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Life after Pediatric Critical Illness: Risk Factors for Reduced Health-related Quality of Life and Functional Decline

Survivors of a critical illness are at risk to develop physical, cognitive, and psychological impairments that can persist for months to years after they leave the hospital. Health-related quality of life (HRQL) and functional abilities are important measures of outcomes after a critical illness, as they reflect not only the effects of the critical illness, its treatment, and comorbid illness but also physical disability, cognitive impairment, and psychological disorders (depression, anxiety, and post-traumatic stress disorder) after a critical illness in adults (1). A review of HRQL in 557 adult survivors of acute respiratory distress syndrome found a substantially lower HRQL in both physical and mental components compared with age- and sex-matched healthy populations, which was associated with functional disability (2). The preponderance of evidence regarding long-term outcomes after a critical illness comes from adult ICU populations, and less is known about long-term outcomes for children after a critical illness. Children admitted to a pediatric ICU (PICU) have increased vulnerability to develop new or worsening long-term morbidities, including a reduced quality of life and new functional disability. For example, studies of children who had been admitted to a PICU found that they had a reduced HRQL (3) and a high rate of functional disability (up to 82%) after they were discharged from the hospital (4). These findings suggest that, like adult populations, many PICU survivors develop physical, cognitive, and psychological impairments that are associated with reduced HRQL and functional disability.

Although the data regarding HRQL and functional outcomes after a pediatric critical illness have increased in the past 10 years, there are few data regarding risk factors associated with a reduced HRQL or functional decline after pediatric respiratory failure. It is important to understand the risk factors for post-ICU morbidities in pediatric populations in order to understand the full effects of critical illness in children and to identify potential interventions to prevent or improve outcomes. In a study presented in this issue of the *Journal*, Watson and colleagues (pp. 900–909) evaluated risk factors for a post-PICU decline in functioning and reduced HRQL in children with respiratory failure (5). Children 2 weeks to 17 years of age who were enrolled in the RESTORE (Randomized Evaluation of Sedation Titration for Respiratory Failure) trial were included in the study. Age-appropriate, validated measures of HRQL and functional abilities were assessed at 6 months after PICU discharge via medical record reviews of baseline functioning and parental interviews, and postdischarge functional status and HRQL were assessed by telephone interviews. The parents/guardians of 960 patients were interviewed, and 91% of these patients were discharged home and 6% were discharged to a rehabilitation or assisted-living facility (5).

Post-PICU morbidity was common in pediatric patients with acute respiratory failure. The prevalence of functional decline was 20%, and 19% of the patients had a reduced quality of life. Among patients with normal baseline functioning, 49% had functional decline and 19% had reduced HRQL. Risk factors included sociodemographic factors, preexisting health status, and factors associated with the critical illness factors that occurred during the child's hospital course (*see* Table 1 for a summary) (5). The authors found that the magnitude of the new morbidities was similar to that observed in severe underlying diseases such as cancer (5). Similar to findings in adults (6), the trajectories of outcomes were variable and included a continued decline over

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Table 1. Multivariable Risk Factors for Functional Impairment and Reduced Health-related Quality of Life

Outcomes	Sociodemographic Factors	Preexisting Health Factors	Hospital Course Factors
Decline in functioning	NA	Baseline impaired function Prematurity Cancer	Etiology of respiratory failure Duration of mechanical ventilation Clonidine
Impaired growth and development*	NA	Receipt of methadone Inadequate pain management	NA
Health-related quality of life	Older age Non-white or Hispanic	Cancer	Inadequate sedation management

Definition of abbreviation: NA = not applicable.
*Independent risk factors.

time, improvement over time, no change over time, and decline and then improvement. The etiology of the risk factors is likely multifactorial. Importantly, comorbid disease and impaired baseline function increased the risk of poor outcomes (5).

Support for the findings of Watson and colleagues comes from a multicenter study that found that in patients with a trauma or oncologic or neurologic diagnosis, unscheduled admission to the PCIU, mechanical ventilation, renal replacement therapy, cardiopulmonary resuscitation, and extracorporeal membrane oxidation were risk factors for a new functional disability (7). A retrospective study found that PICU patients with multiple organ dysfunction on Day 1 of the study had worse functional disability than children who did not have multiple organ dysfunction (8). Although they were not assessed in the study by Watson and colleagues (5), similar risk factors for cognitive impairments have been identified after a pediatric critical illness, including younger age, lower socioeconomic status, mechanical ventilation, high oxygen requirements, and the use of sedatives and pain medications (9). Additional research is needed to determine whether the risk factors identified also have adverse effects on cognitive outcomes.

The strengths of this study include the large multicenter population and the evaluation of post-PICU discharge functioning and HRQL using reliable and validated instruments, and new information regarding risk factors for functional decline and reduced HRQL after a pediatric critical illness (5). The limitations of this study include the lack of socioeconomic data, estimation of baseline function based on interviews with the parents and medical records, lack of baseline HRQL, and parent/proxy report—all of which the authors acknowledge. Another limitation is the use of the Pediatric Overall Performance Category and Pediatric Cerebral Performance Category, which rely on parental/legal guardian reports rather than on performance-based measures and therefore may be less sensitive, especially in populations with baseline impairments (5). Future studies to directly assess functional outcomes using performance-based measures are needed. Studies are also needed to characterize outcome trajectories at time points more distant from the critical illness to understand the trajectories over time, and to assess the effects of potential interventions. Determining which factors may be potentially modifiable to improve long-term outcomes after a pediatric critical illness should also be the focus of future research. ■

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