

# Performance of different urinalysis parameters in predicting clinically significant bacteriuria



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## Introduction

- Overuse and misuse of urine cultures leads to an increase in diagnosis of asymptomatic bacteriuria, further leading to inappropriate antibiotics use and associated adverse events.
- Urinalysis (UA) parameters are often used to determine whether urine cultures should be performed or if treatment is indicated in cases of suspected urinary tract infection (UTI).
- However, there is disagreement over which UA parameters should be used as screening tests for UTI.
- Objective:** Our goal was to compare the performance of different UA parameters in predicting clinically significant bacteriuria.

## Methods

- Design:** We performed a retrospective review of UA and urine culture data between January 1, 2015 and December 31, 2020, from four sites –
  - Duke University Hospital,
  - Duke Regional Hospital,
  - Duke Raleigh Hospital, and
  - Duke Private Diagnostic Clinics
- UA and urine cultures were included if they were ordered within 24 hours.
- Urine culture results were categorized as positive, negative, or mixed.
- A positive culture with bacterial growth >100,000 colony forming units/mL was considered to be clinically significant bacteriuria.
- Analysis:** We evaluated UA parameters graphically and with descriptive statistics. Performance characteristics were calculated considering clinically significant bacteriuria as true.

**Funding:** NIH-NIDDK K12DK100024 (KURe)

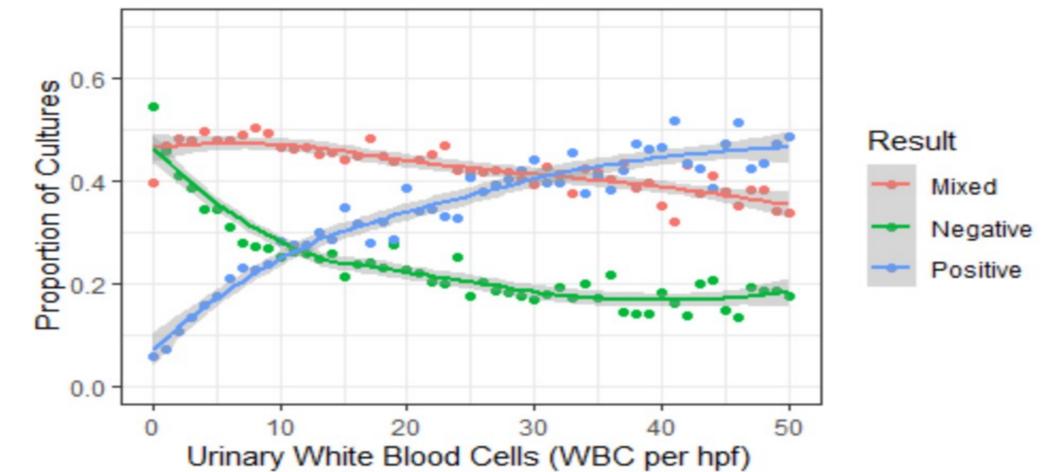
**Table 1: Diagnostic performance of individual UA parameters for clinically significant bacteriuria**

Leukocyte Esterase	≥Trace	≥1+	≥2+
<b>Sensitivity</b>	0.87	0.78	0.58
<b>Specificity</b>	0.55	0.67	0.83
<b>PPV</b>	0.43	0.48	0.57
<b>NPV</b>	0.91	0.89	0.84
WBC Count/hpf	≥5	≥10	≥20
<b>Sensitivity</b>	0.78	0.61	0.41
<b>Specificity</b>	0.55	0.73	0.86
<b>PPV</b>	0.32	0.38	0.44
<b>NPV</b>	0.90	0.87	0.84
Nitrite	Positive		
<b>Sensitivity</b>	0.41		
<b>Specificity</b>	0.95		
<b>PPV</b>	0.75		
<b>NPV</b>	0.80		
Bacteria Count/hpf	5-50	>50	
<b>Sensitivity</b>	0.92	0.75	
<b>Specificity</b>	0.39	0.75	
<b>PPV</b>	0.39	0.57	
<b>NPV</b>	0.92	0.88	

NPV-Negative Predictive Value, PPV-Positive Predictive Value, hpf- high powered field  
N may vary by parameter as different UA panels may or may not include all parameters.  
Also, missing or erroneous results were excluded (e.g., colorimetric interference with nitrite assay for example).

## Results

- There were 240,195 encounters with UA and urine culture results during the 6-year period; 50.7% included a microscopic UA.
- 29% percent were positive, 30.7% were negative, 46.9% were mixed urine cultures. 38% were outpatient encounters.
- Table 1 shows the sensitivity, specificity, negative predictive value (NPV) and positive predictive value (PPV) of microscopic UA parameters for clinically significant bacteriuria.
- WBC count distributions for positive and negative cultures crossed at a value of 10/high powered field (Figure below).



## Conclusions

- Trace leukocyte esterase and low-level pyuria had a high NPV and could help physicians rule out clinically significant bacteriuria. No single UA parameter had a high enough PPV to predict clinically significant bacteriuria.
- Future studies should look at combining UA parameters to improve NPV and PPV, and evaluate the performance of these criteria for clinical diagnosis of UTI.