Testimony for the of the United States Committee on Science, Space, and Technology

Subcommittee on Research and Technology

June 26, 2014

On behalf of Riley Hospital for Children at IU Health, let me begin by thanking you for your continued commitment to improving patient safety by focusing on hospital acquired infections (HAIs). For more than 85 years, Riley Hospital at IU Health has been one of the nation's leading children's hospitals. In fact, Riley was once again distinguished this year as the only nationally ranked children's hospital in Indiana by *U.S. News & World Report*. Each year, Riley provides care, support and comfort to 215,000 inpatients and outpatients from across Indiana, the nation and the world. Part of Indiana University Health, Riley enjoys a unique partnership with the Indiana University School of Medicine, giving our highly skilled physicians access to innovative treatments using the latest research and technology.

I am sure you are quite familiar with the statistics on HAIs: CDC estimates that there are 2 million infections every year in the United States with 100,000 attributable deaths. Every day, 1 out of every 25 patients in the US has a hospital acquired infection, resulting in at least 7.5 million excess hospital days and 3-10 times increase in length of stay. The conservative cost estimate is $5-6 billion for direct costs and total costs calculated by the National Nosocomial Infection Surveillance System (NNIS) could range from $30-100 billion per year. Whether the HAI is due to a blood or urinary catheter infection, surgical site infection, ventilator associated pneumonia, or clostridium difficile (c. difficile) from antibiotic therapy, there is tremendous cost to patients and families beyond any of the dollar figures noted above. Every day in America, families suffer from preventable events during hospitalization. Last spring, there was a newborn at our facility who had undergone heart surgery. His 3 year old brother was being cared for by extended family so that the parents could be at the bedside of their critically ill baby. All week, the parents had been promising big brother that they would come home on the weekend and take him to the zoo so he could spend time with them. Two days before the scheduled visit home, the baby got a central line associated bloodstream infection. He decompensated giving his parents more sleepless nights of fear and continued time away from the older child. The ripples felt by our patients due to these events are significant and have long lasting effects far beyond one admission.

The keystone in fighting infections has always been prevention. Vaccines have changed the practice of infectious diseases since the first endeavors by Edward Jenner and smallpox. Further advancements in infection prevention in the hospital occurred in 2006 with the Michigan Keystone project led by Drs. Berenholtz and Pronovost and their colleagues. By describing what is commonly known as the "the bundle"—a series of easy interventions used in combination that can decrease infection risk—and linking it to traditional prevention efforts such as hand hygiene and isolation, hospitals have succeeded in decreasing their HAI rates by 55-65%. At Riley, we have employed the bundle and since 2007, have decreased our central line associated bloodstream infection rate by close to 70% and have been steady at that rate for the last 3 years. And while these foundational pieces of care can never be abandoned, we appear to have reached a plateau on prevention with these techniques alone. There is a multitude of factors that contribute to our inability to further prevention: endogenous flora, human factors including non-compliance, recovery time, and need for ongoing devices to support life-saving technologies that have changed the face of medicine in America.

Our only other defense is a reactive position—to treat infections once they have already set up. While antibiotics have been critical over the last century to treat infectious diseases, their use has stimulated the development of multidrug resistant organisms. While this is not a new problem, considering methicillin resistance was first described in 1968, one year after the drug was introduced to the market, the rate of resistance development has been accelerated. This is directly due to antibiotic overuse and there is not a single antibiotic that has shown the ability to avoid resistance. While research continues, there is agreement by all parties that there are not enough antibiotics in the drug pipeline to effectively battle organisms like methicillin resistant staphylococcus aureus, vancomycin resistant enterococcus, vancomycin resistant staphylococcus aureus, and c difficile. These organisms are prominent players in HAIs occurring in about 16% of cases. These infections account for 20% longer length of stay and 30% increased costs over infections without resistance and the resultant mortality is high. Our current strategies of antimicrobial stewardship and isolation practices have slowed development and spread of resistance but have not eradicated it and the CDC considers MDRO infections as an emerging threat to United States healthcare.

In light of all these factors and the knowledge that many microbes come from the translocation of one's own bacterial flora, we need additional weapons in our arsenal to thwart the infections that pose significant danger to our hospitalized patients. To do that, we will need to consider new and innovative approaches to infection prevention that, although will not replace our traditional strategies, can potentially augment them and take us to the next level from where we are currently plateaued. UV light and metal coatings such as copper and silver have been used as disinfectants in water and on surfaces for years and their success has been clear. If we can take these technologies and look for additional clinical applications for patients, more infections could be prevented which would have additional downstream effects to slow the development of resistance. For example, the use of nanoparticle metal ions could be used to coat implantable devices in patients. These charged ions would act like a sword, piercing the cell membrane of organisms that land on the devices looking for an opportunity to cause infection. Once pierced, the cell becomes incapable of replication and dies, thereby disallowing infection to set up. Advantages over antimicrobial impregnated devices include no loss of activity over time since the antibiotic effect wanes over a period of weeks and no contribution to the development of resistance. Device related infections are major cause of morbidity and mortality as well as cost in surgical site infections. For infections such as spinal fusions, ventriculoperitoneal shunts (VPS), and cardiac repairs, the potential benefits are significant. If we take the case of one VPS infection, infection can go right into the central nervous system, an area where it could do massive damage. Management requires 2 surgeries and generally 3 or more weeks of antibiotics in the hospital for therapy. Opportunities to prevent the spread of infection up the catheter and across the valve into the central nervous system could potentially protect brain function in our most vulnerable of patients.

Despite the fact that the germ theory was described by Pasteur in the mid-19th century and the Institute of Medicine first published the *To Err is Human Report* in 1999, we continue to struggle with HAIs and their effects on the patients who trust us to care for them. Healthcare costs are severely and negatively impacted by infections that to a large degree should be preventable. To make further strides in our war on germs, we need to support new technologies permitting us to turn our resources toward other initiatives to meet our patients' needs and, above all, do no harm.