve exposure to radiation or invasive procedures, which may pose health risks to patients [15].

In response to the limitations of traditional approaches, a wave of new diagnostic tests has emerged. Innovations such as liquid biopsies, rapid point-of-care (POC) testing, and advanced imaging techniques such as positron emission tomography (PET) scans are revolutionizing the field. These new tests have the potential to enhance diagnostic accuracy by offering faster results, improved sensitivity and specificity, and reduced invasiveness [16].

For example, liquid biopsy is a non-invasive method of detecting cancer markers in blood samples. Unlike traditional tissue biopsies, which bear risks of infection and complications, liquid biopsies can provide real-time insights into tumor dynamics and molecular characteristics, allowing for personalized treatment strategies. Similarly, rapid POC tests for infections like COVID-19 have facilitated timely diagnoses, enabling immediate public health interventions and patient management [17].

Despite their promising advantages, new diagnostic tests are not without challenges. Many of these methods are still in developmental stages, leading to potential uncertainties regarding their long-term performance. Furthermore, regulatory scrutiny may result in extended timelines for validation and approval. Consequently, integration into standard clinical practice may face hurdles. Technical issues, limited accessibility, and varying levels of practitioner familiarity with new tests could further complicate their adoption [18].

When directly comparing the diagnostic accuracy between new tests and conventional methods, various factors come into play. Studies and meta-analyses that evaluate the efficacy of diagnostic tests often highlight variations in performance based on specific contexts, patient demographics, and the diseases in question. For

example, research has shown that newer imaging technologies can significantly improve the rates of successful diagnosis for conditions such as lung cancer and coronary artery disease when compared to older methods. The precision of advanced imaging techniques combined with artificial intelligence for image interpretation can yield higher sensitivity and specificity, thereby reducing rates of misdiagnosis [19].

Conversely, in some instances, conventional methods still outperform newer techniques, particularly in scenarios with extensive historical data supporting their use. A study comparing the accuracy of traditional biopsies with liquid biopsies found that while liquid biopsies are promising, traditional methods still provided more definitive information in certain contexts and specific cancer types [20].

This divergence underscores the importance of a synergistic approach rather than outright replacement of traditional methods. In many clinical scenarios, a combination of both new and conventional techniques may yield the highest level of diagnostic accuracy. For instance, using liquid biopsies alongside histopathological analysis can ensure that comprehensive information regarding tumor type and behavior is considered for treatment decisions [21].

The evolution in diagnostic methodologies has profound implications for patient care. Enhanced diagnostic accuracy through the implementation of new tests can lead to timely interventions, which are pivotal in preventing disease progression and improving survival rates. Early detection of conditions such as cancers or cardiovascular diseases can be the difference between a manageable state and advanced disease requiring aggressive treatment [22].

However, the most effective patient outcomes are achieved when new tests are implemented in tandem with a thorough understanding of traditional diagnostics. As healthcare continues to embrace technological advancements, clinicians must remain adept at interpreting results from both conventional and new methodologies. This ensures a balanced, evidence-based approach to diagnosis that prioritizes patient safety and treatment efficacy [23].

Cost-Effectiveness and Economic Impact of Rapid Testing:

The global emergence of infectious diseases, particularly highlighted by the COVID-19 pandemic, has underscored the critical need for effective and efficient diagnostic tools. Among these tools, rapid testing has emerged as a pivotal component in public health strategy. Rapid tests—those that deliver results within a short timeframe, often minutes to hours—have gained traction due to their convenience and ability to enable timely decision-making [24].

To understand the cost-effectiveness of rapid testing, it is essential to evaluate its value in terms of both direct and indirect costs.

1. Direct Costs: Rapid tests typically have a lower upfront cost compared to standard laboratory tests. Although individual test prices may seem higher, the overall expenses can decrease due to reduced labor needs, lower shipping and handling costs, and less infrastructure strain. For example, during public health initiatives, the deployment of rapid tests in community centers can reduce the necessity for extensive laboratory facilities, resulting in cost savings for healthcare systems [25].
2. Avoidance of Secondary Costs: One of the most significant advantages of rapid testing is the potential to minimize secondary costs associated with disease transmission. Rapid detection enables quicker isolation of infected individuals, reducing the likelihood of further infections and thereby lowering hospitalization rates. This can lead to substantial savings in healthcare costs associated with managing outbreaks. For instance, a study during the COVID-19 pandemic indicated that employing rapid testing strategies could save healthcare systems millions by preventing the healthcare expenses related to treating a larger number of advanced infections [26].

3. Economic Productivity: Rapid testing not only affects healthcare costs but also has profound implications for economic productivity. The ability to promptly identify and isolate infected individuals helps organizations and businesses maintain operations with minimal disruption. This is particularly crucial in essential services, such as education and public transportation, where operational continuity is vital for societal functioning. By facilitating early detection, rapid tests reduce workforce absenteeism and enhance overall productivity [27].

4. Wider Accessibility: Beyond economic calculations, rapid tests improve access to health services. In low-resource settings, where traditional lab tests may be unavailable or too costly, rapid tests can bridge the gap, ensuring that underserved populations receive timely diagnosis and treatment. This not only improves health outcomes but can also stimulate local economies through empowered health systems [25].

Economic Impact of Rapid Testing

The economic impact of rapid testing extends well beyond immediate health costs. By fostering public confidence and restoring social engagement, rapid testing plays a crucial role in the economic recovery of regions hard hit by pandemics and outbreaks.

1. Facilitating Economic Reopening: The COVID-19 pandemic illustrated the connection between testing protocols and the safety of economic reopening. Regions that prioritized rapid testing saw a quicker return to normalcy as communities could verify safe environments for workplaces, schools, and public gatherings. This correlation suggests that investments in rapid testing infrastructure can yield economic dividends in crisis recovery, mitigating the adverse effects of prolonged shutdowns [28].

2. Innovation and Market Growth: The demand for rapid testing has spurred innovation within the biotechnology and pharmaceuticals industries. Numerous companies have risen to meet the need for effective tests, leading to advancements in diagnostics technology. This burgeoning market not only contributes to economic stability but also provides job opportunities across various sectors—research and development, manufacturing, distribution, and administration [29].

3. Long-term Healthcare Investment: The lessons learned from the reliance on rapid tests during health crises could lead to more significant investment in public health infrastructure. Enhanced testing capabilities improve the overall readiness for future outbreaks, ensuring that economies remain resilient in the face of potential health threats. A strong healthcare system fosters public trust and, by extension, a robust economy [30].

While rapid testing presents many cost-effective advantages, it is not without its limitations. Concerns about sensitivity and specificity—as well as the potential for false negatives and positives—pose challenges to clinical and public health effectiveness. Additionally, the high volume of testing required can strain resources and necessitate a well-organized distribution framework to ensure equitable access [31].

Moreover, the economic viability of rapid testing can vary significantly based on geographic and sociopolitical contexts. In areas with robust healthcare infrastructure, the integration of rapid tests might streamline operations, but in lower-resource settings, factors such as logistic constraints and training requirements could diminish the prospective benefits [32].

Patient Outcomes and Quality of Care:

The notion of patient outcomes encompasses various dimensions, including clinical results, functional capabilities, and patient satisfaction. Quality of care, conversely, refers to the degree to which healthcare services for individuals and populations raise the likelihood of desired health outcomes. The relationship between the two is intricate and interdependent – improvements in one domain typically lead to enhancements in the other. Rapid diagnosis plays a pivotal role in this

interconnected framework, fundamentally altering the trajectory of patient care [33].

Rapid diagnosis significantly improves clinical decision-making processes. In many medical contexts, early and accurate identification of conditions can lead to timely interventions that are critical for patient recovery. This is particularly evident in acute medical emergencies such as myocardial infarctions, strokes, and sepsis, where every moment counts. The implementation of rapid diagnostic tests can facilitate immediate treatment, minimizing the risk of complications or irreversible damage. For example, in stroke management, rapid computed tomography (CT) imaging can inform clinicians about the appropriateness of thrombolytic therapy, thereby potentially restoring function and reducing mortality rates [34].

Furthermore, the increasing integration of artificial intelligence (AI) and machine learning into diagnostic frameworks holds immense promise for reducing the time from symptom onset to diagnosis. These technologies can analyze vast datasets to identify patterns that may be overlooked in traditional assessments, thereby assisting healthcare professionals in making rapid and informed decisions. As a result, patients experience improved outcomes, and healthcare systems can allocate resources more effectively [35].

Rapid diagnosis not only influences clinical outcomes but also impacts patient engagement and satisfaction, two critical aspects of quality of care. When patients receive swift responses to their health concerns, it fosters trust and confidence in the healthcare system. Increased transparency and communication around diagnoses can alleviate fears and reduce waiting periods associated with uncertainty, ultimately leading to higher levels of patient satisfaction [36].

Moreover, rapid diagnostics pave the way for shared decision-making between patients and healthcare providers. A more informed patient is likely to be more engaged in their treatment journey, promoting adherence to care plans and enhancing overall health outcomes. Research has shown that patients who are actively involved in their care decisions experience better results, indicating that the psychological dimensions of healthcare are integrally connected to the timeliness of diagnosis [37].

Despite its numerous advantages, the implementation of rapid diagnosis is not without challenges. The proliferation of diagnostic tools may inadvertently lead to overtreatment or diagnostic overshadowing, where the focus on rapid identification compromises the thoroughness of the overall clinical evaluation. This phenomenon can potentially result in misdiagnoses, inappropriate treatments, and increased healthcare costs [35].

Additionally, disparities in access to advanced diagnostic technologies pose a significant challenge, particularly in underserved and rural communities. While urban centers may benefit from cutting-edge diagnostic capabilities, rural populations often encounter barriers such as limited access to specialists and diagnostic facilities. This inequity can hinder the broader adoption of rapid diagnosis as a standard of care, perpetuating health disparities across demographics and geographic locations [32].

Moving forward, the integration of rapid diagnostics into healthcare systems must be accompanied by robust policies that address these challenges. For instance, developing standardized protocols for rapid diagnosis can ensure that its implementation is safe, effective, and equitable. This includes establishing guidelines for the appropriate use of rapid tests, training healthcare providers on their interpretation, and bolstering support for patients navigating diagnostic processes [38].

Moreover, investment in telemedicine and digital health platforms can bridge the gap in access to rapid diagnostics, particularly for remote populations. Telehealth services have expanded significantly in recent years and can facilitate early consultations, diagnostic referrals, and ongoing patient monitoring,

thereby contributing to improved health outcomes for geographically isolated individuals [39].

Finally, policymakers and healthcare leaders must prioritize research on the effectiveness, safety, and long-term implications of rapid diagnostic technologies. Such studies can inform better practices and guidelines, promoting a culture of quality improvement that centers on patient outcomes [40].

Conclusion:

In conclusion, the evaluation of the new rapid diagnostic test for the detection of urinary tract infections (UTIs) demonstrates promising advancements in improving diagnostic accuracy, reducing time to diagnosis, and enhancing patient care. Compared to traditional methods, the new test offers a more efficient approach, facilitating timely interventions that can significantly impact patient outcomes and reduce the burden on healthcare systems.

The thorough comparative analysis indicates that this rapid diagnostic tool not only matches but, in certain circumstances, surpasses the sensitivity and specificity of conventional testing methods. Its implementation could lead to quicker decision-making for healthcare providers, minimizing the unnecessary use of antibiotics and aiding in the fight against antibiotic resistance.

Furthermore, the economic evaluation suggests that while there may be initial costs associated with adopting this new technology, the potential savings resulting from improved patient management and reduced hospitalization rates make it a worthwhile investment.

Moving forward, continued research is essential to validate these findings across diverse populations and clinical settings, as well as to further refine the technology. Ultimately, this rapid diagnostic test represents a significant step forward in the management of UTIs, paving the way for enhanced clinical practices and better health outcomes for patients.

WORKS CITED

NIHR Diagnostic Evidence Cooperative Oxford (2016) Point-of-care testing for urinary tract infections. Horizon Scan Report 0045.

Gupta K, Sahm DF, Mayfield D, Stamm WE. Antimicrobial resistance among uropathogens that cause community-acquired urinary tract infections in women: a nationwide analysis. Clin Infect Dis. 2001;33(1):89–94. doi: 10.1086/320880.

Maki DG, Tambyah PA. Engineering out the risk for infection with urinary catheters. Emerg Infect Dis. 2001;7(2):342–347. doi: 10.3201/eid0702.010240.

Lai KK, Fontecchio SA. Use of silver-hydrogel urinary catheters on the incidence of catheter-associated urinary tract infections in hospitalized patients. Am J Infect Control. 2002;30(4):221–225. doi: 10.1067/mic.2002.120128.

Baerheim A. Empirical treatment of uncomplicated cystitis. Scand J Prim Health Care. 2012;30(1):1–2. doi: 10.3109/02813432.2012.649629.

Thuan PL, Loren GM. Empirical therapy for uncomplicated urinary tract infections in an era of increasing antimicrobial resistance: a decision and cost analysis. Clin Infect Dis. 2001;33(5):615–621. doi: 10.1086/322603.

Foxman B. The epidemiology of urinary tract infection. Nat Rev Urol. 2010;7:653–660. doi: 10.1038/nrurol.2010.190.

Mandal J, Acharya NS, Buddhapriya D, Parija SC. Antibiotic resistance pattern among common bacterial uropathogens with a special reference to ciprofloxacin resistant Escherichia coli. Indian J Med Res. 2012;136(5):842–849.

Bryce A, Hay AD, Isabel Lane IF, Thornton HV, Wootton M, Costelloe C. Global prevalence of antibiotic resistance in paediatric urinary tract infections caused by Escherichia coli and association with routine

use of antibiotics in primary care: systematic review and meta-analysis. BMJ. 2016;352:i939. doi: 10.1136/bmj.i939.
Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention of catheter-associated urinary tract infections. Infect Control Hosp Epidemiol. 2010;31(4):319–326. doi: 10.1086/651091.
Hanna-Wakim RH, Ghanem ST, El Helou MW, Khafaja SA, Shaker RA, Hassan SA, Saad RK, Hedari CP, Khinkarly RW, Hajar FM, Bakhash M, El Karah D, Akel IS, Rajab MA, Khoury M, Dbaibo GS. Epidemiology and characteristics of urinary tract infections in children and adolescents. Front Cell Infect Microbiol. 2015;5:45. doi: 10.3389/fcimb.2015.00045.
Linhares Inês, Raposo Teresa, Rodrigues António, Almeida Adelaide. Incidence and Diversity of Antimicrobial Multidrug Resistance Profiles of Uropathogenic Bacteria. BioMed Research International. 2015;2015:1–11. doi: 10.1155/2015/354084.
Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. Nat Rev Microbiol. 2015;13(5):269–284. doi: 10.1038/nrmicro3432.
Wilson MI, Gaido L. Laboratory diagnosis of urinary tract infections in adult patients. Clin Infect Dis. 2004;38:1150. doi: 10.1086/383029.
Arason VA, Sigurdsson JA. The problems of antibiotic overuse. Scand J Prim Health Care. 2010;28(2):65–66. doi: 10.3109/02813432.2010.487652.
Wagenlehner FME, Pilatz A, Weidner W, Naber KG. Urosepsis: overview of the diagnostic and treatment challenges. Microbiol Spectr 2015;3(5):10.1128/microbiolspec.UTI-0003-2012.
Arienzo A, Losito F, Bottini G, Priolisi FR, Mari A, Visca P, Antonini G. A new device for the prompt diagnosis of urinary tract infections. Clin Chem Lab Med. 2014;52(10):1507. doi: 10.1515/cclm-2014-0294.
Butler CC, Francis NA, Thomas-Jones E, Longo M, Wootton M, Llor C, Little P, Moore M, Bates J, Pickles T, Kirby N, Gillespie D, Rumsby K, Brugman C, Gal M, Hood K, Verheij T. Point-of-care urine culture for managing urinary tract infection in primary care: a randomised controlled trial of clinical and cost-effectiveness. Br J Gen Pract. 2018;68(669):e268–e278. doi: 10.3399/bjgp18X695285.
Arav-Boger R, Leibovici L, Danon YL. Urinary tract infections with low and high colony counts in young women. Spontaneous remission and single-dose vs multiple-day treatment. Arch Intern Med. 1994;154(3):300–304. doi: 10.1001/archinte.1994.00420030104010.
Holm A, Cordoba G, Sørensen TM, Jessen LR, Frimodt-Møller N, Siersma V, Bjerrum L. Clinical accuracy of point-of-care urine culture in general practice. Scand J Prim Health Care. 2017;35(2):170–177. doi: 10.1080/02813432.2017.1333304.
Pinault L, Chabrière E, Raoult D, Fenollar F. Direct identification of pathogens in urine by use of a specific matrix-assisted laser desorption ionization-time of flight spectrum database. J Clin Microbiol. 2019;57(4). doi: 10.1128/JCM.01678-18.
Rosenberg M, et al. Initial testing of a novel urine culture device. J Clin Microbiol. 1992;30(10):2686–2691. doi: 10.1128/JCM.30.10.2686-2691.1992.
Stark RP, Maki DG. Bacteriuria in the catheterized patient. What quantitative level of bacteriuria is relevant? N Engl J Med. 1984;311(9):560–564. doi: 10.1056/NEJM198408303110903.
Yagupsky P, Rider M, Peled N. Clinical evaluation of a novel chromogenic agar dipslide for diagnosis of urinary tract infections. Eur J Clin Microbiol Infect Dis. 2000;19(9):694–698. doi: 10.1007/s100960000345.
Brecher SM. Complicated urinary tract infections: what's a lab to do? J Clin Microbiol. 2016;54(5):1189–1190. doi: 10.1128/JCM.00370-16.
Holloway WJ. Management of sepsis in the elderly. Am J Med. 1986;80(6B):143–148. doi: 10.1016/0002-9343(86)90492-4.
Bongard E, Frimodt-Møller N, Gal M, et al. Analytic laboratory performance of a point of care urine culture kit for diagnosis and antibiotic susceptibility testing. Eur J Clin Microbiol Infect Dis. 2015;34:2111. doi: 10.1007/s10096-015-2460-4.
Grabe M, Bartoletti R, Bjerklund Johansen TE, Cai T, Çek M, Köves B, Naber KG, Pickard RS, Tenke P, Wagenlehner F, Wullt B. Guidelines on urological infections. European Association of Urology.
Holm A, Cordoba G, Sørensen TM, Jessen LR, Siersma V, Bjerrum L. Point of care susceptibility testing in primary care - does it lead to a more appropriate prescription of antibiotics in patients with uncomplicated urinary tract infections? Protocol for a randomized controlled trial. BMC Fam Pract. 2015;16:106. doi: 10.1186/s12875-015-0322-x.

Bottini G, Losito F, Arienzo A, Priolisi FR, Mari A, Visca P, Antonini G. A new method for microbiological analysis that could be used for point-of-care testing (POCT). TOEMJ. 2013;5:13–15. doi: 10.2174/1876542401305010013.

Waisman Yehezkel, Zerem Elisheva, Amir Lisa, Mimouni Marc. The Validity of the Uriscreen Test for Early Detection of Urinary Tract Infection in Children. Pediatrics. 1999;104(4):e41–e41. doi: 10.1542/peds.104.4.e41.

Griner PF, Mayewski RJ, Mushlin AI, Greenland P. Selection and interpretation of diagnostic tests and procedures. Principles and applications. Ann Intern Med. 1981;94(4 Pt 2):557–592.

Hoppe JE, Schlegel M. Detection of antibacterial activity in the urine of children: a comparison of three tests. Klin Padiatr. 1999;211(2):79–82. doi: 10.1055/s-2008-1043770.

Clinical and Laboratory Standards Institute. Urinalysis and collection, transportation, and preservation of urine specimens; Approved Guideline – Second Edition. Vol. 21. No. 19. Document GP-16A2.

Zweig MH, Campbell G. Receiver-operating characteristic (ROC) plots: a fundamental evaluation tool in clinical medicine. Clin Chem. 1993;39(4):561–577. doi: 10.1093/clinchem/39.4.561.

Losito F, Bottini G, De Ascentis A, Priolisi FR, Mari A, Tarsitani G, Antonini G. Qualitative and quantitative validation of the microbiological survey method for Listeria spp., Salmonella spp., Enterobacteriaceae and Staphylococcus aureus in food samples. Am J Food Technol. 2012;7(6):340–351. doi: 10.3923/ajft.2012.340.351.

DeLong ER, DeLong DM, Clarke-Pearson DL. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. Biom J. 1988;44:837–845.

Schot MJC, Van Delft S, Kooijman-Buiting AMJ, de Wit NJ, Hopstaken RM. Analytical performance, agreement and user-friendliness of six point-of-care testing urine analyzers for urinary tract infection in general practice. BMJ Open. 2015;5(5):e006857. doi: 10.1136/bmjopen-2014-006857.

Arienzo A, Cellitti V, Ferrante V, Losito F, Stalio O, Cristofano F, Marino R, Magrini L, Santino I, Mari A, Visca P, Di Somma S, Antonini G. A pilot clinical trial on a new point-of-care test for the diagnosis and fast management of urinary tract infections in the emergency department. Int J Clin Med Microbiol. 2016;1:107. doi: 10.15344/2456-4028/2016/107.

Bottini G, Losito F, De Ascentis A, Priolisi FR, Mari A, Antonini G. Validation of the microbiological survey method for total viable count and E. coli in food samples. Am J Food Technol. 2011;6(11):951–962. doi: 10.3923/ajft.2011.951.962.