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Major Article

# The first point prevalence survey of health care–associated infection and antimicrobial use in a Japanese university hospital: A pilot study

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***Background:*** Point prevalence surveys (PPSs) in Japanese hospitals have not yet been reported. The purpose of this pilot PPS study was to evaluate the epidemiology of health care–associated infections (HAIs) and antimicrobial use in a Japanese tertiary university hospital.
***Methods:*** A 1-day, cross-sectional PPS was performed at a Japanese university hospital. Data on demographics, active HAIs, and antimicrobial use of all inpatients were collected using a data collection form.
***Results:*** Of 841 patients, 85 (10.1%) had 90 active HAIs, and 308 patients (36.6%) were administered 494 antimicrobials. Among the 90 HAIs and 58 pathogens, the most frequent infection and isolated pathogen were pneumonia (20.0%) and *Enterobacteriaceae* (27.6%), respectively. Of the 118 antimicrobials used for treatment of HAIs, carbapenems were the most frequently administered category of antimicrobials (22.9%). In regard to antimicrobials for surgical prophylaxis, 37 of 119 (31.1%) were administered to patients on postoperative day 3 or later, and 48 of 119 (40.3%) were administered orally.
***Conclusions:*** The incidence of HAIs is higher than in other developed countries. The social and medical situation in Japan may affect patient demographics, active HAIs, and antimicrobial use. Multicenter PPSs are necessary to uncover the real epidemiology of HAIs and antimicrobial use in Japan.


Reducing health care–associated infections (HAIs) and promoting antimicrobial stewardship are among the central missions of hospitals to improve patient health outcomes and reduce antimicrobial resistance. Baseline data of HAIs and antimicrobial use are essential for infection control and prevention in hospitals. A point prevalence survey (PPS) is considered a useful cross-sectional surveillance technique to evaluate HAIs and antimicrobial use. The scale of reported PPSs has become multicenter, multistate, and multinational.[1-4]

In Japan, there have been few reports about the hospital epidemiology of infectious diseases. Although specific surveillance of hospital infections, such as catheter-related bloodstream infections, catheter-associated urinary tract infections, ventilator-associated pneumonia, and surgical site infections at the targeted ward, is conducted, PPS data of HAIs and antimicrobial use have not yet been reported.[5-8] To have an overview of HAIs and antimicrobial use is essential for improving the quality of medical care. The aim of this study was to investigate the prevalence of HAIs and antimicrobial use in Nagoya University Hospital (NUH) by a PPS.

## METHODS

### *Study design*

### *Setting and data collection*

The survey was performed at NUH in Aichi, Japan. NUH is a 1,035-bed, tertiary care, university-affiliated hospital and cancer center

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for children and adults. The hospital provides adult, pediatric, and geriatric services, including medical and surgical subspecialties and comprehensive outpatient and ambulatory services. NUH has 2 intensive care units (ICUs), a maternal-fetal intensive care unit, and a neonatal intensive-growing care unit (NICU/GCU). The numbers of beds of the general wards, psychiatric ward, ICUs, maternal-fetal ICU, and NICU/GCU are 917, 50, 26, 6, and 36, respectively. The 5-year (2009-2013) average numbers of outpatients per day, total number of operations per year, length of hospital stay (days), and bed occupation rate were 2,350, 8,035, 13.4, and 85.1%, respectively.

The PPS was performed using a standardized PPS questionnaire on July 3, 2014. The NUH PPS protocol 2014 was created with some modification to the European Centre for Diseases Prevention and Control (ECDC) surveillance protocol.[9] All inpatients as of 8 AM on the survey day at NUH were included in the present study. Fifteen investigators (7 doctors, 1 junior resident, 4 pharmacists, and 3 nurses) participated in the study. Doctors and pharmacists reviewed the medical records on the survey day to collect demographic and clinical data. Nurses collected patient data from the devices in place on the morning of the survey day, including peripheral venous catheters, central venous catheters or ports (CVCs), urinary catheters, and tracheal-tracheostomy tubes. All investigators checking medical records were instructed about study protocol and definitions of HAIs before the PPS, and all patients with HAIs were judged by 2 independent trained investigators.

The collected data included each patient's background characteristics (age, sex, duration of hospital stay, and underlying diseases), McCabe score,[10] devices in place, detection history of drug-resistant (DR) microorganisms within 3 months, active HAIs, antimicrobial use, and any consultations with the infection control team (ICT) within the last month, such as for treatment advice, infection control, or vaccination, including any remarks from a member of the ICT. If a patient had any active HAIs or received at least 1 antimicrobial, further information was collected.

This study adhered to the Japanese ethical guidelines for epidemiologic studies, and the study protocol was approved by the Institutional Review Board of Nagoya University Graduate School of Medicine (No. 4386).

### *DR microorganisms*

DR microorganisms were defined as follows: methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-intermediate or vancomycin-resistant *S aureus*, vancomycin-resistant *Enterococcus*, toxin A– or toxin B–producing *Clostridium difficile* as defined according to the Clinical and Laboratory Standards Institute M100-S24,[11] and *C difficile* toxin as checked by C. DIFF QUIK CHEK COMPLETE (TECHLAB, Blacksburg, VA). DR gram-negative rods (GNRs) were defined by the following criteria: (1) *Enterobacteriaceae*: resistant to any third-generation cephalosporins (3GC: cefotaxime, ceftriaxone, or ceftazidime) or nonsusceptible to imipenem or meropenem; (2) *Acinetobacter* spp or *Pseudomonas aeruginosa*: resistant to at least 2 classes among any fluoroquinolones, any aminoglycosides, any carbapenems, or β-lactams (resistant to at least 2 of piperacillin, ceftazidime, and cefepime); (3) nonfermenting GNRs other than *Acinetobacter* spp and *P aeruginosa*: resistant to any carbapenems; and (4) *Bacteroides* spp: resistant to any carbapenems.

### *Case definitions*

HAI was defined as follows: (1) infection occurring on day 3 or later after admission (day 1: day of admission); (2) infections related to a prior hospitalization in an acute care hospital within the preceding 48 hours; (3) *C difficile* infection related to a previous hospitalization in an acute care hospital within 28 days before diagnosis; or (4) surgical site infection related to surgery within 30 days of the operation (or within 1 year in cases of implant infection).

Active HAI was defined as HAI with signs and symptoms present on the survey day or HAIs with antimicrobial therapy still being given. Febrile neutropenia, which was defined according to the 2010 clinical practice guideline,[12] was separated from clinical sepsis in adults and children in our protocol. Febrile neutropenia and clinical sepsis were selected only when a case was diagnosed as having infectious diseases that did not meet any corresponding diagnostic criteria.

Information about device-associated infection (the term is only used for pneumonia, bloodstream infection, and urinary tract infection) and HAI causative organisms detected was collected from all patients with active HAIs.

### *Antimicrobial use*

For patients receiving at least 1 dose of antimicrobials on the survey day or antimicrobials for surgical prophylaxis within 24 hours, additional data were collected as follows: antimicrobial category, purpose of antimicrobial use, and route of systemic administration (intravenous, oral, inhaled, and anal). The purpose of antimicrobial use was divided into treatment for active HAIs, treatment for community- or nursing care facility–associated infections, medical prophylaxis (eg, cotrimoxazole for prevention of pneumocystis pneumonia), surgical prophylaxis, and others. Data on antimicrobial use for surgical prophylaxis were collected if antimicrobials were given within 24 hours before the survey day.

### *Statistical analysis*

All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria). More precisely, it is a modified version of R commander (The R Foundation for Statistical Computing) designed to add statistical functions frequently used in biostatistics.[13]

Comparisons of patients with and without HAIs were performed. Continuous variables were analyzed using the Mann-Whitney *U* test. Categorical variables were analyzed using the $\chi^2$ test or Fisher exact test, as appropriate. A *P* value <.05 was considered significant.

## RESULTS

On the day of the survey, 841 patients were hospitalized and enrolled in this survey. Table 1 shows the patient demographic and clinical characteristics. The median age of the patients was 61 years, and patients >65 years old accounted for 43.3%. According to the McCabe score, 292 (34.7%) had ultimately fatal diseases (estimated prognosis: 1-5 years) or rapidly fatal diseases (<1 year). DR GNR, MRSA, and toxin A– or toxin B–producing *C difficile* were detected in 3.2%, 3.9%, and 1.2% of all patients, respectively. None of carbapenem-resistant *Enterobacteriaceae*, multidrug-resistant *P aeruginosa*, multidrug-resistant *Acinetobacter* spp, vancomycin-resistant *Enterococcus*, or vancomycin-intermediate or vancomycin-resistant *S aureus* were detected within the 3-month study period. The ICT was involved in some way in the care of 98 patients (11.7%), such as by commenting on treatment or infection control in the patients' medical records within the last month.

Overall, 85 patients (10.1%) had at least 1 active HAI. Active HAIs occurred significantly more frequently in men than women, patients with hematologic malignancy and hematopoietic stem cell