occurrence of 2 cases, as determined by the health department, fulfilled the definition for an outbreak investigation and triggered water restrictions and extensive testing of the environment and patients for *Legionella*. The cases and the implications of these actions are reviewed in the context of new information about false-positive urinary-antigen tests and changes to the outbreak case definitions for Legionnaires' disease by the Council of State and Territorial Epidemiologists (CTSE). This includes "probable" cases that have no positive diagnostic tests.

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Poster Presentation

Whole-Genome Sequencing Reveals Diversity of Carbapenem-Resistant *Pseudomonas aeruginosa* Collected Through the Emerging Infections Program

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Background: Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) is a frequent cause of healthcare-associated infections (HAIs). The CDC Emerging Infections Program (EIP) conducted population and laboratory-based surveillance of CRPA in selected areas in 8 states from August 1, 2016, through July 31, 2018. We aimed to describe the molecular epidemiology and mechanisms of resistance of CRPA isolates collected through this surveillance. **Methods:** We defined a case as the first isolate of *P. aeruginosa* resistant to imipenem, meropenem, or doripenem from the lower respiratory tract, urine, wounds, or normally sterile sites identified from a resident of the EIP catchment area in a 30-day period; EIP sites submitted a systematic random sample of isolates to CDC for further characterization. Of 1,021 CRPA clinical isolates submitted, 707 have been sequenced to date using an Illumina MiSeq. Sequenced genomes were classified using the 7-gene multilocus sequence typing (MLST) scheme, and a core genome MLST

Figure 1. Phylogeny of CRPA isolates made from cgMLST scheme reveals broad genetic diversity. Inner ring is colored by ST, outer ring by the EIP site of collection.

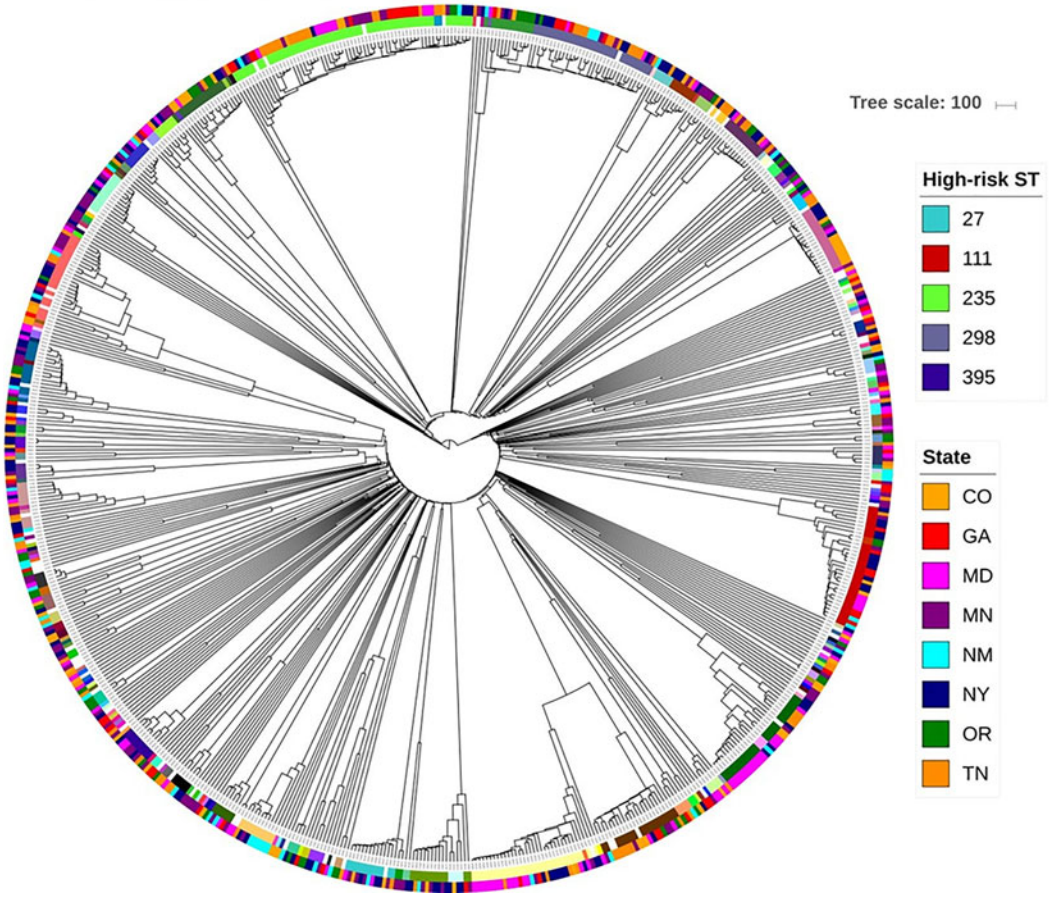

Fig. 1.

(cgMLST) scheme was used to determine phylogeny. Antimicrobial resistance genes were identified using publicly available databases, and chromosomal mechanisms of carbapenem resistance were determined using previously validated genetic markers. **Results:** There were 189 sequence types (STs) among the 707 sequenced genomes (Fig. 1). The most frequently occurring were high-risk clones ST235 (8.5%) and ST298 (4.7%), which were found across all EIP sites. Carbapenemase genes were identified in 5 (<1%) isolates. Overall, 95.6% of the isolates had chromosomal mutations associated with carbapenem resistance: 93.2% had porinD-associated mutations that decrease membrane permeability to the drugs; 24.8% had mutations associated with overexpression of the multidrug efflux pump MexAB-OprM; and 22.9% had mutations associated with overexpression of the endogenous β-lactamase *ampC*. More than 1 such chromosomal resistance mutation type was present in 37.8% of the isolates. **Conclusions:** The diversity of the sequence types demonstrates that HAIs caused by CRPA can arise from a variety of strains and that high-risk clones are broadly disseminated across the EIP sites but are a minority of CRPA strains overall. Carbapenem resistance in *P. aeruginosa* was predominantly driven by chromosomal mutations rather than acquired mechanisms (ie, carbapenemases). The diversity of the CRPA isolates and the lack of carbapenemase genes suggest that this ubiquitous pathogen can readily evolve chromosomal resistance mechanisms, but unlike carbapenemases, these cannot be easily spread through horizontal transfer.

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Poster Presentation

Competency of Infection Preventionists in Japan

Hanako Misao, Shizuoka University; Kazumi Kawakami, Juntendo University

Backgrounds: In the United States, the Association for Professionals in Infection Control and Epidemiology (APIC) announced a competency model for infection preventionists (IP) in 2011. On the other hand, IPs in Japan must develop their career by themselves because there are no guidelines of career development for Japanese IPs. In recent years, infectious diseases and infection control issues have become more global. **Objective:** Aiming for international collaboration among IPs, the purpose of this study were to clarify the actual competencies of IPs in Japan and the United States and to compare the competencies of both. We report on the competencies of IPs in Japan. **Methods:** Semistructured interviews were conducted with 67 certified nurses in infection control (CNIC) who responded to the translated version of the APIC Competency Model Assessment Tool. From the qualitative descriptive analysis of interview verbatim records, we extracted the behavioral characteristics and completed the questionnaire "Survey of Competency for Infection Preventionist," which consisted of 130 items. A survey form was created using Survey Monkey. We sent e-mails to ask anonymous survey collaboration, including the URL of the survey form, to 2,284 CNIC and CNS in infection control professionals. The research was approved by the research ethics committee at the facility to which the researcher belongs (Juntendo University, approval no. 30–49). **Results:** The number of responses was 648 and the response rate was 28.4%. The mean years of experience as nurses of 648 respondents was 24.7 (SD, 6.9), and >60% belonged to general hospitals. The scores of mean and standard deviation of each category were as follows: "Clarification of infectious disease process" (mean, 79.1; SD, 13.2); "HAI surveillance and epidemiological survey" (mean, 49.3; SD, 12.3); "Prevention and control of transmission of infectious microorganisms" (mean, 93.8; SD, 17.3); "Management and communication" (mean, 128.5; SD, 23.7); "Education and Research" (mean, 56.8; SD, 11.0); "Employee and occupational health" (mean, 40.6; SD, 9.6); and the total score of all categories (mean, 449.4; SD, 74.4). Based on years of experience as infection preventionists, we divided them into 3 groups: beginners, competent, and experts. As the career level increased, each category score for competency increased (ANOVA, $P < .001$). However, the mean scores of competency did not reach 70% of the total score for the following categories: "Prevention and control of transmission of infectious microorganisms." "Education and research," and "Employee and occupational health." **Conclusions:** The competencies that need to be strengthened for the career development of Japanese IPs have been clarified.

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Developing a Competency Model for Nurses Certified in Infection Control in Japan

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Background: In July 2019, 2,793 nurses were registered as certified nurse in infection control (CNIC) at the Japanese Nursing Association (JNA). Most CNICs work as full-time infection preventionists (IPs) in hospitals. However, a competency model for CNICs has not been developed in Japan yet. Therefore, we developed a competency model for CNICs. **Methods:** We conducted a 2-phase explanatory sequential mixed-methods study between November 2013 and October 2019. The participants were 1,711 CNICs listed on the JNA website. Phase 1 was a cross-sectional study using self-administered questionnaires that included 10 competency domains based on the Association for Professionals in Infection Control and Epidemiology Competency Assessment Tool. Considering years of experience as an IP and full-time position, participants' career stages were novice, competent, proficient, and expert. The CNICs who answered the questionnaire were included in the interview during phase 2, which was a descriptive qualitative study. Specifically, 10–30 participants were selected from each career stage. Semi-structured individual interviews were conducted, and verbatim transcripts were analyzed qualitatively. The knowledge, skills, and abilities of CNICs were extracted at each career stage. This study was approved by the Research Ethics Committee of Juntendo University (approval no. 25-27). **Results:** During phase 1, 1,711 CNICs were invited to participate: 975 returned the questionnaire (57% response rate) and 969 (99.3%) responses were valid and used in the analysis. Only 257 participants agreed to attend the interviews. In phase 2, interviews were conducted with 67 CNICs: 30 novice, 20 competent, 13 proficient, and 4 expert. The mean years of experience as a nurse and CNIC were 22.2 (SD, 7.0) and 5.3 (SD, 3.1), respectively. As the career stage advanced, the contents and range of infection prevention role and activities in the hospital or community expanded across competency domains. In clarification of infection process,