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Epidemiology of Sepsis Among Adolescents at Community Hospital Emergency Departments: Implications for Rory's Regulations

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Abstract

In 2012, Rory Staunton, a healthy 12-year-old boy, presented to the emergency department (ED) of a community hospital in New York with symptoms that, in retrospect, were determined to be caused by sepsis. He was seen, discharged, and subsequently died of septic shock. Consequently, the governor introduced Rory's Regulations, which mandated that hospitals in New York implement protocols to recognize and treat sepsis according to evidence-based guidelines. These efforts may result in large public health benefits for patients.¹ However, crucial to Rory's case was that his diagnosis was missed. Efforts to avoid missed or delayed diagnosis are greatly enhanced by knowledge of the frequency and course of similar cases, yet such data are unknown. We therefore examined the electronic health records of healthy adolescents who presented to 12 community hospital EDs in southwestern Pennsylvania during the same period (January 1, 2010, through December 31, 2012) with signs and symptoms similar to those of Rory Staunton.

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Acquisition, analysis, or interpretation of data: Evans, Watson, Carcillo, Seymour.

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Methods

Rory presented with 3 of the 4 systemic inflammatory response syndrome (SIRS) criteria: fever, tachycardia, and tachypnea. We selected all adolescents (12–17 years of age) who were previously healthy (Pediatric Complex Chronic Condition score of 0)² and presented with 3 or more age-appropriate SIRS criteria. In electronic health record data, we determined who was suspected of having infection and thus met the current definition of pediatric sepsis by identifying the combination of orders for a body fluid culture (eg, bacterial, viral, and fungal) and antibiotics.^{3,4} We measured the frequency with which infection was suspected after 24 hours, which served as a marker of delayed diagnosis, and the frequency of a poor course, which was defined as admission to the intensive care unit, transfer to an acute care facility, or in-hospital death, confirmed by manual medical record review. The University of Pittsburgh Institutional Review Board approved this study with waiver of consent. All data were deidentified. We analyzed data with STATA software, version 14.2 (StataCorp).

Results

During 3 years, the 12 EDs evaluated 1 308 871 encounters, 43 654 (3.3%) of which were with healthy adolescents. Of these encounters, 899 (2.0% of healthy adolescents, 0.07% of ED visits) had 3 or more SIRS criteria (Figure). Among these cases, 158 patients (17.6%) were suspected of having infection (and met the sepsis criteria), of whom 11 (7.0%) were suspected of infection after 24 hours. Of the 158 patients, 25 (15.8%) were admitted to the intensive care unit, 27 (17.1%) were transferred to another facility, 12 (7.6%) had lactate measured, and 1 (0.6%) died (Table). The adolescent who died received antibiotics 19 hours after presentation. No patients who did not meet the sepsis criteria died. Thus, an ED treated a mean of 36 357 patients (95% CI, 36 295–36 419) each year, of whom 25 (95% CI, 23–27) presented similarly to Rory Staunton and 4 (95% CI, 3.7–5.1) had sepsis. Each ED would treat 2.8 fatal sepsis cases (95% CI, 0.1–15.5) every 100 years.

Discussion

Health care policy is often motivated by powerful anecdotes, such as the case of Rory Staunton. However, it is important to be explicit about the goals and challenges of any proposed policy so that policy makers and the public are not disappointed if expectations are not met. Although sepsis is a major cause of morbidity and mortality worldwide, the typical community ED in the United States may see few presentations similar to that of Rory Staunton because only a small fraction of patients have sepsis. Although estimates may be different for patients younger than Rory, these EDs may uncommonly encounter a patient with sepsis whose condition worsens or for whom the diagnosis is determined later. Current quality improvement initiatives are well motivated and may have positive influence on patients of all ages with sepsis¹; however, these initiatives may not ensure that deaths from sepsis are avoided, particularly among adolescents. In addition, the benchmarks for success of quality improvement initiatives, such as risk-adjusted mortality, may not be able to prove whether the initiatives have successfully reduced the risk of future cases like Rory Staunton's.

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Figure. Proportion of Healthy Adolescent Encounters by Age
SIRS indicates systemic inflammatory response syndrome.

TableCharacteristics of 899 Healthy Adolescents Presenting With 3 or More SIRS Criteria^a

Characteristic	Patients With Sepsis (n = 158)		Patients Without Sepsis (n = 741)
	Poor Course (n = 43)	No Poor Course (n = 115)	
Time until sepsis suspected, h			
24	35 (81.4)	112 (97.4)	0
>24	8 (18.6)	3 (2.6)	0
Age, mean (SD), y	16 (2)	16 (2)	16 (2)
Male sex	21 (48.8)	40 (34.8)	270 (36.4)
Race			
White	26 (60.5)	81 (70.4)	533 (71.9)
Black	10 (23.3)	22 (19.1)	134 (18.1)
Other	7 (16.3)	12 (10.4)	74 (10.0)
Positive blood culture results	4 (9.3)	2 (1.7)	0
All 4 SIRS criteria in 24 h	13 (30.2)	30 (26.1)	86 (11.6)
Maximum SOFA points in 24 h			
0	14 (32.6)	70 (60.9)	507 (68.4)
1	4 (9.3)	26 (22.6)	117 (15.8)
2	25 (58.1)	19 (16.5)	117 (15.8)
Hospital admission	26 (60.5)	30 (26.1)	180 (24.3)
Poor course			
Admission to intensive care	25 (58.1)	0	30 (4.0)
Transfer to acute care facility or hospital	27 (62.8)	0	83 (11.1)
In-hospital mortality	1 (2.3)	0	0
Serum lactate within 24 h	9 (20.9)	3 (2.6)	0
Serum lactate, median (IQR), mg/dL	16.2 (9.0–24.3)	9.0 (8.1–17.2)	0
Mechanical ventilation ^b	18 (41.9)	0	12 (1.6)
Vasopressor use ^b	4 (9.3)	0	0
Hospital length of stay, median (IQR), d	7 (1–15)	2 (1–3)	2 (1–2)

Abbreviations: IQR, interquartile range; SIRS, systemic inflammatory response syndrome; SOFA, sequential organ failure assessment.

SI conversion factors: to convert lactate to millimoles per liter, multiply by 0.111.

^aData are presented as number (percentage) of patients unless otherwise indicated.^bAt any point during the hospital encounter.