

Original Publication

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Infections in Older Adults: A Case-Based Discussion Series Emphasizing Antibiotic Stewardship

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Abstract

Introduction: Compared with younger populations, adults 65 years and older are more likely to suffer infection-related morbidity and mortality, experience antibiotic-related adverse events, and acquire multidrug-resistant organisms. We developed a series of case-based discussions that stressed antibiotic stewardship while addressing management of common infections in older adults. **Methods:** Five 1-hour case-based discussions address recognition, diagnosis, and management of infections common in older adults, including those living in long-term care settings: urinary tract infections, upper respiratory tract infections, lower respiratory tract infections, skin and soft tissue infections, and *Clostridium difficile* infection. The education was implemented at the skilled nursing centers at 15 Veterans Affairs medical centers. Participants from an array of disciplines completed an educational evaluation for each session as well as a pre- and postcourse knowledge assessment. **Results:** The number of respondents to the educational evaluation administered following each session ranged from 68 to 108. Learners agreed that each session met its learning objectives (4.80-4.89 on a 5-point Likert scale, 5 = *strongly agree*) and that they were likely to make changes (2.50-2.89 on a 3-point scale, 3 = *highly likely to make changes*). The average score on the five-question knowledge assessment increased from 3.6 (72%) to 3.9 (78%, $p = .06$). **Discussion:** By stressing recognition of atypical signs and symptoms of infection in older adults, diagnostic tests, and antibiotic stewardship, this series of five case-based discussions enhanced clinical training of learners from several disciplines.

Keywords

Editor's Choice, Pneumonia, Bronchitis, Urinary Tract Infections, Older Adults, Cellulitis, Asymptomatic Bacteriuria, Nursing Homes, Antimicrobial Stewardship, Antibiotic Stewardship, Clostridium Difficile Infection, Clostridium Infections

Educational Objectives

By the end of this activity, learners will be able to:

1. Identify signs and symptoms of infection in older adults.
2. Describe an appropriate diagnostic workup for an older adult with a suspected infection that recognizes the influence of the patient's setting (community dwelling or long-term care) on the associated risks and available resources.
3. Decide when further diagnostic testing is appropriate for an older adult with a suspected infection.
4. Select the appropriate antibiotic therapy when indicated.
5. Apply basic principles of antibiotic stewardship to the care of older adults with infections.

Introduction

By 2050, approximately 20% of the US population will be 65 years or older.¹ As people live longer, they accumulate chronic health conditions and, compared to younger individuals, are at increased risk for developing infections. Older adults also suffer from greater infection-related morbidity and mortality as a result of immunologic senescence, frailty, and cognitive functional impairments.² Furthermore, older adults may manifest atypical signs and symptoms of infection, making early recognition and diagnosis of

Appendices

- A. Urinary Tract Infection Cases.docx
- B. Upper Respiratory Tract Infection Cases.docx
- C. Lower Respiratory Tract Infection Cases.docx
- D. Skin and Soft Tissue Infection Cases.docx
- E. Clostridium Difficile Infection Cases.docx
- F. Images for Lower Respiratory Tract.pptx
- G. Images for Skin and Soft Tissue.pptx
- H. Urinary Tract Infection Discussion Guide.docx
- I. Upper Respiratory Tract Infection Discussion Guide .docx
- J. Lower Respiratory Tract Infection Discussion Guide .docx
- K. n and Soft Tissue Infection Discussion Guide.docx
- L. Clostridium Difficile Infection Discussion Guide .docx
- M. knowledge Assessment Questions.docx
- N. Education Evaluation Form .doc

All appendices are peer reviewed as integral parts of the Original Publication.

infections challenging. Together, these factors may contribute to a lower threshold for prescribing antibiotics for older adults.

Regardless of the care setting, providers are more likely to prescribe antibiotics to older adults. Among outpatients, while the overall rate of antibiotic use among adults decreased between 2000 and 2010, it increased by 30% for adults 65 years and older.³ In 2011, the rate of outpatient antibiotic prescriptions among adults 65 years and older was 1,048 prescriptions per 1,000 persons, exceeding one prescription per person.⁴ In acute care settings, although the use of antibiotics per hospital day remained largely unchanged between 2006 and 2012, the rate of prescribing was highest among adults 65 years and older.⁵ In long-term care (LTC) settings, which provide care for approximately four million adults each year,⁶ approximately 10% of LTC residents are on antibiotics on any given day.⁷

A substantial proportion of antibiotic prescriptions are unnecessary or inappropriate, with estimates ranging from at least 30% in outpatient and acute care settings to as high as 75% in LTC settings.⁸ Exposure to antibiotics increases the risk of adverse events, including drug-drug interactions, allergic reactions, *Clostridium difficile* infection (CDI), and acquisition of multidrug-resistant organisms. Antibiotics remain among the leading causes of adverse drug effects resulting in older adults seeking emergency department care.^{9,10} In their study of over 100,000 LTC residents in Ontario, Canada, Daneman, Bronskill, Gruneir, et al. demonstrated that residents at LTC facilities with high rates of antibiotic use had the highest rates of antibiotic-related complications, even accounting for those who did not receive antibiotics.¹¹

The challenges with early recognition and diagnosis of common infections in older adults, particularly in the LTC population, coupled with the risks of antibiotic exposure, highlight the need for educational tools that encompass principles from both geriatrics and infectious diseases. Here, we describe a five-topic case-based discussion series with the goal of improving knowledge related to the recognition, diagnosis, and management of infections common among older adults. The target audience for this case series included physicians, nurse practitioners, physician assistants, pharmacists, and nurses caring for older adults in outpatient, long-term, and acute care settings. The cases stressed antibiotic stewardship principles, including antibiotic selection, interpreting results of microbiologic tests, and choosing length of antibiotic treatment.

While *MedEdPORTAL* has published several curricula focusing on either geriatrics or infectious diseases, only one previous publication specifically addresses infections in older adults.¹² Published in 2007 and geared towards medical students, this case describes an older male with community-acquired pneumonia who develops a hospital-acquired infection with a drug-resistant pathogen. The case does consider antibiotic stewardship, but it is not a prominent feature. Our curriculum not only addresses an array of infections in older adults but also stresses principles of antibiotic stewardship, incorporates recommendations from the most recent clinical guidelines available, and is designed for a wide array of learners.

Methods

Curriculum Overview

Infectious disease clinicians (Robin L. P. Jump, Christopher J. Crnich, and Rebekah Moehring) with experience in caring for older adults in LTC facilities developed several teaching cases concerning common infections in older adults. The teaching cases addressed older adults in acute care (two cases), ambulatory care (seven cases), and LTC settings (10 cases). Each case contained several discussion questions intended to spur interaction and sharing between participants. The cases were incorporated into five sessions covering the following topics: urinary tract infections (UTIs) and asymptomatic bacteriuria, upper respiratory tract infections, lower respiratory tract infections, skin and soft tissue infections, and CDI. Each session included three to four cases supplemented with laboratory data, physical exam findings, and several open-ended discussion questions. The learning objectives for the sessions and a brief description of each case are shown below.

UTI and Asymptomatic Bacteriuria Cases (Appendix A)

Objectives:

1. Distinguish UTIs from asymptomatic bacteriuria.
2. Determine appropriate treatment of UTIs using short courses and narrow-spectrum agents.
3. Identify options for nonantimicrobial management of patients with potential UTIs.

Description: Cases featured asymptomatic bacteriuria in a hospitalized patient, asymptomatic bacteriuria in a community-dwelling older adult with a planned urinary tract procedure, urosepsis in a hospitalized patient (including empiric antibiotic therapy, antibiotic de-escalation, and length of therapy), and catheter-associated asymptomatic bacteriuria and UTI in an LTC resident (including sample collection and catheter management).

Upper Respiratory Tract Infection Cases (Appendix B)

Objectives:

1. Distinguish between viral and bacterial upper respiratory tract infections.
2. Identify appropriate antibiotic treatment for bacterial upper respiratory infection.

Description: Cases featured viral upper respiratory tract infection in a community-dwelling older adult (addressing symptoms, typical evolution of symptoms, and adjunctive therapies), bacterial rhinosinusitis in an LTC resident (addressing likely pathogens, empiric therapy, and considerations for failure to respond to therapy), and Group A streptococcal infection (strep throat) in a community-dwelling older adult (discussing differentiation from a viral upper respiratory tract infection, assessment of a penicillin allergy, and nonpenicillin options for treatment).

Lower Respiratory Tract Infection Cases (Appendix C)

Objectives:

1. Differentiate acute bronchitis from pneumonia.
2. Become familiar with objective tools to guide decisions about hospital admission.
3. Show awareness of diagnostic testing for suspected pneumonia.
4. Recognize empiric antibiotic regimens for community-acquired pneumonia.

Description: Cases featured community-acquired pneumonia in a community-dwelling older adult (discussing diagnostic criteria, tools to help evaluation for outpatient vs. inpatient treatment, empiric therapy, and length of therapy), pneumonia in an LTC resident (addressing collecting appropriate information over the phone, diagnostic studies, empiric antibiotic therapy, antibiotic de-escalation, and length of therapy), mimics of pneumonia (differentiation of heart failure from pneumonia in an LTC resident), and aspiration pneumonia in an LTC resident (including chemical pneumonitis, clinical course, and prevention).

Skin and Soft Tissue Infection Cases (Appendix D)

Objectives:

1. Recognize and implement appropriate treatment for cellulitis.
2. Discuss the management of diabetic foot ulcers.
3. Assess and respond to pressure ulcers.

Description: Cases featured lower extremity cellulitis in a community-dwelling older adult (addressing likely pathogens, treatment options, response to therapy, and prevention), subcutaneous abscess/furunculosis in a community-dwelling older adult (addressing likely pathogens, approach to treatment, and length of therapy), diabetic foot infection in an LTC resident (addressing uninfected diabetic foot ulcers, mild and

severe diabetic foot infection, and osteomyelitis), and sacral decubitus pressure ulcer in an LTC resident (addressing wound care and osteomyelitis).

CDI Cases (Appendix E)

Objectives:

1. Identify strategies to prevent CDI.
2. Discuss initial treatment for mild and severe cases.
3. Describe management of recurrent CDI.

Description: Cases featured nonsevere CDI, infection control and prevention in the LTC setting, and avoidance of “tests of cure”; recurrent CDI in an LTC resident (including antibiotic treatment, fecal microbiota transplant, and other adjunctive therapies); severe CDI in a community-dwelling older adult (including diagnosis and treatment as well as testing for *C. difficile*); and asymptomatic carriage of *C. difficile* in an LTC resident and recognition of other causes for loose stool/diarrhea.

The sessions on lower respiratory tract infections and skin and soft tissue infections also included several images; these are contained within the primary material for each session (Appendices C & D). Appendices F and G include annotated versions of the same images. The accompanying discussion guides (Appendices H-L) provided answers and references, incorporating recommendations based on guidelines published by the Infectious Diseases Society of America, other peer-reviewed literature, and expert opinion.

Target Audience

The sessions were designed as small-group discussions, typically with five to 15 learners, and were well suited to a multidisciplinary group. Our participants were recruited from skilled nursing facilities at Veterans Affairs medical centers (VAMCs) and included professionals and trainees from several disciplines, such as medicine, nursing, and pharmacy. We offered subsequent iterations of the sessions to medical students, internal medicine residents, fellows in infectious disease and geriatrics, advanced clinical practice nurses, and multidisciplinary teams working in primary care.

Session Structure and Overview

Each session was designed to last for about 1 hour. Sessions were held weekly for 5-6 consecutive weeks. Learners received the cases via email prior to the session or as printed material upon arrival. While no preparation was required for the individual learners, the session facilitators reviewed the discussion guides prior to each session, becoming familiar with the answers so as to better lead the discussions. The sessions could be offered in any order, and learners could attend all or a subset of the sessions.

The physical location for the sessions varied. In general, learners met in a conference room around a large table. A screen to present images was helpful, but not required, for the sessions on lower respiratory tract infections and skin and soft tissue infections. Some sessions were held via videoconference, permitting the facilitator and learners to be in geographically distinct locations. When necessary, due to lack of video equipment, some experienced facilitators also conducted sessions via a conference call; when this occurred, the participants received the cases via email prior to the session.

The sessions began with brief introductions of the learners and facilitator (5-8 minutes). One of the learners was asked to read the first case and answer the first question. Other learners were asked to read and answer subsequent questions, which helped sustain engagement. The facilitator would invite other participants to share their answers, setting a positive tone and encouraging people to ask questions while also guiding them through the case. Some prompts for this included the following:

- “That’s a great answer. What are some other thoughts (from others in the room)?”
- “That’s a good question. What do the rest of you think about that?”

- “What are some other ideas or comments about this?”
- “Any questions or thoughts before we move onto the next case?”

Within the hour-long session, the discussion for each case lasted 10-15 minutes. At the conclusion of each session, the facilitator distributed the discussion guides via email or as printed material. The discussion guides had the same material within each of the cases as well as narrative answers for each question and references to relevant guidelines and primary literature. For sessions in which the learners may have held a robust discussion, not every case could be addressed. These were discussed in a subsequent session or left for the learners to review on their own using the discussion guide. The course did not require any homework or follow-up.

Appendix M contains five questions used to assess learners’ pre- and postcourse knowledge. These were administered prior to the first session and after the last session. The time needed to answer all five questions was around 20 minutes. Answers to the questions were 1: A, 2: A, 3: C, 4: D, and 5: E.

Data Collection and Analysis

We used the knowledge assessment questions to evaluate change in knowledge among the learners and an educational evaluation to collect quantitative and qualitative feedback.

A subset of learners recruited from 10 VAMCs answered the knowledge assessment questions online (Qualtrics, Provo, UT) prior to the first session and following completion of the fifth session. Their participation in the knowledge assessment was both voluntary and anonymous. Using R (Version 3.4.2, R Foundation for Statistical Computer, Vienna, Austria), we summarized the data using descriptive statistics. A 95% confidence interval (CI) and Student *t* test measured differences in the aggregate mean pre- and postcourse scores.

Following each session, learners completed an educational evaluation (Appendix N) as part of the process of receiving continuing medical education (CME) credits. These evaluations provided quantitative and qualitative feedback to the individual facilitators and were used to assess the overall effectiveness of course content. This feedback also informed subsequent revisions of the cases and discussion guides.

Results

Collectively, our team offered the five sessions as a minicourse to learners from 15 VAMCs. Each facilitator initially gave the session as face-to-face meetings at his or her own VAMC and subsequently used tele- or videoconferencing to administer the sessions to two to three other VAMCs in the same geographic region. The sessions were promoted primarily to clinicians and staff caring for residents at each facility’s skilled nursing center, termed a community living center (CLC). The medical director, director of nursing, and infection preventionist for the CLCs all served as the primary points of contact, gauging the interest of their staff and colleagues as well as helping to schedule the five sessions with the individual facilitators. Once a schedule was agreed upon, some learners invited others to join the sessions such that each session typically had five to 15 learners, though some had as few as two and others as many as 23.

The learners were from several disciplines and held a variety of roles, including the following: infection preventionist, staff nurse, nursing assistant, nurse practitioner, pharmacist, attending physician, resident physician, physician assistant, and social worker. While we did not formally record the role of all learners, over 80% of those who completed the educational evaluation were prescribers (e.g., physicians, nurse practitioners, and physician assistants).

To assess changes in knowledge, we used an online survey to ask learners the same five questions before the first session and after the fifth session. The average precourse score was 3.6 out of 5 (72%; 95% CI, 3.3-3.8) compared to an average posttest score of 3.9 out of 5 (78%; 95% CI, 3.6-4.2; $p = .06$), indicating a trend towards improved knowledge.

The [Table](#) summarizes the quantitative outcomes from the educational evaluation completed by participants seeking CME credit for individual sessions. The number of respondents ranged from 68 for the session on lower respiratory tract infections to 108 for the session on skin and soft tissue infections. Quantitative outcomes from each session indicated that all respondents either agreed or strongly agreed that the sessions met their learning objectives. Assessed using a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*), the average score ranged from 4.80 for the upper respiratory tract infections session to 4.89 for the lower respiratory tract infections session. Similarly, all respondents indicated they were somewhat or highly likely to implement change. Assessed using a 3-point scale (1 = *not likely to change*, 3 = *highly likely to change*), the average score ranged from 2.50 for upper respiratory tract infections to 2.89 for skin and soft tissue infections. Overall, these quantitative outcomes indicate that respondents to the educational evaluation received the sessions favorably and felt they would influence their daily practice.

Table. Results of the Educational Evaluation

Topic	Learning Objectives Met ^a	Likely to Implement Change ^b
Urinary tract infection and asymptomatic bacteriuria (N = 70)	4.85	2.79
Upper respiratory tract infections (N = 80)	4.80	2.50
Lower respiratory tract infections (N = 68)	4.89	2.84
Skin and soft tissue infections (N = 108)	4.83	2.89
<i>Clostridium difficile</i> infections (N = 78)	4.87	2.78

^aScores are based on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

^bScores are based on a 3-point scale (1 = *not likely*, 3 = *highly likely*).

Qualitative comments revealed themes specific to the content of each session and general themes of antibiotic stewardship. With regard to UTIs versus asymptomatic bacteriuria, respondents indicated that they would be less likely to give antibiotics to asymptomatic patients and to avoid collecting urine from asymptomatic patients with indwelling urinary catheters, both of which are consistent with the learning objectives for that session. For the session on upper respiratory tract infections, while some comments reflected the learning objective of distinguishing between viral and bacterial upper respiratory infections, others indicated only a change in antibiotic choice rather than minimizing their use. For lower respiratory tract infections, comments addressed increased use of rapid diagnostic tests and changes in the approach to management of aspiration pneumonia; for skin and soft tissue infections, the comments focused on nurse visits and use of care plans. The session on CDI yielded comments regarding avoidance of repeat tests on patients without clinical symptoms. General themes about antibiotic stewardship addressed a higher threshold for starting antibiotic therapy, decreasing the length of antibiotic therapy, de-escalation from broad- to narrow-spectrum agents when possible, and offering education to staff, patients, and their family members about avoiding unnecessary antibiotics. These comments are consistent with general principles of antibiotic stewardship.¹³

Written comments describing potential changes in patient management strategies are shown below.

- UTI and asymptomatic bacteriuria:
 - “Less likely to give antibiotics to asymptomatic patients.”
 - “Keeping in mind early de-escalation of antibiotics when appropriate.”
 - “Decreasing length of treatment with antibiotics.”
 - “Not collecting urine from asymptomatic patients with indwelling urinary catheters.”
- Upper respiratory tract infections:
 - “Improved assessment skills to better differentiate between viral and bacterial infections.”
 - “Do not use quinolones as first line treatment for upper respiratory tract infections.”
 - “Avoid macrolides for bacterial rhinosinusitis.”
 - “Shorter course of antibiotic treatment for acute sinusitis.”
 - “Use fewer antibiotics and offer symptomatic care.”

- “More confident to decide whether to give antibiotics.”
- “Educate family members and stand firm when pressured to prescribe antibiotics.”
- Lower respiratory tract infections:
 - “Treatment and duration of therapy for aspiration pneumonia.”
 - “Increase use of rapid diagnostic tests.”
 - “Do not give unnecessary antibiotics and stop when indicated.”
 - “Length of antibiotic therapy.”
- Skin and soft tissue infections:
 - “Treatment and duration of therapy for aspiration pneumonia.”
 - “Increase use of rapid diagnostic tests.”
 - “Do not give unnecessary antibiotics and stop when indicated.”
 - “Length of antibiotic therapy.”
- CDIs:
 - “If stool is formed, no need to recheck.”
 - “No tests of cure for asymptomatic patients.”
 - “Provide education to staff, patients, and families.”

Discussion

This series of five case-based discussions addresses an important knowledge gap at the intersection of geriatrics and infectious diseases.¹⁴ The simultaneous aging of the population and increasing prevalence of multidrug-resistant pathogens result in a need for providers from an array of disciplines to recognize, diagnose, and treat older adults with possible infections. The course content emphasizes LTC, a setting that may be unfamiliar to many providers outside geriatrics.

The educational materials presented here have several strengths. The case-based format permits flexibility in implementation, including offering the sessions in any order or to a multidisciplinary group of learners. Additionally, each guide could be used as a stand-alone session or, with limited adaptation, separated into individual cases suitable for brief discussions lasting 10-15 minutes. This may be a useful approach for incorporating teaching into rounds with resident or medical student teams. An additional strength is that the cases use real-world scenarios replete with borderline results, which help to generate discussion among participants and provide important insight into the day-to-day management of patients. Finally, the facilitated-discussion format permits learners to respond in the context of practice patterns specific to their discipline and practice setting.

The educational materials also have some limitations. For our implementation, all of the session facilitators were academic physicians who had expertise in infectious diseases and/or geriatrics and were familiar with LTC settings. Although similar training or experience is beneficial, most experienced clinicians should be able to use the discussion guides to facilitate a robust discussion and learning experience. Furthermore, the cases do not include the care of older adults in the intensive care unit or involve discussions pertaining to goals of care. Some facilitators may wish to adapt the cases to address these topics. Finally, while the course content is evidence based, infectious diseases in general and multidrug-resistant pathogens and antimicrobial stewardship in particular are evolving areas. New evidence may render some of the content out of date. Notably, since the initial development of the cases, new guidelines have been published addressing the treatment of hospital-acquired pneumonia and CDI.^{15,16} The cases and answer keys have been updated to reflect the most recent guidelines and evidence.

A notable challenge related to these sessions is recruitment. During the initial outreach to VAMCs by our team, some facilities responded quickly and with enthusiasm, while others were either slow or not responsive. Despite several attempts at outreach to the latter group, we did not succeed in scheduling educational sessions. Reasons for this may have related to lack of time or interest by the clinicians at those VAMCs. Offering CME credit or strong engagement by facility leadership may support successful recruitment, especially for learners at sites that are geographically separate from facilitators.

The format of the course permits implementation in a variety of settings. The initial offering for these cases was small-group discussions with the facilitator and learners in the same room. The Veterans Health Administration has a robust video-teleconferencing system with both equipment and technical support available at every VAMC. We used this system to permit facilitators to teach the course to learners at geographically distant VAMCs. The use of video equipment enhanced the experience for learners and facilitators, leading to a more personal connection that would otherwise not have been feasible. Given that no patient information is being exchanged, a secure network is not necessary, and thus, internet-based conference systems could also be used for the course. For those occasions when technical challenges precluded use of video equipment, we were also able to offer the sessions via a telephone conference call.

Regardless of the communication medium used, our experience was that while the facilitator could be off-site, the learners needed to be gathered together in the same physical space. The interplay among the learners seemed to enhance their engagement in the activity. Also, our perspective is that when the learners were all from the same practice or facility, having everyone in the same room meant they all heard the same material, which in turn seemed to facilitate a sense of teamwork and, perhaps, of accountability.

During implementation and analysis of the five-session course, we identified opportunities for improvement. First, we did not systematically ascertain the roles of individual learners at each of the sessions, and other than the educational evaluation form used to claim CME credit, we did not seek feedback from people in different roles regarding the course material. Soliciting the viewpoints of individuals from different clinical disciplines as well as across stages of training may help improve the content and format of the educational material. Specifically, increased input from nurses might enhance aspects of nonmedical interventions, including supportive care. Second, we did not assess whether the educational content led to practice change. Measurement of such change could be achieved by following a specific group of learners, such as internal medical residents, over time, with periodic assessment of their self-reported practice patterns. Another approach would be to assess changes in the antibiotic prescribing patterns of clinicians who participate in the sessions compared to those who do not. Finally, as mentioned above, infectious diseases in general and multidrug-resistant pathogens and antimicrobial stewardship in particular are evolving areas. The introduction of new guidelines and evidence may render some of the content out of date. Continuing to revise the content in light of new evidence will help ensure the educational experience remains timely and relevant.

By teaching providers to incorporate antibiotic stewardship principles into their practice, these case-based discussions may help improve the care of older adults with infections. Over time, this may help to improve patient safety and reduce antimicrobial-associated adverse events as well as the prevalence of *C. difficile* and multidrug-resistant organisms.

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Ethical Approval

The University Hospitals Case Medical Center Institutional Review Board approved this study.

Disclaimer

The findings and conclusions in this publication are those of the authors, who are responsible for its content, and do not necessarily represent the views of the VA or of the United States Government.

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