2151. Accuracy of Physician Adjudication of Infection in Patients with Systemic Inflammatory Response Syndrome (SIRS)

Morgan Walker, MD[1]; Diana Hamer, PhD[2]; Mandi Musso, PhD[3]; Catherine O'Neal, MD[4]; Christopher Thomas, MD[5] and Hollis O'Neal Jr., MD, MSc[6]; [1]Internal Medicine, LSU Health Baton Rouge, Baton Rouge, Louisiana, [2]Our Lady of the Lake Regional Medical Center, Baton Rouge, Louisiana, [3]Our Lady of the Lake, Baton Rouge, Louisiana, [4]Infectious Diseases, Lousiana State University Health Sciences Center, Baton Rouge, Louisiana, [5]Pulmonary and Critical Care Medicine, LSUHSC Baton Rouge Internal Medicine, Baton Rouge, Louisiana, [6]Pulmonary and Critical Care Medicine, Louisiana State University Health Sciences Center, Baton Rouge, Louisiana

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Background. The definition of sepsis evolves with improved understanding of the pathophysiology, but the presence of infection remains essential for the diagnosis. Despite this fact, there are currently no universal objective definitions for infections, which increases the variability in sepsis diagnoses. This variation makes interpretation of diagnostic studies, therapeutic interventions, and prognostic tools challenging. In this study, we compared physician adjudication of infection to standardized definitions of infection in patients meeting two of four Systemic Inflammatory Response Syndrome (SIRS) criteria.

Methods. In a prospective observational study performed in two academic medical centers, patients with two of four SIRS criteria were enrolled in Emergency Departments from February 2016 to December 2016. Diagnostic and physiologic data were abstracted for 151 patients at admission. Each medical record was independently reviewed by one Emergency Medicine and one critical care (CC) physician from a 10-member adjudicating committee to determine the presence of infection. In the case of disagreement, a third CC physician served as the tiebreaker. Objective definitions of infection were derived from consensus surveillance definitions.

Results. Overall, both adjudicators and the objective definitions agreed on the presence of infection 93% of the time and on the absence of infection 82.7% of the time. Of the patients adjudicated as indeterminate or not infected, eight and 13 met one objective definition of infection, respectively. The greatest discordance between physician adjudicated infection and objective definitions occurred in pneumonia patients (Table 1).

	Physician Adjudication		
Objective definition of infection	Infected	Indeterminate	Not infected
Not infected	4	11	62
Infected (*Pneumonia*)	53	8 (5)	13 (4)
Total	57	19	75

Conclusion. Implicit to the definition of sepsis is the presence of infection. Therefore, standardized methods of defining infections are necessary to decrease the variability in diagnoses and allow comparability among clinical trials. The application of objective definitions could prove to be a reproducible and reliable foundation for use by clinical investigators.

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2152. Epidemiology and Clinical Outcomes of Contemporary, Third-Generation Left Ventricular Assist Device (LVAD) Infections

Todd E. Hershberger, PharmD[1]; Keith S. Kaye, MD, MPH[2]; Carol Chenoweth, MD, MS, FSHEA, FIDSA[2]; Lindsay Petty, MD[2]; Simona O. Butler, PharmD, BCPS[1]; Angela M. Clark, PharmD, BCPS[1]; Gregory Eschenauer, PharmD, BCPS[1]; Owen Albin, MD[3]; Francis D. Pagani, MD, PhD[1] and Twisha S. Patel, PharmD, BCPS[1]; [1]Michigan Medicine, Ann Arbor, Michigan, [2]Internal Medicine, Division of Infectious Diseases, Michigan Medicine, Ann Arbor, Michigan, [3]Division of Infectious Diseases, University of Michigan, Ann Arbor, Michigan

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Background. Infection is a common complication following implantation of an LVAD. The purpose of this study was to characterize the epidemiology and clinical outcomes of infections in patients who received the HeartWare LVAD, a newer intra-pericardial device.

Methods. Adult patients with a HeartWare LVAD implanted between 2009 and 2017 at Michigan Medicine were screened for inclusion. LVAD-associated infection was defined using INTERMACS criteria. Patients were followed from device implantation to either infection, death, heart transplantation, device exchange, or last known follow-up to date. Exclusions included implantation of a right-sided VAD, alone or in combination with an LVAD. The primary outcomes were the incidence of LVAD-associated infections per 1,000 device days and per 100 person-years.

Results. Of the 183 patients included, 43 (23.5%) developed an LVAD-associated infection with incidence rates of 0.39 infections per 1,000 device days and 14.3 infections per 100 patient years. The median time to infection was 305 days (IQR, 172–581). *Staphylococcus* spp. (26%) and *Streptococcus* spp. (20%) were the most common causative pathogens identified. The results of a univariate analysis for infection are shown in Figure 1. There were no statistically significant differences in all-cause mortality (40% vs. 17%, *P* = 0.08) and incidence of heart transplantation

(19% vs. 34%, *P* = 0.09) between those with infection and those without infection; the number of hospital readmissions were more common in patients with infection (median, 4 vs. 2, *P* < 0.01).

Conclusion. LVAD-associated infection remains a major complication among recipients of the HeartWare LVAD, with about one-quarter of patients developing infection over time despite improved device design. Infection contributes to the increased hospitalizations seen in this population.

Figure 1. Comparison of Baseline Characteristics Between Patients with LVAD-Associated Infections and Non-Infected Patients

	Infected (n=43)	Non-infected (n=140)	P-value
Age[1]	59 (50-67)	57 (44-63)	0.01
Sex, Male[2]	34 (79)	104 (74)	0.69
Caucasian[2]	33 (77)	111 (79)	0.83
INTERMACS Profile[3]	2.9±0.7	2.5±1.0	0.02
Bridge to Transplant[2]	25 (58)	80 (57)	>0.99
Ischemic Cardiomyopathy[2]	21 (49)	58 (41)	0.52
Diabetes[2]	22 (51)	38 (27)	0.01
Previous Sternotomy[2]	14 (33)	30 (21)	0.16
Antibiotic Prophylaxis[2]	22 (51)	58 (41)	0.49
Device Days[1]	305 (172-581)	490 (263-905)	0.02

[1]median (interquartile range) [2]number (%) [3]mean±SD

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2153. Impact of Norovirus Testing Changes on Hospital-Acquired Norovirus Infections

Josephine Fox, MPH, BSN, RN, CIC[1]; Neil Anderson, MD, ABP-MM, D(ABMM)[2]; Lydia Grimes, MSN, BS, CIC[1]; Rebecca Rojek, MPH[1]; Helen Wood, RN, BSN, MA, CIC[1] and Hilary Babcock, MD, MPH[3]; [1]Infection Prevention, Barnes-Jewish Hospital, Saint Louis, Missouri, [2]Clinical Microbiology Laboratory, Washington University School of Medicine, Saint Louis, Missouri, [3]Washington University School of Medicine, St Louis, Missouri

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Background. Norovirus is highly contagious and can spread rapidly through healthcare facilities. Controlling transmission of norovirus infections can be challenging. Early diagnosis allows for infection prevention measures to be implemented in a timely manner. The objective of this study was to determine the effect of decreasing barriers to norovirus testing on hospital-acquired (HA) cases.

Methods. A before-after study was conducted evaluating the impact of increasing the availability of norovirus testing on HA infections. From January 1, 2012 to October 16, 2017, all norovirus tests required the approval from the laboratory medicine resident, and testing was performed once a day. A polymerase chain reaction (PCR) system that required a two-step process was used. On October 17, 2017, the laboratory began using a PCR that performs testing in one step, allowing the laboratory to perform testing more frequently. Approval of the laboratory medicine resident was no longer required. HA norovirus rates and percent of positive test pre and post-implementation were compared using chi-square analysis. HA cases were defined as patients admitted without signs or symptoms of norovirus infection on inpatient units. A Mann–Whitney *U* test was used to compare the average of HA infections per cluster pre and post-implementation. A cluster was defined as two or more associated cases. No other infection prevention interventions were implemented during this time frame.

Results. After implementation of the new testing methodology, there was no difference in percent of positive norovirus test between the study periods [9.4% (46/487) pre-implementation vs. 6.9% (11/160) post-implementation, *P* = 0.16]. The proportion of norovirus infections that were HA increased slightly after implementation [37% (17/46) pre-implementation vs. 55% (6/11) post-implementation, *P* = 0.16]. There was no difference in HA norovirus infections associated with a cluster between the study periods [3.6 cases/cluster pre-intervention vs. 2.5 cases/cluster post-intervention, *P* = 0.86]

Conclusion. There was no significant difference in the number of HA norovirus cases with improved testing availability. A limitation to this study is the short length of the post-implementation evaluation period compared with the pre-implementation period.

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2154. How Well Are We Estimating the True Burden of Acute Gastroenteritis? Validation of Acute Gastroenteritis-Related ICD Codes in Pediatric and Adult U.S. Populations

Talia Pindyck, MD, MPH[1]; Aron J. Hall, DVM, MSPH[2]; Jacqueline Tate, PhD[2]; Cristina V. Cardemil, MD, MPH[2]; Anita Kambhampati, MPH[3]; Mary E. Wikswo, MPH[4]; Scott Grytdal, MPH[2]; Daniel C. Payne, PhD, MSPH[4]; Umesh D. Parashar, MBBS, MPH[2] and New Vaccine Surveillance Network and SUPERNOVA Network; [1]Division of Viral Diseases, CDC, Atlanta, Georgia, [2]Division of Viral Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia, [3]IHRC, Inc.,

contracting agency to the Division of Viral Diseases, Centers for Diseases Control and Prevention, Atlanta, Georgia, Atlanta, Georgia, [4]Centers for Disease Control and Prevention, Atlanta, Georgia

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Background. International Classification of Diseases (ICD) diagnostic codes from acute gastroenteritis (AGE)-associated medical encounters are used for AGE disease burden estimates, yet the validity of AGE-related ICD codes in both pediatric and adult populations is unknown. We estimated the validity of AGE-related diagnostic codes in these populations using two different multi-regional AGE active surveillance platforms.

Methods. Diagnostic codes, demographic and clinical characteristics, and stool pathogen results from AGE-associated medical encounters were obtained for enrolled children <5 years old from seven sites in NVSN from December 1, 2011 to June 30, 2016, and for adult Veterans in four sites from SUPERNOVA from December 1, 2016 to February 28, 2018. SUPERNOVA also enrolled age- and time-matched non-AGE controls. Using AGE cases from the active surveillance networks, sensitivity and specificity of AGE ICD codes were estimated overall and stratified by age and health care setting using exact binomial tests.

Results. ICD codes were collected from 14,952 enrolled children <5 years old with AGE, and 625 enrolled adults (525 AGE cases and 100 controls). The sensitivity of all-cause AGE codes in children was 54% (9,127/14,952, 95% confidence interval [CI] 54–55%), and in adults was 54% (283/525; 95% CI 50–58%), with a specificity of 100% (100/100; 95% CI 97–100%). Stratified analyses demonstrated higher sensitivity of all-cause AGE codes in children in the inpatient as compared with outpatient setting: 59% (417/675; 95% CI 57–61%) vs. 53% (934/1827; 95% CI 52–54%). In adults, this trend was reversed; all-cause AGE codes had a higher sensitivity in the outpatient as compared with the inpatient setting: 72% (50/69; 95% CI 60–83%), vs. 51% (233/456; 95% CI 46–56%), respectively.

Conclusion. Across two different AGE active surveillance platforms, one enrolling only children and one enrolling only adults, the estimated sensitivity of all-cause AGE ICD codes were similarly low. This suggests that current national estimates for AGE disease burden may be underestimating the true burden of AGE pathogens in the United States, and emphasizes the importance of active, prospective surveillance.

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2155. Elevated Temperature Results in Earlier Diagnosis of Infectious and Inflammatory Postoperative Complications

Elias Baied, DO[1]; Jennifer Paruch, MD[2]; Urmila Ravichandran, MS[3]; Frances Lahrman, DO[1]; Huma Saeed, MD[1]; Katherine Kaplar, DO[3,4]; Ronak Parikh, DO[3,4]; Eric Bhaimia, DO[1]; Rema Padman, PhD[5]; Jennifer Grant, MD[6]; Mark Talamonti, MD[2] and Nirav Shah, MD, MPH[7]; [1]Internal Medicine, University of Chicago (NorthShore), Evanston, Illinois, [2]Surgery, NorthShore University HealthSystem, Evanston, Illinois, [3]NorthShore University HealthSystem, Evanston, Illinois, [4]University of Chicago, Chicago, Illinois, [5]Healthcare Informatics, Carnegie Mellon University, Pittsburgh, Pennsylvania, [6]Infectious Disease, NorthShore University HealthSystem, Evanston, Illinois, [7]Infectious Diseases/Informatics, NorthShore University Health Systems, Evanston, Illinois
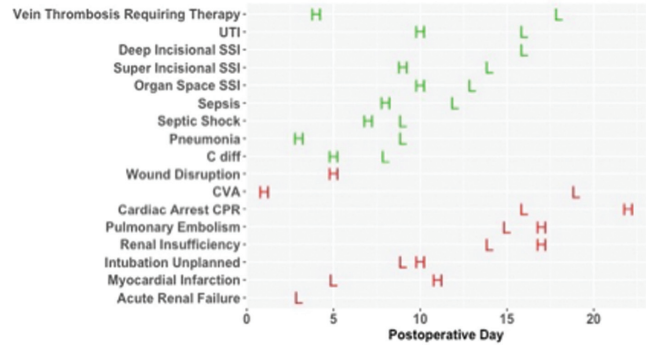
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Background. Medical students are taught that wind, water and wound complications occur at specific post-operative times. This may influence the timing of work-up for specific complications. The goal of this study was to investigate the relationship between post-operative temperature curve and time to diagnosis of inflammatory complications.

Methods. We reviewed patients who underwent pancreatectomy at an academic health system from January 2015–February 2018. Clinical data including complications were extracted using definitions set by the National Surgical Quality Improvement Program and temperature was extracted from the Data Warehouse. Time of diagnosis, as determined by labs, microbiologic cultures, radiology and procedures, was extracted for each complication. Group-based trajectory modeling, a technique used to identify distinct clusters of temperature trajectories of patients in the postoperative setting was used to group patients into low- and high-temperature trajectories.

Results. Among 195 patients who underwent pancreatectomy, 35.5% (69/195) experienced at least one complication within 30 days of surgery. Of the patients who developed complications, 49% (n = 34) and 51% (n = 35) were classified into the low and high temperature trajectory groups based on their temperature trajectory. For most individual inflammatory complications, time to diagnosis was later in the low rather than high temperature groups (Figure 1) and this was significant when averaging all inflammatory complications (12.7d low and 8.6d high; P = 0.002). Time to diagnosis tended to be later in the high rather than low temperature trajectory but this was not statistically significant when averaging all non-inflammatory complications (11.7d low and 11.9d high; P = 0.95).

Conclusion. We identified earlier diagnosis of inflammatory complications in patients with elevated temperature trajectories. There was no difference in timing of diagnosis for non-inflammatory complications. Temperature trajectory modeling may allow for earlier diagnosis of patients at high risk for inflammatory complications.

Figure 1. Time to diagnosis by low (L) and high (H) temperature trajectories.

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2156. Cyclical Continuum Modeling: A Process-Based Approach to Identifying and Quantifying Health Disparities in Patients with Serious Musculoskeletal Infections

Martha Carvour, MD, PhD[1]; Allyssa Chiu, DPM, MS[1] and Kimberly Page, PhD, MPH, MS[1]; [1]University of New Mexico Health Sciences Center, Albuquerque, New Mexico

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Background. Complex infectious disease processes, including serious musculoskeletal infections, may result in differential health disparities at successive phases in a clinical course. Previously, our group proposed the application of cyclical continuum modeling to the study of these complex clinical processes.

Methods. Using a retrospective cohort of over 1,600 adult patients in the University of New Mexico Health System with serious musculoskeletal infections, including septic arthritis, osteomyelitis, and/or infectious myositis, we performed preliminary proof-of-concept cyclical continuum modeling analyses. The experiences of patients in different racial/ethnic groups were compared using a logistic regression model adjusted for age and sex. Outcomes in multiple categories were reviewed—primary risk factors for limb loss (e.g., diabetes mellitus and peripheral vascular disease), secondary risk factors for limb loss (e.g., osteomyelitis and multiple musculoskeletal infection types), and outcomes or complications of infection (e.g., sepsis, antibiotic use, and amputation). Preliminary cyclical visualization tools were used to demonstrate differences in health outcomes across racial/ethnic groups.

Results. Although significantly younger than other members of the cohort, American Indian/Alaskan Native patients (17.7% of cohort) had high odds of primary and secondary risk factors yet low odds of amputation. Hispanic patients (40.2% of cohort) tended to have high odds of primary and secondary factors as well as amputation. Black non-Hispanic patients (2.6% of cohort) had high odds of primary risk factors and low odds of osteomyelitis, yet Black non-Hispanic patients were most likely to undergo an amputation. Initial cyclical visualization techniques showed promise for comparing the relative distribution of racial/ethnic disparities across the clinical course.

Conclusion. Health disparities encountered by patients with serious musculoskeletal infections may be studied using a process-based approach. Future development of cyclical continuum modeling methods should focus on applications of both relative and absolute epidemiological measures and cyclical visualization methods.

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2157. Design, Implementation, and Analysis Considerations for Cluster Randomized Trials in Infection Control and Hospital Epidemiology: A Systematic Review

Lyndsay O'Hara, PhD, MPH[1]; Natalia Blanco, PhD, MPH[1]; Surbhi Leekha, MBBS, MPH[1]; Kristen Stafford, PhD, MPH[1]; Gerard Slobogean, MD, MPH[2] and Anthony Harris, MD, MPH[1]; [1]Department of Epidemiology and Public Health, University of Maryland School of Medicine, Baltimore, Maryland, [2]Orthopaedics, University of Maryland School of Medicine, Baltimore, Maryland

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Background. A cluster randomized trial (CRT) is a comparative study in which clusters or groups rather than individuals are randomized to interventions or treatments. CRT are being utilized with increasing frequency in the study of interventions in infection control and hospital epidemiology. The aims of this study were (1) to identify critical design, implementation, and analysis principles to consider when planning a CRT of interventions in the healthcare setting and (2) to review published CRT in infection control and hospital epidemiology and synthesize key characteristics of these published studies using the principles identified above.