

Using Big Data to Prevent Infections

A SCALABLE HEALTH WHITEPAPER

SCALABLE
HEALTH



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BIG DATA ANALYTICS REDUCES INFECTIONS IN HOSPITALS

Healthcare-associated infections (HAIs) develop while patients are receiving medical treatment in a healthcare facility. They are a major yet often preventable threat to patient safety. Despite strict hygiene protocols within the healthcare setting, about 1 in 25 patients will develop an infection.

According to the CDC, more than 2 million patients contract a hospital-related infection annually. The most common HAIs are pneumonia, sepsis, urinary tract infection, and surgical site infection. HAIs are extremely dangerous to patients as their existing conditions may have left them with compromised immune systems. HAI detection can become difficult as symptoms often present that are similar to other common ailments. Treatment is often further complicated by drug-resistant strains and/or the patient's already compromised health.

Numerous conditions are contributing to an increased risk of contracting an HAI including longer hospital stays, surgical procedures, inadequate hygiene protocols, and overuse of antibiotics. In response, hospitals are combining traditional infection control practices with advanced data technologies to combat this problem.

Of the various HAIs, sepsis is the most pervasive, deadly, and expensive to treat.

Sepsis – Deadly and Expensive

Sepsis is a life-threatening condition that arises when the body's

response to infection injures its tissues and organs. As sepsis worsens, blood flow to vital organs such as the brain, heart, and kidneys becomes impaired. Patients with sepsis are at a higher risk of developing blood clots leading to varying degrees of organ failure and tissue death (gangrene).

Most people recover from mild sepsis, but the mortality rate for septic shock is nearly 50 percent. Patients with a history of sepsis are at a higher risk of future infections. Sepsis frequently arises in hospitals because it commonly stems from another medical condition – an infection in the lungs, urinary tract, skin, appendicitis, or as the result of invasive medical procedures (e.g., the insertion of a vascular catheter that introduces bacteria into the bloodstream).

The signs that a patient has system inflammatory response syndrome (SIRS), a precursor to Sepsis, can be difficult to diagnose, even in a hospital setting, because early manifestations often mimic other conditions. Common symptoms include fever, chills, rapid breathing and heart rate, rash, confusion, and disorientation. To diagnose sepsis, physicians must obtain historical, clinical, and laboratory findings indicative of infection and organ dysfunction. Chest x-rays or CT scans can also be used to identify infections.

According to estimates, over 2,00,000 patients die from Sepsis (systemic inflammation caused by severe infection) annually. The disease also results in longer and increased healthcare costs.

PREVENT SEPSIS AND IMPROVE EARLY RECOGNITION

● Improve health conditions.

George is a 72-year-old man with diabetes. During his check-up, George's healthcare provider takes the opportunity to strengthen his chronic disease care (glucose control and skin care), provide recommended vaccines, and share information about symptoms that indicate an infection is worsening or sepsis is developing.



Educate patients and their families ●



One month later, George has a cut on his foot that might be infected. He calls his healthcare provider, who tells him how to take care of the cut and signs of infection. Two days later, his foot is worse and he becomes short of breath, has clammy skin, and is more tired than usual. He recognizes symptoms are worsening and it could be sepsis. He seeks medical attention immediately.

● Think sepsis. Act fast.

At the hospital, a healthcare provider recognizes the signs and symptoms of sepsis. She immediately orders tests to determine the source of infection and starts appropriate treatment, including antibiotics. She documents the dose, duration, and purpose of antibiotics.



Reassess patient management ●



Healthcare providers closely monitor George's progress and adjust therapy as needed. When George improves, his providers transfer him to a rehabilitation facility to continue his recovery. The hospital care team discusses his treatment plan with the team at the new facility.

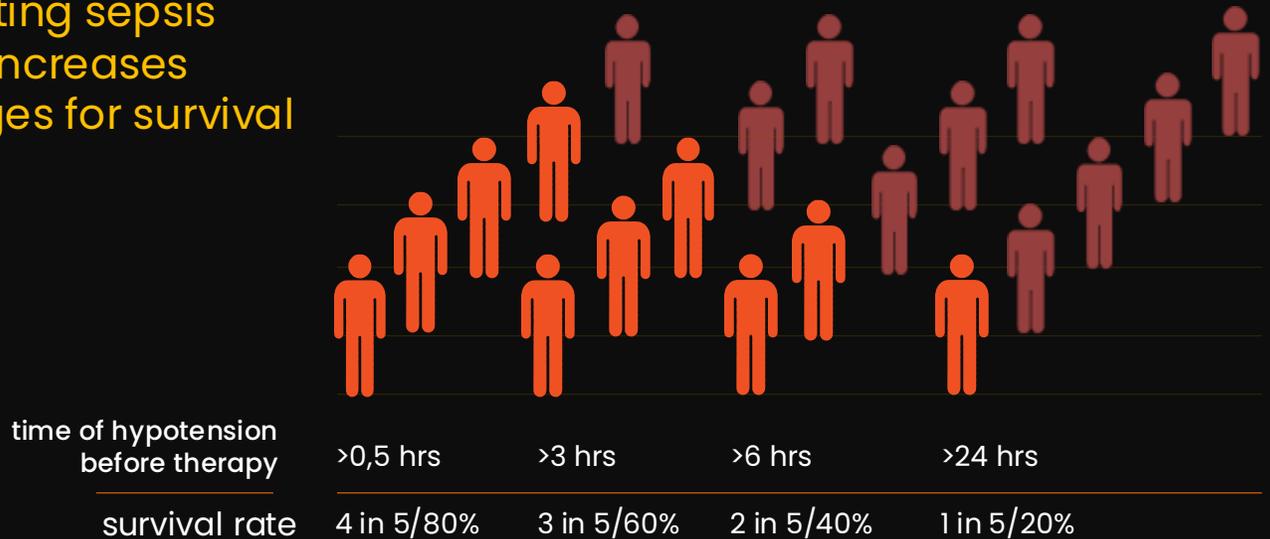
One of the most challenging aspects of sepsis is diagnosing it early to prevent health deterioration. Hospitals have been collecting infection data for decades and this data can offer actionable insights into prevention and care. Empowered with this information, doctors will be better equipped to identify and diagnose infections earlier. This allows for faster intervention before the patient becomes further compromised.

The average length of stay (LOS) of a hospitalized patient with sepsis is 75% longer than for those hospitalized for other ailments. Sepsis is the most expensive inpatient condition with an annual cost of over \$20 billion and representing more than 5% of inpatient costs.

Prevention and Early Intervention

According to Mayo Clinic – many doctors view sepsis as a three-stage syndrome starting with sepsis and progressing through severe sepsis to septic shock. The ideal scenario is to treat sepsis during its early stages before it becomes more dangerous.

Detecting sepsis early increases changes for survival



According to the CDC, the “surviving sepsis campaign” was an international effort organized by physicians that developed and promoted widespread adoption of practice improvement programs grounded in evidence-based guidelines. The goal was to improve the diagnosis and treatment of sepsis. Included among the guidelines were sepsis screening for high-risk patients; taking bacterial cultures soon after the patient arrived at the hospital; starting patients on broad-spectrum intravenous antibiotic therapy before the results of cultures are obtained; identifying the source of infection and taking steps to control it (e.g., abscess drainage); administering intravenous fluids to correct a loss or decrease in blood volume; and maintaining glycemic (blood sugar) control. These and similar guidelines have been tested by many hospitals and have shown potential for decreasing hospital mortality due to sepsis.

In addition, data analytics provides actionable insights into sepsis infection, intervention, and its impact on healthcare outcomes. Data analytics delivers crucial insights into sepsis, tracking infection patterns and impacts. This enables better disease communication, surveillance, and early detection, allowing providers to proactively identify and mitigate HAI risks.

Data reveals that handwashing, a fundamental prevention technique is poorly executed. 62% of men and 40% of women don't wash hands regularly, and 95% of those who do, do it incorrectly. Monitoring

handwashing and instrument cleaning improves sepsis prevention. Baseline compliance is 70%, but monitoring drives it above 90%.

The challenge with sepsis is early indicators are similar to many common ailments – fever, chills, respiratory difficulties – this sepsis may not be diagnosed early. To diagnose sepsis, physicians must obtain historical, clinical, and laboratory findings indicative of infection and organ dysfunction. According to AAFP – in septic shock, the initiation of antibiotic therapy within one hour increases survival; with each hour antibiotic therapy is delayed, survival is delayed by about 8%.

Wearables aid in early sepsis detection, particularly post-discharge. They transmit real-time vitals, enabling timely intervention and preventing organ failure and high mortality rates associated with septic shock.

Hospitals are now able to correlate real-time patient data from electronic health records with data indicating emerging environmental conditions to identify who is at risk and what is the best approach to mitigating the risk of infection. This information is added to the knowledge base of where and when an outbreak occurs and which care providers and other patients interacted with the sepsis patient to develop actionable insights into containing the outbreak.

BIG DATA AND RISK REDUCTION

Steps can be taken to control and prevent HAIs in a variety of settings. Research shows that when healthcare facilities, care teams, and individual doctors are aware of infection problems and take specific steps to prevent them, the rates of some targeted HAIs (e.g., CLABSIs) can decrease by more than 70 percent. Preventing HAIs is possible, but it takes a conscious effort from everyone – Clinicians, healthcare facilities and systems, quality improvement groups, and the federal government – working together towards improving care, protecting patients, and saving lives.

Amongst all HAIs, sepsis is the most life-threatening. By identifying patients at risk through population health analysis, care providers can then determine appropriate preventive care procedures to reduce the risk of sepsis. This is coupled with real-time monitoring of high-risk patients through wearables and aggregating patient data through EHRs and other test results from various departments within the hospital for greater care outcomes.

Sepsis is preventable. Big Data can help.....

Pediatric

RED FLAGS... Think SEPSIS!

Pediatric patients are at higher risk



$< 36^{\circ}\text{C}$
 $\geq 38.5^{\circ}\text{C}$

Core temperature



Increased respiratory rate



Inappropriate tachycardia

see PEWS chart



Altered mental state

Inc., sleepiness, irritability,
lethargy, floppiness



Prolonged capillary refill

(reduced skin perfusion)



Have a lower threshold of suspicion for:

Patients younger than 3 months,
chronic disease, recent surgery,
immunocompromised

Suspect Sepsis. Say Sepsis. Save someone's life today

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