

Undernutrition increases healthcare utilization of children in the pediatric intensive care unit (PICU)

According to the American Society for Parenteral and Enteral Nutrition, **pediatric undernutrition** is defined as:

An **imbalance between nutrient requirement and intake**, resulting in **cumulative deficits of energy, protein or micronutrients** that may **negatively affect growth, development** and other relevant outcomes.¹



A **vicious cycle of undernutrition** has been proposed, where:



- **Undernutrition leads to impaired immunity**, making the host more vulnerable to infections or disease.²
- **Infections impact the nutritional state** through increased nutrient requirements and loss of appetite, leading to further undernutrition.²

An estimated **2 million** PICU admissions in 2015³

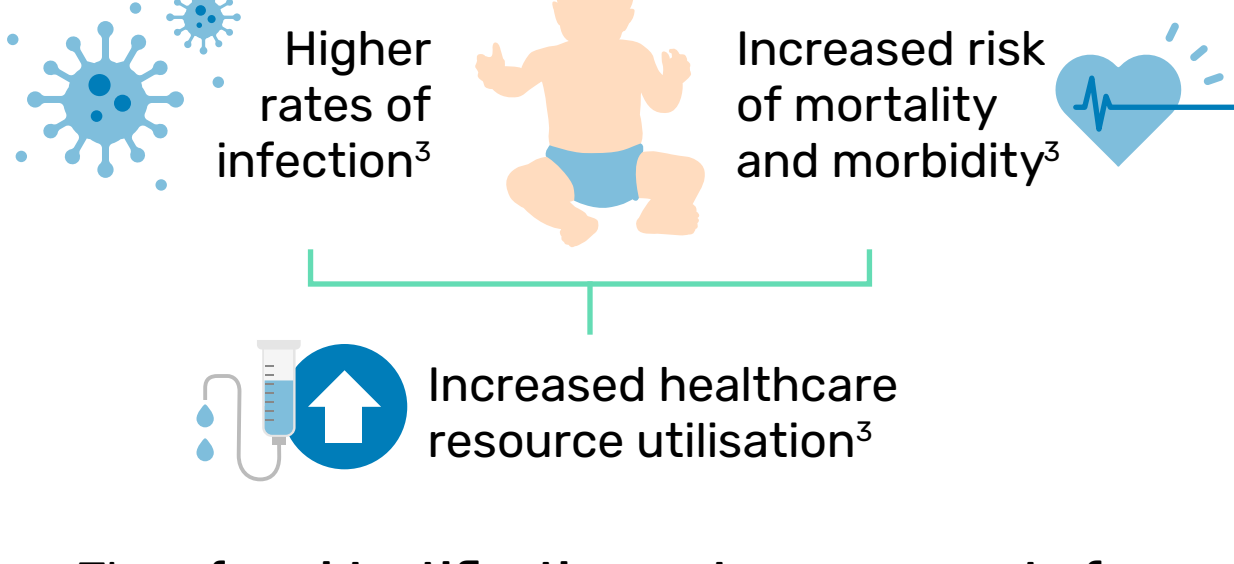


Per patient cost of approximately **\$50,000**³



Total cost of nearly **\$25 billion** a year³

Children with undernutrition have been shown to have:



Therefore, **identification and management of undernutrition is a key component of care in the PICU.**¹

Pediatric undernutrition in the PICU of a major academic urban tertiary care center was studied to **investigate the prevalence of undernutrition, its impact on healthcare costs and the impact of implementing screening and coding for undernutrition.**³



Study design



Retrospective study



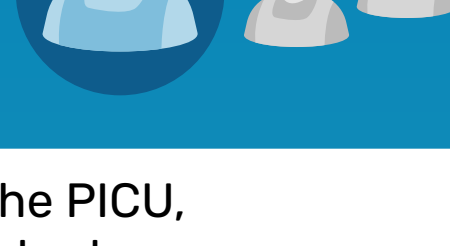
Electronic medical records of children admitted to the PICU from 2011 to 2019 analyzed (N=8,725)



To identify children receiving a coded diagnosis of malnutrition and compare healthcare utilization in PICU patients with and without undernutrition

Results

About **1 in 5** PICU patients received a coded diagnosis of malnutrition (**19.1%**).³

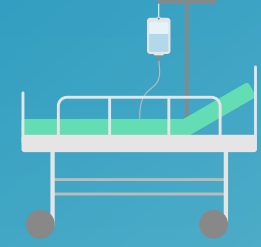


Compared with patients in the PICU, undernourished patients had:



Nearly 2X as many clinical diagnoses, indicating that these children were more severely ill³

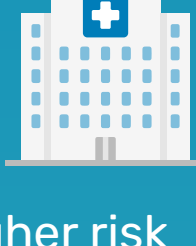
>2 times longer length of stay (LOS)³



Higher healthcare costs

Estimated increase of **\$93,415** per patient³

Higher 30-day hospital readmission rate³



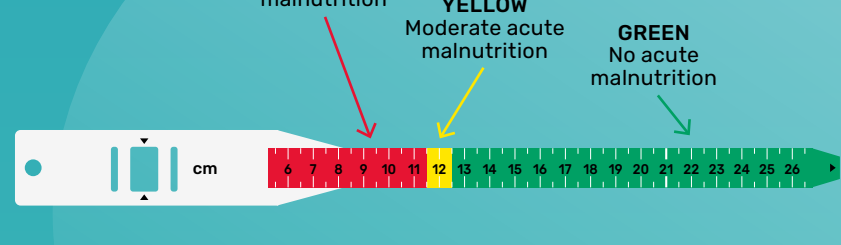
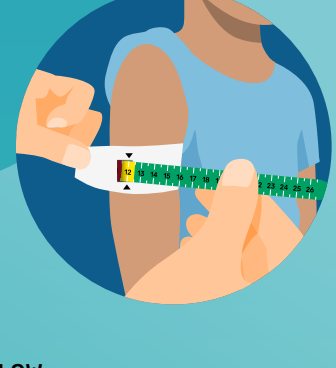
↑ **Significantly higher risk of in-hospital mortality** ($p < 0.01$)³

↑ **Significantly higher risk of 30-day all-cause hospital readmission** ($p < 0.01$)³

	Undernourished n=783	Not undernourished n=3,323	p-value
Length of stay (days), median (IQR)	13 (6-28)	5 (3-10)	<0.01
30-day redmission (occurrence), mean (SD)	0.10 (0.29)	0.07 (0.26)	0.03
Secondary dignoses, mean (SD)	13 (8-18)	6 (3-11)	<0.01

Implementation of a Mid-Upper-Arm Circumference undernutrition screening tool:³

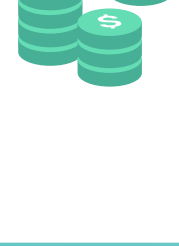
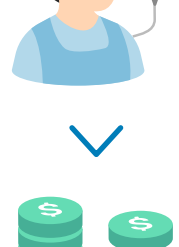
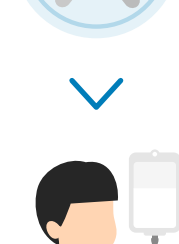
- Was practical and feasible
- Increased undernutrition identification
- Decreased LOS in both groups



Conclusion

This study demonstrated that:³

- **Undernourished children have longer PICU hospitalization stays.**
- **Undernourished children are at a greater risk of hospital readmission** which can lead to greater healthcare costs.³
- **Cost of PICU care for an undernourished child can be approximately \$100,000 more per hospitalization**, compared to a child who is not undernourished.
- **The implementation of a simple undernutrition screening tool in the PICU setting was both feasible** and increased the identification of undernutrition, **leading to a reduction in LOS.**



Commence **early enteral nutrition within 24 hours of admission** unless contraindicated.

Polymeric formulae should be the first choice and energy-nutrient dense feed (ENDFs) should be considered for those with fluid restrictions.

ENDFs are recommended for infants in the recovery phase of critical illness to achieve optimal (catch-up) growth, particularly when high intakes are not tolerated or possible.

Identifying patients with undernutrition and providing timely nutrition support may improve patient outcomes and reduce healthcare burden in these patients, highlighting the need for hospital policies and programs to identify and treat undernutrition in the PICU.³



ENDF, energy-nutrient dense feed; ESPNIC, European Society of Pediatric and Neonatal Intensive Care; IQR, interquartile range; LOS, length of stay; PICU, pediatric intensive care unit; SD, standard deviation.

References:
 1. Becker P et al. Nutr Clin Pract 2015;30:147-61.
 2. Darnton-Hill I et al. Preventive Nutrition: The Comprehensive Guide for Health Professionals. Available at: https://www.researchgate.net/publication/295107165_The_Impact_of_Micronutrients_on_Inflammation_and_Health_in_Low- and_Middle-Income_Countries. Accessed December 2023.
 3. Khlevner J et al. Nutrients 2023;15:3011.