

Determining Appropriateness of Initiating Antibiotic Therapy in Nursing Home Residents

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Poll Question 1

Do you presently work part-time or full-time in the nursing home setting [MD, NP, PA, social worker, administrator, DON, ADON, staff nurse, pharmacist]?

a. Yes

b. No

Poll Question 2

For those working in nursing homes, does your facility have an antimicrobial stewardship program?

- a. Yes
- b. No
- c. Do not know

Rationale for Evaluating Appropriateness of Antibiotic Therapy in Nursing Home Residents

- Upwards of 70% of residents in nursing homes receive at least one course of antibiotics yearly

[van Buul et al J Am Med Dir Assoc 2012;13:568.e1-13]

- As many as 75% of antibiotic prescriptions in nursing home residents have been considered inappropriate

[Pulia et al Antimicrob Resist Infect Control 2018;7:74]

- Unnecessary antibiotic therapy can result in adverse drug reactions, *C. difficile* infection, and development of antibiotic resistance

[Mody, Crnich JAMA Intern Med 2015;175:1339-1341]

Background

- CMS, in its revision of the conditions of participation, requires long-term care facilities to have an antimicrobial stewardship program that includes protocols and monitoring for antibiotic use¹
- CDC developed core elements for antimicrobial stewardship in nursing homes of which one component is Identifying inappropriate use of antibiotics and implementing interventions to improve use²

¹Centers for Medicare & Medicaid Services. (2016). *Reform of requirements for long-term care facilities: Final rule (CMS-3260-P)*, 2016

²CDC. *The Core Elements of Antibiotic Stewardship for Nursing Homes*. Atlanta, GA: US Department of Health and Human Services, CDC; 2015

Background

- However, determining appropriateness of initiating antibiotic therapy in the nursing home setting has been a major challenge.
- For example, identifying residents with urinary tract infection (UTI) has been challenging resulting in publication of multiple decision tools for the diagnosis and treatment of UTI in the last 2 decades¹

¹Mylotte *Drugs Aging* 2021;38:29-41

Clinical Vignette

- The medical director of a 100-bed skilled nursing facility is chairperson of the antibiotic stewardship program (ASP) that includes the infection preventionist, a pharmacist, a facility physician, and two staff nurses
- The ASP evaluates appropriateness of antibiotic therapy focusing on UTI, pneumonia, and skin/soft tissue infection
- The ASP team utilized the revised McGeer criteria¹ for evaluating appropriateness of initiating antibiotic therapy

¹Stone et al. Infect Control Hosp Epidemiol 2012 Oct;33(10):965-977

Clinical Vignette [continued]

- After collecting data for 12 months, the range of the monthly rate of appropriateness of initiating treatment was reviewed: UTI (25-42%), pneumonia (24-50%), and SSTI (39-42%)
- The low rate of appropriateness of initiating antibiotic treatment and the variability of the monthly rate for these infections was concerning to the ASP team.
- Because of these concerns, the ASP team changed to using the Loeb criteria¹ for evaluating appropriateness of initiating antibiotic therapy

¹Loeb et al. Infect Control Hosp Epidemiol 2001 Feb;22(2):120-124

Clinical Vignette [continued]

- After 6 months of utilizing the Loeb criteria, the range of the monthly rate of appropriateness for each infection was reviewed: UTI (11-42%), pneumonia (25-33%), and SSTI (10-40%)
- Two different criteria found low rates of appropriateness of initiating antibiotic therapy
- The ASP team was concerned that this may not be an accurate assessment of the ability of facility practitioners to prescribe antibiotics appropriately.

Clinical Vignette [continued]

- In trying to better understand the results of these evaluations, the ASP team realized that they needed to learn more about the revised McGeer and Loeb criteria
- The ASP team considered several questions that needed to be answered before developing a plan to improve the appropriateness of antibiotic prescribing

Clinical Vignette [continued]

1. How were the revised McGeer and Loeb criteria developed and for what purpose were they principally designed?
2. Are there studies that utilized the revised McGeer or Loeb criteria for evaluating appropriateness?
3. Are there limitations of the revised McGeer or Loeb criteria for determining appropriateness?
4. Are there alternative methods for assessing appropriateness?
5. In addition to initiating antibiotic therapy, are there other elements of the prescribing process that need to be considered when assessing the appropriateness?

How were the revised McGeer and Loeb criteria developed and for what purpose were they principally designed?

Development of the revised McGeer criteria

- Prior to 1991 there were no standardized surveillance definitions for infection in the nursing home setting that would allow for monitoring infection rates that could be used for comparing rates among nursing homes
- In 1989 a group of those interested in infection and infection control in nursing homes were assembled by Dr. Allison McGeer and, by consensus, developed surveillance definitions for infection that were published in 1991 and have been referred to as the “McGeer criteria” [McGeer et al Am J Infect Control 1991;19(1):1-7]
- The McGeer criteria were accepted as a standard for surveillance for infection in nursing homes by APIC and SHEA
- These criteria were also accepted as the standard for diagnosis and treatment of infection by DHHS and CMS

Development of the revised McGeer criteria

- In 2009, under the leadership of Dr. Namalie Stone from the CDC, the SHEA LTC SIG undertook a revision of the McGeer criteria that was published in 2012 [“revised McGeer criteria”]
[Stone et al infect Control Hosp Epidemiol 2012;33:965-977]
- The only major changes were the definitions for pneumonia and UTI
- There is a statement in the 2012 paper that specifically warns against using infection surveillance definitions to determine when it is appropriate to initiate antibiotic therapy in a nursing home resident

: “The criteria that define infections for surveillance purposes were selected to increase the likelihood that the events captured by application of the definitions are true infections. Presentations of infection in older residents of LTCFs may be atypical, so failure to meet surveillance definitions may not fully exclude the presence of infection. For this reason, the surveillance definitions presented here may not be adequate for real-time case finding, diagnosis, or clinical decision making (eg, antibiotic initiation).”

Development of the Loeb criteria

- In 2000, members of SHEA with an interest in infections in nursing homes, led by Dr. Mark Loeb, developed minimum criteria for initiating antibiotic treatment in nursing home residents with suspected infection [“Loeb criteria” or “Loeb minimum criteria”]
- The rationale for developing these criteria was to try to deal with the overuse of antibiotics in the nursing home setting by providing a method for practitioners to decide when it was indicated to prescribe antibiotics
- It was hypothesized that if the minimum criteria were utilized in practice, there would be a reduction in inappropriate antibiotic use and potentially a reduction in the risk for developing antibiotic resistance.

Summary

- Surveillance definitions, such as the revised McGeer criteria, were not designed to be used to assess appropriateness of antibiotic therapy
- Loeb criteria were specifically designed to assist clinicians in deciding when to initiate antibiotic therapy

Are there published studies that have utilized the revised McGeer or Loeb criteria for evaluating the appropriateness of initiating antibiotic therapy in nursing home residents?

Literature Review

- A literature search using Google Scholar and Medline with Ovid for the period January 1, 1992 to March 31, 2022 identified 21 studies published in English that utilized the McGeer, revised McGeer, or Loeb criteria to evaluate the appropriateness of initiating antibiotic therapy in nursing home residents
- The 21 studies were categorized into 4 groups:
 - use of the McGeer criteria alone [N = 4]
 - revised McGeer criteria alone [N = 4],
 - Loeb criteria alone [N = 6], or
 - studies comparing the McGeer, revised McGeer, and Loeb criteria (N = 7)

Summary of the Literature Review

- Regardless of the criteria utilized, rates of appropriateness were low and there was considerable variability in level of appropriateness of initiating antibiotic therapy by type of infection for each criteria
- Methodology of these studies varied:
 - Design: retrospective vs prospective
 - Variation in how the study population was identified
 - Variation in sample size
- Variation in how study population was identified is exemplified by studies of UTI:
 - identification of infection by an infection control nurse
 - residents with a positive urinalysis
 - suspected infection by nursing staff
 - residents with a urine culture
 - infection logs indicating treatment for UTI

Infection Studied	McGeer criteria	Revised McGeer criteria	Loeb criteria	
UTI	28 ²⁴	18 ²⁸	10 ³¹	29 ³⁵
	15 ⁶	13 ²⁹	16 ³²	44 ¹¹
	51 ²⁷	15 ⁴⁰	8 ³³	30 ⁴⁰
		32 ⁴¹	17 ³⁴	40 ⁴¹
		28 ⁴²		36 ⁴²
Pneumonia	No studies	78 ²⁷		30 ³⁸
		7 ³⁸		
SSTI	65 ²⁴	25 ³⁹		43 ³¹
	33 ²⁶	36 ⁴²		78 ³⁵
				78 ¹¹
				48 ³⁹
				72 ⁴²

Data are %
Appropriateness
Of Initiating
Antibiotic Rx

Are there limitations of the McGeer criteria, revised McGeer criteria, or Loeb criteria for determining the appropriateness of initiating antibiotic therapy in nursing home residents?

Limitations

- Surveillance definitions should not be utilized to determine appropriateness of initiating antibiotic therapy in nursing home residents because of their high specificity and low sensitivity
- Loeb criteria requires signs/symptoms that are localized to the infection site and this impacts use of the criteria due to:
 - lack of chart documentation of signs and symptoms, especially if the evaluation is done retrospectively
 - residents with cognitive impairment may not be able to provide accurate history
- It is unclear the extent to which the Loeb criteria is utilized by providers in LTCFs for prescribing antibiotics

Are there alternative approaches to the McGeer, revised McGeer, and Loeb criteria for assessing the appropriateness of initiating antibiotic therapy in nursing home residents?

Alternative Approaches for Determining Appropriateness of Antibiotic Therapy in Nursing Home Residents

- The revised McGeer criteria and Loeb criteria rely almost exclusively on the presence of localizing signs and symptoms
- However, chart documentation of signs and symptoms in nursing home residents with suspected infection is poor and residents with cognitive impairment may not be able to provide an accurate history of symptoms
- In the absence of documentation of localizing signs/symptoms, clinicians prescribe antibiotics based only on the presence of non-localizing signs and symptoms (acute change in mental status, falls, decreased appetite, acute change in functional status, fever); this has been a particular issue in the diagnosis of UTI

Consideration for including non-localizing signs and symptoms in criteria for initiating antibiotic therapy and for use in clinical definitions of infection

- In 2013 it was suggested that non-localizing signs and symptoms be considered for inclusion in criteria for initiating antibiotic therapy in nursing home residents

[Rowe, Juthani-Mehta Aging Health 2013;9:519-528]

- Because of the long-standing dogma that an acute change in mental status is an atypical manifestation of UTI, there has been a focus on the association of delirium and UTI

[Krinitcki et al J Am Geriatr Soc 2021;69:3312-3323]

- However, three systematic reviews of the association between delirium and UTI in the elderly have been published with

contradictory results [Balogun Can Geriatr J 2014;17:22-26; Mayne BMC Geriatrics. 2019;9:32; Krinitcki et al J Am Geriatr Soc 2021;69:3312-3323]

Non-localizing Signs and Symptoms as Part of Infection Surveillance Definitions

- A *post hoc* study of data collected as part of a prevalence survey of infections in 161 nursing homes in the United States used the revised McGeer criteria plus a modification of the CAM to define an acute change in mental status to identify infection

[Penna Infect Control Hosp Epidemiol 2020;41:848-850]

- Addition of the modified CAM for defining acute confusion increased the number of infections identified by 12% compared to using the revised McGeer criteria alone.

Non-localizing Signs and Symptoms as Clinical Predictors of Infection in Nursing Home Residents

- A recent review evaluated the role of non-localizing signs and symptoms as clinical predictors of infection in nursing home residents [Rowe et al Infect Control Hosp Epidemiol 2020 Dec 9:1-10]
- The non-localizing signs or symptoms identified as potential indicators of infection in nursing home residents were **fever, hypothermia, hypotension, new-onset hyperglycemia, and delirium**
- The authors of this review stated that the findings will be used as “the foundation for an update to the Loeb minimum criteria”.

Published Algorithms to Identify Infections in Nursing Home Residents Using Non-localizing Signs and Symptoms

- An algorithm to evaluate appropriateness of initiating antibiotic treatment for suspected UTI in nursing home residents included an option to initiate treatment in the absence of localizing signs and symptoms of UTI if there is a change in status associated with one or more “warning signs” (fever, rigors, delirium, or unstable vital signs) [Crnich, Drinka Ann Long Term Care 2014:43–47]. This algorithm is part of toolkit to improve the diagnosis and treatment of UTI in nursing home residents

[Ford et al JAMA Network Open 2019;2(9):e199526]

- In the United Kingdom, published guidelines for the identification of UTI, lower respiratory tract infection, and SSTI in nursing home residents modified the Loeb criteria such that non-specific signs/symptoms **by themselves** could initiate an evaluation for infection

[Hughes et al BMC Geriatr 2020;20(1):59]

Other efforts to Identify Infections in Nursing Home Residents

- **Medical Societies:**

- Infectious Diseases Society of America. Clin Infect Dis 2009;48:149-171
- AMDA's Infection Advisory Subcommittee. J Am Med Dir Assoc 2017;18:913
- AMDA's Infection Advisory Subcommittee. J Am Med Dir Assoc 2020;21:12-24

- **Federal agency:**

- AHRQ <https://www.ahrq.gov/nhguide/toolkits/determine-whether-to-treat/index.html>

- **States:**

- Minnesota Antimicrobial Stewardship Program Toolkit for Long-Term Care Facilities.
<https://www.health.state.mn.us/diseases/antibioticresistance/hcp/asp/ltc>

In addition to initiating antibiotic therapy, are there other elements of the prescribing process that need to be considered when assessing the appropriateness of antibiotic therapy in nursing home residents?

Components of the Antibiotic Prescribing Process

- Decision to treat
- Choice of antibiotic
- Dosing of antibiotic in an elderly population
- Antibiotic “timeout” after 2-3 days of treatment to:
 - Assess response
 - Review any imaging, lab, or microbiological data
 - Continue, escalate, de-escalate, or discontinue treatment
 - Determine the duration of treatment

Duration of Antibiotic Therapy

- Of the prescribing components, only duration of therapy has been extensively studied with verification that short course treatment of pneumonia, UTI, and SSTI is effective and safe
[Wald-Dickler and Spellberg Clin Infect Dis 2019;69:1476-1479]
- Studies in nursing home residents have identified excessively long durations of antibiotic treatment that should be a target for antibiotic stewardship programs:
 - Daneman et al JAMA Int Med 2013;173:673–682;
 - Kabbani Antimicrob Steward Healthcare Epidemiol 2021;1, e58:1-7;
 - Langenstroer et al Infect Control Hosp Epidemiol 2022.
<https://doi.org/10.1017/ice.2022.202>

Non-Clinical Factors Influencing the Decision to Initiate Antibiotic Therapy in Nursing Home Residents

- Provider-, resident-, family-, and facility-level factors may influence the decision to initiate antibiotic therapy but there has been minimal evaluation of these issues to date
- A recent study in 1,664 U.S. nursing homes found several facility-level factors correlated with higher rates of antibiotic use:
 - proportion of short-stay (≤ 100 days) residents making up $\geq 75\%$ of a facility population,
 - for-profit ownership,
 - proportion of residents with low cognitive performance scale making up $\geq 50\%$ of a facility population,
 - proportion of long-stay residents with pressure ulcers making up $\geq 5\%$ of a facility population, and
 - at least 1 resident on a ventilator

[Kabbani Antimicrob Steward Healthcare Epidemiol 2021;1, e58:1-7]

Implications for Practice,
Policy, and/or Research

- Efforts to assess appropriateness of initiating antibiotic therapy in nursing home residents are well-intentioned
- However, the many various approaches for assessing appropriateness of antibiotic therapy in nursing home residents demonstrate the lack of consensus on how this should be done
- The lack of consensus results in data that are not comparable

Suggestions for providing consistency and validity to the assessment of the appropriateness of initiating antibiotic therapy in nursing home residents

- First, **standardize** and **validate** clinical definitions of infection for the nursing home setting [? Revision of Loeb criteria]
- Second, standardize the methodology for assessing appropriateness of initiating antibiotic therapy
 - Standardize how the study population is selected (infection logs, antibiotic logs, provider diagnosis)
 - Evaluations should be done prospectively
 - **Criteria for the clinical diagnosis of infection that will be used for evaluating appropriateness of initiating antibiotic treatment need to be effectively disseminated to nursing home practitioners and staff**
- Practitioners and staff need to not only be educated regarding the decision to initiate treatment but also other components of the prescribing process
 - Antibiotic “timeout” protocol
 - Determining duration of treatment

Other issues that need to be addressed

- When evaluating appropriateness of antibiotic therapy in nursing homes, a distinction should be made between residents admitted for post-acute care and those on long-term care because the rate of antibiotic use in the post-acute population tends to be higher [Kabbani Antimicrob Steward Healthcare Epidemiol 2021;1, e58:1-7]
- Further study of the association of provider-, resident-, family-, and facility-level factors with antibiotic use in nursing home residents will be important to account for these factors when assessing appropriateness of antibiotic treatment in this population.

In the near term, after reviewing the literature, what can the ASP team do to potentially improve prescribing and the process of evaluating appropriateness of antibiotic therapy?

- Stop using surveillance definitions to assess appropriateness
- Continue to use the Loeb criteria for evaluating appropriateness, despite its limitations, because it was specifically designed to assist providers in the decision to initiate antibiotic therapy
- Nursing staff and practitioners need to be educated about the Loeb criteria and how to use the criteria for prescribing antibiotics
- Re-evaluate appropriateness of antibiotic therapy
- ASP team should consider developing an antibiotic timeout protocol and develop a plan to monitor duration of therapy and limit duration to 7 days when appropriate.

Final Comments

- The lack of a gold standard for the diagnosis of bacterial infection in nursing home residents makes it impossible to construct the “perfect” set of criteria for initiating antibiotic therapy
- Criteria for the diagnosis of bacterial infection will continue to be based on consensus of expert opinion
- However, the evidence base regarding signs and symptoms (localizing or non-localizing) of infection indicating the need for antibiotic therapy needs to be improved
- To improve the evidence base, randomized trials to assess the impact of approaches to evaluation, as well as treatment, of infections in nursing home residents are required including evaluation of non-localizing signs and symptoms in the presentation of infection.

Thank You

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