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# Validity of Pediatric Yorkhill Malnutrition Score to detect pediatric hospitalized malnutrition



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## ABSTRACT

**Introduction:** Hospitalized malnutrition in children is a nutritional imbalance that occurs during hospital treatment, regardless the nutritional status at admission. Hospitalized malnutrition can be prevented, with periodic evaluation of nutrition status and early detection of hospital malnutrition. Pediatric Yorkhill Malnutrition Score (PYMS) can be one of the instruments used at Sanglah Hospital to prevent hospital malnutrition. This study aims to know the validity of PYMS to detect hospitalized malnutrition in pediatric patient at Sanglah Hospital.

**Method:** This Study was a prospective cohort study, performed at Sanglah Hospital Denpasar between August and December 2017. The subjects were collected using consecutive sampling method. PYMS

was measured when admitted. Hospitalized malnutrition was defined if there is any weight loss during hospitalization. Between August and December 2017, 240 subjects were retained for analysis.

**Result:** The incidence of hospitalized malnutrition was 14.1%. The combined high risk and medium risk of PYMS had 97.1% sensitivity, and 47.1% specificity, positive predictive value (PPV) 23.2% and negative predictive value (NPV) 98.9% for detecting children who are at risk for hospitalized malnutrition.

**Conclusion:** Pediatric Yorkhill Malnutrition Score is acceptable for a screening tool, however it also important to ensure to the staff low score does not negate referral for dietetic assessment.

**Keywords:** Hospitalized malnutrition, screening tool, PYMS

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## INTRODUCTION

Hospitalized malnutrition in children is a nutritional imbalance that occurs during hospital treatment, regardless the nutritional status at admission. Hospitalized malnutrition is associated with increased length of stay, increased morbidity, and increased mortality.<sup>1,2</sup> In children nutrition needed not only for growth and development but also for healing process, reduced length of stay and reduced the occurrence of complication.<sup>2,3</sup> The incidence of hospitalized malnutrition increased with increasing length of stay.<sup>4</sup> The prevalence of hospitalized malnutrition in inpatient children were 6.1-51.6%.<sup>3</sup> The incidence hospitalized malnutrition in inpatient children at Sanglah hospital was 30.1%.<sup>4</sup> Hospitalized malnutrition is one indicator of hospital care.<sup>3</sup>

Early detection of hospital malnutrition is important, but there were currently no appropriate indicators for early detection of hospital malnutrition. Most hospital malnutrition checks take considerable time with analytical methods and often require laboratory tests, making it less appropriate to use as a screening tool.<sup>3</sup> Pediatric Yorkhill Malnutrition Score (PYMS) is one of the instruments to detect hospital malnutrition, that was developed in tertiary children's hospital Royal Hospital for Sick Children (RSHC), Yorkhill,

Glasgow. PYMS examination quite simple, by assessing the four variables of body mass index, history of weight loss, decreased ability to eat and the patient's clinical condition affecting the patient's nutritional status. PYMS may be used in pediatric patients as well as in pediatric surgery patients.<sup>5</sup>

Hospitalized malnutrition can be prevented, with periodic evaluation of nutrition status and early detection of hospital malnutrition.<sup>2</sup> Pediatric Yorkhill Malnutrition Score can be one of the instruments used at Sanglah Hospital to prevent hospital malnutrition, despite research on the validity of PYMS were limited. This study aims to evaluate the validity of PYMS to detect hospitalized malnutrition in pediatric patient at Sanglah Hospital.

## METHOD

This observational analytic study was using prospective cohort approach. This study was done on August 2017 until December 2017 at Sanglah Hospital Denpasar. Target population was pediatric patients. The reachable population was pediatric patients at Sanglah hospital Denpasar. Informed consent was obtained from the parents. The inclusion criteria were pediatric patient aged 1 month until 17 years old with

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expected length of stay (LOS) at least one day. Patients with incomplete data were excluded. This study was performed under supervision of Nutrition and Metabolic Disease Subdivision, Department of Child Health in Sanglah Hospital, Medical School of Udayana University and approved by ethical clearance 2018.02.1.0517 from the Ethics Committee of Faculty of Medicine, Udayana University-Sanglah General Hospital, Bali-Indonesia.

Subjects were consecutively enrolled until complete the required sample size. Based on previous study, the prevalence of hospitalized malnutrition in children is 30,1%.<sup>4</sup> The minimum subjects required in this study is 238 subjects. Age, sex, nutritional status, and PYMS score were recorded. Weight was measured at admission and discharge by trained medical staff. Nutritional status was categorized as malnourished, well-nourished, and obese.

Descriptive data are shown as median and percentage in table. Unpaired t-test was used to compare between hospitalized malnutrition subject and subject without hospitalized malnutrition if the data was not normal using Mann-Whitney test. Categorical data were compared with Chi-square and Fisher test if the Chi-square condition unfulfilled.

PYMS is a screening tool for risk of nutritional status and growth for children. A score of 0 indicates low risk, 1 indicates medium risk and 2 or above high risk. PYMS consists of 4 question with a maximum score 7 points:

- a. Is the patient's BMI below the limit on the BMI table?
  - Yes (2 points)
  - No (0 points)
- b. Has the child lost weight recently?
  - Yes, unintentional weight loss, clothes looser, poor weight gain (if <2 years) (1 point)
  - No (0 point)
- c. Has the child had a reduced intake (including feeds) for at least the past week?
  - Yes, no intake (or a few sips of feed only) for at least the past week (2 point)
  - Yes, decrease of usual intake for at least the past week (1 point)
  - No, usual intake (0 point)
- d. Will the child's nutrition be affected by the recent admission/condition for at least the next week?
  - Yes, no intake (or a few sips of feed only) for at least the next week (2 point)

- Yes, for at least the next week decreased intake and/or increased requirements and/or increased losses (1 point)
- No (0 point)

Hospitalized malnutrition define if the patient has weight loss > 2% if the patient length of stay less than one week, or 5% if more than one month, or 10% if more than six-month hospitalization.

## RESULT

Between August and December 2017, 389 subjects fulfilled the inclusion criteria. One hundred and forty-nine subjects were excluded because incomplete data. Two hundred and forty subjects were retained for analysis.

The characteristics of subjects are described in [table 1](#). The median age of all subjects was three year, 53% was male and 40.6% was female. In this study, 45% subject was malnourished, 40.4% subject was well nourished, and 14.6% was obese. The minimum length of stay was three days, the longest length of stay was 100 days. There was 14.1% suffered hospitalized malnutrition. There were 40.8% of subject with low risk, 13.3% medium risk and 45.8% high risk.

Result of validity was presented in two table based on the group of malnutrition risk. The high risk of PYMS had 64.7% sensitivity, and 57.2% specificity, PPV 20% and NPV 90.7%. ([Table 2](#)) However, when the high risk was combined with the medium risk the PYMS had 97.1% sensitivity, and 47.1% specificity, PPV 23.2% and NPV 98.9% for detecting children who are at risk for hospitalized malnutrition ([Table 3](#)).

There was no different between subject with hospitalized malnutrition and subject without hospitalized malnutrition in sexes, ages, and nutritional status. There was significant difference in length of stay. The subject with hospitalized malnutrition had a longer lengths of stay ( $p < 0.05$ ) ([Table 4](#)).

## DISCUSSION

Hospitalized malnutrition can be caused by decrease in appetite due to the illness so that the nutrient intake was low, on the other hand nutritional requirements are indispensable for the healing process. Hospitalized malnutrition alone will sever the underlying disease and slow the healing period.<sup>4</sup> European Society for Parenteral and Enteral Nutrition (ESPEN) recommended every hospital to use hospital malnutrition screening tools to the patient to detect nutritional deficiencies

**Table 1 Subject characteristic based on risk of malnutrition**

Variables	n = 240
Age (year), median (minimum-maximum)	3 (1-17)
<b>Sex</b>	
Male, n (%)	128 (53.3)
Female, n (%)	112 (46.7)
<b>Nutritional status</b>	
Malnourished, n (%)	108 (45)
Well-nourished, n (%)	97 (40.4)
Obese, n (%)	35 (14.6)
<b>Length of stay, median (minimum-maximum)</b>	7 (3-100)
<b>Body mass index</b>	
Below the limit, n (%)	94 (39.2)
Above the limit, n (%)	146 (60.8)
<b>Weight loss recently</b>	
No, n (%)	216 (90)
Yes, n (%)	24 (10)
<b>Decrease food intake</b>	
No, n (%)	185 (77.1)
Yes, decrease intake, n (%)	53 (22.1)
Yes, no intake, n (%)	2 (0.8)
<b>Clinical condition affect food intake</b>	
No, n (%)	207 (86.3)
Yes, decrease intake, n (%)	28 (11.7)
Yes, no intake, n (%)	5 (2.1)
<b>Hospitalized Malnutrition</b>	
No, n (%)	206 (85.9)
Yes, n (%)	34 (14.1)
<b>Risk of malnutrition</b>	
Low risk, n (%)	98 (40.8)
Medium risk, n (%)	32 (13.3)
High risk, n (%)	110 (45.8)

**Table 2 Sensitivity and specificity of PYMS in high risk and low + medium risk group**

		Hospitalized malnutrition	
		Yes	No
Malnutrition Risk	High risk	22	88
	Low + medium risk	12	118
Sensitivity		64.7%	
Specificity		57.2%	
Positive predictive value		20.0%	
Negative predictive value		90.7%	

and whether these nutritional deficiencies can occur when the patient is in care. Based on ESPEN the hospital's malnutrition screening tool should include at least four basic questions:<sup>6,7</sup>

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, causing nutritional status to worsen more rapidly or to develop a poor nutritional status rapidly from fairly normal states.

Pediatric Yorkhill Malnutrition Score was based on the basic principles laid down by ESPEN. The basic screening principles by using PYMS to look at the nutritional status at the time of hospitalization, the previous weight loss, the reduced intake due to the underlying disease, and the severity of the disease that causes interruption of the patient's feed intake at the time of treatment.<sup>6,7</sup> The objective of PYMS is to identify the nutritional status of the patient, the need for intervention to the nutritional status of the patient, and to predict the nutritional status outcome without intervention from the patient.<sup>7</sup> Pediatric Yorkhill Malnutrition Score screening tool is a questionnaire consisting of four questions. The patient's current nutritional status measured using anthropometric status, making the PYMS easy to use by anyone at the time of inpatient care, on the other hand there was a problem of differences in the determination of risk status when screening done by different people.<sup>5,7</sup> In this study PYMS conducted by the researcher who is a senior pediatric resident.

The prevalence of hospitalized malnutrition in pediatric ward Sanglah Hospital was 14.1%. The prevalence of hospitalized malnutrition varied from 15.5% to 51.6%.<sup>8,9</sup> This difference was happened due to different criteria for hospitalized

**Table 3** Sensitivity and specificity of PYMS in nutritionally medium + high risk and low-risk group

		Hospitalized malnutrition	
		Yes	No
Malnutrition Risk	Medium + high risk	33	109
	Low risk	1	97
Sensitivity		97.1%	
Specificity		47.1%	
Positive predictive value		23.2%	
Negative predictive value		98.9%	

**Table 4** Comparison between subject with hospitalized malnutrition and subject without hospitalized malnutrition

	Hospitalized Malnutrition		p-value
	Yes	No	
Sex			0.579*
Male, n (%)	20 (58.8)	108 (52.4)	
Female, n (%)	14 (41.2)	98 (47.6)	
Age (year), median (minimum-maximum)	3,5 (1-16)	3 (1-17)	0.972**
Nutritional status			0.547*
Malnourished, n (%)	18 (52.9)	90 (43.7)	
Wellnourished, n (%)	11 (32.4)	86 (41.7)	
Obese, n (%)	5 (14.7)	30 (14.6)	
Length of stay, days, median (minimum-maximum)	24.5 (3-100)	7 (3-42)	<0.05**

\* Chi-Square test

\*\* Mann-Whitney

malnutrition. Some researchers use the criteria of any weight loss, some use decrease of Z-score weight per height more than 0,5 SD, others define as a loss of weight greater than 2% or a decrease in BMI greater than 0.25 SD.<sup>4,10</sup>

In our study there was significant difference in length of stay in each group. Length of stay significantly longer in hospitalized malnutrition group. This finding was previously reported in previous study.<sup>11</sup> However, length of stay is related to adverse effect of immune system vulnerability, increased risk of infections, gastrointestinal complication, impaired organ function, higher treatment cost and increased mortality.<sup>11,12</sup> Length of hospital stay is negatively related with satisfaction of hospital food in inpatient children patient, that could lead to lack of intake of nutrition in the patient.<sup>10</sup> In our study, the median for length of stay was seven day. There was a significant difference between subject with hospitalized malnutrition group and subject without hospitalized malnutrition group ( $p < 0.05$ ) in length of stay in hospital. In previous study at

Sanglah hospital found that length of stay more than fourteen days increased 8.1 times the risk of hospitalized malnutrition.<sup>13</sup> The patients with chronic illness tended to have a higher PYMS score, and tend to have a longer length of stay.<sup>14</sup> This study did not analyze the disease of the patient, whether acute or chronic disease.

There is discrepancy between hospitalized malnutrition and nutritional status on admission. In the study before found that normal weight and mildly malnourished patients do not draw the attention of the healthcare team to a possible need of nutritional support, while patient with moderate malnutrition receives special care.<sup>10</sup> In this study there were no differences in prevalence of hospitalized malnutrition in each of nutritional status (Table 4), with p-value was 0.5. In Sanglah hospital every patient in pediatric ward will be done nutrition assessment by the resident, then they all will be followed up by the nutritionist, although they have no malnutrition. In this study we used Waterlow classification to determine nutritional status, while in PYMS used BMI.

The study that held in Hasan Sadikin Bandung Hospital found that the sensitivity of PYMS was 95.1% and the specificity was 76.2%.<sup>6</sup> That found PYMS much better than the other screening tool like modified Simple Pediatric Nutritional Risk Score (SNRS), STRONG-kids and STAMP. On previous study at Sanglah hospital found that modified SNRS had 79% sensitivity and 71% specificity.<sup>15</sup> On the Gerasimidis study that compares STAMP, PYMS and SGNA, which involved 2.174 children found that PYMS had 85% sensitivity and 87% specificity and was conclude that PYMS was a better screening tool to identified hospitalized malnutrition risk in children.<sup>5</sup> In our study the sensitivity of high-risk group was 64.7% and the specificity was 57.2%. However when the high risk combined with medium risk the sensitivity was 97.1% and the specificity was 47.1%. Patients who had BMI less than -2 SD were in the high-risk group due to PYMS score at hospital admission, these made false positive frequently occurred especially in patients with patients with short length of stay. These might be happening because the policy in Sanglah hospital to do the nutritional assessment in all pediatric patient that came to hospital. The nutritionist team could make early intervention by at Sanglah Hospital when the pediatric patient came to hospital, which made numbers of false-positive case increase and decreased the specificity.

Limitation of this study is sensitivity and specificity found in the group in a combination of high risk with a combination of low and medium risk is low enough so that it is less relevant as a tool for diagnostic.

## CONCLUSION

The sensitivity of PYMS in high-risk group was 64.7% and the specificity was 57.2%. However when the high risk combined with medium risk the sensitivity was 97.1% and the specificity was 47.1%. This result is acceptable for a screening tool, however it also important to ensure to the staff low score does not negate referral for dietetic assessment for other valid reasons.

## CONFLICT OF INTEREST

Author have no conflict of interest regarding all aspect in this study.

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