

# What Role Should PCR have in the Clinical Workup of Urinary Tract Infections?

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## ABSTRACT

Urinary Tract Infections (UTIs) are among the most common infections that are encountered in medicine globally. It is known that UTIs are associated with decreased quality of life in addition to a financial and economic burden. Recently, data from the global burden of disease study 2019 reported over 400 million UTIs diagnosed on a worldwide scale, resulting in over 230,000 deaths and over 520,000 DALYs. Interesting findings from this study also included an increase in mortality rate from 2.77/100,000 to 3.13/100,000 between the years 1990 to 2019.

**Keywords:** Clinical workup; Urinary tract infections; DNA databases; Mortality; Economic burden

## INTRODUCTION

Recent medicine has questioned the use of Urine Culture (UC) as a means for identification, diagnosis, and treatment/management of UTIs [1]. The differences in sensitivity of urine culture when compared to that of PCR has been somewhat agreed upon, but other aspects have become more conversational. For example, the consideration of possible overdiagnosis as a result of increased sensitivity, and subsequent overtreatment. Another point of interest involves the economic burden that PCR may have on the healthcare system. One argument made suggests that PCR may detect normal flora of the urinary tract. These questions are all important to address to allow providers a better understanding while also ensuring that antimicrobial stewardship is prioritized [2].

## DESCRIPTION

UC is the gold standard for UTI detection, although not necessarily indicated in the management of a simple UTI. In young women with symptoms suggestive of UTI, treatment may be started immediately. Other populations including older women presenting with atypical symptoms, patients with recurrent UTIs, or pregnant persons may be candidate for culture [3].

UC remains a mainstay of urinary infections due to its sensitivity and associated financial burden. Sensitivity is reported to hover somewhere between 51%-95% depending on the degree of

infection within the specimen itself. While the starting price of culture is around \$30-60, PCR methodologies may be significantly more expensive. While prices are not as established for PCR analysis, a company called pathnostics, has an at-home UTI testing kit priced at \$499 [4].

UC is indicated in patients with recurrent infections as a means to document pathogens and assist in the long-term workup and management of a patient. Patients with recurrent UTIs are recommended acute self-treatment, post-coital prophylaxis, or continuous daily prophylaxis the latter 2 conferring protection for up to 5 years. Notably, infection typically returns in these patients within the next 6 months [5].

In contrast to UC, PCR does have some features of its own. In a study published in 2020, PCR has been demonstrated to have a higher rate of detection (56%) compared to culture (37%). In this same study, PCR and culture had agreeable results in 74% of specimens, and there was disagreement in results in 24% of specimens. Another potential positive impact that PCR may provide includes the ability to detect polymicrobial infections. The aforementioned study identified 175 polymicrobial infections, 169 of which were diagnosed by PCR, and 39 diagnosed with culture. PCR detected polymicrobial infections in 12% of cultures that were resulted as negative. Other literature suggests that up to 1/3 of UTIs in the elderly population are polymicrobial [6].

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PCR also offers a potentially quicker turnaround time. PCR may allow for results to be generated within 5 hours. This is a significantly quicker turnaround when compared to UC which may allow for results within 24 hours-48 hours. Increasing antimicrobial resistance, in terms of both incidence and complexity, suggests increased importance of accurate microbial identification [7].

Another point of discussion stems from the preliminary research that is been completed on the urinary tract microbiome at equilibrium. An article published in 2022 suggests that PCR is capable of identifying microbes present in urine both alive and dead. Because the urinary tract microbiome is still being investigated, the presence of a potential pathogen, especially without respect to its viability, may not be enough to consider it an actual pathogen.

## CONCLUSION

The conversation surrounding the use of PCR in modern medicine, in place of a traditional urine culture continues to remain controversial. While advancements are encouraged and sought after, it is important to be internal skeptics until research proves and necessitates advancement. While UC is more affordable and has been shown to have a sensitivity ranging from 51%-95%, PCR may have a role in recurrent and complicated UTIs. The sensitivity of PCR is generally agreed to exceed that of UC. Additionally, PCR results generally take a mere 5 hours to receive and act upon provided that the provider is promptly notified. This does introduce a potential pitfall of increased testing speed being that the time it takes a provider to interpret results and initiate treatment if necessitated is a limiting factor in the overall time it takes to treat a UTI.

Because the outcome of recurrent UTIs involves prophylactic treatment options for the patient, PCR may be a reasonable

choice in these patients to make sure no undetected pathogens are causative. However, the potential drawback of UTI testing remains overdiagnosis is possible. The data concerning polymicrobial infections is of particular interest and deserves further investigation. There is debate whether the detection of polymicrobial infection by PCR, in an otherwise negative culture report, is over-detection or true detection.

Similarly, a comparison of endogenous flora and an infectious state, the normal equilibrium, should be investigated to better understand which microbes may actually be pathogenic.

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