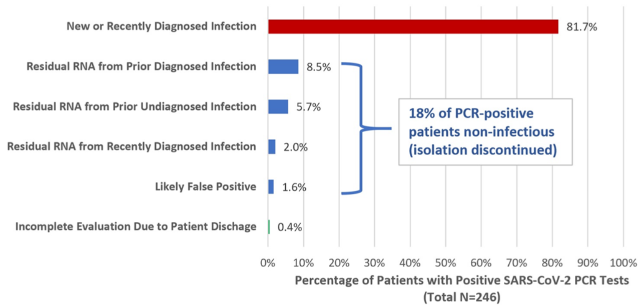
Figure 2. Assessments of Positive SARS-CoV-2 RT-PCR Tests in Hospitalized Patients



assessments of SARS-CoV-2 RT-PCR tests by infection control practitioners using clinical data, Ct values, repeat tests, and serologies can safely validate the release many patients from isolation and thereby conserve resources and facilitate patient care.

Funding: No
Disclosures: None

Antimicrobial Stewardship & Healthcare Epidemiology 2021;1(Suppl. S1):s8–s9
doi:10.1017/ash.2021.15

Presentation Type:
Poster Presentation - Top Poster Award
Subject Category: COVID-19

Model Input and Optimization: Improving the Speed and Accuracy of Our COVID-19 Hospitalization Forecasts

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Background: During the COVID-19 pandemic, public-health decision makers have increasingly relied on hospitalization forecasts that are routinely provided, accurate, and based on timely input data to inform pandemic planning. In North Carolina, we adapted an existing agent-based model (ABM) to produce 30-day hospitalization forecasts of COVID-19 and non–COVID-19 hospitalizations for use by public-health decision makers. We sought to continually improve model speed and accuracy during forecasting. **Methods:** The geospatially explicit ABM included movement of agents (ie, patients) among 104 short-term acute-care hospitals, 10 long-term acute-care hospitals, 421 licensed nursing homes, and the community in North Carolina. Agents were based on a synthetic population of North Carolina residents (ie, >10.4 million agents). We assigned SARS-CoV-2 infections to agents according to county-level susceptible, exposed, infectious, recovered (SEIR) models informed by reported COVID-19 cases by county. Agents' COVID-19 severity and probability of hospitalization were determined using agent-specific characteristics (eg, age, comorbidities). During May 2020–December 2020, we produced weekly 30-day forecasts of intensive care unit (ICU) and non-ICU bed occupancy for COVID-19 agents and non–COVID-19 agents statewide and by region under a range of SARS-CoV-2 effective reproduction numbers. During the reporting period, we identified optimizations for faster results turnaround. We evaluated the incorporation of real-time hospital-level occupancy data at model initialization on forecast accuracy using mean absolute percent error (MAPE). **Results:** During May 2020–December 2020, we provided 31 weekly reports of 30-day hospitalization forecasts with a 1-day turnaround time. Reports included (1) raw and smoothed 7-day average values for 42 model output variables; (2) static visuals of ICU and non-ICU bed demand and capacity; and (3) an interactive Tableau workbook of hospital demand variables. Identifying code efficiencies reduced a single model runtime from ~100 seconds to 28 seconds. The use of cloud computing reduced simulation runtime from ~20 hours to 15 minutes. Across forecasts, the average MAPEs were 21.6% and 7.1% for ICU and non-ICU bed demand, respectively. By incorporating hospital-level occupancy data, we reduced the average MAPE to 6.5% for ICU bed demand and 3.9% for non-ICU bed demand, indicating improved accuracy. **Conclusions:** We adapted an ABM and continually improved it during COVID-19 forecasting by optimizing code and computing resources and including real-time hospital-level occupancy data. Planned SEIR model updates for enhanced forecasts include the addition of compartments for undocumented infections and recoveries as well as permission of reinfection from recovered compartments.

Funding: No
Disclosures: None

Antimicrobial Stewardship & Healthcare Epidemiology 2021;1(Suppl. S1):s9
doi:10.1017/ash.2021.16

Presentation Type:
Poster Presentation - Top Poster Award
Subject Category: COVID-19

Retrospective Study on Personal Protective Equipment During Pandemic Link to Outbreak of Carbpenem-Resistant Enterobacteriace

Kenisha Evans; Jennifer LeRose; Angela Beatriz Cruz; Lavina Jabbo and Teena Chopra

Background: In 2019, according to the Centers for Disease Control and Prevention, carbapenem-resistant Enterobacteriaceae (CRE), had cost the lives of >35,000 patients, particularly the most virulent plasmid-mediated New Delhi metallo-β-lactamase (NDM). Although healthcare systems normally have strict surveillance and infection control measures for CRE, the rapid emergence of novel SAR-CoV-2 and COVID-19 led to a shortage of personal protective equipment (PPE) and medical supplies. As a result, routine infection practices, such as contact precautions, were violated. Studies have shown this depletion and shift in resources compromised the control of infections such CRE leading to rising horizontal transmission. **Method:** A retrospective study was conducted at a tertiary healthcare system in Detroit, Michigan, to determine the impact of PPE shortages during the COVID-19 pandemic on NDM infection rates. The following periods were established during 2020 based on PPE availability: (1) pre-PPE shortage (January–June), (2) PPE shortage (July–October), and (3) post-PPE shortage (November–December). Rates of NDM per 10,000 patient days were compared between periods using the Wilcoxon signed rank-sum test. Isolates were confirmed resistant by NDM by molecular typing performed by the Michigan State Health Department. Patient characteristics were gathered by medical chart review and patient interviews by telephone. **Results:** Overall, the average rate of NDM infections was 1.82 ±1.5 per 10,000 patient days. Rates during the PPE shortage were significantly higher, averaging 3.6 ±1.1 cases per 10,000 patient days (P = .02). During this time, several infections occurred within patients on the same unit and/or patients with same treating team, suggesting possible horizontal transmission. Once PPE stock was replenished and isolation practices were reinstated, NDM infection rates decreased to 0.77 ±1.1 per 10,000 patient days. **Conclusion:** Control of CRE requires strategic planning with active surveillance, antimicrobial constructs, and infection control

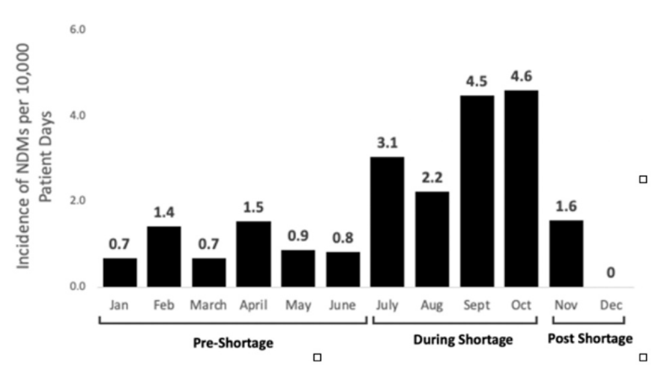

Figure 1.

measures. The study illustrates that in times of crisis, such as the COVID-19 pandemic, the burden of effective infection control requires much more multidisciplinary efforts to prevent unintentional lapses in patient safety. A swift response by the state and local health departments at a tertiary-care healthcare center conveyed a positive mitigation of the highest clinical threats and decreased horizontal transmission of disease.

Funding: No
Disclosures: None

Antimicrobial Stewardship & Healthcare Epidemiology 2021;1(Suppl. S1):
doi:10.1017/ash.2021.17

Presentation Type:
Poster Presentation - Top Poster Award
Subject Category: COVID-19

A Cluster of Aspergillosis Associated with SARS-CoV-2

Kerrie VerLee; Jim Codman; Russell Lampen; Chau Nguyen; Tunisia Peters; Greg Kruse; Derek VanderHorst; Doreen Marcinek and Molly Kane-Carbone

Background: Coronavirus disease 2019 (COVID-19) has demonstrated a variety of presentations and clinical complications, among them coinfection of pneumonia with the mold *Aspergillus* spp. Patients at risk for invasive disease include transplant recipients and those with prolonged neutropenia, immune disorders, cystic fibrosis, and steroid use. There have been recent descriptions of coronavirus disease–associated pulmonary aspergillosis (CAPA). An outbreak investigation into a cluster of *Aspergillus fumigatus* infections in a health system intensive care unit uncovered a community-onset (CO) increase in CAPA. **Methods:** A multidisciplinary outbreak investigation was conducted evaluating sources of contamination, completion of construction projects, and changes in clinical processes. Retrospective chart review was done for the prior 18 months and incidence density rates for *Aspergillus* infections from June 2019 through December 2020 were calculated per 10,000 patient days, stratified by unit, specimen source, and coinfection with COVID-19. Data were linked with all positive and negative COVID-19 tests performed by the health system's regional laboratory from March to December 2020. Healthcare-onset (HO) classification was based on infections identified ≥7 days after admission. Statistical analysis was calculated with significance at $p < 0.05$. **Results:** Over the last 18 months, 82 patients were identified positive with *Aspergillus* cultures; of which 10 (12%) met CAPA definitions. *Aspergillus fumigatus* was the most common species and accounted for 62% of samples, followed by *Aspergillus niger* (17%). Median rates of HO *Aspergillosis* were 0.45 cases per 10,000 patient days, whereas the median total rates of infection were 1.97 cases per 10,000 patient days. Rates of CAPA coincided with COVID-19 hospitalization rates. In the spring and fall, surges of COVID-19, the rate ratio of CAPA to COVID hospitalized infections per 10,000 patient days, ranged from 0.006 to 0.015. Once CAPA infections were adjusted for, rates of CO *Aspergillus* remained high, whereas HO cases suggested baseline acquisition. **Conclusion:** This study outlines rates of CO aspergillosis as well as CAPA rates coinciding with the healthcare system's spring and fall surges of COVID-19 hospitalizations. Despite the determination that this was not a hospital-acquired cluster, the investigation revealed some areas for opportunity in construction processes along with maintaining coverage of all patient supplies to reduce the risk of contamination.

Funding: No
Disclosures: None

Antimicrobial Stewardship & Healthcare Epidemiology 2021;1(Suppl. S1):s10
doi:10.1017/ash.2021.18

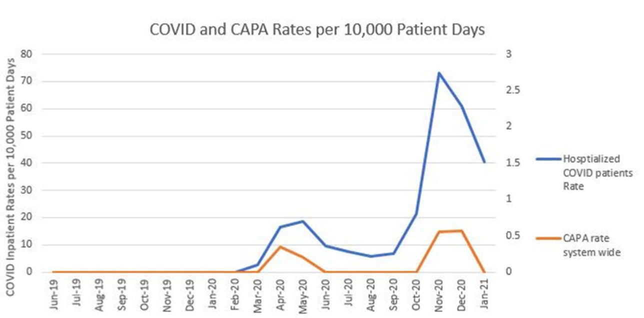

Figure 1.

Presentation Type:
Poster Presentation - Top Poster Award
Subject Category: COVID-19

Molecular Epidemiology of Large COVID-19 Clusters at an Academic Medical Center, March–October 2020

Takaaki Kobayashi; Miguel Ortiz; Stephanie Holley; William Etienne; Kyle Jenn; Oluchi Abosi; Holly Meacham; Lorinda Sheeler; Angie Dains; Mary Kukla; Alexandra Trannel; Alexandre Marra; Mohammed Alsuhaibani; Paul McCray; Stanley Perlman; Bradley Ford; Daniel Diekema; Melanie Wellington; Alejandro Pezzulo and Jorge Salinas

Background: COVID-19 in hospitalized patients may be the result of community acquisition or in-hospital transmission. Molecular epidemiology can help confirm hospital COVID-19 transmission and outbreaks. We describe large COVID-19 clusters identified in our hospital and apply molecular epidemiology to confirm outbreaks. **Methods:** The University of Iowa Hospitals and Clinics is an 811-bed academic medical center. We identified large clusters involving patients with hospital onset COVID-19 detected during March–October 2020. Large clusters included ≥10 individuals (patients, visitors, or HCWs) with a laboratory confirmed COVID-19 diagnosis (RT-PCR) and an epidemiologic link. Epidemiologic links were defined as hospitalization, work, or visiting in the same unit during the incubation or infectious period for the index case. Hospital onset was defined as a COVID-19 diagnosis ≥14 days from admission date. Admission screening has been conducted since May 2020 and serial testing (every 5 days) since July 2020. Nasopharyngeal swab specimens were retrieved for viral whole-genome sequencing (WGS). Cluster patients with a pairwise difference in ≤5 mutations were considered part of an outbreak. WGS was performed using Oxford Nanopore Technology and protocols from the ARTIC network. **Results:** We identified 2 large clusters involving patients with hospital-onset COVID-19. Cluster 1: 2 hospital-onset cases were identified in a medical-surgical unit in June 2020. Source and contact tracing revealed 4 additional patients, 1 visitor, and 13 employees with COVID-19. Median age for patients was 62 (range, 38–79), and all were male. In total, 17 samples (6 patients, 1 visitor, and 10 HCWs) were available for WGS. Cluster 2: A hospital-onset case was identified via serial testing in a non–COVID-19 intensive care unit in September

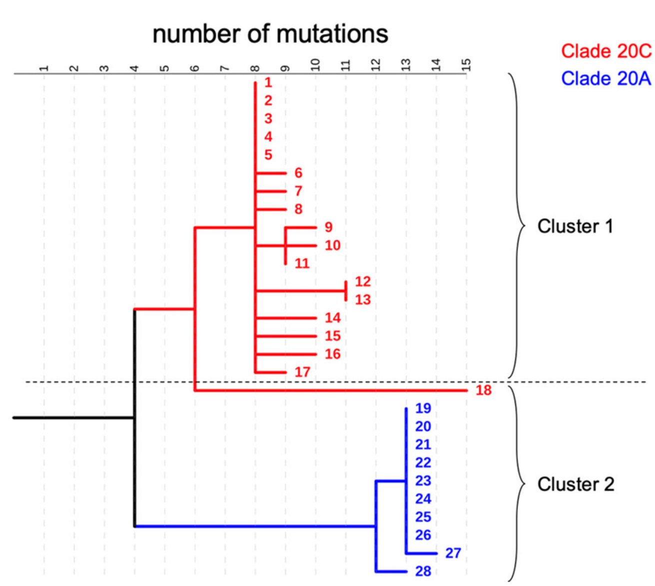

Figure 1.