

Sensitivity and specificity test of alarm malnutrition for hospital-acquired malnutrition among pediatric patients

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Abstract

Detecting the risks for hospital-acquired malnutrition in children can be performed by using nutritional screening tools. One

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of the screening tools that has been created is Alarm Malnutrition. This study aimed to test the sensitivity and specificity of Alarm Malnutrition in detecting the risks for hospital-acquired malnutrition in comparison to Screening Tool for the Risk on Nutritional status and Growth (STRONGkids). This study employed cross sectional design and involved 168 hospitalized children (1 month to 18 years) at pediatric ward. The data were analyzed using diagnostic approach which resulted in sensitivity and specificity values. The statistical tests showed that the sensitivity and specificity values of Alarm Malnutrition and STRONGkids were 32,2% and 81,6% respectively. These results indicated that this screening tool was not better than STRONGkids which has been previously used in Indonesia. Alarm Malnutrition needs to be developed and improved in order to achieve better performance in detecting the risks for hospital-acquired malnutrition.

Introduction

Nutrition becomes an important component for children to achieve better development and maintain their health. Poor nourished condition might lead to a condition called malnutrition and increase the morbidity and mortality rates.¹ Malnutrition acquired by children during their stay in the hospital was called as hospital-acquired malnutrition (HaM). HaM in children during hospitalization made them experiencing weight loss of $\geq 2\%$ during ≤ 7 days of hospital stay.²

Hospital-acquired Malnutrition (HaM) in children remains a major problem in Indonesia. In Bali hospitals, the HaM cases with high risks and moderate risks reached 12.4% and 87.6% respectively.³ Another data from Dr. Cipto Mangunkusumo National Central Public Hospital (RSUPN Dr. Cipto Mangunkusumo) showed that there were 13.8% cases in which weight loss occurred after 72 hours of hospitalization.⁴

HaM in children might affect their recovery process during the hospital stay. The length of stay became 9 days longer and the cost became 3 times higher in children who suffered from HaM.⁵ Furthermore, such condition will also burden the family with low-middle income due to the increased hospital cost.⁶

The children who suffered from HaM might increase the mortality rates in the hospitals. Infectious disease, particularly diarrhea, became the main cause of this condition.⁷ In addition, children who were treated for gastroenteritis, gastritis, and pneumonia diagnosis might experience fluid loss and decreased nutrient absorption which will then deteriorate their condition.⁸

Screening tools play an important role in detecting HaM in hospitalized children. This screening tool is expected to be able to detect the risks for HaM in children, therefore it can help to determine the next therapy in accordance with the children's need.

There were many screening tools to detect the risks for HaM, such as Screening Tool for Risk on Nutritional Status and Growth (STRONGkids), Subjective Global Nutrition Assessment (SGNA), and Screening Tool for the Assessment of Malnutrition in Pediatrics (STAMPS), yet there was not any screening tool set as the standard to be applied in all hospitals.

Besides the data from these screening tools, the children's weights were also measured during the hospitalization. These data aimed to show whether the child suffered from HaM or not. One of the screening tools to detect the risks for HaM was Alarm Malnutrition that used in this research.⁹ Alarm Malnutrition contained six points of objective assessments including gender, age, medical diagnosis, diet, nutrition route and nursing early warning score. Alarm malnutrition has calculation of risk scoring called malnutrition-at-risk (MaR): i) High risk: >45.5 and ii) Low risk: ≤45.5. To compare with, screening tool risk on nutritional status and growth for kids (STRONGKids) is used as a tool for assessing the risk of malnutrition in children aged 1 month to 18 years which has 4 points of assessment containing a history of symptoms experienced by the child. STRONGKids scoring: i) High risk: 4-5 and ii) Low risk: 0-3. Both of these assessments were complemented by measurements of body weight from day one to day two. This screening tool was expected to be a good tool to detect HaM in children.

Materials and Methods

This study employed cross-sectional design with diagnostic test approach. The samples were selected by using non-probability sam-

pling technique with consecutive sampling approach and involving 168 children aged 1 month to 18 years old. The exclusion criteria of this study, namely experienced dehydration and fluid retention, had tumor and/or organomegaly, and were treated less than 72 hours. On the first day, every child was weighed using weighing scales based on their age. Furthermore, on the second day, there were weight measurement day 2 and HaM risks assessment using STRONGkids and Alarm Malnutrition at the same time.

This study has obtained ethical clearance from the Research Ethical Committee Universitas Indonesia (KET-212/UN2.F1/ETIK/PPM.00.02/2020).

Results

The result showed the frequent characteristics found in children who suffered from HaM, which were toddler, male, had infectious disease, with length of stay ≥ 4 days and had given oral nutrition support (Table 1).

The data distribution of HaM screening using Alarm Malnutrition indicated 129 children (76.8%) at low risk, while STRONGkids indicated 108 children (64.3%) at low risk. Meanwhile, the HaM assessment showed 15 children (8.9%) experienced HaM and 153 children (91.1%) did not experience HaM (Table 2).

The data from HaM diagnostic test using Alarm Malnutrition resulted in sensitivity and specificity values of 32.2% and 81.6% respectively. Furthermore, the positive predictive and negative predictive values were 48.7% and 68.9% respectively (Table 3). The

Table 1. Distribution of respondent characteristics June-September 2020 (n=168).

Variable	n	%	HaM	
			Yes	No
Age				
Infant (<12 month)	36	21.4	5	31
Toddler (1-3 years)	42	25	8	34
Pre-schooler (4-6 years)	21	12.5	2	19
School-aged child (7-12 years)	42	25	0	42
Adolescent (>13 years)	27	16.2	0	27
Total	168	100	15	153
Sex				
Male	95	56.5	9	86
Female	73	43.5	6	67
Total	168	100	15	153
Medical Diagnosis				
Cardiovascular system	1	0.6	0	1
Respiratory system	21	12.5	2	19
Nervous system	13	7.7	2	11
Oncology	17	10.1	2	15
Infectious	43	25.6	7	36
Others	73	43.5	2	71
Total	168	100	15	153
Length of Stay				
<4 days	79	47	4	75
≥4 days	89	53	11	78
Total	168	100	15	153
Types of Nutrition Support				
Oral	135	80.4	11	124
Parenteral	0	0	0	0
Enteral	33	19.6	4	29
Total	168	100	15	153

value of Area Under the Curve (AUC) of Alarm Malnutrition from ROC Curve is 0.480 (95% IK 0.31 – 0.65) with p-value 0.833. STRONGKids had value of AUC from ROC Curve is 0.465 (95% CI 0.278 – 0.652) with p-value 0,710. Statistically, the AUC value is classified as very weak. (Figure 1).

Discussion

This study found that toddler was the age category that frequently experienced HaM. Such finding was supported by a study conducted by Niseteo, Hojsak, and Kola who found many toddlers

Table 2. Distribution of Risk Hospital-acquired Malnutrition (HaM) with Alarm Malnutrition and STRONGkids June-September 2020 (n=168).

Variable	N	%
Alarm Malnutrition		
Low-risk	129	76.8
High-risk	39	23.2
Total	168	100
STRONGkids		
Low-risk	108	64.3
High-risk	60	35.7
Total	168	100

Table 3. Frequency of diagnostic test using alarm malnutrition and STRONGKids June-September 2020 (n=168).

	STRONGKids		Total
	High-risk (%)	Low-risk (%)	
Alarm Malnutrition			
High-risk	19 (48,7)	20 (51,3)	39
Low-risk	40 (31)	89 (69)	129
Total	59 (35,1)	109 (64,9)	168 (100)

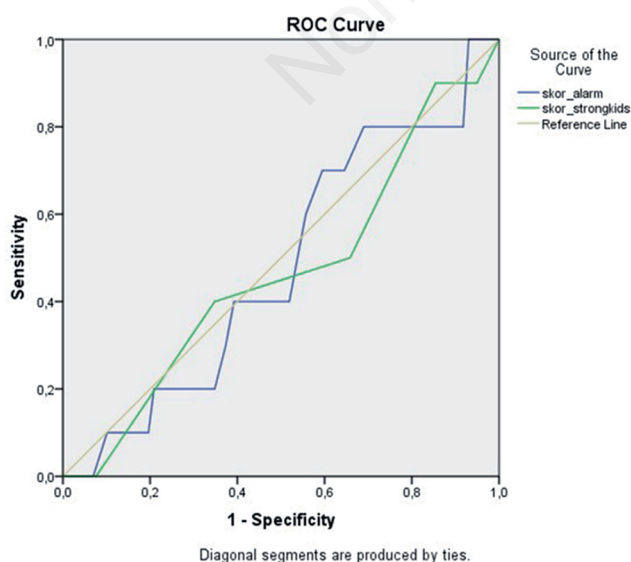


Figure 1. ROC Curve of Alarm Malnutrition and STRONGKids.

suffered from HaM during hospitalization. In terms of sex category, HaM was frequently found in male. Even though there was no definite reason related to the difference in sex category, studies showed that boys tended to be more difficult to persuade to finish their meals compared to girls.^{10,11}

In terms of medical diagnosis, the children who suffered from HaM were frequently found in infectious disease category. This finding was different from the other studies that showed gastrointestinal/liver disease and respiratory disorders as the most frequently found in children with HaM.¹² Oral nutrition category was also frequently found in this study. These two categories were affected by the data collecting process because it was conducted during pandemic coronavirus disease, which led to changes in hospital policies regarding inpatient care, such as reduction of infectious disease patients and admission to intensive care units.

In length of stay category, most of the children who suffered from HaM have been treated for ≥ 4 days. From a study conducted in Finland, it was found that the average length of stay for patients who suffered from HaM was 4-12 days compared to those who did not.¹³ Another study also mentioned that children with HaM will have approximately 9 days of hospital stay.¹⁴

This study showed that the results of sensitivity and specificity values of STRONGkids were better than Alarm Malnutrition. It indicated that STRONGkids was considered as a good screening tool in detecting the risks for HaM.¹³ Several hospitals also used STRONGkids that has been modified based on the hospital specification.¹⁵

Alarm Malnutrition needs some modification and improvement in the cut off value of MaR so it can be used as a screening tool accordance with the characteristics of the child. Besides being proven as good, STRONGkids is also easy to use, therefore it can help the nurses in detecting the risks for HaM in children.³ The positive predictive and negative predictive values in this study also showed that STRONGkids had better accuracy value compared to Alarm Malnutrition.¹³ A limitation of this study is due to the data collection process, which took place during pandemic situation, which affected the variety of patients hospitalized in the hospital.

Conclusions

HaM risks assessment in children needs a good, accurate, and easy-to-use screening tool. STRONGkids becomes the screening tool that has been proven good in detecting the risks for HaM, and it can be used for children aged 1 month to 18 years old. Alarm Malnutrition screening tool needs to be improved in order to achieve better performance in detecting the risks for hospital-acquired malnutrition.

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