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Fluoroquinolone Prescribing and Use in Canadian Primary Care Practice

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Abbreviations

COPD	chronic obstructive pulmonary disease
FP	family physician
NP	nurse practitioner

Introduction

CADTH undertook a study into antibiotic prescribing and use in Canadian primary care practice, with a particular emphasis on fluoroquinolone use. The study investigated current practices and implementation issues for antibiotic therapies from the perspective of family physicians (FPs), nurse practitioners (NPs), and pharmacists. The research findings are based on the results of qualitative research in the form of surveys of primary care practitioners, as well as on a targeted review of the literature on fluoroquinolones use in Canada. CADTH sought to understand and explain experiences and decision-making processes around outpatient prescribing of antibiotics for specific indications. This report presents a summary of the findings.

Issue

Five different systemic fluoroquinolones (a type of antibiotic) are marketed in Canada: ciprofloxacin, moxifloxacin, levofloxacin, norfloxacin, and ofloxacin. Systemic fluoroquinolones are used to treat several types of bacterial infection of varying seriousness and severity. In this era of increasing antimicrobial resistance, it is essential to use the various classes of antibiotics judiciously and to use them based on current clinical practice guidelines. In addition, antibiotics are not without side effects; in some cases, adverse reactions can be serious, prolonged, and even fatal. According to a number of studies relating to Canadian statistics on fluoroquinolone use, prescribing of this drug class continues to increase from year to year,^{1,2} with urinary tract infections (UTIs) among the most common reasons for recommending fluoroquinolones in Canada.³ There is limited Canadian information on the reasons behind prescribing of fluoroquinolones among health care practitioners.

The use of systemic (taken by mouth or by injection) fluoroquinolones is associated with serious adverse events. These include effects on the central and peripheral nervous system, hypersensitivity, myasthenia gravis exacerbation, phototoxicity, QT prolongation (a heart rhythm disorder), and tendon rupture. Rarely, some of these adverse events have the potential to lead to persistent disabilities.⁴

In November 2015, the US Food and Drug Administration (FDA) released a report on fluoroquinolones for the treatment of acute bacterial sinusitis; acute bacterial exacerbation of chronic bronchitis in patients with chronic obstructive pulmonary disease; and uncomplicated UTIs (cystitis). The FDA identified that the benefits and risks of fluoroquinolones do not support the current labelled indications for the three conditions.⁵ Health Canada has reviewed the safety of fluoroquinolones and has recommended that the safety information for all fluoroquinolone products be updated. Health Canada is working with manufacturers to update the safety information of all systemic fluoroquinolone products marketed in Canada.⁴

Objective

The objective of this study was to explore antibiotic-prescribing practices of primary care providers across Canada for four acute bacterial infections:

- uncomplicated cystitis (a simple infection of the bladder)
- uncomplicated pyelonephritis (a simple infection of the kidney)
- acute bacterial exacerbation of chronic bronchitis in chronic obstructive pulmonary disease (COPD)
- acute bacterial sinusitis.

Methods

Survey

Ipsos Public Affairs conducted an online survey of primary health care providers to better understand their experience and decision-making processes regarding outpatient prescribing of antibiotics for four specific indications. These indications are:

- uncomplicated cystitis
- uncomplicated pyelonephritis
- acute bacterial exacerbation of chronic bronchitis in COPD
- acute bacterial sinusitis.

In total, 202 health care providers participated (100 FPs, 50 NPs, and 52 pharmacists) across 10 provinces (there were no participants from the three territories), and across urban, rural, and remote practice settings.

Table 1 provides the breakdown of all providers by practice setting and years of practice.

Table 1: Survey Participant Specialty, Practice Setting, and Years of Practice

	Total Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
All family physicians	100	80	20	24	39	37
All nurse practitioners	50	32	18	28	20	2
All pharmacists	52	43	9	24	19	9

Primary care practitioners were contacted using a market research panel that includes health care professionals who had agreed to be contacted for market research studies. The online survey, available in English and French, was approximately 10 minutes in length and hosted by Ipsos. All participants were offered monetary recognition for their time and effort in completing the survey. For the length of the survey, a \$60 honorarium was provided for FPs and \$65 for NPs and pharmacists.

Literature Search Strategy

The literature search was performed by an information specialist using a peer-reviewed search strategy.

Published literature was identified by searching the following bibliographic databases: MEDLINE, with in-process records and daily updates through Ovid; Embase through Ovid; the Cumulative Index to Nursing and Allied Health Literature (CINAHL) through EBSCO; and PubMed. The search strategy comprised both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. A series of searches was performed to gain background information on fluoroquinolones, qualitative data related to fluoroquinolone prescription and use, and current practice and prescription patterns related to fluoroquinolones within the Canadian context. Retrieval was limited to English-language documents published from January 1, 2006 up to March 13, 2017.

Grey literature (literature that is not commercially published) was identified by searching the *Grey Matters* checklist (www.cadth.ca/grey-matters), which includes the websites of regulatory agencies, health technology assessment agencies, clinical-guideline repositories, and professional associations. Google and other Internet search engines were used to search for additional Web-based materials.

Strengths and Limitations

The strength of this study lies in the quality and richness of the responses and comments offered by survey participants. Survey participants were willing to share their rationale for antibiotic choices and their opinions regarding fluoroquinolone prescribing.

The limitations of this study stem from the relatively small number of participants (particularly NPs and pharmacists), as well as the study's inherent self-selection bias. Participants were invited and remunerated for their participation in the study. We also note that not all provinces were represented in each of the three sample groups, and there were no participants from any of the three territories. Local treatment guidelines, antibiotic-resistance patterns, and drug formularies vary across jurisdictions, which may contribute to regional differences. Practice and prescribing patterns may also vary across regions for other reasons, such as access, age of population, etc. Additionally, pharmacists in some practice settings may not always be aware of the indication for which a drug is prescribed.

Results

Family Physicians

Of the FPs surveyed, 38% were from Ontario, 21% were from Quebec, 15% were from British Columbia, 19% were from the three prairie provinces, and 7% were from Atlantic Canada. The majority of FPs reported their practice

serves an urban population (82%), while 18% of physician respondents indicated they served rural populations, and 3% served remote populations.

With respect to length of time practicing in primary care, 24% reported practicing for 10 years or fewer, 39% reported practicing between 11 and 25 years, and 37% of those surveyed reported practicing for more than 25 years.

Table 2: Family Physician Survey Respondent Information

	Total Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
All family physician respondents	100	82	18	24	39	37
British Columbia	15	13	2	4	7	4
Alberta	14	13	1	3	7	4
Saskatchewan	4	2	2	0	0	4
Manitoba	1	0	1	0	0	1
Ontario	38	35	3	12	14	12
Quebec	21	16	5	4	7	10
New Brunswick	2	0	2	0	2	0
Nova Scotia	2	1	1	0	2	0
Prince Edward Island	1	0	1	0	0	1
Newfoundland and Labrador	2	0	2	1	0	1

Information Sources

The majority of FPs cited their previous clinical experience as their primary source of information when considering possible antibiotic treatment options for the four indications queried. Approximately half of the physician respondents also cited both local or organizational treatment guidelines and continuing professional development materials as sources of information. FPs also consider a range of Web and mobile applications when prescribing antibiotics for their patients. UptoDate,⁶ Bugs & Drugs,⁷ Medscape,⁸ WebMD,⁹ and the *Sanford Guide to Antimicrobial Therapy*¹⁰ were the most cited. Nearly a third of respondents indicated they confer with their physician colleagues or review local practice patterns, while some also referenced clinical practice guidelines (national and international).

In general, these trends in information sources cited were observed across provinces and in both urban and rural/remote settings. Similarly, responses across years of practice of FP respondents were similar to one another, with some exceptions: the majority of FPs with the most years of practice (25 or more years) indicated their previous clinical experience is their primary source of information when considering antibiotics treatments; however, most FPs practicing for fewer than 25 years, particularly those with fewer than 10 years of practice experience, cited computer applications and websites as their primary information sources.

Table 3: Family Physician–Reported Antibiotic Treatment Information Sources (Uncomplicated Cystitis and Pyelonephritis)

Information Source	All Family Physician Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
Applications (websites, mobile)	82	65	17	22	35	25
Previous clinical experience	68	54	14	15	18	35
Internal/organizational or local treatment guidelines	44	37	7	11	19	14
Continuing professional development material	40	32	8	7	19	14
Colleagues or local practice patterns	24	18	6	5	9	10
National or international clinical practice guidelines	12	8	4	4	8	0
Other clinical decision-making tools	4	3	1	3	1	0
Other	3	2	1	2	1	0

Antibiotic-Prescribing Influencers

Participants were asked about factors that influence their choice of treatment when prescribing antibiotics for the four noted indications. For FPs, the most commonly cited factors considered across indications were allergy history, patient medical history, and drug effectiveness. Information from reports on outpatient usage patterns also supports the notion of antibiotic allergies as an important factor in prescribing by FPs.¹¹ More than half of FPs surveyed also cited drug safety, local antibiotic-resistance patterns, known patient intolerances, and costs for patients as factors influencing their prescribing decision. A number of respondents indicated that etiology (suspected or confirmed), diagnostic certainty, and drug availability also impacted treatment choices.

Table 4: Family Physician–Reported Antibiotic-Prescribing Influencers (Uncomplicated Cystitis)

Prescribing Influencer	Number of Family Physician Respondents	Prescribing Influencer	Number of Family Physician Respondents
Allergy history	82	Suspected or confirmed etiology	50
Drug effectiveness	75	Diagnostic uncertainty	47
Drug safety	68	Availability	39
Medical history	65	Patient expectation or preference	35
Local resistance patterns	65	Compliance history	29
Costs for patient	57	Costs for health care system	22
Known patient tolerance issues	56	Patient/provider threshold for failure	9

Across the four indications, surveyed FPs practicing in rural/remote settings tended to place greater emphasis on drug availability and known patient tolerance issues than did their urban counterparts. Similarly, both costs for the patient and costs for the health care system also influenced antibiotic-prescribing decisions to a greater degree in rural/remote practices than in urban settings.

Regional Resistance Patterns

Because several clinical practice guidelines recommend that health care professionals consider regional resistance patterns for antibiotic prescribing, FPs were asked about their access to current data on this. Overall, 33% of FPs indicated they have access to data on regional resistance patterns; 38% reported not having access, and 29% were unsure if they did. Across most provinces, while the proportion of FPs who said they have access to current data was similar, 42% of FPs in Ontario and 62% in Quebec indicated they do not have access to this information.

Respondents were asked where they obtained data about regional resistance patterns. Some FPs said their hospital labs provide resistance rates to them and provide continuing medical education. A number of physicians also referenced reports produced by their provincial government, ministry of health, or their local health authority. Information available from published literature, websites, and applications such as Bugs & Drugs⁷ and Spectrum¹² were also cited.

Antibiotics for Uncomplicated Cystitis

Survey respondents were asked which antibiotic they prescribe as a first choice for treating uncomplicated cystitis. Nearly half of all FPs surveyed (49%) indicated they prescribe nitrofurantoin. Sulfonamides were prescribed by 21% of FPs surveyed, followed closely by fluoroquinolones (19%). Fosfomycin (9%) and beta-lactams (2%) were also identified by FPs as their first choice for treatment of uncomplicated cystitis.

The rural FPs surveyed reported a preference for sulfonamides as a first-choice therapy (50%) more frequently than did their urban counterparts (14%). Rural FPs also reported a greater preference for nitrofurantoin (40%) compared with their urban counterparts (23%).

Approximately 31% of urban FPs reported fluoroquinolones as a preferred second-choice therapy compared with 10% of the rural FPs surveyed.

FPs with more than 25 years of practice experience indicated a greater preference for prescribing fluoroquinolones than did FPs with fewer than 25 years.

Table 5: Family Physician–Reported First- and Second-Choice Antibiotic for Uncomplicated Cystitis Therapy

Antibiotic	Number of Family Physicians	
	First Choice	Second Choice
Nitrofurantoin	48	25
Sulfonamides	21	32
Fluoroquinolones	19	27
Fosfomycin	9	9
Beta-lactams	2	6
Other	1	1

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first and second choice for therapy for uncomplicated cystitis.

- **Nitrofurantoin** was indicated as a first choice by the majority of FPs surveyed. Respondents cited the drug’s effectiveness and relatively low local resistance rates as primary reasons for prescribing it. FPs also stated that the low cost of the drug and its tolerability for patients (e.g., few side effects) were reasons for using nitrofurantoin. Although less popular as a second choice in treating uncomplicated cystitis, respondents who did select it as a second choice also cited similar reasons for prescribing this antibiotic.
- **Sulfonamides** were also popular among surveyed FPs as a first- and second-choice therapy for uncomplicated cystitis, with most physicians stating the drug’s low cost and effectiveness as the main reasons for prescribing this class.
- **Fluoroquinolones** were cited as a first choice among one-fifth of the FPs surveyed, and as a second choice among one-quarter of FPs. The reasons for this are stated in the next section.

Fluoroquinolone Use for Uncomplicated Cystitis

FPs participating in the survey were asked to describe when and why they might prescribe a fluoroquinolone as a treatment for uncomplicated cystitis. A range of responses was provided, including the following:

- “I would not prescribe unless the client had an allergy to other choices and there were no other options.”
- “I think we need to keep this class for the future. I think it’s grossly overused. I use it only in my complicated cystitis.”
- “(I) now try to avoid (fluoroquinolones) due to issues raised regarding safety.”
- “I try to avoid broad-spectrum antibiotics such as Levaquin and Cipro for fear of side effects such as yeast or *C. difficile*.”

The most frequent reasons cited for prescribing a fluoroquinolone were patient allergy or sensitivity to the first- (or second-) choice antibiotics (28% of respondents), or due to antibiotic resistance (26%). Some FPs indicated

that fluoroquinolones would be prescribed for this indication when first- and second-choice therapies proved unresponsive, or as a “last resort” (13%).

A large number of respondents (20%) stated they might prescribe a fluoroquinolone based on laboratory or culture results, or a patient’s prior history with this class of antibiotics. A number also indicated that prescribing would also depend on a patient’s recent antibiotic use and their age (12%).

Antibiotics for Uncomplicated Pyelonephritis

When asked about first-choice therapies for uncomplicated pyelonephritis, a large majority of FPs indicated they prescribe antibiotics from the fluoroquinolone class. Sulfonamides were cited by 11% of respondents, beta-lactams were cited by 8%, and nitrofurantoin was cited by 4%. As a second-choice therapy, fluoroquinolones were again the most popular choice for this indication, as cited by 42% of respondents.

With respect to practice setting, as a first-choice therapy for uncomplicated pyelonephritis, fluoroquinolones were more popular among urban FPs (84%) than among their rural counterparts (50%). Conversely, rural FPs favoured sulfonamides for first-choice therapy considerably more than the urban FPs surveyed (35% and 5%, respectively). When queried about their second choice for this indication, fluoroquinolones were the most-cited drug class across both urban and rural/remote settings, followed by sulfonamides and beta-lactams.

Years of practice did not impact fluoroquinolone prescribing by FPs for uncomplicated pyelonephritis, as this was found to be the most popular first choice across all groups.

Table 6: Family Physician–Reported First- and Second-Choice Antibiotic for Uncomplicated Pyelonephritis Therapy

Antibiotic	Number of Family Physicians ^a	
	First Choice	Second Choice
Fluoroquinolones	77	42
Sulfonamides	11	23
Beta-lactams	8	24
Nitrofurantoin	4	7
Aminoglycosides	0	2
Macrolides	0	1
Other	0	1

^a Not all respondents provided an answer to this question.

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first choice for uncomplicated pyelonephritis therapy.

- **Fluoroquinolones** were cited by the majority of FPs as a first choice due to drug effectiveness and efficacy, as well as patient tolerance. Its perceived safety, spectrum of coverage, and relative strength as

an antibiotic were additional reasons stated by respondents. Physicians also noted treatment guidelines and renal penetration as additional reasons why this was their first choice.

Those citing fluoroquinolones as their second choice for therapy reasoned that it is very effective, although costly; many FPs noted resistance issues and known side effects. Respondents indicated there are complications associated with prescribing these antibiotics, so they avoided using them for uncomplicated cases.

- **Sulfonamides** were also popular among FPs as a first and second choice for treating uncomplicated pyelonephritis, with most physicians stating drug effectiveness, few side effects, and low cost as the main reasons for prescribing this class.
- **Beta-lactams** were cited as first-choice therapies because of their relatively low cost and drug effectiveness. Respondents indicating this class as their second choice cited practice guidelines as the rationale for their decision.
- **Nitrofurantoin** was indicated by a small number of FPs as a first choice. The drug's effectiveness and relatively low local resistance rates were the primary reasons given for prescribing it. While slightly more popular as a second choice in treating uncomplicated pyelonephritis, respondents who did select it as a second choice also cited resistance rates as a reason for prescribing this antibiotic.

Fluoroquinolone Use for Uncomplicated Pyelonephritis

Respondents were asked to describe why they might or might not prescribe a fluoroquinolone as a treatment for uncomplicated pyelonephritis. A range of responses was provided, with many FPs say they prescribe a fluoroquinolone as their first choice. Actual responses by FPs regarding why they would prescribe a fluoroquinolone for this indication included the following:

- “Generally it is first-line choice, so in most cases.”
- “Because I know that this is an effective option.”
- “I use it for complicated cases and high-risk individuals.”
- “I would only consider another class of antibiotic if a patient was unable to afford a fluoroquinolone.”
- “If few other practical options exist, as in the case of multiple allergies.”
- “I think we need to keep the fluoroquinolones for the future and not overuse now.”

For this indication, prescribing a fluoroquinolone for uncomplicated pyelonephritis was the most popular first- and second-choice therapy across nearly all provinces, practice settings, and years of practice.

Antibiotics for Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

Of the antibiotics prescribed for the treatment of acute bacterial exacerbation of chronic bronchitis in COPD (herein referred to as “bronchitis”), a nearly equal number of FPs cited macrolides (36%) and beta-lactams (32%) as being their first choice, while 20% indicated they would choose a fluoroquinolone.

For this indication, beta-lactams were the most popular second-choice antibiotic (cited by 34% of physician respondents), followed by fluoroquinolones (25%), and macrolides (23%).

Overall, there were no marked differences in first-choice therapy between urban and rural/remote FPs, although urban FPs (23%) tended to prefer fluoroquinolones as a first choice slightly more than did their rural counterparts (10%). Tetracyclines were favoured by rural FPs (20%) more than by urban FPs (6%) as their first choice for “bronchitis” therapy.

Years of practice did not impact antibiotic prescribing by FPs whose first choice was macrolides for treating “bronchitis”. However, with respect to second-choice therapies, fluoroquinolones were preferred by 38% of FPs who had more than 25 years of practice experience compared with 26% of those with 10 to 25 years of practice, and 17% of physicians with fewer than 10 years of experience. Conversely, tetracyclines were considered second-choice therapy by 13% of FPs with up to 25 years of practice, whereas no FPs with more than 25 years of practice cited tetracyclines as their second choice.

Table 7: Family Physician–Reported First- and Second-Choice Antibiotic for Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

Antibiotic ¹	Number of Family Physicians ^a	
	First Choice	Second Choice
Macrolides	36	23
Beta-lactams	32	34
Fluoroquinolones	20	25
Tetracyclines	9	8
Sulfonamides	0	5
Other	1	3

^a Not all respondents provided an answer to this question.

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first and second choice for therapy for “bronchitis.”

- Macrolides** were indicated by the majority of FPs as their first choice. As primary reasons for prescribing macrolides, they cited the drug’s effectiveness, and good patient tolerance and compliance. Many FPs also stated that the drug’s broad spectrum of coverage and guideline-

recommended use were reasons this would be a first choice. Those FP respondents who cited macrolides as their preferred second-choice therapy preferred it for its spectrum of coverage and potency, while recognizing it may have more side effects than other options.

- **Fluoroquinolones** were cited as a first choice among one-fifth of the FPs surveyed, and as a second choice among one-quarter of FPs. Some FPs citing fluoroquinolones as their preferred second-choice therapy referenced practice guidelines that supported this antibiotic as second-choice therapy for treating this indication.
- **Beta-lactams** were the second-most cited first-choice therapy and the most-cited second-choice therapy for “bronchitis.” The broad spectrum of coverage of this antibiotic class, patient tolerability, and clinical-guideline recommendations were cited as key reasons for choosing beta-lactams.

Fluoroquinolone Use for Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

FPs were also asked to describe when and why they might prescribe a fluoroquinolone as a treatment for acute bacterial exacerbation of chronic bronchitis in COPD (herein referred to as “bronchitis”). A range of responses was provided, including the following:

- “In severe cases, if the patient is more fragile or prone to potential complications.”
- “In complicated patients, patients allergic to first-line choices, treatment failures with first-line choices.”
- “Only when the less expensive ones fail.”
- “Never prescribed one.”
- “Do not have access to respiratory fluoroquinolones.”

The most frequent reasons cited for prescribing a fluoroquinolone were allergy or intolerance to first- (or second-) choice antibiotics, including beta-lactams and macrolides (24% of respondents). Severe or complex cases (16%), and patients with multiple comorbidities and frequent exacerbations (12%) were also stated by many FPs as situations when they would prescribe one. Overall, fluoroquinolone use as a first- or second-choice therapy for “bronchitis” was not favoured by the majority of FPs in the survey.

As noted earlier, prescribing a fluoroquinolone for “bronchitis” was favoured more by urban FPs than by their rural counterparts (23% versus 10%). Physicians with more than 25 years of practice experience were also more likely to prescribe a fluoroquinolone as second-choice “bronchitis” therapy (38%) than were FPs with one to 10 years of practice (17%).

Antibiotics for Acute Bacterial Sinusitis

When asked about first-choice therapies for acute bacterial sinusitis (herein referred to as “sinusitis”), nearly three-quarters of FPs indicated they prescribe antibiotics from the beta-lactam class (74%). Macrolides were

cited by 16% of physician respondents, followed by fluoroquinolones (5%) as preferred first-choice therapies. Beta-lactams were the most popular second-choice antibiotic for this indication, as cited by 43% of respondents.

With respect to practice setting, beta-lactams were the primary choice among both urban and rural FP respondents as a first-choice therapy for “sinusitis.” However, as a second-choice therapy, rural FPs (65%) favoured this class of antibiotics more than their urban counterparts (38%). Conversely, macrolides were preferred by 35% of urban physicians as a second-choice therapy for “sinusitis” compared with 15% of rural FPs. While 9% of urban FPs cited tetracyclines as a preferred second-choice therapy, no rural FPs indicated this drug class as their second choice.

Beta-lactams were the most popular first-choice therapy for “sinusitis” among all FPs surveyed. When considering this antibiotic for second-choice therapy, 51% of the most experienced FPs (more than 25 years of practice) preferred beta-lactams compared with 33% of those with fewer than 10 years of practice.

A total of 22% of the physicians surveyed who had 25 or more years of practice preferred macrolides for first-choice therapy. This was more than the FPs who had 11 to 25 practice years and those who had 10 or fewer years of practice (13% and 12%, respectively). Conversely, for use as second-choice “sinusitis” therapy, macrolides were preferred by 50% of FPs with fewer than 11 years of practice experience, whereas physicians who had been practicing more than 25 years were less likely to use this drug class (16%). Among this latter group of FPs, 24% were more likely to choose a fluoroquinolone for second-choice therapy than those with 11 to 25 years of practice (5%) and those with 10 or fewer years of practice (4%).

Table 8: Family Physician–Reported First- and Second-Choice Antibiotic for Acute Bacterial Sinusitis Therapy

Antibiotic	Number of Family Physicians ^a	
	First Choice	Second Choice
Beta-lactams	74	43
Macrolides	16	30
Fluoroquinolones	5	15
Tetracyclines	1	7
Sulfonamides	1	3
Other	0	2

^a Not all respondents provided an answer to this question.

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first and second choice for therapy for acute bacterial “sinusitis.”

- **Beta-lactams** were indicated by the majority of FPs as a first choice. Respondents cited the effectiveness of these drugs and the practice-guideline recommendation for “sinusitis” therapy as primary reasons

for prescribing them. Many FPs also stated that the low cost of the drug and patient tolerability were reasons for using this class of antibiotics.

Although slightly less popular as a second choice in treating “sinusitis,” beta-lactams were still the most popular second choice. Respondents who chose them as their second choice cited similar reasons for prescribing these antibiotics, including the relative safety and effectiveness of these drugs.

- **Macrolides** were cited by FPs as a second-choice therapy for treating “sinusitis” more than twice as often as it was selected as the first choice. Those physicians who favoured this antibiotic as their first choice indicated macrolides’ efficacy, effectiveness, and safety as well as its recommendations in practice guidelines as the main reasons for prescribing this class.
- **Fluoroquinolones** were also cited by the FPs as a first-choice therapy for “sinusitis” but were more popular as a second-choice therapy due to their effectiveness, strength, and safety. Some respondents also noted that the practice recommendations and guidelines they consult suggest fluoroquinolones are appropriate.

Fluoroquinolone Use for Acute Bacterial Sinusitis

FPs were asked to describe when and why they prescribe a fluoroquinolone as a treatment for acute bacterial sinusitis (herein referred to as “sinusitis”). Actual responses by FPs included the following:

- “Very rarely, as in the case of allergies to multiple antibiotics.”
- “Second line when the first line failed or contraindicated.”
- “For severe cases or in those patients (where) I am worried about complications or decompensation.”
- “Too much of an overkill.”

Frequent reasons cited by FPs as to why a fluoroquinolone would be prescribed included allergy to first- (or second-) choice antibiotics (13% of respondents), and the failure of first- and second-choice treatments. There were many FPs (25%) who indicated that fluoroquinolones would be prescribed for this indication as a third-choice therapy, or as a last choice when first- and second-choice therapies failed.

A number of respondents (18%) stated they would prescribe a fluoroquinolone for complicated or severe cases and for some elderly patients. However, many FPs (21%) indicated they would not consider a fluoroquinolone to be an option for “sinusitis” therapy.

As noted earlier, prescribing a fluoroquinolone for “sinusitis” was favoured more by urban FPs than by the rural FPs surveyed. Moreover, physicians with more than 25 years of practice were almost five times more likely to prescribe a fluoroquinolone as second-choice “sinusitis” therapy than were FPs with fewer years of practice.

Nurse Practitioners

Of the NPs surveyed, 54% were from Ontario, 14% were from British Columbia, 14% were from the three prairie provinces, 14% were from Atlantic Canada, and 4% were from Quebec. The majority of NPs reported their practice serves an urban population (72%), while 34% of NP respondents indicating they serve rural populations, and 4% serve remote populations.

With respect to length of time practicing in primary care, 56% reported practicing for 10 years or fewer, 40% reported practicing between 11 and 25 years, and 4% of those surveyed reported practicing for more than 25 years.

Table 9: Nurse Practitioner Survey Respondent Information

	Total NP Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
All NP respondents	50	32	18	28	20	2
British Columbia	7	6	1	6	1	0
Alberta	3	2	1	0	3	0
Saskatchewan	2	1	1	1	1	0
Manitoba	2	1	1	1	1	0
Ontario	27	18	9	16	11	0
Quebec	2	2	0	1	1	0
New Brunswick	2	0	2	1	0	1
Nova Scotia	3	1	2	1	2	0
Prince Edward Island	0	0	0	0	0	0
Newfoundland and Labrador	2	1	1	1	0	1

NP = nurse practitioner.

Information Sources

The majority of NPs cited mobile applications and websites as their primary sources of information when considering possible antibiotic treatment options for the four indications queried. NPs referenced a range of Web and mobile applications when prescribing antibiotics for their patients. UptoDate,⁶ Bugs & Drugs,⁷ and the *Sanford Guide to Antimicrobial Therapy*¹⁰ were the most frequently cited.

Approximately two-thirds of the NP respondents also cited their previous clinical experience as a source of information in their decision-making. Approximately one-half of all respondents indicated they also consider both local or organizational treatment guidelines, as well as material from continuing professional development. Nearly one-third of respondents indicated they consult national or international clinical practice guidelines, and approximately one-quarter cited colleagues or local practice patterns as sources of information when prescribing.

In general, these trends in the information sources cited by NPs were observed across provinces and in both urban and rural/remote settings. Similarly, responses regarding NPs' main sources of information were similar across years of practice.

Table 10: Nurse Practitioner–Reported Antibiotic Treatment Information Sources (Uncomplicated Cystitis and Pyelonephritis)

Information Source	All Nurse Practitioner Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
Applications (websites, mobile)	48	30	18	28	19	1
Previous clinical experience	31	18	13	19	11	1
Internal/organizational or local treatment guidelines	27	16	11	16	10	1
National or international clinical practice guidelines	19	13	6	9	6	4
Continuing professional development material	16	11	5	9	7	0
Colleagues or local practice patterns	12	9	3	7	5	0
Other clinical decision-making tools	9	4	5	4	5	0

Antibiotic-Prescribing Influencers

Participants were asked about factors that influence their choice of treatment when prescribing antibiotics for the four noted indications. For NPs, the most commonly cited factors considered across indications were allergy history, patient medical history, and drug effectiveness. More than one-half of NPs surveyed also cited drug safety, suspected or confirmed etiology, local resistance patterns, known patient intolerances, and costs for patients as factors influencing their prescribing decisions. A number of respondents indicated that diagnostic certainty and drug availability also impacted treatment choices.

Table 11: Nurse Practitioner–Reported Antibiotic-Prescribing Influencers (Uncomplicated Cystitis)

Prescribing Influencer	Number of Nurse Practitioner Respondents	Prescribing Influencer	Number of Nurse Practitioner Respondents
Allergy history	48	Local resistance patterns	27
Medical history	46	Diagnostic uncertainty	25
Drug effectiveness	37	Availability	20
Suspected or confirmed etiology	33	Compliance history	18
Costs for patient	33	Patient expectation or preference	12
Drug safety	32	Costs for health care system	7
Known patient tolerance issues	30	Patient/provider threshold for failure	5

These trends in factors affecting treatment choices were similarly observed across urban and rural/remote practice settings, with one exception: across the four indications, NPs practicing in rural/remote settings tended to be considerably less influenced by patient expectation or preference compared with their urban counterparts. The number of years of practice for the NPs surveyed did not seem to be a factor influencing antibiotic prescribing.

Regional Resistance Patterns

Several clinical practice guidelines recommend that health care professionals consider regional antibiotic-resistance patterns when prescribing. For that reason, NPs were asked about their access to current data on this. Overall, 38% of the NPs surveyed indicated they have access to data on regional resistance patterns, while 26% reported they do not have access, and 36% were unsure if they did.

Respondents were asked where they obtained data about regional resistance patterns. Many NPs cited their hospital and community laboratories as providing resistance rates and culture reports. They also received antibiograms from their local health authority and information from public health units. A number of NPs also noted they obtain information from pharmacists and from colleagues who are infectious disease specialists, while some mentioned websites such as Bugs & Drugs.⁷

Antibiotics for Uncomplicated Cystitis

Survey respondents were asked about what antibiotics they prescribe as a first choice for uncomplicated cystitis. The majority of NPs (56%) indicated they prescribe nitrofurantoin. Sulfonamides were prescribed by 44% of the NPs surveyed, and fluoroquinolones by 4%.

For second-choice antibiotics, nitrofurantoin was the most popular second choice for this indication, as cited by 36% of the NPs surveyed. Similar to first-choice therapies, sulfonamides were the second-most cited second choice for uncomplicated cystitis therapy (32%). Respondents also cited fluoroquinolones (18%) and beta-lactams (12%) as preferred options for this indication.

When considering choices for first-choice therapy among urban and rural/remote NPs, rural NPs tended to prefer sulfonamides as a first-choice therapy (67%) more than their urban counterparts (31%). Nitrofurantoin for first-choice therapy is preferred by urban NPs (66%) more than their rural counterparts (39%). However, for second-choice therapy, 56% of rural NPs reported a preference for nitrofurantoin compared with 25% of their urban counterparts. NPs in urban settings (38%) indicated they favour sulfonamides as second-choice therapy more than did NPs in rural locations (22%).

Table 12: Nurse Practitioner–Reported First- and Second-Choice Antibiotic for Uncomplicated Cystitis Therapy

Antibiotic	Number of Nurse Practitioners	
	First Choice	Second Choice
Nitrofurantoin	25	17
Sulfonamides	20	15
Fosfomycin	2	4
Fluoroquinolones	2	9
Beta-lactams	1	5

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first and second choice for therapy for uncomplicated cystitis.

- **Nitrofurantoin** was indicated by the majority of NPs as a first choice. Respondents cited the drug’s effectiveness and guidelines recommending this antibiotic as primary reasons for prescribing. Many NPs stated that the low cost of the drug and patient tolerability (e.g., few side effects) were also reasons for prescribing. Although slightly less popular as a second choice in treating uncomplicated cystitis, respondents who indicated nitrofurantoin as their second choice cited similar reasons for prescribing this antibiotic, with many emphasizing its ease of use.
- **Sulfonamides** were also popular among NPs as a first- and second-choice therapy for treating uncomplicated cystitis. Most NPs cited ease of compliance due to the short duration of therapy and patient tolerability as the main reasons for prescribing this class.
- **Fluoroquinolones** were not highly preferred as a first choice among the NPs surveyed, but were more popular as a second-choice therapy because of recommendations in practice guidelines.

Fluoroquinolone Use for Uncomplicated Cystitis

NPs participating in the survey were asked to describe when and why they might prescribe a fluoroquinolone as a treatment for uncomplicated cystitis. Actual responses by NPs included the following:

- “I would not, unless the client had an allergy to other choices and there were no other options.”
- “Absolutely last line.”
- “I try and reserve use of fluoroquinolones, but if there are allergies or resistance then I would use norfloxacin because it typically has less chance for resistance.”
- “Multiple treatment failures, other antibiotic use in the past three months, or when the allergy profile has reduced my options.”
- “I would prescribe a fluoroquinolone for known resistance to other antibiotics and based on urinary culture results.”

The most frequently described reasons for prescribing a fluoroquinolone were patient allergy or sensitivity to first- (or second-) choice antibiotics (53% of respondents) and culture reports (32%). There were many NPs (30%) who indicated they would prescribe fluoroquinolones for this indication when first- and second-choice therapies failed.

Antibiotics for Uncomplicated Pyelonephritis

When asked about first-choice therapies for uncomplicated pyelonephritis, 52% of NPs indicated they prescribe antibiotics from the fluoroquinolone class. Sulfonamides were the first therapy of choice, as cited by 34% of respondents.

Regarding second-choice antibiotics, fluoroquinolones were the most popular second choice for this indication, as cited by 42% of respondents. Sulfonamides were the next-most popular second choice among the NPs surveyed (34%). Beta-lactams were favoured by 22% of respondents for second-choice therapy.

When queried about second-choice therapy, fluoroquinolones were favoured more by NPs in urban practice (50%) than by those in rural settings (28%). Similarly, sulfonamides were more popular among urban NPs (41%) than among rural NPs (22%) as second-choice therapy. Conversely, NPs working in rural practice had a greater preference for prescribing beta-lactams (39%) than their urban counterparts (13%).

Table 13: Nurse Practitioner–Reported First- and Second-Choice Antibiotic for Uncomplicated Pyelonephritis Therapy

Antibiotic	Number of Nurse Practitioners	
	First Choice	Second Choice
Fluoroquinolones	26	20
Sulfonamides	17	16
Nitrofurantoin	4	1
Beta-lactams	3	10
Aminoglycosides	0	3

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first choice for uncomplicated pyelonephritis therapy.

- **Fluoroquinolones** were cited by the majority of NPs as a first choice due to the effectiveness of this drug class and its broad spectrum of coverage. Many NPs also noted fluoroquinolones are recommended in treatment guidelines as first-choice therapy for this indication.
- Fluoroquinolones were also the most popular as second-choice therapy. NP respondents noted that fluoroquinolones are generally accepted as second-choice treatment and are recommended by guidelines and in resources such as UptoDate.⁶

- **Sulfonamides** were also popular among NPs as a first and second choice in treating uncomplicated pyelonephritis. Most NPs cited ease of use (dosing) and good patient tolerance as primary reasons. Many NPs also noted their practice guidelines recommend sulfonamides for first- and second-choice therapy for this indication.
- **Nitrofurantoin** was indicated by a small number of NPs as a first choice. They cited relatively low local resistance rates and guideline recommendations as primary reasons for prescribing this drug.
- **Beta-lactams** were cited as first- and second-choice therapies, with guideline recommendations given as rationale for their decision.

Fluoroquinolone Use for Uncomplicated Pyelonephritis

Respondents were asked to describe when and why they might prescribe a fluoroquinolone as a treatment for uncomplicated pyelonephritis. Actual responses by NPs regarding why they would prescribe a fluoroquinolone for this indication included the following:

- “Normally, I would prescribe first.”
- “When the culture result shows that it would be sensitive to that antibiotic.”
- “Ciprofloxacin is usually my second choice for treatment. I usually base decision of treatment on patient symptoms, previous medication tried/failed, and urine culture results.”

A number of NPs surveyed noted they would base their decisions on culture reports (23% of respondents) and also on a patient’s history of drug resistance (18%).

Antibiotics for Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

NPs were asked about antibiotics they prescribe for acute bacterial exacerbation of chronic bronchitis in COPD therapy (herein referred to as “bronchitis”). An equal number of NPs cited beta-lactams (40%) and macrolides (40%) as their first choice. Of the NPs surveyed, 16% indicated they would prescribe a tetracycline as their first choice, while 10% indicated they would choose a fluoroquinolone.

Beta-lactams were the most popular second-choice antibiotic for this indication, as cited by 40% of NP respondents. Macrolides were the second-most cited choice for second-choice “bronchitis” therapy (24%) followed by fluoroquinolones (24%), tetracyclines (14%), and sulfonamides (8%).

Table 14: Nurse Practitioner–Reported First- and Second-Choice Antibiotic for Chronic Bronchitis in COPD Therapy

Antibiotic	Number of Nurse Practitioners	
	First Choice	Second Choice
Beta-lactams	19	19
Macrolides	19	11
Tetracyclines	8	7
Fluoroquinolones	4	10
Sulfonamides	0	3

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first and second choice for therapy for “bronchitis.”

- **Beta-lactams** were the most-cited first- and second-choice therapy for “bronchitis.” Respondents indicated they preferred them because of their effectiveness and patient tolerability. Their broad spectrum of coverage and their recommendation in clinical guidelines as first- and second-choice therapy were also cited as key reasons for choosing beta-lactams.
- **Macrolides** were indicated by a number of NPs as a preferred first- and second-choice therapy. Respondents cited their effectiveness and high levels of compliance as primary reasons for prescribing these drugs. Many NPs also stated that macrolides’ broad spectrum of coverage and their recommendation in clinical guidelines were reasons they would choose a macrolide.
- **Fluoroquinolones** were cited as their first choice by a small number of the NPs surveyed, and as their second choice by one-quarter of NPs. Reasons provided included tolerance and guideline recommendations regarding use for more severe exacerbations.

Fluoroquinolone Use for Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

NPs were also asked to describe when and why they might prescribe a fluoroquinolone as a treatment for acute bacterial exacerbation of chronic bronchitis in COPD (herein referred to as “bronchitis”). Actual responses by NPs included the following:

- “When treatment failure with other choices or resistance is confirmed.”
- “I usually do not tend to prescribe quinolones for this, as I find they are more useful for people with severe issues.”
- “Complicated COPD or other risk factors.”
- “I consider fluoroquinolones potent and use for exceptional cases that do not respond to my previous two choices.”

Frequent reasons cited as to why a fluoroquinolone would be prescribed were allergy (25% of respondents) or failure of first- (or second-) choice

antibiotics (15%). Severe and complex cases (28%), and cases where the patient is elderly, high-risk, or has previous exacerbations (10%), were also stated by many NPs as reasons why they would prescribe one.

Antibiotics for Acute Bacterial Sinusitis

Respondents were asked about their first-choice therapies for acute bacterial sinusitis (herein referred to as “sinusitis”). The majority of NPs indicated they prescribe antibiotics from the beta-lactam class (88%). Fluoroquinolones were cited by 6% of NP respondents, followed by tetracyclines (4%) as preferred first-choice therapies.

Regarding second-choice antibiotic therapy for this indication, macrolides were the preferred second choice, as cited by 42% of respondents. This was followed by beta-lactams (32%) and tetracyclines (24%). Sulfonamides and fluoroquinolones were preferred by only a small number of NPs surveyed.

With respect to practice setting, beta-lactams were the primary choice among urban and rural NP respondents as a first-choice therapy for “sinusitis.” However, as a second-choice therapy, urban NPs (38%) favour this class of antibiotics more than their rural counterparts (22%). Conversely, macrolides were preferred as a second-choice therapy for “sinusitis” by 61% of NPs practicing in rural settings compared with 31% of urban NPs. While 34% of urban NPs cited tetracyclines as a preferred second-choice therapy, only 6% of rural NPs indicated this drug class as their second choice.

Table 15: Nurse Practitioner–Reported First- and Second-Choice Antibiotic for Acute Bacterial Sinusitis Therapy

Antibiotic	Number of Nurse Practitioners	
	First Choice	Second Choice
Beta-lactams	44	16
Fluoroquinolones	3	3
Tetracyclines	2	12
Macrolides	1	21

Survey participants were asked about their reasons for prescribing a particular antibiotic as their first- or second-choice therapy for acute bacterial sinusitis.

- Beta-lactams** were indicated by the majority of NPs as a first choice. Practice guidelines recommending beta-lactams as the first choice for “sinusitis” therapy was the primary reason cited for prescribing. Many NPs also stated that the safety of these drugs and their tolerability by patients were reasons for using this class of antibiotics. Although not the preferred second-choice treatment for “sinusitis,” respondents who chose beta-lactams as their second choice cited similar reasons for prescribing this antibiotic class, noting these are recommended in practice guidelines as second-choice therapy.

- **Macrolides** were cited by a small number of NPs as a first-choice therapy for treating “sinusitis”; however, it was the most popular choice among NPs as a second-choice therapy. Those NPs who favoured this antibiotic class cited the broad-spectrum coverage of these drugs. They also cited good tolerance and compliance (based on dosing schedule) by patients as reasons for choosing them.

Fluoroquinolone Use for Acute Bacterial Sinusitis

NPs were asked to describe when and why they might prescribe a fluoroquinolone as a treatment for this indication (“sinusitis”). Actual responses by NPs included the following:

- “When there is no other option for the patient related to tolerance/allergies.”
- “I don’t often but would if there was an allergy.”
- “Only if they have failed at least two other antibiotics with good compliance.”
- “In the case of treatment failures with multiple drug allergies.”
- “Only if the antibiogram suggests it.”

Frequent reasons cited by NPs as to why a fluoroquinolone would be prescribed included allergy to first- (or second-) choice antibiotics (43% of respondents) and failure of first- and second-choice treatments (40%). There were some NPs who indicated that fluoroquinolones would be prescribed for this indication when first- and second-choice therapies failed or in more severe cases (10%). For others, the results of a culture/sensitivity report would guide their prescribing (13%).

Pharmacists

In addition to FPs and NPs, pharmacists were surveyed to provide an additional perspective regarding antibiotic prescribing in general, and fluoroquinolones prescribing in particular. Unlike FPs and NPs, pharmacists do not prescribe drugs for these conditions and will not always know the indications for treatment. However, the responses from the pharmacists surveyed support the trends observed in the responses from the FPs and NPs.

Of the pharmacists surveyed, 42% were from Ontario, 15% were from British Columbia, 19% were from the three prairie provinces, 13% were from Quebec, and 10% were from Atlantic Canada. The majority of pharmacists reported their practice serves an urban population (88%), while 15% indicated they serve rural populations and 2% serve remote populations.

With respect to length of time practicing in primary care, 54% reported practicing for 10 years or fewer, 36% reported practicing between 11 and 25 years, and 17% of those surveyed said they have been practicing for more than 25 years.

Table 16: Pharmacist Survey Respondent Information

	Total Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
All pharmacist respondents	52	43	9	24	19	9
British Columbia	8	7	1	4	4	0
Alberta	7	6	1	3	1	3
Saskatchewan	2	1	1	0	1	1
Manitoba	1	1	0	0	0	1
Ontario	22	19	3	13	6	3
Quebec	7	6	1	3	4	0
New Brunswick	2	1	1	0	2	0
Nova Scotia	3	2	1	1	1	1
Prince Edward Island	0	0	0	0	0	0
Newfoundland and Labrador	0	0	0	0	0	0

Information Sources

The majority of pharmacists cite mobile applications and websites as their primary sources of information when considering antibiotic treatments prescribed for adult patients with one of the four indications queried. Pharmacists reference a range of Web and mobile applications, with RxTx,¹³ Bugs & Drugs,⁷ and the *Sanford Guide to Antimicrobial Therapy*¹⁰ being the most cited.

Nearly two-thirds of pharmacist respondents also cited local or organizational treatment guidelines as a key source of information. Over one-half of all respondents indicated they consider their previous clinical experience as well as material from continuing professional development. Just over one-third of respondents stated they review local practice patterns or consult with colleagues, and one-quarter said they consult national or international clinical-practice guidelines.

Generally, these trends in the information sources cited were observed across provinces, and in both urban and rural/remote settings. Similarly, responses across years of practice groups were in line with one another when considering main sources of information.

Table 17: Pharmacist–Reported Antibiotic Treatment Information Sources (Uncomplicated Cystitis and Pyelonephritis)

Information Source	All Pharmacist Respondents	Urban Practice	Rural/Remote Practice	Years of Practice		
				1 to 10	11 to 25	More Than 25
Applications (websites, mobile)	50	41	9	23	19	8
Internal/organizational or local treatment guidelines	31	25	6	15	11	5
Previous clinical experience	30	24	6	15	10	5
Continuing professional development material	29	23	6	12	12	5
Colleagues or local practice patterns	20	16	4	9	8	3
National or international clinical practice guidelines	12	10	2	7	3	2
Other clinical decision-making tools	10	8	2	7	2	1

Regional Resistance Patterns

Because several clinical practice guidelines recommend that health care professionals consider regional antibiotic-resistance patterns when prescribing, pharmacists were asked about their access to current data on this. Overall, 25% of pharmacists indicated they have access to data on regional resistance patterns, while 35% reported they do not have access, and 40% were unsure if they did.

Respondents were asked where they obtained data about regional resistance patterns. Respondents said their hospital laboratories provide resistance rates. They also receive antibiograms from their local health authority and information from public health units. A number of pharmacists also noted they obtain information from online sources, and one pharmacist noted referencing websites such as Bugs & Drugs.⁷

Antibiotics for Uncomplicated Cystitis

Pharmacists were asked about what antibiotics they see commonly prescribed by practitioners for uncomplicated cystitis, with the understanding that they may not be privy to the particular indication in all cases. The majority of pharmacists (71%) indicated they see nitrofurantoin prescribed most often for this indication. Sulfonamides were cited as being the second-most commonly prescribed antibiotic (65%), followed by fluoroquinolones (42%), and fosfomycin (15%).

Pharmacists indicated that of the antibiotics prescribed for uncomplicated cystitis, some were prescribed by practitioners more commonly than others. Specifically, they identified nitrofurantoin as the most prescribed (44%); an equal number indicated sulfonamides (27%) and fluoroquinolones (27%), and also beta-lactams (2%).

Table 18: Pharmacist-Reported Common Antibiotic(s) Seen Prescribed by Practitioners for Uncomplicated Cystitis Therapy

Antibiotic	Number of Pharmacists ^a
Nitrofurantoin	37
Sulfonamides	34
Fluoroquinolones	22
Fosfomycin	8
Beta-lactams	5

^a Respondents invited to select all that apply.

Fluoroquinolone Use for Uncomplicated Cystitis

Survey participants were asked more specifically about when they might see a fluoroquinolone prescribed as a treatment for uncomplicated cystitis.

A range of responses was provided by pharmacists. Actual responses by pharmacists regarding when they see fluoroquinolones prescribed included the following:

- “When the patient is allergic to alternatives.”
- “If it’s the second course or prescribed by older physicians with many years of experience.”
- “Based on culture results, if renal function (is) too low for nitrofurantoin, or allergy.”
- “I frequently see ciprofloxacin (prescribed) for patients who have confirmed bacterial uncomplicated cystitis, and when the patient does not have contraindications.”

Some pharmacists noted that, overall, they see fluoroquinolones frequently prescribed for uncomplicated cystitis. The most frequent reasons cited for prescribing a fluoroquinolone were patient allergy or intolerance to other antibiotics, and antibiotic resistance. Several pharmacists indicated that fluoroquinolones might be prescribed for this indication when first- and second-choice therapies failed. Other responses cited included acute cases when culture results indicated it was necessary, and when the patient was elderly.

Finally, survey participants were asked about the circumstances under which they would contact a prescribing clinician. The most-often cited reason for contacting the practitioner was when the pharmacist found an allergy or noted a drug interaction with the prescribed drug. Also frequently cited were concerns about dosing, treatment duration, known patient intolerances, and the patient’s prescribing history (e.g., patient had been prescribed the same antibiotic in the three months prior). A few pharmacists also noted that patient back pains or renal problems would also prompt them to contact the prescribing clinician.

Antibiotics for Uncomplicated Pyelonephritis

Survey respondents were asked about what antibiotics they see commonly prescribed by practitioners for outpatient therapy for uncomplicated pyelonephritis, with the understanding they may not be privy to the particular indication in all cases. The majority of pharmacists (71%) indicated they see fluoroquinolones most commonly prescribed.

Beta-lactams were cited as the second-most commonly prescribed antibiotic (54%), followed by sulfonamides (50%).

Pharmacists indicated observing that practitioners prescribe some of these antibiotics more commonly than others. A total of 63% of respondents reported seeing fluoroquinolones prescribed the most for this indication.

Table 19: Pharmacist-Reported Common Antibiotic(s) Seen Prescribed by Practitioners for Uncomplicated Pyelonephritis Therapy

Antibiotic	Number of Pharmacists ^a
Fluoroquinolones	37
Beta-lactams	28
Sulfonamides	26

^a Respondents invited to select all that apply.

Fluoroquinolone Use for Uncomplicated Pyelonephritis

Survey participants were asked more specifically about when they might see a fluoroquinolone prescribed as a treatment for uncomplicated pyelonephritis. Pharmacists cited a variety of responses, including the following:

- “It is the treatment for the majority of infections (95%).”
- “See it a lot as first line.”
- “Often as initial treatment, or if patient has an allergy or intolerance to first choice.”
- “Chronic/severe cases of uncomplicated pyelonephritis.”
- “Quite often, over-prescribed.”

Several pharmacists indicated that fluoroquinolones seem to be the drug of choice for uncomplicated pyelonephritis. Other responses included instances of bacterial resistance and when the patient has back pain (a typical symptom of this indication).

In addition, participants were asked what circumstances would prompt them to contact a prescribing clinician. The reason cited most often was when the pharmacist found an allergy or intolerance with the drug prescribed. Several respondents also stated that dosing concerns and possible drug interactions would also prompt them to contact the prescribing clinician. A few survey respondents added that a patient’s history or failure with a certain drug and

contraindications would be cause for contact, while a few indicated they would seldom contact the prescribing clinician.

Antibiotics for Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

Survey participants were asked about what antibiotics they see commonly prescribed by practitioners for therapy for acute bacterial exacerbation of chronic bronchitis in COPD (here-in referred to as “bronchitis”), with the understanding they may not be privy to the particular indication in all cases. The majority of pharmacists (83%) indicated they see beta-lactams prescribed most commonly.

Macrolides were cited by 73% of pharmacists as being the second-most commonly prescribed antibiotic, followed by fluoroquinolones (50%), and tetracyclines (23%).

Of the antibiotics prescribed for “bronchitis,” pharmacists indicated that some were prescribed by practitioners more commonly than others. Specifically, 52% indicated they see macrolides prescribed most often, with fluoroquinolones being the second-most commonly prescribed (19%). An equal number of participants cited sulfonamides and tetracyclines as also being frequently prescribed (10% each), while a few felt that no drug was prescribed more than any other.

These prescribing practices observed by pharmacists were relatively equal across urban and rural practice settings, with the exception of fluoroquinolone prescribing: 56% of pharmacists practicing in urban settings cited fluoroquinolones as being commonly prescribed for “bronchitis,” compared with 22% of pharmacists in rural/remote practice settings.

Table 20: Pharmacist-Reported Common Antibiotic(s) Seen Prescribed by Practitioners for Acute Bacterial Exacerbation of Chronic Bronchitis in COPD Therapy

Antibiotic	Number of Pharmacists ^a
Beta-lactams	43
Macrolides	38
Fluoroquinolones	26
Tetracyclines	12
Sulfonamides	1

COPD = chronic obstructive pulmonary disease.

^a Respondents invited to select all that apply.

Fluoroquinolone Use for Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

Survey participants were asked more specifically about when they might see a fluoroquinolone prescribed as a treatment for acute bacterial exacerbation of chronic bronchitis in COPD (here-in referred to as “bronchitis”).

Pharmacists provided a range of responses regarding fluoroquinolone prescribing for “bronchitis” treatment, with most indicating that this antibiotic class was often prescribed by practitioners for both first- and second-choice therapy. Actual responses by pharmacists included the following:

- “Previously unresponsive to another antibiotic.”
- “Complicated cases or previous treatment failure.”
- “I normally see a fluoroquinolone in advanced COPD when they need more gram-negative coverage, or after macrolide failure.”
- “Often as initial treatment or if a patient has an allergy to others.”
- “Ease of use with once-daily dosing in patients who are hospitalized.”

The most frequent reasons cited for a fluoroquinolone being prescribed were patient allergy or intolerance to other antibiotics, and failure of first- (or second-) choice therapies. A number of pharmacists indicated that fluoroquinolones are often prescribed for complicated or advanced cases of COPD. Practitioners were also seen prescribing this class of antibiotics for “bronchitis” when patients were elderly or had a known history of antibiotic resistance.

Participants were also asked about circumstances when they might contact a prescribing clinician. The reason cited most often for contacting the practitioner was when the pharmacist found there was an allergy with the drug prescribed. Several respondents also stated that possible drug interactions and a patient’s history with treatment failure or recent antibiotic use would also prompt them to contact the prescribing clinician. Many survey respondents stated they would also get in contact in situations where there are questions or concerns regarding dosage and duration. One pharmacist also indicated they would contact the prescribing clinician when the antibiotic prescribed is not a first-line option.

Antibiotics for Acute Bacterial Sinusitis

Participants were asked to indicate which therapies they see commonly prescribed by practitioners for acute bacterial sinusitis (here-in referred to as “sinusitis”), with the understanding they may not be privy to the particular indication in all cases. The majority of pharmacists indicated they see beta-lactams most commonly prescribed for “sinusitis.” Macrolides were cited by 63% of the respondents as the second-most commonly prescribed antibiotic, followed by fluoroquinolones (19%).

Pharmacists indicated observing that practitioners prescribe some of these antibiotics more commonly than others. Respondents reported seeing beta-lactams as the most commonly prescribed, followed by macrolides.

These prescribing practices observed by pharmacists were similar across urban and rural practice settings with one exception: while 23% of pharmacists in urban settings reported fluoroquinolone prescribing for “sinusitis,” pharmacists in rural settings did not observe any prescribing of these drugs.

Table 21: Pharmacist-Reported Common Antibiotic(s) Seen Prescribed by Practitioners for Acute Bacterial Sinusitis Therapy

Antibiotic	Number of Pharmacists ^a
Beta-lactams	38
Macrolides	33
Fluoroquinolone	10

^a Respondents invited to select all that apply.

Fluoroquinolone Use for Acute Bacterial Sinusitis

Survey participants were asked more specifically about when they might see a fluoroquinolone prescribed as a treatment for this indication (“sinusitis”).

Pharmacists cited responses ranging from never having seen it prescribed for this condition, to having seen it prescribed in special cases. Actual responses by pharmacists included the following:

- “I very rarely see a fluoroquinolone in this population.”
- “In severe cases, and in patients who have had a previous treatment failure with first and second line.”
- “I can’t say I’ve seen it.”
- “If there’s an intolerance or allergy to initially prescribed medication.”

The most frequent reason cited for when a fluoroquinolone might be prescribed for sinusitis was patient allergy to other antibiotics. However, participants indicated they rarely or infrequently saw fluoroquinolones prescribed by practitioners for this indication. Many pharmacists cited treatment failure with other antibiotics and complex or more severe cases as common instances when a fluoroquinolone would be prescribed.

Finally, participants were asked what circumstances would prompt them to contact a prescribing clinician. The reason cited most often was when the pharmacist found an allergy or known intolerance with the drug prescribed. A number of respondents stated that dosing concerns and contraindications would also prompt them to get in contact with the prescribing clinician.

Discussion

This study sought to better understand trends among primary care providers in the use of systemic oral fluoroquinolones relative to other antibiotics for the treatment of four acute and uncomplicated bacterial infections.

In general, the study found that fluoroquinolone-prescribing practices across indications were similar between prescribing practitioners in this study (FPs and NPs). The NPs surveyed tended to mention risks of use (renal issues, ruptured tendons, etc.) more than did the FPs surveyed. FPs, while also aware of the risks, may be more likely to prescribe these drugs because of efficacy, tolerability, and broad spectrum of coverage. Both prescribing

groups cited local guidelines and web applications as key factors in influencing their decision to prescribe a certain antibiotic.

The prescribing of a fluoroquinolone for the four indications, as observed by the surveyed pharmacists, was also aligned with FP and NP therapy preferences. All three groups of primary care providers surveyed raised the concern that fluoroquinolones may be over-prescribed and not always the appropriate choice for these indications (other than for uncomplicated pyelonephritis). They also indicated they should be reserved for more chronic, complex cases. Overall, the urban primary care prescribers surveyed were more likely to prescribe a fluoroquinolone than rural or remote prescribers.

It is clear there are a number of factors that influence antibiotic prescribing and provider decision-making. The literature, though limited in terms of prescribing fluoroquinolones for the four indications specifically, indicated some support for the survey results as they pertained to factors influencing prescribing. As the survey results showed, the cost to the patient was a factor frequently reported as influencing the choice of antibiotic. Based on the usage patterns observed in one Canadian study, populations with a higher socioeconomic level are more likely to receive a fluoroquinolone prescription.²

This report was not intended to represent all primary care clinicians across Canada but, rather, to provide insight into prescribing practices and explore possible trends. Generally, prescribers have the opportunity to consider other options prior to prescribing fluoroquinolones, except for uncomplicated pyelonephritis, as fluoroquinolones are indicated as the first-choice treatment in those cases.

Opportunities also exist for interventions to influence appropriate prescribing of fluoroquinolones. A number of studies have demonstrated the positive effect of policy changes, education, and information dissemination.¹⁴⁻¹⁸ Education around risks associated with fluoroquinolones and investigation into a greater understanding of allergies in relation to antibiotics,¹¹ as well as a review of local, national, and international guidelines, may be considered for future improvements around fluoroquinolone prescribing. Allergies, in particular, were mentioned by all primary care providers in these surveys. This supports assertions that if a patient experiences an adverse reaction, providing patient education and documenting details could help avoid labelling a side effect an “allergy.”¹⁹

Many treatment guidelines recommend that primary care practitioners access information on regional antibiotic-resistance patterns when deciding upon appropriate antibiotic prescribing.^{20,21} However, for those participating in this survey, there appears to be an information gap about this. Improved access to this information as well as education around its use may be an opportunity to improve prescribing of antibiotics.

Education to address gaps in knowledge or practice regarding appropriate prescribing of fluoroquinolones should likely be tailored to context (urban, rural, remote), as well as to the relative experience of the primary care provider, and targeted to sources where providers already receive information.

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Appendix 1: Survey of Family Physicians and Nurse Practitioners

The questions in the survey of family physicians and nurse practitioners were developed by CADTH in collaboration with Ipsos Public Affairs. The survey was designed to gather information about experiences and decision-making processes around outpatient prescribing of antibiotics for specific indications.

Primary Care Practitioner Practice

1. In which province or territory do you practice/are you located?

- | | | | |
|---|--|---|--------------------------------|
| <input type="checkbox"/> Alberta | <input type="checkbox"/> Newfoundland and Labrador | <input type="checkbox"/> Ontario | <input type="checkbox"/> Yukon |
| <input type="checkbox"/> British Columbia | <input type="checkbox"/> Northwest Territories | <input type="checkbox"/> Prince Edward Island | |
| <input type="checkbox"/> Manitoba | <input type="checkbox"/> Nova Scotia | <input type="checkbox"/> Quebec | |
| <input type="checkbox"/> New Brunswick | <input type="checkbox"/> Nunavut | <input type="checkbox"/> Saskatchewan | |

2. Please identify your main role:

- | | | | |
|---|---|-------------------------------------|---|
| <input type="checkbox"/> Family physician | <input type="checkbox"/> Nurse practitioner | <input type="checkbox"/> Pharmacist | <input type="checkbox"/> Other (please specify) |
|---|---|-------------------------------------|---|

3. Which populations does your practice serve? (check all that apply)

- | | | | |
|--------------------------------|--------------------------------|---------------------------------|---|
| <input type="checkbox"/> Urban | <input type="checkbox"/> Rural | <input type="checkbox"/> Remote | <input type="checkbox"/> Other (please specify) |
|--------------------------------|--------------------------------|---------------------------------|---|

4. How many years have you been practicing in primary care?

Indication A: Uncomplicated Cystitis

A1. What sources of information do you refer to when considering possible antibiotic treatment options for adult patients with uncomplicated UTIs: cystitis or pyelonephritis? (check all that apply)

- Internal/ organizational or local treatment guidelines
- Continuing professional development material
- Previous clinical experience
- Other (please specify)
- National or international clinical practice guidelines
- Colleagues or local practice patterns
- Other clinical decision making tools
- Apps (please select all that apply)
 - UptoDate
 - Dynamed
 - Bugs and Drugs
 - Sanford Guide to Antimicrobial Therapy
 - RxTx
 - Spectrum MD
 - WebMD
 - Medscape
 - Other (please specify)

A2. Which of the following factors influence your choice of treatment when prescribing antibiotics for adult patients with uncomplicated cystitis, that occurs in a healthy host [excluding pregnant women] in the absence of structural or functional abnormalities of the urinary tract? (check all that apply)

- Suspected or confirmed etiology
- Compliance history
- Costs for health care system
- Diagnostic certainty
- Medical history
- Patient expectation or preference
- Local resistance patterns
- Drug safety
- Allergy history
- Availability
- Known patient tolerance issues
- Other (please specify)
- Drug effectiveness
- Costs for patient
- Patient and/or provider threshold for failure

A3. What antibiotic do you prescribe as your first choice for therapy for uncomplicated cystitis?

A4. Why do you prescribe this antibiotic as your first choice for therapy?

A5. What antibiotic do you consider as your second choice for therapy for uncomplicated cystitis?

A6. Why do you consider this as your second choice for therapy?

A7. Do you have any other comments on the choice of antibiotic for therapy for uncomplicated cystitis?

- Yes (please provide details)
- No

A8. Describe when and why you might prescribe a fluoroquinolone (e.g. ciprofloxacin, levofloxacin, norfloxacin, ofloxacin) as a treatment for uncomplicated cystitis.

Indication B: Uncomplicated Pyelonephritis

B1. Which of the following factors influence your choice of treatment when prescribing antibiotics for adult patients with uncomplicated pyelonephritis, that occurs in a healthy host [excluding pregnant women] in the absence of structural or functional abnormalities of the urinary tract? (check all that apply)

- | | | | |
|--|--|--|---|
| <input type="checkbox"/> Suspected or confirmed etiology | <input type="checkbox"/> Compliance history | <input type="checkbox"/> Costs for health care system | <input type="checkbox"/> Diagnostic certainty |
| <input type="checkbox"/> Medical history | <input type="checkbox"/> Patient expectation or preference | <input type="checkbox"/> Local resistance patterns | <input type="checkbox"/> Drug safety |
| <input type="checkbox"/> Allergy history | <input type="checkbox"/> Availability | <input type="checkbox"/> Known patient tolerance issues | <input type="checkbox"/> Other (please specify) |
| <input type="checkbox"/> Drug effectiveness | <input type="checkbox"/> Costs for patient | <input type="checkbox"/> Patient and/or provider threshold for failure | |

B2. What antibiotic do you prescribe as your first choice for therapy for uncomplicated pyelonephritis?

B3. Why do you prescribe this antibiotic as your first choice for therapy? (please provide details)

B4. What antibiotic do you consider as your second choice for therapy for uncomplicated pyelonephritis?

B5. Why do you consider this as your second choice of therapy? (please provide details)

B6. Do you have any other comments on the choice of antibiotic for therapy for uncomplicated pyelonephritis?

- Yes (please provide details)
- No

B7. Describe when and why you might prescribe a fluoroquinolone (e.g. ciprofloxacin, levofloxacin, norfloxacin) as a treatment for uncomplicated pyelonephritis. (please provide details)

Indication C: Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

C1. What external sources of information do you refer to when considering possible antibiotic treatment options for adult patients with acute bacterial exacerbation of chronic bronchitis in COPD? (check all that apply)

- Internal/ organizational or local treatment guidelines
- Continuing professional development material
- Previous clinical experience
- Other (please specify)
- National or international clinical practice guidelines
- Colleagues or local practice patterns
- Other clinical decision making tools
- Apps (please select all that apply)
 - UptoDate
 - Dynamed
 - Bugs and Drugs
 - Sanford Guide to Antimicrobial Therapy
 - RxTx
 - Spectrum MD
 - WebMD
 - Medscape
 - Other (please specify)

C2. Which of the following factors influence your choice of treatment when prescribing antibiotics for adult patients with acute bacterial exacerbation of chronic bronchitis in COPD? (check all that apply)

- Suspected or confirmed etiology
- Compliance history
- Costs for health care system
- Diagnostic certainty
- Medical history
- Patient expectation or preference
- Local resistance patterns
- Drug safety
- Allergy history
- Availability
- Known patient tolerance issues
- Other (please specify)
- Drug effectiveness
- Costs for patient
- Patient and/or provider threshold for failure

C3. What antibiotic do you prescribe as your first choice for therapy for acute bacterial exacerbation of chronic bronchitis for COPD?

C4. Why do you prescribe this antibiotic as your first choice for therapy? *(please provide details)*

C5. What antibiotic do you consider as your second choice for therapy for acute bacterial exacerbation of chronic bronchitis for COPD?

C6. Why do you consider this as your second choice of therapy? *(please provide details)*

C7. Do you have any other comments on the choice of antibiotic for therapy for acute bacterial exacerbation of chronic bronchitis for COPD?

- Yes *(please provide details)*
- No

C8. Describe when and why you might prescribe a fluoroquinolone (e.g. ciprofloxacin, levofloxacin, moxifloxacin, ofloxacin) as a treatment for patients with acute bacterial exacerbation of chronic bronchitis in COPD. *(please provide details)*

Indication D: Acute Bacterial Sinusitis

D1. What external sources of information do you refer to when considering possible antibiotic treatment options for adult patients with acute bacterial sinusitis? (check all that apply)

- Internal/ organizational or local treatment guidelines
- Continuing professional development material
- Previous clinical experience
- Other (please specify)
- National or international clinical practice guidelines
- Colleagues or local practice patterns
- Other clinical decision making tools
- Apps (please select all that apply)
 - UptoDate
 - Dynamed
 - Bugs and Drugs
 - Sanford Guide to Antimicrobial Therapy
 - RxTx
 - Spectrum MD
 - WebMD
 - Medscape
 - Other (please specify)

D2. Which of the following factors influence your choice of treatment when prescribing antibiotics for adult patients with acute bacterial sinusitis? (check all that apply)

- Suspected or confirmed etiology
- Compliance history
- Costs for health care system
- Diagnostic certainty
- Medical history
- Patient expectation or preference
- Local resistance patterns
- Drug safety
- Allergy history
- Availability
- Known patient tolerance issues
- Other (please specify)
- Drug effectiveness
- Costs for patient
- Patient and/or provider threshold for failure

D3. What antibiotic do you prescribe as your first choice for therapy for acute bacterial sinusitis?

D4. Why do you prescribe this antibiotic as your first choice for therapy? (please provide details)

D5. What antibiotic do you consider as your second choice for therapy for acute bacterial sinusitis?

D6. Why do you consider this as your second choice of therapy? *(please provide details)*

D7. Do you have any other comments on the choice of antibiotic for therapy for acute bacterial sinusitis?

- Yes *(please provide details)*
- No

D8. Describe when and why you might prescribe a fluoroquinolone (e.g. levofloxacin, moxifloxacin) as a treatment for acute bacterial sinusitis. *(please provide details)*

Regional Resistance Patterns

QE1. Several clinical practice guidelines recommend that health care professionals consider the “regional resistance patterns” when selecting an antibiotic drug. Do you have access to current data concerning regional resistance patterns?

- Yes
- No
- Unsure

QE2. Where do you obtain data about regional resistance patterns? *(please provide details)*

QE3. Lastly, do you have any other comments you would like to share regarding your prescribing practices around antibiotics for the all the indications described?

QE4. Thank you for completing the survey. Would you be interested in participating in further research about the prescribing of antibiotics in the form of a telephone interview?

- Yes *(please provide details)*
- No

Appendix 2: Survey of Pharmacists

The questions in the survey of pharmacists were developed by CADTH in collaboration with Ipsos Public Affairs. The survey was designed to gather information about experiences and decision-making processes around outpatient prescribing of antibiotics for specific indications.

Primary Care Practitioner Practice

1. In which province or territory do you practice/are you located?

- | | | | |
|---|--|---|--------------------------------|
| <input type="checkbox"/> Alberta | <input type="checkbox"/> Newfoundland and Labrador | <input type="checkbox"/> Ontario | <input type="checkbox"/> Yukon |
| <input type="checkbox"/> British Columbia | <input type="checkbox"/> Northwest Territories | <input type="checkbox"/> Prince Edward Island | |
| <input type="checkbox"/> Manitoba | <input type="checkbox"/> Nova Scotia | <input type="checkbox"/> Quebec | |
| <input type="checkbox"/> New Brunswick | <input type="checkbox"/> Nunavut | <input type="checkbox"/> Saskatchewan | |

2. Please identify your main role:

- Family physician
 Nurse practitioner
 Pharmacist
 Other (please specify)

3. Which populations does your practice serve? (Check all that apply)

- Urban
 Rural
 Remote
 Other (please specify)

4. How many years have you been practicing in primary care?

Indication A: Uncomplicated Cystitis

A1. What sources of information do you refer to when it comes to antibiotic treatments prescribed for adult patients with uncomplicated UTIs: cystitis or pyelonephritis? (check all that apply)

- | | | | |
|---|---|---|---|
| <input type="checkbox"/> Internal/ organizational or local treatment guidelines | <input type="checkbox"/> Continuing professional development material | <input type="checkbox"/> Previous clinical experience | <input type="checkbox"/> Other (please specify) |
| <input type="checkbox"/> National or international clinical practice guidelines | <input type="checkbox"/> Colleagues or local practice patterns | <input type="checkbox"/> Other clinical decision making tools | |
| <input type="checkbox"/> Apps (please select all that apply) | | | |
| <input type="checkbox"/> UptoDate | | | |
| <input type="checkbox"/> Dynamed | | | |
| <input type="checkbox"/> Bugs and Drugs | | | |
| <input type="checkbox"/> Sanford Guide to Antimicrobial Therapy | | | |
| <input type="checkbox"/> RxTx | | | |
| <input type="checkbox"/> Spectrum MD | | | |
| <input type="checkbox"/> WebMD | | | |
| <input type="checkbox"/> Medscape | | | |
| <input type="checkbox"/> Other (please specify) | | | |

A2. In your practice, what is the most commonly prescribed antibiotic(s) you see prescribed by practitioners for therapy for uncomplicated cystitis? (please select the ones most commonly seen)

- | | | |
|--|--|--|
| <input type="checkbox"/> Beta lactam antibiotic | <input type="checkbox"/> Fosfomycin trometamol | <input type="checkbox"/> Fluoroquinolone |
| <input type="checkbox"/> Trimethoprim-sulfamethoxazole (TMP-SMX) | <input type="checkbox"/> Pivmecillinam | <input type="checkbox"/> Nitrofurantoin monohydrate/ macrocrystals |
| <input type="checkbox"/> Other (please specify) | | |

A3. Of the ones you selected, is there one antibiotic you see in your practice that is more commonly prescribed by practitioners? (select one response only)

- | | | |
|--|---|--|
| <input type="checkbox"/> Beta lactam antibiotic | <input type="checkbox"/> Fosfomycin trometamol | <input type="checkbox"/> Fluoroquinolone |
| <input type="checkbox"/> Trimethoprim-sulfamethoxazole (TMP-SMX) | <input type="checkbox"/> Pivmecillinam | <input type="checkbox"/> Nitrofurantoin monohydrate/ macrocrystals |
| <input type="checkbox"/> Other (please specify) | <input type="checkbox"/> None is prescribed more often than the other | |

A4. Describe when you might see a fluoroquinolone (e.g. ciprofloxacin, levofloxacin, norfloxacin, ofloxacin) prescribed as a treatment for uncomplicated cystitis. *(please provide details)*

A5. In which circumstances would you contact a prescribing clinician? *(describe circumstances and other action(s) you would take)*

A6. Do you have any other comments on the choices of antibiotic for therapy that you see prescribed by practitioners for uncomplicated cystitis?

- Yes *(please provide details)*
- No

Indication B: Uncomplicated Pyelonephritis

B1. What sources of information do you refer to when it comes to antibiotic treatments prescribed for adult patients with uncomplicated pyelonephritis? (check all that apply)

- Internal/ organizational or local treatment guidelines
- Continuing professional development material
- Previous clinical experience
- Other (please specify)
- National or international clinical practice guidelines
- Colleagues or local practice patterns
- Other clinical decision making tools
- Apps (please select all that apply)
 - UptoDate
 - Dynamed
 - Bugs and Drugs
 - Sanford Guide to Antimicrobial Therapy
 - RxTx
 - Spectrum MD
 - WebMD
 - Medscape
 - Other (please specify)

B2. In your practice, what are the most commonly prescribed antibiotics you see prescribed by practitioners for outpatient therapy for uncomplicated pyelonephritis? (please select the ones most commonly seen)

- Fluoroquinolone
- Amoxicillin-clavulanate
- Other (please specify)
- Trimethoprim-sulfamethoxazole (TMP-SMX)
- Second and third generation cephalosporin (cefepodoxime, cefdinir, cefaclor)

B3. Of the ones you selected, is there one antibiotic you see in your practice that is more commonly prescribed by practitioners? (select one response only)

- Fluoroquinolone
- Amoxicillin-clavulanate
- Other (please specify)
- Trimethoprim-sulfamethoxazole (TMP-SMX)
- Second and third generation cephalosporin (cefepodoxime, cefdinir, cefaclor)
- None is prescribed more often than the other

B4. Describe when you might see a fluoroquinolone (e.g. ciprofloxacin, levofloxacin, norfloxacin) as prescribed a treatment for uncomplicated pyelonephritis. (please provide details)

B5. In which circumstances would you contact a prescribing clinician? (describe circumstances and other action(s) you would take)

B6. Do you have any other comments on the choices of antibiotic for therapy that you see prescribed by practitioners for uncomplicated pyelonephritis?

- Yes (please provide details)
- No

Indication C: Acute Bacterial Exacerbation of Chronic Bronchitis in Chronic Obstructive Pulmonary Disease

C1. What sources of information do you refer to when it comes to antibiotic treatments prescribed for adult patients with acute bacterial exacerbation of chronic bronchitis in COPD? (check all that apply)

- Internal/ organizational or local treatment guidelines
- Continuing professional development material
- Previous clinical experience
- Other (please specify)
- National or international clinical practice guidelines
- Colleagues or local practice patterns
- Other clinical decision making tools
- Apps (please select all that apply)
 - UptoDate
 - Dynamed
 - Bugs and Drugs
 - Sanford Guide to Antimicrobial Therapy
 - RxTx
 - Spectrum MD
 - WebMD
 - Medscape
 - Other (please specify)

C2. In your practice, what are the most commonly prescribed antibiotics you see prescribed by practitioners for therapy for acute bacterial exacerbation of chronic bronchitis for COPD? (please select the ones most commonly seen)

- | | | |
|--|--|--|
| <input type="checkbox"/> Advanced macrolide (azithromycin, clarithromycin) | <input type="checkbox"/> Trimethoprim-sulfamethoxazole (TMP-SMX) | <input type="checkbox"/> Cephalosporin (cefuroxime, cefpodoximem cefdinir) |
| <input type="checkbox"/> Fluoroquinolone | <input type="checkbox"/> Doxycycline | <input type="checkbox"/> Amoxicillin-clavulanate |
| <input type="checkbox"/> Other (please specify) | | |

C3. Of the ones you selected, is there one antibiotic you see in your practice that is more commonly prescribed by practitioners? (select one response only)

- | | | |
|--|---|--|
| <input type="checkbox"/> Advanced macrolide (azithromycin, clarithromycin) | <input type="checkbox"/> Trimethoprim-sulfamethoxazole (TMP-SMX) | <input type="checkbox"/> Cephalosporin (cefuroxime, cefpodoximem cefdinir) |
| <input type="checkbox"/> Fluoroquinolone | <input type="checkbox"/> Doxycycline | <input type="checkbox"/> Amoxicillin-clavulanate |
| <input type="checkbox"/> Other (please specify) | <input type="checkbox"/> None is prescribed more often than the other | |

C4. Describe when you might see a fluoroquinolone (e.g. ciprofloxacin, levofloxacin, moxifloxacin, ofloxacin) prescribed as a treatment for acute bacterial exacerbation of chronic bronchitis for COPD. (please provide details)

C5. In which circumstances would you contact a prescribing clinician? (describe circumstances and other action(s) you would take)

C6. Do you have any other comments on the choices of antibiotic for therapy for acute bacterial exacerbation of chronic bronchitis for COPD that you see prescribed by practitioners?

- Yes (please provide details)
- No

Indication D: Acute Bacterial Sinusitis

D1. What sources of information do you refer to when it comes to antibiotic treatments prescribed for adult patients with acute bacterial sinusitis? *(check all that apply)*

- Internal/ organizational or local treatment guidelines
- Continuing professional development material
- Previous clinical experience
- Other (please specify)
- National or international clinical practice guidelines
- Colleagues or local practice patterns
- Other clinical decision making tools
- Apps (please select all that apply)
 - UptoDate
 - Dynamed
 - Bugs and Drugs
 - Sanford Guide to Antimicrobial Therapy
 - RxTx
 - Spectrum MD
 - WebMD
 - Medscape
 - Other (please specify)

D2. In your practice, what are the most commonly prescribed antibiotics you see prescribed by practitioners for therapy for acute bacterial sinusitis? *(please select the ones most commonly seen)*

- Amoxicillin
- Amoxicillin-clavulanate
- Trimethoprim-sulfamethoxazole (TMP-SMX)
- Fluoroquinolone
- Clindamycin and a cephalosporin (cefixime or cefpodoxime)
- Doxycycline
- Macrolides (clarithromycin or azithromycin)
- Trimethoprim-sulfamethoxazole
- Oral second or third generation cephalosporins
- Other (please specify)

D3. Of the ones you selected, is there one antibiotic you see in your practice that is more commonly prescribed by practitioners?

- | | | |
|--|--|---|
| <input type="checkbox"/> Amoxicillin | <input type="checkbox"/> Amoxicillin-clavulanate | <input type="checkbox"/> Trimethoprim-sulfamethoxazole (TMP-SMX) |
| <input type="checkbox"/> Fluoroquinolone | <input type="checkbox"/> Clindamycin and a cephalosporin (cefixime or cefpodoxime) | <input type="checkbox"/> Doxycycline |
| <input type="checkbox"/> Macrolides (clarithromycin or azithromycin) | <input type="checkbox"/> Trimethoprim-sulfamethoxazole | <input type="checkbox"/> Oral second or third generation cephalosporins |
| <input type="checkbox"/> Other (please specify) | <input type="checkbox"/> None is prescribed more often than the other | |

D4. Describe when you might see a fluoroquinolone (e.g. levofloxacin, moxifloxacin) as prescribed a treatment for acute bacterial sinusitis. (please provide details)

D5. In which circumstances would you contact a prescribing clinician? describe circumstances and other action(s) you would take)

D6. Do you have any other comments on the choices of antibiotic for therapy that you see prescribed by practitioners for acute bacterial sinusitis?

- Yes (please provide details)
- No

Regional Resistance Patterns

QE1. Several clinical practice guidelines recommend that health care professionals consider the “regional resistance patterns” when selecting an antibiotic drug. Do you have access to current data concerning regional resistance patterns?

- Yes
- No
- Unsure

QE2. Where do you obtain data about regional resistance patterns? (please provide details)

QE3. Lastly, do you have any other comments you would like to share regarding your prescribing practices around antibiotics for the all the indications described?

QE4. Thank you for completing the survey. Would you be interested in participating in further research about the prescribing of antibiotics in the form of a telephone interview?

- Yes (*please provide details*)
- No