Survey of Healthcare-Associated Infections and Antimicrobial Use in U.S. Nursing Homes for use in Exploring the Development of a National Prevalence Model

Request for New Data Collection

Part B

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B. Collections of Information Employing Statistical Methods

1. Respondent Universe and Sampling Methods

Respondents for the 2017 data collection are nursing homes located in EIP sites. There are approximately 3,800 nursing homes in the 10 EIP states (Table 1). For some EIP sites, the catchment area will consist of a few counties within a particular region of the state and in others, the catchment area will be expanded to include the entire state. The decision on the catchment area size will be decided by EIP site personnel, and will be based on the number of nursing homes available for recruitment, feasibility, and available resources. Nursing homes certified by the Centers for Medicare & Medicare Services (CMS) in each EIP site catchment area are eligible for participation. The goal is to recruit a random sample of 20 nursing homes at each EIP site. There is no precedent for sample stratification in nursing home prevalence surveys (4,5,10-12), nor data available to determine which nursing home characteristics would be appropriate to use as stratification criteria. The largest HAI prevalence survey with nursing homes, performed by the ECDC in 2010, included a non-stratified convenience sample of 722 facilities from 28 countries (range 2-111 per country) and 61,932 residents (4). For the Department of Veterans Affairs nursing home prevalence surveys conducted in 2003, 2005 and 2007 all of the 133 VA-owned and operated facilities were included. They did not conduct an analysis of facility-level factors associated with HAI prevalence. For this CDC nursing home survey, there are approximately 3,800 nursing homes within the 10 EIP States and it would not feasible to include them all. Therefore, a sample of randomly selected nursing homes will be used. Based on the long-standing relationships that EIP sites have with their healthcare facilities, we anticipate that we will meet our 2017 recruitment goals.

Table 1: Nursing homes, beds, and occupancy rates by EIP state and for the US.

EIP State	No. nursing homes	No. nursing home beds	Mean beds per facility	Occupancy rate (%)	Estimated residents per day
CA	1,226	121,381	99	86	104,388
CO	211	20,371	97	79	16,093
CT	231	27,841	121	90	25,057
GA	358	38,883	109	86	33,439
MD	230	28,487	124	86	24,499
MN	380	30,405	80	89	27,060
NM	71	6,716	95	82	5,507
NY	631	116,448	185	92	107,132
OR	138	12,276	89	63	7,734
TN	320	37,104	116	84	31,167
EIP Total	*3,796*	*439,912*	*116*	--	*382,077*
US Total	15,663	1,697,484	108	83	1,408,912

CMS Nursing Home data compendium, 2013. Available at /www.cms.gov/Medicare/Provider-Enrollment-and Certification/CertificationandComplianc/downloads/nursinghomedatacompendium_508.pdf
National Center for Health Statistics. Health, United States, 2014: With Special Feature on Adults Aged 55–64. Hyattsville, MD. 2015. Available at: www.cdc.gov/nchs/data/hus/hus14.pdf#101

To generate a random sample of nursing homes, EIP staff will create a list of all CMS certified nursing homes in their catchment area, using information available from the CMS Nursing Home Compare website, to create a sampling frame. The lists of nursing homes will be randomly sorted using a random number generator tool, then contacted for participation in the random order until 20 participants are identified. EIP personnel will contact nursing home to participate in the 2017 data collection through, email, telephone, and in-person communications. EIP site project staff will have up to four attempts to establish contact with a selected nursing home, after four attempts a nursing home will be considered a non-responder, and the next nursing home on the list will be contacted. Nursing home participation in the 2017 survey is voluntary.

In the 2017 survey, data will be collected on all eligible residents in each participating nursing home. No sampling of nursing home residents will occur. Although, residents newly admitted to the nursing home (i.e., those who have not been residents for at least 24 hours) will be excluded.

2. Procedures for the Collection of Information

As described above, nursing homes will be selected through a random sampling process, and all eligible (i.e., not newly admitted) residents within participating facilities will be included in the survey. The sample size formula for random samples can be used to estimate the number of residents targeted for inclusion in the survey across all EIP sites:

$$N \geq \left(\frac{Z\alpha/2}{m}\right)^2 \times P \times (1-P)$$

where $Z\alpha/2 = 1.96$, P = expected proportion of residents with HAIs (or receiving antimicrobials), and *m* = precision of the estimate (half the width of the desired confidence interval). This sample size estimate is based on the experience from the CDC nursing home prevalence pilot, and used an estimated HAI prevalence of 6%, an estimated AU prevalence of 11%, and a desired precision of +/- 0.5%. The number of residents necessary to achieve this precision was 8,614 for HAIs and 14,884 for AU. Therefore, the proposed minimum sample size for this survey is 15,000 eligible residents, giving us acceptable precision of the overall HAI prevalence and antimicrobial use prevalence estimates.

The 2017 survey data will be collected by nursing home staff (the NH Team) and by EIP personnel (the EIP Team). Data will be obtained from resident medical records and other nursing home information systems (e.g., Medication Administration Records, Laboratory Information Systems). To obtain information about the presence of medical devices, such as central lines and urinary catheters and ventilators, data collectors may review medical records and/or consult with healthcare facility staff on inpatient units. Residents are not interviewed. To obtain information needed to complete the healthcare facility assessment, the nursing home staff member completing the assessment or EIP personnel providing assistance, may need to consult with other nursing home staff within the facility.

All data collectors will receive training in data collection procedures. This training will be developed and conducted by CDC personnel or by EIP team members. In the pilot nursing home survey, webinar training was provided to data collectors prior to their survey date by CDC personnel with assistance from EIP team members.

Each participating nursing home, in collaboration with their EIP Team, will select in advance the date on which the 2017 survey will be conducted. A range of acceptable survey dates from which to choose will be provided; we anticipate they will be between April and September 2017.

The CDC-developed data management system will include multiple business rules that prevent erroneous data entry in a number of circumstances (e.g., entry of a nursing home admission date that is after the survey date). In addition, during the data cleaning process CDC personnel will query the submitted data to identify unusual or outlier values to be verified by sites.

Data obtained from the sample of participating nursing homes will be used to estimate the national burden of HAIs in US nursing homes. This will be achieved using an approach similar to that used for nation burden estimation in the CDC's hospital prevalence survey; however, adjustments to the methods are necessary.

For the hospital survey, the established Rhame and Sudderth formula (1) was used to convert the measure of HAI prevalence obtained from the survey hospital sample to an estimated incidence. A key component of this formula is length of hospital stay of patients, measured in days. Hospital length of stay in days (or a proxy measure) was collected for patients from the sample of hospitals, and was also available in the National Inpatient Sample (NIS), a nationally representative sample of community-based hospitals with sample weighting, which enabled national HAI burden estimation to be performed (2).

In the nursing home setting, use of resident length of stay data is not an appropriate. First, for a majority of persons the nursing home represents their place of residence, and they are therefore not "discharged" until end of life care is needed or death occurs. CMS data indicate that on a given day, 86% of US nursing home residents are considered "long-stay" residents and their average length of nursing home stay is measured in years. Second, data on length of stay would not be available for residents in the sample of nursing homes participating in the survey (since it is a point prevalence survey), and waiting for these data to become available would likely take many years, and be entirely impractical. Finally, Rhame and Sudderth state their formula is unreliable when length of stay is long (1), "*For chronic care facilities and services with long duration of hospitalization, [the] equation produces high rates of infection even when few infections are occurring*". For these reasons, investigators from the ECDC used an alternative approach to estimate the HAI burden in Europe (3): one where HAI prevalence, data on the number of nursing home residents in Europe (obtained from country-level administrative data), and data on the mean duration of an HAI, were used to estimate the HAI burden.

The approach to national burden estimation for this CDC nursing home survey will be to analyze the data collected from the sample of nursing home participants to determine the HAI prevalence. Then we plan to perform log binomial (or other appropriate) modeling to identify factors significantly associated with HAI prevalence. The relevant factors could include factors such as resident-type (short- or long-stay), indwelling urinary catheter use, diabetes, or presence of wounds/pressure ulcers. Then, to create an estimate of national HAI burden, adjusting for the relevant factors identified, we will use data from Nursing Home Compare, which includes data for every active nursing home in the United States (currently 15,691 facilities). Because the CMS Nursing Home Compare includes data for all U.S. nursing homes, sample weights are not used.

3. Methods to Maximize Response Rates and Deal with Non Response Bias

This project is an assessment of HAI prevalence and antimicrobial use in U.S. nursing homes and is not a traditional survey. Facilities will be identified for participation based on their location within an EIP catchment area. Healthcare facilities, including nursing homes, in EIP catchment areas have existing working relationships with EIP personnel through their

participation in on-going infection surveillance activities, including EIP staff routinely contacting healthcare facility to conduct medical chart reviews. EIP personnel will provide information about the 2017 survey to facilities in their catchment areas through email, telephone and in-person communications. An informational document describing project goals and participation requirements will be provided to facilities (Attachment H).

Based on discussions with lead investigators for the two European CDC prevalence surveys in long-term care facilities, and our own experiences conducting a small pilot, the 2017 survey has been designed to minimize the data collection burden on nursing home participants. For the majority of participants, the only data collection they will be responsible for is the completions of the Healthcare Facility Assessment (Attachment C). This is because, as for the CDC hospital prevalence survey, EIP site project staff will be able to perform all of the remaining data collection. We anticipate the limited data collection burden placed on nursing home staff will help to maximize participation in the survey.

Furthermore, we believe that nursing homes will have significant interest in the 2017 survey as part of national efforts to prevent HAIs and improve antimicrobial use and reduce the emergence and spread of HAIs and antimicrobial resistant pathogens. For example, the 2015 CDC Core Elements of Antibiotic Stewardship for Nursing Homes, recommending the implementation of antibiotic stewardship activities in all nursing home www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html, and the 2015 Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria (CARB) initiative www.hhs.gov/ash/carb/. The CDC pilot nursing home survey experience confirmed a high level of enthusiasm for this project among nursing home staff. We may also work with key stakeholder professional organizations (e.g., The Society for Post-Acute and Long-Term Care Medicine, the National Association Directors of Nursing Administration/Long Term Care, The Society for Healthcare Epidemiology of America, and the Association for Professionals in Infection Control and Epidemiology) to disseminate information about the survey and encourage participation.

Data from the CMS Nursing Home Compare will be used to assess the impact of non-response bias on the prevalence of HAI and antimicrobial use. Because these datasets contain facility-level characteristics for all active nursing homes in the United States, we will be able to obtain data for nursing homes that are randomly selected for participation in the survey, but decline participation or do not respond to EIP staff attempts to contact them. The CMS Nursing Home Compare data for nursing homes that participate in the survey and non-respondents can be compared to determine if systemic differences between the two groups exists with respect to 1) variables commonly used to describe nursing homes (size, ownership, staffing-ratios, CMS quality measures), and 2) the variables that are found to be associated with HAI or antimicrobial use prevalence during analysis of data for sample of participating nursing homes. Similarly, an assessment of how the sample of nursing homes participating in the survey can be compare to data for all nursing homes in the United States.

4. Tests of Procedures or Methods to be Undertaken

This survey was modeled on prior prevalence surveys performed in acute care hospitals by the CDC (2015 survey [OMB Control No. 0920-0852, expiration date 12/31/2016]), and in European long-term care facilities by the European CDC. Staff with expertise in designing and conducting these surveys were consulted during the design and development of this survey. Additionally, we conducted a pilot HAI and antimicrobial use prevalence survey in nine nursing homes in 4 EIP states (CT, NY, MN and NM) in 2013/14. This experience was instrumental in informing plans for the 2017 survey, including modifications to the data collection instruments and instructions, and delineating data collection roles and responsibilities among the NH team and EIP Team.

5. Individuals Consulted on Statistical Aspects and Individuals Collecting and/or Analyzing Data

CDC statistician consulted for project design and data analysis:
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Data will be collected by EIP personnel and by local facility staff as described previously. Identification of the specific EIP surveillance officers and local facility staff members who will participate in training and data collection activities is at the discretion of the EIP site or the facility, respectively.

References:

1. Rhame FS, Sudderth WD. Incidence and prevalence as used in the analysis of the occurrence of nosocomial infections. Am J Epidemiol 1981;113:1-11.
2. Magill SS, Edwards JR, Bamberg W, et al. Multistate Point-Prevalence Survey of Health Care–Associated Infections. *N Engl J Med* 2014;370:1198-208.
3. European Centre for Disease Prevention and Control. Point prevalence survey of healthcare associated infections and antimicrobial use in European long-term care facilities. April–May 2013. Stockholm: ECDC; 2014.