TEXTO & CONTEXTO ENFERMAGEM

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FACTORS ASSOCIATED WITH THE CLINICAL DETERIORATION RECOGNIZED BY AN EARLY WARNING PEDIATRIC SCORE

Juliana de Oliveira Freitas Miranda[1]
Climene Laura de Camargo[2]
Carlito Lopes Nascimento Sobrinho[1]
Daniel Sales Portela[3]
Paloma de Sousa Pinho[4]
Thaiane de Lima Oliveira[1,5]

[1]Universidade Estadual de Feira de Santana. Feira de Santana, Bahia, Brasil.
[2]Universidade Federal da Bahia, Escola de Enfermagem. Salvador, Bahia, Brasil.
[3]Faculdade Pitágoras. Porto Seguro, Bahia, Brasil.
[4]Universidade Federal do Recôncavo da Bahia. Feira de Santana, Bahia, Brasil.
[5]Hospital Estadual da Criança da Bahia. Feira de Santana, Bahia, Brasil.

ABSTRACT

Objective: To identify the factors associated with clinical deterioration recognized by a Pediatric Early Warning Score.

Method: A cross-sectional study conducted in a tertiary pediatric public hospital with 271 children aged from zero to ten, hospitalized between May and October 2015. For the identification of the children with and without signs of clinical deterioration, the translated, adapted and validated version of the *Brighton Pediatric Early Warning Score* was applied to the Brazilian context. Logistic regression analysis and prevalence ratio (PR) were used to measure the association between the variables studied. A 95% Confidence Interval (CI) and *p value* were adopted as a measure of statistical significance to identify potential associated factors.

Results: The factors associated with the clinical deterioration of the children studied were age ≤ 2 years old (p=0.000), hospitalization in the emergency unit (p=0.000), comorbidity (p=0.020) and clinical diagnosis of respiratory disease (p=0.000).

Conclusion: Children ≤ 2 years old, with comorbidity, diagnosed with respiratory disease and hospitalized in the emergency unit showed an increased likelihood of clinical deterioration. The identification of factors associated with clinical deterioration may alert and direct the health team to children more susceptible to this phenomenon.

DESCRIPTORS: Clinical deterioration. Hospitalized child. Alert. Child health. Pediatric nursing.

FATORES ASSOCIADOS À DETERIORAÇÃO CLÍNICA RECONHECIDA POR UM ESCORE PEDIÁTRICO DE ALERTA PRECOCE

RESUMO

Objetivo: identificar os fatores associados à deterioração clínica reconhecida por um Escore Pediátrico de Alerta Precoce.

Método: estudo de corte transversal, realizado num hospital público pediátrico terciário, com 271 crianças de zero a dez anos, hospitalizadas entre maio e outubro de 2015. Para a identificação das crianças com e sem sinais de deterioração clínica, foi aplicada a versão traduzida, adaptada e validada do *Brighton Pediatric Early Warning Score* para o contexto brasileiro. Foram utilizadas a análise de regressão logística e a razão de prevalência (RP) para medir a associação entre as variáveis estudadas. O Intervalo de Confiança (IC) de 95% e *Valor de p* foram adotados como medida de significância estatística para a identificação dos potenciais fatores associados.

Resultados: os fatores associados à deterioração clínica das crianças estudadas foram idade ≤ 2 anos (p=0,000), internamento na unidade de emergência (p=0,000), comorbidade (p=0,020) e diagnóstico clínico de doença respiratória (p=0,000).

Conclusão: crianças ≤ 2 anos, portadoras de comorbidade, com diagnóstico de doença respiratória e internadas na unidade de emergência apresentaram aumento da probabilidade de deterioração clínica. A identificação de fatores associados à deterioração clínica pode alertar e direcionar a equipe de saúde para crianças mais suscetíveis a esse fenômeno.

DESCRITORES: Deterioração clínica. Criança hospitalizada. Alerta. Saúde da criança. Enfermagem pediátrica.

FACTORES ASOCIADOS AL DETERIORO CLÍNICO RECONOCIDO POR UNA PUNTUACIÓN PEDIÁTRICA DE ALERTA TEMPRANA

RESUMEN

Objetivo: identificar los factores asociados al deterioro clínico reconocido por una Puntuación Pediátrica de Alerta Temprana.

Método: estudio de corte transversal realizado en un hospital público pediátrico terciario con 271 niños de cero a diez años de edad, hospitalizados entre mayo y octubre de 2015. Para identificar a los niños con y sin signos de deterioro clínico, se aplicó la versión traducida, adaptada y validad del *Brighton Pediatric Early Warning Score* para el contexto brasileño. Se utilizaron el análisis de regresión logística y la relación de prevalencia (RP) para medir la asociación entre las variables estudiadas. Se adoptaron el Intervalo de Confianza (IC) del 95% y el *Valor de p* como medida de significancia estadística para identificar los potenciales factores asociados.

Resultados: los factores asociados al deterioro clínico de los niños estudiados fueron los siguientes: edad ≤ 2 años (p=0,000), internación en la unidad de emergencia (p=0,000), comorbilidad (p=0,020) y diagnóstico clínico de enfermedad respiratoria (p=0,000).

Conclusión: los niños con una edad máxima de 2 años, con alguna comorbidad, con diagnóstico de enfermedad respiratoria e internadas en la unidad de emergencia presentaron una mayor probabilidad de deterioro clínico. Identificar factores asociados al deterioro clínico puede servir como alerta y orientar al equipo de salud hacia los niños más susceptibles a este fenómeno.

DESCRIPTORES: Deterioro clínico. Niño hospitalizado. Alerta. Salud infantil. Enfermería pediátrica.

INTRODUCTION

The clinical deterioration of a patient is commonly translated by the alteration of his vital data, associated with other neurological, respiratory and cardiovascular clinical signs. There are some concepts in the literature for clinical deterioration. After a conceptual analysis of this phenomenon, an operational definition was proposed: "A dynamic state experienced by a patient compromising hemodynamic stability, marked by physiological decompensation accompanied by subjective or objective findings".[1:1365]

In children, clinical deterioration usually precedes cardiac arrest. Children who die or deteriorate unexpectedly in the hospital setting often show clinical signs of worsening in a period prior to recognition of their severity.[2] Therefore, nurses and health professionals who care for hospitalized children need to recognize, in a timely manner, the main warning signs that may determine the deterioration of their clinical conditions, which expose them to the risk of complications and death, in order to trigger interventions timely.[3]

In the pediatric setting, there has been certain concern on the part of the services and health professionals to create care systems for clinically deteriorating children in the hospital setting. In this sense, strategies such as rapid response systems and adoption of pediatric early warning scores have been developed, in international contexts, to assist in the recognition of the critical state of the child and to trigger the necessary and early support for CPA prevention.[4]

The main function of these scores, internationally known as *Pediatric Early Warning Score* (*PEWS*), and increasingly introduced in the pediatric clinical practice, is to support the health team in the early recognition and intervention in the clinical deterioration of hospitalized children.[5]

Among the *PEWS*, the *Brighton Pediatric Early Warning Score* (*BPEWS*) was the first Pediatric Early Warning Score developed to recognize signs of clinical deterioration in hospitalized children and was published in 2005 in England,[6] and validated for the first time in 2017 for a Brazilian context.

Although any child may deteriorate and therefore require hospitalization and/or intensive care, some factors may make them more exposed to this risk. Studies show that conditions such as age under 1 or 2 years old, male gender and respiratory diseases were more prevalent in children admitted to the ICU.[7–12] Risk factors such as respiratory history and history of previous hospitalization were associated with the need for hospitalization in children under one year old.[13]

In this context, pediatric patients undergoing clinical deterioration require the health teams to be prepared to early recognize the signs of severity and to provide prompt care in order to avoid serious adverse events resulting from their clinical worsening. In addition, factors that may increase the likelihood of clinical deterioration in children need to be known.

Based on the above, this study aimed to identify the factors associated with clinical deterioration recognized by a pediatric early warning score.

METHOD

This is a cross-sectional study conducted in the clinical-surgical inpatient units of a 280-bed tertiary pediatric public reference hospital located in the inland of Bahia, Brazil.

A sample of 271 children from zero to ten years old participated in this study, from May to October 2015. The sample calculation was made using the following formula: $N=1.96^2(0.20(1-0.20))/(0.05^2)+10\%=270$. The proportion of clinical deterioration adopted for the sample calculation was 20%, based on a pilot test with 30 children. The CI spectrum was 0.10. The CI semi-amplitude as acceptable error was 0.05 above or 0.05 below. The value of Z was 1.96.

Due to the lack of data on the prevalence of clinical deterioration in hospitalized children in the Brazilian literature, a pilot test was performed to obtain the proportion used in the sample calculation

described above. In this pilot test, 30 children were evaluated by a pediatrician based on the criteria of the Primary Clinical Evaluation of the Severely Sick Child recommended by the *American Heart Association* (AHA) and by the *American Academy of Pediatrics* (AAP)[14] and, of these, 06 (20%) showed signs of clinical deterioration, which was the proportion adopted for sample calculation.

All the children participating in the study were assessed by applying the translated, adapted, and validated version of the *Brighton Pediatric Early Warning Score* to the Brazilian context – *BPEWS*-Br (Chart 1) for the purpose of identifying signs of clinical deterioration,[15–16] given the difficulty in establishing well-defined criteria that serve as a reference to determine such an event.[17]

Chart 1 – *Brighton Pediatric Early Warning Score* to the Brazilian context (*BPEWS*-Br).

Components	0	1	2	3	Partial score
Neurological status	Active	Sleepy/ Hypoactive	Irritable	Lethargic/Obtunded or reduced response to pain	
Cardiovascular	Normal color or CRT 1-2 sec.	Pale or CRT 3 sec or HR above upper age limit.	Patchy skin or CRT 4 sec or HR ≥ 20 bpm above the upper age limit.	Grayish/Cyanotic or CRT ≥ 5 sec or HR ≥ 30 bpm above the upper age limit or bradycardia for the age.	
Respiratory	RR normal for the age, without retraction.	RR above upper age limit, use of accessory muscles or FiO2 ≥ 30% or 4 liters/min of O_2.	RR ≥ 20 rpm above the upper limit for the age; subcostal, intercostal and suprasternal retractions or FiO2 ≥ 40% or 6 liters/min of O_2.	RR ≤5 rpm below the lower limit for age; subcostal, intercostal, suprasternal, sternal retractions and grunting or FiO2 ≥ 50% or 8 liters/min of O_2.	
Add 2 extra points if nebulized until 15 minutes ago or persistent vomiting after surgery.					
				Final score	

Source: Adapted from Miranda JOF, Camargo CL, Sobrinho CLN, Portela DS, Monaghan A, Freitas KS, et al.[15]

Sociodemographic (age, gender, parental education, family income, social program enrollment) and clinical (inpatient unit, history of hospitalization, comorbidity, diagnosis, clinical warning signs) data were collected from the children and the *BPEWS*-Br was applied by a pediatric specialist nurse, previously trained to apply the score. The score may range from 0 to 13 points, and score 3 was used as the cutoff point to trigger clinical deterioration.[15–16] Thus, children with final scores ≤ 2 were classified as "no signs of deterioration"; those with a score ≥ 3 were classified as "with signs of deterioration".

The selection of the participants was nonrandom, consecutive and was based on the inclusion criteria (children aged 0 to 10 years old admitted during the collection period, regardless of length of stay) and exclusion criteria (children aged ≥ 11 years old, with discharge prescribed, in isolation, with cancer or heart disease). 15 to 20 children per day of collection were evaluated until the calculated sample was reached.

Children with heart disease were excluded because there is an early warning score of deterioration validated specifically for this population. Children in the oncology unit and in isolation were excluded because their manipulation was restricted by low immunity and the risk of cross-infection during data collection.

To confront the information and to identify possible typing errors, two databases were built in EpiData 3. For data analysis, the *Statistical Package for the Social Science (SPSS®) version 24.0 for Windows* was used.

In the bivariate analysis, the prevalence ratio (PR) was calculated, with respective confidence intervals of 95% and p value ≤ 0.05, using Pearson's chi-square test, to assess statistical significance. Logistic regression modeling made it possible to evaluate the association between clinical deterioration and a set of explanatory variables (potential associated factors) simultaneously.[18]

To define the final model, the procedures described by Hosmer and Lemeshow were followed.[18] The pre-selection of the variables for this model had as criteria the relevance found in the literature and the p value ≤ 0.25 for statistical significance.[19] Subsequently, only variables with a p value ≤ 0.05 remained in the final model associated with the dependent variable.

The ethical criteria were met during data collection (application of parental consent and consent term for clinically stable children > 6 years old),[20] to comply with the precepts of Resolution No. 466 of December 12th, 2012 of the National Health Council.

RESULTS

Of the total children participating in the study (271), 46.8% were ≤2 years old, 20.7% were from three to five years old and 32.5% were from six to ten years old, 63.5% were male and 60.9% did not live in the municipality.

Among the children who were showing signs of clinical deterioration (44), the majority (70.5%) was ≤2 years old, and male (70.5%). Of the companions, 43.2% completed Elementary School II, 59.1% reported living with an income of up to one minimum wage and 50% were enrolled in the Federal Government's *Bolsa Familia* Program.

Regarding the clinical aspects of the deteriorating children, 52.3% had some comorbidity, 93.2% had clinical diagnosis as the cause of hospitalization, most were hospitalized in the emergency observation and stabilization units (54.5%), hospitalized for less than seven days (65.9%) and had a history of previous hospitalization (59.1%).

Table 1 shows a prevalence of clinical deterioration of 16.2% among the 271 children assessed, based on the BPEWS-Br score ≥ 3. The mean score in these children was 3.6.

Table 1 – Distribution of the children assessed for the presence or absence of clinical deterioration and mean BPEWS-Br score. Feira de Santana, Bahia, Brazil, 2015. (N=271)

Clinical deterioration	N	%	BPEWS-Br mean score	Minimum	Maximum	SD*
Present	44	16.2	3.6	3	7	0.948
Absent	227	83.8	0.6	0	2	0.761

*SD: Standard Deviation.

The data in Table 2 reveal that being younger than two years old, being admitted to the emergency unit, having a history of previous hospitalization, presenting some comorbidity, as well as having a respiratory diagnosis were statistically significant when associated with clinical deterioration.

Table 2 – Bivariate analysis between the sociodemographic and clinical variables according to clinical deterioration recognized by BPEWS-Br. Feira de Santana, Bahia, Brazil, 2015.

Characteristics	Clinical deterioration (n=271)					
	Yes	**%**	**No**	**%**	**PR***	**95% CI†** **p-value‡**
Age (years old)						
≤2	31	24.4	96	75.6	2.7	1.48-4.93
3-10	13	9.0	131	91.0	-	p=0.000
Gender						
Male	31	18.0	141	82.0	1.37	0.75-2.50
Female	13	13.1	86	86.9	-	p=0.293
Family income						
Up to 1 minimum wage	26	13.5	167	86.5	0.58	0.34-1.00
More than 1 minimum wage	18	23.1	60	76.9	-	p=0.052
Received family allowance						
No	22	18.6	96	81.4	1.29	0.75-2.22
Yes	22	14.4	131	85.6	-	p=0.345
Hospitalization unit						
Emergency	24	30.4	55	69.6	2.92	1.71-4.97
Nursing wards	20	10.4	172	89.6	-	p=0.000
Previous hospitalization						
Yes	26	18.2	117	81.8	1.29	0.75-2.25
No	18	14.1	110	85.9	-	p=0.000
Time of hospitalization						
>7 days	15	1.3	98	86.7	0.72	0.41-1.28
<7 days	29	18.4	129	61.6	-	p=0.264
Comorbidity§						
Present	23	23.0	77	77.0	1.87	1.09-3.21
Absent	21	12.3	150	87.7	-	p=0.020
Diagnosis						
Clinical	41	17.2	197	82.8	1.89	0.62-5.77
Surgical	03	9.1	30	90.1	-	p=0.235
Respiratory diagnosis						
Yes	28	40.0	42	60.0	5.0	2.90-8.72
No	16	8.0	185	92.0	-	p=0.000

*PR: Prevalence Ratio; †CI: Confidence Interval; ‡Pearson Chi-Square; §Diabetes, hypertension, sickle cell anemia, kidney disease, neuropathy, asthma, autoimmune disease.

Four of these factors were corroborated after logistic regression and are presented in Table 3. Children under two years of age were 2.8 times more likely to deteriorate than those between three and ten years old. In children hospitalized in the emergency room, the likelihood of deterioration was 3.3 times higher than in the Nursing wards. For children with some comorbidity, the probability was 2.7 times higher than for those without comorbidity. Regarding the diagnosis of hospitalization, children hospitalized for respiratory problems were 5.9 times more likely to deteriorate when compared to children hospitalized for other causes (Table 3).

Table 3 – Variables associated with the clinical deterioration recognized by BPEWS-Br after logistic regression analysis. Feira de Santana, Bahia, Brazil, 2015.

Variable	PR*	(95%) CI†	p-value‡
Age			
≤ 2 years old	2.8	1.29 – 6.18	0.00
3-10 years old	–	–	–
Hospitalization unit			
Emergency	3.3	1.55 – 7.21	0.00
Nursing wards	–	–	-
Comorbidities			
Present	2.7	1.29 – 5.95	0.00
Absent	–	–	–
Respiratory diagnosis			
Yes	5.9	2.79 – 12.87	0.00
No	–	–	–

*PR: Prevalence Ratio; †CI: Confidence Interval; ‡Logistic regression model

DISCUSSION

This study applied *BPEWS*-Br to identify signs of clinical deterioration in the children evaluated, with a prevalence of 16.2%, from a score ≥ 3 points. Regarding the sociodemographic and clinical profile of the children with clinical deterioration recognized by the score, there was a predominance of children under two years old, with a family income below one minimum wage, hospitalized for less than seven days, with a history of previous hospitalization, with some comorbidity and hospitalized for respiratory diagnosis. The statistically significant factors in both bivariate analysis and logistic regression model, which may increase the likelihood of clinical deterioration, were age ≤ 2 years old, hospitalization in the emergency unit, presence of comorbidity and respiratory diagnosis.

A survey conducted in Norway with 761 patients used a modified version of the *BPEWS* and the same cutoff point (≥ 3), finding a prevalence of clinical deterioration equal to the one in this study (16.2%).[21] In another study in the United States, an adapted version of the *BPEWS* was adopted to evaluate 2,979 patients, and 73.2% of them had a score ≤ 2, 8% had a score of 3, 8% a score of 4, 7% a score of 5 and 1.2% a score ≥ 7.[17]

Clinical deterioration is often understood as a worsening of a patient's clinical condition. However, there is no consensus on how to diagnose its occurrence. Some studies have considered the need for hospitalization[22–24] or admission/transfer to the ICU[17,21,24–26] to determine clinical deterioration in children. Thus, the lack of standardized criteria that determine the presence of this phenomenon in the pediatric population ends up leaving a gap about its prevalence in the hospital environment.

From a qualitative perspective, the existence of processes to identify and respond to pediatric clinical deterioration, as well as assessment practices and the use of tools to support the recognition of patients at risk of deterioration were identified by parents and health professionals as factors which may influence the care escalation of clinically deteriorating children.[27] In this context, the Pediatric Early Warning Scores, developed to identify signs of worsening in children, could be an alternative for investigating the occurrence of clinical deterioration and triggering the need for urgent care in hospitalized children.[4]

Lower airway disease, cardiovascular disease and younger age were also associated with clinical deterioration translated by *BPEWS* ≥ 3. Transfer to high-level care units was significantly higher among patients with *BPEWS* ≥ 3 compared to patients with *BPEWS* ≤ 2.[21] A high PEWS score was associated with the need for ICU transfer.[26,28]

In Brazil, some abstracts publications were found in congress annals, but few publications in journals about the use of early warning scores to recognize pediatric clinical deterioration.[15–16,29] However, certain studies have described the profile of pediatric patients admitted to the hospital or intensive care unit,[7–12] These events are considered indicators of worsening of the hospitalized child's clinical condition. Some of the results of these studies corroborate data already described in the literature and evidenced by this research.

Regarding the studies on the profile of children who needed to be admitted to the hospital or were in the ICU, age < 2 years old, male gender and hospitalization for respiratory causes were more prevalent.[7–12] The median hospital stay was 8.8 days[10] and 3.4 days.[9] In the ICU, these times were 6.9 days[7] and 5.4 days.[8]

Acute respiratory diseases remain the most frequent cause of child mortality in developing countries.[13]

A study on the causes of hospitalization of children aged from zero to four years old in the Unified Health System indicated respiratory diseases as the first cause of hospitalization in Brazil, followed by infectious and parasitic diseases.[30]

With regard to the factors associated with the need for the hospitalization of children, several research studies have shown that low maternal schooling, low income,[13,31] history of previous hospitalization[13,31–32] and pre-existing diseases[13,33] may increase the risk of hospitalization. The existence of certain underlying diseases was present in 51% of the ICU admission cases and was associated with a higher risk of mortality.[9]

From the results obtained in this study and the discussions presented, it is important to highlight that children in hospitals, regardless of their age, diagnosis, clinical history and inpatient unit, need to be monitored daily by the health team for possible signs of deterioration of their clinical conditions.

In this sense, early warning scores can help nurses and staff in the daily assessment of signs of clinical worsening in children, as well as direct to early intervention, as nurses are considered the forefront of patient care in the hospital and play a key role in recognizing and responding to clinical deterioration.[1] In addition, the systematization of the registration of vital and clinical data, through a simple and structured instrument, can assist the care team, contributing to the provision of safe care and allocation of care and human resources according to the patient's real needs.[29]

The following aspects are considered as limitations of the present study: cross-sectional and unicentric study, small non-probabilistic sample and the gap in the national literature on the use of Early Warning Pediatric Scores as a criterion to identify clinical deterioration in Brazilian children, which made it difficult to discuss the data.

CONCLUSION

This study used *BPEWS*-Br to recognize the clinical deterioration in hospitalized children and showed a prevalence of 16.2% of this phenomenon. In addition, children up to two years old, with some comorbidity, hospitalized for respiratory diagnosis and in an emergency unit, deteriorated more when compared to other children, which requires the health team to pay more attention to these patients.

The identification of factors associated with pediatric clinical deterioration, even before the onset of signs of severity, could alert and direct the health team's gaze to children more susceptible to this phenomenon.

REFERENCES

1. Padilha RM, Mayo AM. Clinical deterioration: A concept analysis. J Clin Nurs [Internet]. 2018 [cited 2019 Jan 08];27:1360-8. Available from: https://dx.doi.org/10.1111/jocn.14238

2. Lambert V, Matthews A, MacDonell R, Fitzsimons J. Paediatric early warning systems for detecting and responding to clinical deterioration in children: a systematic review. BMJ Open [Internet]. 2017 [cited 2019 Jan 08];7:e014497. Available from: https://dx.doi.org/10.1136/bmjopen-2016-014497.

3. Miranda JOF, Camargo CL, Nascimento Sobrinho CL, Portela DS. Reconhecimento da deterioração das condições clínicas em crianças hospitalizadas. In: Associação Brasileira de Enfermagem, Sociedade Brasileira de Enfermeiros Pediatras; Gaíva MAM, Toso BRGO, Mandetta MA, eds. PROENF Programa de Atualização em Enfermagem: Saúde da Criança e do Adolescente: Ciclo 11. Porto Alegre, RS(BR): Artmed Panamericana; 2016. p.9-31.

4. Tibballs J. Systems to prevent in-hospital cardiac arrest. J Paediatr Child Health [Internet]. 2011 [cited 2015 Mar 20];21(7):322-8. Available from: https://dx.doi.org/10.1016/j.paed.2011.03.007

5. Murray JS, Williams LA, Pignataro S, Volpe D. An integrative review of pediatric early warning system scores. Pediatric Nurs [Internet]. 2015 [cited 2019 Jan 09]; 41(4):165-74. Available from: https://www.pediatricnursing.net/ce/2017/article4104165174.pdf

6. Monaghan A. Detecting and managing deterioration in children. Paediatr Nurs [Internet]. 2005 [cited 2014 Mar 20];17(1):32-5. Available from: https://dx.doi.org/10.7748/paed2005.02.17.1.32.c964

7. Batista NOW, Coelho MCR, Trugilho SM, Pinasco GC, Santos EFS, Ramos-Silva V. Clinical-epidemiological profile of hospitalised patients in pediatric intensive care unit. J Hum Growth Dev [Internet]. 2015 [cited 2016 Apr 12];25(2):187-93. Available from: https://dx.doi.org/10.7322/jhgd.103014

8. Alves MVMFF, Bissiguini P de O, Nitsche MJT, Olbrich SRLR, Luppi CHB, Toso LAR. Profile of patients admitted in a pediatric intensive care unit of a hospital school in the countryside of São Paulo. Cienc Cuid Saude [Internet]. 2014 [cited 2015 Mar 20];13(2):294-301. Available from: https://dx.doi.org/10.4025/cienccuidsaude.v13i2.21912

9. Krmpotic K, Lobos AT. Clinical profile of children requiring early unplanned admission to the PICU. Hosp Pediatr [Internet]. 2013 [cited 2016 May 10];3(3):212-8. Available from: https://dx.doi.org/10.1542/hpeds.2012-0081

10. Oliveira BRG, Viera CS, Furtado MCC, Mello DF, Lima RAG. Profile of morbidity of children hospitalized in a public hospital: implications for nursing. Rev Bras Enferm [Internet]. 2012 [cited 2015 May 05];65(4):586-93. Available from: https://dx.doi.org/10.1590/s0034-71672012000400006

11. Molina RCM, Marcon SS, Uchimura TT, Lopes EP. Characterization of hospitalizations at a pediatric intensive care unit of a teaching hospital in Southern Brazil. Ciência, Cuid Saúde [Internet]. 2008 [cited 2016 May 10];7(Suppl.1):112–20. Available from: http://www.periodicos.uem.br/ojs/index.php/CiencCuidSaude/article/view/6581/3894

12. Tume L. The deterioration of children in ward areas in a specialist children's hospital. Nurs Crit Care. 2007 [cited 2016 May 10];12(1):12-9. Available from: https://dx.doi.org/10.1111/j.1478-5153.2006.00195.x

13. Macedo SEC, Menezes AMB, Albernaz E, Post P, Knorst M. Risk factors for acute respiratory disease hospitalization in children under one year of age. Rev Saúde Pública [Internet]. 2007 [cited 2016 May 10];41(3):351-8. Available from: https://dx.doi.org/10.1590/s0034-89102007000300005

14. American Heart Association. Abordagem sistemática à criança gravemente doente ou ferida. In: American Heart Association. Suporte avançado de vida em pediatria manual do profissional. Estados Unidos da América: Orora Visual, 2017, p. 29-67.

15. Miranda JOF, Camargo CL, Nascimento Sobrinho CL, Portela DS, Monaghan A, Freitas KS, et al. Translation and adaptation of a pediatric early warning score. Rev Bras Enferm [Internet]. 2016 [cited 2017 Dec 26];69(5):833-41. Available from: https://dx.doi.org/10.1590/0034-7167-2015-0096

16. Miranda JOF, Camargo CL, Nascimento Sobrinho CL, Portela DS, Monaghan A. Accuracy of a pediatric early warning score in the recognition of clinical deterioration. Rev Latino-Am Enfermagem 2017 [cited 2017 Dec 26];25:e2912. Available from: https://dx.doi.org/10.1590/1518-8345.1733.2912

17. Tucker KM, Brewer TL, Baker RB, Demeritt B, Vossmeyer MT. Prospective evaluation of a pediatric inpatient early warning scoring system. J Spec Pediatr Nurs [Internet]. 2009 Apr [cited 2015 Apr 13];14(2):79-85. Available from: https://dx.doi.org/10.1111/j.1744-6155.2008.00178.x

18. Hosmer JR, Lemeshow S. Appled Logistic Regression. New York, NY(US): John Wiley & Sons; 2000.

19. Almeida Filho N, Barreto MN. Epidemiologia & saúde: fundamentos, métodos e aplicações. Rio de Janeiro, RJ(BR): Guanabara Koogan; 2011.

20. Miranda JOF, Santos DV, Camargo CL, Nascimento Sobrinho CL, Santa Rosa DO, Souza GMS. Construction and application of a consent form: an experience report. Texto Contexto Enferm [Internet]. 2017 [cited 2017 Dec 14];26(3):e2460016. Available from: https://dx.doi.org/10.1590/0104-07072017002460016

21. Solevåg AL, Eggen EH, Schröder J, Nakstad B. Use of a modified pediatric early warning score in a department of pediatric and adolescent medicine. PLoS One [Internet]. 2013 Jan [cited 2015 Mar 24];8(8):e72534. Available from: https://dx.doi.org/10.1371/journal.pone.0072534

22. Seiger N, Maconochie I, Oostenbrink R, Moll H a. Validity of different pediatric early warning scores in the emergency department. Pediatrics [Internet]. 2013 [cited 2016 May 10];132(4):e841-50. Available from: https://dx.doi.org/10.1542/peds.2012-3594

23. Bradman K, Borland M, Pascoe E. Predicting patient disposition in a pediatric emergency department. J Paediatr Child Health [Internet]. 2014 Oct [cited 2015 Apr 13];50(10):e39-44. Available from: https://dx.doi.org/10.1111/jpc.12011

24. Gold DL, Mihalov LK, Cohen DM. Evaluating the Pediatric Early Warning Score (PEWS) system for admitted patients in the pediatric emergency department. Acad Emerg Med [Internet]. 2014 Nov [cited 2015 Mar 12]; 21(11):1249-56. Available from: https://dx.doi.org/10.1111/acem.12514

25. Zhai H, Brady P, Li Q, Lingren T, Ni Y, Wheeler DS, et al. Developing and evaluating a machine learning based algorithm to predict the need of pediatric intensive care unit transfer for newly hospitalized children. Resuscitation [Internet]. 2014 Aug [cited 2015 Apr 13];85(8):1065-71. Available from: https://dx.doi.org/10.1016/j.resuscitation.2014.04.009

26. Elita L, Triratna S, Bahar E. Validation of the Pediatric Early Warning Score to determine patient deterioration from illness. Paediatr Indones [Internet]. 2016 [cited 2019 Jan 09];56(4):251-6. Available from: https://dx.doi.org/10.14238/pi56.4.2016.251-6

27. Gawronski O, et al. Qualitative study exploring factors influencing escalation of care of deteriorating children in a children's hospital. BMJ Pediatrics Open [Internet]. 2018 [cited 2019 Jan 09];2:e000241. Available from: https://dx.doi.org/10.1136/bmjpo-2017-000241

28. Dean NP, Fenix JB, Spaeder M, Levin A. Evaluation of a pediatric early warning score across different subspecialty patients. Pediatric Critical Care Med [Internet]. 2017[cited 2018 Mar 20];18(7):655-60. Available from: https://dx.doi.org/10.1097/pcc.0000000000001176

29. Pereira R, Mansur DGN, Ionemoto HF. Implantação de escore de alerta de gravidade precoce em Hospital Infantil privado: Relato de experiência. Rev. Soc. Bras. Enferm. Ped. [Internet]. 2016 [citado em 2019 Jan 13];16(2):81-4. Available from: https://sobep.org.br/revista/images/stories/pdf-revista/vol16-n2/vol_16_n_2-relato_de_experiencia_2.pdf

30. Oliveira BRG, Viera CS, Collet N, Lima RAG. Causes of hospitalization in the National Healthcare System of children aged zero to four in Brazil. Rev Bras Epidemiol [Internet]. 2010 [cited 2016 Mar 20];13(2):268-77. Available from: https://dx.doi.org/10.1590/s1415-790x2010000200009

31. Barreto MDS, Marcon SS. Hospitalization in the second year of life in children considered at risk at birth. Esc Anna Nery - Rev Enferm [Internet]. 2014 [cited 2016 Mar 20];18(2):227-33. Available from: https://dx.doi.org/10.5935/1414-8145.20140033

32. Silva VLS, França GVA, Santos IS, Barros FC, Matijasevich A. Características e fatores associados à hospitalização nos primeiros anos de vida: coorte de nascimentos de Pelotas de 2004, Rio Grande do Sul, Brasil. Cad Saúde Pública [Internet]. 2017 [cited 2016 Mar 20];33(10):e00035716. Available from: https://dx.doi.org/10.1590/0102-311x00035716

33. Caetano JDRDM, Bordin IAS, Puccini RF, Peres CDA. Fatores associados à internação hospitalar de crianças menores de cinco anos, São Paulo, SP. Rev Saude Publica [Internet]. 2002 [cited 2016 Mar 20];36(3):285-91. Available from: https://dx.doi.org/10.1590/S0034-89102002000300005

NOTES

CONTRIBUTION OF AUTHORITY
Study design: Miranda JOF, Camargo CL, Sobrinho CLN.
Data collection: Miranda JOF, Portela DS, Oliveira TL.
Analysis and interpretation of data: Miranda JOF, Camargo CL, Sobrinho CLN, Pinho PS.
Discussion of the results: Miranda JOF, Camargo CL, Sobrinho CLN, Pinho PS.
Writing and/or critical review of content: Miranda JOF, Camargo CL, Sobrinho CLN.
Review and final approval of the final version: Miranda JOF, Camargo CL, Sobrinho CLN.

ETHICS COMMITTEE IN RESEARCH
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CONFLICT OF INTEREST
There is no conflict of interest.

CORRESPONDING AUTHOR
Juliana de Oliveira Freitas Miranda
julidefreitas@hotmail.com