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Controversies in Long Term Care

Clinical Uncertainties in the Approach to Long Term Care Residents With Possible Urinary Tract Infection

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A B S T R A C T

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Urinary tract infection (UTI) is arguably the most common infection in the long term care (LTC) setting. Making the diagnosis of UTI and deciding when to initiate treatment with antimicrobial therapy is a challenge to all LTC providers. Widespread prevalence of asymptomatic bacteriuria, lack of an accepted clinical or laboratory gold standard to start antibiotics for UTI, and a high prevalence of cognitive impairment in the LTC population all contribute to this challenge. Several consensus based criteria for diagnosing UTI have been published, though these vary from each other owing to different intended purposes. The McGeer and updated Stone criteria are intended for surveillance and benchmarking purposes. The 2005 Loeb criteria represent minimal criteria for the initiation of antimicrobial therapy. Our review focuses on residents without a urinary catheter. The Loeb criteria should be updated, by inclusion of isolated fever in those with profound cognitive impairment as well as scrotal or prostate swelling tenderness to be consistent with the updated McGeer criteria by Stone et al. Urine testing and antimicrobial therapy should not be ordered in those with isolated nonspecific signs or noninfectious symptoms such as fatigue or delirium. Both cavalier urine testing and unnecessary antimicrobial therapy contribute to direct patient harm as well as the rapidly escalating threat of antimicrobial resistance. Observation and monitoring of residents in whom the diagnosis of UTI is unclear is a best practice that should be implemented. Facilities should consider addressing UTI management as part of their quality assurance and performance improvement process.

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There are few clinical problems in long term care (LTC) that prove more controversial than the approach to the resident with suspected urinary tract infection (UTI).^{1–7} Urinary tract infections are the most common type of infection identified in LTC residents. While we can rest assured that LTC residents have been diagnosed with UTI since opening of the first nursing facilities, no gold standard has emerged for diagnosing UTI in this population. Each clinician is left relying on

her or his own clinical judgment to decide whether a UTI is present or absent. To explore this controversy in greater detail, consider the following case which should be familiar to all LTC providers.

Case

Mrs Smith is a 92-year-old female with stage 5 Alzheimer's disease. She resides in a nursing facility because of severe knee arthritis, which has prevented her from walking for the past year. In addition to the arthritis and dementia, she suffers from depression and advanced glaucoma. The nursing home staff contacts the on-call physician 1 weekend after noting the resident's urine is dark and concentrated. The nursing staff also reports the resident is slightly more confused. The resident is afebrile with normal vitals and has no urinary catheter in place. The nursing staff verbalizes a request to "send off a urine." The on-call physician complies by ordering a urine analysis and culture. No antibiotic is started. Two days later the primary attending is called with the urine results, having little knowledge of the clinical situation

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surrounding the original test order. The resident has been stable with no fever or urinary symptoms. The urine analysis is remarkable for moderate pyuria and 1+ nitrites. The culture grows greater than 100,000 CFU of a gram negative rod for which an antibiotic is ordered.

At the next quality improvement (QI) meeting, the facility infection control practitioner expresses concern over the rate of UTIs within the facility. In particular, the infection control practitioner notes this case did not meet the McGeer criteria for UTI and feels the resident should not have been treated. One week later, the patient continues to have dark urine but remains stable with no fever or urinary symptoms. The resident's family now requests "a repeat urine to make sure the infection has resolved."

This case highlights several important questions that LTC clinicians confront and for which there is a controversial evidence base.

- (1) Are there minimal criteria that should be considered prior to initiating antimicrobial treatment for suspected UTI in a LTC resident?
- (2) Is there a potential for harm when ordering urine tests for LTC residents in the setting of non-specific symptoms?
- (3) Should clinicians order a urine culture to perform a test of cure?
- (4) Is withholding an antibiotic in the presence of nonspecific symptoms the same as failure to treat?
- (5) What is the role of the facility's infection control program and the medical director in reducing over-diagnosis and treatment of UTI?

Are There Minimal Criteria That Should Be Considered Prior to Initiating Antimicrobial Treatment for Suspected UTI in a LTC Resident?

Despite being recognized as the most commonly diagnosed infection in LTC settings, there is no universally accepted definition of UTI used for initiating treatment. Several consensus based definitions of UTI have been promulgated and revised over time to improve their performance.^{8–11} While differing in the precise criteria applied, all of these definitions require the presence of urinary tract signs and symptoms. Urinary tract signs and symptoms include dysuria, new onset frequency, urgency, incontinence, flank pain/tenderness, suprapubic pain, gross hematuria, or focal tenderness or swelling of the testis, epididymis, or prostate. Recent catheter trauma, obstruction, or purulent drainage around the catheter also provides evidence of localization in the face of systemic infectious illness in addition to the localizing signs and symptoms described above. These consensus definitions have gained wide spread acceptance among infection control experts. In practice, however, many clinicians consider the presence of nonspecific symptoms such as fever alone, functional decline, behavioral changes, and mental status changes when diagnosing UTI in older adults.^{1,5,12,13} This is due to wide appreciation that diseases frequently present atypically in frail older adults, particularly those with cognitive impairment.^{14–17} Unfortunately, nonspecific symptoms are just that: nonspecific. They can be present in any number of other infectious or noninfectious conditions and, therefore, have low positive predictive value.^{7,18} For example, Orr et al estimated UTI to be present in less than 10% of nursing facility residents with positive urine cultures and in whom the only symptom present was fever.¹⁹ Boscia et al found no association between malaise, anorexia or fatigue and the presence of bacteriuria.²⁰ Studies exploring the association between mental status changes or delirium and UTI are very limited. Available evidence does not support a clear association of mental status changes or delirium with uncomplicated UTI.^{2,21,22} The role of fever and leukocytosis in diagnosing UTI is imprecise in frail older adults. Studies evaluating the association

between fever and UTI have not used consistent definitions. In 2 studies looking at hospitalized patients with bacteremic UTI, typical urinary symptoms were absent; however, fever, defined several ways, was present in the vast majority.^{23,24} Leukocytosis (>11,000 leukocytes/mm³) was also present in the majority of these patients. These studies only evaluated hospitalized patients with bacteremic infections; whether the findings apply to patients with typical non-bacteremic UTI remains to be proven. Patients with significantly advanced cognitive impairment present a challenge in that they may not be able to report any symptoms. In this group of selected patients, the presence of fever, peripheral leukocytosis, or hemodynamic instability alone may be adequate to warrant antimicrobial treatment.^{4,14} Thus, nonspecific symptoms in the absence of urinary symptoms should not be used alone to rule in a UTI, with the possible exception of isolated fever or leukocytosis in patients with significantly advanced cognitive impairment.^{14,15}

A number of investigators have attempted to refine the consensus UTI definitions in the hopes of creating a stronger evidence base and resolving the contentious role of nonspecific findings.^{13–15} Unfortunately, these studies have suffered from a key methodological flaw: the absence of a uniformly applied and accepted UTI definition for case finding purposes.³ In all of these studies, the outcome definition used was "suspected UTI," which simply amounts to whatever criteria the clinician decided to use at the time.

The McGeer criteria are perhaps the most widely quoted consensus criteria. The McGeer criteria were first composed over 2 decades ago and have recently been updated by Stone and colleagues (Table 1).^{10,11} Confusion over the role of these criteria exists, and many clinicians are unfamiliar with the criteria.^{12,25} The role of the McGeer, and now Stone, criteria for UTI are for *surveillance* purposes, not determining if antimicrobials should be used. Surveillance definitions are designed to be highly *specific*, so that rates can be reliably benchmarked across facilities. Surveillance criteria are not meant to be highly *sensitive* and, therefore, may miss cases of disease when truly present. The McGeer and Stone criteria for UTI are, thus, intended to compare rates of UTI within a facility over time and between facilities for benchmarking purposes. These criteria are often determined retrospectively following a full assessment over time. Given their intended purpose, the McGeer criteria should not be considered the standard for minimal criteria for initiating antimicrobial therapy for UTI.

In contrast, clinicians must make treatment decisions in real time, often during a phone contact on the night of disease onset.^{26–28} Criteria used in this situation must be designed to be applied prospectively. The Loeb criteria for UTI were specifically designed for this purpose (Table 1).⁸ These criteria were updated in 2005. Building on evidence from randomized controlled trials, observational studies, and qualitative studies, algorithms incorporating minimum criteria for ordering a urine culture and initiating antimicrobial treatment for UTI were developed.^{29,30} These criteria were supported by a cluster randomized controlled trial of an educational intervention. The trial led to a 31% reduction in prescriptions for UTI without any increase in hospitalizations or mortality.⁹ Reduction in UTI treatment rates and overall antibiotic use were also found in a separate single facility study using very similar criteria.³¹ Two Agency for Healthcare Research and Quality funded studies attempting to implement the Loeb criteria were recently conducted.^{32,33} In a QI study conducted by the American Institutes for Research, antimicrobial utilization for UTI improved in facilities demonstrating adherence to the Loeb criteria.³⁴ A separate study conducted by Abt Associates failed to find an association between the Loeb criteria and antibiotic utilization. However, in the Abt study, adherence to the Loeb criteria was determined by retrospective chart review, was exceptionally low, and was determined only for a subsample of residents in which an antimicrobial was prescribed.^{35,36}

Table 1
Comparison of Criteria for Diagnosing and/or Treating Noncatheter-Related Urinary Tract Infection (UTI) in Long Term Care (LTC) Settings

	1991 McGeer ¹⁰	2012 Stone (Updated McGeer) ¹¹	2005 Loeb Diagnostic ⁹	2005 Loeb Treatment ^{9,1}
Intended Purpose of Criteria	Surveillance and Benchmarking	Surveillance and Benchmarking	Minimum Criteria for Ordering a Urine Culture	Minimal Criteria for Initiating Antimicrobials
Criteria	Resident has at least 3 of the following signs and symptoms: <ul style="list-style-type: none"> • Fever $\geq 38^{\circ}\text{C}$ or chills • New or increased burning pain on urination, frequency, or urgency • New flank or suprapubic pain or tenderness • Change in character of the urine • Worsening of mental or functional status 	Both criteria 1 and 2 must be met. <ol style="list-style-type: none"> 1. At least 1 of the following signs and symptoms: <ol style="list-style-type: none"> a. Dysuria OR acute pain, swelling, tenderness of the testes, epididymis, or prostate b. Fever* or leukocytosis AND at least 1 of the following: <ol style="list-style-type: none"> i. CVAT ii. Suprapubic pain iii. Gross hematuria iv. New or increased incontinence v. New or increased urgency vi. New or increased frequency c. If no fever or leukocytosis, then 2 or more of the following: <ol style="list-style-type: none"> i. Suprapubic pain ii. Gross hematuria iii. New or increased incontinence iv. New or increased urgency v. New or increased frequency 2. One of the following: <ol style="list-style-type: none"> a. $\geq 10^5$ CFU/mL of no more than 2 organisms in a voided urine b. $\geq 10^2$ CFU/mL of any number of organisms in an in/out catheter sample 	Fever $>37.9^{\circ}\text{C}$ and 1 or more of the following, order a urine culture: <ul style="list-style-type: none"> • Dysuria • Urgency • Flank pain • Shaking chills • Urinary incontinence • Frequency • Gross hematuria • Suprapubic pain OR If no fever, order urine culture if there is new onset burning on urination, or 2 or more of the following: <ul style="list-style-type: none"> • Urgency • Flank pain • Shaking chills, • Urinary incontinence • Frequency • Gross hematuria • Suprapubic pain OR If fever $>37.9^{\circ}\text{C}$ but 2 or more symptoms of non-UTI infection, DO NOT ORDER A URINE	Positive urine culture ($>10^5$ CFU/mL) and dysuria, OR Positive urine culture ($>10^5$ CFU/mL) and 2 or more of the following: <ul style="list-style-type: none"> • Fever • Urgency • Flank pain • Urinary incontinence • Shaking chills • Frequency • Gross hematuria • Suprapubic pain

CVAT, costovertebral angle tenderness.

*Single oral temperature $>37.8^{\circ}\text{C}$ ($>100^{\circ}\text{F}$) OR repeated oral temperatures $>37.2^{\circ}\text{C}$ (99°F) or rectal temperatures $>37.5^{\circ}\text{C}$ (99.5°F) OR single temperature $>1.1^{\circ}\text{C}$ (2°F) over baseline from any site.

¹D'Agata, Loeb, and Mitchell recently stated "The original SHEA (Loeb) criteria were developed for the general NH population and did not take into consideration the unique characteristics of residents with profound cognitive impairment who are nonverbal. fever alone may be adequate evidence to justify antimicrobial initiation for a suspected UTI, so long as there are no additional symptoms (eg, new cough) to suggest an alternative source of infection." Clinicians must be diligent to stop antimicrobials if urine testing is negative.¹⁴

Lack of an association is not surprising given the known challenges with incomplete documentation of infections and infectious symptoms in LTC resident charts, and the insufficient power in this study.²⁷ Ongoing adherence with the Loeb criteria remains a challenge for facilities and future research is critically needed in this area. Taken together, these studies provide some support, albeit limited, of the feasibility and effectiveness of the Loeb criteria.

In the case presented, the clinician should not rely on the McGeer criteria for deciding whether to initiate antimicrobial therapy. The clinician could consider using the Loeb criteria which have been developed for this purpose. The resident in question would not have met the Loeb criteria for either obtaining a urine culture, or initiating antimicrobial therapy once the culture results had returned. The lack of urinary symptoms and stability of this resident's clinical course over time would argue against the diagnosis of UTI. As always, clinical judgment should be exercised. In this case where not only are the Loeb criteria not fulfilled, but there is no documented fever, leukocytosis, or hemodynamic instability, there is little to suggest a serious infection or to support treatment with an antimicrobial agent. The resident in this case would be best managed by

continued observation. The recent McGeer revision by Stone et al includes the most extensive list of potential diagnostic criteria for infections in long term care facilities constructed to date. The revision includes additional, more precise surveillance criteria for constitutional illness that include a complete blood count with differential as well as the addition of scrotal or prostate tenderness or swelling, purulent urethral drainage, and recent catheter trauma or obstruction. These additional signs and symptoms could be included in a facility's assessment protocols to determine if antibiotic treatment is needed.

Is There a Potential for Harm When Ordering Urine Tests for LTC Residents in the Setting of Nonspecific Symptoms?

To answer this question, the clinician must consider several issues: whether urine testing can accurately identify a UTI, what harms are associated with unnecessary antibiotic usage, and whether urine testing drives overtreatment of UTI (ie treatment of asymptomatic bacteriuria).

In interpreting the value of a clinical test, clinicians are trained to consider the pre-test probability of a disease in a given population. The problem in the case of UTI, though, is that while LTC residents are frequently treated for UTI, many of the “infections” identified are actually cases of asymptomatic bacteriuria.^{14,15,25,27,31,37–39} Asymptomatic bacteriuria is extremely common among nursing home residents, with prevalence rates of between 15% and 50%.^{40–44} Asymptomatic bacteriuria is simply the presence of bacteria in the urine, regardless of the quantity present, in a person without any symptoms. Studies have consistently documented the futility of antimicrobial therapy in residents with asymptomatic bacteriuria.^{41,45–48} Thus, there is a high likelihood of obtaining a positive urine analysis or culture in any LTC resident regardless of whether a UTI is present or not. This translates into a very high false positive rate (ie, low positive predictive value). Urine analyses and urine cultures do not rule in the diagnosis, they can only rule out the diagnosis of UTI when negative.^{5,18,49–52}

Unnecessary antimicrobial therapy poses serious threats. Antibiotic use is one of the largest risk factors for having an adverse drug event, many of which may be preventable.^{53–55} In a study of 2 Rhode Island nursing homes, inappropriate antibiotic prescribing for asymptomatic bacteriuria was associated with a 12% incidence of *Clostridium difficile* colitis within 3 weeks and an 8-fold increased risk of *Clostridium difficile* colitis within 3 months of treatment.²⁵ In another study of 234 antibiotic courses for presumed UTI in 5 New Haven nursing homes, adverse outcomes included drug rash as well as *Clostridium difficile* infection.¹³ More importantly, there is the growing crisis of antimicrobial resistance across the healthcare system which threatens to return healthcare to the pre-antibiotic era.^{11,56–68} For example, *Klebsiella pneumoniae* resistance to third generation cephalosporins has increased by more than 2-fold in LTC residents from 1999–2010, and the rate of carbapenem resistance is rapidly increasing.⁵⁷ Antibiotic exposure and poor antibiotic stewardship are major drivers of this growing resistance.^{11,64,69–71} What is alarming is that LTC facilities play a significant part in the spread of antimicrobial resistance to other parts of the healthcare system.^{72,73} Unfortunately, in the setting of uncertainty clinicians tend to overestimate the benefit of treatment for a given person, while simultaneously overlooking the potential for adverse outcomes.^{15,74}

What is clear from the literature is that urine tests drive treatment decisions. If a urine test is ordered, there is a high likelihood the resident will receive antibiotic treatment, regardless of whether a UTI is present or not.^{5,13–15,52} In a study that included asymptomatic older adults presenting to the emergency department for reasons unrelated to possible infection, urine cultures were positive in 14%. Seventy-one percent of these asymptomatic, noninfected individuals received antibiotics unnecessarily.⁵² Two LTC intervention trials seeking to reduce overtreatment of asymptomatic UTI have been conducted. As a central component, both of these trials incorporated algorithms to reduce unnecessary urine testing with the consideration that urine testing drives overtreatment.^{9,30,31} Both trials were successful in reducing overtreatment. The first study included information about mortality and hospitalizations and found no negative outcomes resulting from the reduced treatment of UTI.⁹

Thus, by ordering a urine test not only does the clinician gain very little information, she/he also increases the risk of treating asymptomatic bacteriuria, and by extension, increases the risk of adverse drug events, *Clostridium difficile* infection, and antimicrobial resistance. The risks, then, of obtaining a urine analysis or urine culture are essentially the risks posed by unnecessary antibiotic treatment. Unnecessary urine testing not only can, but does lead to harm. Urine testing should only be performed when there is a reasonable likelihood the resident may have a UTI, as judged by meeting at least minimal criteria for initiating antibiotics.

Should Clinicians Order a Urine Culture to Perform a “Test of Cure”?

As noted in the discussion above, there is absolutely no evidence to support the ordering of urine cultures in asymptomatic residents. Current guidelines from the Infectious Disease Society of America strongly recommend against testing of asymptomatic residents, and this is a core message of the AMDA and American Geriatric Society’s (AGS) Choosing Wisely Campaigns.^{75,76} Repeat urine testing in the case above is never indicated and should not be done.

Is Withholding an Antibiotic in the Presence of Nonspecific Symptoms the Same as Failure to Treat?

When contacted regarding a resident’s change in condition, the clinician is generally expected to take some tangible action. In the case presented, the symptoms are nonspecific and do not meet accepted diagnostic or surveillance criteria.^{8–11,31} The symptoms in this case could easily be due to dehydration, a new medication, acute renal failure, worsening heart failure, depression with reduced oral intake, or any number of other conditions. Likewise, while urine cultures can facilitate choice of the antibiotic agent, their positive predictive value are so low that positive results should not impact decisions to initiate antibiotics.^{5,18,49–52} By not formulating a wide differential diagnosis, blithely focusing on the resident’s urine, and initiating potentially unnecessary antimicrobial treatment, the clinician risks misdiagnosis and the potential for adverse drug events, *Clostridium difficile* infection, and antimicrobial resistance as discussed above.

Owing to the unique nature of the LTC setting, clinicians rarely evaluate residents personally before diagnosing UTI.^{26,27} Remaining options then are to prescribe an antimicrobial agent, or to simply observe and monitor. Clinicians faced with this dilemma frequently opt for antimicrobial therapy citing concerns over missing an infection, delaying treatment, or not meeting a resident’s or family’s expectations.^{15,74} In doing so, clinicians overvalue the benefits of immediate antimicrobial therapy to the patient and undervalue the strong likelihood of negative outcomes. This was elegantly captured in a qualitative study evaluating the use of clinical pathways for UTI management where a facility staff member reported, “we go along with what the family wants most of the time unless not possible or may be dangerous.”²⁹ This comment poignantly illustrates how adverse drug events, *Clostridium difficile*, and antimicrobial resistance are frequently not considered likely possibilities in an individual resident.

On the other hand, clinicians may not consider observation and monitoring, or “watchful waiting,” as taking action. This cannot be further from the truth. Uncertainty and observation are part of medicine. Watchful waiting is a skilled service and a cornerstone of clinician practice. In a study evaluating the impact of an educational intervention to reduce antimicrobial prescribing, Pettersson et al demonstrated an increase in the rate of observation and monitoring interventions (where antimicrobial therapy was held or delayed) without any increase in hospitalizations.⁷⁷ In the case above, the absence of urinary symptoms and the absence of progression of symptoms from initial presentation would suggest that antimicrobial initiation is not warranted. The clinician should support continued monitoring. Such a decision is supported from the experience of multiple randomized controlled trials showing no benefit to treatment of asymptomatic bacteriuria.^{9,31,45–48} Facilities should develop and implement observation protocols that include monitoring vital signs, attention to hydration status, repeated physical assessments by nursing home staff, and prompt communication of any changes in condition. Informing residents and family members about

<input type="checkbox"/> Obtain vital signs (BP, Pulse, Resp Rate, Temp, Pulse Ox) every ____ hours for ____ days.
<input type="checkbox"/> Record fluid intake each shift for ____ days.
<input type="checkbox"/> Notify physician if fluid intake is less than ____ cc daily.
<input type="checkbox"/> Offer resident ____ ounces of water / juice every ____ hours.
<input type="checkbox"/> Notify physician, NP, or PA if condition worsens, or if no improvement in ____ hours.
<input type="checkbox"/> Obtain the following blood work _____.
<input type="checkbox"/> Consult pharmacist to review medication regimen.
<input type="checkbox"/> Contact the physician, NP, PA with an update on the resident's condition on _____.

Fig. 1. Example of an observation order set.

observation protocols can also be reassuring.⁷⁸ Figure 1 provides an example of an observation order set clinicians can use to standardize the observation process.

What Is the Role of the Facility's Infection Control Program and the Medical Director in Reducing Over-Diagnosis and Treatment of UTI?

Under federal nursing home licensure regulations, all nursing facilities must have an infection control program that “investigates, controls, and prevents infections in the facility.”⁷⁹ Moreover, it is expected that the medical director be actively involved in oversight of the program, and that the facility communicates information about infection control to the attending physicians. Since UTI is the most commonly diagnosed infection in LTC settings, and since the prevalence of UTI is one of the publically reported nursing facility quality measures,⁸⁰ facilities have a strong incentive to ensure they track and manage UTI appropriately. UTI management should be considered as a quality assurance and performance improvement (QAPI) initiative by all nursing facilities. Appropriate QAPI targets are ones that are prevalent, pose significant safety and liability risks, are associated with significant costs, and have the potential to significantly impact resident quality of life.⁸¹ The role of the medical director in facilitating the QAPI process cannot be overstated, especially given the limited skills and experience of nursing home staff in implementing QI interventions.⁸² The medical director should review any unnecessary drug citations. The medical director might also review residents being frequently treated for UTI, collaborate with practitioners and nursing staff to establish minimum criteria for ordering urine diagnostics, communicate findings from the facility's urinary antibiogram with clinicians, or promote the use of decision support tools such as standardized communication forms for reporting changes in a resident condition (e.g. Situation, Background, Assessment, Response or SBAR forms). The infection control program should track the incidence of UTI within a facility using a standard definition such as the ones described above. It should be understood the definition used for surveillance may differ from that used to initiate antimicrobial therapy. The facility should also track the rate of antimicrobial starts when minimal criteria for antimicrobial therapy are not met. This information should be shared with the medical director and performance feedback provided to individual clinicians. The medical director should also work with the infection control program to establish continuous training for staff regarding symptoms of UTI and

criteria that should be met before consideration is given to urinary testing. Resident and family education are also important. AMDA's and the American Geriatrics Society's Choosing Wisely Campaigns are tools that can be used to educate residents, families, as well as staff and physicians.^{75,76} Another potential educational tool specifically designed for LTC is the recently developed Agency for Healthcare Research and Quality pamphlet, *Not All Infections Need Antibiotics!*, expected to be released in the near future (personal communication American Institutes for Research to DN, 10/29/2013).

Conclusions

Practitioners must rely on consensus based criteria for the diagnosis of UTI. Identifying signs and symptoms localized to the urinary tract is an important though controversial prerequisite to avoiding overtreatment of asymptomatic bacteriuria. For patients with significantly advanced cognitive impairment who cannot reliably report symptoms, presence of fever, leukocytosis, or hemodynamic instability alone may be adequate to justify initiation of antimicrobial therapy. However, the use of other nonspecific symptoms such as fatigue or mental status changes alone in diagnosing or treating UTI, especially in the absence of a urinary catheter, is not recommended. The McGeer criteria have been designed for surveillance and benchmarking purposes, but meeting these specific criteria should not be a prerequisite for initiation of antimicrobial therapy. Over reliance on urinary tests such as urine analyses and urine cultures leads to unnecessary treatment of asymptomatic bacteriuria as well as adverse drug events, *Clostridium difficile* infection, and antimicrobial resistance and should be avoided. There is no role for ordering urine tests in asymptomatic residents as tests of cure. Observation and monitoring of residents in whom the diagnosis of UTI is unclear is a best practice that allows for further data gathering, can provide reassurance to residents and family members, may optimize antimicrobial therapy, and minimizes the chance of misdiagnosis. Facilities should consider addressing UTI management as part of their QAPI process.

References

1. Snustad D. Response to “Clinical practice guideline for the evaluation of fever and infection in older adult residents of long term care facilities: 2008 update by the Infectious Diseases Society of America.” *J Am Geriatr Soc* 2009;57: 2157–2158.
2. Balogun S, Philbrick JT. Delirium, a symptom of UTI in the elderly: Fact or fable? A systematic review. *J Am Med Dir Assoc* 2013;14:B21.

3. Drinka P. Does urinary tract infection cause residents' mental status change? *J Am Geriatr Soc* 2009;57:2387–2388.
4. High KP, Bradley SF, Gravenstein S, et al. Clinical practice guideline for the evaluation of fever and infection in older adult residents of long term care facilities: 2008 update by the Infectious Diseases Society of America. *Clin Infect Dis* 2009;48:149–171.
5. Walker S, McGeer A, Simor AE, et al. Why are antibiotics prescribed for asymptomatic bacteriuria in institutionalized elderly people? A qualitative study of physicians' and nurses' perceptions. *CMAJ* 2000;163:273–277.
6. High KP, Yoshikawa TT. Reply to Dr Snustad. *J Am Geriatr Soc* 2009;57:2158–2159.
7. Gau JT, Clay S. Diagnostic accuracy of criteria for urinary tract infection in nursing homes. *J Am Geriatr Soc* 2008;56:571.
8. Loeb M, Bentley DW, Bradley S, et al. Development of minimum criteria for the initiation of antibiotics in residents of long term care facilities: Results of a consensus conference. *Infect Control Hosp Epidemiol* 2001;22:120–124.
9. Loeb M, Brazil K, Lohfeld L, et al. Effect of a multifaceted intervention on number of antimicrobial prescriptions for suspected urinary tract infections in residents of nursing homes: Cluster randomised controlled trial. *BMJ* 2005;331:669.
10. McGeer A, Campbell B, Emori TG, et al. Definitions of infection for surveillance in long term care facilities. *Am J Infect Control* 1991;19:1–7.
11. Stone ND, Ashraf MS, Calder J, et al. Surveillance definitions of infections in long term care facilities: Revisiting the McGeer criteria. *Infect Control Hosp Epidemiol* 2012;33:965–977.
12. Juthani-Mehta M, Drickamer MA, Towle V, et al. Nursing home practitioner survey of diagnostic criteria for urinary tract infections. *J Am Geriatr Soc* 2005;53:1986–1990.
13. Juthani-Mehta M, Quagliarello V, Perrelli E, et al. Clinical features to identify urinary tract infection in nursing home residents: A cohort study. *J Am Geriatr Soc* 2009;57:963–970.
14. D'Agata E, Loeb MB, Mitchell SL. Challenges in assessing nursing home residents with advanced dementia for suspected urinary tract infections. *J Am Geriatr Soc* 2013;61:62–66.
15. Phillips CD, Adepoju O, Stone N, et al. Asymptomatic bacteriuria, antibiotic use, and suspected urinary tract infections in four nursing homes. *BMC Geriatr* 2012;12:73.
16. Resnick NM, Marcantonio ER. How should clinical care of the aged differ? *Lancet* 1997;350:1157–1158.
17. Yoshikawa TT, Ouslander JG, editors. *Infection Management for Geriatrics in Long Term Care Facilities*. 2nd ed. New York: Informa Healthcare; 2007.
18. Sundvall PD, Ulleryd P, Gunnarsson RK. Urine culture doubtful in determining etiology of diffuse symptoms among elderly individuals: A cross-sectional study of 32 nursing homes. *BMC Fam Pract* 2011;12:36.
19. Orr PH, Nicolle LE, Duckworth H, et al. Febrile urinary infection in the institutionalized elderly. *Am J Med* 1996;100:71–77.
20. Boscia JA, Kobasa WD, Abrutyn E, et al. Lack of association between bacteriuria and symptoms in the elderly. *Am J Med* 1986;81:979–982.
21. Das R, Towle V, Van Ness PH, Juthani-Mehta M. Adverse outcomes in nursing home residents with increased episodes of observed bacteriuria. *Infect Control Hosp Epidemiol* 2011;32:84–86.
22. Juthani-Mehta M, Tinetti M, Perrelli E, et al. Interobserver variability in the assessment of clinical criteria for suspected urinary tract infection in nursing home residents. *Infect Control Hosp Epidemiol* 2008;29:446–449.
23. Barkham TM, Martin FC, Eykyn SJ. Delay in the diagnosis of bacteraemic urinary tract infection in elderly patients. *Age Ageing* 1996;25:130–132.
24. Woodford HJ, Graham C, Meda M, Miculeviciene J. Bacteremic urinary tract infection in hospitalized older patients—are any currently available diagnostic criteria sensitive enough? *J Am Geriatr Soc* 2011;59:567–568.
25. Rotjanapan P, Dosa D, Thomas KS. Potentially inappropriate treatment of urinary tract infections in two Rhode Island nursing homes. *Arch Intern Med* 2011;171:438–443.
26. Levy CR, Eilertsen T, Kramer AM, Hutt E. Which clinical indicators and resident characteristics are associated with health care practitioner nursing home visits or hospital transfer for urinary tract infections? *J Am Med Dir Assoc* 2006;7:493–498.
27. Richards CL Jr, Darradji M, Weinberg A, Ouslander JG. Antimicrobial use in post-acute care: A retrospective descriptive analysis in seven long term care facilities in Georgia. *J Am Med Dir Assoc* 2005;6:109–112.
28. Pettersson E, Vernby A, Molstad S, Lundborg CS. Infections and antibiotic prescribing in Swedish nursing homes: A cross-sectional study. *Scand J Infect Dis* 2008;40:393–398.
29. Lohfeld L, Loeb M, Brazil K. Evidence-based clinical pathways to manage urinary tract infections in long term care facilities: A qualitative case study describing administrator and nursing staff views. *J Am Med Dir Assoc* 2007;8:477–484.
30. Loeb M, Brazil K, Lohfeld L, et al. Optimizing antibiotics in residents of nursing homes: Protocol of a randomized trial. *BMC Health Serv Res* 2002;2:17.
31. Zabarsky TF, Sethi AK, Donskey CJ. Sustained reduction in inappropriate treatment of asymptomatic bacteriuria in a long term care facility through an educational intervention. *Am J Infect Control* 2008;36:476–480.
32. Federal Register. 2011. Available at: <http://www.gpo.gov/fdsys/pkg/FR-2011-01-26/html/2011-1540.htm>. Accessed August 9, 2013.
33. Federal Register. 2010. Available at: <http://www.gpo.gov/fdsys/pkg/FR-2010-07-01/html/2010-15796.htm>. Accessed August 9, 2013.
34. Frentzel E, Moudouni D, Garfinkel S, et al. Standardizing antibiotic use in long term care settings (SAUL Study): Final report. August 15, 2012. American Institutes for Research, Texas A&M University School of Rural Public Health, TMF Health Quality Institute; 2012.
35. Olsho LE, Bertrand RM, Edwards AS, et al. Does adherence to the Loeb minimum criteria reduce antibiotic prescribing rates in nursing homes? *J Am Med Dir Assoc* 2013;14:309.e1–309.e7.
36. Standardizing Antibiotic Use in Long Term Care Settings (SAUL Study): Final Report October 17, 2012. Abt Associates Inc, University of North Carolina; 2012.
37. Benoit SR, Nsa W, Richards CL, et al. Factors associated with antimicrobial use in nursing homes: A multilevel model. *J Am Geriatr Soc* 2008;56:2039–2044.
38. Blix HS, Bergman J, Schjott J. How are antibacterials used in nursing homes? Results from a point-prevalence prescription study in 44 Norwegian nursing homes. *Pharmacoepidemiol Dr S* 2010;19:1025–1030.
39. Loeb M, Simor AE, Landry L, et al. Antibiotic use in Ontario facilities that provide chronic care. *J Gen Intern Med* 2001;16:376–383.
40. Nicolle LE. Urinary tract infections in long term care facilities. *Infect Control Hosp Epidemiol* 1993;14:220–225.
41. Nicolle LE. Urinary tract infection in long term care facility residents. *Clin Infect Dis* 2000;31:757–761.
42. Yoshikawa TT, Nicolle LE, Norman DC. Management of complicated urinary tract infection in older patients. *J Am Geriatr Soc* 1996;44:1235–1241.
43. Mou TW, Sirotty R, Ventry P. Bacteriuria in elderly, chronically ill patients. *J Am Geriatr Soc* 1962;10:170–178.
44. Abrutyn E, Mossey J, Levison M, et al. Epidemiology of asymptomatic bacteriuria in elderly women. *J Am Geriatr Soc* 1991;39:388–393.
45. Abrutyn E, Mossey J, Berlin JA, et al. Does asymptomatic bacteriuria predict mortality and does antimicrobial treatment reduce mortality in elderly ambulatory women? *Ann Intern Med* 1994;120:827–833.
46. Nicolle LE, Bjornson J, Harding GK, MacDonell JA. Bacteriuria in elderly institutionalized men. *N Engl J Med* 1983;309:1420–1425.
47. Nicolle LE, Mayhew WJ, Bryan L. Prospective randomized comparison of therapy and no therapy for asymptomatic bacteriuria in institutionalized elderly women. *Am J Med* 1987;83:27–33.
48. Ouslander JG, Schapira M, Schnelle JF, et al. Does eradicating bacteriuria affect the severity of chronic urinary incontinence in nursing home residents? *Ann Intern Med* 1995;122:749–754.
49. Juthani-Mehta M, Tinetti M, Perrelli E, et al. Role of dipstick testing in the evaluation of urinary tract infection in nursing home residents. *Infect Control Hosp Epidemiol* 2007;28:889–891.
50. Sundvall PD, Gunnarsson RK. Evaluation of dipstick analysis among elderly residents to detect bacteriuria: A cross-sectional study in 32 nursing homes. *BMC Geriatr* 2009;9:32.
51. Wagenlehner FM, Naber KG, Weidner W. Asymptomatic bacteriuria in elderly patients: Significance and implications for treatment. *Drugs Aging* 2005;22:801–807.
52. Ducharme J, Neilson S, Ginn JL. Can urine cultures and reagent test strips be used to diagnose urinary tract infection in elderly emergency department patients without focal urinary symptoms? *CJEM* 2007;9:87–92.
53. Crossley K, Henry K, Irvine P, Willenbring K. Antibiotic use in nursing homes: Prevalence, cost and utilization review. *Bull N Y Acad Med* 1987;63:510–518.
54. Field TS, Gurwitz JH, Avorn J, et al. Risk factors for adverse drug events among nursing home residents. *Arch Intern Med* 2001;161:1629–1634.
55. Takahashi P, Trang N, Chutka D, Evans J. Antibiotic prescribing and outcomes following treatment of symptomatic urinary tract infections in older women. *J Am Med Dir Assoc* 2004;5:511–515.
56. Bradley SF, Terpenning MS, Ramsey MA, et al. Methicillin-resistant *Staphylococcus aureus*: Colonization and infection in a long term care facility. *Ann Intern Med* 1991;115:417–422.
57. Braykov NP, Eber MR, Klein EY, et al. Trends in resistance to carbapenems and third-generation cephalosporins among clinical isolates of *Klebsiella pneumoniae* in the United States, 1999–2010. *Infect Control Hosp Epidemiol* 2013;34:259–268.
58. Crnich CJ, Duster M, Hess T, et al. Antibiotic resistance in non-major metropolitan skilled nursing facilities: Prevalence and interfacility variation. *Infect Control Hosp Epidemiol* 2012;33:1172–1174.
59. Furuno JP, Shurland SM, Zhan M, et al. Comparison of the methicillin-resistant *Staphylococcus aureus* acquisition among rehabilitation and nursing home residents. *Infect Control Hosp Epidemiol* 2011;32:244–249.
60. Maslow JN, Lee B, Lautenbach E. Fluoroquinolone-resistant *Escherichia coli* carriage in long term care facility. *Emerg Infect Dis* 2005;11:889–894.
61. Mody L, Kauffman CA, Donabedian S, et al. Epidemiology of *Staphylococcus aureus* colonization in nursing home residents. *Clin Infect Dis* 2008;46:1368–1373.
62. Muder RR, Brennen C, Wagener MM, et al. Methicillin-resistant staphylococcal colonization and infection in a long term care facility. *Ann Intern Med* 1991;114:107–112.
63. Stone ND, Lewis DR, Lowery HK, et al. Importance of bacterial burden among methicillin-resistant *Staphylococcus aureus* carriers in a long term care facility. *Infect Control Hosp Epidemiol* 2008;29:143–148.
64. van Buul LW, van der Steen JT, Veenhuizen RB, et al. Antibiotic use and resistance in long term care facilities. *J Am Med Dir Assoc* 2012;13:568.e1–568.e13.

65. Viray M, Linkin D, Maslow JN, et al. Longitudinal trends in antimicrobial susceptibilities across long term care facilities: Emergence of fluoroquinolone resistance. *Infect Control Hosp Epidemiol* 2005;26:56–62.
66. Strausbaugh IJ, Crossley KB, Nurse BA, Thrupp LD. Antimicrobial resistance in long term care facilities. *Infect Control Hosp Epidemiol* 1996;17:129–140.
67. Crnich CJ, Safdar N, Robinson J, Zimmerman D. Longitudinal trends in antibiotic resistance in US nursing homes, 2000–2004. *Infect Control Hosp Epidemiol* 2007;28:1006–1008.
68. Bonomo RA. Multiple antibiotic-resistant bacteria in long term care facilities: An emerging problem in the practice of infectious diseases. *Clin Infect Dis* 2000;31:1414–1422.
69. Loeb MB, Craven S, McGeer AJ, et al. Risk factors for resistance to antimicrobial agents among nursing home residents. *Am J Epidemiol* 2003;157:40–47.
70. Das R, Perrelli E, Towle V, et al. Antimicrobial susceptibility of bacteria isolated from urine samples obtained from nursing home residents. *Infect Control Hosp Epidemiol* 2009;30:1116–1119.
71. Swaminathan M, Sharma S, Poliansky Blash S, et al. Prevalence and risk factors for acquisition of carbapenem-resistant enterobacteriaceae in the setting of endemicity. *Infect Control Hosp Epidemiol* 2013;34:809–817.
72. Lee BY, Song Y, Bartsch SM, et al. Long term care facilities: Important participants of the acute care facility social network? *PLoS One* 2011;6:e29342.
73. Won SY, Munoz-Price LS, Lolans K, et al. Emergence and rapid regional spread of *Klebsiella pneumoniae* carbapenemase-producing *Enterobacteriaceae*. *Clin Infect Dis* 2011;53:532–540.
74. Drinka PJ, Crnich CJ, Nace DA. An antibiotic prescription induces resistance at the individual level more than the group level. *J Am Med Dir Assoc* 2013;14:707–708.
75. Choosing Wisely, An Initiative of the ABIM Foundation: Five Things Physicians and Patients Should Question. 2013. Available at: <http://www.ama-assn.org/tools/choosingwisely.cfm>. Accessed October 29, 2013.
76. Choosing Wisely, An Initiative of the ABIM Foundation: Five Things Physicians and Patients Should Question. 2013. Available at: http://www.americangeriatrics.org/health_care_professionals/clinical_practice/clinical_guidelines_recommendations/choosingwisely. Accessed August 9, 2013.
77. Pettersson E, Vernby A, Molstad S, Lundborg CS. Can a multifaceted educational intervention targeting both nurses and physicians change the prescribing of antibiotics to nursing home residents? A cluster randomized controlled trial. *J Antimicrob Chemother* 2011;66:2659–2666.
78. Carusone SC, Loeb M, Lohfeld L. Pneumonia in care and the nursing home: A qualitative descriptive study of resident and family member perspectives. *BMC Geriatr* 2006;6:2.
79. State Operations Manual, Appendix PP. Available at: http://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/downloads/som107ap_pp_gui_delines_ltcf.pdf. Accessed October 29, 2013.
80. Nursing Home Compare. Available at: <http://www.medicare.gov/nursinghomecompare/>. Accessed October 29, 2013.
81. QAPI At A Glance: A Step by Step Guide to Implementing Quality Assurance and Performance Improvement (QAPI) in Your Nursing Home. 2013. Available at: <http://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/QAPI/Downloads/QAPIAtAGlance.pdf>. Accessed October 29, 2013.
82. Smith KM, Castle NG, Hyer K. Implementation of quality assurance and performance improvement programs in nursing homes: A brief report. *J Am Med Dir Assoc* 2013;14:60–61.