RESEARCH

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Defining characteristics of the nursing diagnosis "ineffective airway clearance"

Características definidoras do diagnóstico de enfermagem "desobstrução ineficaz de vias aéreas"

Características definidoras del diagnóstico de enfermería "desobstrucción ineficaz de las vías aéreas"

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ABSTRACT

Objective: to analyze the defining characteristics of the nursing diagnosis "ineffective airway clearance" in children with acute respiratory infection. **Method:** cross-sectional descriptive study, developed in two hospitals specialized in care for children. It was held a detailed respiratory evaluation of the child to identify the defining characteristics of the diagnosis under study. **Results:** a total of 249 children were evaluated, 55.8% were male and the median age was 13.76 months. Ineffective airway clearance was identified in 222 children (89.2%). The following defining characteristics presented statistically significant associations: dyspnea, expectoration, orthopnea, respiratory adventitious sounds, decreased breath sounds and ineffective cough. Decreased breath sounds, ineffective cough and respiratory adventitious sounds composed the logistic regression model. **Conclusion:** the characteristics decreased breath sounds, ineffective cough and respiratory adventitious sounds have better predictive capacity for the diagnosis "ineffective airway clearance" in children with acute respiratory infection.
Key words: Nursing Diagnosis; Nursing; Breath; Respiratory infections; Child.

RESUMO

Objetivo: analisar as características definidoras do diagnóstico de enfermagem "desobstrução ineficaz de vias aéreas" em crianças com infecção respiratória aguda. **Método:** estudo transversal, descritivo, desenvolvido em dois hospitais especializados no atendimento a crianças. Realizou-se avaliação respiratória detalhada da criança para a identificação das características definidoras do diagnóstico em estudo. **Resultados:** foram avaliadas 249 crianças, sendo 55,8% do sexo masculino e com mediana de idade de 13,76 meses. Desobstrução ineficaz de vias aéreas foi identificado em 222 crianças (89,2%). As seguintes características definidoras apresentaram associação estatisticamente significante: dispneia, expectoração, ortopneia, ruídos adventícios respiratórios, sons respiratórios diminuídos e tosse ineficaz. Sons respiratórios diminuídos, tosse ineficaz e ruídos adventícios respiratórios compuseram o modelo de regressão logística. **Conclusão:** as características sons respiratórios diminuídos, tosse ineficaz e ruídos adventícios respiratórios apresentam melhor capacidade de predição para o diagnóstico "desobstrução ineficaz de vias aéreas" em crianças com infecção respiratória aguda.
Descritores: Diagnóstico de Enfermagem; Enfermagem; Respiração; Infecções Respiratórias; Criança.

RESUMEN

Objetivo: analizar las características definidoras del diagnóstico de enfermería "desobstrucción ineficaz de vías aéreas" en niños con infección respiratoria aguda. **Método**: estudio transversal, descriptivo, desarrollado en dos hospitales especializados en la

atención al niño. Se realizó evaluación respiratoria detallada del niño para la identificación de las características definidoras del diagnóstico en estudio. **Resultados**: fueron evaluados 249 niños, siendo 55,8% del sexo masculino y con mediana de edad de 13,76 meses. Desobstrucción ineficaz de vías aéreas fue identificada en 222 niños (89,2%). Las siguientes características definidoras presentaron asociación estadísticamente significante: disnea, expectoración, ortopnea, ruidos adventicios respiratorios, sonidos respiratorios disminuidos y tos ineficaz. Sonidos respiratorios disminuidos, tos ineficaz y ruidos adventicios respiratorios compusieron el modelo de regresión logística. **Conclusión**: las características sonidos respiratorios disminuidos, tos ineficaz y ruidos adventicios respiratorios presentan mejor capacidad de predicción para el diagnóstico "desobstrucción ineficaz de vías aéreas" en niños con infección respiratoria aguda.
Palabras clave: Diagnóstico de Enfermería; Enfermería; Respiración; Infección Respiratorias; Niño.

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INTRODUCTION

The classification system of nursing diagnoses (ND) in NANDA International (NANDA-I) is one of the most publicized and used worldwide. In this, there is a standardization of the language so that this can be used in the process, in the reasoning of the product, in the clinical trial of current or potential health problems and on life processes[1].

The use of classification systems such as NANDA-I taxonomy qualifies care, gives visibility to the nursing work process, contributes to the organization of professional practice and generates its own nomenclature[1-2]. The NANDA-I has been constantly refining nursing diagnoses, as part of nursing practice, and encourages studies to expand its use and increase the degree of accuracy of its elements.

In specific clinical situations, the diagnostic inference process can become even more complex and subject to uncertainties. Respiratory nursing diagnoses have common defining characteristics, which can contribute to little accurate diagnostic inferences[3]. Studies aimed at better definition and practical application of these diagnostic tests can help making the diagnostic inference process more accurate.

This proximity between the nursing diagnoses can be a point of doubt among less experienced evaluators and nursing students. At that point, an erroneous diagnostic detection can jeopardize the rest of the process, leading to inadequate care plan and consequently to inappropriate results for the clinical situation of the individual assessed[4].

The nursing diagnosis "ineffective airway clearance (IAC)" was inserted in 1980, and revised in 1996 and 1998. It is part of the domain 11 (Safety / protection) in its second class (physical injury). This is defined as: inability to clear secretions or obstructions of the respiratory tract, to maintain a clear airway[2].

Such a diagnosis can be found in both adults and children in a variety of clinical situations. A major disease that occurs in early childhood and is associated with IAC is acute respiratory infection (ARI). The pathophysiology of ARIs and the properties inherent in children may explain the high occurrence of this nursing diagnosis.

ARIs are the leading cause of hospitalization in children under five years old and the third in mortality, second to perinatal diseases and sepsis. About 40% of children who seek health services are affected by ARI, which is directly or indirectly responsible for approximately two million deaths per year[5]. This figure is influenced by the socioeconomic status of the population that is more exposed to this serious health problem, as unsanitary conditions and inadequate nutritional status are important risk factors for its onset, as well as the inappropriate immune response to ARI.

Acute respiratory infections account for wide range of disease processes of different etiologies and severities affecting the respiratory tract. The symptoms of ARI ranges from cough, fever, dyspnea, sore throat, earache, anorexia, coryza, sub and intercostal retractions, wheezing chest and even cyanosis[5-6].

Respiratory diagnoses presented by children with ARI represent priority nursing phenomena as directly affect tissue oxygenation, which is a vital function. Therefore, health problems that affect tissue oxygenation processes need fast and resolving nursing interventions.

Based on the above, this study aimed to identify the most prevalent defining characteristics (DCs), verifying the strength of the association of these characteristics with the nursing diagnosis IAC, and to establish which DCs together have better ability to predict the occurrence of this diagnosis.

METHOD

This is a cross-sectional study of analytical type, developed in two pediatric public hospitals of in a Brazilian northeastern capital city. Children with a maximum of 5 years of age and an initial medical diagnosis of ARI were included. This cutoff to age was adopted because this is the population in which ARI is most prevalent, with greater potential of data to the overall health of the individual. It was established as exclusion criteria: intense crying with onset or worsening of cyanosis and cardiovascular and neurological comorbidities influencing the presence of respiratory diagnoses or making the make respiratory evaluation not viable. However, any of the individuals initially identified for the sample were excluded from the study.

To determine the sample size, it was used the frequencies for IAC found in a study of asthmatic children, in which IAC was present in 66.7% of subjects[7]. The confidence level was 95% and the absolute sampling error was set at 5.9%. By using the formula for sample size calculation of infinite population, it was met the sample of 249 individuals[8]. These were selected consecutively between the months of January to May 2011.

Data collection was conducted by the author, two nurses and four students of the graduate Nursing course. A workshop

of eight hours has been developed by the researcher so that collection instrument's peculiarities were discussed and so that any doubts were clarified, in order to minimize collection biases.

It was held clinical evaluation with a focus on respiratory system. The general data about the child's hospitalization included: gender (male, female), medical diagnostics, number of admissions in the last year, age (months), length of stay (days), family income (in reais), number of family members, breastfeeding (months), family history of asthma (yes/no) and attendance at day care (yes/no). The respiratory evaluation itself was based on defining characteristics of the nursing diagnosis in question, through detailed respiratory physical examination. Information regarding the objective data of respiratory evaluation was collected directly with children, whereas those of identification and review of symptoms were collected with the father or mother. Other information regarding hospitalization was obtained from medical records, such as the day of entry in hospital, medical diagnostics and notes of professionals about the clinical condition of the child. In the presence of contradictory information between medical records and parents, those provided by parents were considered.

Two nurses were asked to perform the diagnostic inferences. They were participating in a research group in diagnostics, nursing results or interventions. Such nurses attended a training lasting eight hours, in which the following issues were addressed: elements that make up the respiratory nursing diagnoses, critical thinking, diagnostic reasoning and diagnostic inference. After the training, they were subjected to assessment based on the resolution of 12 fictitious medical records, which were applied three times in random order. At the end, it was verified the efficiency (E), false-positive rate (FPR), false-negative rate (FNR) and trend (T). The criteria used to consider the suitability of nurses were "E" > 0.8; FPR and FNR ≤ 0.10; T between 0.8 and 1.2[9]. The two nurses have obtained acceptable levels for all aspects evaluated.

Nurses received clinical information of each child, compiled in an Excel software spreadsheet, so that they performed individually the inference of IAC. Where there were divergences, they were invited to discuss cases until reaching a consensus.

The data were processed using the SPSS software version 19.0 for Windows. Descriptive analysis was performed by presenting the frequencies of nominal variables and central tendency (mean or median) and dispersion values: standard deviation (SD) or interquartile range (IR) for numeric variables, respectively. It was used tests of association between nominal variables and the presence of the nursing diagnosis in question. To assess the normality of the data, it was used the Kolmogorov-Smirnov test. The Mann-Whitney[10] test was used for non-normal numerical variables, and the t test for difference of means of variables with normal distribution. The odds ratio was calculated to measure the magnitude of the effect of independent variables on the occurrence of the nursing diagnosis.

Logistic regression analysis was performed based on the DCs of largest association with IAC. All variables with p values less than 0.2 were included in the initial model. The analysis of adequacy of adjustment of the final model was based on omnibus test. We calculated the coefficient of determination of the model based on the R2 Nagelkerke and the observed values were compared to the expected values through the Hosmer-Lemeshow test. The significance level was 0.05.

In observing the ethical and administrative aspects of the research, official letters were referred to the direction of institutions, which contained the objectives of the study, period in which the data collection would be carried out and the methodology adopted. The project was submitted to the REC (Research Ethics Committee) of the proposing entity, and received assent. Legal guardians of children in the sample ensured their participation in the study by signing the Informed Consent Form.

RESULTS

Of the 249 children evaluated in the study, 139 (55.8%) were male, as shown in Table 1. It was found median age of 13.76 months (IR = 22.28). The median hospitalization time presented a median of one day (IR = 1.00), and only 33 (13.3%) children attended day care. The average length of attendance at day care was 9.23 months (SD = 9.76) (data not shown in table).

Table 1 - Association between sociodemographic variables and presence of the nursing diagnosis "ineffective airway clearance", Fortaleza, Brazil, 2011

	Ineffective Airway Clearance		
	Present	Absent	p value OR (CI 95%)
Gender			
Male	124	15	0.976* 0.988(0.44-2.20)
Female	98	12	
Attendance at day care			
Yes	26	7	0.047** 0.868 (0.72-1.04)
No	196	20	
Family history of asthma			
Yes	108	6	0.006* 1.133 (1.03-1.23)
No	107	21	

	Stations' Average		p value†
	Present	Absent	
Age in months	122.69	144.00	0.147
Days of hospitalization	120.99	157.96	0.006
Family income	122.15	120.75	0.923
Number of family members	122.85	138.00	0.291
Number of admissions in the last year	123.88	124.94	0.929
Months of breastfeeding	123.88	124.94	0.631
Time attending day care	15.77	21.57	0.169

*Notes: *Pearson's χ^2 test; ** Fisher's exact test; † Mann-Whitney test (for station's average).*

Of the pneumopathies investigated in the family up to the second degree, asthma was the most prevalent (46.2%) as shown in Table 1. However, in the evaluated children, the medical diagnosis of asthma was found in 44 individuals (17.7%). Among the ARIs found, pneumonia was the most common, with 79.9%.

The ND in question is highly prevalent in this population. IAC was found in 222 children (89.2%). The most frequently defining characteristics manifested were: ineffective cough (91.3%), respiratory adventitious sounds (77.1%), dyspnea (69.3%), change in respiratory rate (56.6%), orthopnea (54.2%) and expectoration (32.1%) (Table 2).

Table 2 - Association between the nursing diagnosis "ineffective airway clearance" and its defining characteristics, Fortaleza, Brazil, 2011

Defining characteristics	Ineffective Airway Clearance			
	Present (%) n = 222	Absent (%) n = 27	Total (%) N = 249	p value OR (CI95%)
Agitation				
Present	42 (16.9)	3 (1.2)	45 (18.1)	0.240**
Absent	180 (72.3)	24 (9.6)	204 (81.9)	1.867(0.53-6.49)
Cyanosis				
Present	10 (4.0)	1 (0.5)	11 (4.5)	0.661**
Absent	212 (85.1)	26 (10.4)	238 (95.5)	1.226 (0.15 – 9.97)
Dyspnea				
Present	156 (62.6)	13 (5.2)	169 (67.8)	0.020*
Absent	66 (26.5)	14 (5.7)	80 (32.2)	2.545 (1.13 – 5.71)
Expectoration				
Present	77 (30.9)	4 (1.6)	81 (32.5)	0.017*
Absent	145 (58.2)	23 (9.3)	168 (67.5)	4.071 (1.18 -13.99)
Changes in respiratory rate				
Present	128 (51.4)	13 (5.2)	141 (56.6)	0.346*
Absent	94 (37.8)	14 (5.6)	108 (43.4)	1.466 (0.65- 3.26)
Change in respiratory rythym				
Present	14 (5.6)	1 (0.5)	15 (6.1)	0.499**
Absent	208 (83.5)	26 (10.4)	234 (93.9)	1.750 (0.22-13.85)
Wide eyes				
Present	1 (0.5)	0	1 (0.5)	0.892**
Absent	221 (88.7)	27 (10.8)	248 (99.5)	0.891 (0.85-0.93)
Orthopnea				
Present	127 (51.0)	8 (3.3)	135 (54.3)	0.006*
Absent	94 (37.9)	19 (7.8)	113 (45.7)	3.209 (1.34-7.64)
Respiratory adventitious sounds				
Present	190 (76.3)	2 (1.0)	192 (77.3)	< 0.001*
Absent	32 (13.0)	25 (9.7)	57 (22.7)	74.219 (16.75-328.71)
Decreased breath sounds				
Present	28 (11.2)	14 (5.6)	42 (16.8)	< 0.001**
Absent	194 (77.9)	13 (5.3)	207 (83.2)	0.134 (0.05-0.31)
Absent cough				
Present	5 (2.5)	2 (1.0)	7 (3.5)	0.169**
Absent	217 (87.2)	25 (9.3)	242 (96.5)	0.288 (0.05-1.56)
Ineffective cough				
Present	213 (85.5)	8 (3.2)	221 (88.7)	< 0.001**
Absent	5 (2.5)	16 (8.8)	21 (11.3)	85.200 (24.96-290.74)
Difficult vocalization				
Present	14 (5.6)	0	14 (5.6)	0.191**
Absent	208 (83.5)	27 (10.9)	235 (94.4)	0.885 (0.84-0.92)

*Notes: * Pearson's χ^2 test; ** Fisher's exact test; OR – odds ratio; CI - confidence interval.*

Table 3 - Logistic regression for the diagnosis "ineffective airway clearance" in children with acute respiratory infection, Fortaleza, Brazil, 2011

	Coefficient	S.E.	χ^2	p value	OR	CI 95%	
						Minimum	Maximum
Decreased breath sounds	-2.299	0.712	10.416	< 0.001	0.100	0.025	0.405
Ineffective cough	1.912	0.453	17.826	< 0.001	6.764	2.785	16.430
Respiratory adventitious sounds	3.818	0.897	18.125	< 0.001	45.513	7.848	263.934

Hosmer-Lemeshow test	Sig	Omnibus test	Sig	Nagelkerke R^2
3,253	0.197	272.586	< 0.001	0.901

Notes: χ^2 - Chi-square; OR – odds ratio; CI - confidence interval; Coef - coefficient of the variable; S.E - standard error; Sig – p value; R2- coefficient of determination.

An association was found between children who did not attend day care and the presence of IAC (p = 0.047). Children who did not attend day care had 14% less chance of developing the diagnosis. Having family history of asthma increased by 13% the chance of developing IAC (p = 0.006). In addition, children with IAC showed lower stations' average, i.e., shorter hospital stay (p = 0.006). These data are detailed in Table 1.

The following CD were found with significant association: dyspnea (p = 0.020), expectoration (p = 0.017), orthopnea (0.006), respiratory adventitious sounds (p <0.001), decreased breath sounds (p <0.001) and ineffective cough (p <0.001). For the CDs expectoration, orthopnea, dyspnea and ineffective cough, the children had chance to 4, 3, 2 and 85 times greater to develop IAC, respectively. Children with decreased breath sounds showed around 87% of reduction in the chance to have IAC (Table 2).

Table 3 shows the logistic regression model with the best adequacy for the prediction of IAC. For this model, three defining characteristics assist in the correct classification of 90% of individuals suspected of having IAC (R^2 = 0.901): decreased breath sounds, ineffective cough and respiratory adventitious sounds. This model showed good general adequacy (Omnibus test, p <0.001), with expected values similar to those observed (Hosmer-Lemeshow test, p = 0.197). According to the model, the likelihood of IAC is higher among those with ineffective cough and respiratory adventitious sounds, and absence of decreased breath sounds.

DISCUSSION

The ND under study showed high prevalence in the population of children with ARI studied. This finding corroborates that found in the literature. The presence of IAC can be justified by the characteristics of the underlying disease itself, in which there is the production of secretion in the respiratory tract. Other factors that can influence the greater occurrence of this ND are characteristics of the child population: narrower airways and prone to retention of secretion, thus increasing the potential complication of the infection[7,11].

Among the clinical indicators of IAC, there are other factors that can influence the occurrence of this ND in children with ARI, as attendance to day care, family history of asthma and days of hospitalization. A minority of children attended day care (13.2%), which can be explained both by the low age of the children and the sociodemographic household level. Attendance at day care is an important risk factor for ARI in the preschool age group. The children attending day care in this study did it for 9.23 months on average. Non-attendance at day care was a protective factor for IAC, with 14% lower chance[12].

Besides ARIs, it was observed that the asthma was the second most frequently encountered disease. It is emphasized that the ARI is one of the main causes of complicating an asthmatic base condition, which, in turn, is complicating factor of ARI cases. The bronchospasm, characteristic of asthma attacks, decrease the light of smaller airways, hampering thereby expectoration. It starts, then, a process of retention of secretions[13].

The occurrence of asthma, especially in early childhood, has an important hereditary factor involved. The association found between history of asthma in relatives up to the second degree and the occurrence of IAC (p = 0.006, OR = 1.13) can be justified by the very onset of the disease in which asthma patients have a greater chance of complications from respiratory infectious conditions[7].

As the ARI is an acute condition and the clinical picture of children can change quickly, researchers chose to evaluate infants in the first days of hospitalization. It was observed that, as the length of stay increased, the presence of IAC (0.006) decreased. Because it is an acute morbidity, often the first treatment measures for the ARI are instituted quickly, and the clinical picture of the children improves in the early days, most of the times[14].

The DC "ineffective cough" had a high frequency in this study. At this point, it is noteworthy that the respiratory system and other systems in the child meet certain degree of immaturity[14]. So, the response of the child's respiratory system to the presence of secretions in the airway may be deficient, hindering their mobilization through coughing.

The presence of this DC gave the child 85 times greater chance of manifesting IAC. This finding is confirmed in literature, but with variations as to the magnitude, which can be justified by particular characteristics of the study population[6,9]. Another DC that had high frequency in this study and

in several others found in the literature was "respiratory adventitious sounds". The presence of this DC is indicative of the presence of secretions in the airway and can cause noises as crackles, snoring and / or wheezing, depending on the characteristics and location of the secretion in the tracheobronchial tree. This DC presented 74 times more chance for the occurrence of IAC; other studies confirm this finding[7,11].

The DC "dyspnea" was found in about two-thirds of the children, becoming an important clinical indicator for IAC. This DC was defined as respiratory difficulty and is indicative of various respiratory problems. With the presence of secretion in alveolar-capillary membrane, the body increases the pulmonary ventilation to supply the deficiency in the diffusion of gases. This increase in ventilation occurs by raising the respiratory frequency and depth, with activation of accessory muscles of respiration.

So, after shooting these compensatory mechanisms of the airway, the person has feeling of respiratory distress, and such signals are representative of dyspnea. In children, the perceived dyspnea is often difficult to assess. In these situations, the observed aspect of dyspnea is more important.

In the present study, the occurrence of the DC "dyspnea" increased in 2.5 times the risk for developing IAC. This finding is corroborated by study of asthmatic children, which also found moderate amount of sensitivity and specificity for IAC. This finding reinforces the argument that such DC is secondary to several respiratory disorders, not having specific relationship with obstructive diseases or impairment of the gas diffusion process.

Orthopnea was another DC with high frequency in the studied sample. This DC is a kind of dyspnea in which the child feels improvement in respiratory distress by lifting the chest. When the child lifts the thorax, he decreases the load generated by the weight of the very chest wall, thus facilitating an increase in lung expansion. Similar findings are found in the literature [7,11,15].

The DC "expectoration" is often found in children who manifest IAC. In this study, this characteristic was present in situations in which expectoration was spontaneously present or upon interventions for fluidizing and physiotherapy activities. It is noteworthy that a minority of children had spontaneous expectoration[11,16].

In the pediatric population, the expectoration process is hampered by airway narrowing and by the child's inability to expel secretions from the respiratory tract by the mouth. Often, children swallow the secretion that reaches the lower part of the pharynx, causing associated diarrheal frame. Therefore, problems in expectoration are important predictors of severity and may indicate retention of secretions, especially in children younger than 2 years of age[14].

The presence of this DC increases the chance of the child developing IAC in four times. Similar finding is also found in studies in the literature, in which one-third of the individuals presented this DC[11]. In a study conducted with children with asthma, expectoration was present in 50% of cases and presented six times greater chance for the occurrence of IAC[7].

Other DC that showed statistical association with the presence of IAC was "decreased breath sounds", but it proved to be a protective factor for the occurrence of IAC ($p < 0.001$; OR = 0.134). In the population studied, this DC is present especially in cases of complication of the infection, occurring impairment of the pleural membrane and the formation of collections of pus in the pleural space. This process is called infectious pleural effusion.

This occurrence hinders the auscultation of pulmonary sounds in two ways: first, when there is infectious fluid in the pleural space, depending on the amount, it may hamper lung expansion, thus altering the auscultation; and the presence of extra material in the pleural cavity, which is physiologically virtual due to the proximity between the visceral and parietal pleura, prevents auscultation of vesicle murmurs as it is soundproofing.

Besides the DCs "decreased breath sounds", "cough ineffective" and "respiratory adventitious sounds" present, separately, statistical association with IAC, they also provide a joint relationship that increases the likelihood (90% predictive power) to correctly classify children with IAC.

CONCLUSION

The nursing diagnosis IAC was highly prevalent in this study, in 89.2% of the assessed children. The most prevalent defining characteristics and associated statistically with IAC were: dyspnea, expectoration, orthopnea, respiratory adventitious sounds, decreased breath sounds and ineffective cough. Among them, decreased breath sounds, ineffective cough and respiratory adventitious sounds composed the logistic regression model with better adequacy and greater predictive power, confirming the relevance of these for the occurrence of IAC.

Knowing the clinical indicators of IAC in specific populations, such as pediatric, can help nurses in the diagnostic inference process. Identifying how each defining characteristic is associated or is representative of IAC is another very important point.

Clinical indicators associated with respiratory evaluation exhibit varied spectra of occurrence, as well as IAC. It is suggested, for future studies, that such indicators are qualified in varying degrees so that one can determine more accurately the degree of child's respiratory impairment.

The diagnostic inference process was still pervaded by subjectivity, although it has been provided a training in which aspects related to the qualification of diagnosticians nurses were evaluated.

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