# AIxURO: Enhancing Diagnostic Accuracy in Bladder Cancer Detection with AI-Assisted Urine Cytology

S. Lajara, W.L. Yang, G.W. Shao, T.J. Liu, S.N. Khader

PRESENTED BY

**Sigfred Lajara, MD**

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# Introduction

- ***Objective:***

  Assess the diagnostic performance of AIxURO in detecting high-grade urothelial carcinoma using whole-slide images. AIxURO is an AI-assisted tool for urine cytology that is aligned with The Paris System for Reporting Urinary Cytology guidelines.

- ***Rationale:***

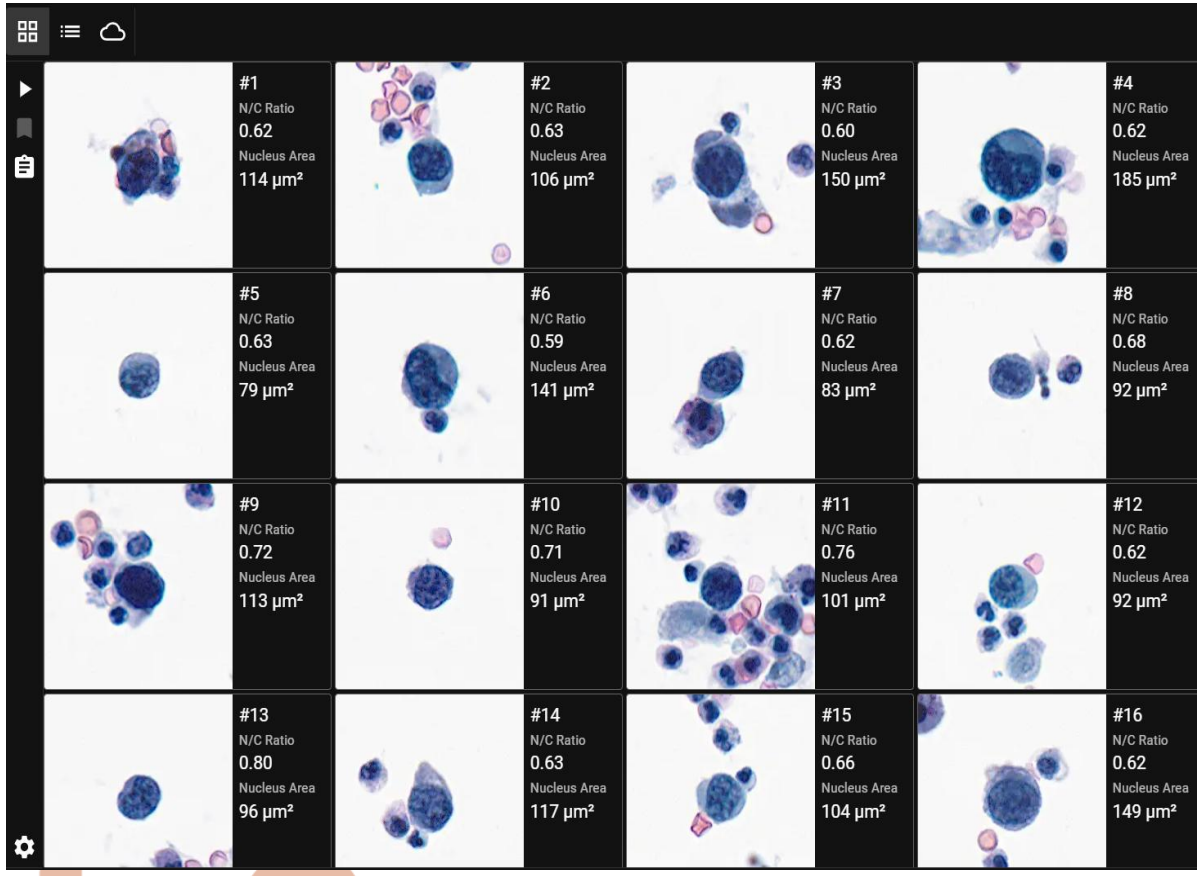
  Urine cytology interpretation can be subjective; AIxURO has the potential to improve accuracy by providing easily accessible objective parameters.

- ***Hypothesis:***

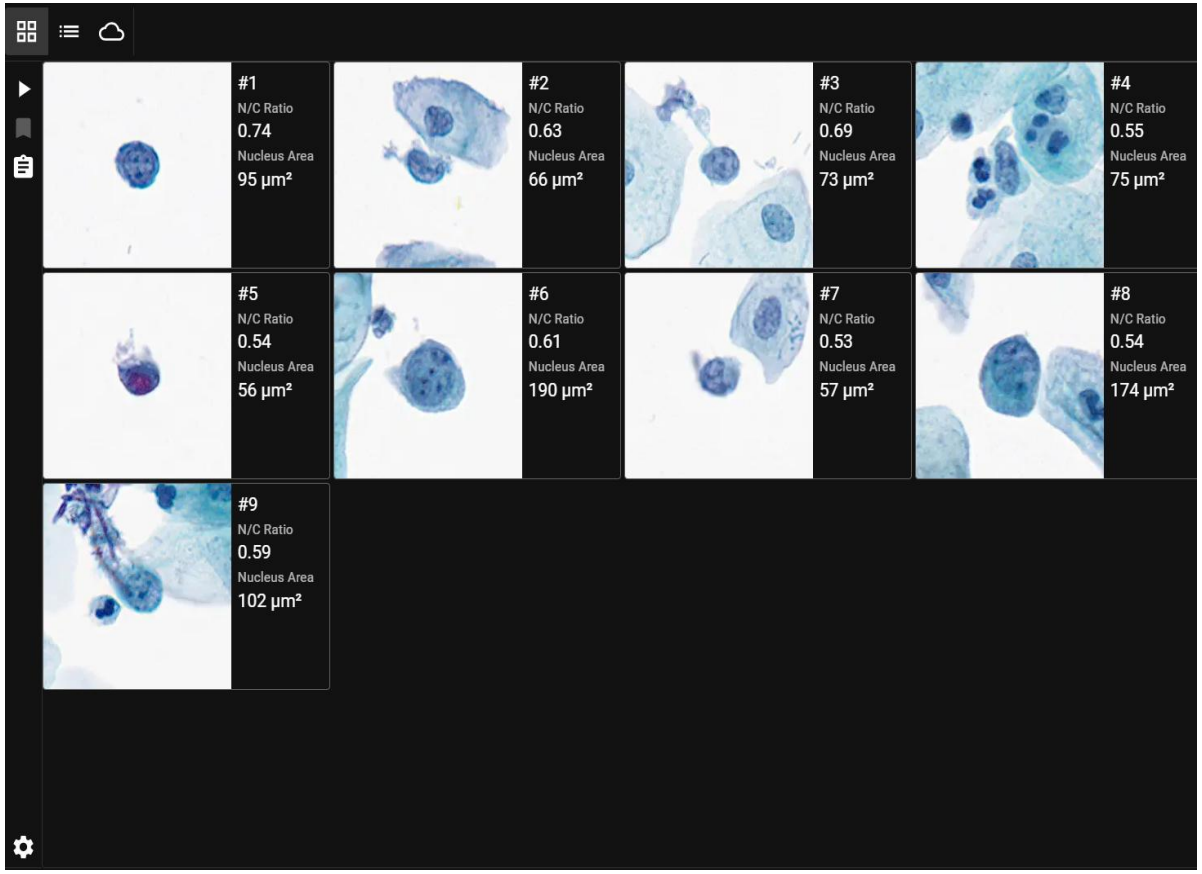
  AIxURO enhances sensitivity and accuracy compared to microscopy and performs consistently across different digital slide scanners.

# AI-generated Thumbnail Gallery Ranks Target Cells by Cytomorphologic Features for Focused Review

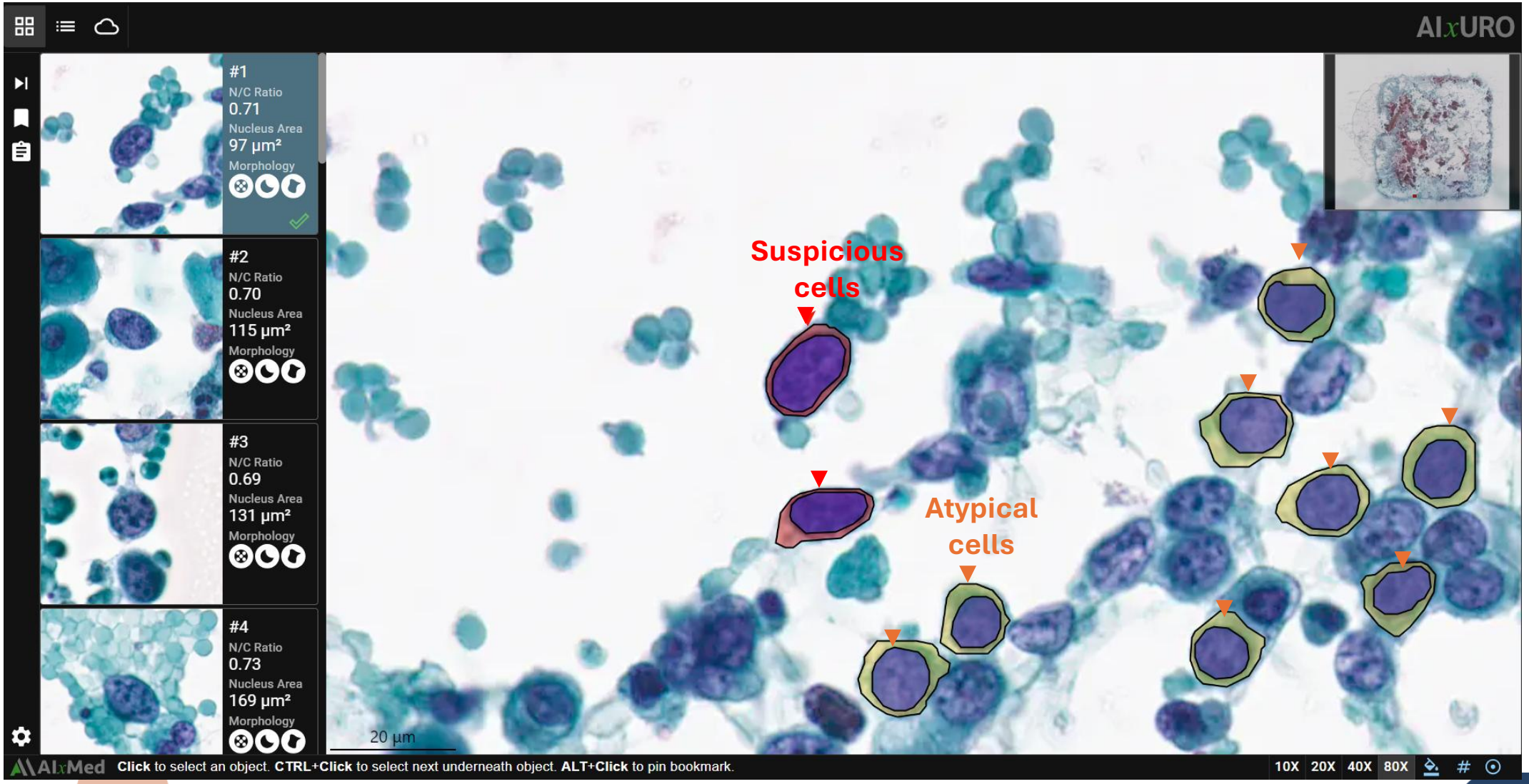
## HGUC case



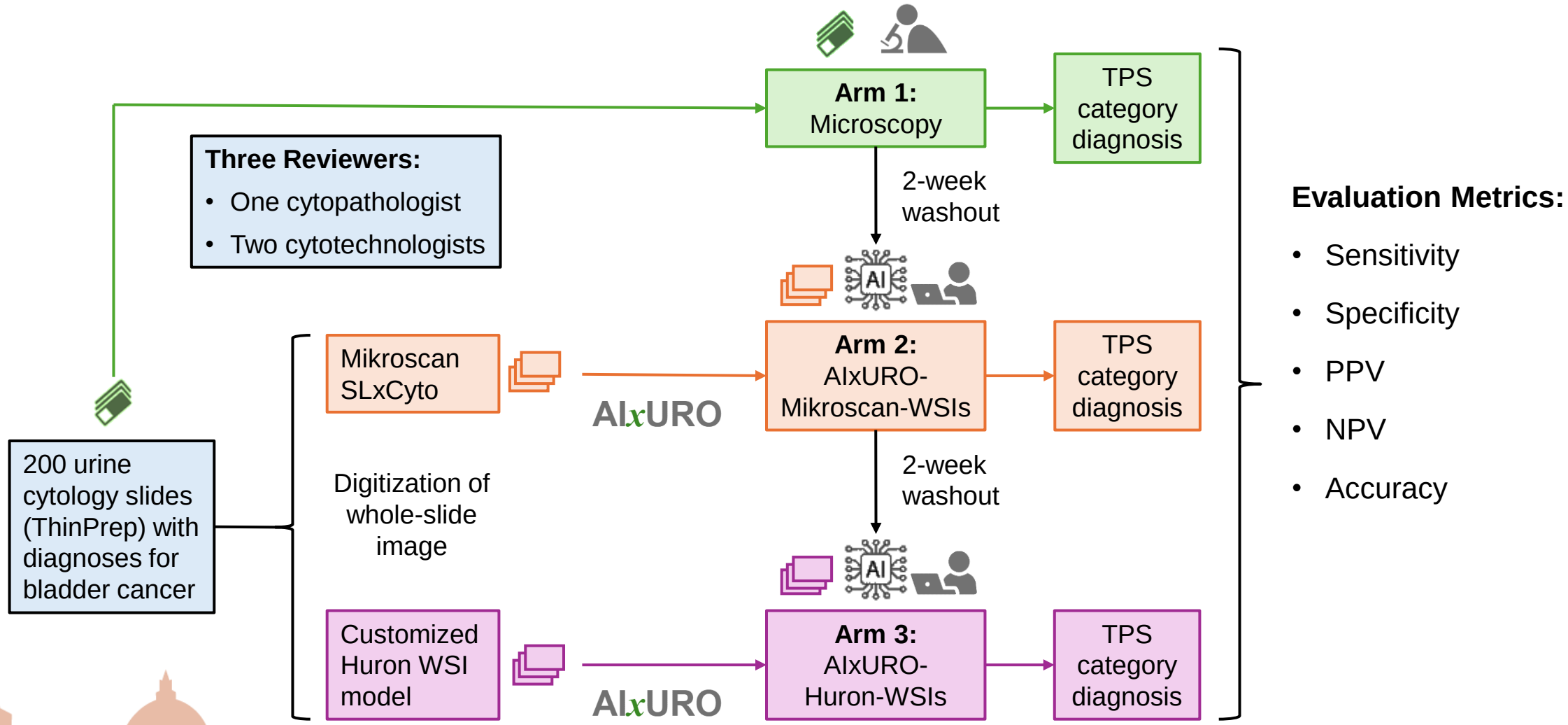

## NHGUC case



# Interface of AIxURO Viewing Software



# Study Design




**Evaluation Metrics:**

- Sensitivity
- Specificity
- PPV
- NPV
- Accuracy

# Results:

**Distribution of Cytology Cases by TPS Diagnostic Categories**

| TPS Cytology Category | Case Number |
|---|---|
| NHGUC | 100 (50.0%) |
| AUC | 35 (17.5%) |
| SHGUC | 32 (16.0%) |
| HGUC | 33 (16.5%) |
| Total | 200 (100.0%) |

**Binary Diagnosis by the Cytology Report**

**N= 200; total 600 reads**

Negative: NHGUC

Positive: AUC/SHGUC/HGUC (AUC+)

| Modality | Arm 1: Microscopy | Arm 2: AIxURO-Mikroscan-WSIs | Arm 3: AIxURO-Huron-WSIs |
|---|---|---|---|
| Sensitivity | 79.3% | 85.0% | 88.3% |
| Specificity | 94.3% | 85.7% | 82.3% |
| PPV | 97.4% | 94.9% | 94.2% |
| NPV | 48.6% | 53.2% | 63.8% |
| Accuracy | 86.8% | 85.3% | 85.3% |

# Results:

## Distribution of Cases by Biopsy Diagnostic Categories

| Number of Cases with Available Biopsy Reports | 98 (49.0%) |
|---|---|
| **Biopsy Category** | **Case Number** |
| NHGUC | 20 (20.4%) |
| LGUC | 5 (5.1%) |
| AUC (Favor Reactive) | 4 (4.1%) |
| AUC | 2 (2.0%) |
| SHGUC | 1 (1.0%) |
| CIS | 17 (17.3%) |
| HGUC | 49 (50.0%) |
| Cytology and Biopsy Reports Obtained Within a 3-month Interval | 72 (73.5%) |

## Binary Diagnosis by the Biopsy Report

**N= 72; total 216 reads**

Negative: NHGUC/LGUC/AUC (Favor Reactive)

Positive: AUC/SHGUC/CIS/HGUC

| Modality | Arm 1: Microscopy | Arm 2: AIxURO-Mikroscan-WSIs | Arm 3: AIxURO-Huron-WSIs |
|---|---|---|---|
| Sensitivity | 84.6% | 92.0% | 93.2% |
| Specificity | 59.2% | 55.6% | 50.0% |
| PPV | 89.3% | 89.2% | 88.2% |
| NPV | 49.0% | 63.4% | 64.8% |
| Accuracy | 78.2% | 82.9% | 82.4% |

# Results:

## Distribution of Cases by Biopsy Diagnostic Categories

| Number of Cases with Available Biopsy Reports | 98 (49.0%) |
|---|---|
| **Biopsy Category** | **Case Number** |
| NHGUC | 6 (6.1%) |
| LGUC | 1 (1.0%) |
| AUC (Favor Reactive) | 0 (0.0%) |
| AUC | 0 (0.0%) |
| SHGUC | 0 (0.0%) |
| CIS | 1 (1.0%) |
| HGUC | 8 (8.2%) |
| Cytology and Biopsy Reports Obtained Within a 3-month Interval When the Indication Is Hematuria | 16 (16.3%) |

## Binary Diagnosis by the Biopsy Report

**N= 16; total 48 reads**

Negative: NHGUC/LGUC/AUC (Favor Reactive)

Positive: AUC/SHGUC/CIS/HGUC

| Modality | Arm 1: Microscopy | Arm 2: AIxURO-Mikroscan-WSIs | Arm 3: AIxURO-Huron-WSIs |
|---|---|---|---|
| Sensitivity | 90.0% | 96.7% | 100.0% |
| Specificity | 77.8% | 77.8% | 77.8% |
| PPV | 94.2% | 94.6% | 93.7% |
| NPV | 66.0% | 85.4% | 81.8% |
| Accuracy | 85.4% | 89.6% | 91.7% |

# Conclusions

- With using AIxURO, there was improved sensitivity and accuracy in detecting bladder cancer compared to conventional microscopy, both when comparing with the ground truth and biopsy reports.
- Demonstrated consistent results using two digital WSI platforms.
- Shows strong potential for clinical adoption of AI-assisted urine cytology.

# Conclusions

- Limitations
  - Reviewers were only provided with patient age and gender. While in our practice, we mostly have access to clinical histories and cystoscopy reports.
  - History was limited to what was mentioned in the report.
    - Plan to review clinical history in the electronic medical record.
  - The biopsy results were only based on report review.
    - Plan to have surgical pathology slides reviewed by a GU pathologist.

# Thank You