Infection Management and Multidrug-Resistant Organisms in Nursing Home Residents With Advanced Dementia

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IMPORTANCE Infection management in advanced dementia has important implications for (1) providing high-quality care to patients near the end of life and (2) minimizing the public health threat posed by the emergence of multidrug-resistant organisms (MDROs).

DESIGN, SETTING, AND PARTICIPANTS Prospective cohort study of 362 residents with advanced dementia and their health care proxies in 35 Boston area nursing homes for up to 12 months.

MAIN OUTCOMES AND MEASURES Data were collected to characterize suspected infections, use of antimicrobial agents (antimicrobials), clinician counseling of proxies about antimicrobials, proxy preference for the goals of care, and colonization with MDROs (methicillin-resistant Staphylococcus aureus, vancomycin-resistant enterococci, and multidrug-resistant gram-negative bacteria). Main outcomes were (1) proportion of suspected infections treated with antimicrobials that met minimum clinical criteria to initiate antimicrobial treatment based on consensus guidelines and (2) cumulative incidence of MDRO acquisition among noncolonized residents at baseline.

RESULTS The cohort experienced 496 suspected infections; 72.4% were treated with antimicrobials, most commonly quinolones (39.8%) and third- or fourth-generation cephalosporins (20.6%). At baseline, 94.8% of proxies stated that comfort was the primary goal of care, and 37.8% received counseling from clinicians about antimicrobial use. Minimum clinical criteria supporting antimicrobial treatment initiation were present for 44.0% of treated episodes and were more likely when proxies were counseled about antimicrobial use (adjusted odds ratio, 1.42; 95% CI, 1.08-1.86) and when the infection source was not the urinary tract (referent). Among noncolonized residents at baseline, the cumulative incidence of MDRO acquisition at 1 year was 48%. Acquisition was associated with exposure (>1 day) to quinolones (adjusted hazard ratio [AHR], 1.89; 95% CI, 1.28-2.81) and third- or fourth-generation cephalosporins (AHR, 1.57; 95% CI, 1.04-2.40).

CONCLUSIONS AND RELEVANCE Antimicrobials are prescribed for most suspected infections in advanced dementia but often in the absence of minimum clinical criteria to support their use. Colonization with MDROs is extensive in nursing homes and is associated with exposure to quinolones and third- and fourth-generation cephalosporins. A more judicious approach to infection management may reduce unnecessary treatment in these frail patients, who most often have comfort as their primary goal of care, and the public health threat of MDRO emergence.

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Alzheimer disease affects over 5 million Americans, is the sixth leading cause of death in the United States, and is increasingly recognized as a terminal illness. Identifying opportunities to improve the quality of the care for patients with advanced dementia is a clinical and research priority.

In advanced dementia, patients typically have profound cognitive deficits (no longer recognize family), limited verbal abilities (<5 words), functional impairment (bedbound), and high mortality rates. Suspected infections are commonly diagnosed, and use of antimicrobial agents (antimicrobials) is extensive; 40% of patients receive antimicrobials in the last 2 weeks of life. However, it remains unclear whether antimicrobial treatment confers any life-prolonging or symptomatic benefit in these patients, for whom the primary goal of care is most often palliation. Antimicrobial exposure also contributes to colonization by multidrug-resistant organisms (MDROs), a major public health problem across health care settings. Growing concern has focused on the increasing occurrence of MDRO infection in nursing homes (NHs) and introduction of MDROs into the hospital by NH residents. An estimated 60% of NH residents are colonized with MDROs, and colonization rates among those with advanced dementia are reportedly 3 times higher than those of other residents. Taken together, antimicrobial use in advanced dementia is concerning from the standpoint of both unnecessary individual patient treatment near the end of life and the public health threat of MDRO emergence.

Prior studies have examined potentially inappropriate antimicrobial use in the general NH population, while others have described MDRO colonization in this setting. However, these 2 concerns warrant examination in a single cohort so as to better understand the impact of antimicrobial use on MDRO colonization. Thus, we conducted the Study of Pathogen Resistance and Exposure to Antimicrobials in Dementia (SPREAD), a prospective study of NH residents with advanced dementia over 12 months. The study aims presented in this report are to (1) describe the occurrence and management of suspected infectious episodes, specifically whether antimicrobial treatment initiation was appropriate based on consensus guidelines, (2) identify factors associated with appropriate antimicrobial treatment, (3) describe the prevalence and acquisition of MDRO colonization, and (4) examine the association between antimicrobial exposure and acquisition. The hypotheses underlying these aims were as follows: (1) a high rate of antimicrobial use would be inappropriate, based on consensus guidelines; (2) modifiable factors (e.g., proxy-clinician communication, timeliness of physician examination) would be associated with a higher likelihood of appropriate antimicrobial use; and (3) after other resident-level characteristics are adjusted for, greater antimicrobial exposure would be associated with MDRO acquisition.

Methods

Data were obtained from SPREAD, the methodology of which is detailed elsewhere. Proxies provided written informed consent for both the NH residents’ and their own participation, and the Hebrew SeniorLife institutional review board approved the study’s conduct. From September 2009 through November 2012, residents with advanced dementia and their proxies were recruited from 35 Boston area NHs. Eligibility criteria included age 65 or older, dementia (any type, from the medical records), an available English-speaking proxy, and a nurse-measured Global Deterioration Scale (GDS) score of 7 (range, 1-7; higher scores indicate worse dementia). A GDS score of 7 is characterized by profound memory deficits (cannot recognize family members), severely curtailed verbal ability (command of <5 words), incontinence, and inability to walk.

Resident Variables

Resident data were collected for 12 months from 2 assessment types; full assessments (at baseline, quarterly thereafter, and within 14 days of death) and infection screens (monthly).

Baseline data abstracted from the medical records by the research team included demographics (age, sex, and race), cause of dementia (Alzheimer disease, multiple infarctions, and other), and common comorbidities (congestive heart failure, chronic obstructive lung disease, and diabetes). Baseline cognition was assessed directly by resident interview using the Test for Severe Impairment (TSI) (range, 0-24; lower scores indicate greater impairment). At baseline and quarterly thereafter, nurses were interviewed by the research team to quantify functional status (using the Bedford Alzheimer Nursing Severity-Subscale (BANS-S)) (range, 7-28; higher scores indicate greater disability) and pressure ulcers (stages 1-4). Other data abstracted from the medical records by the research team at each full assessment included advance directives, devices in use (feeding tubes, Foley catheters), hospitalizations, and hospice admission. Advance directives included “do not resuscitate” (DNR), “do not hospitalize” (DNH), “withhold intravenous antimicrobials,” and “withhold all antimicrobials (intravenous, intramuscular, and oral).”

At baseline and quarterly thereafter, research nurses collected rectal and nasal swabs to assess colonization with the following MDROs: methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococci (VRE), and multidrug-resistant gram-negative bacteria (MDRGNB). Specimens were couriered to a single microbiology laboratory where they were processed specifically for the purposes of this research study. To process specimens, swabs were plated onto selective media that allowed growth of only those MRDOs under investigation. Species identification and susceptibility testing were performed per Clinical and Laboratory Standards Institute methodology. The MDRGNB were defined as gram-negative bacilli resistant to 3 or more of the following: ampicillin-sulbactam or piperacillin-tazobactam combination drugs, ceftriaxone or ceftazidime, ciprofloxacin, gentamicin, and meropenem. Colonization was defined as recovery of an MDRO at either the rectum or nares.

Infection screens were performed at baseline, monthly, and within 14 days of death. Medical records were reviewed to determine if a possible infection occurred between screens, as indicated by any of the following: (1) suspected infection docu-
Antimicrobial exposure was calculated from baseline until the assessment date. This exposure variable, measured as DOT/1000 resident-days, was skewed (ie, 0 for a large portion of residents) and therefore examined in 2 formats: (1) any antimicrobials (≥1 day) and (2) log-transformed DOT/1000 resident-days + 1, allowing for residents with no exposure. Exposure was examined for all antimicrobials and classes prescribed for more than 10% of episodes, including quinolones, third- and fourth-generation cephalosporins, penicillins, and first-generation cephalosporins. Covariates selected based on the literature as potentially associated with MDRO acquisition included demographic data, BANS-S score, devices, pressure ulcer higher than stage 2, and 1 or more hospitalizations in the prior 90 days. Generalized estimating equations accounted for clustering at the facility level. Covariates associated with the outcome at P < .10 in bivariable analyses were entered into multivariable models. Hazard ratios (HRs) with 95% CIs were computed. Analyses were conducted using SAS software, version 9.3 (SAS Institute Inc).

Results

Resident Characteristics

There were 951 eligible NH residents with advanced dementia of whom 362 residents (38%) were recruited. Refusal by proxies (n = 587) and physicians (n = 2) were the reasons for nonparticipation. Nonparticipating and participating eligible NH residents did not differ by age, sex or race.

Baseline resident characteristics are detailed in Table 1. Briefly, their mean (SD) age was 86.5 (7.3) years; 85.1% were women; and 92.5% were white. Their mean (SD) BANS-S score was 21.2 (2.7), and 61.3% had TSI scores of 0, indicating severe functional and cognitive impairment, respectively. A total of 135 (37.3%) residents died, and 5 were lost to follow-up (3 relocated and 2 withdrawn). The mean (SD) follow-up time was 287.3 (118.7) days.

At baseline, 94.8% of proxies stated that the primary goal of care was comfort. Only 32.9% of proxies were counseled by clinicians that infections were common in advanced dementia; 37.8% were counseled about antimicrobial use; and 45.3% were asked their preferences regarding antimicrobial use.

Suspected Infections

A total of 66.3% of residents experienced at least 1 suspected infection (range, 0-9 episodes per resident) over 12 months (Table 2). There were a total of 496 episodes, distributed as follows: respiratory tract, n = 148 (29.8%); urinary tract, n = 196
(39.5%); skin, n = 69 (13.9%); and fever with unclear source, n = 83 (16.7%). Other episode characteristics included hospital transfer, 11.1%; physician or physician extender examination within 72 hours, 56.7%; and documented discussion between the proxy and clinician, 53.9%.

**Antimicrobial Use**

The proportions of suspected infections treated with antimicrobials were as follows: all episodes, 72.4% (n = 359 of 496); respiratory tract, 70.3% (n = 104 of 148); urinary tract, 75.5% (n = 148 of 196); skin, 95.8% (n = 66 of 69); and febrile only, 49.4% (n = 41 of 83). A total of 51.9% of residents had at least 1 antimicrobial course over 12 months. The median and mean (SD) DOT/1000 resident-days for all antimicrobials were 13.8 (interquartile range, 0.0-39.1) and 34.6 (67.9), respectively. The most common antimicrobial classes prescribed for the treated episodes (n = 359) were quinolones, 39.8%; third- or fourth-generation cephalosporins, 20.6%; penicillins, 17.6%; and first-generation cephalosporins, 14.2%. No other class was prescribed for more than 10% of episodes.

The proportions of treated episodes meeting minimum criteria for antimicrobial treatment initiation were all episodes, 44.0% (n = 158 of 359); respiratory tract, 33.7% (n = 35 of 104); urinary tract, 18.9% (n = 28 of 148); skin, 95.4% (n = 63 of 66); and febrile only, 78.0% (n = 32 of 41). Among the 201 treated episodes for which criteria were not met, the most common antimicrobials used were: quinolones, 42.8%; third- or fourth-generation cephalosporins, 19.4%; penicillins, 21.4%; and first-generation cephalosporins, 6.0%.

In bivariable analyses, factors associated with minimum criteria being present to initiate treatment with antimicrobials at P < .10 were as follows: higher BANS-S score, hospice, proxy counseled about antimicrobials, source was not the urinary tract, within 30 days of death, clinical examination within 72 hours, and not on a weekend. After multivariable adjustment, variables significantly associated with minimum criteria being present were proxy counseled about antimicrobials (adjusted OR [AOR], 1.42; 95% CI, 1.08-1.86) and source not the urinary tract (referent) (respiratory tract AOR, 2.33 [95% CI, 1.12-4.84]; febrile episode AOR, 14.92 [95% CI, 5.16-43.14]; and skin AOR, 102.92 [95% CI, 28.49-371.85]).

**Multidrug-Resistant Organisms**

We collected 1388 rectal specimens (mean [SD] per resident, 3.86 [1.46]) and 1359 nasal specimens (mean per resident, 3.78 [1.51]). Only 4.0% of scheduled swabs were missed because of resident absence or refusal (n = 113). Forty-two residents had swabs at baseline only (ie, no follow-up swabs) because they were study participants for less than 3 months: 38 died, 2 relocated, and 2 withdrew. Two residents refused baseline swabs. Among the remaining 360 residents, the proportion colonized at baseline were as follows: any MDRO, 45.6% (n = 164 of 360); MDRGNB, 36.9% (n = 133 of 360); MRSA, 12.8% (n = 46 of 360); and VRE, 0.3% (n = 1 of 360). The proportion of all residents (n = 362) colonized at some point over 12 months (baseline or follow-up) were as follows: any MDRO, 66.9% (n = 242 of 362); MDRGNB, 54.4% (n = 197 of 362); MRSA, 27.1% (n = 98 of 362); and VRE, 0.8% (n = 3 of 362).

### Table 1. Baseline Characteristics of Participant Nursing Home Residents With Advanced Dementia and Their Proxies

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Residents or Proxies (n = 362)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>86.5 (7.3)</td>
</tr>
<tr>
<td>Female</td>
<td>308 (85.1)</td>
</tr>
<tr>
<td>White</td>
<td>335 (92.5)</td>
</tr>
<tr>
<td>Cause of dementiaa</td>
<td></td>
</tr>
<tr>
<td>Alzheimer disease</td>
<td>269 (74.3)</td>
</tr>
<tr>
<td>Vascular failure</td>
<td>45 (12.4)</td>
</tr>
<tr>
<td>Other</td>
<td>66 (18.2)</td>
</tr>
<tr>
<td>Comorbid conditions</td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>63 (17.4)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>42 (11.6)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>67 (18.5)</td>
</tr>
<tr>
<td>BANS-S score, mean (SD)b</td>
<td>212 (2.7)</td>
</tr>
<tr>
<td>TSI = 0d</td>
<td>222 (61.3)</td>
</tr>
<tr>
<td>Hospice recipient</td>
<td>31 (8.6)</td>
</tr>
<tr>
<td>Advance directives</td>
<td></td>
</tr>
<tr>
<td>Do not resuscitate</td>
<td>319 (88.1)</td>
</tr>
<tr>
<td>Do not hospitalize</td>
<td>161 (44.5)</td>
</tr>
<tr>
<td>No intravenous antimicrobials (can get oral or intramuscular)</td>
<td>61 (16.9)</td>
</tr>
<tr>
<td>No oral, intramuscular, or intravenous antimicrobials</td>
<td>27 (7.5)</td>
</tr>
<tr>
<td>Proxy</td>
<td></td>
</tr>
<tr>
<td>Primary goal of care comfort</td>
<td>343 (94.8)</td>
</tr>
<tr>
<td>Counseled by clinician that infections are common in advanced dementia</td>
<td>119 (32.9)</td>
</tr>
<tr>
<td>Counseled by a clinician about antimicrobial use</td>
<td>137 (37.8)</td>
</tr>
<tr>
<td>Asked by clinician about preferences for antimicrobials use</td>
<td>164 (45.3)</td>
</tr>
</tbody>
</table>

Abbreviations: BANS-S, Bedford Alzheimer Nursing Severity-Subscale; TSI, Test for Severe Impairment.

a Unless otherwise indicated, data are reported as number (percentage) of residents or proxies.

b Total exceeds 100% because some residents had more than 1 type of dementia.

c Possible BANS-S score range, 0 to 24, lower scores indicating greater cognitive impairment.

d Possible TSI score range, 0 to 24, lower scores indicating greater cognitive impairment (dichotomized to equal to 0 vs >0).

Twelve-month cumulative incidence rates of MDRO acquisition were calculated only among residents who met both of the following conditions: (1) no MDRO at baseline and (2) at least 1 follow-up swab. These stipulations resulted in the following numbers of residents available for the acquisition analyses: any MDRO, n = 176; MDRGNB, n = 200; and MRSA, n = 278. Among these residents, the cumulative incidence rates were any MDRO, 47.9%; MDRGNB, 35.8%; and MRSA, 21.3% (Figure). Only 2 residents acquired VRE.

In unadjusted analyses, greater quinolone and third- and fourth-generation cephalosporin use, measured both as greater than 1 day of treatment and higher log DOT/1000-residents days, were significantly associated with MDRO acquisition (Table 3). All antimicrobials considered together, first-generation cephalosporins, and penicillins were not significantly associated with acquisition. Among the covariates, only Foley catheters (HR, 2.20; 95% CI, 0.96-5.05) and hospitalization in the prior 90 days

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were prescribed for the majority of episodes; but only 44% of treated episodes met minimum clinical criteria for antimicrobial treatment initiation. These criteria were more likely to be met if the suspected source was not the urinary tract and proxies were counseled about antimicrobials. Colonization by MDROs was extensive. Over 12 months, 67% of residents were colonized, and the cumulative incidence rate of MDRO acquisition among residents not colonized at baseline was 48%. Quinolones and third- and fourth-generation cephalosporins were the most commonly used antimicrobial classes, and greater exposure to these agents was significantly associated with MDRO acquisition.

**Discussion**

In this prospective study of NH residents with advanced dementia, suspected infections were common; antimicrobials were prescribed for the majority of episodes; but only 44% of treated episodes met minimum clinical criteria for antimicrobial treatment initiation. These criteria were more likely to be met if the suspected source was not the urinary tract and proxies were counseled about antimicrobials. Colonization by MDROs was extensive. Over 12 months, 67% of residents were colonized, and the cumulative incidence rate of MDRO acquisition among residents not colonized at baseline was 48%. Quinolones and third- and fourth-generation cephalosporins were the most commonly used antimicrobial classes, and greater exposure to these agents was significantly associated with MDRO acquisition.

This study confirms that antimicrobials are extensively prescribed in advanced dementia, but further demonstrates that much of this use may be unwarranted. The proportion of treated infections meeting minimum clinical criteria for antimicrobial treatment initiation was lower in our cohort than in
the general NH population, particularly for respiratory and urinary tract infections.14,15 Inadequate documentation or assessment by clinicians, as well as their unfamiliarity with the criteria, may have contributed to our findings. However, the challenges associated with decisions to initiate antimicrobial therapy in the NH setting are compounded in advanced dementia. Confirmatory laboratory and radiographic investigations are often not readily available. Clinicians may be particularly reluctant to order uncomfortable or inconvenient tests in NH residents with advanced dementia. Thus, treatment decisions are often made empirically based on clinical presentation. However, patients with severe dementia are severely cognitively impaired, effectively mute, and cannot reliably express symptoms. Not surprisingly, treatment criteria were met for 95% of skin infections, which can be assessed primarily by observable signs, compared with 19% of urinary tract infections, assessment of which is more reliant on subjective complaints. While asymptomatic bacteruria is the most common reason for potentially inappropriate antimicrobial use in NHs,14,15,37,38 exactly what constitutes “symptomatic” in advanced dementia, and hence the application of the minimum criteria for treatment of urinary tract infections in these patients, is not straightforward. Diagnosing urinary tract infections in advanced dementia is further confounded by the fact that urinalyses and urine cultures are frequently positive, regardless of whether clinical criteria for antimicrobial initiation are present.34

Patients with advanced dementia are usually nearing the end of life, and infections characterize the final stage of their disease.2,39 Clinicians making care decisions must consider not only clinical criteria for starting treatment with antimicrobials but also whether such treatment aligns with the goals of care. Over 50% of our study residents received antimicrobials, yet comfort was the stated primary goal of care for 95% of them.2 For these residents, the burdens associated with assessing and treating infections may outweigh the benefits, particularly when the likelihood of a bacterial infection is low. While the extent to which NH residents with advanced dementia suffer from infections is difficult to assess, antimicrobials may not provide greater symptomatic relief than high-quality palliative care. The workup and treatment of infections can be uncomfortable, particularly when parenteral therapy or hospitalization is involved.40 Even oral antimicrobials may contribute to distress, as these patients commonly have swallowing problems.3 Older persons are also particularly susceptible to adverse effects of antimicrobials,41 including Clostridium difficile.

Table 3. Association Between Characteristics of Residents and Time to First Acquisition of Any MDRO*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Residents (n = 176)</th>
<th>HR (95% CI)</th>
<th>Unadjusted</th>
<th>Adjustedb</th>
</tr>
</thead>
<tbody>
<tr>
<td>All antimicrobial agents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any use, No. (%)c</td>
<td>65 (36.9)</td>
<td>1.20 (0.80-1.80)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Days of therapy/1000 resident-days, mean (SD), log</td>
<td>1.4 (1.9)</td>
<td>1.06 (0.95-1.18)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Quinolones</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any use, No. (%)c</td>
<td>32 (18.2)</td>
<td>2.00 (1.40-2.86)c</td>
<td>1.89 (1.28-2.81)</td>
<td></td>
</tr>
<tr>
<td>Days of therapy/1000 resident-days, mean (SD), log</td>
<td>0.6 (1.3)</td>
<td>1.20 (1.08-1.33)c</td>
<td>1.18 (1.06-1.32)</td>
<td></td>
</tr>
<tr>
<td>Third- or fourth-generation cephalosporins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any use</td>
<td>12 (6.8)</td>
<td>1.73 (1.10-2.70)c</td>
<td>1.57 (1.03-2.40)</td>
<td></td>
</tr>
<tr>
<td>Days of therapy/1000 resident-days, mean (SD), log</td>
<td>0.2 (0.8)</td>
<td>1.18 (1.01-1.38)c</td>
<td>1.16 (1.00-1.35)</td>
<td></td>
</tr>
<tr>
<td>Penicillins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any use, No. (%)c</td>
<td>14 (8.0)</td>
<td>2.05 (0.67-6.33)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Days of therapy/1000 resident-days, mean (SD), log</td>
<td>0.3 (1.0)</td>
<td>1.21 (0.90-1.61)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>First-generation cephalosporins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any use, No. (%)c</td>
<td>13 (7.4)</td>
<td>1.83 (0.68-4.93)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Days of therapy/1000 resident-days, mean (SD), log</td>
<td>0.3 (0.9)</td>
<td>1.20 (0.91-1.56)</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: HR, hazard ratio; MDRO, multidrug-resistant organism.

*c Including methicillin-resistant Staphylococcus aureus, vancomycin-resistant enterococci, and multidrug-resistant gram-negative bacteria.

*b Both the unadjusted and adjusted HRs account for clustering at the facility level in the generalized estimating equations. The adjusted HRs are also adjusted for whether the resident had a Foley catheter (n = 8 of 176 [4.6%]) and a hospitalization in the prior 90 days (n = 10 of 176 [5.7%]).

*d These exposure variables were significant at P < .05 in unadjusted analyses and entered into a multivariable model.
tridium difficile infections. For the minority of NH residents for whom life prolongation remains a goal, it is unclear if antimicrobial treatment prolongs survival. Treatment of asymptomatic bacteruria does not extend life. In an observational study, NH residents with advanced dementia who received antimicrobials for pneumonia lived longer, but also had more discomfort, than those untreated. While only 38% of proxies were counseled about antimicrobial use, when they were, the minimum criteria for use were more likely to be met, suggesting that clinicians who deliberate these risks and benefits with proxies also may be more judicious in prescribing antimicrobials. Qualitative studies, involving both proxies and clinicians, may be a useful next step to further our understanding about how goals of care are integrated into these decisions.

Our analyses highlight potentially inappropriate antimicrobial treatment prolongs survival. and highercarecosts. Unmeasuredconsequences of MDROs in NHs include the effect of isolation practices on the residents’ quality of life and the organizational impact of infection control policies on the facility. Our analyses highlight potentially inappropriate antimicrobial use in advanced dementia, particularly of quinolones and third- and fourth-generation cephalosporins, as an opportunity to reduce MDRO colonization in this setting.

This study has limitations that warrant comment. Its generalizability is uncertain; however, facility and resident characteristics were similar to those nationwide. The SPREAD study was not designed to examine facility effects on outcomes, although our analyses accounted for clustering at the facility level. As in other studies involving swabs from NH residents, our recruitment rate was 38%. Demographic characteristics of nonparticipants were similar to those of participants, and their exclusion is unlikely to have significantly biased our main findings. Minimum criteria for antimicrobial treatment initiation are based on consensus guidelines and do not reflect the nuances of individual treatment decisions. Finally, inadequate power may account for the lack of significant associations between other individual antimicrobial classes with MDRO acquisition.

Conclusions

While treatment decisions regarding infections in advanced dementia are challenging, our study suggests an approach that may improve the quality of these decisions. First, as part of advance care planning, families of patients with dementia should be counseled to expect infections in the end stage of the disease. The risks and benefits involved in assessing and treating infections should be reviewed and aligned with the goals of care. If the decision is to forego antimicrobials, suspected infections should not be worked up, and symptoms should be treated solely with palliative measures. If the use of antimicrobials remains consistent with preferences, treatment initiation should be guided by consensus criteria. A more judicious approach to infection management in advanced dementia may avoid unnecessary treatment burden in these terminally ill patients and reduce the of rapidly growing public health threat of MDRO emergence.

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