

## Sepsis care bundles: a work in progress



Sepsis affects 27–30 million people worldwide every year, resulting in 6–9 million deaths annually. The condition occurs when the body has an extreme immune response to an infection, causing widespread inflammation. Without early diagnosis and treatment, sepsis can lead to tissue damage, organ failure, and death. The Surviving Sepsis Campaign (SSC) was formed in collaboration between the Society of Critical Care Medicine and the European Society of Intensive Care Medicine in 2002. The aim of SSC is to reduce mortality from sepsis globally, and their first evidence-based clinical practice guidelines were published in 2004, with updates every four years thereafter.

The use of sepsis care bundles was proposed when the first SSC guidelines were published, a bundle being a brief, straightforward set of evidence-based practices that improve patient outcomes when used together. The individual elements comprising sepsis care bundles continue to evolve over time. Two sepsis care bundles were recommended from the 2012 SSC guidelines. The 3-hour bundle, to be completed within 3 hours of sepsis diagnosis, includes blood cultures drawn before administration of broad-spectrum antibiotics, lactate measurement, broad-spectrum antibiotics, and an intravenous fluid bolus for hypotension or elevated lactate. The 6-hour bundle, to be completed within 6 hours of diagnosis, includes vasopressors for hypotension that is unresponsive to fluids, measurement of central venous pressure and central venous oxygen saturation for persistent hypotension or initially elevated lactate, and re-measurement of elevated lactate.

In 2012, 12-year-old Rory Staunton died from undiagnosed sepsis in New York. Following his death, his family created a non-profit foundation to raise sepsis awareness and advocate for improved diagnosis and treatment. In 2013, the New York state legislature passed “Rory’s Regulations”, which requires all hospitals in the state to adopt evidence-based bundles based on accepted best practices for treating adults and children with sepsis. The regulations also mandated that hospitals report the treatment and outcome for each sepsis patient to the State Department of Health. As a result, a large database was formed that has been used to study the effect of sepsis bundles—and the promptness of their completion after sepsis diagnosis—on patient outcomes. A recent retrospective study analysed data from 1179 paediatric patients, whose sepsis treatment was reported to the New York State Department of Health from 2014–2016. For 294 of the 1179 patients, the 1-hour bundle mandated by New York for paediatric sepsis (blood cultures, broad-spectrum antibiotics, and an intravenous fluid bolus) was completed on time. Therefore, only 25% of paediatric patients received the 1-hour sepsis bundle within the mandated 1 hour.

Analyses indicated that patient mortality was reduced when the 1-hour sepsis bundle was completed within 1 hour, compared to when it took longer. Furthermore, data that were collected for completion times of up to 4 hours showed that mortality increased 2% an hour until the 1-hour bundle was completed. Prompt completion of any individual element of the bundle was not associated with reduced mortality.

Idris Evans, first author of the study, (University of Pittsburgh School of Medicine, Pittsburgh, PA, USA) summarised the study’s results: “Timely completion of [the] mandated 3-element bundle for New York paediatric patients was associated with a 40% reduction in mortality for paediatric patients.” Evans also commented about the interest in seeing evidence for the effectiveness of a policy that is shown any time a policy is put into effect. No randomised clinical trials currently exist, so observational studies are useful. He added, “Our future direction will be to figure out causality.”

The decrease in mortality associated with prompt completion of the 1-hour paediatric sepsis bundle was similar to the result from an earlier retrospective study with 49 331 adult patients in New York who had received sepsis treatment in 149 emergency departments between 2014 and 2016. Analyses showed that after sepsis was diagnosed, mortality increased with every hour that passed before completion of New York’s mandated 3-hour sepsis care bundle for adults (blood cultures, lactate measurement, and broad-spectrum antibiotics). Interestingly, emergency departments in small rural hospitals were most likely to administer antibiotics promptly and complete the 3-hour sepsis care bundle on time.



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For more on the **global burden of sepsis** see <https://www.global-sepsis-alliance.org/sepsis/>

For more on the **surviving sepsis campaign** see [www.survivingsepsis.org](http://www.survivingsepsis.org)

For more on the **Rory Staunton Foundation** see <https://rorystauntonfoundationforsepsis.org>

For the **retrospective study of paediatric patients** see *JAMA* 2018; **320**: 358–67

For the **study of adult sepsis patients in New York** see *N Engl J Med* 2017; **376**: 2235–44

For the sepsis bundle petition  
see [emcrit.org/sscpetition](http://emcrit.org/sscpetition)

Sepsis care bundles were revised earlier this year on the basis of the 2016 SSC guidelines and the 2016 designation of sepsis as a medical emergency by the US Centers for Disease Control and Prevention. The 3-hour and 6-hour bundles are now combined into an hour-1 bundle, all elements of which are to be initiated within one hour of emergency department triage or sepsis diagnosis (blood cultures, lactate measurement, broad-spectrum antibiotics, intravenous fluid bolus for hypotension or elevated lactate, vasopressors for hypotension unresponsive to fluids, and re-measurement of elevated lactate). This hour-1 bundle has not always been well received, as some emergency department physicians cite the low-to-moderate quality of evidence supporting some strongly recommended elements of the bundle, and are concerned that removing clinician judgment from the decisions around sepsis might negatively affect individual patient care. Shortly after publication of the 2018 bundle update, 21 physicians from Canada, Europe, the UK, and the USA organised an

international petition to request that these guidelines not be used as the basis for any sepsis care protocols, and to call for the retraction of the 2018 bundle revision. At the time of writing, more than 5500 clinicians have signed this petition, which has a numerical goal of 10 000 signatures.

Elliot Melendez (Johns Hopkins All Children's Hospital, St. Petersburg, FL, USA) commented that the performance of sepsis care bundles is but one part of the puzzle in improving sepsis care: "It is appropriate to use the lessons learned to help guide further improvement." He added that to improve sepsis care in general, acknowledging the three major aims in management of care is important: improving mechanisms for early recognition of sepsis, creating a standardised treatment bundle, and instituting a way of evaluating how well these processes are being implemented. He summarised, "You need all three for best outcomes."

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