

(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  $\beta$ -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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#### Presentation Type:

Poster Presentation

#### Competency of Infection Preventionists in Japan

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**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,

one of the crucial competencies, the novice needed to consult reference material about the infectious disease each time due to lack of knowledge. Although the competent CNICs understood the frequent occurrence of infectious disease, they needed the specialist's advice. However, the proficient and expert CNICs could interpret information independently, and importantly, expert CNICs could distinguish between what they know and do not know. **Conclusions:** Using an explanatory sequential mixed-methods approach, we developed a competency model for CNICs that may encourage CNICs to develop their expertise and that is useful in assessing the qualities or abilities of CNICs. In the future, this model can be used to develop systematic educational programs for CNICs.

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#### **Development of a Risk Prediction Model for Central-Line-Associated Bloodstream Infection (CLABSI) in Patients With Continuous Renal Replacement Therapy**

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**Background:** The number of patients with end-stage renal disease and acute kidney injury in China is large and increasing year by year. Continuous renal replacement therapy (CRRT) is one of the important treatment methods. However, long-time CRRT would inevitably lead to CLABSI, which would seriously affect the treatment and prognosis of the patient. Although CLABSIs can be prevented and controlled, the rate of CLABSI in China is still higher than in other countries. Therefore, it is urgent to find new intervention methods on the basis of existing methods. Surveillance is the prerequisite of infection prevention and control. We sought to develop a risk prediction model for CLABSI in patients with CRRT according to uncontrollable risk factors, which could be used for early assessment and screening of high-risk infection groups. Such a tool would bring the supervision and infection control to the forefront in addressing these issues. **Methods:** We selected 3,103 CRRT patients in the West China Hospital of Sichuan University from January 2013 to December 2018 using the hospital infection and infectious disease monitoring module of electronic medical records (EMR) system with the integration and elimination criteria. Data mining and feature selection were performed using Weka software. Separately, prediction models developed by Weka software and SPSS software were compared with each other using the area under the curve (AUC) method to assess the performance of the forecasting models. **Result:** The incidence of CLABSI in CRRT patients was 8.01 per 1,000 catheter days (238 of 29,711). According to the multifactor regression analysis by SPSS software, the retaining time of dialysis catheter, C-reactive protein levels, total bilirubin, acute pancreatitis, and systemic inflammation reaction syndrome were the risk factors. According to the Youden's index, the cutoff point of the retaining time of dialysis catheter was 5.5 days; the cutoff point of CRP was 112.5mg/L; and the cutoff point of total bilirubin was 14.15  $\mu\text{mol/L}$ . The prediction models of CLABSI for CRRT patients were developed: The AUC of the prediction model developed by SPSS software was 0.763 (95% CI, 0.717–0.809). The receiver operating characteristic (ROC) curve analysis showed that the AUCs of the prediction models developed separately by Weka software

using Bayes, logistic regression analysis, multiple layer Perceptron and J48, and SPSS software through logistic regression analysis were between 0.6 and 0.8. Using the down-sampling technique, the AUC ranged between 0.7 and 0.9, and the sensitivity, precision, and  $\kappa$  value increased. Thus, these models had definite clinical significance. **Conclusion:** The prediction models of CLABSI for CRRT patients, developed based on the big healthcare data, not only had good judgment ability, but also had good application value for individual evaluations and the target population. **Funding:** This study was supported by the Health Commission of Sichuan Province.

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#### **Effectiveness of Stewardship Intervention for Urinary Tract Infections in Primary Care: A Difference in Differences Study**

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Adherence to 2011 Infectious Diseases Society of America (IDSA) guidelines for urinary tract infections (UTIs) remains low in primary care. Fluoroquinolones are commonly prescribed to treat uncomplicated cystitis, and most antibiotic prescriptions have durations that exceed current recommendations. We performed a difference-in-differences study to assess the effectiveness of a stewardship intervention in a family medicine clinic at an academic outpatient center from August 2016 to March 2019. During our intervention period, the FDA released 2 additional warnings about the side effects of fluoroquinolones. **Methods:** The study had 2 sites (intervention and comparison) and 3 periods: baseline, before the intervention, and the intervention. During the first 2 years, we obtained baseline data and performed interviews (preintervention period) exploring provider prescribing decisions for cystitis at both sites. During the intervention period at the intervention site only, we presented an educational lecture including an overview of the IDSA guidelines, definitions for various UTI syndromes and actual clinical examples, and instruction on use of a decision aid. During the audit and feedback phase, providers were contacted once per month in person or by phone to provide follow-up on whether their treatment decision adhered to the IDSA guidelines. We performed a log-binomial regression analysis of the primary outcome, adherence to the IDSA guidelines for management of uncomplicated cystitis, both to antibiotic choice and duration of therapy. **Results:** We performed 156 audit-and-feedback sessions with 13 providers during the intervention period (March 2018–2019). Patients in both sites were similar in terms of age and Charlson comorbidity index. Adherence to the guidelines for antibiotic choice and duration increased in the intervention period at both sites (Fig. 1). The treatment of cystitis in the intervention period of the intervention site was 11.5 times (95% CI, 6.1–21.6) as likely to be guideline-adherent as the treatment in the baseline period of the comparison site (Fig. 2). **Conclusions:** Adherence to IDSA guidelines for the choice of antibiotic and duration increased in both intervention and comparison sites. Even though the intervention site started with higher compliance, improvement was also greater in the