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Original Contributions

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DISPARITIES IN ADHERENCE TO PEDIATRIC SEPSIS GUIDELINES ACROSS A SPECTRUM OF EMERGENCY DEPARTMENTS: A MULTICENTER, CROSS-SECTIONAL OBSERVATIONAL IN SITU SIMULATION STUDY

David O. Kessler, MD, MSCI, FAAP,* Barbara Walsh, MD,† Travis Whitfill, MPH,‡ Sandeep Gangadharan, MD,§ Marcie Gawel, MSN,‡ Linda Brown, MD, MSCE,‖¶ and Marc Auerbach, MD, MSCI ‡ for the INSPIRE ImPACTS investigators[1]

*Department of Pediatrics, Columbia University Medical Center, New York Presbyterian Morgan Stanley Children's Hospital of New York, New York, New York, †Department of Pediatrics, University of Massachusetts Memorial Medical Center, Worcester, Massachusetts, ‡Department of Pediatrics, Yale University School of Medicine, New Haven, Connecticut, §Department of Pediatrics, Long Island Jewish Medical Center, New Hyde Park, New York, ‖Department of Pediatrics, and ¶Department of Emergency Medicine, Alpert Medical School of Brown University, Providence, Rhode Island

Reprint Address: David O. Kessler, MD, MSCI, FAAP, Department of Pediatrics, Columbia University Medical Center, 3959 Broadway, CHN-1-116, New York, NY 10032

☐ **Abstract—Background: Each year in the United States, 72,000 pediatric patients develop septic shock, at a cost of $4.8 billion. Adherence to practice guidelines can significantly reduce mortality; however, few methods to compare performance across a spectrum of emergency departments (EDs) have been described. Objectives: We employed standardized, in situ simulations to measure and compare adherence to pediatric sepsis guidelines across a spectrum of EDs. We hypothesized that pediatric EDs (PEDs) would have greater adherence to the guidelines than general EDs (GEDs). We also explored factors associated with improved performance. Methods: This multi-center observational study examined in situ teams caring for a simulated infant in septic shock. The primary outcome was overall adherence to the pediatric sepsis guideline as measured by six subcomponent metrics. Characteristics of teams were compared using multivariable logistic regression to describe factors associated with improved performance. Results: We**

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Affiliations: **Department of Anesthesiology and Critical Care Medicine, University of Pennsylvania Perelman School of Medicine, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA; ††Department of Pediatrics and Emergency Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland, USA; ‡‡Department of Pediatrics and Emergency Medicine, University of Pennsylvania Perelman School of Medicine, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA; §§Department of Emergency Medicine, Brown University Alpert School of Medicine, Providence, Rhode Island, USA; ‖‖‖Department of Critical Care Medicine and Pediatrics, Children's Hospital of Pittsburgh, University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania, USA.

[1] Study Group Authorship: INSPIRE stands for International Network for Simulation-Based Pediatric Innovation, Research and Education; ImPACTS stands for Improving Pediatric Acute Care Through Simulation. INSPIRE ImPACTS investigators (Group By-line authors): Akira Nishisaki, MD, MSCE,** Vinay Nadkarni, MD,** Jessica Katznelson, MD,†† Megan Lavoie, MD,‡‡ Khoon-Yen Tay, MD,‡‡ Janette Baird PhD,§§ and Melinda Hamilton MD, MSc‖‖‖.

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enrolled 47 interprofessional teams from 24 EDs. Overall, 21/47 teams adhered to all six sepsis metrics (45%). PEDs adhered to all six metrics more than GEDs (93% vs. 22%; difference 71%, 95% confidence interval [CI] 43–84). Adherent teams had significantly higher Emergency Medical Services for Children readiness scores, MD composition of physicians to total team members, teamwork scores, provider perceptions of pediatric preparedness, and provider perceptions of sepsis preparedness. In a multivariable regression model, only greater composite team experience had greater adjusted odds of achieving an adherent sepsis score (adjusted odds ratio 1.38, 95% CI 1.01–1.88). Conclusions: Using standardized in situ scenarios, we revealed high variability in adherence to the pediatric sepsis guideline across a spectrum of EDs. PEDs demonstrated greater adherence to the guideline than GEDs; however, in adjusted analysis, only composite team experience level of the providers was associated with improved guideline adherence.

☐ **Keywords—sepsis; simulation; pediatrics; emergency medicine; quality control**

INTRODUCTION

Severe sepsis is a leading cause of morbidity and mortality in pediatric patients, with over 72,000 cases in the United States and 7.5 million deaths worldwide every year (1–4). The social and economic costs are also high, with mean hospital stays of 15 days and charges of over $4.8 billion dollars per year (5,6). Pediatric patients receive care across a diverse spectrum of hospitals in this country, and only 10% are cared for in pediatric-specific emergency departments (EDs) (7–9). Differences exist between hospitals that treat a higher volume of pediatric patients with regard to equipment, resources, and policies, but little is known about how these differences impact the quality of sepsis care (10).

Adherence to pediatric sepsis guidelines is associated with improved outcomes across all settings (11–17). Interventions aimed at improving specific performance measures can improve outcomes. Examples in the literature include efforts to improve the recognition of septic shock, prompt vascular access, rapid fluid administration of 60 mL/kg, initiation of vasopressor support, and intravenous (i.v.) antibiotics (13–17). A robust method of comparing the quality of pediatric sepsis care across a diverse spectrum of hospitals is needed to describe gaps in care and inform targeted interventions. Research describing the processes of actual pediatric sepsis care across a spectrum of EDs is limited by the low frequency of clinical events in each ED, the cost of this type of research, and the lack of standardization in patient presentations in this condition.

Simulation-based research leverages the standardization provided by preprogrammed simulated patients to answer diverse research questions that cannot otherwise be feasibly assessed (18,19). Standardized in situ simulation-based assessments can be used as an investigative methodology to compare the quality of care across a spectrum of departments without the unpredictability, variability, and higher stakes inherent to studying the processes of care delivered to actual patients. For example, Hunt et al. used simulation scenarios across 35 general EDs in North Carolina to evaluate the quality of pediatric trauma care (20). The data revealed significant deficits in pediatric trauma care at these institutions and thus, targeted educational interventions were created and implemented.

In situ simulation, in which simulation is physically integrated into the clinical environment, has certain advantages over center-based simulation. It provides a high degree of contextual fidelity and increased realism for the providers who are caring for the patient with their standard team in their actual clinical environment. In situ simulation provides opportunities to assess clinical teams' performance in infrequent or high-risk clinical scenarios. It utilizes on-duty clinical providers, alleviating the need to schedule health care workers on nonclinical days, pay overtime, or schedule additional providers to backfill the clinical unit while one team of clinical workers is off the unit for training. It can lead to identification of latent safety threats and knowledge gaps, as well as deficiencies in the clinical systems, the environment, and the provider team. In situ simulation offers the opportunity to stress the system and identify those areas that are at highest risk and have the greatest need for remediation (21). Properly developed and validated simulation-based assessments provide robust measurement of the processes of patient care and adherence to guidelines (22–26).

Our primary aim was to utilize a standardized in situ simulation scenario to measure and compare adherence to pediatric sepsis guidelines across a spectrum of EDs. Our secondary aim was to describe the provider and systems factors associated with better performance in an in situ simulated pediatric septic shock resuscitation scenario. We hypothesized that pediatric emergency departments (PEDs) would have greater adherence to pediatric sepsis guidelines compared to general emergency departments (GEDs).

METHODS

Design

This multicenter, cross-sectional observational study measured the performance of interprofessional teams of health care providers using in situ simulation-based