Supplementary Material

Methods

Systematic Search of the Literature and Critical Appraisal of a Topic
In search of signs of effort of breathing for a clinical work of breathing (WOB) assessment, we first performed a systematic search of the literature and critical appraisal of a topic (CT) as described below. Our aim was to identify articles from which we could select the broadest panel of signs of effort of breathing as described in children.

Question
What are clinical observations (signs of effort of breathing) with a good predictive value in assessing the severity of WOB in children admitted to the pediatric intensive care unit (PICU)?

Domain
Diagnosis
PICO
P: children (0–18 years) admitted to the PICU with respiratory distress or respiratory failure.
I: clinical observations.
C: no observations.
O: predictive value of clinical observations.

Finding the Evidence
Search in database of PubMed and CINAHL.
Final selection: seven articles (Fig. 1).

Selected Articles
1. Davies et al1
2. Shah et al2
3. Walsh et al3
4. Shein et al4
5. Bekhof et al5
6. Bekhof et al6
7. Justicia-Grande et al7

Summary of the Research Methods and Results
A literature search in PubMed and CINAHL resulted in 654 items. After an initial assessment of title and abstract, 11 articles were selected. These articles were fully read after which seven articles were included. The selected articles were reviewed by two reviewers. Four out of seven articles were systematic reviews and three were prospective cohort studies (Table 1). Sixty-five score instruments were found. The score instruments described contain a large and varying amount of clinical observations related to WOB. Many score instruments were used in research situations where validity and reliability were not tested, and used in a homogeneous patient group (such as asthma, bronchiolitis, and croup).

Conclusion
No research has been done into a generic observational score instrument for WOB in children admitted to the PICU. Of all observations, only the item “retractions” has been validated as a reliable observation for WOB in children.

Evaluation
Based on this systematic literature search we included retractions as one of the items for signs of effort of breathing. Subsequently we selected 11 additional items after a consensus meeting by a local panel of experts, consisting of one PICU physician, one research nurse/clinical epidemiologist and two PICU nurses with specific respiratory expertise. The total 12 items were categorized into four WOB domains (breathing rate, inspiratory effort, expiratory effort, and general signs of effort of breathing; Table 1 of the main manuscript).
Fig. 1 Search strategy. SR, systematic review.
<table>
<thead>
<tr>
<th>Author</th>
<th>Design</th>
<th>Outcome</th>
<th>Patients</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Final judgment</th>
<th>LoE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walsh et al³</td>
<td>Prospective cohort study</td>
<td>Reliability bronchiolitis severity assessment tool</td>
<td>Patients 0–18 years with a clinical diagnosis of bronchiolitis</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>Useful</td>
<td>Grade C</td>
<td></td>
</tr>
<tr>
<td>Shein et al⁴</td>
<td>Prospective cohort study</td>
<td>Objective measurements vs. clinical assessment</td>
<td>Patients 0–18 years after extubation</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>Useful, recent</td>
<td>Grade A2</td>
<td></td>
</tr>
<tr>
<td>Bekhof et al⁵</td>
<td>Prospective cohort study</td>
<td>Intraobserver and interobserver variation in clinical assessment of children with dyspnea.</td>
<td>Patients 0–7 years with acutely wheezing</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>Useful</td>
<td>Grade C</td>
<td></td>
</tr>
<tr>
<td>Bekhof et al⁶</td>
<td>Systematic review</td>
<td>To assess validity, reliability, and utility of all available pediatric dyspnea scores</td>
<td>Patients 0–18 years with wheezing, asthma and bronchiolitis</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td>+</td>
<td>Useful</td>
<td>Grade A1</td>
</tr>
<tr>
<td>Davies et al¹</td>
<td>Systematic review</td>
<td>Evaluation of psychometric properties</td>
<td>Patients 0–19 years with bronchiolitis</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td>+</td>
<td>Useful, recent</td>
<td>Grade A1</td>
</tr>
<tr>
<td>Shah et al²</td>
<td>Systematic review</td>
<td>Pneumonia</td>
<td>Patients 0–19 years with suspected pneumonia</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>NA</td>
<td>NA</td>
<td>+</td>
<td>Useful, recent</td>
<td>Grade A1</td>
</tr>
<tr>
<td>Justicia-Grande et al⁷</td>
<td>Literature review</td>
<td>Review of the different dyspnea scores designed for assessing severity in acute respiratory distress and analyze their strengths and their flaws, validity</td>
<td>Patients &lt;2 to &gt; 12 years</td>
<td>+</td>
<td>+</td>
<td>±</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>NA</td>
<td>NA</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: LoE, level of evidence.

Note: 1, clearly focused issue; 2, recruitment acceptable; 3, exposure accurately measured; 4, outcome accurately measured; 5, all important confounding factors described; 6, missed confounding factors; 7, confounding factors in design; 8, follow-up complete enough; 9, follow-up long enough; 10, precision of results; 11, a priori design provided; 12, duplicate study selection and data extraction; 13, comprehensive literature search; 14, status of publication as inclusion criterion; 15, list of studies provided; 16, characteristics of included studies provided; 17, scientific quality of included studies assessed and documented; 18, methods used to combine findings appropriate; 19, likelihood of publication bias assessed; 20, conflict of interest stated.
References
2 Shah SN, Bachur RG, Simel DL, Neuman MI. Does this child have pneumonia?: the rational clinical examination systematic review JAMA 2017;318(05):462–471