



## Letters

## Variability of the Acute Asthma Intensity Research Score in the pediatric emergency department



Asthma is the most common chronic disease of childhood, and acute asthma exacerbations use a significant amount of pediatric emergency department (PED) resources.<sup>1–3</sup> The ability to quickly and accurately evaluate acute asthma exacerbation severity is essential for providing appropriate, quality care in an efficient manner. Furthermore, in increasingly busy emergency departments in which multiple health care professionals may take care of a single patient, there needs to be low interrater variability of asthma severity assessment among health care professionals so that exacerbation severity can be efficiently communicated.

The clinical team in our tertiary, urban, academic children's hospital PED manages approximately 3,100 acute asthma exacerbation per year. We previously reported higher-than-expected treatment variability of asthma exacerbations in the PED.<sup>4</sup> At that time, we were using the 15-point Pediatric Asthma Score to evaluate our asthma exacerbations.<sup>5</sup>

As part of a quality improvement initiative, a multidisciplinary asthma steering committee created a hospital-wide clinical pathway guideline (CPG) for asthma exacerbation assessment and management and implemented the CPG in May 2014. The Acute Asthma Intensity Research Score (AAIRS) was incorporated in the CPG to guide clinical assessment and management of exacerbations, but no formal training in the use of the AAIRS was provided before the start of the CPG.

The AAIRS is a 7-component bedside severity score with a 17-point range of possible score values (scale, 0–16, with 16 being most severe). The components of the score include the evaluation of the presence of 3 groups of accessory muscle use, a room air oxygen saturation value, and severity measures of air entry, wheezing, and expiratory phase prolongation. The AAIRS has demonstrated discrimination and responsiveness to predict the criterion standard percentage of predicted forced expiratory volume in 1 second.<sup>6</sup> However, to our knowledge, the interrater reliability of AAIRS has yet to be reported. The objective of this study was to evaluate the interrater agreement of the individual AAIRS components and the total AAIRS among health care professionals (physicians or nurse practitioners, nurses, and respiratory therapists).

In July 2014, clinical team members were recruited for study participation. Participants were asked to assess individual AAIRS components in tandem with at least one other clinical team member for children aged 3 to 17 years with acute asthma exacerbations. The

only patient inclusion criterion was physician-diagnosed asthma. Participants did not receive any formal training in the use of the AAIRS for the duration of the study, and no participants had any previous experience using it in clinical practice.

Clinical team members were recruited from individuals who routinely worked in the PED. Participants included physicians or nurse practitioners, nurses, and respiratory therapists. All participants who completed AAIRS scoring sheets for this research signed informed consent forms; the AAIRS was also in routine clinical use after the establishment of the CPG in May 2014.

Evaluations were completed on paper score sheets by circling the individual components of AAIRS, and evaluations were completed at the time of asthma presentation and after 1 hour of treatment. Clinical team members completed the evaluations independently and placed the score sheets in a locked mailbox in the PED workroom. Participants were asked to not share or discuss their assessments with one another. The research score sheets were not used to guide clinical care. All participants signed informed consent forms, and the study was approved by our institutional review board.

We calculated interobserver agreement for all 3 clinical team member groups (respiratory therapists vs nurses, respiratory therapists vs physicians or nurse practitioners, nurses vs physicians or nurse practitioners). For analysis of the individual components of AAIRS, we used  $\kappa$  statistics. For the analysis of the total AAIRS, we used the intraclass correlation coefficient. All analyses were performed using the R statistical package.<sup>7</sup>

During the study period from July 1, 2014, to November 27, 2014, AAIRS research score sheets were completed for patients with 144 individual asthma exacerbations. The presence of an asthma exacerbation was determined by the treating physician. All evaluated patients had physician-diagnosed asthma, the median age was 5 years (interquartile range, 3.3–8 years), and 33% were female. For each asthma exacerbation, all 3 clinical team member groups had the opportunity to complete an AAIRS evaluation. In total, 22 different respiratory therapists, 50 different nurses, and 48 different physicians or nurse practitioners completed AAIRS research score sheets. Respiratory therapists vs physicians or nurse practitioners had the best total AAIRS intraclass correlation coefficient both before and after treatment (0.77 and 0.66, respectively; Table 1). The after-treatment assessment for nurses vs physicians or nurse practitioners of the sternocleidomastoid muscle use had the highest  $\kappa$  statistic (0.81), and in general the evaluation of accessory muscle use had greater  $\kappa$  statistics than other AAIRS components. The lowest  $\kappa$  statistic was seen for nurses vs physicians or nurse practitioners for the assessment of before-treatment expiratory phase.

Our study results indicate that although there is good interrater reliability for the overall AAIRS evaluation, there were several

**Disclosures:** Authors have nothing to disclose.

**Funding:** This project was supported by grant T32 GM07569 from Vanderbilt University in clinical pharmacology (Dr O'Connor), grant K23 HL80005 from the National Heart, Lung, and Blood Institute (Dr Arnold), and grant UL1 RR024975 from the National Center for Research Resources, National Institute of Health (Vanderbilt Clinical and Translational Science Award).

**Table 1**  
Measures of interrater agreement for acute asthma intensity research score (AAIRS) among clinical team members caring for children with acute asthma exacerbations

| Component                     | RT vs RN         |                 | RT vs Physician or NP |                 | RN vs Physician or NP |                 | Overall          |                 |
|-------------------------------|------------------|-----------------|-----------------------|-----------------|-----------------------|-----------------|------------------|-----------------|
|                               | Before treatment | After treatment | Before treatment      | After treatment | Before treatment      | After treatment | Before treatment | After treatment |
| SCM <sup>a</sup>              | 0.51             | 0.63            | 0.49                  | 0.70            | 0.35                  | 0.81            | 0.40             | 0.36            |
| Intercostal <sup>a</sup>      | 0.76             | 0.63            | 0.53                  | 0.53            | 0.27                  | 0.42            | 0.43             | 0.23            |
| Subcostal <sup>a</sup>        | 0.71             | 0.64            | 0.67                  | 0.48            | 0.64                  | 0.42            | 0.60             | 0.37            |
| Air entry <sup>a</sup>        | 0.22             | 0.14            | 0.30                  | 0.29            | 0.24                  | 0.25            | 0.19             | 0.18            |
| Wheezing                      | 0.35             | 0.34            | 0.46                  | 0.25            | 0.16                  | 0.32            | 0.25             | 0.21            |
| SpO <sub>2</sub> <sup>a</sup> | 0.62             | 0.69            | 0.60                  | 0.36            | 0.40                  | 0.49            | 0.40             | 0.41            |
| Expiratory phase <sup>a</sup> | 0.21             | 0.35            | 0.26                  | 0.34            | 0.06                  | 0.35            | 0.12             | 0.28            |
| Total score <sup>b</sup>      | 0.74             | 0.64            | 0.77                  | 0.66            | 0.61                  | 0.53            | 0.65             | 0.49            |

Abbreviations: NP, nurse practitioner; RN, registered nurse; RT, respiratory therapist; SCM, sternocleidomastoid muscle; SpO<sub>2</sub>, transcutaneous pulse oximetry.

<sup>a</sup>κ statistic (categorical variable).

<sup>b</sup>Intraclass correlation coefficient (continuous variable).

components of the score that have poor interrater reliability. Specifically, the evaluation of air entry, wheezing, and the expiratory phase have particularly poor interrater reliability before and after treatment. We believe this might relate to the lack of formal training in the AAIRS during the study period. Despite these observations, the AAIRS predicts PED disposition.<sup>8</sup>

The evaluation of asthma severity involves clinical assessment and spirometry when possible. However, there is evidence that concordance between spirometry and asthma symptoms can be low, with a significant proportion of children having greater severity of asthma on spirometry than would be predicted by clinical symptoms alone.<sup>9</sup> Therefore, there is a need for clinical tools that help to better predict asthma severity and that are available at the bedside.

There are a number of pediatric asthma exacerbation scores available for clinical use, but few have been sufficiently validated.<sup>10</sup> The AAIRS has been validated against forced expiratory volume in 1 second and has demonstrated similar discrimination and responsiveness to another score, the Pediatric Respiratory Assessment Measure.<sup>6</sup> A next step is to implement an educational video that teaches correct severity assessment of pediatric asthma exacerbations using the AAIRS. After implementation of this teaching tool, we plan to reevaluate the interrater reliability of the AAIRS.

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## Anaphylaxis as a delayed reaction of methimazole therapy



The thionamides methimazole and propylthiouracil are the most commonly used antithyroid medications for the treatment of Graves disease but are associated with a high frequency of adverse effects. The most common adverse reactions are hepatotoxicity, agranulocytosis, and cutaneous reactions.<sup>1</sup> Mild pruritus, urticaria, and rashes are the most common cutaneous reactions reported.<sup>2</sup> We report the case of an 18-year-old woman with Graves disease, who presented with repeated episodes of anaphylaxis after treatment

with methimazole for 5 years. Anaphylactic reactions subsided only after withdrawal of methimazole therapy.

An 18-year-old woman with a history of Graves disease was admitted with 3 days of sensation of throat closing; tongue, lip, and facial swelling; urticaria; shortness of breath; and recurrent bouts of emesis. Symptoms were unresponsive to prednisone, which was given at another hospital the day before. Medications included methimazole and atenolol with variable adherence to methimazole therapy. Her medical history included Graves disease treated with various doses of methimazole for 5 years, followed by an unsuccessful radioactive iodine ablation 3 months before presentation. Because of persistent clinical and biochemical hyperthyroidism, her

**Disclosures:** Dr Gavrilova has served as a consultant for Baxter. The other authors have nothing to disclose.