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Combating Sepsis: A Public Health Perspective

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Abstract

Public health professionals and organizations have an opportunity to create a more comprehensive sepsis prevention strategy that spans the continuum of care and merges existing infection prevention strategies with chronic disease management and improved education on the signs and symptoms of worsening infection and sepsis. Recent public health efforts have improved our understanding of US national sepsis epidemiology and focused on increasing sepsis awareness. Additional opportunities and challenges include creating more integrated sepsis and infection prevention programs that encompass outpatient and inpatient care.

Keywords

sepsis; public health; epidemiology; prevention

Sepsis is defined as a syndrome of life-threatening organ dysfunction due to a person's dysregulated response to infection [1]. Practically speaking, it is the final common pathway for how infections cause death. Sepsis is a frequent cause of severe disease and death globally [2], and in the United States an estimated 1.7 million adult cases occur annually, contributing to 265 000 deaths each year [3]. This broad syndrome encompasses diverse presentations, such as a newborn in the neonatal intensive care unit with a group B streptococcal bloodstream infection, a 7-year-old hospitalized with severe influenza, a 60-year-old undergoing chemotherapy for lymphoma who acquires mucositis and multidrug-resistant gram-negative rod bacteremia, and an 80-year-old with severe pneumonia without an identified pathogen.

Public health organizations have worked for decades to track and prevent infections that can lead to sepsis and to reduce the burden of chronic diseases that increase the risk of sepsis. A growing recognition of sepsis burden has prompted state and national initiatives to improve and benchmark the quality of care within healthcare facilities. Public health professionals have the opportunity to go further, establishing a comprehensive approach to sepsis that

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extends beyond the hospital by integrating prevention, early recognition, treatment, and tracking of sepsis into public health initiatives.

NATIONAL TRENDS IN SEPSIS BURDEN

A thorough understanding of the burden and epidemiology of sepsis is essential to guide development of a comprehensive strategy for prevention and early recognition. Sepsis burden has been difficult to quantify because there is no definitive diagnostic test and sepsis diagnosis and identification can vary widely, even among critical care experts [4]. Previous estimates of the incidence of sepsis and the related mortality rate have relied on administrative coding and/or death certificates, with each approach presenting significant limitations [5] and resulting in a wide estimated mortality rate range [6]. To better inform policy makers, public health officials, clinicians, and the public, the Centers for Disease Control (CDC) Prevention Epicenters Program recently led a large collaborative study to measure national sepsis trends and burden, using objective clinical data obtained from the electronic health records of adult patients in 409 hospitals.

The clinical data used to identify patients with sepsis was adapted from the Sepsis-3 criteria, which relies on suspicion of infection and associated organ dysfunction, based on the sequential organ failure assessment (SOFA) score [3]. In contrast to previous estimates based on administrative coding data that have suggested increasing incidence and decreasing mortality rates, this study found no change in the incidence of adult sepsis and associated mortality rates from 2009 to 2014 [3]. The estimated adult prevalence of 1.7 million sepsis cases and contribution to 265 000 deaths falls within the broad range of previous estimates and confirms the immense public health impact of sepsis [3]. In March 2018, the CDC released its “Hospital Toolkit for Adult Sepsis Surveillance” [7], a document that contains specifications and guidance for hospitals using this validated approach to objectively track sepsis outcomes for internal quality improvement initiatives and measure the effectiveness of sepsis prevention efforts. This approach will allow healthcare facilities to innovate sepsis care using objective definitions of sepsis, rather than just strictly assessing adherence to sepsis protocols.

COMPREHENSIVE SEPSIS PREVENTION FRAMEWORK

Public health infection prevention efforts have been particularly effective when focused on specific pathogens or settings where transmission of pathogens are likely to occur (eg, vaccination, outbreak response, food safety, and prevention of healthcare-associated infections). However, the identity and source of the infection-causing pathogen are unknown in 30%-70% of patients with sepsis [8-10], which makes it more difficult to design specific infection prevention strategies. Primary prevention strategies that focus on chronic diseases or exposures that confer increased risk of infection are particularly important, and accounting for the immune response to severe infection is a crucial component in the development of sepsis [11]. Therefore, a sepsis prevention framework is needed that recognizes patient risk factors and prevention opportunities, before the onset of sepsis and before the patient presents to the hospital (Figure 1).

Sepsis prevention is already built into many public health interventions. Public health organizations play an important role in supporting programs that prevent infections or reduce infection risks. However, public health efforts can also help clinicians identify opportunities for preventing sepsis and educating patients about how to avoid infections that can lead to sepsis. Explicitly framing existing interventions and programs that reduce infections as providing the additional benefit of sepsis prevention would increase perceived value to patients and clinicians, especially in an era where there is growing public awareness of sepsis burden. For example, in a 65-year-old man with lung cancer undergoing chemotherapy and radiation who presents with sepsis due to influenza pneumonia, one can identify many missed opportunities for prevention of sepsis-related morbidity effects.

Such opportunities included smoking cessation to reduce the risk of lung cancer, annual vaccinations to prevent influenza and other infections, proper infection control practices during visits to healthcare providers to prevent transmission of influenza in the clinic, and early detection and treatment of influenza. To prevent morbidity effects in a child with sepsis due to *Salmonella* gastroenteritis, appropriate efforts would include a broad range of food safety steps, in addition to prompt identification and treatment of infection and sepsis in outpatient, urgent care, and emergency department settings.

BUILDING PARTNERSHIPS AND INCREASING AWARENESS

Strong partnerships among clinical professional organizations, patient advocacy groups, and public health organizations are critical to developing successful initiatives to increase sepsis awareness and early recognition among both patients and healthcare providers. In August 2016, a CDC *Vital Signs* report [12] highlighted the importance of integrating public health prevention efforts and sepsis. In September 2017, the CDC launched a national educational campaign, “Get Ahead of Sepsis”[13], which aims to raise awareness and knowledge about prevention, early recognition, and timely treatment of sepsis among the public and among healthcare providers. In addition, this campaign aligns with antibiotic stewardship efforts by emphasizing the importance of rapid appropriate antibiotic treatment when sepsis is suspected, reminding clinicians to reassess antibiotic therapy in 24-48 hours to adjust or stop therapy when additional clinical information is available.

FUTURE PUBLIC HEALTH OPPORTUNITIES AND CHALLENGES

Future public health initiatives should encompass the spectrum of sepsis, from prevention and early identification in the outpatient setting to treatment and management in the hospital and postsepsis care. To reduce the burden of sepsis, public health organizations should partner with clinical communities to create initiatives that prevent infections that can lead to sepsis and promote clinician knowledge about recommended early sepsis recognition and care. Prevention and early infection identification programs that span the spectrum of increasingly integrated outpatient and inpatient healthcare systems could prevent the onset of sepsis or reduce associated deaths. Antibiotic stewardship programs that reduce unnecessary antibiotic use could reduce the sepsis burden; studies have demonstrated that recent antibiotic exposure increases the risk of sepsis, an effect hypothesized to result from alterations in the microbiome [14].

Sepsis detection and treatment could be improved with the development of new diagnostic tools that could rapidly identify the causative organisms and guide more effective and specific antibiotic therapy. Such technologies would complement antibiotic stewardship efforts and reduce the risk of antibiotic resistance. New biomarkers that can rapidly predict the likelihood of sepsis and poor outcomes are also needed. As the treatment of sepsis evolves, there are opportunities for public health organizations to disseminate new research findings and treatment guidelines, in coordination with professional societies' recommendations and sepsis awareness and prevention programs. In addition, whereas CDC's surveillance definition may be an important initial step toward tracking the impact of efforts to reduce morbidity and mortality rates associated with sepsis, new methods are also needed to better quantify the impact of specific interventions. Sepsis survivors often suffer long-term health problems [15]; additional research should measure the public health impact and other long-term outcomes among these survivors.

Finally, our understanding of pediatric sepsis lags behind. Studies that estimate pediatric sepsis burden and trends using an objective surveillance definition (analogous to the study by Rhee et al [3]) would provide a better baseline for measuring the impact of new initiatives, because prior studies were based on administrative codes [16]. Others have also argued that the pediatric definitions of sepsis are in need of an update analogous to the adult Sepsis-3 definition, which could lead to improvements in clinical care, research, coding practice, and advocacy [17].

In conclusion, sepsis remains an important public health challenge. As our understanding of sepsis improves, more persons can survive sepsis or avoid sepsis entirely through the partnership of public health professionals, clinical experts, patient advocacy groups, and the public.

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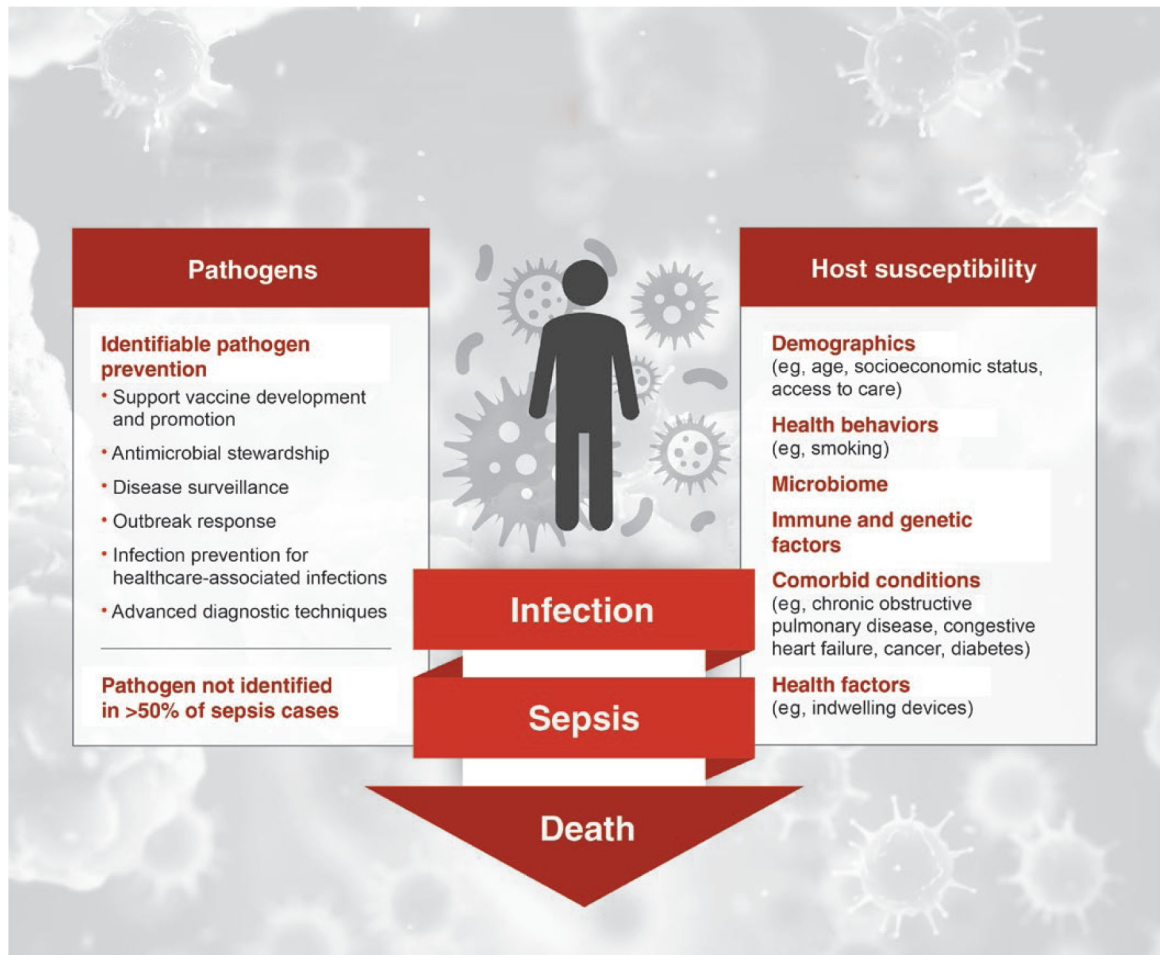


Figure 1. Infections and sepsis: risk factors and opportunities for prevention.