



Published in final edited form as:

J Gerontol Geriatr Res. 2018 ; 7(2): . doi:10.4172/2167-7182.1000467.

Frequency of Infection during Fever Episodes among Long-Term Care Residents

Rupak Datta, MD PhD^{1,*}, Sonali Advani, MBBS MPH¹, Andrea Rink, RN¹, Luann Bianco, BA¹, Peter H. Van Ness, PhD MPH², Vincent Quagliarello, MD¹, and Manisha Juthani-Mehta, MD¹

¹Yale School of Medicine, Department of Internal Medicine, Section of Infectious Diseases, New Haven, CT USA

²Yale School of Medicine, Department of Internal Medicine, Section of Geriatrics, New Haven, CT USA

Abstract

Background—Empirical data regarding the frequency of infection during fever episodes among women in long-term care facilities are lacking.

Methods—We conducted a case-series analysis of women long-term care residents enrolled in a randomized trial evaluating cranberry capsules to reduce bacteriuria plus pyuria across twenty-one long-term care facilities in CT, USA. Fever episodes identified during adverse event surveillance were assessed using established guidelines for older adults. Among fever episodes, infections were classified using standardized infection surveillance definitions in long-term care residents.

Results—We identified 123 fever episodes among 80 women long-term care residents. Median age was 88 years (range, 65–101), and 81% (N=65) had dementia. Among 123 fever episodes, 79 (64%) met criteria for 86 total infections (lower respiratory tract, N=43; pneumonia, N=27; gastroenteritis, N=9; urinary tract, N=7).

Conclusion—Data from this study suggest that approximately two-thirds of fever episodes involve infection among women in long-term care facilities. These data may guide provider assessments of fever in older adult women in long-term care facilities.

Keywords

Fever; Infection; Long-term; Care; Residents

Introduction

Comorbid conditions affecting older adults may preclude reliable clinical assessment of infection [1]. Consequently, infection diagnoses often rely on vital signs [2]. However, fever

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

*Corresponding author: Rupak Datta, Department of Internal Medicine, Section of Infectious Diseases, Yale School of Medicine, P.O. Box 208022, New Haven, CT, USA, Tel: 2037857571; Fax: 2037853864; rupak.datta@yale.edu.

All authors report no conflicts of interest related to this work.

interpretation among older adults is complicated by lower baseline temperatures, blunted host immune responses, and contributing non-infectious causes [3–5]. The importance of accurate fever interpretation is underscored by widespread antimicrobial overuse in long-term care settings [6]. We sought to provide empirical data regarding the frequency of infectious causes for fever episodes among women in long-term care facilities.

Methods

We conducted a case series analysis of all adverse events in women residents enrolled in a randomized trial evaluating cranberry capsules to reduce bacteriuria plus pyuria across 21 long-term care facilities between August 2012 and October 2015 [7]. Fever episodes that were identified during adverse event surveillance were subsequently evaluated using Infectious Diseases Society of America (IDSA) guidelines for older adults [8]. The Yale University Human Investigation Committee approved this study.

For all participants, we recorded demographics, comorbidities, and medications. Fever episodes were evaluated in a stepwise manner. Initially, we assessed whether temperatures exceeded 100 F. Among temperatures <100 F, we assessed whether two oral temperatures exceeded 99 F during the adverse event and subsequently whether temperatures were 2 F above baseline (i.e., last temperature documented prior to adverse event). Based on this hierarchy, fever episodes were identified and plotted against baseline temperatures. For all fever episodes, we identified related hospitalizations, deaths, diagnostic tests, infections and antimicrobials. Infections were classified using surveillance definitions [9]. Antimicrobial-days were described among fever episodes with and without infection.

Results

Among 3830 total adverse events, we identified 123 (3%) fever episodes among 80 women participants. Median age was 88 years (range, 65–101), and 94% (N=75) were white. Of these 80 participants, 81% (N=65) had dementia, 34% (N=27) had congestive heart failure, and 20% (N=16) had daily bladder incontinence. Median number of medications was 11 (range, 3–20).

Among 123 fever episodes, 79 (64%) met criteria for 86 total infections (lower respiratory tract, N=43; pneumonia, N=27; gastroenteritis, N=9; urinary tract, N=7). There were no *Clostridium difficile* infections. Infections occurred among fever episodes managed with (N=60/83, 72%) and without (N=19/40, 48%) administration of antimicrobials (Table 1). Figure 1 shows the baseline and febrile temperature distribution. Median antimicrobial-days varied between fever episodes with (6 days, range 0–36) versus without (1 day, range 1–98) infection.

Discussion

Among fever episodes in women long-term care residents, we show that approximately two-thirds met criteria for infection. Among fever episodes managed with empiric antimicrobials, the majority met surveillance criteria for infection. These findings have implications for providers managing long-term care residents admitted with fever and

provide empiric data supporting the use of consensus-derived definitions for fever and infection.

Our work highlights the complementary roles of antimicrobial and diagnostic stewardship. Whereas most fever episodes were managed judiciously with antimicrobials, with prompt discontinuation when infection was excluded, diagnostic testing may be inappropriate and occasionally excessive. In our sample, there were seven-fold more urine cultures ordered than urinary tract infections identified. Evidence suggests multifaceted interventions reduce inappropriate urine cultures in hospitals [10]. The data from this study, however limited, suggest that similar work needs to be conducted in long-term care facilities.

Our study has limitations. First, it may lack generalizability as only women were enrolled. However, our study builds upon data evaluating the association between body temperature and infection limited to older adults receiving antimicrobials [11]. Second, this was an observational secondary analysis, and diagnostic testing for infection was up to physician discretion. Third, temperature assessments were subject to random and unavoidable measurement error which may have caused fever misclassification. However, fever misclassification was likely non-differential with regard to infection, and this limitation has been described in prior reports [1,3,11]. Finally, we did not collect data on medications that may have masked fever.

Conclusion

We show that approximately two-thirds of fever episodes involve infection among women in long-term care facilities when applying IDSA fever guidelines and established infection surveillance definitions. These data may guide provider assessments of fever in older women in long-term care facilities.

Acknowledgments

This work was supported by the Yale School of Medicine, Section of Infectious Diseases (grant number 2T32AI007517-16 (RD)), Claude D. Pepper Older Americans Independence Center (grant number P30 AG021342), R01 AG041153 (MJM), and K07 AG030093 (VQ) from the National Institutes of Health.

References

1. Norman DC. Clinical features of infection in older adults. *Clin Geriatr Med.* 2005; 32:433–441.
2. Jackson MM, Schafer K. Identifying clues to infections in nursing home residents. The role of the nurses' aide. *J Gerontol Nurs.* 1993; 19:33–442.
3. Castle SC, Norman DC, Yeh M, Miller D, Yoshikawa TT. Fever response in elderly nursing home residents: are the older truly colder? *J Am Geriatr Soc.* 1991; 39:853–857. [PubMed: 1885858]
4. Gomolin IH, Aung MM, Wolf-Klein G, Auerbach C. Older is colder: temperature range and variation in older people. *J Am Geriatr Soc.* 2005; 53:2170–2172. [PubMed: 16398904]
5. Zell JA, Chang JC. Neoplastic fever: a neglected paraneoplastic syndrome. *Support Care Cancer.* 2005; 13:870–877. [PubMed: 15864658]
6. Daneman N, Bronskill SE, Gruneir A, Newman AM, Fischer HD, et al. Variability in antibiotic use across nursing homes and the risk of antibiotic-related adverse outcomes for individual residents. *JAMA Intern Med.* 2015; 175:1331–1339. [PubMed: 26121537]

7. Juthani-Mehta M, Van Ness PH, Bianco L, Rink A, Rubeck S, et al. Effect of cranberry capsules on bacteriuria plus pyuria among older women in nursing homes: A randomized clinical trial. *JAMA*. 2016; 316:1879–1887. [PubMed: 27787564]
8. High KP, Bradley SF, Gravenstein S, Mehr DR, Quagliarello V, 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. *J Am Geriatr Soc*. 2009; 57:375–394. [PubMed: 19278394]
9. Stone ND, Ashraf MS, Calder J, Crnich CJ, Crossley K, et al. Surveillance definitions of infections in long-term care facilities: Revisiting the McGeer criteria. *Infect Control Hosp Epidemiol*. 2012; 33:965–977. [PubMed: 22961014]
10. Trautner BW, Grigoryan L, Petersen NJ, Hysong S, Cadena J, et al. Effectiveness of an antimicrobial Stewardship approach for urinary catheter-associated asymptomatic bacteriuria. *JAMA Intern Med*. 2015; 175:1120–1127. [PubMed: 26010222]
11. Sloane PD, Kistler C, Mitchell CM, Beeber AS, Bertrand RM, et al. Role of body temperature in diagnosing bacterial infection in nursing home residents. *J Am Geriatr Soc*. 2014; 62:135–140. [PubMed: 25180381]

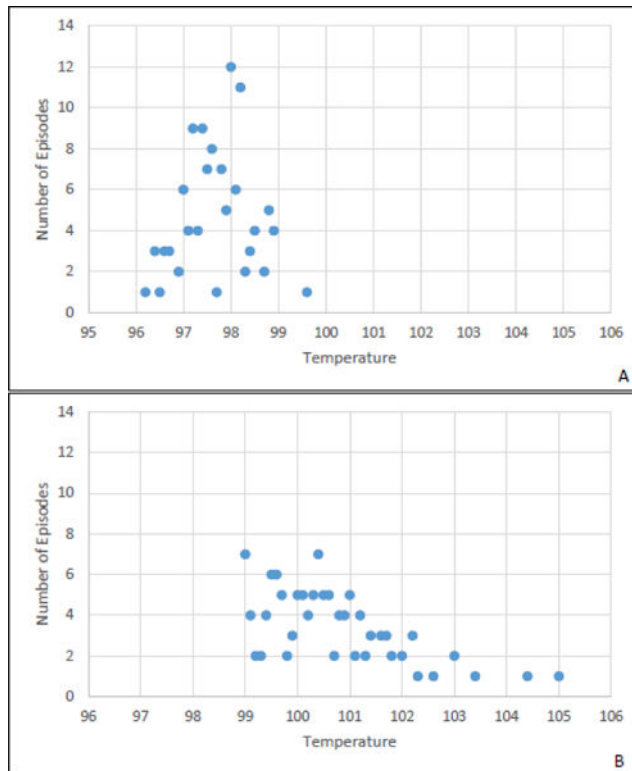


Figure 1. Baseline (A) and febrile (B) temperature distribution among 123 fever episodes. Fever episodes were identified from 80 women long-term care residents enrolled in a randomized trial. Baseline temperature was defined as the last routine temperature documented prior to the adverse event. All residents have both baseline and febrile temperatures depicted in the Figure 1. Each dot may represent more than one resident.

Table 1

Descriptive characteristics of 123 fever episodes among 80 women long-term care residents participating in a randomized trial.

| Characteristic | No. (%) |
|--|----------|
| Infectious diseases Society of America criteria for fever | |
| Single temperature >100 F | 77 (63%) |
| Repeated temperatures >99 F | 28 (23%) |
| Temperature >2 F above baseline | 18 (15%) |
| Diagnostic tests ordered | |
| Chest X-ray | 65 (53%) |
| Urine culture | 49 (40%) |
| Stool culture | 1 (1%) |
| Antimicrobial therapy | |
| Administered | 83 (67%) |
| Not Administered | 40 (33%) |
| Severity | |
| Hospitalization | 23 (19%) |
| Death | 9 (7%) |

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript