

# rainbow Acoustic Monitoring®

Noninvasive and continuous monitoring of acoustic respiration rate



RRa Acoustic Waveform



RRa Measurement

- > The respiratory signal is separated and processed using acoustic signal processing that leverages Masimo Signal Extraction Technology (SET®) to display continuous respiration rate (RRa®) and an acoustic respiration waveform, a visualization of the acoustic signal caused by the patient's airflow.
- > Clinicians have the option to use the acoustic sensor to listen to the sound of a patient's breathing through a point-of-care device at the bedside and remotely from a Masimo Patient SafetyNet™ view station.
- > An adhesive Respiratory Acoustic Sensor (RAS) detects acoustic signals produced by the turbulent airflow in the upper airway that occurs during inhalation and exhalation, while signal processing algorithms convert the acoustic patterns into breath cycles to calculate respiration rate.
- > Continuous monitoring of SpO2 and RRa, as well as other physiologic parameters, on a single Masimo Pulse CO-Oximeter®, provides clinicians with more data to make informed care decisions and helps facilitate well-rounded patient assessment.



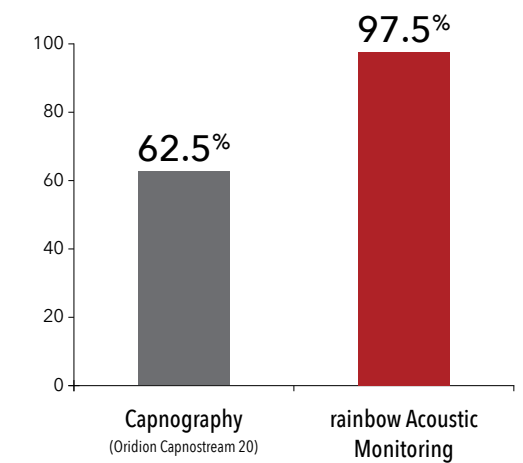
## The Need for Continuous Respiration Monitoring

Continuous monitoring of respiration rate is especially important for post-surgical patients receiving patient-controlled analgesia for pain management. The Anesthesia Patient Safety Foundation (APSF) and The Joint Commission recommend continuous oxygenation and ventilation monitoring for all patients receiving opioid-based pain medications.<sup>1,2</sup>

Neonatal intensive care unit (NICU) patients (neonates) need continuous monitoring of vital signs such as respiration rate without causing discomfort or irritation.<sup>3</sup> Respiratory conditions are the most common reason for admission to a neonatal unit in both term and preterm infants.<sup>4</sup> Respiratory rate (RR) is one of the most sensitive markers of a patient condition and a core aspect of multiple clinical assessment tools.<sup>5</sup>

In a study of 40 pediatric patients (12 months to 18 years of age) undergoing post-anesthesia care, in which researchers compared acoustic respiration rate monitoring using RRA to nasal capnography, impedance pneumography, and a reference method (counting breaths), researchers found that the difference in bias and precision between RRA and capnography was not significant, but that 97.5% of the patients (39) demonstrated good tolerance of the acoustic sensor, whereas 62.5% (25) demonstrated good tolerance of the nasal cannula. The researchers concluded, "Continuous respiration rate measurement from noninvasive, acoustic monitoring showed good agreement with nasal capnography, but was much better tolerated in post-surgical pediatric patients. Acoustic monitoring has the potential to increase the safety of pediatric patients by providing a reliable and accurate method for the continuous monitoring of respiration rate."<sup>6</sup>

**Pediatric Patient Tolerance**



15 out of 40 pediatric patients removed the nasal cannula while only one removed the rainbow<sup>®</sup> acoustic sensor.<sup>6</sup>



### RAS-45 Infant/Neonatal Sensor

- > Small size with a chest application site away from the face allows for continuous respiratory rate monitoring without interfering with daily care activities, such as feeding, holding, bathing, and supine positioning.
- > Customizable neonatal profiles on Masimo devices automatically configure monitoring ranges and alarm thresholds to the most applicable settings for the patient population, simplifying nursing workflows.



### RAS-45 Adult/Pediatric Sensor

- > Continuous respiration rate monitoring of patients with RRA may provide clinicians with an indication of changes in respiration or incidence of respiratory pause.
- > Small size with thin, flexible adhesive allows for comfortable application on patients with smaller necks or fragile skin.



## RAS-125 Sensors



- > Breathable cloth allows air to penetrate tape for enhanced adhesion on adult and pediatric patient, including diaphoretic patients
- > Also available in a short-term monitoring sensor option



RAS-125c

## RAS Specifications

### ACCURACY – (ARMS)<sup>7</sup>

#### RAS-125c/RAS-45

Breaths per Minute (bpm), Accuracy Range (Adult/Pediatric) . . . . . 4-70 bpm<sup>8</sup>  
 Breaths per Minute (bpm), Accuracy Range (Infants/Neonates) . . . . . 4-120 bpm<sup>9</sup>  
 Adults/Pediatrics/Infants/Neonates. . . . . 1 bpm

### WEIGHT RANGE

RAS-45 (Adult/Pediatric) . . . . . >10 kg, neck application  
 RAS-45 (Infant/Neonatal) . . . . . <10 kg, chest application  
 RAS-125c (Adult/Pediatric) . . . . . >10 kg, neck application  
 RAS-125c, Short-Term (Adult/Pediatric) . . . . . >10 kg, neck application

### COMPATIBILITY

Compatible Oximeters . . . . . Systems containing Masimo rainbow SET™ or licensed to use rainbow Acoustic Monitoring® sensors

### INFORMATION

Single-use / Non-sterile / Packaged 10 per box / Does not contain natural rubber latex

### ORDERING INFORMATION

RAS Sensor <sup>†</sup>	Part Number
RAS-45 (Adult/Pediatric) . . . . .	4171
RAS-45 (Infant/Neonatal) . . . . .	4425
RAS-125c (Adult/Pediatric) . . . . .	3475
RAS-125c, Short Term (Adult/Pediatric) . . . . .	3483

\*The use of the trademark Masimo PATIENT SAFETYNET is under license from University Health System Consortium. † Requires RAM Dual Cable to obtain RRa measurement.

<sup>1</sup> Stoelting RK et al. *APSF Newsletter*. 2011.(www.apsf.org). <sup>2</sup> The Joint Commission Sentinel Event Alert. Issue 49, August 8, 2012. [http://www.jointcommission.org/assets/1/18/SEA\\_49\\_opioids\\_8\\_2\\_12\\_final.pdf](http://www.jointcommission.org/assets/1/18/SEA_49_opioids_8_2_12_final.pdf). <sup>3</sup> Abbas et al. *BioMedical Engineering OnLine*. 2011, 10:93. <sup>4</sup> Pramanik AK et al. *Pediatr Clin North Am*. 2015; 62: 453 -469. <sup>5</sup> Keir et al. *J Clin Monit Comput*. (2015) 29:455 -460. DOI 10.1007/s10877-014-9621-3. <sup>6</sup> Patino M et al. *Pediatric Anesthesia*. 2013, no. 12: 1166-1173. <sup>7</sup> ARMS accuracy is a statistical calculation of the difference between device measurements and reference measurements. Approximately two-thirds of the device measurements fell within ± ARMS of the reference measurements in a controlled study. <sup>8</sup> Respiration rate accuracy for the rainbow Acoustic Monitoring sensor and device has been validated for the range of 4 to 70 breaths per minute in bench top testing. Clinical validation was performed with the rainbow® Acoustic Monitoring sensors and monitoring devices for up to 30 breaths per minute in adult subjects (>30kg) and up to 50 breaths per minute in pediatric subjects (>10kg). <sup>9</sup> Respiration rate accuracy for the RAS-45 Inf/Neo sensor has been validated for the range of 4 to 120 breaths per minute in bench top testing. Clinical validation was performed with the RAS-45 Inf/Neo sensor and monitoring device for up to 82 breaths per minute in infant and neonatal subjects.

Caution: Federal (USA) law restricts this device to sale by or on the order of a physician. See instructions for use for full prescribing information, including indications, contraindications, warnings, and precautions.

**Masimo U.S.**  
 Tel: 1 877 4 Masimo  
 info-america@masimo.com

**Masimo International**  
 Tel: +41 32 720 1111  
 info-international@masimo.com

