rainbow Acoustic Monitoring®

Noninvasive and continuous monitoring of acoustic respiration rate

RRa Acoustic Waveform

RRa Measurement

RRa®

> 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 visualisation 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 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 SpO_2 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.
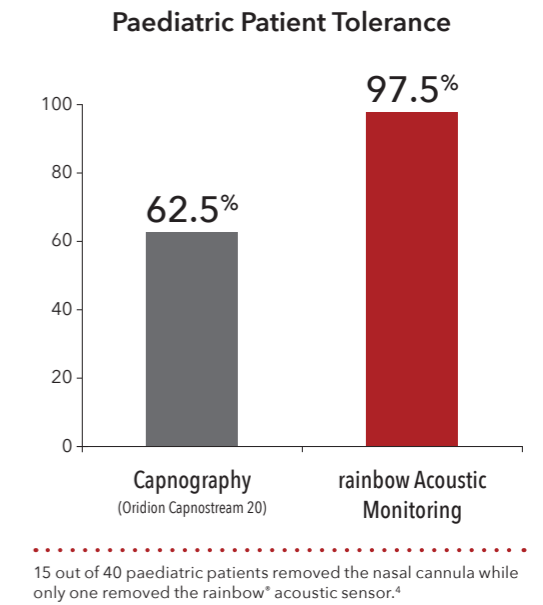
Masimo

The Need for Continuous Respiration Monitoring

Respiratory rate (RR) is one of the most sensitive markers of a patient's condition and a vital component of clinical assessment and monitoring. Doctors use a number of methods to assess RR.[1]

Neonatal intensive care unit (NICU) patients (neonates) need continuous monitoring of vital signs such as respiration rate without being caused discomfort or irritation.[2] Respiratory conditions are the most common reason for admission to a neonatal unit in both term and preterm infants.[3]

In a study of 40 paediatric patients (12 months to 18 years of age) undergoing post-anaesthesia 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 paediatric patients. Acoustic monitoring has the potential to increase the safety of paediatric patients by providing a reliable and accurate method for the continuous monitoring of respiration rate."[4]

Paediatric Patient Tolerance

	Capnography (Oridion Capnostream 20)	rainbow Acoustic Monitoring
	62.5%	97.5%

15 out of 40 paediatric patients removed the nasal cannula while only one removed the rainbow® acoustic sensor.[4]

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.

> Customisable 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/Paediatric 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 paediatric patients, including diaphoretic patients

> Also available in a short-term monitoring sensor option

RAS-125c

RAS Specifications

ACCURACY – (A_{RMS})[5]

RAS-125c/RAS-45
Breaths per Minute (bpm), Accuracy Range (Adult/Paediatric) . . . . 4–70 bpm[6]
Breaths per Minute (bpm), Accuracy Range (Infants/Neonates) . . . . 4–120 bpm[7]
Adults/Paediatrics/Infants/Neonates. . . . . .1 bpm

WEIGHT RANGE

RAS-45 (Adult/Paediatric) . . . . >10 kg, neck application
RAS-45 (Infant/Neonatal). . . . . <10 kg, chest application
RAS-125c (Adult/Paediatric) . . . . >10 kg, neck application
RAS-125c, Short-Term (Adult/Paediatric) . . . . >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[†]	Part Number
RAS-45 (Adult/Paediatric)	4171
RAS-45 (Infant/Neonatal).	4425
RAS-125c (Adult/Paediatric).	3475
RAS-125c, Short Term (Adult/Paediatric)	3483

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

[1] Keir et al. *J Clin Monit Comput*. (2015) 29:455 -460. DOI 10.1007/s10877-014-9621-3. [2] Abbas et al. *BioMedical Engineering OnLine*. 2011, 10:93. [3] Pramanik AK et al. *Pediatr Clin North Am*. 2015; 62: 453 -469. [4] Patino M et al. *Pediatric Anesthesia*. 2013, no. 12: 1166-1173. [5] A_{RMS} accuracy is a statistical calculation of the difference between device measurements and reference measurements. Approximately two-thirds of the device measurements fell within ± A_{RMS} of the reference measurements in a controlled study. [6] 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 paediatric subjects (>10kg). [7] 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.

For professional use. 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