

Implementation of STRONGkids for identifying nutritional risk in pediatric intensive care unit: a survey of Chinese practice

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To the Editor: In children's growth process, regularly monitoring of the growth indices, such as children's body weight, height, and other physical measurements, is helpful for the early diagnosis of nutritional risk and abnormal growth.^[1] Several studies have suggested that hospitalized children, even those with mild clinical conditions, are at risk for developing malnutrition. An early determination of children at risk for developing malnutrition might avoid or diminish nutrition-associated complications and decrease the length of hospital stays. The Screening Tool for Risk on Nutritional status and Growth (STRONGkids) tool was developed according to the latest European Society for Parenteral and Enteral Nutrition (ESPEN) guidelines^[2] and was shown to correlate well with the current nutritional status and hospital length of stay (LOS) in a Dutch pediatric population as well as with the risk for later nutritional intervention in a small British group of hospitalized children.

A cross-sectional, observational study was conducted in the pediatric intensive care unit (PICU) at West China Hospital, Sichuan University from July 2019 to May 2020. During this time, all consecutively enrolled PICU patients who met the following criteria were included in this study: (1) The patient had complete medical data, including nursing documents, medical records, orders, physical restraints (PRs), *etc*; (2) The patient's age was <18 years. Patients were excluded from the study if they or their legal representatives refused to participate.

This study was approved by the Ethics Committee of West China Hospital, Sichuan University in 2019 (No. 1113), and written informed consent was obtained from the participants and their parents.

Two methods (direct observation and a review of patient records) were used to collect data. Age, sex, diagnosis (cardiovascular system disease, digestive system disease, nervous system disease, respiratory system disease,

urinary/reproductive system disease, postoperative/infection and others including burns, electric shock, car accident, etc), and length of PICU stay were assessed among all children. The presence or absence of mechanical ventilation (MV), central venous pressure (CVP), arterial blood pressure (ABP), physical restraint (PR), analgesia, and sedation were also assessed. We used the STRONGkids^[2] nutritional risk screening tool to quantify the risk for malnutrition.

All data were entered into the Statistical Package for the Social Sciences (version 24.0, SPSS Inc., Chicago, IL, USA). Data are reported as the means (standard deviations) or percentages. Univariate analysis was conducted using Chi-square tests (categorical variables). Statistical significance was set at $P < 0.05$ (two-tailed). The general data and clinical data of the patients were used as independent variables, and the nutritional risk was used as the dependent variable in the univariate analysis. A logistic regression model was established using the statistically significant factors in the univariate analysis as independent variables (selection criteria of the variables were $P < 0.05$).

A total of 1086 patients for whom there was complete information were included in the investigation. Among them, 43.4% of the patients were younger than 1 year, 53.8% of the pediatric patients were male, 36.0% of the pediatric patients had been diagnosed with cardiovascular system disease, 60.9% of the patients stayed in the PICU for <96 h, 9.6% of them were at high nutritional risk, and 90.4% of them were at moderate nutritional risk.

The clinical characteristics of the nutritional risk in pediatric patients are summarized in Supplementary Table 1, <http://links.lww.com/CM9/A440>. The prevalence of participants with an age <1 year, digestive system disease, and a LOS ≥ 96 h was higher in the high nutritional risk group than in the moderate nutritional risk group ($P < 0.01$). The prevalence of MV, CVP, ABP, PR,

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analgesia, and sedation was higher in the moderate nutritional risk group than in the high nutritional risk group ($P < 0.05$).

In logistic regression analysis, the factors that affected nutritional risk in pediatric patients included age (1–3 years *vs.* < 1 year; OR = 0.460; 95% CI: 0.239 to 0.883, $P = 0.020$; 3–6 years *vs.* < 1 year; OR = 0.252, 95% CI: 0.101 to 0.625, $P = 0.003$; 6–18 years *vs.* < 1 year; OR = 0.236, 95% CI: 0.094 to 0.595, $P = 0.002$), PR (OR = 0.449, 95% CI: 0.282 to 0.714, $P = 0.001$), sedation (OR = 0.597, 95% CI: 0.361 to 0.988, $P = 0.045$), LOS (OR = 1.801, 95% CI: 1.135 to 2.858, $P = 0.012$), and diagnosis (digestive system disease *vs.* cardiovascular system disease; OR = 2.028, 95% CI: 1.093 to 3.763, $P = 0.025$) [Table 1]. This model had a good fit according to the Hosmer–Lemeshow goodness-of-fit test ($R^2 = 0.085$, $\chi^2 = 6.806$, $P = 0.558$), and the accuracy of the model was 90.5%.

The results of the study showed that age < 1 year, no PR, no sedation, LOS (≥ 96 h), and digestive system disease were independent risk factors for high nutritional risk. Infants, particularly preterm babies and those with rapid growth and development, are nutritionally vulnerable as a result of low nutrient stores.^[3] We think that suitable PR and sedation can reduce some unnecessary activities and body metabolism as well as reduce consumption to avoid a high risk of malnutrition among pediatric patients.

The results of the present study were consistent with those of previous studies.^[4,5] Yan *et al*^[4] found that 93.73% of hospitalized children in the Department of Gastroenterology were at moderate and high nutritional risk, and there were significant differences in the nutritional risk scores among children of different ages and types of digestive

diseases. Sanaa *et al*^[5] found that the STRONGkids score was significantly positively correlated with the duration of hospital stay, indicating that the STRONGkids score can be a predictive tool.

However, we noticed some differences between our findings and those of other studies. In a sample of 1038 psychiatric inpatients, Funayama and Takata^[3] found that PR substantially increased the risk of deep vein thrombosis (DVT) and aspiration pneumonia. They also found that bedridden status was closely related to the incidence of DVT and aspiration pneumonia. These differences are likely due to the population, diseases, and bedridden status.

We conclude that the STRONGkids screening tool is easy to use for determining the risk of malnutrition in hospitals, ensuring prompt interventions that may contribute to overall improvements in patient care, as well as shortening the hospitalization period. The results indicate that nutritional risk is a major problem, reaching significantly high frequencies in hospitalized pediatric patients. All pediatric patients who are hospitalized in the PICU are at risk for malnutrition, so they need nutritional support during the hospital stay.

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Conflicts of interest

None.

Variables	B	SE	Wald χ^2	P value	OR (95% CI)
Age	–	–	17.837	< 0.0001	–
1–3 years	–0.777	0.333	5.440	0.020	0.460 (0.239–0.883)
3–6 years	–1.379	0.464	8.835	0.003	0.252 (0.101–0.625)
6–18 years	–1.442	0.471	9.368	0.002	0.236 (0.094–0.595)
MV	0.276	0.298	0.861	0.353	1.318 (0.736–2.362)
CVP	–0.761	0.426	3.193	0.074	0.467 (0.203–1.076)
ABP	0.258	0.274	0.885	0.347	1.294 (0.756–2.215)
PR	–0.801	0.237	11.420	0.001	0.449 (0.282–0.714)
Analgesia	0.051	0.276	0.034	0.855	1.052 (0.612–1.807)
Sedation	–0.516	0.257	4.036	0.045	0.597 (0.361–0.988)
LOS (≥ 96 h)	0.588	0.236	6.243	0.012	1.801 (1.135–2.858)
Diagnosis	–	–	15.494	0.017	–
Digestive system disease	0.707	0.315	5.033	0.025	2.028 (1.093–3.763)
Nervous system disease	–0.616	0.509	1.466	0.226	0.540 (0.199–1.464)
Respiratory system disease	–0.734	1.072	0.469	0.493	0.480 (0.059–3.921)
Urinary system disease	–0.679	1.076	0.398	0.528	0.507 (0.062–4.176)
Postoperative/infection	0.974	0.498	3.828	0.050	2.648 (0.998–7.022)
Other	0.854	0.706	1.462	0.227	2.348 (0.589–9.364)
Constant	–1.863	0.400	21.705	< 0.0001	0.155

PICU: Pediatric intensive care unit; MV: Mechanical ventilation; CVP: Central venous pressure; ABP: Arterial blood pressure; PR: Physical restraint; LOS: Length of stay; SE: Standard error; OR: Odds ratio; CI: Confidence interval.

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