Subjective and objective parameters in paediatric respiratory conditions: cultural adaptation to Portuguese population

Parâmetros anamnésicos e semiológicos em condições respiratórias pediátricas: adaptação cultural para a população portuguesa

**Ana Manuela Ferreira da Silva Alexandrino[a, b], Rita Isabel Garrido Vieira Santos[b, c],
Maria Cristina Damas Argel de Melo[b, d], José Adelino Mesquita Bastos[a], Guy Postiaux[e]***

[a] Universidade de Aveiro (UA), Aveiro, Portugal
[b] Instituto Politécnico do Porto (IPP), Porto, Portugal
[c] Universidade do Porto (UP), Porto, Portugal
[d] University of Brighton, Brighton, England, United Kingdom
[e] Haute Ecole Condorcet, at the Haute Ecole Charleroi Europe, Hainaut, Belgium

Abstract

Introduction: Young children are at high risk of respiratory infections. The severity of the disease is based on the assessment of signs and symptoms, although there is a lack of validated scales to the Portuguese population. **Objective:** The aim of this study was to accomplish the cultural adaptation and validation of the subjective and objective parameters in paediatric respiratory conditions, according to Postiaux. **Methods:** We ensured the cultural adaptation of the "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*", created by Guy Postiaux. Then we analysed content, conceptual and construct validity, as well as test-retest reliability. The Portuguese version was applied in a sample of 59 children, with a mean age of 23.05 ± 8.34 months, 55.9% male. **Results:** We stablished semantics and construct validity and adopted the title "*Paediatric Respiratory Severity Score" (PRSS). PRSS* obtained a good internal consistency (α de Cronbach = 0.80) and an excellent intra-rater reliability (ICC = 0.91). Subjective parameters revealed a Cronbach' α = 0.80 and an ICC = 0.90. Objective parameters obtained a Cronbach' α = 0.73 and an ICC = 0.85. The application of PRSS to the sample showed that 37.3% of the children had a normal health condition (*PRSS* = 8) and 62.7% of

* AMFSA: Doctoral Student, e-mail: ama@estsp.ipp.pt
RIGVS: Doctoral Student, e-mail: rvs@estsp.ipp.pt
MCDAM: PhD, e-mail: cam@estsp.ipp.pt
JAMB: PhD, e-mail: mesquitabastos@gmail.com
GP: BS Specialist, e-mail: guy.postiaux@gmail.com

the children had a moderate impairment of their health condition (9 ≤ *PRSS* ≤ 16). **Conclusion:** *Paediatric Respiratory Severity Score is a valid and reliable measure to assess the severity of acute respiratory infections in children under 36 months of age.*

Keywords: Respiratory Tract Infections. Pediatrics. Health Promotion. Validation Studies.

Resumo

Introdução: As crianças pequenas são uma população de risco para infeções respiratórias, cuja severidade é estabelecida através da avaliação de sinais e sintomas. Há contudo poucas escalas validadas para a população portuguesa. Objetivo: O nosso objetivo foi realizar a adaptação cultural e validação dos parâmetros anamnésicos e semiológicos em condições respiratórias pediátricas, segundo Postiaux. Métodos: Procedemos à adaptação cultural de "Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant", *criada por Guy Postiaux. Seguidamente avaliamos as equivalências semântica, de conteúdo, conceptual e de construção e a confiabilidade teste reteste. A escala foi posteriormente aplicada numa amostra de 59 crianças, com média de idades de 23,05 ± 8,34 meses, 55,9% do sexo masculino. Resultados: As equivalências semântica e de conteúdo foram verificadas, sendo atribuído o título de Escala de Severidade Respiratória Pediátrica (ESRP). Realizou-se ainda a equivalência de construção (α de Cronbach = 0,80) e a confiabilidade teste reteste (ICC = 0,91). A análise dos parâmetros anamnésicos revelou um α de Cronbach = 0,80 e um ICC = 0,90. A análise dos parâmetros semiológicos mostrou um α de Cronbach = 0,73 e um ICC = 0,85. A aplicação da ESRP à amostra revelou que 37,3% crianças apresentaram um índice de severidade normal (ESRP=8) e 62,71% um índice moderado (9 ≤ ESRP ≤ 16). Conclusão: A ESRP é uma medida válida e confiável para avaliação dos sinais e sintomas de infeção respiratória.*

Palavras-chave: Infecções Respiratórias. Pediatria. Promoção da Saúde. Estudos de Validação.

Introduction

Acute respiratory infections (ARI) are the most frequent illness in children under 2 years of age (1 - 4). Parents make a considerable use of healthcare services to cope with ARI, thus becoming a burden for children and their families (1, 4). Furthermore, ARI are the main cause of worldwide morbidity, leading to school and work absenteeism (5).

ARI are classified as Upper Respiratory Tract Infections (URTI) and Lower Respiratory Tract Infections (LRTI), depending on which part of the respiratory tract is most severely affected. URTI are very common in children, including initial signs and symptoms, such as, cough, rhinorrhoea, nasal obstruction and fever, however, about one third of these children develop LRTI, which generally have a more severe impact on children´s health. The severity of LRTI depends on the clinician's interpretation of a constellation of clinical findings, for instance, increased difficult breathing and respiratory rate, paradoxical breathing, chest in drawing, nasal flaring or cyanosis (6 - 8).

There are some severity scores described in literature, such as, the *Kristjansson Respiratory Score* (KRS), the *Wang Respiratory Score* (WRS) and the *Respiratory Distress Assessment Instrument* (RDAI), which help the clinician to assess the severity of ARI (9 - 11). However, these scores are mainly focused in the presence of signs of respiratory distress, so they have a limited use in mild episodes of ARI.

Postiaux G et al. designed a classification system of the severity of ARI in children, including general signs and symptoms, besides the typical signs of respiratory distress, so, it may be applied to a wider range of ARI, including URTI (12).

The aim of the present study was to ensure the cultural adaptation of the scale "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*", according to Postiaux, as well as to analyse its construct validity and intra-rater reliability. This scale will allow

an objective assessment of the signs of ARI in children, either in clinical settings, to monitoring the child's health condition, as in community settings, such as day-care centres, which constitute an environment highly favourable for the transmission of common respiratory pathogens. Moreover, this instrument may be used as a standard assessment of the respiratory health condition of children, thereby facilitating the scientific investigation in paediatric respiratory physiotherapy.

Methods

Ethics

This study was part of a research project which obtained ethical approval from the Ethics Committee of Oporto University's approval (Nº13/CEUP/2011). After Ethical approval the day-care centres' administrators were contacted in order to give their formal consent, and then, the children´s caregivers were informed about the aims and procedures of the study, expressing their written formal consent according to the Declaration of Helsinki.

Cross-Cultural Adaptation

The first step was to cross-culturally adapt the "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*" to Portuguese population (12). This process followed international recommendations, including translation to Portuguese, back-translation to French, evaluation by an expert panel and pilot-testing the final version.

The content validity was achieved according to the Delphi's method, which relied on the analysis of the pre-final Portuguese version by a panel of 3 physiotherapists with experience in the treatment of children with respiratory diseases. The construct validity was analysed against eight questions based on literature, which were related to each item of the scale (13).

Instrument

Postiaux G et al. created a severity score which summarizes the main subjective and objective parameters that are present in children with ARI, allowing to assess the severity of the respiratory impairment (12). The subjective parameters are obtained from a clinical interview to caregivers, who are asked to report the children's symptoms from the past 24 hours. The objective parameters are obtained from a clinical assessment of the health professional. The evaluator must give a punctuation between 1 (normal) and 3 (severe) to each parameter, according to the severity of the health condition of the child. The final score is calculated as the sum of all the 8 parameters, varying from 8 to 24. The child's health condition is considered to be *Normal* if the total score is 8, *Moderate* if the total score is between 9 and 16, and *Severe* if total score is between 17 and 24.

Procedures

After obtaining the formal consent from the author of the original scale, we started the cultural adaptation process according to the timeline presented in Figure 1.
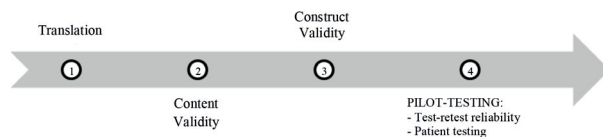
Figure 1 - Timeline with the steps that were conducted towards the cross-cultural adaptation and validation of the scale *"Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant"*.

1. Translation

In order to prepare the forward translation of the original scale, there were recruited two Portuguese professional translators, native speakers and fluent in French. Each of the translators independently produced a forward translation to Portuguese of the original scale. Then, both translators and the local project investigator agreed on a single reconciled Portuguese version. Afterwards, two French native bilingual translators were recruited to produce the backward translation to French. The backward version and the original version of the scale were compared among each other by a panel of experts, giving rise to a consensus version of the second Portuguese version of the scale "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*" (13, 14).

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2. Content Validity

The content validity was achieved according to the Delphi's method, which relied on the analysis of the pre-final Portuguese version by a panel of 3 physiotherapists with at least 5 years of experience in the treatment of children with respiratory diseases. They were given a comprehension test, besides the pre-final Portuguese version, in order to obtain a written analysis of all parameters, which allowed to identify and correct any errors introduced by the translation process (13, 14). Then, the local project manager meet the 3 experts in order to discuss and correct any suggestions, given rise to the final Portuguese version of the scale "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*".

3. Construct Validity

The construct validity is obtained when there is a relationship between 2 procedures that measure the same concept (13, 14). So, the final Portuguese version of the scale was delivered to the parents and physiotherapists of 5 children, along with the following eight questions based on literature, which were related to each item of the scale (15).

- Subjective parameters

"In the past 24h did your child:

1) Present cough? If yes, it was combined with secretions?
2) Present any changes in appetite?
3) Present fever? If yes, what was the value?
4) Present nasal secretions? If yes, what did it look like?"

- Objective parameters

"In your clinical evaluation did the child:

1) Present breathing difficulties?
2) Present any signs of respiratory distress? If yes, which were they?
3) Present secretions? If yes, please quantify.
4) Which were your auscultatory findings?"

4. Pilot-testing

a) Test-retest reliability

In order to perform the test-retest reliability we asked the 3 experts to assess and re-assess the respiratory condition of children, throughout 72h, using the final Portuguese version of the scale (14). Additionally, in the second evaluation we asked parents if their child had any change in their respiratory condition. Those who answered *yes* were excluded from the test-retest analysis.

b) Patient-testing

The final Portuguese version of the scale was then applied to a different sample of children, obtained from two day-care centres of Porto. The subjective parameters were obtained by a clinical interview to children´s caregivers and the objective parameters were obtained by the clinical assessment of a blinded respiratory physiotherapist.

Statistics

All statistical analysis were carried out using IBM® SPSS® Statistics 20 (SPSS® IBM Corporation, Route 100) for Windows 7®, with a confidence interval of 95% (significance level of $\alpha = 0.05$).

The Cronbach's α was used to test the internal consistency of the parameters, using the Nunnally and Bernstein´s classification: : $\alpha \geq 0,9$ excellent; $0,7 \leq \alpha < 0,9$ good; $0,6 \leq \alpha < 0,7$ fair; $0,5 \leq \alpha < 0,6$ poor; $\alpha < 0,5$ unacceptable (16, 17). The intraclass correlation coefficient (ICC) was used for test-retest reliability, according to Fleiss' classification (17). Descriptive statistical methods were used to characterize the sample (means, standard deviations and relative frequencies) (18).

Results

1. Translation

The versions derived from the forward translation and backward translation were adequate, and did not require grammatical changes. At the end of the meeting we concluded that the Portuguese version of the scale "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*" did not present underlying or ambiguous concepts and it showed to be a simple, brief and understandable instrument.

2. Content Validity

The panel of experts has made some suggestions concerning the content's analysis of the first Portuguese version of the scale. There were some remarks about the original title, since experts considered it too long. They suggested instead "*Paediatric Respiratory Severity Score*" (*PRSS*) (*Escala de Severidade Respiratória Pediátrica).*

The panel of experts also suggested to include the following instructions: *"The purpose of this score is to assess the respiratory health condition of the child. Please fill in the "Subjective Parameters" according to the clinical interview to the child's caregiver, and the "Objective Parameters" according to your clinical evaluation of the child."*

Experts also suggest to change the concept "pyrexia" by "fever", since they considered it a more common word. Finally, the experts suggested to alter the order of the parameters, so all subjective parameters could appear before the objective parameters.

Still, the panel of experts considered that the scale was a simple and clear instrument, which may be easily used to assess the respiratory condition of a child.

The final Portuguese version of *"Paediatric Respiratory Severity Score"* is presented in Table 1.

Table 1 - Final Portuguese version of Paediatric Respiratory Severity Score (PRSS)

Subjective and Objective Parameters	Score		
	1 = Normal	2 = Moderate	3 = Severe
Cough	Absent or rare	Productive	Dry, repeated, nocturnal
Nutrition	Normal appetite	Loss of appetite	Loss of weight, vomiting
Fever	Absent	> 37.5º	> 38.5º
Rhinorrhoea	Absent	Liquid	Purulent
Dyspnoea	Absent	Chest in drawing; Tachypnea >50	Paradoxical Breathing
Respiratory Sounds	Normal	Decreased	Very decreased; bronchial
Adventitious Sounds	Absent	Crackles OR Wheezing	Crackles AND Wheezing
Secretions	0 to 2	3 to 8	More than 8

3. Construct Validity

The PRSS was delivered to the parents and the physiotherapists of 5 children, along with eight questions related to each item of the scale. It was obtained a good internal consistency (Cronbach´s α = 0.80), as it can be seen in Table 2.

Table 2 - Construct validity of the Paediatric Respiratory Severity Score

Parameters		Cronbach's α	Cronbach's α
Subjective Parameters	Cough	1.00	0.88
	Nutrition	1.00	
	Fever	1.00	
	Rhinorrhoea	0.50	
Objective Parameters	Dyspnoea	1.00	0.73
	Respiratory Sounds	1.00	
	Adventitious Sounds	0.55	
	Secretions	0.38	

4. Pilot-testing:

a) Test-retest Reliability

From an initial sample of 35 children who attended a day-care centre in Porto, 22 children were excluded, so a final sample of 13 children between 10 and 28 moths was obtained. Children had a mean age of 18.69 ± 1.54 months and 53.8% were male. The results revealed an *ICC* = 0.91 (Table 3), meaning an excellent test-retest reliability (17).

Table 3 - Test-retest reliability of the Paediatric Respiratory Severity Score

Parameters		ICC*	ICC*
Subjective Parameters	Cough	0.87	0.90
	Nutrition	1.00	
	Fever	1.00	
	Rhinorrhoea	0.85	
Objective Parameters	Dyspnoea	1.00	0.85
	Respiratory Sounds	1.00	
	Adventitious Sounds	0.84	
	Secretions	0.73	

Note: ICC = Intraclass correlation coeficiente.

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b) Patient-testing

From an initial sample of 72 children under 36 months of age, 13 were excluded because they missed the day-care in evaluation day or because parents did not give their consent, so, a final sample of 59 children was obtained.

The application of PRSS to the final sample revealed that 37.3% (n = 22) of the children had a normal respiratory health condition, and 62.7% (n = 37) had a moderate impairment of the respiratory health condition. There were no cases of severe impairment of the respiratory health condition.

Table 4 shows de frequency of children according to the score given to each parameter. Concerning the subjective parameters, most of the children presented: no cough (71.2%), normal appetite (96.6%), no fever (96.6%), and liquid rhinorrhoea (47.5%). Regarding objective parameters, none of the children presented dyspnoea and all children had normal lung sounds; most of the children presented no adventitious sounds (84.7%) and few secretions (78%).

Table 4 - Frequency of children according to the score given to each parameter of the Paediatric Respiratory Severity Score

(To be continued)

Subjective Parameters	Score		Frequency (%)
Cough	Absent or rare	1 - Normal	71.2
	Productive	2 – Moderado	27.1
	Dry, repeated, nocturnal	3 – Severo	1.7
Nutrition	Normal appetite	1 – Normal	96.6
	Loss of appetite	2 – Moderate	3.4
	Loss of weight, vomiting	3 – Severe	0
Fever	Absent	1 – Normal	96.6
	> 37.5	2 – Moderate	3.4
	> 38.5	3 – Severe	0
Rhinorrhoea	Absent	1 – Normal	40.7
	Aquosa	2 – Moderate	47.5
	Purulenta	3 – Severe	11.9

(Conclusion)

Objective Parameters	Score		Frequency (%)
Dyspnoea	Absent	1 – Normal	100
	Chest in drawing; Tachypnea > 50	2 – Moderate	0
	Paradoxical Breathing	3 – Severe	0
Respiratory Sounds	Normal	1 – Normal	100
	Decreased	2 – Moderate	0
	Very decreased; bronchial	3 – Severe	0
Adventitious Sounds	Absent	1 – Normal	84.7
	Crackles OR Wheezing	2 – Moderate	13.6
	Crackles AND Wheezing	3 – Severe	1.7
Secretions	0 to 2	1 – Normal	78
	3 to 8	2 – Moderate	18.6
	More than 8	3 – Severe	3.4

Discussion

The purpose of this study was to analyse the psychometric characteristics of the scale "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*". This scale can be used to assess the severity of the acute respiratory infections in children, even in the initial stages of the infection or in mild episodes of ARI, when there are no signs of respiratory distress.

The *Pediatric Respiratory Severity Score (PRSS)* showed to be a simple instrument, which may be used in a consistent way. According to Postiaux G et al, *PRSS* seems to be able to detect any changes in the respiratory health condition of a child, so it may be used to assess the effect of therapeutic interventions, such as respiratory physiotherapy techniques (12).

In fact, there are very few instruments that can be used on infants and young children in order to evaluate the severity of mild episodes of ARI, such as most URTI. This limits the scientific research concerning cardiopulmonary diseases in children, therefore, most

of the existing research concerns LRTI, namely bronchiolitis, and are conducted in hospital settings (19). Even the existing scores of severity, such as *Kristjansson Respiratory Score (KRS)*, *Wang Respiratory Score (WRS)*, *and Respiratory Distress Assessment Instrument (RDAI)*, are mainly used in children with bronchiolitis with signs of respiratory failure (9, 20). Nevertheless, these scores have good psychometric characteristics, being related to gold standard measures, such as O2 saturation, so, they are often used, either in the clinical assessment, as in scientific investigation in children (9, 10, 21, 22). However, as these scores evaluates the signs of respiratory distress, they cannot be used in mild cases of ARI or in community settings.

Therefore, Postiaux G et al. developed a severity score, which summarizes the main subjective and objective parameters that are observed in children with ARI, including early signs of ARI, such as cough, secretions or rhinorrhoea, allowing the assessment of the respiratory condition of the child, even in the absence of respiratory distress (12).

This study showed that PRSS has good psychometric characteristics, namely, content validity, construct validity and test-retest reliability.

The subjective parameters revealed better values of test-retest reliability than the objective parameters, which enhances the importance of including caregivers in the clinical assessment of their child, since they presented excellent levels of consistency in their answers. This fact is not fully consensual in literature, since some authors stated that objective parameters are more reliable than subjective parameters, while other investigators reported a low consistency between observers regarding children's assessment (20, 21).

The subjective parameters "nutrition" and "fever" obtained the best values of construct validity and reliability, which seems to be related to the characteristics of the sample, since children who are in day-care centres generally have a normal appetite and have no fever. In opposition, "rhinorrhoea" obtained the lowest value, which may be due to difficulties in its classification. In fact, there are many types of rhinorrhoea described in literature, concerning a multitude of characteristics, such as rheology, macroscopic features, or aetiology (23, 24). Furthermore, the question that was used along PRSS to assess the construct validity of the parameter "rhinorrhoea" could have been too imprecise, causing some dispersion in the caregivers' answers.

Nevertheless, Tomé D et al. used in their study a preliminary version of PRSS, detecting a relationship between the score that was given to the parameter "rhinorrhoea" and the middle ear condition of children attending day-care centres, as well as a higher frequency of normal tympanograms in children classified as having no rhinorrhoea (25). Also Santos R et al. found better severity scores in children without nasal obstruction in comparison with children with nasal obstruction, when using a similar version of the PRSS (26).

The results concerning the parameter "cough" also suggests some difficulties in its classification, either by caregivers as by experts. In fact, it seems that there is no consensus in literature regarding the semantics of cough, since the classification of cough may depend on its cause, duration, behaviour or characteristics (27).

In what concerns the objective parameters, "dyspnoea" and "respiratory sounds" obtained the higher values of internal consistency, as well as test-retest reliability. This is due to the characteristics of our sample, since it was not probable that the children who are at the day-care centre have decreased lung sounds or dyspnoea.

Nevertheless, "adventitious respiratory sounds" and "secretions" showed the lowest values. In the first case, we believe that this was due to the diversity of terminologies used to classify the adventitious lung sounds (28). In fact, the *Groupe d'Etude Pluridisciplinaire Stéthacoustique*, has been evoking that is necessary to achieve an international consensus regarding the classification of the auscultatory findings (28, 29). This is also a priority for the *European Respiratory Society (ERS)*, who created the *ERS Task Force on lung sounds*, which includes experts from several countries, aiming the establishment of a consensus' nomenclature for pulmonary auscultation (30). However, in a recent publication, the ERS reported that a poor to fair agreement (κ < 0.40) was usually found for the detailed descriptions of the adventitious sounds, whereas moderate to good agreement was reached for the combined categories of crackles (κ = 0.62) and wheezes (κ = 0.59) (31). Also the existing studies about pulmonary auscultation in children have reported a poor to fair reliability (31, 32). Other reasons may be related to these findings, such as the difficulty in performing the technique of pulmonary auscultation in children, since they have small thoraxes, high respiratory rates, irregular breathing patterns and sometimes crying is present (33).

Furthermore, the low results concerning the parameter "secretions" may be related to difficulties in quantifying the secretions. It is known that children do not expel secretions to the exterior, instead they swallow it (33).

So, it is not always possible to see the exact amount of secretions that is expelled from the respiratory tract.

Nonetheless, PRSS seems to be a reliable measure in order to assess the signs of ARI, even in initial stages or in mild episodes. The results concerning test-retest reliability are similar to the most used scores, that is, the *Kristjansson Respiratory Score* (*ICC* = 0.89) and the *Wang Respiratory Score* (*ICC* = 0.99), and superior to the results of the *Respiratory Distress Assessment Instrument* (RDAI) (*ICC* = 0.39) (21, 22).

Pilot-testing in a sample of children under 36 months attending day-care centres showed that most of the children presented a moderate impairment of the respiratory health condition (8 < PRSS ≤ 16), mainly due to the presence of rhinorrhoea and secretions. Several studies showed that children who attend day-care centres have an increased risk of ARI, due to the close contact among each other, thus increasing the viral transmission (2, 3, 34). Moreover, the data was collected in winter, so there was a high frequency of ARI due to seasonality (1, 35).

The PRSS seems to have a good potential, not only to assess the effects of respiratory physiotherapy techniques, but also to be used in community settings in order to identify at-risk populations and thus providing early intervention measures. This is a fundamental step to develop health promotion programmes and to the prevention of ARI in children.

This study faced some limitations, that is, the inexistence of a *Gold Standard measure,* with which PRSS could be compared in order to analyse the criterion validity. Most of the studies about the validation of similar scores used O2 saturation as a *Gold Standard* measure. However, this would serve no purpose in less severe cases of ARI, since the O2 saturation is normal. Furthermore, the small sample size limits the external validity of these results.

Conclusion

The Portuguese version of "*Paramètres anamnestiques et cliniques utiles au suivi et à l'achèvement de la toilette bronchopulmonaire du nourrisson et de l'enfant*", namely, *Paediatric Respiratory Severity Score* is a valid and reliable measure in order to assess the severity of acute respiratory infections in children under 36 months of age. So, it can be used to assess and monitoring the respiratory health condition of children, either in clinical as in research settings.

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