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Infection Prevention and Antimicrobial Stewardship Knowledge for Selected Infections Among Nursing Home Personnel

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Abstract

OBJECTIVE—To assess knowledge about infection prevention among nursing home personnel and identify gaps potentially addressable through a quality improvement collaborative.

DESIGN—Baseline knowledge assessment of catheter-associated urinary tract infection, asymptomatic bacteriuria, antimicrobial stewardship, and general infection prevention practices for healthcare-associated infections.

SETTING—Nursing homes across 14 states participating in the national “Agency for Healthcare Research and Quality Safety Program for Long-Term Care: Healthcare-Associated Infections/ Catheter-Associated Urinary Tract Infection.”

PARTICIPANTS—Licensed (RNs, LPNs, APRNs, MDs) and unlicensed (clinical nursing assistants) healthcare personnel.

METHODS—Each facility aimed to obtain responses from at least 10 employees (5 licensed and 5 unlicensed). We assessed the percentage of correct responses.

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SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit <http://dx.doi.org/doi:10.1017/ice.2016.228>

RESULTS—A total of 184 (78%) of 236 participating facilities provided 1 response or more. Of the 1,626 respondents, 822 (50.6%) were licensed; 117 facilities (63.6%) were for-profit. While 99.1% of licensed personnel recognized the definition of asymptomatic bacteriuria, only 36.1% knew that pyuria could not distinguish a urinary tract infection from asymptomatic bacteriuria. Among unlicensed personnel, 99.6% knew to notify a nurse if a resident developed fever or confusion, but only 27.7% knew that cloudy, smelly urine should not routinely be cultured. Although 100% of respondents reported receiving training in hand hygiene, less than 30% knew how long to rub hands (28.5% licensed, 25.2% unlicensed) or the most effective agent to use (11.7% licensed, 10.6% unlicensed).

CONCLUSIONS—This national assessment demonstrates an important need to enhance infection prevention knowledge among healthcare personnel working in nursing homes to improve resident safety and quality of care.

As of 2012, nearly 1.4 million people in the United States were living in 15,700 nursing homes.¹ The burden of infection in nursing homes is high, with an estimated 1.6–3.8 million infections occurring in nursing home residents in the United States per year.^{2,3} A cross-sectional survey in US nursing homes found that 12% of nursing home residents had an infection, most commonly a urinary tract infection, pneumonia, or cellulitis.^{4,5} Asymptomatic bacteriuria (ASB) is pervasive, and treatment of ASB is a leading cause of unnecessary antibiotic use.⁶ Thus, preventing and controlling the spread of infections in nursing homes is an important public health issue.

The high priority placed on infection prevention and optimizing antimicrobial use in nursing homes is reflected in recent policy updates. The Centers for Medicare and Medicaid Services proposed several major reforms as conditions of participation for nursing homes, one of which is that each facility must include an antimicrobial stewardship component in the mandatory infection prevention and control program.⁷

To inform the design of a program to improve infection prevention in nursing homes, we assessed healthcare personnel knowledge of catheter-associated urinary tract infection (CAUTI), ASB, antimicrobial stewardship, and selected infection prevention topics. Because we were particularly interested in understanding differences in knowledge between licensed and unlicensed personnel,⁸ one assessment for licensed personnel and another for unlicensed personnel were administered to the first 2 cohorts of nursing home facilities that joined the Agency for Healthcare Research and Quality (AHRQ) Safety Program for Long-Term Care: Healthcare-Associated Infections/CAUTI.⁹ The key objective was to help facilities identify knowledge gaps to inform educational needs of frontline healthcare personnel within the collaborative.

METHODS

Program Overview

The “AHRQ Safety Program in Long-Term Care: Healthcare-Associated Infections/CAUTI” was designed to engage more than 500 nursing homes in all 50 states in CAUTI prevention, through 5 different cohorts. The program provided professional development for frontline personnel (nurses and clinical nursing assistants) regarding technical interventions (eg,

catheter care and maintenance), and socio-adaptive interventions (eg, team building) aimed at preventing CAUTI. To determine the educational needs of the nursing home personnel participating in this program, a knowledge assessment was administered at the start of each cohort. Facility demographic characteristics were also provided by the program lead at each nursing home. We report here the knowledge assessment results from cohorts 1 and 2. The institutional review board of the University of Michigan determined the study was not regulated as human subjects research. The Health Research & Educational Trust likewise received exempt status for this project.

Knowledge Assessment Development

The infection prevention knowledge assessment was developed with input from physicians, infection preventionists, nurses, patient safety and quality advisors, and a representative from the Centers for Disease Control and Prevention. Several questions were based on a published survey of infection prevention practices in nursing homes.^{10,11} In general, the instrument was designed to assess knowledge in the following domains: team building, CAUTI definitions, CAUTI infection surveillance and reporting, safety culture, hand hygiene, standard precautions, and antimicrobial stewardship. These domains were aligned with the collaborative onboarding webinars and training modules. Two versions of the knowledge assessment were developed, tailoring questions for licensed and unlicensed personnel (Online Supplemental Material). Licensed personnel included physicians (MD), registered nurses (RN), advanced practice registered nurses (APRN), and licensed practical nurses (LPN). Unlicensed personnel were mainly certified nursing assistants.

Knowledge Assessment Administration

Baseline knowledge assessments were administered at 236 facilities in the first 2 cohorts of the program between March 28 and November 24, 2014. Organizational leads asked each facility to submit responses from at least 10 employees, 5 licensed and 5 unlicensed personnel.

Statistical Analysis

Descriptive statistics were generated to examine respondent and facility characteristics. We assessed the percentage of correct responses to questions within the CAUTI, ASB, antimicrobial stewardship, and general infection prevention domains. Pooled results across cohorts 1 and 2 are presented for licensed and unlicensed personnel.

RESULTS

Characteristics of Respondents and Facilities

The overall response rate was 184 (78%) of 236 facilities, representing 14 states (Table 1). Of the 68 facilities in cohort 1, we received responses from 49 (72%); for the 168 facilities in cohort 2, we received responses from 135 (80%). The average number of respondents per facility was 8.8 (median [range], 10 [1–32]). A total of 822 respondents (50.6%) were licensed personnel (439 RNs, 378 LPNs, and 5 physicians).

Among the facilities, 117 (63.6%) were for-profit. The average number of residents per facility was 98 (median [range], 82 [12–389]). Large facilities, defined as having more than 100 residents, constituted 40.8% of our sample. A total of 102 (55.4%) of the 184 facilities reported that the main point of contact for infection prevention issues was a practitioner with more than 5 years of infection prevention experience. Additionally, only 93 facilities (50.5%) reported that the main point of contact for infection prevention issues had specific training in infection prevention. In 94 facilities (51.1%), the main point of contact for infection prevention issues conducted personnel education and development activities. Specific training for personnel, either by the facility or by an external organization, was provided on appropriate antibiotic use, catheter insertion, and hand hygiene in 142 (77.2%), 170 (92.4%), and 184 (100%) of the facilities, respectively.

Licensed Personnel

The percentages of correct responses from licensed personnel across several knowledge domains are presented in Table 2. Licensed personnel knew that ASB is very common in persons with indwelling urinary catheters (90.7%). However, only 36.1% understood that pyuria does not distinguish between UTI and ASB; and only 60.1% of respondents knew that screening urine cultures on admission was not appropriate. Clinically based questions about the National Healthcare Safety Network surveillance definitions used in this program elicited many incorrect answers. For example, only 39.6% of respondents correctly identified the date of the CAUTI event when presented with 4 clinical options. Understanding how to determine whether a CAUTI was present on admission was limited, both when presented with brief clinical scenarios (39.1% correct) and when provided a longer case study and asked to determine whether a CAUTI had been present on admission (30.7% correct). Only 61.4% of respondents correctly identified fever as an evidence-based symptom of CAUTI when given a choice between fever, cloudy urine, foul-smelling urine, and a change in urine color. Less than one-third of licensed personnel knew to rub hands for 15 seconds when washing, and less than 20% of licensed personnel chose alcohol-based hand rub as the most effective agent. Other questions that elicited incorrect responses were whether blood-glucose meters should be shared between residents (31.1% correct) and whether personal protective equipment for standard precautions should vary based on the infection status of the resident (26.1%).

Unlicensed Personnel

The percentages of correct responses from unlicensed personnel are presented in Table 3. Nearly all respondents (99.6%) were aware that fever and new-onset confusion should be reported to a nurse. Likewise, most knew that treating bacteria in the urine of a resident without symptoms of UTI can lead to a multidrug-resistant organism (89.4%) and that measures to prevent the spread of resistant organisms include limiting antibiotic overuse and performing hand hygiene (88.3%). Questions related to the CAUTI surveillance criteria elicited many incorrect answers. Only 57.9% recognized the appropriate criteria for a change in mental status as new or as worse than usual. Likewise, less than one-third (26.6%) were correctly able to identify that fever but not urine color, odor, or cloudiness is a sign of CAUTI that merits urine culture. Only 25.2% of unlicensed personnel correctly identified how long to rub hands while washing, and even fewer (10.6%) knew which cleansing agent

was most effective at killing germs. Knowledge was also limited as to whether blood-glucose meters should be shared (44.4% correct) and application of standard precautions (16.5% correct).

DISCUSSION

Knowledge assessments of licensed and unlicensed personnel in nursing homes were conducted to assess their knowledge of CAUTI, ASB, antimicrobial stewardship, and other infection prevention topics. This information served as the basis for identifying the educational needs of participants in a national AHRQ Safety Program. Our most important findings are gaps in knowledge about the clinical symptoms of CAUTI, distinguishing CAUTI from ASB, and ways to apply the surveillance definitions of CAUTI to clinical scenarios. We also found limited knowledge of selected general infection prevention topics, including the specific procedures to follow for hand hygiene. These identified gaps were common among both licensed and unlicensed personnel and thus represent important targets for personnel education about infection prevention.

The questions requiring application of knowledge of CAUTI and ASB definitions to clinical scenarios elicited mostly incorrect responses. Possible explanations include a lack of familiarity with how to perform CAUTI surveillance, as most participating nursing home facilities were not performing National Healthcare Safety Network–based surveillance for CAUTI at the time of entry into the program cohorts. Other contributing factors may include limited training in infection prevention among nursing home personnel,¹² the complexity of the surveillance criteria themselves, and ingrained biases about what signs and symptoms should trigger an assessment for CAUTI.¹³

The lack of knowledge about hand hygiene protocols was noteworthy, as 100% of facilities reported that specific training in hand hygiene is offered to personnel. Many factors may have led to this discrepancy, including logistical challenges to train part-time personnel, and limited uptake by the personnel being trained.⁸ This difference between personnel having knowledge of facts but having difficulty applying these facts to clinical scenarios inspired us to create case-based teaching modules reinforcing existing knowledge while enabling personnel to apply learned facts to clinical scenarios.¹⁴ Thus, high priority was placed on teaching how to perform CAUTI surveillance through case examples in the clinical content webinars.

Our findings are in accord with those of several previous studies. A survey of Department of Veterans Affairs (VA) physicians, nurse practitioners, and physician assistants working in long-term care settings likewise reported significant gaps in knowledge about antibiotic stewardship and how to manage infections in older adults.^{15,16} Our knowledge assessment reveals similar knowledge gaps in non-VA facilities and includes clinical nurse assistants, who in nursing homes often generate the first request for urine testing or treatment for a possible UTI.¹⁷ The gaps in knowledge that we identified around inappropriate screening for ASB are also similar to those previously reported for acute care.^{13,18–20}

Our study has several limitations. First, we do not have respondent-level demographic information, other than information about credentials, which limited our ability to examine the influence of respondent-level factors on various infection prevention knowledge domains. This knowledge assessment was exploratory and performed to prepare for a large-scale quality improvement program in nursing homes. Second, the sampling was not randomized, as facility leads were at liberty to select respondents at their facility. The knowledge assessment was not previously validated; but through this work we have created and refined a tool that can be used in other projects to measure baseline personnel knowledge relevant to CAUTI prevention. Although facilities participating in this program were not randomly selected, we have conducted separate analyses suggesting that participating facilities did not differ from nonparticipating facilities across a number of key characteristics.

This program represents the largest collaborative of long-term care facilities focused on infection prevention and CAUTI to date. As such, our findings on long-term care personnel knowledge have important implications for infection prevention policies and practices in nursing homes. First, we identified multiple gaps in knowledge of CAUTI, ASB, antimicrobial stewardship, hand hygiene, and standard precautions. Variable knowledge of diagnosis and prescribing guidelines for CAUTI and ASB is one of the challenges for antimicrobial stewardship in nursing homes.¹⁷ Second, we found a lack of knowledge about how to perform CAUTI surveillance. Finally, we found that the biases leading to inappropriate management of ASB previously identified in acute care are likewise present in nursing homes. Lessons learned here and the assessment tool are highly relevant to helping nursing homes meet the new Centers for Medicare and Medicaid Services requirements for having an active antimicrobial stewardship component within a robust infection prevention program.⁷ As nursing homes expand and enhance their infection prevention programs, educational efforts can repair the gaps identified.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1

Characteristics of Respondents and Participating Facilities in Study of Infection Prevention and Antimicrobial Stewardship Knowledge for Selected Infections Among Nursing Home Personnel

Respondent characteristics (N = 1,626)	
Licensed personnel	
Physician (MD)	5 (0.3%)
RN	439 (27.0%)
LPN	378 (23.2%)
Unlicensed personnel	
CNA	634 (39.0%)
Other	170 (10.5%)
Facility characteristics (N = 184, cohorts 1 and 2)	
Facility ownership	
For-profit	117 (63.6%)
Nonprofit	67 (36.4%)
Facility size	
1–100 residents	109 (59.2%)
>100 residents	75 (40.8%)
Main point of contact for infection prevention	
Physician (MD)	2 (1.1%)
RN	144 (78.3%)
LPN	32 (17.4%)
Other	6 (3.3%)
Years of infection prevention experience for the main point of contact	
0–3 years	47 (25.5%)
3–5 years	35 (19.0%)
>5 years	102 (55.4%)
Main point of contact for infection prevention has specific infection prevention training	
Yes	93 (50.5%)
No	91 (49.5%)
Facility performs CAUTI surveillance	
Yes	126 (68.5%)
No	58 (31.5%)
Facility provides training in hand hygiene	
Yes	184 (100%)

NOTE. CAUTI, catheter-associated urinary tract infection; CNA, certified nursing assistant; LPN, licensed practical nurse; RN, registered nurse.

TABLE 2

Licensed Personnel Responses to Infection-Prevention Knowledge Assessment Questions

Question or topic	No. of responses	% of responses that were correct
CAUTI recognition and management		
Recognize fever but not urine color, odor, or cloudiness as a CAUTI symptom	813	61.4%
Recognize that screening urine cultures on admission are not indicated	815	60.1%
Recognize that fever and positive urine culture should be treated with antibiotics	816	95.6%
Recognize whether a CAUTI was present on admission in brief scenarios	811	39.1%
Understand the date of the CAUTI event in brief clinical scenarios	811	39.6%
Identify CAUTI was present on admission in a longer case study (cohort 2 only)	701	30.7%
Asymptomatic bacteriuria and pyuria		
Recognize definition of ASB (cohort 1 only)	114	99.1%
Recognize that ASB is common in catheterized residents (cohort 2 only)	700	90.7%
Understand that pyuria does not distinguish ASB from urinary tract infection	814	36.1%
General infection prevention		
Identify measures to prevent spread of resistant organisms (cohort 1 only)	115	100%
How long to rub hands with soap when washing ^a	818	28.5%
Which product is most effective at killing germs on hands (cohort 2 only)	704	11.7%
Recognize that blood glucose meters should not be shared among residents ^b	815	31.1%
Recognize that standard precautions do not differ by infection status of the resident	810	26.1%

NOTE. A total of 822 licensed personnel were respondents. ASB, asymptomatic bacteriuria; CAUTI, catheter-associated urinary tract infection.

^aChoices were at least 5 seconds, at least 15 seconds, at least 30 seconds, and at least 60 seconds.

^bThe long-term care guide developed for this program recommends that blood glucose meters not be shared, whenever possible.

TABLE 3

Unlicensed Personnel Responses to Infection-Prevention Knowledge Assessment Questions

Question or topic	No. of responses	% of responses that were correct
CAUTI recognition		
Identify steps to take if resident has fever and confusion	793	99.6%
Identify criteria that meet definition of a change in mental status (cohort 2 only)	734	57.9%
Recognize fever but not urine color, odor, or cloudiness as a CAUTI symptom	781	26.6%
Asymptomatic bacteriuria and pyuria		
Cloudy, smelly urine should not trigger a urine culture	788	27.7%
Understand that treating asymptomatic patients can lead to antimicrobial resistance	783	89.4%
General infection prevention		
Identify measures to prevent spread of resistant organisms (cohort 1 only)	60	88.3%
How long to rub hands with soap when washing ^a	797	25.2%
Which product is most effective at killing germs on hands (cohort 2 only)	730	10.6%
Recognize that blood glucose meters should not be shared among residents ^b	791	44.4%
Recognize that standard precautions do not differ by infection status of the resident	786	16.5%

NOTE. A total of 804 unlicensed personnel were respondents. CAUTI, catheter-associated urinary tract infection.

^aChoices were at least 5 seconds, at least 15 seconds, at least 30 seconds, and at least 60 seconds.

^bThe long-term care guide developed for this program recommends that blood glucose meters not be shared, whenever possible.