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Riesgo nutricional y factores asociados en pacientes pediátricos hospitalizados a través de STRONGKids

Nutritional risk and associated factors in hospitalized paediatric patients through the STRONGKids

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RESUMEN

Introducción: El uso de instrumentos para la identificación del riesgo nutricional en niños hospitalizados contribuye para la evaluación y la intervención adecuada.

Objetivo: Evaluar el riesgo nutricional y factores asociados en pacientes pediátricos hospitalizados, a través de instrumentos STRONGkids.

Métodos: Estudio transversal, con 122 niños y adolescentes de ambos sexos, internados en un hospital público pediátrico en el municipio de Bahia entre octubre y noviembre de 2013. Todos los pacientes fueron sobmetidos, en las primeras 48 horas después de la admisión a proyección de riesgo nutricional (STRONGkids), a evaluación antropométrica y evaluación de las condiciones socioeconómicas. Se utilizó el programa STATA for MAC para análisis de los datos, adoptando el nivel de significancia menor que el 5%.

Resultados: La edad media fue de 61,6 meses (±5.12DP), predominando el sexo masculino (68%). La edad materna media fue de 31.2 meses (±7.69DP). El tiempo medio de permanencia hospitalaria fue de 8.4 días (±7.31DP). La prevalencia de desnutrición fue de 13.9%, de acuerdo con la antropométrica. El STRONGkids identificó 63.1% de los pacientes con medio y alto riesgo nutricional. Algunos factores se asociaron con medio y alto riesgo nutricional, como la edad materna ($p<0.02$), diagnóstico nutricional ($p<0.01$) y baja condición socioeconómica ($p<0.04$). Además de eso, este estudio mostró asociación específica entre riesgo nutricional y tiempo de permanencia hospitalaria, que se hizo más evidente cuando se ajustó el modelo a la condición socioeconómica.

Conclusiones: La edad materna, el diagnóstico antropométrico y la condición socioeconómica fueron factores de riesgo importantes para el medio y alto riesgo nutricional en esta población. Esas características pueden ser utilizadas para orientar protocolos de intervención preventiva de la desnutrición hospitalaria.

PALABRAS CLAVE

Desnutrición, Hospitales, Pediatría, Triaje, Antropometría.

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ABSTRACT

Background: The use of nutritional screening tools to identify nutritional risk in hospitalized children contributes to the adequate evaluation and intervention.

Objective: Evaluating the nutritional risk and associated factors in hospitalized paediatric patients through the $STRONG_{kids}$.

Methods: It is a cross-sectional study including 122 both sex children and adolescents admitted in a public paediatric hospital in Bahia, Brazil, between October and November 2013. The patients were submitted to the $STRONG_{kids}$ screening, anthropometric and socioeconomic evaluations at the first 48 hours of the admission. The statistical analyses included the Poisson regression model and it was adopted the significance level <5%.

Results: The mean age was 61,6 months (±5.12SD), predominantly male (68%). The mean time of length of hospital stay was 8.4 days (±7.31). Malnutrition prevalence was 13.9%, according to anthropometry. The $STRONG_{kids}$ identified 63.1% of patients with medium or high nutritional risk. Maternal age (p=0.02), anthropometric diagnosis (p=0.01) and socioeconomic condition (p=0.02) were factors associated to the medium and high nutritional risk. Also, we identified an association between medium and high nutritional risk at the admission and a longer period of hospital stay (PR=3.27; p=0.01), which was more relevant when adjusted by socioeconomic condition (PR=4.17; p<0.01).

Conclusions: Maternal age, anthropometric diagnosis and socioeconomic condition were factors related to medium or high nutritional risk in this population. The medium or high nutritional risk at the admission was associated to a longer period of hospitalization. These are important findings that could guide the adoption of nutritional protocols to prevent hospital malnutrition.

KEYWORDS

Malnutrition; Hospital, Paediatrics; Screening; Anthropometry.

ABBREVIATIONS LIST

ABEP: Brazilian Association of Research Companies.

AIC: Akaike Information Criterion.

BMI/A: Body Mass Index by Age.

CCEB: Brazil Economic Classification Criteria.

H/A: Height by Age.

IBRANUTRI: Brazilian Survey of Nutrition Assessment Hospital.

LOS: Length of Hospital Stay.

$STRONG_{kids}$: Screening Tool for Risk of Impaired Nutritional Status and Growth.

SUS: Brazilian Public Health System.

W/A: Weight by Age.

W/H: Weight by Height.

WHO: World Health Organization.

BACKGROUND

The nutritional screening is a simple method that allows identifying the hospital malnutrition risk degree. Recognizing this risk early allows to establish more effective intervention measures[1].

In the last years, the implementation of nutritional screening protocol has been recommended as a strategy to improve the nutritional management in hospitalized children and to avoid adverse events[2].

In Brazil, the Ministry of Health enforced the implementation of screening protocol for patients admitted by the Public Health System as a condition for payment of enteral and parenteral nutritional therapy[3]. However, there are not scientific publications about the use of nutritional screening tools in ill children.

A number of tools were developed and validated to detect the nutritional risk or to evaluate the nutritional status in hospitalized children in Europeans countries, for instance, Nutrition Risk Score (NRS), Subjective Global Nutritional Assessment (SGNA), Paediatric Yorkhill Malnutrition Score (PYMS), Screening Tool for the Assessment of Malnutrition in Paediatrics (STAMP), Paediatric Nutritional Risk Score (PNRS) and Screening Tool For Risk Of impaired Nutritional Status and Growth ($STRONG_{kids}$)[4].

Although a lot of screening tools are available to evaluate, at the time of the hospital admission, the nutritional status or the risk of children develop malnutrition in the hospital, none of them is universally accept in paediatrics patients[5]. Despite this, studies have demonstrated that the early detection of malnutrition risk contributes to reduce the complications of the hospitaliza-

tion, accelerating the recovering, saving resources of the health system, and improving the health care and nutrition services[6].

Recently, the screening tool $STRONG_{kids}$ was translated to the brazilian Portuguese and culturally adapted[3], so that it can encourages its replicability in the Brazilian context. Thus, this study aimed to evaluate the nutritional risk of hospitalized children, according to their categories and associated factors in a public hospital of Bahia, using the $STRONG_{kids}$ tool.

MATERIALS AND METHODS

It is a cross-sectional study undertaken in the period of October to November, 2013, in an high complexity hospital, located in Feira de Santana, state of Bahia. This hospital serves exclusively to the Public Health System, with 154 beds and with 95% of occupancy rate, on average.

It was adopted as inclusion criteria of this study being between one month and 18 incomplete years old, being admitted by the emergency of the referred hospital and being accompanied by a responsible. All the patients with neuropathy, amputation of limbs, paraplegic or quadriplegic, or any one with not confirmed clinic diagnosis, besides cases that were impossible to perform the anthropometric evaluation, were excluded.

Thus, it was included in the study 122 children and adolescent. The sample power was calculated considering a prevalence of 62% of children and adolescent with diagnosis of medium and high nutritional risk in the moment of the admission, as found in the STRONGkids original study[7]. Considering these conditions, the sample has a power (1-ß) of 81,8% to detect the prevalence of nutritional risk, according to the STRONGkids screening, considering 5% of significance level and two-tailed tests, indicating that the sample size is enough to perform non-biased estimates of the parameters in the population study[8].

The weight and height measures were performed by the use of the WHO (World Health Organization) standard methodology[9,10]. The measurement of the weight was done using an infant balance (Filizola Beyond Technology BP Baby®), with a maximum capacity of 15 kilograms and sensibility of 1 gram; and a mechanical balance (Welmy®) with maximum capacity of 150 kilograms and sensibility of 100 grams. An anthropometric ruler with 2 meters was used to measure the height of children higher than 1 meter. For children lower than 1 meter, it was used a portable horizontal anthropometric ruler (Balmak®), graduated in 1 millimetre.

It was used the software *Who Anthro* (for children younger than 5 years old) and *Who Anthro Plus* (for patients older than 5 years old) to classify the indicators weight by height (W/H), weight by age (W/A), height by age (H/A) and body mass index by age (BMI/A), in the respective z-score curves. This is the evaluation method recommended by the Brazilian Ministry of Health for anthropometric diagnosis of children younger and older than 5 years old. The individual was considered malnourished when at least one of these indicators was altered.

The variable age of children/adolescent was categorized in two groups, using five complete years as the cut-off (<=5 and >5 years old). The maternal age was categorized using 25 years old as the cut-off. For the nutritional status, it was grouped in malnourished and non-malnourished.

For the socioeconomic classification, each patient was classified in A1, A2, B1, B2, C1, C2, D or E, according to the Brazilian Criteria of Economic Classification (CCEB) of the Brazilian Association of Research Companies (ABEP), where A1 is the best classification and E the worst. Because of the statistical analysis, this variable was classified as a binary variable, grouping one category in A1 to C2 and another category in D or E[11].

The length of hospital stay (LOS) was grouped in: <=9 days and >9 days, according to the criteria used by the Brazilian Survey of Nutritional Hospital Assessment (IBRANUTRI), in 2001, for the association between malnutrition and LOS[12].

It was used the prevalence to characterize the distribution of the outcome and exposition variables in the study population. The comparison of the outcome variable nutritional risk according to the exposition variables was performed using the Chi-squared test, for categorical variables.

It was performed the Poisson Multiple Regression to identify the variables associated to the medium and high nutritional risk prevalence and to the high time of hospital stay prevalence. It was used the prevalence ratio (PR) as the estimator in the modelling, which compare the outcome prevalence in the exposed individuals with the prevalence in non-exposed individuals[13]. We have chosen this modelling because the "rare disease"

assumption (prevalence lower than 10%) was not achieved in this study, which means that the use of Odds Ratio (OR) is not recommended, since it tends to calculate overestimated estimates and/or less accurate confidence interval[14].

Thus, it was performed two models: one to evaluate the factors associated to the nutritional risk and another one to evaluate the relationship between the LOS and the nutritional classification. The first one used the medium and high nutritional risk as the outcome variable and the age, sex, maternal age, socioeconomic classification and anthropometric diagnosis as the exposition variables. The second model used the LOS as outcome variable and the nutritional classification as the exposition variable.

The model explanation capacity was measured by the use of the pseudo-R^2 for binomial models that evaluates the fit of the log-likelihood of the full model compared to the reduced model[15]. The Akaike Information Criterion (AIC) – which evaluates the lost information of an adopted model – was calculated to assess the fit of the Poisson multiple models. Thus, the less information lost, better is the fit of the model (the lower AIC, better the fit)[16].

The data collection was performed using a questionnaire that contained demographics, anthropometric, socioeconomic and healthy information. Beside this, it was used the brazilian version of the $STRONG_{kids}$ form to undertake the nutritional screening[3]. All the data were simultaneously collected in the first 48 hours of the admission. Before the beginning of the data collection, it was performed a pilot study aiming to correct the possible failures or mistakes of the questionnaire and to qualify the research for the collection.

The statistical analyses were performed in the software STATA for MAC, version 12.0. First, the univariate analysis was performed to select the variables to be included in the multivariate model. For this selection, it was adopted the significance level lower than 20%. The variable was kept in the final model when the significance level was lower than 5%.

This study was submitted to the ethics committee of the Federal University of Reconcavo of Bahia and it was approved by the opinion nº CAAE 20045513.0.0000.0056. The informed consent term was signed by the children's guardians and the assent term for adolescents was signed by those who were able to understand the objective of the research and their participation.

RESULTS

In this study have participated 122 patients, and no child/adolescent or guardian have refused to be included in the research. The mean age identified was 61.6 months (±5.12SD). Considering the maternal age, the mean found in this study was 31.2 years (±7.69SD). The mean time of hospital stay identified in this study was 8.4 days (±7.31SD).

The characteristics of the patients are described in the Table 1. It was observed that most participants were younger than or equal to 5 years of age, were male and were classified between the classes A1 and C2 of the socioeconomic condition. Besides this, most of their mothers were older than 25 years.

The most common causes of hospital admission were chronic diseases (cardiopathies, kidney failure and type 1 diabetes mellitus), followed by infectious, digestive tract and nutritional disorders diseases (Table 1).

It was found that most of the patients evaluated stayed in the hospital for less than 9 days and were classified as non-malnourished, according to the anthropometry (86.1%). Considering the nutritional screening, more than half of the patients were classified with medium or high nutritional risk, according to the $STRONG_{kids}$ classification (Table 1).

In the Table 2 are presented the factors related to the nutritional risk in children and adolescents admitted in the hospital, according to the $STRONG_{kids}$ classification. It was observed that most of the malnourished patients (according to the anthropometric evaluation) were with medium or high nutritional risk (according to the $STRONG_{kids}$ classification). Furthermore, most of the patients classified in the classes D and E of the socioeconomic condition were also classified in the medium and high risk, according to the nutritional screening. These relationships were statistically significant ($p<0.05$) (Table 2).

The results of the univariate analysis between the LOS and the independents variables are presented in the Table 3. It was observed that most of the individuals that stayed in the hospital for more than nine days were classified with medium or high nutritional risk, according to the nutritional screening, and this relationship was statistically significant ($p=0.01$) (Tabela 3).

The results of the Poisson multivariate regression, aiming to evaluate the factors associated to the nutritional screening, according to the $STRONG_{kids}$ classifica-

Table 1. Sociodemographic, clinics and anthropometrics characteristics of children and adolescents admitted in a public hospital. Feira de Santana-Ba, 2013.

Variables	N	%
Age		
≤ 5 years	68	55.7
> 5years	54	44.3
Sex		
Female	54	44.3
Male	68	55.7
Socioeconomic classification		
A1 to C2	80	65.6
D and E	42	34.4
Maternal Age		
≤ 25 years	27	22.1
> 25 years	95	77.9
Clinic Diagnosis		
Chronic Diseases	17	13.1
Infectious Diseases	5	4.1
Digestive Tract Diseases	5	4.1
Nutritional Disorders	4	3.3
Others	91	74.6
Length of hospital stay (LOS)		
≤ 9 days	86	70.5
> 9 days	36	29.5
Anthropometric Diagnosis		
Malnourish	17	13.9
Non-malnourish (eutrophic/ overweight/obesity)	105	86.1
Nutritional Screening		
Low risk	45	36.9
Medium and high risk	77	63.1

N=122.

tion, are presented in the Table 4. Patients whose mothers were adolescent had 3.65 greater chance of being classified with medium and high nutritional risk, according to the $STRONG_{kids}$ tool, if compared to those whose mothers were adults (Table 4).

Considering the anthropometric diagnosis, children and adolescents malnourished were 7.44 times more likely to be classified with medium or high nutritional risk – according to the $STRONG_{kids}$ classification –, when compared to those eutrophics or overweight/obese (Table 4).

It was also possible to identify that individuals classified in the lowest socioeconomic condition (D and E) had 4.06 times more likely to be classified with medium and high nutritional risk in the nutritional screening (Table 4), if compared to those with better socioeconomic conditions.

The specific association between length of hospital stay and the nutritional classification, according to the $STRONG_{kids}$ screening, is presented in the Table 5. The crude model identified that individuals with medium and high nutritional risk at the moment of the admission, were 3.27 times more likely to stay for more than nine days admitted in the hospital, when compared to those admitted with low nutritional risk, according to the $STRONG_{kids}$ screening (Table 5).

When this model was adjusted by the socioeconomic condition (final model), the chance of children and adolescents admitted with medium and high nutritional risk staying for more than nine days in the hospital increased to 4.17 times, if compared to those classified with low risk in the moment of the admission. It is also possible to observe that the final model fitted appropriately to the data – considering the AIC reduction (from 144.9 to 141.5) –, and that the inclusion of the socioeconomic variable increased the explanatory power of the model, which is observed by the increase of the pseudo-R^2 from 4.8% (crude model) to 8.4% (final model) (Table 5).

DISCUSSION

A number of nutritional screening tools have been proposed and studied aiming to identify patients in nutritional risk at the moment of the hospital admission around the world. Although it is observed an increase in the number of publications related to the use of these tools in the clinical practice, there are not, in the scientific literature, recent publications evaluating the use of nutritional screening tools in Brazilian paediatric

Table 2. Univariate analyses between $STRONG_{kids}$ nutritional screening and the independent variables. Feira de Santana-Ba, 2013.

Variables	$Strong_{Kids}$: Low risk n(%)	$Strong_{Kids}$: medium and high risk n(%)	P value
Age			
≤ 5 years	23 (33.8)	45 (66.2)	0.43
> 5 years	22 (40.7)	32 (59.3)	
Sex			
Female	21 (38.9)	33 (61.1)	0.68
Male	24 (35.3)	44 (64.7)	
Maternal age			
≤ 25 years	6 (22.2)	21 (77.8)	0.07
> 25 years	39 (41.0)	56 (59.0)	
Anthropometric Diagnosis			
Malnourish	2 (11.8)	15 (88.2)	**0.02****
Non-malnourish (eutrophic/ overweight/obesity)	43 (41.0)	62 (59.0)	
Socioeconomic classification			
A1 to C2	21 (50.0)	21 (50.0)	**0.03***
D and E	24 (30.0)	56 (70.0)	

hospitals. Therefore, the present study was important by the pioneering in the use of the $STRONG_{kids}$ screening tool to detect the malnutrition risk in children and adolescents admitted in a Brazilian public hospital.

In a recent study, six nutritional screening tools specifics for hospitalized children were evaluated according to their objectives, clinical use and validity. Considering the authors conclusions, one of the most important is referred to the $STRONG_{kids}$ nutritional screening tool, that showed to be easier and more practical if compared to the others screening tools, besides to better correlate anthropometric parameters and length of hospital stay[4].

In the present study, the prevalence of medium and high nutritional risk in patients admitted in the hospital were similar to those identified in studies undertaken in other countries, using the STRONGkids screening. Recent studies detected medium and high nutritional risk in 62% of hospitalized children in Holland[7], 63% in New Zeeland[17], 68% in Italy[18], 76% in United Kingdom[19] and 59% in Iran[5]. These results also corroborate to the last findings identified by studies in China – where the prevalence of hospitalized children with medium and high nutritional risk was 52%[20] – and in Romania, that detected 58% of medium and high nutritional risk in hospitalized children, according to the STRONGkids screening tool[21].

The present study showed that the STRONGkids screening detected medium and high nutritional risk in 80% of the malnourished patients. That is because two children presenting growth deficit were included in the malnourished group, since it could be caused by a previous malnutrition, which was possible to recover the weight, but not the height. However, it worth noting that these children could have a short stature due to other factors, as genetic, for example.

Studies around the world have documented the prevalence of hospital malnutrition. It is difficult to determine this prevalence, since there is no a standard or consensual method to define malnutrition. However,

Table 3. Univariate analyses between the length of hospital stay (LOS) and the independent variables. Feira de Santana-Ba, 2013.

Variables	LOS ≤9 days n(%)	LOS >9 days n(%)	P value Age
Age			
≤ 5 years	44 (64.7)	24 (35.3)	0.11
> 5 years	42 (77.8)	12 (22.2)	
Sex			
Female	37 (68.5)	17 (31.5)	0.6
Male	49 (72.1)	19 (27.9)	
Maternal Age			
≤ 25 years	16 (59.3)	11 (40.7)	0.1
> 25 years	70 (73.7)	25 (26.3)	
Nutritional Screening			
Low risk	38 (84.4)	7 (15.6)	**0.01***
Medium and high risk	48 (62.3)	29 (37.7)	
Socioeconomic Classification			
A1 to C2	25 (59.5)	17 (40.5)	0.05
D and E	61 (76.3)	19 (23.7)	

Table 4. Factors associated to medium and high nutritional risk, according to the $STRONG_{kids}$ screening, in children and adolescents admitted in a public hospital. Feira de Santana-Ba, 2013.

Variable	PR	CI 95%	P value*
Maternal Age			
>=25 years	-	-	-
< 25 years	3.65	1.18-11.25	0.02
Anthropometric Diagnosis			
Eutrophic/ overweight/ obesity3	7.44	-	-
Malnutrition	-	1.5-36.8	0.01
Socioeconomic Classification			
A1 to C2	-	-	-
D and E	4.06	1.17-6.57	0.02

Table 5. Association between the length of hospital stay and the nutritional classification, according to the $STRONG_{kids}$ screening, in children and adolescents admitted in a public hospital. Feira de Santana-Ba, 2013.

	PR (CI 95%); p value*	
	Crude model**	**Final Model*****
Nutritional screening		
Low risk	Reference	Reference
Medium and high risk	3.27 (1.29-8.3); 0.01	4,17 (1.56-11.11); <0.01
Pseudo-R^2	4,8%	8,4%
AIC	144.9	141.5

* Poisson multivariate regression model.
** Crude model for the relationship between LOS and nutritional classification according to the $STRONG_{kids}$ screening.
*** Model fitted by the socioeconomic conditions.

studies suggest prevalence values around 7 to 24% of malnutrition in hospitalized paediatric patients in developed countries[21].

A literature review about prevalence of acute malnutrition in hospitalized children with mixed clinical diagnosis revealed prevalence of 6.1% in Germany, 11-21% in France, 8-14% in United Kingdom, 6.9% in Brazil and 7.1% in the United States (USA)[22].

In Brazil, studies show that the malnutrition in hospitalized paediatric patients can reach indices above 50%, being the second most frequent cause of death in individuals younger than 5 years of age in developing countries[23].

In the present study, the prevalence of malnutrition was 17%, according to the anthropometric diagnosis. Similar results were found in Holland (19%)[7] and in Italy (20%)[18] in paediatric patients at the moment of the hospital admission. However, brazilian authors identified prevalence of malnutrition in 41.87% and 71.2% of the admitted children[24,25]. Probably, this difference can be explained by the socioeconomic condition of the evaluated sample, whose 65% were classified in the worse socioeconomic stratus.

Studies have demonstrated that the hospital malnutrition is one of the most onerous diseases for the Brazilian Public Health System (SUS)[26]. Furthermore, there is evidence that the infant malnutrition is related to growth deficit, infectious diseases and damage of the psychomotor development[27].

The most of the evaluated patients in this study have stayed admitted for less than nine days, which differs of the results identified in a brazilian hospital in the state of Ceará, where 62.4% of the hospitalized children stayed at the hospital for more than nine days, which is probably associated to the elevated prevalence of malnutrition in the evaluated sample[24]. However, another study identified a LOS mean of 7.5 days, very similar to that one observed in our study, which can to be justified, between other reasons, by the unfavourable socioeconomic conditions and malnutrition[28].

Considering the conditions associated to the medium and high nutritional risk, the findings identified in the present study showed a consistent association between this outcome and maternal age, anthropometric diagnosis and socioeconomic classification. Publications evaluating the risk factors for nutritional risk in hospitalized children are scarce, limiting the discussion of the present study. However, study undertaken with children younger than 5 years in Recife, state of Pernambuco-Brazil, identified the malnutrition as a condition that is more frequently manifested in children from family classified with low socioeconomic conditions, with prevalence of nutritional risk and malnutrition 3.4 times greater when family presented per capita income less than 0.25 minimum wages[29].

Thus, this study brings important contributions about the nutritional risk in hospitalized children, demonstrating that some characteristics, as maternal age and socioeconomic conditions, can to be determinate to evaluate the malnutrition risk in hospitalized children, at the moment of the admission. Our findings are also important for identifying that there is more chance of children classified with medium and high nutritional risk at the

moment of the admission – according to the nutritional screening – staying for more than nine days in the hospital. Considering that independent of the cause the malnutrition is followed by physiologic changes, contributing to a more elevated risk of complications and death in hospitalized children[30], the findings of the present study are even more relevant.

CONCLUSION

The results obtained in this study allow concluding that, beside the low prevalence of malnutrition, according to the anthropometric evaluation, most of patients admitted in the hospital were classified with medium and high nutritional risk, using the nutritional screening tool $STRONG_{kids}$. In a original way, these findings showed the maternal age, anthropometric diagnosis and socioeconomic conditions as factors related to the medium and high nutritional risk.

Furthermore, this study identified a specific relationship between nutritional risk at the moment of the admission and the length of hospital stay. This association was even more relevant when adjusted by the socioeconomic conditions, which means that if the individual is admitted at the hospital with medium or high nutritional risk, according to the nutritional screening, and he is from a family classified in the low socioeconomic category, greater is the chance of him staying hospitalized for a period longer than nine days.

Considering the importance of the nutritional care to prevent the hospital malnutrition and its consequences, adopting a nutritional screening protocol at the moment of the admission could positively benefit the patients, especially those classified as medium or high nutritional risk but that have anthropometric indicators compatibles to the normality.

By the other hand, the replication of studies using the translated and adapted version of the nutritional screening tool $STRONG_{kids}$ in a huge sample and in health services with different complexities is the first step to the safe use of this nutritional screening tool in brazilian hospitals.

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