

EDUCATION SERIES

Treatment Challenges: Urinary Tract Infections, Older Adults and Antibiotic Resistance

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Statement of Funding

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Introduction

As anyone who has ever experienced a urinary tract infection (UTI) knows, they can be painful, disruptive, and for some people, highly embarrassing. The impact of UTIs goes well beyond the medical condition itself. At the most personal level, many older adults may be hesitant to bring up UTIs with anyone at all, due to stigma, shame or embarrassment. Depending on how UTI symptoms present, the older person may not even be aware of their condition, or ascribe the symptoms to age or other factors.

Often associated with younger women, many older people may not think of UTIs as conditions which apply to them. Some health care providers may not be as attuned to checking for UTIs in older adults despite their prevalence and negative impacts. Government and health policymakers may not keep UTIs, and their associated treatments, front of mind when they are thinking about health care supports – and may be unaware of the economic impacts of the infection or the need for careful antibiotic stewardship.

In short, UTIs are no joke. They are often medically overlooked, poorly managed and personally underreported. UTIs negatively impact physical, psychological, mental and social well-being. And all of these can be improved with education and awareness, policy change, and destigmatization.

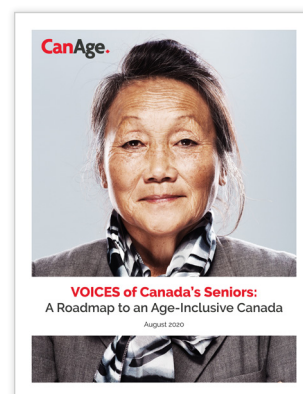
But why is a seniors' advocacy organization focussing on UTIs and incontinence? In short, because UTIs are a growing problem, both in terms of Canada's rapidly aging population in real numbers, and also in terms of impact.

At CanAge, we work tirelessly to educate, empower and mobilize people on the issues that matter most to seniors and their families. As an independent, non-partisan, not-for-profit organization, we believe every Canadian – independent of age – deserves a vibrant, connected, and meaningful life with equitable access to the resources needed to thrive.

As a pan-Canadian organization, CanAge also knows that older Canadians are diverse in their experiences, perspectives, passions, and contexts. As a group, Canadian seniors will represent 23% of the population by 2030. Politically engaged, Canadian seniors are consistently the most active voter group

at the polls, with approximately 72% of seniors indicating that they vote in every election and nearly 80% voting in the last 2 federal elections. The needs of a rapidly aging population must be a key priority for policy-makers.

In 2020, CanAge released its **VOICES of Canada's Seniors: A Roadmap for an Age-Inclusive Canada**. It outlines a way forward for Canada, with 6 Compass Points, 40 Issues and 135 specific evidence-based Recommendations.



The 6 Compass Points of the VOICES Roadmap are:

- V** Violence and Abuse Prevention
- O** Optimal Health and Wellness
- I** Infection Prevention and Disaster Response
- C** Caregiving, Long-Term Care, Home Care and Housing Resources
- E** Economic Security
- S** Social Inclusion



In our UTI 101 series, CanAge explores the effects of incontinence and urinary tract infections amongst each of these 6 Compass Point areas.

V - Violence and Abuse Prevention investigates the links between incontinence, care dependence and elder abuse, neglect and self-neglect.

O - Optimal Health and Wellness digs into issues such as medical under-diagnosis, antibiotic stewardship and co-morbidities and underreporting by individuals due to stigma, embarrassment or conflation of symptomatology.

I - Infection Prevention and Disaster Response explores how long term care IPAC standards intersect with the prevalence, prevention and treatment of UTIs.

C - Caregiving, Long-Term Care, Home Care and Housing Resources delves both how and why avoidable UTIs remain the primary reason for hospital admissions from congregate

care settings and also what we can do to promote urinary health across the housing continuum.

E - Economic Security uncovers both the substantial financial burden UTIs place on the healthcare system as well as the significant cost to an individual for incontinence products and UTI treatments.

S - Social Isolation connects the often tragic and direct links between UTIs on the one hand, and incontinence, loneliness and stigma on the other.

CanAge is committed to the health and well-being of all Canadians as we age. We hope that this series will help to shift minds, policies and treatments options for UTIs and incontinence.

It's time to take this issue on seriously. We hope that this paper, this series and our additional knowledge tools will help to put us on the path to well-being and confidence in aging.

Executive Summary

This paper highlights how treatment of urinary tract infections in older adults intersects with the urgent problem of antibiotic resistance.

As one of the most commonly occurring infections across healthcare settings, urinary tract infections are a frequent cause for prescribing antibiotics. This paper considers antibiotic resistance in the context of the challenges of accurately diagnosing and treating UTIs in older adults. Older adults will sometimes have an innocuous condition called asymptomatic bacteriuria, or present with non-specific symptoms. Both situations often result in needless and potentially dangerous antibiotic prescriptions. Harm can occur on an individual level (ex. side effects, drug-drug interactions) up to the global, urgent and costly harms of antibiotic resistance. Antibiotic resistance threatens our ability to treat infectious diseases, and this paper urges policy makers, healthcare professionals, advocates and the general public to consider how inappropriate prescription of antibiotics for UTIs in older adults is contributing to this global health emergency.

This paper provides a brief overview of this topic. It is the third in a series of papers that explore different aspects of UTIs and incontinence, including: **Urinary Tract Infections 101: Improving Well-Being with Knowledge & Supports, Prevention of Urinary Tract Infections: Reducing Risk and Protecting Older Adults** and **Urinary Incontinence: The Impact on the Well-being of Older Adults**.

For further information on these topics, please refer to the individual papers in the series.

Introduction

UTIs are one of the most common infections found across healthcare settings, including long-term care (LTC) and inpatient units. An estimated 30-50% of antibiotics used in long-term care are to treat UTIs.¹ UTIs are the most frequent complaint in outpatient clinics in the US² and have been found to be the most common healthcare associated infection in Canada.³ Generally, the standard treatment for a UTI is a course of antibiotics.⁴ As such, UTIs are one of the most frequent reasons for prescribing antibiotics. In a perfect world, UTIs would be accurately diagnosed and treated with the right antibiotic for the correct duration. Recurring UTIs, often defined as two or more UTIs in a 6-month period⁵, would be prevented through antibiotic prophylaxis (taking antibiotics in order to prevent an infection from occurring in the first place). However, the world is not perfect and numerous factors converge to complicate the treatment of UTIs in older adults. These factors include the global problem of antibiotic resistance, accurately diagnosing UTIs in older people, and effectively delivering the right treatment. This paper examines each of these factors and their implications, including the human and financial burden of treating UTIs.

UTIs are one of the most frequent reasons for prescribing antibiotics.

Antibiotic Resistance

A major contextual factor complicating UTI treatment is what the World Health Organization considers one of the biggest threats to global health: antibiotic resistance.⁶ Antibiotic resistance occurs when bacteria change in response to the use of antibiotics, rendering medications useless. Although antibiotics have had an extraordinary impact on human health and life expectancy⁷, antibiotic resistance threatens our ability to successfully treat infectious diseases, leading to worse health outcomes including the spread of disease, increased disability and death.⁶ Antibiotic resistance is a natural process, but it is unnaturally accelerated when we use antibiotics inappropriately, such as prescribing antibiotics when we don't need them.⁶ A UTI-specific example is fluoroquinolones, a class of antibiotic that is now less widely used as a first-line of treatment for UTIs in part because of side effects and in part because the bacteria it attacks has

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become more resistant - with rates of resistance growing from 1.2% in 1998 to 30% in 2013.⁸

Note that bacteria become resistant to antibiotics, people do not (World Health Organization 2020).⁶ Risk factors for developing antibiotic-resistant infections vary based on personal and medical history. Demographic factors, such as ethnicity, older age, gender, history of travel to a developing country and living in a retirement home can all influence antibiotic resistance. Resistant infections often appear alongside conditions such as catheterization, diabetes and/or other immunodeficiencies. A history of using specific antibiotics for clinical treatment may also increase risk of bacterial resistance.⁹ Summed up, the patient profile, the infection and the resistance of the bacteria all play a role in determining the appropriate antibiotic for treatment.¹⁰ Although some antibiotics continue to effectively treat UTIs in older adults, antibiotic resistance is a global problem and as a global community, it is not a problem we are on track to solve. Experts in the field, and validated by the World Health Organization, have found that there is insufficient development of new antibiotics to keep pace with antibiotic resistance, leaving us all vulnerable (WHO 2021; Ventola 2015).^{11, 12} Antibiotics are essential to the treatment of UTIs in older adults and as such, the importance of antibiotic resistance cannot be understated.

Accurate Diagnosis

Symptom Presentation and Communicating Symptoms

The right treatment requires an accurate diagnosis. As discussed in our previous paper, [Urinary Tract Infections 101: Improving Well-Being with Knowledge & Supports](#), one challenge to accurately diagnosing UTIs is how the infection may present in older adults. Older adults may or may not present with localized urinary symptoms such as pain when urinating and increase in frequency and urgency, they may have other or additional symptoms and there may be other medical explanations for symptoms.^{13, 14} Additionally, people living with cognitive impairment may have trouble communicating symptoms to their healthcare providers, also

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making accurate diagnosis difficult.¹⁵ UTI symptoms may present differently in older adult populations. For example, more typical presentations of infection, such as fever, may not occur. Older adults tend to show more non-specific and vague symptoms, such as confusion or functional decline, which could be a result from a variety of medications, other illnesses or environmental impacts.¹⁶ If non-specific symptoms exist, other causes for the symptoms should be evaluated and ruled out, for example, changes to diet, new medication, or dehydration.^{17, 18} In order to diagnose a UTI in an older adult, UTI specific symptoms as well as a urinalysis should occur. Some of these symptoms, which may appear in combination, can include dysuria (pain when urinating), blood in urine, fever, or increased urgency and frequency of urination. For those in LTC homes or those with cognitive impairment, identifying symptoms may be more challenging.^{13, 17}

Asymptomatic Bacteriuria

An important challenge to accurate diagnosis of UTIs in older adults is asymptomatic bacteriuria (ABU), which is defined as the existence of bacteria in urine without any UTI symptoms. ABU becomes more common as we age and can be found in 15%–30% of men in LTC and 25%–50% of women in LTC.¹⁷ It is often confused for a UTI and can lead to misdiagnosis and improper antibiotic use. Anywhere between 30–40 % of prescriptions for UTI cases are mistakenly diagnosed and are in fact cases of ABU.¹⁵ In Ontario long-term care settings, it is estimated that up to 80% of residents with ABU are treated with antibiotics.¹⁷ There are many causes for having bacteria in urine. ABU alone, without any UTI clinical symptoms, should not warrant antibiotic prescription. There is significant evidence to show no benefit for older adults to take antibiotics to treat ABU, and significant risks, discussed in more detail below.^{13, 17, 18, 19}

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Testing Protocols

Combined with ABU, symptom presentation and challenges with communicating symptoms, the tests often used in diagnosing UTIs are frequently unreliable for older adults.

Dipstick tests are instant tests that can detect abnormalities in a urine sample. Although dipsticks can detect signs of infection and bacteria in the urine, they are unable to distinguish between ABU and UTIs.^{17, 18, 19} Another test is a urine culture, which takes longer to complete but can identify the type and quantity of bacteria present in the urine sample. Cultures, in the absence of specific urogenital symptoms, have also been found to be unreliable in older people.¹⁸ Both tests also require a 'clean catch' sample. This means the sample is collected midstream in order to avoid contamination and skewed results. Clean catch samples can be challenging to collect, especially in older adult populations: in one study, 38% of urine collected from older adults was contaminated.¹⁵ Clinicians need better training for collecting a clean sample as well as improved understanding of urinalysis for more informed prescribing.¹⁵ This is reflected in a research project with the goal of creating a tool to effectively diagnose UTIs in frail older adult patients, where 13 out of 14 experts interviewed believed that dipsticks and cultures were an ineffective way to test for infection.¹⁸ Instead, they should only be used to rule out UTIs, with cultures being used to help choose the right antibiotic if a UTI is present. Positive test results from urinalysis do not warrant treatment - UTI specific symptoms must also be present in older adults.^{13, 17, 18}

Despite evidence and guidelines to the contrary, positive test results continue to justify UTI diagnosis and antibiotic prescribing. Research suggests a number of explanations. One, some healthcare providers believe they are an efficient tool for determining the presence of an infection, indicating a need for education.^{15, 17} In interviews to understand collaboration and communication within the hospital for UTI management, many junior doctors were unaware of the complexity with ABU and older adults and did not know that antibiotics should not be used to treat ABU. Nurses in the same study also routinely performed and relied on dipstick tests, even when patients presented with vague non-specific symptoms, advocating for antibiotics. A related second factor, while some more senior doctors reported being distrustful of dipstick test results as a diagnostic tool, they were still likely to prescribe antibiotics when patients presented with positive dipsticks and non-specific symptoms. This can be described as 'prescribing etiquette', where clinicians may feel the need to pacify patients and colleagues by prescribing antibiotics. As Saukko and colleagues (2019) found: "Interviews with

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junior doctors found that antibiotic overprescribing was driven by overreliance on laboratory results, fear of poor outcomes, perceived pressure from peers and patients, and difficulties in interpreting symptoms”(2).¹⁵ Three, some research shows communication gaps can lead to inappropriate prescribing of antibiotics for UTIs, including between healthcare providers in the same setting, between settings as well as between healthcare providers and patients and their families. For example, patients may not be aware of the unreliability of dipsticks and request antibiotics, or test results may be interpreted differently by different clinicians.¹⁵ Finally, there may be challenges related to guidelines governing antibiotic use. A context-specific example can be found in some nursing homes, where it is common practice to provide low or half dose antibiotics to vulnerable patients to prevent infections, such as UTIs. In fact, nearly 70% of prophylactic antibiotics given in nursing homes are given to prevent UTIs. Guidelines for using antibiotics as a prophylactic tool, such as dosage and duration of days on a medication, are lacking and vary by jurisdictions. Sloane, Tandan and Zimmerman (2020) state that “Vague guidelines and lack of strong nursing home data lead to substantial prescribing that can be thought of as preventive, because the motivating factor for the prescription is not professional standards but a feeling that doing something is better than doing nothing”(182).²⁰ It is possible this perspective might also apply to individual patients as well, where clinicians may think about prescribing on an individual level, rather than thinking about the implications of antibiotic resistance.

Communication Gaps

Similar to communication gaps about testing, misunderstandings between different clinicians and patients about symptoms for UTI in older adults has led to miscommunication between these groups and incorrect antibiotic prescribing. For example, clinicians and patients both need to focus on symptoms that are specific to UTI, rather than non-specific symptoms that may present during infection. Educating patients on relevant signs and symptoms for UTI is another key method to ensure antibiotics are appropriately prescribed. It is important that in healthcare

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settings, the roles of each party involved is understood to ensure clear communication.¹⁵

Sometimes, the rationale for prescription may be absent on medical records, which can lead to further confusion.²⁰ Some nurses and physicians often relied too heavily on vague symptoms, which has already been determined to be an ineffective way to accurately diagnose an infection.^{15, 16} Challenges to communicate with older adults who have cognitive impairment and functional decline may also force clinicians to rely on presenting symptoms more heavily, even if they are not specific to UTIs.^{13, 15, 16}

Human and Economic Impact

Health Burden

Although antibiotics are life-saving and the empiric treatment for UTIs, older adults may also experience negative effects of antibiotic medications worthy of careful consideration. Research indicates older people tend to: be more vulnerable to side effects, take more medications (polypharmacy) increasing the chances of drug-drug interactions and have age-related changes that affect how medications operate in the body (ex. how they are absorbed and eliminated) The negative impacts of taking antibiotics can range from adverse reactions like gastrointestinal discomfort, to bleeding risks in a drug-drug interaction.²¹ Obviously, for older people with true UTIs, the benefits of antibiotics likely outweigh the risks and there is evidence that antibiotics compared to no antibiotics or deferred antibiotics presents its own risks, including bloodstream infection.²² However, when considering the possible risks associated with antibiotics, two groups of older adults are of particular concern: those with ABU and those with recurring UTIs. For the first group, given the discussion of ABU above, it is evident that people are needlessly put at risk, as antibiotics have no benefit in the case of ABU. For people with recurrent UTIs, there is some evidence that using antibiotics prophylactically can be helpful in preventing UTIs.²³ However, a recent Ontario-based study examining people 65+ receiving antibiotics prophylactically compared to antibiotics as treatment found the former group was at increased risk for hospitalization, C. difficile, and side effects of antibiotics,

A recent Ontario-based study examining people 65+ receiving antibiotics prophylactically compared to antibiotics as treatment found the former group was at increased risk for hospitalization, C. difficile, and side effects of antibiotics, concluding that the risks associated with antibiotic prophylaxis outweighed the potential benefit of preventing a UTI.²⁴

concluding that the risks associated with antibiotic prophylaxis outweighed the potential benefit of preventing a UTI.²⁴ With regard to people living in nursing homes, some authors argue that even with a lack of data on the effects of antibiotic prophylaxis over the long-term, the possibilities for treating UTIs without antibiotics and high level of antibiotic resistance present in nursing home infections are a strong argument against the practice.²⁰

As discussed here and above, antibiotic resistance is also a concern, as age is a risk factor. A study examining US data found that people 65+ hospitalized with a UTI diagnosis experienced more severe outcomes if there was antibiotic resistance present. Patients were more likely to die, stay in the hospital longer, and be discharged to another healthcare facility instead of home. The same study found the prevalence of hospital admissions associated with antibiotic resistance increased over the study period (2009-2016), from 3.64% to 6.88%.²⁵

Finally, related to accurately diagnosing and treating UTIs, a recent Ottawa-based study examined charts of a sample of 1001 older adult patients (65+) in an emergency department who were diagnosed with a UTI. Those that had a positive culture and were treated with an ineffective antibiotic for the bacteria in question or who had a negative culture were more likely to experience return ER visits, urgent readmission or death. The authors concluded that such patients may require follow-up but it is also perhaps useful to consider this study in the context of antibiotic resistance and making an accurate UTI diagnosis in the first place, keeping in mind the risks of treatment and the wrong diagnosis.²⁶

Financial Burden

UTIs and recurrent infections are costly to the healthcare system – a study showed that in the United States annual costs for UTI treatment are around \$2.47 billion.²⁷ Nearly 10% of all bacterial infections have mounted some resistance to antibiotics. As more bacteria continue to become resistant, the cost for treatment will also increase. Current annual spending for treating antibiotic resistant infections in the U.S. totals \$2.2 billion. In one study, UTIs comprised 61% of all antibiotic resistant infections. Treating individuals who have infections

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that are antibiotic resistant costs approximately 165% greater than those with other infections. The costs were higher for older individuals, non-Hispanic black patients, and individuals with poor health and other comorbidities.²⁸

Spotlight: Increasing Access to Diagnosis and Treatment with Pharmacists

Pharmacists are starting to play a more active role in UTI management and treatment. Generally, pharmacists are more accessible in the community and require less wait time in comparison to family physicians or hospital and emergency department services. In most uncomplicated UTIs, pharmacists are able to complete assessments in the community for patients based on specific guidelines and prescribe antibiotics as needed.²⁷ In more complex cases, some pharmacists have been brought into emergency departments to help with UTI treatment and antibiotic stewardship. In one study, pharmacists were responsible for examining urine cultures to identify infection, determine the most effective antibiotic to use (based on organism resistance) and collaborate with other clinicians to choose the most effective treatment plan. The pharmacists were also able to recognize cases of ABU before prescriptions were distributed. Lingenfelter and colleagues (2016) observed that “several studies have demonstrated that pharmacist monitoring of antibiotic selection has been associated with decreased costs and improved compliance to guidelines in outpatient and inpatient settings”(1602).²⁹ Pharmacist involvement in both the community and hospital setting can help to better manage UTIs in patients and reduce the financial burden on our healthcare system. Pharmacists visits cost nearly half the price of a family physician visit and almost 5 times less than emergency room visits. In Canada, if 25% of people with uncomplicated UTIs sought out help from pharmacists, a \$51.1 million dollar saving could be obtained over five years.²⁷

Pharmacist involvement in both the community and hospital setting can help to better manage UTIs in patients and reduce the financial burden on our healthcare system.

Conclusion

Antibiotics are an essential part of treatment against infections like UTIs. However, we must be careful and intentional in how and when we use antibiotics in order to stop increasingly high numbers of bacteria that have become resistant to antibiotics. Without a gold standard test for UTI detection and atypical presentations of UTI symptoms in older adults, misdiagnosis continues to be pervasive. Proper training and identification of UTI in older adults will lead to better diagnosis and treatment options.

UTIs can be managed by taking preventative approaches. For more information on preventive techniques against UTIs, please see Paper No. 2 of this series, [Prevention of Urinary Tract Infections: Reducing Risk and Protecting Older Adults](#).

References

1. Genao, Liza, and Gwendolen T Buhr. 2012. "Urinary Tract Infections in Older Adults Residing in Long-Term Care Facilities." *The Annals of Long-Term Care : The Official Journal of the American Medical Directors Association* 20 (4): 33–38.
2. Medina, Martha, and Edgardo Castillo-Pino. 2019. "An Introduction to the Epidemiology and Burden of Urinary Tract Infections." *Therapeutic Advances in Urology* 11 (May): 1756287219832172–1756287219832172. <https://doi.org/10.1177/1756287219832172>.
3. Mitchell, Robyn, Geoffrey Taylor, Wallis Rudnick, Stephanie Alexandre, Kathryn Bush, Leslie Forrester, Charles Frenette, et al. 2019. "Trends in Health Care–Associated Infections in Acute Care Hospitals in Canada: An Analysis of Repeated Point-Prevalence Surveys." *Canadian Medical Association Journal* 191 (36): E981. <https://doi.org/10.1503/cmaj.190361>.
4. Chu, Christine M., and Jerry L. Lowder. 2018. "Diagnosis and Treatment of Urinary Tract Infections across Age Groups." *American Journal of Obstetrics and Gynecology* 219 (1): 40–51. <https://doi.org/10.1016/j.ajog.2017.12.231>.
5. Wagenlehner, Florian, Björn Wullt, Stefania Ballarini, Daniel Zingg, and Kurt G. Naber. 2018. "Social and Economic Burden of Recurrent Urinary Tract Infections and Quality of Life: A Patient Web-Based Study (GESPRIT)." *Expert Review of Pharmacoeconomics & Outcomes Research* 18 (1): 107–17. <https://doi.org/10.1080/14737167.2017.1359543>.
6. "Antibiotic Resistance." n.d. Accessed June 24, 2021. <https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance>.
7. Cutler, David, Angus Deaton, and Adriana Lleras-Muney. 2006. "The Determinants of Mortality." *The Journal of Economic Perspectives* 20 (3): 97–120. <https://doi.org/10.1257/jep.20.3.97>.
8. Lin, Kevin, Yorgo Zahlanie, Jessica K Ortwine, Norman S Mang, Wenjing Wei, L Steven Brown, and Bonnie C Prokesch. 2020. "Decreased Outpatient Fluoroquinolone Prescribing Using a Multimodal Antimicrobial Stewardship Initiative." *Open Forum Infectious Diseases* 7 (6): ofaa182–ofaa182. <https://doi.org/10.1093/ofid/ofaa182>.
9. Yelin, Idan, Olga Snitser, Gal Novich, Rachel Katz, Ofir Tal, Miriam Parizade, Gabriel Chodick, Gideon Koren, Varda Shalev, and Roy Kishony. "Personal Clinical History Predicts Antibiotic Resistance of Urinary Tract Infections." *Nature Medicine* 25, no. 7 (July 2019): 1143–52. <https://doi.org/10.1038/s41591-019-0503-6>.
10. Nicolle, Lindsay E. 2016. "Urinary Tract Infections in the Older Adult." *Infectious Diseases in Geriatric Medicine* 32 (3): 523–38. <https://doi.org/10.1016/j.cger.2016.03.002>.
11. "2020 Antibacterial Agents in Clinical and Preclinical Development: An Overview and Analysis." Accessed June 25, 2021. <https://www.who.int/publications-detail-redirect/9789240021303>.
12. Ventola, C. Lee. 2015. "The Antibiotic Resistance Crisis: Part 1: Causes and Threats." *P&T (Lawrenceville, N.J.)* 40 (4): 277–83.
13. Rowe, Theresa Anne, and Manisha Juthani-Mehta. 2014. "Diagnosis and Management of Urinary Tract Infection in Older Adults." *Urinary Tract Infections: Diagnostic and Management Issues* 28 (1): 75–89. <https://doi.org/10.1016/j.idc.2013.10.004>.
14. Godbole, Gauri P., Nicole Cerruto, and Ruchir Chavada. 2020. "Principles of Assessment and Management of Urinary Tract Infections in Older Adults." *Journal of Pharmacy Practice and Research* 50 (3): 276–83. <https://doi.org/10.1002/jppr.1650>.

15. Saukko, Paula M., Beryl A. Oppenheim, Mike Cooper, and Emily K. Rousham. "Gaps in Communication between Different Staff Groups and Older Adult Patients Foster Unnecessary Antibiotic Prescribing for Urinary Tract Infections in Hospitals: A Qualitative Translation Approach." *Antimicrobial Resistance & Infection Control* 8, no. 1 (December 2019): 130. <https://doi.org/10.1186/s13756-019-0587-2>.
16. Duin, D. van. "Diagnostic Challenges and Opportunities in Older Adults With Infectious Diseases." *Clinical Infectious Diseases* 54, no. 7 (April 1, 2012): 973–78. <https://doi.org/10.1093/cid/cir927>.
17. "Management of Urinary Tract Infections (UTIs) in Non-catheterized Long-Term Care Home Residents" Public Health Ontario, n.d., <https://www.publichealthontario.ca/-/media/documents/u/2016/uti-ltch-management.pdf?la=en>
18. Buul, Laura W. van, Hilde L. Vreeken, Suzanne F. Bradley, Christopher J. Crnich, Paul J. Drinka, Suzanne E. Geerlings, Robin L.P. Jump, et al. "The Development of a Decision Tool for the Empiric Treatment of Suspected Urinary Tract Infection in Frail Older Adults: A Delphi Consensus Procedure." *Journal of the American Medical Directors Association* 19, no. 9 (September 2018): 757–64. <https://doi.org/10.1016/j.jamda.2018.05.001>.
19. Rousham, Emily, Michael Cooper, Emily Petherick, Paula Saukko, and Beryl Oppenheim. "Overprescribing Antibiotics for Asymptomatic Bacteriuria in Older Adults: A Case Series Review of Admissions in Two UK Hospitals." *Antimicrobial Resistance & Infection Control* 8, no. 1 (December 2019): 71.
20. Sloane, Philip D., Meera Tandan, and Sheryl Zimmerman. "Preventive Antibiotic Use in Nursing Homes: A Not Uncommon Reason for Antibiotic Overprescribing." *Journal of the American Medical Directors Association* 21, no. 9 (September 2020): 1181–85. <https://doi.org/10.1016/j.jamda.2020.07.026>.
21. Giarratano, Angela, Samantha E. L Green, and David P Nicolau. 2018. "Review of Antimicrobial Use and Considerations in the Elderly Population." *Clinical Interventions in Aging* 13: 657–67. <https://doi.org/10.2147/CIA.S133640>.
22. Gharbi, Myriam, Joseph H Drysdale, Hannah Lishman, Rosalind Goudie, Mariam Molokhia, Alan P Johnson, Alison H Holmes, and Paul Aylin. 2019. "Antibiotic Management of Urinary Tract Infection in Elderly Patients in Primary Care and Its Association with Bloodstream Infections and All Cause Mortality: Population Based Cohort Study." *BMJ* 364. <https://doi.org/10.1136/bmj.1525>.
23. Ahmed, Haroon, Freya Davies, Nick Francis, Daniel Farewell, Christopher Butler, and Shantini Paranjothy. 2017. "Long-Term Antibiotics for Prevention of Recurrent Urinary Tract Infection in Older Adults: Systematic Review and Meta-Analysis of Randomised Trials." *BMJ Open* 7 (5): e015233–e015233. <https://doi.org/10.1136/bmjopen-2016-015233>.
24. Langford, Bradley J, Kevin A Brown, Christina Diong, Alex Marchand-Austin, Kwaku Adomako, Arezou Saedi, Kevin L Schwartz, et al. 2021. "The Benefits and Harms of Antibiotic Prophylaxis for Urinary Tract Infection in Older Adults." *Clinical Infectious Diseases*. <https://doi.org/10.1093/cid/ciab116>.
25. Nguyen, Hoa Q, Nga T. Q Nguyen, Carmel M Hughes, and Ciaran O'Neill. 2019. "Trends and Impact of Antimicrobial Resistance on Older Inpatients with Urinary Tract Infections (UTIs): A National Retrospective Observational Study." *PloS One* 14 (10): e0223409–e0223409. <https://doi.org/10.1371/journal.pone.0223409>.
26. Woodfine, Jason D., and Carl van Walraven. 2019. "Should Emergentologists Follow up on Patients Diagnosed with UTI Having Negative Urine Cultures? Implications for Processing Post-Discharge Laboratory Results." *Journal of Evaluation in Clinical Practice* 25 (2): 260–64. <https://doi.org/10.1111/jep.13049>.

References

27. Sanyal, Chiranjeev, Donald R. Husereau, Nathan P. Beahm, Daniel Smyth, and Ross T. Tsuyuki. "Cost-Effectiveness and Budget Impact of the Management of Uncomplicated Urinary Tract Infection by Community Pharmacists." *BMC Health Services Research* 19, no. 1 (December 2019): 499. <https://doi.org/10.1186/s12913-019-4303-y>.
28. Thorpe, Kenneth E., Peter Joski, and Kenton J. Johnston. "Antibiotic-Resistant Infection Treatment Costs Have Doubled Since 2002, Now Exceeding \$2 Billion Annually." *Health Affairs* 37, no. 4 (April 2018): 662–69. <https://doi.org/10.1377/hlthaff.2017.1153>.
29. Lingenfelter, Erin, Zachary Drapkin, Kelly Fritz, Scott Youngquist, Troy Madsen, and Megan Fix. "ED Pharmacist Monitoring of Provider Antibiotic Selection Aids Appropriate Treatment for Outpatient UTI." *The American Journal of Emergency Medicine* 34, no. 8 (August 2016): 1600–1603. DOI: 10.1016/j.ajem.2016.05.076






Authors

This CanAge report was written by the CanAge Policy & Research Team.



Authored by CanAge.
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