Antimicrobial Stewardship News
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IDWeek 2022: Highlighted DCASIP Research and Abstracts

This newsletter will highlight some of the research coming out of the Duke Center for Antimicrobial Stewardship and Infection Prevention by summarizing the IDWeek 2022 abstracts presented. Overall there were 3 oral presentations and 16 poster presentations. None of these projects could have been possible without the collaboration and partnership of many of you.

The presentations reviewed in this newsletter can be found on the DCASIP website.

Oral Abstracts

Hospital COVID-19 Burden Impact on Inpatient Antibiotic Use Rates
Dodds-Ashley E, Lokhnygina Y, Doughman D, Foy KR, Nelson AD, Dyer A, Jones TM, Johnson MD, Davis A, Advani S, Cromer A, Mavrogiorgos N, Daniels LM, Marx AH, Kalu I, Sickbert-Bennett E, Spires SS, Anderson DJ, Moehring RW

We performed a longitudinal analysis of Antibiotic Use (AU) data from 30 southeast US hospitals. AU was collected for all antimicrobial agents and specific subgroups: broad spectrum (NHSN group for hospital-onset infections), CAP (ceftriaxone, azithromycin, levofloxacin, moxifloxacin, and doxycycline), and antifungal. Monthly COVID burden was defined as all patient days attributed to a COVID admission. Three pandemic phases (1: 3/20-6/20; 2: 7/20-10/20; 3: 11/20-2/21) were compared to baseline (1/2018-1/2020). We observed increases in all antimicrobial use and agents for CAP during the first two pandemic phases. Increased use of the broad-spectrum agent category was seen in the first pandemic phase only. Use for all categories was not significantly different from baseline in any phase for antifungals and none of the agent groupings in the third phase despite that being the time period with the highest spike in COVID cases. When adjusting for surgical volumes, Charlson comorbidity index, seasonality and time since 2018, changes in hospital AU observed during the first year of COVID pandemic appeared unrelated to COVID burden and may have been due to indirect pandemic effects (e.g., case mix, healthcare resource shifts). This may reflect our ability to effectively implement treatment guidelines encouraging providers to avoid antibiotics in these cases of viral pneumonia. This merits further investigation to guide ongoing stewardship efforts.

Cumulative Antibiotic Exposure and Risk for Candidemia
Dougherty J, Turner NA, Yarrington ME, Spires SS, Moehring RW, Alexander BD, Park LP, Johnson MD

Numerous studies have identified broad-spectrum antibiotic use as a risk factor for invasive candidiasis, but few studies have evaluated how duration of therapy and spectrum of exposure impact risk. We used antibiotic spectrum indexing, survival analysis, and multivariable Cox proportional hazard regression, to characterize the depth and breadth of antibiotic exposure among adults hospitalized at Duke University Health System from 2016 through 2021. Patients who developed candidemia were more likely to have been exposed to broader spectrum antibiotics, and candidemia does occur sooner in patients exposed to a broader spectrum. Unexpectedly, this study does not provide evidence that broad-spectrum antibiotic exposure lies on the causal pathway to candidemia. The findings from this single-center, retrospective cohort study highlight important limitations in prior studies and emphasize the complexity of describing this classical association between antibiotics, the microbiome and invasive Candida infection.

Efficacy of shortened high-level disinfection (HLD) protocols for GI duodenoscopes with disposable tips used for endoscopic retrograde cholangiopancreatography (ERCP)

Warren BG, Muralidharan S, Brown HS, Barrett A, Graves AM, King C, Mohammed FS, Triplin C, Anderson DJ, Seidelman J, Smith BA, Dufault D

We conducted a prospective observational study at Duke University Health System on the contamination of Pentax duodenoscopes with disposable tips used for endoscopic retrograde cholangiopancreatography (ERCP). We evaluated an abbreviated cycle of one manual wash (MW) followed by one high-level disinfection (HLD) cycle compared to a pair of MW-HLD cycles. Each study scope was sampled after one MW-HLD cycle, and again after a 2nd MW-HLD cycle. Microbiological cultures were assessed for any bacterial flora as well as C. difficile, Gram-negatives, and Enterococci spp. and included: 1) The elevator tab, 2) elevator channel distal opening, 3) composite duodenoscope tip, 4) the elevator channel. In total, 46 duodenoscopes were included resulting in 92 sample events and 368 total samples. After one MW-HLD cycle, 19 of 46 (41%) duodenoscopes remained contaminated, including 5 (11%) with VRE. After two MW-HLD cycles, 11 (24%) remained contaminated and 0 (0%) with VRE (p=0.08, 0.02, respectively). Results were similar at the sample location level (p=0.03, 0.01, respectively). Our data demonstrate that 1 MW-HLD cycle is insufficient at decontaminating duodenoscopes with disposable tips but do support the use of two MW-HLD cycles as VRE was identified after one MW- HLD cycle, but not after two MW-HLD cycles.

Posters

Implementation of a Clinical Decision Support Panel for Urine Culture Ordering

Yarrington ME, McClellan F, Dunkerson T, Reynolds SS, Polage CR, Smith BA, Seidelman J, Lewis SS, Advani SD

We conducted a pre-post intervention study within the Duke University Health System after clinical decision support (CDS) was incorporated into urine culture order entry in the electronic health record. The CDS provided education about indications for culture and prompted catheter removal or exchange prior to specimen collection when catheters were identified to be present > 7 days based on hard-coded EHR logic. Analysis revealed a significant decrease in urine culture orders (1.1% decrease/month) and antibiotic use for UTI indications (2.8% decrease/month), but no significant change in CAUTI rates. Evaluation of the safety reporting system revealed no apparent increase in safety events.

Performance of urinalysis parameters in predicting significant bacteriuria: Making the case for a population-specific approach to diagnostic stewardship

Advani SD, Turner NA, Schmader KE, Wrenn R, Moehring RW, Polage CR, Vaughn V, Anderson DJ

In this 6-year retrospective review of 221,933 paired UA and urine cultures from three NC hospitals, we found that low-level pyuria (WBC≥5) or trace leukocyte esterase may be adequate as single criterion in reflex urine culture (RUC) algorithms. The high NPV ≥ 0.90 of pyuria was maintained among most patient age and sex subgroups with the exception of females ≥65 and patients with indwelling catheters. RUC algorithms should include clinical decision support and or education to target symptomatic patients. Lastly, laboratories should validate these findings on their own data.

Antibiotic Use (AU) Adjustment by Infection-Related Patient Volume Across a Health System

S. Shaefer Spires, MD, Elizabeth Dodds Ashley PharmD, MHS, Travis M. Jones, PharmD, April P. Dyer, PharmD, Melissa D. Johnson, PharmD, MHS, Alicia Nelson, MPH, Deverick J. Anderson, MD, MPH, Christine Zurawski, MD, Todd Parker, MD, Ouida Corry-Wiggins, PharmD, Melina Diaz, MD, Moiz V. Master, MD, Rebekah W. Moehring, MD, MPH, Angelina Davis, PharmD, MS.

We performed a retrospective analysis of hospital administrative data from 8 hospitals from a single health system in DASON that all use the same coding department, in the calendar year 2020. In order to adjust AU based on the burden of infection diagnoses at the facility level, primary ICD-10 codes were determined infectious (I-PDX) vs non-infectious by

coding department. We then used the proportion of infectious primary diagnosis codes to adjust the denominator of the AU rate of the facility (DOT/1000 patient days) creating a novel denominator, infectious patient days. There was a notable difference in ranking of the hospitals when ordering them by DOT/1000 patient days vs DOT/Infectious patient days x 1000. We also ranked them using infectious encounters. These metrics provide an example of a parsimonious adjustment of AU using patient level data already collected at any facility. Future optimization might include indirect standardization using PDX categories and other patient level factors readily collected.

Cost-Avoidance Associated with Active Stewardship of Remdesivir

Dyer A, Locklear E, Okoye O, Dodds-Ashley E

The COVID-19 pandemic presented many challenges for antimicrobial stewardship programs. Many DASON hospitals had reduced stewardship staffing resources and programs were tasked with the additional workload of stewarding and distributing novel agents for the treatment of COVID-19, including remdesivir. UNC Health Southeastern (UNC HSE) maintained a strict remdesivir approval process of pharmacy-director review of patients to ensure they met EUA and guideline-based appropriateness criteria with the ID physician resolving any disputes throughout 2021. The goal of remdesivir stewardship at UNC Health Southeastern was to optimize care; however, the shift in workflow presented an unrecognized opportunity for stewards to reduce remdesivir costs. At UNC HSE, 28.1% of COVID admissions received remdesivir in 2020 and annual remdesivir expenditures were $693,680. In 2021, 47.45% of COVID-19 admissions received remdesivir and drug expenditures were $1,248,000. The DASON mean % of COVID admissions receiving remdesivir in 2020 was 44.08% and 60.07% in 2021. A total cost avoidance of $726,407 was calculated based on the hospital's below-benchmark use of remdesivir. This work highlights how dedicating hospital resources to consistently steward high-cost agents can result in significant cost-savings for an organization while ensuring patients receive appropriate, guideline-directed care.

Impact and Sustainability of Antimicrobial Prescribing Feedback with Peer Comparison to Hospitalists in a Community Hospital

Travis M. Jones, Kevin V. Patel, Amy L. Birkhimer, S. Shaefer Spires, Elizabeth Dodds Ashley

We presented antibiotic prescribing feedback with peer comparison using novel denominator metrics to hospitalists at Sovah Health Danville on five occasions between April 2018 and November 2021. These feedback reports included educational pearls for agents and disease states of interest to the stewardship team as well as antibiogram data. In addition, we shared alternative recommendations for select disease states based on locally developed guidelines. In total, 31 hospitalists received antibiotic prescribing feedback. In the month following feedback sessions, substantial reductions in targeted agent prescribing were observed, and facility-wide targeted agent use decreased 31% from 2017 to 2021.

Pandemic Hits: Evaluation of an Antimicrobial Stewardship Program Website for Hospital

Perez R, Yarrington M, Adams M, Davis A, Deri C, Drew RH, Smith M, Spivey J, Wrenn R, Moehring RW

Our ASP team directly maintained and edited an internal web application, Duke CustomID, to disseminate updated guideline, policy, and drug information during COVID-19. We aimed to describe website engagement and maintenance during the dynamic pandemic period by using web analytics to evaluate website page views and day requiring page edits throughout the course of the pandemic. Use of our site increased over time, and especially during surges. Our ASP's website was a highly utilized, practical tool for disseminating practice-changing information during the pandemic. An electronic reference customized for local practice and rapidly updated by ASPs offers critical support for front-line clinicians.

Utility of a Risk Assessment Model in Predicting 30-day Unplanned Hospital Readmission in Adult Patients Receiving Outpatient Parenteral Antimicrobial Therapy

Brenneman E, Funaro J, Dicks K, Yarrington M, Drew RH

We conducted a retrospective review of the OPAT patient population at Duke University Hospitals from July 2019 - February 2020 in order to identify patients at highest risk of unplanned 30-day readmission. We applied a readmission risk prediction model developed by Durojaiye and colleagues from the United Kingdom that identifies patients at high risk of readmission. Of 470 eligible OPAT patients, 20% had an unplanned readmission within 30 days of discharge, with 60% of the readmissions being directly related to OPAT. The DUHS cohort had significant differences from the UK cohort, with DUHS patients having more comorbidities, more deep-seated infections, longer durations of IV antibiotics, and different modes of OPAT. The UK model was not discriminatory for the DUHS patient population and could not predict risk of readmission. Further review is being conducted to identify risk factors for readmission within the DUHS population.

Measuring the Contamination of Transport and Emergency Ambulances and Emergency Medical Service (EMS) Providers

Graves AM, Schaps D, Isaacson J, Barrett A, King C, Warren BG, Anderson DJ

Healthcare-associated infection prevention is traditionally focused on stationary medical facilities; however, medical transports are not connected to an isolated medical facility but to many. Data on ambulance and EMS provider contamination and transmission are limited. We conducted a prospective observational study at two agencies in central North Carolina to determine the contamination of ambulances and EMS providers prior to a day shift and deemed ready for use, and after shift completion, but before disinfection. Our results showed there were more clinically important pathogens harbored pre-shift and ready for service, with 59% (59/100) of those CIPs harbored on EMS uniforms, and 70% (62/88) of new CIPs found post-shift were harbored on EMS uniforms. Our data demonstrate provider uniforms were contaminated upon arrival and ambulances were contaminated when deemed ready for service.

Impact of the COVID-19 Pandemic on Healthcare-Associated Infections (HAI) by Race and Ethnicity in a Large Network of Community Hospitals: A Call to Action

Gettler E, Kalu I, Advani SD, Seidelman J, Krishnan JR, Campbell M, Lewis SS, Smith BA, Anderson DJ

In efforts to evaluate the impact of the COVID-19 pandemic on HAIs among different racial and ethnic groups, we conducted a retrospective cohort analysis of prospectively-collected data on central line-associated bloodstream infections, catheter-associated urinary tract infections, and laboratory-identified *Clostridioides difficile* infections by race and ethnicity in a network of community hospitals in the southeastern United States from January 2019 to June 2021. We defined the COVID-19 pre-pandemic period from January 1, 2019 to February 29, 2020, and the pandemic period from March 1, 2020 to June 30, 2021. In our analysis, the highest number of CLABSI occurred in Black patients in both study periods, while the highest proportion of CAUTI and CDI occurred in White patients. The ratio of CLABSI counts among Black patients compared to White patients was 1.3 in the pre-COVID period, which significantly increased to 1.5 after the start of the pandemic. Similar trends were not observed for other HAIs. Patient safety events may differ across racial and ethnic groups and negatively impact health outcomes. Further investigation is needed.

Understanding the Impact of COVID-19 Pandemic on Central Line-Associated Bloodstream Infections (CLABSIs): Expanding Analysis to the Microbiologic Level

Krishnan JR, Dodds Ashley ES, Cromer A, Anderson DJ, Advani SD, Johnson MD

We compared CLABSI rates across 38 DICON hospitals between pre-pandemic (1/1/2018-3/30/2020) and pandemic periods (4/1/2020-12/31/2021) using pre-post statistics and segmented regression models. The mean monthly CLABSI rate per hospital increased from 0.63 to 1.01 per 1,000 central line days in the pandemic period, driven by increases in CLABSIs by *Candida*, coagulase-negative *Staphylococcus* (CoNS), and Enterococcal species. Upon regression modeling, we found that the COVID-19 pandemic was associated with substantial increases in CLABSIs, driven in part by *Candida* and *Enterococcus* species, though observed changes in CoNS and *E. coli* CLABSIs appear to have occurred independently

of COVID-19. Further study is needed to understand infection prevention and patient-specific factors that might explain these trends by organism.

Comparison of Trends in Hospital-Onset Bloodstream Infections (HOBSIs) and Central Line Associated Bloodstream Infections (CLABSIs) across a Three-Hospital Health System in the COVID Era

Krishnan JR, Gettler E, Campbell M, Kalu I, Seidelman J, Smith BA, Lewis SS

Hospital-onset bloodstream infection (HOBSI) incidence has been proposed as a complementary quality metric to central line-associated bloodstream infection (CLABSI) surveillance, but data regarding the correlation between the two metrics is limited. We used both pre-post statistics and regression analysis to compare incidence of HOBSIs and CLABSIs between a pre-pandemic and pandemic period at a three-hospital health system (Duke University Hospital System). The median monthly HOBSI rate per patient days increased in the pandemic period, whereas median monthly CLABSI rates per both central line days and patient days were stable. Our regression analysis found that monthly rates of HO-BSIs increased over time (which appeared to occur independently of COVID-19), while no changes in monthly CLABSIs rates were observed with respect to time or the COVID-19 pandemic. Thus, HOBSIs rates did not correlate with CLABSI incidence across a three-hospital health system from 2017 and 2021, and more study is needed to understand HOBSI as a potential quality metric.