TABLE 1. Seroreactivity in Donors and Microbiological Culture Positivity Rate in Blood Products at Tata Medical Center, Kolkata, India

Seroreactivity in donors (September 2013–August 2014)	Anti-HIV: 13 of 6,900 (0.19%)
	HBsAg: 47 of 6,900 (0.68%)
	Anti-HCV: 55 of 6,900 (0.79%)
	RPR test for syphilis: 12 of 6,900 (0.17%)
	Malaria antigen test: 0 of 6,900 (0%)
Microbiological culture positive rate in blood products	Packed RBCs: 2 of 31 (6.45%); *Staphylococcus warneri, Sphingomonas paucimobilis*
(September 2013–August 2014)	Platelets: 1 of 46 (2.1%); *Micrococcus luteus*
	Fresh-frozen plasma: 2 of 15 (13.3%); *S. warnerii, S. epidermidis*

NOTE. HIV, human immunodeficiency virus; HBsAg, hepatitis B surface antigen; HCV, hepatitis C virus; RPR, rapid plasma reagin; RBC, red blood cells.

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Infectious Complications Following Transrectal Ultrasound-guided Prostate Biopsy: A Canadian Tertiary Cancer Center Experience

To the Editor—Transrectal ultrasound (TRUS)-guided prostate biopsy, used to diagnose prostate cancer, is associated with infectious complications ranging from simple cystitis to severe sepsis.[1] Antimicrobial prophylaxis prior to TRUS-guided prostate biopsy, most commonly using ciprofloxacin, has been shown to reduce infectious complications.[2] Recent reports, however, have documented increasing rates of infections complicating TRUS-guided prostate biopsy, including infections secondary to fluoroquinolone-resistant *Escherichia coli*.[3]

We reviewed the temporal trends of infectious complications following TRUS-guided prostate biopsy at Princess Margaret Cancer Center, a 130-bed Canadian tertiary-care cancer center in Toronto, Canada, where ciprofloxacin prophylaxis is routinely prescribed prior to these procedures. Passive surveillance for complications following TRUS-guided prostate biopsy has been conducted since 2003. Following biopsy, patients are provided with both written and verbal instructions to return to the emergency department if they develop complications including fever, dysuria, or hematuria within 1 week of biopsy and to contact their urologist. Additionally, at the bottom of each computer-generated procedure report sent to the referring physician, the following message appears: "Please let us know if the patient has any late complications."

A telephone number for a private voicemail is provided. Finally, all patients who return for repeat procedures to our center are questioned about complications of the last procedure. A database is maintained that includes presenting symptoms, clinical syndrome, and results of microbiologic investigations.

We performed a retrospective cohort study of all patients with infectious complications occurring within 30 days of TRUS-guided prostate biopsy between January 1, 2003, and December 31, 2013. Definite infections were defined as either a positive blood or urine culture in patients meeting National Healthcare Safety Network (NHSN) criteria for bloodstream or urinary tract infection, respectively. Possible infections were defined as a clinical diagnosis and empiric treatment for cystitis, pyelonephritis, prostatitis, epididymo-orchitis, or sepsis without culture confirmation. Differences in proportions of complications over time were calculated using a χ^2 test. Approval was received from the hospital's Research Ethics Board.

A total of 19,279 men underwent TRUS-guided prostate biopsy during the study period. Their median age was 63 years (interquartile range, 58–70 years) with a mean prostate volume of 49 ± 24 mL. More than 97% of patients received ciprofloxacin 500 mg twice daily for 3 days starting on the night before the procedure. Infectious complications occurred in 159 of the 19,279 patients (0.8%). Between 2003 and 2013, overall infectious complications, including definite and possible infections increased from 0.3% to 1.9%; definite urinary tract infections increased from 0.05% to 0.8% ($P < .0001$); and bloodstream infections increased from 0.1% to 0.6% ($P < .0001$) (Figure 1). *E. coli* accounted for 85 of 89 positive cultures (95%) from urine and blood, of which 93% were resistant to ciprofloxacin. Resistance of *E. coli* isolates was as follows: trimethoprim/sulfamethoxazole, 58%; gentamicin, 42%; cephalosporins, 32%; and nitrofurantoin, 8%. Excluding nitrofurantoin resistance, 34 of 85 *E. coli* isolates (40%) were resistant to ≥ 3 of the antimicrobial classes listed.

Our center, similar to many other centers across North America, continues to use ciprofloxacin as the standard prophylactic agent to prevent TRUS-guided prostate biopsy-associated infections. Over the past 10 years, we observed a significant increase in the proportion of TRUS-guided prostate biopsies associated with infectious complications. The vast majority of clinical isolates were ciprofloxacin resistant. Increases in infectious complications following TRUS-guided biopsy have been shown to have a significant impact on healthcare resource utilization. Nam et al[4] described an increase in 30-day hospital admission rate from 1.0% in 1996 to 4.1% in 2005 ($P < .0001$) in Ontario, Canada, following TRUS-guided prostate biopsy; the majority of admissions (72%) were related to infection.

Our findings are consistent with a previous study reporting a 92% rate of ciprofloxacin resistance in *E. coli* isolates causing infection following TRUS-guided biopsy.[5] A recent Australian study reported that fluoroquinolone-resistant *E. coli* sequence type 131, a rectal commensal that is highly transmissible, virulent, and resistant to multiple antimicrobial classes, represented

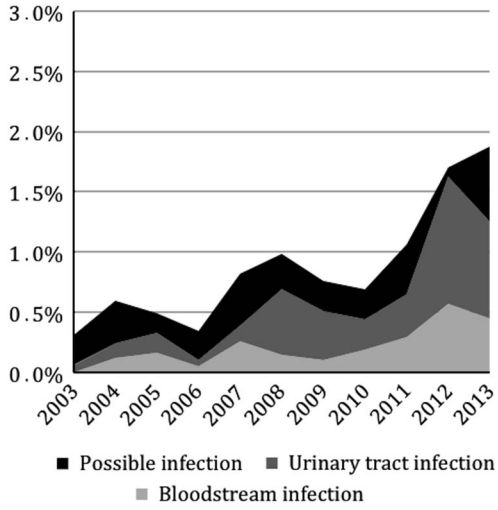

FIGURE 1. Percentage of transrectal ultrasound-guided prostate biopsies associated with infectious complications over time at a Canadian tertiary cancer center.

40% of *E. coli* isolates causing infections in post-TRUS-guided prostate biopsy.[6] Because our surveillance system was passive, specimens were unavailable for typing in our study.

An effective strategy to curtail this rise in infectious complications remains unclear. Due to the presence of multidrug resistance associated with fluoroquinolone-resistance in our study, changing to a single standard prophylactic agent would likely be an ineffective or unsustainable solution. However, rectal swab cultures performed prior to biopsy may allow for targeted antimicrobial prophylaxis strategies. Previous researchers have demonstrated a reduction in both the incidence of infection and cost of care using targeted or additional antimicrobial prophylaxis in men undergoing TRUS-guided prostate biopsy whose preprocedural rectal swab cultures identified fluoroquinolone-resistant bacteria.[7,8] Other adjunctive measures to prevent infection, such as rectal decontamination using nonabsorbable antibiotics, have been considered; however, few data are available to support their efficacy.[2]

A significant limitation of our study is that we relied on a passive method of surveillance to detect complications, which may have failed to detect patients who presented to other institutions with complications. Therefore, the proportion of TRUS-guided prostate biopsies associated with infectious complications in our study may represent an underestimate, which further reinforces the need to readdress preventive strategies.

Due to multidrug resistance among fluoroquinolone-resistant *E. coli* causing infection post-TRUS-guided prostate biopsy at our center, our study did not identify a clear alternate antimicrobial agent for prophylaxis. Further prospective evaluation of targeted prophylaxes, the utility of prior antibiotic history in the selection of prophylactic agent, and nonantibiotic prevention strategies is needed.

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Characteristics of Primary Literature in the Field of Antimicrobial Stewardship, 2000-2013

To the Editor—The spread of drug-resistant pathogens and a lack of novel antimicrobial agents impact human health worldwide. Consequently, antimicrobial stewardship (AS) strategies that conserve the utility of existing antimicrobials and enhance appropriate drug use are of significant importance. Current and widespread interest in AS is reflected by recent governmental statements supporting the expansion of AS initiatives and by a recent white paper from the Society for Healthcare Epidemiology of America that provides guidance for the knowledge and skills required for AS leaders.[1,2] In directing AS efforts, evidence-based interventions are required to ensure the most efficient use of available resources.

A guideline for the development of an institutional program to enhance AS was published in 2007 by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America.[3] Additionally, several reviews have been published on the topic.[4,5] Such publications provide a detailed analysis and perspective of the literature, but opportunity exists to provide a more global perspective on the status of this area of research. The purpose of this letter is to complement existing literature, document trends in practice, elucidate knowledge gaps, and identify future needs by objectively describing characteristics of original AS research from 2000 to 2013.

A structured literature search utilizing PubMed (http://www.ncbi.nlm.nih.gov/pubmed) was performed in August 2014 using the term "antimicrobial stewardship" to identify existing publications within this area of study. Search filters included the following: abstract available, human species, English language, and publication date from January 1, 2000, through December 31, 2013. Search results were exported into a spreadsheet (Excel; Microsoft) and publications were individually assessed. Non-primary literature and publications not investigating an AS strategy were excluded from the analysis. Remaining studies were assessed for the following characteristics: year of publication, journal title, journal profession affiliation(s), author profession(s), location(s) of research, institution type, study focus, and financial data. Journal profession affiliations were determined by reviewing online journal descriptions. The 2007 Infectious Diseases Society of America/ Society for Healthcare Epidemiology of America AS Guideline was used to define and categorize the AS strategy or strategies investigated within each publication.

The literature search identified 305 unique publications, of which 88 (29%) were found to be primary literature investigating an AS strategy. Figure 1 denotes the quantity of AS literature produced annually during the study period. No studies published before 2007 met inclusion criteria, yet the number of included publications gradually increased thereafter. North America produced the largest number of