Stopping sepsis in its tracks

by Susan Cantrell, ELS

Sepsis, a serious condition that arises from the body's response to infection, can cause tissue damage, organ failure, and death.

According to the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project, sepsis is the leading cause of deaths in U.S. hospitals, at a cost of $23,663,000.[1] The Sepsis Alliance website notes that 1.6 million people are diagnosed with sepsis every year, one every 20 seconds. Some 258,000 sepsis patients die every year, one every 2 minutes, which is more than prostate cancer, breast cancer, and AIDS deaths combined.[2] Sepsis also accounts for the highest number of hospital readmissions, 12 percent, with each readmission costing approximately $10,070.[3]

The disconnect

Despite these staggering figures, only 55 percent of adults have ever heard of sepsis.[2] Clearly, there is a disconnect. However, upon closer examination, the disconnect is understandable.

Sepsis can be elusive, because its symptoms may be mistaken for other ailments. Pat Parks, MD, PhD, Medical Director, 3M Critical and Chronic Care Solutions Division, commented, "Unlike other more common conditions or diseases, sepsis does not present with its own uniquely distinguishable set of symptoms, making it hard to identify. Sepsis presents with nonspecific findings—such as increased breathing rate or altered mental status—that mimic the symptoms of other diseases." For that reason, noted Parks, "Sepsis often escapes early attention."

Stephen Claypool, MD, Medical Director, Wolters Kluwer Clinical Software Solutions, explained further, "Sepsis is always precipitated by another infection. There is no single lab test that identifies sepsis. Instead, it's a judgement based on multiple clinical factors, and it's subjective. This has led to experts agreeing on a diagnosis less than 30 percent of the time,[4] thus complicating an adequate understanding of the true sepsis death toll.

"Although mortalities from infectious illnesses usually originate from sepsis, it's rarely listed as the primary cause of death," noted Claypool. He said that the Iwashyna study found that "physicians document sepsis less than 10 percent of the

> **"Unlike other more common conditions or diseases, sepsis does not present with its own uniquely distinguishable set of symptoms, making it hard to identify. Sepsis presents with nonspecific findings — such as increased breathing rate or altered mental status — that mimic the symptoms of other diseases."**
>
> *Pat Parks, MD, PhD, Medical Director,*
> *3M Critical and Chronic Care Solutions Division*

time, which severely limits accurate communication to patients and families,"[4] and that is yet another reason why sepsis does not get the recognition it merits.

Similar comments from BD's Patrick Murray, PhD, Senior Director of Worldwide Scientific Affairs, Medical Affairs, drove home the fact that sepsis needs to be documented on patient records and death certificates. "The public knows about people who have infections such as meningitis, pneumonia, urinary tract infections, or skin infections caused by "flesh-eating bacteria, but they don't know that the serious complication of these infections is caused by the bacteria circulating in the blood.

KenSci's SaaS platform integrates data across EMR, claims, and digital health data.

What is missing is attributing the serious complications of these infections to the systemic spread of the organisms. If the medical community would document this (e.g., death due to meningitis complicated by sepsis) then the level of awareness of this problem would increase."

Another interesting observation came from Greg McKelvey, MD, MPH, Head of Clinical Insights, KenSci, who noted that, while necessary, care from multiple clinicians who are responsible for different aspects of the patient's health may contribute to the oversight of a developing sepsis infection. "Ironically, I think the fact that sepsis is so common contributes to its relative invisibility. Because it is everywhere, no one truly 'owns' it. Unlike diseases confined to a single organ system or population, there is often a diffusion of responsibility at a health-systems level, with tragic consequences."

Claypool concluded, "Lastly, unlike other serious conditions, there are no major quality health-improvement initiatives and few public campaigns to increase sepsis awareness. Without adequate physician recognition, physician agreement, and public campaigns, the public doesn't learn about sepsis."

Sepsis and readmissions

Sepsis is not one of the four medical conditions currently tracked by the Centers for Medicare and Medicaid Services for readmissions, but perhaps it should be added. Since pneumonia, heart failure, heart attack, and chronic obstructive pulmonary disease (COPD) have been tracked, with subsequent penalties levied on medical facilities, their numbers have dropped. Sepsis is more prevalent and more costly than any one of these four conditions.

The Mayr study, published in *JAMA*, showed that "sepsis accounts for 12.2

70-2011-6942-5

percent of readmissions, followed by 6.7 percent for heart failure, 5 percent for pneumonia, 4.6 percent for COPD and 1.3 percent for heart attack. ... Sepsis also costs more. The estimated average cost per readmission for sepsis was $10,070, compared to $9,533 for pneumonia, $9,424 for heart attack, $9,051 for heart failure and $8,417 for COPD."[3]

These numbers call for better understanding of the relation between hospital-acquired infections (HAIs), sepsis, and readmissions. Murray, BD, explained the connection: "It is well-known that a medical stay in the hospital can be complicated by an HAI. This is logical, because there is increased exposure of debilitated patients to organisms circulating in the hospital environment. In many cases, these infections lead to longer periods of hospitalization and associated increased costs. In other cases, the infections may not be identified until after the patient leaves the hospital, resulting in readmissions. If these hospital-acquired infections are serious, leading to sepsis, then the medical complications, as well as associated costs, can rapidly increase."

Parks, 3M, cited the importance of being alert to the possibility of sepsis arising, so that treatment can be started quickly. He also talked about the patient's health status as a contributing factor to the risk of developing sepsis. "Hospital-acquired infections (HAIs) occur in nearly 20 percent of patients," said Parks. "Infections become especially dangerous and can lead to sepsis when they aren't diagnosed and treated immediately. This is more likely to happen during treatments, such as chemotherapy, that suppress the immune system, reducing the patient's ability to respond to infection."

Claypool, Wolters Kluwer, added that patients who have survived sepsis are left with lingering complications, making readmission more likely. "Hospitalized, seriously ill patients often undergo surgeries and procedures, have catheters and needles inserted, and are prescribed medicines that increase susceptibility to HAIs, which can lead to sepsis," said Claypool. "Additionally, discharged sepsis patients leave more deconditioned, more susceptible, and more prone to thirty-day readmissions than any other condition."[5]

McKelvey, KenSci, described the relation between HAIs, sepsis, and readmissions as a vicious cycle. "While the most common path would be HAI leading to sepsis, leading to readmission, each outcome can be the cause or consequence of the other two. Each can be a marker of both patient complexity and quality lapse. The connection is not so much 'line between dots' as it is a vicious cyclic blur."

Fighting back

The best-case scenario for sepsis is not to let it get a toehold in the first place. Prevention is always better than a cure. Best practices, coupled with the appropriate product or technology, is a good place to start.

Parks' policy is to be proactive rather than reactive. "The key to preventing sepsis is to start as far upstream as you can. To be successful at reducing infection risks, health systems need to use a three-pronged approach that relies on highly trained and committed people, implementing policies that incorporate industry standards, and using evidence-based technology."

Parks described a few best practices and products useful in preventing sepsis. "3M offers a range of products to help support facilities' efforts to make prevention a priority from the beginning, noted Parks. "This begins with proper surgical hand antisepsis, including the use of 3M Avagard (chlorhexidine gluconate 1% solution and ethyl alcohol 61%, w/w) Surgical and Healthcare Personnel Hand Antiseptic, followed by sterile gloves, as part of the recommended sterile barrier precautions.

"After eliminating the risk of transferring bacteria from the clinician's hands to the patient, it is critical to protect vascular-access catheters at all points of entry," said Parks. "3M Tegaderm CHG Dressings provide protection at the insertion site, helping to keep bacteria out while still providing a clear window for easy monitoring of the site. Parks also recommends 3M Curos Disinfecting Port Protectors, which "easily twist onto needleless connectors and male-Luer devices to help disinfect and protect ports on the catheter line from contamination."

3M Tegaderm CHG Dressings and Curos port protectors

Fortunately, best practices and the right products benefit not only patients but the facilities to which they are admitted. "Reducing risk of infection early in the course of a treatment can help to avoid sepsis in many patients, which translates to thousands of dollars saved," emphasized Parks. "According to a 2016 *JAMA Internal Medicine* study review, putting $100,000 toward infection prevention can translate to $315,000 in savings."[6]

According to Murray, "BD is committed to assisting the global healthcare community address the healthcare and financial burden associated with sepsis by promoting best practices in blood culturing and offering proven performance in the diagnosis of sepsis through use of BD BACTEC FX Series Automated Blood Culture Instrument and BD BACTEC Blood Culture Media.

"Fundamental for the diagnosis of sepsis is detection of the bacteria circulating in the blood through the use of blood cultures; that is, growth of the organisms in nutrient culture media," stated Murray. "BD has a long history of blood-culture technology, with one of the first automated instruments to allow detection of bacteria and fungi in blood. Over the years, BD has continued to refine the instruments and culture media to allow highly sensitive, automated detection of these pathogens. This work is complemented by the development of identification of organisms by mass spectrometry and use of automated platforms for antimicrobial-susceptibility tests. Ultimately, these technologies—blood culture, microbial identification, and antimicrobial-susceptibility tests—will allow us to guide the physicians' selection of the most appropriate antibiotic for treating a septic patient."

Selection of the appropriate antibiotic affects the patient's health and the facility's bottom line, explained Murray. "In the absence of blood cultures, the physician will tr-eat the patient suspected to be septic with potent, broad-spectrum antibiotics. Although this is appropriate because an untreated septic patient may rapidly deteriorate, the use of empiric antibiotic therapy is frequently ineffective and exposes the patient to unnecessary antibiotic toxicities. The timely isolation and identification of the pathogen and ability to select the most appropriate antibiotic therapy has been documented to improve outcomes and decrease the need for extended hospitalizations and associated costs. It is to achieve these goals that our product-development efforts aspire."

KenSci focuses on prevention of sepsis by means of information technology. McKelvey described how it works. "Our technology, KenSci platform, is a software platform that integrates huge amounts of diverse healthcare data using machine learning, to uncover the signals hidden within that are too subtle or complex for a human acting alone to detect. By uncovering these patterns in sources such

INFECTION PREVENTION
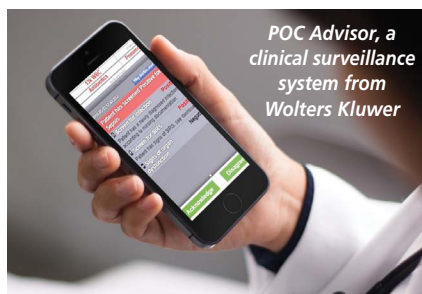
POC Advisor, a clinical surveillance system from Wolters Kluwer

as demographics, vital signs, care history, laboratory tests, etc, the algorithms are able to predict outcomes, such as impending sepsis, that we, as care providers, often struggle to anticipate. So, rather than waiting for a condition to announce itself as an emergency, the trend toward a risky outcome is identified with enough time to act proactively instead of reactively."

This ability to react proactively and quickly can save costs. "Sepsis is the single most expensive primary diagnosis in U.S. hospitals," said McKelvey. "The annual inpatient costs alone for sepsis are over 20 billion dollars. By predicting sepsis risk with high accuracy and timeliness, health systems can target the right care for the right patients at the right time."

Wolters Kluwer's POC Advisor also relies on information technology. Claypool described its advantages. "POC Advisor is a clinical surveillance system that uses real-time prescriptive analytics to identify sepsis in its earliest stages, which is crucial to a patient's survival. Once sepsis is identified, the system sends evidence-based alerts and patient-specific treatment advice to providers at the point of care. By improving sepsis identification and early treatment, POC Advisor not only improves patient outcomes, but also sepsis documentation," said Claypool.

Claypool referred to a study he coauthored with Manaktala,[7] published last year, demonstrating how POC Advisor reduced one hospital's sepsis mortality by 53 percent and 30-day readmissions by 30 percent. "Most importantly," added Claypool, "the alerts achieved unparalleled sensitivity and specificity rates of 95 percent and 82 percent, respectively, meaning clinicians can trust the advice they receive and won't experience alert fatigue."

Claypool also talked about financial advantages of using POC Advisor. He said the data from the Manaktala and Claypool study[7] showed that changes in sepsis documentation may increase revenue by $434,775 per 1,000 cases. "Early treatment of sepsis also has a positive effect on length of stay (LOS), which can significantly reduce costs, especially given that septic patients are most often treated in intensive care, where an extended LOS is most expensive."

On the horizon

Healthcare Purchasing News asked the experts for their opinions on what we can expect to see in sepsis solutions in the future. Murray, BD, believes "The most immediate need is the ability to predict which hospitalized patient is at increased risk of developing sepsis. Although nonspecific biomarkers, such as procalcitonin, C-reactive protein, or leukocyte counts, have been used, more specific markers of the host response to infections could be introduced. An additional need is timely detection and identification of the most common organisms responsible for sepsis. Here again, there have been technologies introduced over the past 10 years that do this, but they have proven to be slow, expensive, and inaccurate. However, a new generation of molecular tests is on the forefront and have been introduced by other in vitro diagnostics manufacturers over the last few years. It should be appreciated that these tests complement and do not replace the current gold standard of blood cultures."

Parks, 3M, also looks toward advances in technology, as well as increased education on sepsis. "Preventing sepsis will rely on integrating more advanced technology upstream, in an effort to diminish the occurrence of sepsis at the source. This includes protecting all points

BD BACTEC FX Series Automated Blood Culture Instrument

BD BACTEC Blood Culture Media Offering

of vascular-access catheter entry. Beyond that, broader education on symptoms of sepsis can enable a quicker process to diagnosis and treatment. Methods to provide earlier diagnosis of sepsis are under development and will represent a major advancement when they become available clinically."

"Technology can support process measures, like sepsis surveillance, with point-of-care alerting," stated Claypool, Wolters Kluwer. "However, most electronic surveillance systems fail to improve outcomes due to poor specificity, which leads to alert fatigue and ignorance of alerts. In fact, 49 percent to 96 percent of physician medication safety alerts are overridden because of alert fatigue."[8] Advanced decision-support systems that alleviate alert fatigue are challenging for healthcare systems to develop in-house. Thus, these facilities will need to turn to third-party vendors with appropriate resources to build more complex, accurate solutions."

McKelvey, KenSci, responded, "We are only at the beginning of the application of machine learning to problems like sepsis. I think in the next few years we will see the sophistication and utility of healthcare artificial intelligence increase dramatically, not just in terms of predictive accuracy but also in how it supports the process of care. The analogy I like to make is that medicine doesn't need the equivalent of self-driving cars, it needs Google Maps." **HPN**

Visit http://www.hpnonline.com/stopping-sepsis-tracks/ for references.