

RESPIRATORY SNAPSHOT

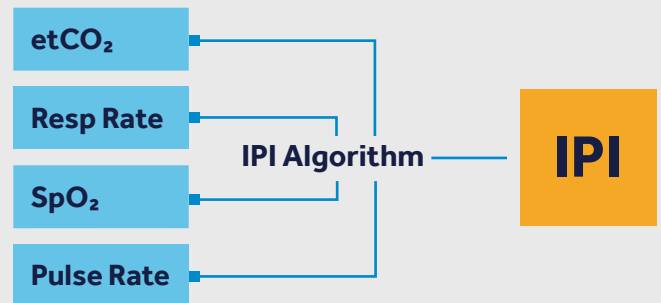


Integrated Pulmonary Index™ Algorithm

The Integrated Pulmonary Index™ (IPI) is an algorithm developed to help clinicians more easily monitor a patient's respiratory status. IPI incorporates four real-time respiratory measurements — end-tidal CO₂ (etCO₂), respiratory rate, pulse oximetry, and pulse rate — into a single number that represents an integrated respiratory status.

IPI is displayed on a scale from 1 to 10, with 10 indicating a normal respiratory status. To help clinicians monitor patients over time, IPI is displayed as a numeric and trend over time. The IPI trend screen provides an early indication of changes in the patient's respiratory status that may not be indicated by the current value of any of these four parameters individually.¹

Smart Capnography™ technology is a family of innovative algorithms designed to simplify the use of etCO₂ monitoring on Microstream™-enabled products.



Intended Benefits

- IPI makes it easier for clinicians to monitor and manage ventilation and oxygenation by providing an integrated snapshot of a patient's respiratory status.²
- The IPI trend screen provides an early indication of changes in respiratory status that may not be indicated by the current value of etCO₂, RR, SpO₂, and PR parameters individually.^{1,3,4}



Selectable History of IPI in Hours

End-tidal CO₂ (etCO₂)

Respiratory Rate (RR)

Pulse Oximetry (SpO₂)

Pulse Rate (PR)

IPI

Integrated Pulmonary Index™ Algorithm

Understanding the IPI Algorithm

The IPI algorithm incorporates four real-time respiratory parameters (etCO₂, respiratory rate, pulse rate and pulse oximetry) into a single number that represents an integrated respiratory status.

A group of medical professionals — including anesthesiologists, nurses, respiratory therapists, and physiologists — evaluated cases with varying parameter values and assigned a numeric value from one to ten to each patient case.³ A mathematical model of normal ranges was created based on their expertise.

IPI	Patient Status
10	Normal
8-9	Within normal range
7	Close to normal range; requires attention
5-6	Requires attention and may require intervention
3-4	Requires intervention
1-2	Requires immediate intervention

Clinical Validation of IPI

The IPI algorithm strongly correlated with the average numeric value provided by the medical evaluators on each case, with mean absolute differences = 0.64 ± 0.5 on the IPI 10-point scale. When compared with all patient-status value data collected from all cases, the average absolute difference between the values provided by the medical professionals and the model was 1 ± 0.35 on the IPI scale.¹

At the Hadassah Medical Center, Jerusalem, Israel, the IPI algorithm has been shown to correlate well with the respiratory status of 57 pediatric patients for procedures under deep sedation.¹

For all 30 postoperative patients enrolled in the study at Shaare Zedek Medical Center, Jerusalem, Israel, the IPI algorithm correlated with the respiratory status of adult patients after surgery under general anesthesia.²

The investigators from both sites concluded that the single numeric value of IPI can be particularly valuable for promoting early awareness to changes in a patient's respiratory status and in simplifying the monitoring of patients in busy clinical environments.

References

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2. Gozal Y, Gozal D. Reliability of the integrated pulmonary index postoperatively. *Society for Technology in Anesthesia (STA)*. January 2009; p. 8. *Eur J Anesthesiol*. 2009; 26 (suppl. 45).
3. Taft A, Ronen M, Epps C, Waugh J, Wales R. A novel integrated pulmonary index (IPI) quantifies heart rate, etCO₂, respiratory rate and SpO₂ (abstract). *Anesthesiology*. 2008;109:A1682.
4. Ronen M, Weissbrod R, Overdyk FJ, Ajizian S. Smart respiratory monitoring: clinical development and validation of the IPI™ (Integrated Pulmonary Index) algorithm. *J Clin Monit Comput*. March 2016. (Epub ahead of print).

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