Review

Nutritional screening tools for hospitalized children: Methodological considerations

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Koen F.M. Joosten [a,*], Jessie M. Hulst [b]

[a] Erasmus MC — Sophia Children's Hospital, Department of Pediatric Intensive Care, Pediatric Intensive Care, Dr. Molewaterplein 60, 3015 GJ Rotterdam, The Netherlands
[b] Erasmus MC — Sophia Children's Hospital, Department of Pediatric Gastroenterology, The Netherlands

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SUMMARY

Children who are admitted to the hospital are at a risk of developing undernutrition, especially children with an underlying disease. High percentages of both acute and chronic undernutrition have been reported in various Western countries for many years. Several nutritional screening tools have been developed for hospitalized children in the last years. This review gives an overview of the nutritional screening tools that are currently available with a focus on their aims, clinical use and validity.

1. Introduction

Several studies in recent years have shown that the percentage of children admitted to the hospital with acute and/or chronic undernutrition remains considerable, despite advances in nutritional therapies and medical interventions.[1–6] In specific diagnostic categories the prevalence of undernutrition is even much higher.[7] There is no accepted gold standard for the assessment of the nutritional status of a child. For the purpose of this review we use the criteria of the WHO to express acute and chronic undernutrition.[8]

Most studies have reported the prevalence of undernutrition upon admission to hospital but there are a considerable number of children who will develop undernutrition during their hospital stay. Remarkably, only a few studies have been published about this issue and they all show that in 20—50% of children the nutritional status deteriorates during admission.[9–13]

The importance of the early identification of nutritional risk and appropriate nutritional management thereafter is highlighted already for many years[14] and numerous nutritional screening tools have been developed for adults and children. Over 70 screening tools for adults and children are reported in the literature.[15] The question is, however, how does one choose an appropriate nutritional screening tool from such a large number available? One has to realize that all these screening tools have been designed with different goals, applications and processes. Furthermore, there is the debate about the usefulness of a screening tool. The usefulness of recommended screening tools is usually based on the aspects of predictive validity (the extent to which a screening tool predicts certain outcomes, such as mortality or body composition), concurrent validity (the extent to which screening tools agree with each other), reproducibility (reliability; agreement between users of a given tool) and practicality.

Currently, there is no consensus on the ideal screening tool to determine on admission those children who are at risk for developing undernutrition during hospital stay and will benefit from nutritional support. Such a screening tool looking at the risk is basically different from measuring the actual nutritional status with weight and height of the child.

The aim of this review is to give an overview of the currently available nutritional screening tools for children admitted to the hospital, and to discuss their aims, clinical use and validity.

2. How to design a screening tool?

It was stated by the ESPEN in 2003[16] that screening tools are designed to detect protein and energy undernutrition and/or to predict whether undernutrition is likely to develop or worsen under the present and future conditions of the patient. Accordingly, screening tools should embody the following four main principles:

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* Corresponding author. Tel.: +31 10 7037029.
E-mail address: k.joosten@erasmusmc.nl (K.F.M. Joosten).

Table 1
Patient characteristics of the screening tools.

Tools	Studied group	Age	Nr of children	High risk group
NRS[17]	Medical	0–17 yr	26	–
PNRS[13]	Medical & Surgical	>1 mnth-18 yr	296	↑Risk >2% weight loss
STAMP[18,19]	Medical & Surgical	2–17 yr	110	–
SGNA[20]	Surgical	>1 mnth-18 yr	175	↑LOS, ↑Infections, ↓SD BMI
PYMS[21,22]	Medical & Surgical except cardiology, renal, orthopedic, critical care	1–16 yr	247	↓SD W/H
STRONG_kids[10]	Medical & Surgical	>1 mnth-18 yr	423	↑LOS ↓SD W/H

NRS = Nutrition Risk Score; PNRS = Pediatric Nutritional Risk Score; STAMP = Screening Tool for the Assessment of Malnutrition in Paediatrics; SGNA = Subjective Global Nutritional Assessment; PYMS = Paediatric Yorkhill Malnutrition Score; STRONG_kids = Screening Tool for Risk Of Impaired Nutritional Status and Growth.

1. How is the actual condition now? This item concerns the actual body composition of the patient. Height and weight can be measured to allow calculation of SD-scores or BMI.
2. Is the condition stable? This item embodies recent weight loss that can be obtained from the patient's history, or even better, from previous measurements in medical records.
3. Will the condition worsen? This question may be answered by asking whether food intake has been decreased up to the time of screening and if so by approximately how much and for how long.
4. Will the disease process accelerate nutritional deterioration? This item covers the underlying disease process which may increase nutritional requirements due to the stress metabolism associated with the severity of the underlying disease (e.g. major surgery, sepsis, and multi trauma), causing nutritional status to worsen more rapidly or to develop a poor nutritional status rapidly from fairly normal states.

It was stated that variables 1–3 should be included in all screening tools, whereas the fourth variable is relevant mainly in the hospital setting. In screening tools, each variable should be given a score, thereby quantifying the degree of risk and allowing a direct link to a defined course of action. Below, these four main principles will be evaluated for each available pediatric screening tool.

3. Screening tools for children admitted to the hospital and their aims

Currently there are 6 screening tools available for children admitted to the hospital;

1. Nutrition Risk Score (NRS)[17]
2. Pediatric Nutritional Risk Score (PNRS)[13]
3. Screening Tool for the Assessment of Malnutrition in Paediatrics (STAMP)[18,19]
4. Subjective Global Nutritional Assessment (SGNA)[20]
5. Pediatric Yorkhill Malnutrition Score (PYMS)[21,22]
6. Screening Tool for Risk Of impaired Nutritional Status and Growth (STRONG_kids).[10]

Table 1 shows the characteristics of each tool and the relationship between risk categories and outcome.

Table 2
Aim of different screening tools.

Tools	Identify nutritional status	Identify need for nutritional intervention	Predict clinical outcome without nutritional intervention
NRS[17]		X	
PNRS[13]		X	X
STAMP[18,19]	X	X	
SGNA[20]	X	X	
PYMS[21,22]	X	X	X
STRONG_kids[10]		X	X

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By using the PRNS tool,[13] screening can be completed after 48 h whereas in the other five tool screening can be done and completed directly on admission. The STRONG_kids, STAMP and PYMS tools[10,18,19,21,22] were originally also designed as a screening tool to be used weekly in the patients with a prolonged hospital stay.

Table 2 summarizes the goals of each screening tool. All tools were designed to identify the need for nutritional intervention, three tools were designed to identify the nutritional status of the child and in three tools clinical outcome was predicted without predefined nutritional intervention.

4. Evaluation of screening tools according to ESPEN principles

Table 3 shows an overview of the content of each of the six screening tools in relation to the four main items of a screening tool according to ESPEN.

The PYMS, the SGNA, the NRS and the STRONG_kids incorporate all these 4 items in their tool.[10,17,20–22] Whereas the PYMS and NRS use anthropometric measurements to define the actual nutritional status, the SGNA and the STRONG_kids rely on a subjective clinical assessment. The SGNA and PNRS have included additional items (gastro-intestinal motility, parental height and functional capacity for SGNA and pain for PRNS).

5. Evaluation of the screening tools

The usefulness of the screening tools was evaluated for each screening tool using a number of different methods (Table 4).

Table 3
Comparison of screening tools according to 4 main principles of a screening tool (ESPEN).[15]

Tools	Current nutritional status	Weight loss	Reduced intake	Disease severity	Other items
NRS[17]	X	X	X	X	
PNRS[13]			X	X	Pain assessment
STAMP[18,19]	X		X	X	
SGNA[20]	X	X	X	X	GI symptoms, functional capacity, parental height
PYMS[21,22]	X	X	X	X	
STRONG_kids[10]	X	X	X	X	

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