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Nursing Home Infection Control Program Characteristics, CMS Citations, and Implementation of Antibiotic Stewardship Policies: A National Study

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Abstract

Recently, the Centers for Medicare & Medicaid Services (CMS) final rule required that nursing homes (NHs) develop an infection control program that includes an antibiotic stewardship component and employs a trained infection preventionist (IP). The objectives of this study were to provide a baseline assessment of (1) NH facility and infection control program characteristics associated with having an infection control deficiency citation and (2) associations between IP training and the presence of antibiotic stewardship policies, controlling for NH characteristics. A cross-sectional survey of 2514 randomly sampled US NHs was conducted to assess IP training, staff turnover, and infection control program characteristics (ie, frequency of infection control committee meetings and the presence of 7 antibiotic stewardship policies). Responses were linked to concurrent Certification and Survey Provider Enhanced Reporting data, which contain information about NH facility characteristics and citations. Descriptive statistics and multivariable regression analyses were conducted to account for NH characteristics. Surveys were received from 990 NHs; 922 had complete data. One-third of NHs in this sample received an infection control deficiency citation. The NHs that received deficiency citations were more likely to have committees that met weekly/monthly versus quarterly ($P < .01$). The IPs in 39% of facilities had received specialized training. Less than 3% of trained IPs were certified in infection control. The NHs with trained IPs were more likely to have 5 of the 7 components of antibiotic stewardship in place (all $P < .05$). The IP training, although infrequent, was associated with the presence of antibiotic stewardship policies. Receiving an infection control citation was associated with more frequent infection control committee meetings. Training and support of IPs is needed to ensure infection control and antibiotic stewardship in NHs. As the CMS rule becomes implemented, more research is warranted. There is a need for increase in trained IPs in US NHs. These data can be used to evaluate the effectiveness of the CMS final rule on infection management processes in US NHs.

Keywords

antibiotic stewardship, nursing homes, infection prevention, infection control, quality improvement

What do we already know about this topic?
Infection control management in nursing homes have been suboptimal with antibiotics being overutilized and 40% of nursing homes receiving deficiency citations each year; therefore the Centers for Medicare & Medicaid Services (CMS) 2016 final rule requires substantial changes.

How does your research contribute to the field?
This study provides a baseline national assessment of infection control management in nursing homes.

What are your research's implications toward theory, practice, or policy?
These data can be used to evaluate the effectiveness of the CMS final rule on infection management processes in US nursing homes.

Introduction

Across the nation, there are more than 1 million elderly persons living in approximately 15 700 nursing homes (NHs) on any given day.[1] These residents are particularly susceptible to infections due to compromised physiologic barriers (eg, skin breakdown and use of devices such as catheters), immunosuppression, malnutrition, dehydration, comorbidities, and/or functional impairments (eg, incontinence and/or

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immobility).[2] The estimated prevalence of infections in NH residents ranges anywhere from 1.4 to 5.2 per 1000 resident care days, which translates to 765 000 to 2.8 million infections annually.[3,4] In addition, many of these infections are caused by multidrug-resistant organisms.[5,6]

Effectively preventing, diagnosing, and managing infections in NHs is difficult for multiple reasons. First, by design, the NH environment is social with shared dining and recreational spaces, which, while desirable to promote quality of life, increases transmission risk.[7] Second, elderly persons may not exhibit the same symptomology as younger adults and communication of symptoms may be difficult for those with cognitive decline.[2] Third, historically, NH infection prevention and control programs are inadequately staffed, have less personnel than hospitals, staff turnover is high, and those in charge of the infection control programs have multiple responsibilities.[8,9] Furthermore, physicians, nurse practitioners, or other advanced practice clinicians may not be available at all times to help with infection management decisions.

With these challenges, it is not surprising that infection prevention and control and management are suboptimal. It has been reported that up to 40% of Centers for Medicare and Medicaid Services (CMS)–certified NHs receive deficiency citations for inadequate infection control each year.[8,10,11] Furthermore, antibiotics are overused in NHs and account for approximately 40% of all medications administered.[12] Between 47% and 79% of NH residents receive antibiotics at least once per year.[13] A recent 1-day point prevalence survey of 9 NHs in 4 states found antibiotics used in 11% of residents and that key prescribing information was not documented for 38% of antibiotics prescribed.[14]

For these reasons, improving infection prevention and control and management, including antibiotic stewardship, in NHs have become national priorities. In 2016, the CMS final rule required that NHs develop an infection control program that includes antibiotic stewardship and employ a trained infection preventionist (IP) whose main responsibility is the infection control program.[15] The Centers for Disease Control and Prevention (CDC) lists 7 core elements of antibiotic stewardship for hospitals and NHs: leadership commitment, pharmacy expertise, action, education, accountability, tracking and reporting of data, and education.[16,17]

Although having an IP with advanced training has been found to improve outcomes in acute care, the impact in the NH setting is not known.[18] Therefore, with this knowledge gap and the new CMS regulations, the objectives of this study were to provide a baseline assessment of (1) NH facility and infection control program characteristics associated with having an infection control deficiency citation and (2) associations between IP training and the presence of antibiotic stewardship policies, controlling for NH characteristics.

Methods

Sample

A survey of randomly sampled US NHs was conducted between December 2013 and December 2014 to describe NH infection control programs. The person in charge of the infection control program was invited to complete the survey. A detailed description of the survey has been published elsewhere.[8] There were 2514 NHs invited to participate and 990 usable surveys were returned. The NHs with complete data were analyzed and characteristics of responding NHs were compared with nonresponders.[8]

Variables

Respondents were asked whether he or she had any specific training and/or certification in infection control; other infection program characteristics assessed included frequency of infection control committee meetings (weekly/monthly, quarterly, and annually/not regularly) and involvement in an infection control collaborative. Turnover of the IP, director of nursing, and facility administrator in the past 3 years was also assessed. The antibiotic stewardship items included were yes/no questions that asked about the presence of the following policies: written guidelines for antibiotic use, collection of antibiotic utilization data, use of antibiotic prescribing guideline/order form, restriction of specific antibiotics, provision of feedback to clinicians on antibiotic prescribing, use of therapeutic formularies, and review of cases to assess antibiotic appropriateness.

Survey responses were linked with concurrent (2013) Certification and Survey Provider Enhanced Reporting (CASPER) data, which contain facility-level characteristics. These included number of beds, percent occupancy, ownership status (for profit, government, nonprofit), setting (metropolitan, large urban center, small urban center, rural), US census region (Northeast, Midwest, South, West), and deficiency citations.

Analysis

Descriptive statistics (ie, means, standard deviations, and percentages) were computed. Wilcoxon rank sums, chi-square, and Fishers exact tests were conducted to examine bivariate associations between (1) facility and infection control program characteristics and infection control citations and (2) IP training and the presence of antibiotic stewardship policies. Multivariable binomial regression analyses with robust standard errors were conducted to account for facility and infection control program characteristics associated with (1) infection control citations and (2) presence of antibiotic stewardship policies. Prevalence ratios (PR) and 95% confidence intervals (CI) were computed.

Table 1. Descriptive Statistics and Bivariate Associations Between Nursing Home Characteristics and Infection Control Deficiency Citations.

	Total N = 922	IC citation n = 320	No IC citation n = 602	*P* value
Facility characteristic				
Total beds (mean, SD)	119 (68)	116 (54)	120 (74)	.45
Percent occupancy (mean, SD)	0.82 (0.15)	0.80 (0.15)	0.83 (0.16)	.06
Ownership				
For profit	646 (70.1)	244 (76.3)	402 (66.8)	<.01
Government	47 (5.1)	20 (6.3)	27 (4.5)	
Nonprofit	229 (24.8)	56 (17.5)	173 (28.7)	
Census region				
Midwest	325 (35.2)	127 (39.7)	198 (32.9)	<.01
Northeast	201 (21.8)	39 (12.2)	162 (26.9)	
South	272 (29.5)	105 (32.8)	167 (27.7)	
West	124 (13.5)	49 (15.3)	75 (12.5)	
Setting				
Metro	668 (72.4)	224 (70.0)	444 (73.8)	.20
Large urban	81 (8.8)	28 (8.8)	53 (8.8)	
Small urban	142 (15.4)	53 (16.6)	89 (14.8)	
Rural	31 (3.4)	15 (4.7)	16 (2.7)	
Owned by multifacility organization	506 (54.9)	171 (53.4)	335 (55.7)	.52
Infection control program characteristic				
IP received training in infection control	359 (38.9)	115 (35.9)	244 (40.5)	.17
IP certified in infection control	25 (2.7)	7 (0.8)	18 (1.9)	.48
Frequency of infection control committee meetings				
Biweekly/weekly/monthly	556 (61.2)	215 (67.8)	341 (57.6)	<.01
Quarterly	245 (27.0)	65 (20.5)	180 (30.4)	
Annually/not regularly/other	108 (11.8)	37 (11.7)	71 (12.0)	
Involved in an infection prevention collaborative	292 (32.2)	104 (33.3)	188 (31.5)	.58
Implemented electronic health records	445 (49.4)	158 (50.3)	287 (48.9)	0.68
Three or more IPs in the previous 3 years	349 (40.7)	132 (45.4)	217 (38.3)	0.05
Three or more DONs in the previous 3 years	348 (41.7)	121 (43.5)	227 (40.8)	0.44
Three or more administrators in the previous 3 years	317 (37.9)	113 (40.2)	204 (36.7)	0.32

Note. Data presented as n (%) unless otherwise noted. IC = infection control; IP = infection preventionist; DON = director of nursing.

Results

Completed surveys were obtained from 990 NHs (39% response rate) and 922 of these NHs had complete survey and CASPER data. There were no differences between responders and nonresponders in bed size, occupancy, setting, or being part of a multifacility organization (see previously published data).[8] However, NHs that responded were more likely to be nonprofit, located in the Northeast, and have fewer infection control or quality of care citations.[8] Approximately one-third (n = 320) of the NHs had received an infection control deficiency citation.

Table 1 presents the descriptive characteristics and bivariate associations of the NH facility and infection control program by infection control citation status. The majority of NHs were for profit (70%) and located in a metropolitan area (72%); half were owned by multifacility organizations (55%). The average bed size of the responding NHs was 119 (SD: ±68) and the mean percent occupancy was 82% (SD: ±15%). Facilities receiving an infection control citation were more likely to be for profit ($P < .01$) and located in the South or Midwest census regions ($P < .01$). No association was found between receiving an infection control citation and bed size, occupancy, metropolitan setting, or being part of a multifacility organization.

Less than 40% of respondents reported specific training in infection control and less than 3% were certified in infection control (Table 1). The majority (61%) of NHs held frequent infection control committee meetings and approximately one-third were involved in an infection prevention collaborative. Turnover of the IP, director of nursing, and facility administrators was high with 41%, 42%, and 38% of NHs reporting more than 3 persons in each role over the last 3 years, respectively. Higher frequency of infection control committee meetings ($P = .004$) and greater IP turnover ($P = .045$) were associated with receiving an infection control

Table 2. Multivariate Analyses Assessing Infection Control Program Characteristics and Infection Control Deficiency Citations, Controlling for NH Characteristics.

Policy/program	PR	95% CIs	*P* value
IP received training in infection control	0.92	0.76-1.10	.36
IP certified in infection control	0.96	0.52-1.78	.89
Frequency of infection control committee meetings			
Biweekly/weekly/monthly	1.39	1.11-1.76	.005
Quarterly	Ref		
Annually/not regularly/other	1.28	0.93-1.78	.13
Involved in an infection prevention collaborative	1.10	0.92-1.32	.31
Implemented electronic health records	1.00	0.84-1.20	.96
Two or more IPs in the previous 3 years	1.16	0.97-1.40	.10
Two or more DONs in the previous 3 years	1.07	0.88-1.29	.51
Two or more administrators in the previous 3 years	1.13	0.93-1.36	.19

Note. NH = nursing homes; PR = prevalence ratios; CI = confidence intervals; IP = infection preventionist; DON = director of nursing. Analyses controlled for NH occupancy, ownership, and census region.

Table 3. Descriptive Statistics and Bivariate Associations Between Training in Infection Control and Having Recommended Antibiotic Stewardship Policies.

Policy/program	Total, N = 922 (%)	Specific training, n = 359 (%)	No specific training, n = 563 (%)	*P* value
Written guidelines in place for antibiotic use	422 (46.5)	161 (45.5)	261 (47.1)	.63
Collection of data on antibiotic utilization	467 (51.4)	197 (55.7)	270 (48.7)	.04
Antibiotic prescribing guideline/order form	152 (16.7)	70 (19.8)	82 (14.8)	.05
Policies to restrict the use of specific antibiotics	65 (7.2)	44 (12.4)	21 (3.8)	<.01
Providing feedback to clinicians on antibiotic prescribing	301 (33.2)	136 (38.4)	165 (29.8)	.01
Use of therapeutic formularies	153 (16.9)	73 (20.6)	80 (14.4)	.02
Review of cases to assess antibiotic appropriateness	395 (43.5)	179 (50.6)	216 (39.0)	<.01
None of the above policies/programs on antibiotic use	105 (11.6)	31 (8.8)	74 (13.4)	.03

citation. In multivariate analyses, only NHs that met biweekly, weekly, or monthly were more likely to have an infection control citation (PR: 1.38, 95% CI: 1.11-1.76, $P = .005$) than those who met quarterly, after controlling for occupancy, ownership status, and region (Table 2).

Table 3 presents the descriptive statistics and bivariate associations between the presence of recommended antibiotic stewardship policies and infection control training of the IP. The most frequently reported policies were collection of data on antibiotic utilization (51%), written guidelines in place for antibiotic use (47%), and review of cases to assess antibiotic appropriateness (44%). The NHs with a trained IP were more likely to have 5 of the 7 antibiotic stewardship policies (all $P < .05$). The presence of a trained IP was not associated with having written guidelines in place for antibiotic use or the use of an antibiotic prescribing guideline/order form. These results were robust in the multivariable analyses, which controlled for NH occupancy, ownership, and region (Table 4). Indeed, NHs with trained IPs were more than 3 times as likely to have a policy to restrict the use of specific antibiotics (PR: 3.29, 95% CI: 1.99-5.44) after controlling for facility characteristics.

Discussion

This study provides a baseline national assessment prior to the 2016 CMS federal rule of associations between NH facility and infection control program characteristics with infection control deficiency citations as well as associations between having a trained IP and the presence of recommended antibiotic stewardship policies. Although several statewide surveys have been conducted on the use of antibiotic stewardship policies in NHs, to our knowledge, this is the first study to assess these policies on a national level and the first to assess associations between a NH having a trained IP and the presence of these policies.[19,20]

We found the most frequently reported recommended antibiotic policies were having guidelines in place for antibiotic use and collection of data on antibiotic utilization. This is similar to previous state-specific studies in which the researchers found that the most frequently reported policies were those that were less resource intensive such as the use of antibiograms and tracking of antibiotic use; policies involving an antibiotic approval process or feedback to clinicians were less frequently reported.[19,20] This is not surprising, as implementation of these types of policies may require

Table 4. Multivariate Analyses Assessing Infection Control Training and Antibiotic Stewardship Policies Controlling for NH Characteristics.

Policy/program	PR	95% CIs	*P* value
Written guidelines in place for antibiotic use	0.99	0.86-1.15	.95
Collection of data on antibiotic utilization	1.14	1.00-1.30	.04
Antibiotic prescribing guideline/order form	1.33	0.99-1.78	.05
Policies to restrict the use of specific antibiotics	3.29	1.99-5.44	<.01
Providing feedback to clinicians on antibiotic prescribing	1.31	1.09-1.57	<.01
Use of therapeutic formularies	1.36	1.02-1.80	.04
Review of cases to assess antibiotic appropriateness	1.29	1.11-1.50	<.01
None of the above policies/programs on antibiotic use	0.62	0.42-0.94	.02

Note. NH = nursing homes; PR = prevalence ratios; CI = confidence interval. Analyses controlled for NH occupancy, ownership, and census region.

additional resources, such as pharmacy and infectious disease consultation, which are limited in the NH setting.[19,21] Indeed, hospital guidelines for antibiotic stewardship programs recommend that the program be co-led by an infectious disease physician and a clinical pharmacist trained in infectious disease.[21]

In NHs, the IP, director of nursing, and/or nursing staff may have more responsibility for implementing antibiotic stewardship programs than staff with similar roles in hospitals due to the limited availability of other clinical experts. However, lack of knowledge by NH nurses on antibiotic stewardship concepts has been found to be an important obstacle to implementation.[22] To improve antibiotic stewardship in NHs, it has been recommended that (1) a multidisciplinary team be assembled that includes at a minimum the medical director, the director of nursing, and an IP; (2) there are clear policies and guidelines; and (3) processes and outcomes are measured.[23] Given the lack of readily accessible, on-site pharmacy and infectious disease support in NHs and need for education of NH nursing staff, an infectious disease consultation service is one proposed solution to these staffing limitations.[24] Expanded access to these types of resources would allow the NH to implement a wider array of antibiotic stewardship policies such as providing clinician feedback and antibiotic restriction.

Overall, employment of trained IPs was lacking. This is similar to a study conducted by Trautner and colleagues where the researchers found that only in half of the participating NHs, the main point of contact for infection prevention had specific infection control training.[25] Lack of training was concerning given the finding that NHs that employed trained IPs were more likely to have antibiotic stewardship policies in place. These results reinforce the urgent need to educate all NH staff, which is one of the core elements of antibiotic stewardship in NHs recommended by the CDC.[17] Professional education for NH IPs is increasingly available. For example, the Association for Professionals in Infection Control and Epidemiology (APIC) recently launched a 2-day certificate course for IPs employed in long-term care and the Agency for Healthcare Research and Quality developed a NH antimicrobial stewardship toolkit.[16,26] Previous researchers have found that training nurses improves their knowledge regarding the care of NH residents with infections and empowers them to be antimicrobial stewards.[27] For change to occur in NHs and antibiotic stewardship programs be successful, "champions" are needed to educate the staff, prescribers, residents, and family.[28] With the new CMS regulations expanding the role of the IP in NHs, it is very likely trained IPs will serve as the champion.

There is a large body of evidence demonstrating associations between high nurse turnover and poor quality of care in hospitals.[29,30] There is also evidence that high nurse turnover rates impact NH quality.[31] The bivariate association of IP training and infection control citation is similar to what has been previously reported;[8] however, in the previous published report, no multivariate analyses were conducted. Furthermore, these results were not found in the multivariate analyses. With the expanded role and increased IP staffing in NHs, future researchers should examine IP workforce stability and outcomes.

In the multivariate analyses, more frequent infection control meetings were independently positively associated with infection control deficiency citations. With the data available, we cannot assess cause and effect; however, it is probable that more frequent meetings were a result of the deficiency citations and an attempt by the NH to improve their infection control program (ie, reverse causality). In previous analyses, we have found that NHs in states with Department of Health infection control training programs or infection reporting regulations specific to NHs were less likely to receive infection control citations.[32] Certainly, NH personnel need support, guidance, and training to establish effective infection control programs that protect residents from the risk of infection transmission, and more frequent infection control meetings may help provide this support. In a previous published report we conducted using the same survey data with different analysis methods and 2015 infection citation data found on NH compare (ie, not data directly from CASPER), we did not find a significant association between frequency of meetings and citations.[8] We chose to use the citation 2013 CASPER

infection citation data in this analysis because we believe it was more concurrent with the survey data. Nevertheless, these results should be interpreted with caution.

This study had limitations. Our survey had a moderate response rate, which may affect generalizability of study results. However, there were no notable differences between respondents and nonrespondents. Although data from the survey were linked to concurrent CASPER files and reflect NHs across the nation, the analysis is cross-sectional and therefore limited to identifying associations only. In addition, there may be omitted confounders that are affecting the presence of some antibiotic stewardship policies (eg, having written antibiotic guidelines and providing feedback to clinicians on antibiotic prescribing could be related to the presence of an on-site medical director, more engaged leadership or other unmeasured NH characteristics). We could not examine the staffing involved in an antibiotic stewardship program, the frequency of implementing the antibiotic stewardship policies, nor all CDC-recommended antibiotic stewardship components. We recommend future researchers examine these issues. Nevertheless, the results provide a national baseline prior to the new CMS ruling. These findings will be useful in evaluating the impact of the CMS ruling in future studies. We recommend that NHs provide resources for their IPs to obtain training. As the CMS rule becomes implemented in 2017, we also recommend that future researchers examine the impact of NH workforce stability and IP training on antibiotic stewardship and ultimately resident outcomes.

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