The critical role of clinical informatics in addressing the global threat of antibiotic resistance, emerging infectious diseases, and healthcare acquired infections

Courtney Hebert, MD, MS[1], Nirav Shah, MD, MPH[2], Juan D. Chaparro, MD[1,3], Ari Robicsek, MD [4], Keith F. Woeltje, MD, PhD[5]
[1]The Ohio State University, Columbus, OH; [2] NorthShore University HealthSystem, Evanston IL, [3]Nationwide Children's Hospital, Columbus, OH, [4]Providence St. Joseph Health Renton, WA, [5]BJC HealthCare, St. Louis, MO

Panel Description:

Panel members: Courtney Hebert, Nirav Shah, Juan Chaparro, Ari Robicsek
Moderator: Keith Woeltje. Dr. Woeltje is the Vice President and Chief Medical Information Officer for BJC HealthCare. In addition, he is a Professor in infectious diseases at Washington University.

Background: The Centers for Disease Control (CDC) recently released a report on the global and ongoing threat of antimicrobial resistance (1), highlighting the need for urgent intervention. In the United States alone, there are over 2.8 million antibiotic resistant infections each year, leading to more than 35,000 deaths (1). These infections include bacteria resistant to our broadest spectrum antibiotics as well as infections that spread in the community and in the hospital at least partly due to over use of antibiotics (e.g., *Clostridium difficile*). The CDC report highlights the need to take meaningful steps towards combating this issue, and argues that new antibiotics are not the way forward. Instead we need to detect infections earlier, prevent the spread of infections, and develop innovations to prevent antibiotic resistance.

In clinical informatics we are uniquely positioned to create and support novel interventions that make a direct impact to the safety and health of our patients, and by doing so help to combat this societal threat of antimicrobial resistance.

Objective: The objective of this panel is twofold. First, four infectious disease physicians who work in the field of clinical informatics, will give brief (10 minute) presentations describing novel informatics interventions focused on healthcare associated infections, over-prescription of antibiotics, and global infectious disease threats. Second, the moderator will lead an interactive discussion with the panelists and participants to determine gaps and future directions at the intersection of infectious diseases and informatics.

Presentation 1:
Bringing geographic information systems (GIS) methodology into the hospital to address healthcare associated infections (HAI)

Presenter: Courtney Hebert is an Infectious Diseases attending and assistant professor in the department of Biomedical Informatics at the Ohio State University.

Description of the problem: Many of the most concerning antibiotic resistant infections such as multidrug resistant Acinetobacter and *Clostridium difficile* are primarily threats to hospitalized

patients. These bacteria can be passed between patients, their environment, and healthcare providers. Infection preventionists (IPs), working within the hospital system, are charged with tracking these infections, identifying potential outbreaks or clusters of infections, investigating the potential causes, and recommending interventions. Although there are multiple electronic tools now to help IPs better perform surveillance, they are limited in their ability to investigate the complex interaction of factors that can be associated with a hospital outbreak. GIS has been used in the field of public health to investigate outbreaks, but has not traditionally been used in indoor environments. **The objective of this talk is to discuss the use of GIS within the hospital setting to address HAI.**

Description of the talk: At the Ohio State University, a transdisciplinary group of collaborators is applying tools and methods from the field of geography and human factors research to the investigation of HAI outbreaks, specifically *Clostridium difficile.* The team is combining room and patient level data with data on patient movements throughout the hospital to identify areas of the hospital at increased risk of transmission. The ultimate goal is to create an interactive tool for IPs to use in outbreak investigation. Dr. Hebert will discuss the team's experience applying GIS to a hospital environment, including issues with generalizing these methods to other healthcare settings. GIS has long been used to investigate outbreaks in the field of public health but there are unique challenges and opportunities when leveraging these methods within the hospital setting.

Presentation 2:
Using predictive analytics and clinical decision support to identify the right antibiotic at the right time for the right patient

Presenter: Nirav Shah is an Infectious Diseases attending and the Medical Director of Quality Innovation and Clinical Practice Analytics at NorthShore University HealthSystem and a clinical assistant professor at the University of Chicago Pritzker School of Medicine

Description of the problem: Antibiotic selection in the empiric window, prior to culture results, is a fine balancing act. Early provision of appropriate antibiotics improves survival of patients with infections. Clinicians often prescribe broad-spectrum antibiotics to ensure adequate coverage but overuse of broad-spectrum therapies has been associated with increasing antimicrobial resistance. The goal is to find the "goldilocks" of antimicrobial therapy. Predictive analytics may be able to identify an adequate regimen for individual patients while limiting the spectrum of therapy. While such tools hold great promise, to date their use to impact care and reduce antimicrobial resistance is limited.

Description of the talk: At NorthShore University HealthSystem (NorthShore) researchers have developed a tool entitled the weighted incidence syndromic combined antibiogram (WISCA) to predict the optimal empiric antibiotic regimen for multiple infectious syndromes. In the ANSWER study, researchers at NorthShore implemented the WISCA tool prospectively with the goal of improving antimicrobial selection and patient outcomes. This talk will cover: results of the ANSWER trial and challenges of implementing WISCA prospectively; the development of a novel clinical decision support tool to provide WISCA at the point-of-care; future work on using

predictive analytics and clinical decision support systems to impact appropriate antimicrobial usage.

Presentation 3:

The role of EHRs in controlling the spread of global infectious diseases threats

Presenter: Juan Chaparro is an Infectious Diseases Faculty and Physician Informaticist at Nationwide Children's Hospital

Description of the problem: As evidenced by the 2014 Ebola outbreak and subsequent cases in the United States, many health care systems found themselves ill-equipped to identify and isolate potential cases of emerging infectious diseases. Although travel and symptom screening through the electronic health record (EHR) is becoming more prevalent, this decision support is often created at the local level and often lags behind outbreak notifications and best practices.

Description of the talk: We will discuss current efforts to create effective decision support to address emerging infectious diseases in an expedited manner. Organizations such as Centers for Disease Control and Prevention and the World Health Organization regularly release notices of emerging infectious diseases and outbreaks relevant to providers, but these remain the domain primarily of travel and infectious disease specialists. This talk will cover existing resources and decision support for outbreak notifications, as well as a potential model to disseminate such decision support in the future.

Presentation 4:

Stories from the trenches – implementing ID-related Clinical Decision Support in the EHR

Presenter: Ari Robicsek is an Infectious Disease physician and Chief Medical Analytics Officer at Providence St Joseph Health, a 50-hospital health care system on the West Coast of the US.

Description of the problem: The advent of Electronic Health Records promised improved methods for directing clinicians to 'do the right thing' through the use of Clinical Decision Support Systems. These have proven challenging to implement well in real world settings.

Description of the talk: The talk will cover experiences with several different Clinical Decision Support Systems in real world settings. These include: a tool for assisting surgeons in assessing whether postoperative fever likely represents infection; EHR-based syndromic surveillance to assist primary care physicians in differentiating influenza from bacterial infection; academic detailing around the use of antibiotic-impregnated bone cement based on EHR-collected usage and outcomes data; pop-up alerts aimed at improving *Clostridium difficile* infection detection.

References:

(1) Centers for Disease Control and Prevention (2019). ANTIBIOTIC RESISTANCE THREATS IN THE UNITED STATES. [online] Available at: https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf [Accessed 3 Dec. 2019].