Use of Prophylactic Antibiotics to Prevent Urinary Tract Infection after Urodynamic Testing and Cystoscopy in Women: A Practice Pattern Study

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**Keywords**
Antibiotic prophylaxis · Urinary tract infection · Urodynamics · Cystoscopy · Women

**Abstract**

**Objectives:** The objective of the study was to determine practice patterns of prescribing prophylactic antibiotics against urinary tract infection (UTI) for urodynamic studies (UDS) and outpatient cystoscopy in women. **Design:** A cross-sectional survey study was conducted of North American female pelvic medicine and reconstructive specialists (FPMRS). **Methods:** An online survey was used to assess prophylactic prescribing patterns of FPMRS that perform UDS and outpatient cystoscopy. This survey was developed and then electronically disseminated through the American Urogynecologic Society to 699 eligible physicians. **Results:** A total of 138 surveys were completed. Approximately half of physicians did not prescribe any antibiotic prophylaxis for UDS or for cystoscopy (54% and 43%, respectively). For patients with perceived risk factors (recurrent UTIs, immunosuppression, known neurogenic lower urinary tract dysfunction, indwelling catheter use, elevated postvoid residual/bladder outlet obstruction, genitourinary anomalies, and diabetes), 32% and 41% of physicians prescribed antibiotic prophylaxis for UDS and cystoscopy, respectively. A minority of physicians always prescribed antibiotics for UDS and cystoscopy (13% and 17%, respectively). **Limitations:** The response rate was a limitation of the study; however, this rate is in keeping with other physician survey studies published within this subspecialty. Selection and response biases may have contributed to the results of this survey study. **Conclusion:** There was no uniform approach to UTI prophylaxis for UDS and outpatient cystoscopy in women which reflects the lack of current guidelines and the low level of evidence on which they are based. This nonuniform practice calls for more research to better define an evidence-based standard of care.

**Introduction**

Urinary tract infection (UTI) is the most common clinically significant complication after urodynamic studies (UDS) and cystoscopy. Incidence estimates of UTI following UDS and cystoscopy vary widely; however, the literature reports rates as high as 28% after UDS and 21% after cystoscopy [1, 2]. To decrease the incidence of UTI, patients are carefully selected to ensure appropriate diag-
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Diagnostics use, aseptic technique is advised, and prophylactic treatment may be prescribed.

The American College of Obstetricians and Gynecologists (ACOG) June 2018 practice bulletin did not recommend routine antibiotic prophylaxis for women undergoing either UDS or cystoscopy [3]. The former UDS recommendation was based on a 2012 Cochrane review that stated the benefit of prophylactic antibiotic use in reducing symptomatic UTI is still unclear based on “a lack of good quality studies and the need for robustly conducted and sufficiently powered randomized controlled trials” [4]. In our 2019 update of this systematic review, we found that antibiotics may significantly decrease bacteriuria in women following UDS; however, no good-quality studies were powered to address their effect on UTI incidence [5]. The latter cystoscopy recommendation is based on the American Urological Association (AUA) practice guideline that referenced numerous randomized controlled trials with conflicting results and, without critically appraising these studies, formulated the conclusion that antimicrobial prophylaxis was “probably not necessary” [6]. The 2012 Society of Obstetrician and Gynecologists of Canada (SOGC) practice guideline commented only on UDS prophylaxis and supported antibiotic prophylaxis for UDS if the practice incidence of UTI was greater than 10% [1, 7]. In the context of minimal knowledge on standard infection rates, and the difficulty in establishing practice-based rates due to patients seeking UTI treatments from different practitioners outside of their urogynecologist or urologist, these recommendations provide little guidance. Of note, a recent update of the Cochrane review on antibiotic prophylaxis for cystoscopy only indicated that antibiotic prophylaxis may reduce UTI [8].

The objective of the present study was to survey a cohort of North American female pelvic medicine and reconstructive surgery (FPMRS) specialists on their routine practice for prophylactic treatment against UTI in the context of UDS and outpatient cystoscopy in women. In addition, we aimed to determine what factors influence the practice patterns of these physicians.

### Table 1. Baseline characteristics

| Characteristic                                      | Included study respondents, n = 138 | Eligible AUGS<sup>a</sup> members, n = 699 |
|----------------------------------------------------|-------------------------------------|---------------------------------------------|
| Specialty training, n (%)                          |                                     |                                             |
| FPMRS/urogynecology                               | 133 (96.4)                          | 654 (87.7)                                 |
| FPMRS/urology                                     | 5 (3.6)                             | 45 (6.1)                                   |
| Years in practice, n (%)                          |                                     |                                             |
| <10 years                                          | 64 (46.4)                           | 332 (51.6)                                 |
| >10 years                                          | 74 (55.6)                           | 312 (48.4)                                 |
| Country of practice, n (%)                         |                                     |                                             |
| Canada<sup>b</sup>                                 | 19 (13.8)                           | 15 (2.2)                                   |
| USA                                                | 119 (86.2)                          | 684 (97.9)                                 |
| Academic or community hospital practice, n (%)     |                                     |                                             |
| Academic                                           | 92 (66.7)                           | 339 (55.5)                                 |
| Community                                          | 31 (22.5)                           | 272 (44.5)                                 |
| Both                                               | 15 (10.9)                           |                                             |
| How many female UDS do you perform per month? n (%)|                                     |                                             |
| 0                                                  | 4 (2.9)                             |                                             |
| <10                                                | 54 (39.1)                           |                                             |
| 10–20                                              | 47 (34.1)                           |                                             |
| >20                                                | 33 (23.9)                           |                                             |
| How many female cystoscopies do you perform per month? n (%)| | |
| 0                                                  | 0 (0.0)                             |                                             |
| <10                                                | 65 (47.1)                           |                                             |
| 10–20                                              | 52 (37.7)                           |                                             |
| >20                                                | 21 (15.2)                           |                                             |

AUGS, American Urogynecologic Society; FPMRS, female pelvic medicine and reconstructive surgery. <sup>a</sup>Membership information provided by AUGS. <sup>b</sup>Please note that the AUGS practice information is self-reported and data on Canadian member practice location are not accurate according to the data collected in this survey.
Materials and Methods

Study Design and Setting
This was a cross-sectional survey study that was distributed to members of the American Urogynecologic Society (AUGS) between August 2019 and November 2019. This project was reviewed and approved by the Mount Sinai Hospital Research Ethics Board (ID# 19-0026-E).

AUGS has 1,166 physician members that were contacted, of whom 699 members were deemed eligible based on study inclusion and exclusion criteria. The survey was conducted online using an electronic survey tool, SimpleSurvey (SimpleSurvey, Montreal, QC, Canada). Based on both the authors’ prior experience and published survey response rates for physician specialists, a convenience sample size of 140, based on a 20% response rate, was set as the target. This was calculated to provide a 95% confidence level and a 7% confidence interval.

Participant Selection
North American physicians that perform UDS and/or outpatient cystoscopy in women and were members of AUGS were eligible to participate in this study. Participants were excluded if they (1) had not completed a fellowship in FPMRS and (2) currently identified as a resident, fellow, or another nonattending role.

Survey Design
All survey questions were developed by the study investigators. Three experts in the field gave qualitative feedback on the survey and these comments were incorporated into the tool. A select sample of five FPMRS physicians were sent the survey to ensure there were no issues with survey comprehension and completion. The survey was reviewed by the AUGS scientific committee where it was then approved for dissemination through the society. The survey was sent to the membership on three separate occasions over the course of 3 months. No other North American society in this subspecialty allows access to their membership for survey distribution and therefore contact for the present study was limited to only the AUGS membership.

The survey collected baseline demographic data and included specialty training, type of practice (academic vs. nonacademic), years in practice, location of practice, and monthly frequency of UDS and cystoscopy procedures. Physicians were then asked their current prescribing patterns for UTI prophylaxis pre- and post-UDS and outpatient cystoscopy, as well as factors that could affect their prescription of prophylaxis. Respondents were also asked to provide sample prescriptions given for prophylactic indications if applicable.

AUGS provided demographic information (type of training as well as years, location, and type of practice) on physician-members eligible to participate in the study. This allowed for response rate calculation and comparison of the survey respondents to the eligible physician-membership population of AUGS.
Statistical Analysis

All analyses were performed using STATA 14.2. Descriptive statistics, including frequencies and proportions, were used to define the practice pattern of physicians as well as factors influencing their decisions. Nonparametric data were analyzed using the Mann-Whitney Test for nonpaired ordinal data, and the Wilcoxon match-paired signed-ranks test was used for paired ordinal data. The Kruskal-Wallis equality-of-populations rank test was used for comparing nonparametric independent measures among more than two groups.

Results

Demographic Characteristics

Of the 699 eligible AUGS membership, 215 completed the survey. Of these, 72 were immediately excluded as 16 identified as fellows, 15 identified as other nonattending physicians, 4 identified as practicing outside of North America, 41 had not completed a fellowship in FPMRS, and one fellowship-trained North American physician reported performing no UDS and no outpatient cystoscopy. The remaining 138 completed surveys were included in the study analysis (19.7% response rate). Baseline demographic characteristics for the survey respondents as well as general demographics on AUGS members that were eligible to complete the survey are summarized in Table 1. The geographic distribution of respondents is demonstrated in Figure 1.

Prescription Patterns

Figure 2 depicts physician prophylactic prescribing habits. Table 2 summarizes the frequency of which certain patient risk factors prompted such prophylaxis. All physicians that either always or occasionally prescribed prophylaxis prescribed antibiotics for both UDS and cystoscopy. One participant reported use of additional prophylactic supplements for UDS (specifying they give cranberry tablets if these were available to the patient), and one participant reported the same for cystoscopy. One participant also stated they encouraged increased water intake for 48 h after UDS.

No difference was noted in use of antibiotic prophylaxis when comparing Canadian and American physicians. Physicians working at nonacademic sites tended to be more likely to prescribe prophylactic antibiotics (p = 0.02 and p = 0.09 for UDS and cystoscopy, respectively) and physicians that were less than 5 years in practice were more likely to prescribe prophylactic antibiotics (p = 0.0001 and p = 0.013 for UDS and cystoscopy, respectively). The number of UDS/cystoscopies performed per month appeared to have no systematic effect on prophylactic prescription patterns.

Specific antibiotics prescribed and the timing when patients are meant to take the antibiotics are given in Figures 3 and 4. Dosing and length of antibiotic course was extremely variable. For both UDS and cystoscopy, nitrofurantoin was the most frequently prescribed antibiotic, typically in the form of a one-time 100-mg dose. This spe-
### Table 2. Patient risk factors promoting prophylaxis administration

| Risk Factor                                | Urodynamics, n = 43 | Cystoscopy, n = 56 |
|--------------------------------------------|---------------------|--------------------|
| **Demographic, n (%)**                     |                     |                    |
| Age 61–70                                   | 1 (2.3)             | 1 (1.8)            |
| Age >70                                     | 6 (14.0)*           | 7 (12.5)           |
| **Comorbidities, n (%)**                    |                     |                    |
| Diabetes mellitus                           | 9 (20.9)            | 10 (17.9)          |
| Obesity                                     | 1 (2.3)             | 1 (1.8)            |
| Immunosuppression                           | 23 (53.5)*          | 21 (37.5)          |
| Cardiac valvular disease                    | 4 (9.3)             | 4 (7.1)            |
| Total joint implant                         | 5 (11.6)*           | 6 (10.7)           |
| Recent prolonged hospitalization            | 2 (4.7)             | 3 (5.4)            |
| Nutritional deficiencies                    | 2 (4.7)             | 2 (3.6)            |
| **Lower urinary tract specific history, n (%)** |                 |                    |
| Genitourinary anomalies                     | 8 (18.6)*           | 10 (17.9)          |
| Prior urological surgery                    | 2 (4.7)             | 2 (3.6)            |
| Hx of recurrent UTIs                        | 34 (79.0)           | 46 (82.1)          |
| Indwelling catheters                        | 13 (30.2)*          | 12 (21.4)          |
| Neurogenic lower urinary tract dysfunction  | 13 (30.2)*          | 12 (21.4)          |
| Elevated post void residual or bladder outlet obstruction | 11 (25.6)* | 12 (21.4) |
| Prior cancellation for UTI                  | 1 (2.3)             | 1 (1.8)            |
| Recent UTI                                  | 1 (2.3)*            | 1 (1.8)            |
| Current positive dipstick                   |                     |                    |
| Patient request                             | 2 (4.7)             | 1 (1.8)            |
| Institutional policy                        | 0                   | 1 (1.8)            |
| Sediment seen                               | 0                   | 1 (1.8)            |
| Instrumentation/trauma to tissue (i.e., biopsy/injection) | 0 | 3 (5.4)* |
| Concomitant UDS                             | 0                   | 1 (1.8)            |

UTI, urinary tract infection; UDS, urodynamic studies. Bolded and * indicate risk factors proven to increase UTI incidence after urological procedures in published literature [5, 8].

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**Fig. 3.** Antibiotics prescribed for prophylaxis.
specific prescription encompassed only 18% of all regimens. All nitrofurantoin prescriptions made up 40% of the regimens and ranged from a 1- to 5-day course. Ciprofloxacin and trimethoprim/sulfamethoxazole were the next most common antibiotics given.

In addition, 86% and 94% of physicians stated they routinely prepared the vagina and/or urethra with antiseptic preparation (e.g., betadine) for UDS and cystoscopy, respectively. Routine sterile draping was reported by 13% and 36% for the respective procedures. No associations were noted between use of routine antiseptic preparation or sterile draping and prescription of prophylactic antibiotics.

Discussion

This was a survey study of a diverse sample of North American FPMRS physicians investigating their prescribing habits for prophylaxis against UTI following UDS and office cystoscopy. Our results showed that only approximately half of surveyed physicians follow current ACOG, AUA, and SOCG guideline recommendations and do not prescribe any prophylaxis for women undergoing UDS and office cystoscopy. Only a minority of surveyed physicians always prescribed antibiotics for prophylaxis after UDS and cystoscopy (13% and 17% respectively) and approximately a third of surveyed physicians prescribed antibiotic prophylaxis based on perceived risk factors predominantly supported by the literature. Interestingly, the most common risk factor given as an impetus to prescribe antibiotic prophylaxis was a history of recurrent UTIs, which has been previously found to not be a risk factor associated with developing UTI after UDS [9].

This finding of noncompliance to guideline recommendations is certainly cause for concern and should instigate further research in this area. This rate of poor adherence is regrettably in keeping with published general guideline adherence rates and, specifically, a Japanese study that demonstrated only a 42% adherence to cystoscopy guidelines for antimicrobial prophylaxis [10]. Though analyses in the literature have indicated numerous possible external barriers to guideline implementation in all areas of medicine, internal barriers of lack of evidence, lack of applicability in general, and lack of applicability to patients also appear relevant in this context [11]. The ACOG guideline is based on an AUA review of contradicting evidence and a Cochrane review summarizing a “lack of good quality studies” [3, 4, 6]. The SOCG recommendation is only applicable if physicians know their practice-specific rate of UTI complication after UDS and cystoscopy, a rate that is not generally established by most specialists and likely less relevant in patients with specific risk factors [8]. Our study and the nonuniform practice patterns it revealed suggest that further research is required to better formulate current UDS and cystoscopy prophylaxis guidelines by establishing the true need and efficacy of antibiotic prophylaxis against UTI women patients undergoing UDS and/or outpatient cystoscopy.

The current study also investigated the association between various physician characteristics and prophylaxis prescribing patterns. The associations we found were largely unexpected. Physicians that were less than 5 years in practice tended to be more likely to prescribe prophylactic antibiotics. This is in contradiction to the commonly held notion that mid- and late-career physicians are more likely to prescribe antibiotics [12]. Despite the recent focus on antimicrobial stewardship and its mandatory adoption at all academic training sites, recent-graduates/early-career physicians appear to find themselves more cautious [13]. On the other hand, the number of UDS/cystoscopies performed per month, which could affect complication prophylaxis, appeared to have no systematic effect. Furthermore, physicians working at nonacademic sites tended to be more likely to prescribe prophylactic antibiotics. This phenomenon, while well acknowledged across specialties, is difficult to pin on a lack of local resources and/or staff training as we previously...
noted that the most recently trained staff also have this inclination [14].

Antibiotic regimens, including antibiotic type, dosage, timing, and length of treatment, reported by survey respondents were extremely variable and yet appeared to be guided by the limited evidence available. At least eight different specific antibiotics were noted and up to 64 different regimens were reported. The most commonly prescribed antibiotics were nitrofurantoin, trimethoprim/sulfamethoxazole, and ciprofloxacin and have all been previously recommended as first- or second-line antimicrobial agents for acute uncomplicated cystitis by the Infectious Diseases Society of America, the European Society for Microbiology and Infectious Diseases, the American Academy of Family Physician, the College of Family Physicians of Canada, and the ACOG [15–18]. Furthermore, trimethoprim/sulfamethoxazole and ciprofloxacin were promoted by the AUA for UTI prophylaxis for UDS and cystoscopy as required [6]. On closer inspection, the wide range of dosage strengths and course lengths reported in our survey appear to vary between the above-noted society recommendations for acute uncomplicated cystitis, the AUA recommended 24-h UDS and/or cystoscopy specific prophylaxis, and the AUA, CUA, ACOG, and SOGC promoted prophylaxis for recurrent UTIs in female patients [6, 15–21]. Further research is required to see if use of the aforementioned guidelines is a reasonable approach, such as utilizing only a one-time prophylactic dose taken immediately prior to or within 2 h after UDS and/or cystoscopy in a fashion similar to post-coital UTI prophylaxis [19].

Our study has a robust survey design process including iterative survey development and scientific review, three rounds of distribution, and reporting adherent to the STROBE guidelines [22]. However, only 19.7% of eligible AUGS members completed the survey. Unfortunately, this anticipated phenomenon of low survey response rates among physician specialists has been well documented in the literature with response rates varying from 27 to 43% [23]. Furthermore, a recent meta-analysis found that web-based surveys specifically have an 11% lower response rate than that of other survey modalities [24]. Although the goal of the present study was to reach a 20% response rate and emulate a recent AUGS survey study that had a 21% response rate [25], it is possible that AUGS’s routine survey distribution (four per year) may have led to compounding survey-fatigue for its members. This low response rate could also be attributed to a lack of clear guidelines which may have caused eligible physicians to be less inclined to disclose their own practice patterns. Comparing respondents to the general AUGS membership appears to indicate that our sample was representative in terms of specialist distribution, years in practice, and country of practice. There were proportionately more respondents that had an academic practice compared to the general membership which is not surprising in the context of this being a research study where response bias would be expected. This bias may have significantly underrepresented the proportion of practitioners prescribing prophylactic antibiotics. Another limitation was the sole distribution through AUGS and the resulting lack of representation of urologists that perform UDS and outpatient cystoscopy in women. Unfortunately, no other access was available to female urology specialists in North America and therefore this inadequacy was unavoidable. As such, the results of this study may be most generalizable to the practice patterns of academic FPMRS physicians.

Conclusions

This survey study of North American FPMRS specialists demonstrated that many practitioners are nonadherent to specialist society recommendations of not prescribing antibiotic prophylaxis against UTI for women undergoing UDS and/or outpatient cystoscopy. Respondents in practice less than 5 years and those practicing in nonacademic settings were more likely to prescribe prophylaxis. Furthermore, prescription regimens for prophylaxis were found to be extremely varied. This study draws attention to numerous areas of required future research including the reasons behind this nonuniform approach and the actual need and usefulness of prophylaxis after UDS and cystoscopy in women.

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Statement of Ethics

This project was reviewed and approved by the Mount Sinai Hospital Research Ethics Board (ID# 19-0026-E). Consent to participate was sought and received from all included participants. Consent included participant’s agreement for their deidentified aggregate data to be published.
Conflict of Interest Statement

A. Benseler has no financial disclaimer/conflict of interest to disclose. C.D. McDermott: Dr. Colleen D. McDermott is a medical advisor for Szio Inc. and COSM Inc. and a speaker for Pfizer. None of these entities were involved in any facet of this study including project development, data collection, and manuscript writing. There is no other financial disclaimer or potential conflicts of interest relating to this project to disclose.

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Author Contributions

A. Benseler and C.D. McDermott: project development, data collection, data analysis, and manuscript writing.

Data Availability Statement

All data generated or analyzed during this study are available upon request and included in online supplemental Digital Content 1 (see www.karger.com/doi/10.1159/000524266 for all online suppl. material); text file of survey sent to physicians (pdf).