Are Culture-Directed Antibiotics Superior in Preventing Complications of Prostate Biopsy: A Comprehensive Look at Over 60,000 Prostate Biopsies in Michigan

Andrew Harris[1], Cory Taylor[1,2], Sabir Meah[3], Corinne Labardee[3], Tudor Borza[3], Brian R. Lane[1,4], for the Michigan Urological Surgery Improvement Collaborative[3]

[1]Michigan State University College of Human Medicine, Grand Rapids, MI
[2]University of Pittsburgh Medical Center, Pittsburgh, PA
[3]Michigan Medicine, Ann Arbor, MI
[4]Corewell Health West, Grand Rapids, MI

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Introduction

Prostate cancer is the most common solid malignancy among men in the United States, with about **1 in 8** diagnosed during their lifetime.[1] **Prostate biopsy (PB)** remains the diagnostic gold standard, yet the traditional **transrectal (TR)** approach carries risk of infection from rectal flora exposure.[2]

Historically, **fluoroquinolones (FQs)** have been the mainstay of prophylaxis, but the rise of **FQ-resistant *E. coli*** has led to higher rates of post-biopsy sepsis and hospitalization, contributing to both **antimicrobial resistance** and substantial healthcare costs.[3],[4]
To reduce these complications, two prophylactic strategies have gained traction:

- **Culture-Directed Antibiotics (CDA):** guided by rectal swab cultures.
- **Multiple Antimicrobial Agents (MAA):** empiric combination therapy.

Prior data from the **Michigan Urological Surgery Improvement Collaborative (MUSIC)** demonstrated that both CDA and MAA lower infection-related hospitalizations compared with single-agent prophylaxis.[5] Meanwhile, the **transperineal (TP)** biopsy technique bypasses the rectum, achieving **very low infection rates without antibiotics**.[6],[7]

Objective:
To compare infection-related complications among **TR-PB with CDA**, **TR-PB with MAA**, and **TP-PB without antibiotics**, and to evaluate outcomes across practices with **routine vs. selective CDA use**.

Methods

Study Design
Retrospective cohort study using data from the MUSIC registry:

- All prostate biopsies performed between **March 2012 – November 2020** were included.

Patients were categorized into three biopsy pathways:

Biopsy Technique	Antibiotic Strategy	Description
Transrectal (TR)	**Culture-Directed Antibiotics (CDA)**	Pre-biopsy rectal swab guides targeted therapy
Transrectal (TR)	**Multiple Antimicrobial Agents (MAA)**	Empiric combination prophylaxis
Transperineal (TP)	**No Antibiotics**	Rectum bypassed; antibiotics not routinely given

Data were collected on **patient factors** (age, race, BMI, diabetes), **biopsy factors** (number of cores, prostate volume), and **30-day outcomes** including infectious complication, infectious hospitalization, emergency department (ED) visit, and hospital readmission.
Univariate and multivariable logistic regression analyses were performed, adjusting for clustering within urologist and patient, with statistical significance defined as $p < 0.05$.

Results

Study Population

- **69,016 prostate biopsies** analyzed.
- Median age: **65 years (IQR 59–70)**
- **14%** of patients had diabetes.
- **77%** were White; **12%** were Black.

Figure 1: Biopsy Technique

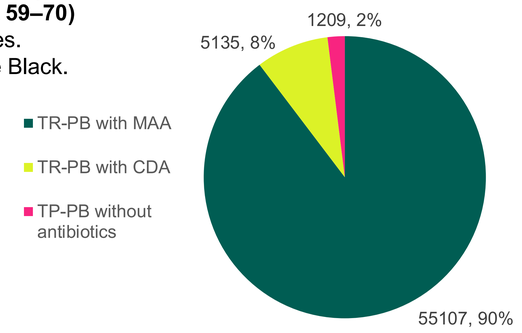
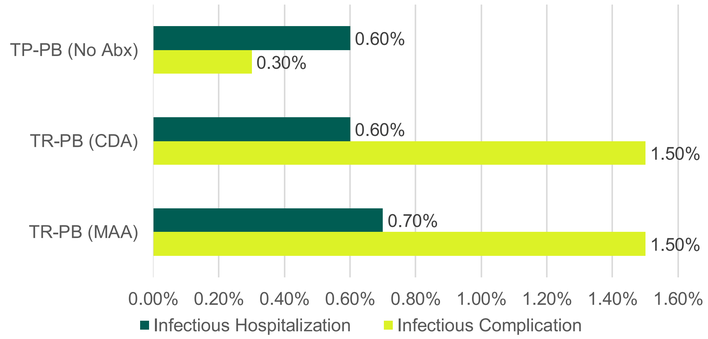
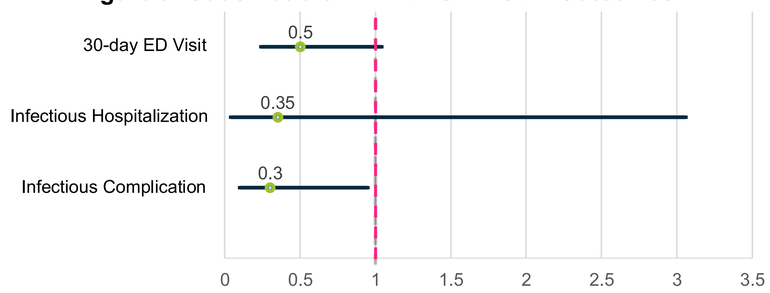


Figure 2: Complication Rates by Biopsy Technique



Infectious complications occurred in approximately **1.5%** of men following TR-PB with either MAA or CDA. **Infectious hospitalization** rates were **0.7%** for MAA and **0.6%** for CDA, with no significant difference between the two. In contrast, **TP-PB without antibiotics** demonstrated the **lowest infection rate (0.3%)**, which was **statistically significantly lower** than both TR-CDA and TR-MAA ($p = 0.017$), while maintaining **similar hospitalization rates (0.6%)**.

Figure 3: Odds Ratio of TP-PB vs TR-CDA Outcomes



Multivariable regression showed that transperineal biopsy was associated with significantly **lower odds of infectious complications** compared with TR-CDA (**OR 0.30, 95% CI 0.10–0.95, $p = 0.04$**). Odds of hospitalization (OR 0.35) and 30-day ED visits (OR 0.50) were lower but not statistically significant.

Conclusions

CDA and MAA prophylaxis **profiles during transrectal** prostate biopsy (TR-PB), with no significant difference in infection or hospitalization rates.

Selective use of CDA (rather than routine use) was associated with a **lower infectious hospitalization rate** ($p = 0.046$), suggesting value in targeted implementation.

Transperineal biopsy (TP-PB) demonstrated the **lowest rate of infectious complications** (0.3%) — despite no antibiotic prophylaxis — supporting its use as a safe, antibiotic-sparing alternative.

Prostate volume and number of cores were not associated with infection risk.

Both **CDA and MAA remain safe**, effective strategies for TR biopsy.

TP biopsy offers the lowest infection risk and supports antibiotic stewardship.

Expanding TP biopsy access may reduce infection-related hospitalizations and antimicrobial resistance statewide.

Limitations
Retrospective design
Non-randomized practice variation
Lower sample size in CDA and TP groups compared with MAA

References

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Acknowledgements

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