

# OXYGEN THERAPY: A KEY TREATMENT REQUIRING CAREFUL REGULATION IN ROUTINE CLINICAL SITUATIONS

Oxygen therapy is the first-line respiratory assistance technique that is most commonly used on a daily basis. Millions of patients receive oxygen every day, either during periods of hospitalisation or at home. Although it is often considered to be a risk-free treatment, several publications have emphasised the need to carefully regulate the amount of oxygen administered in order to avoid complications associated not only with hypoxia but also with hyperoxia, which is receiving increasing levels of attention<sup>1</sup>. Clinicians generally have a positive preconception with respect to oxygen and are more concerned with correcting hypoxia than preventing the onset of hyperoxia. In routine clinical situations, the manual and sporadic adjustment of oxygen flow rates often results in higher than necessary levels of oxygen being administered, thus prolonging the duration of oxygen therapy.

## Oxygen therapy in patients with COPD: a knowledge transfer failure

Oxygen therapy is prescribed in a sub-optimal manner for patients hospitalised for an exacerbation<sup>2</sup> of COPD, yet it has been known for quite some time that excessive oxygen rates can be harmful. Numerous publications have demonstrated that hyperoxia can result in hypercapnia, which can be life-threatening for patients. Despite these recommendations, most patients experiencing an exacerbation of COPD still receive excessively high levels of oxygen<sup>3,4</sup>.

## Risks relating to oxygen toxicity also exist in relation to other pathologies and clinical contexts

The risks associated with hyperoxia also exist in relation to other pathologies, such as strokes and myocardial infarction<sup>5,6</sup>. In the case of myocardial infarction, oxygen therapy is administered as a matter of course, despite clinical data pointing to a potential increase in the size of the infarct owing to coronary vasoconstriction and an increase in oxidative stress. The AVOID study, recently published in the *Circulation* journal, demonstrated that during the acute phase of the infarction, oxygen should be administered only if patients present an SpO<sub>2</sub> lower than 94% and that it must be titrated to prevent hyperoxia. Overly liberal use of oxygen may result in a greater increase in cardiac enzymes and an increase in the size of the infarct<sup>7,8</sup>.

Moreover, numerous publications warn against oxygen toxicity in a pre-hospitalisation context, during operations and in intensive care. A recent study published in the *JAMA* showed that maintaining normoxia in patients receiving mechanical ventilation resulted in a significant reduction in mortality compared with even moderate hyperoxia<sup>9</sup>.

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5 Farquhar H, Weatherall M, Wijesinghe M, et al. Systematic review of studies of the effect of hyperoxia on coronary blood flow. *Am Heart J*. 2009;158(3):371-377.

6 McNulty PH, King N, Scott S, et al. Effects of supplemental oxygen administration on coronary blood flow in patients undergoing cardiac catheterization. *American journal of physiology. Heart and circulatory physiology*. 2005;288(3):H1057-1062.

7 Stub D, Smith K, Bernard S, Nehme Z, Stephenson M, Bray JE, Cameron P, Barger B, Ellims AH, Taylor AJ, Meredith IT, Kaye DM; AVOID Investigators. Air Versus Oxygen in ST-Segment-Elevation Myocardial Infarction. *Circulation*. 2015 Jun 16; 131(24):2143-50.

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9 Girardis M, Busani S, Damiani E, Donati A, Rinaldi L, Marudi A, Morelli A, Antonelli M, Singer M. Effect of Conservative vs Conventional Oxygen Therapy on Mortality Among Patients in an Intensive Care Unit: The Oxygen-ICU Randomized Clinical Trial. *JAMA*. 2016 Oct 18;316(15):1583-1589.



## CLINICAL STUDIES

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- Lellouche F, Lipes J, LHer E. Optimal oxygen titration in patients with chronic obstructive pulmonary disease: A role for automated oxygen delivery? *Can Respir J*. 2013 Jul-Aug;20(4):259-61. PubMed PMID: 23936881.
- Lellouche F, Bouchard PA, Roberge M, LHer E, Maltais F, Lacasse Y. Oxygen Titration And Weaning With FreeO<sub>2</sub> In COPD Patients Hospitalized For Exacerbation. A Randomized Controlled Pilot Study. *International Journal of COPD*. 2016 in press
- Lellouche F, Maltais F, Bouchard PA, Brouillard C, LHer E. FreeO<sub>2</sub>: closed-loop automatic titration of oxygen flow based on SpO<sub>2</sub>. Evaluation in COPD patients during endurance shuttle walking. *Respiratory Care*. 2016 in press.
- LHer E, Dias P, Gouillou M, Paleiron N, Archambault P, Bouchard PA, et al. Automatisation Of Oxygen Titration In Patients With Acute Respiratory Distress At The Emergency Department. A Multicentric International Randomized Controlled Study. *American journal of respiratory and critical care medicine*. 2015;191:A9329. Submitted for publication
- I. Vivodtzev, E. LHer, C. Yankoff, A. Grangier, G. Vottero, V. Mayer, D. Veale, F. Maltais, F. Lellouche, JL Pépin. Automatically adjusted oxygen flow rates to maintain stable oxygen saturations during exercise in O<sub>2</sub>-dependent and hypercapnic COPD patients ERS 2016 meeting: Best abstracts in exercise capacity and testing in chronic lung disease. September 4th 2016 from 14:45 to 16:45 in Room ICC Capital Suite 7.



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FreeO<sub>2</sub>

Optimised oxygen therapy at  
every stage of treatment



# FreeO<sub>2</sub>

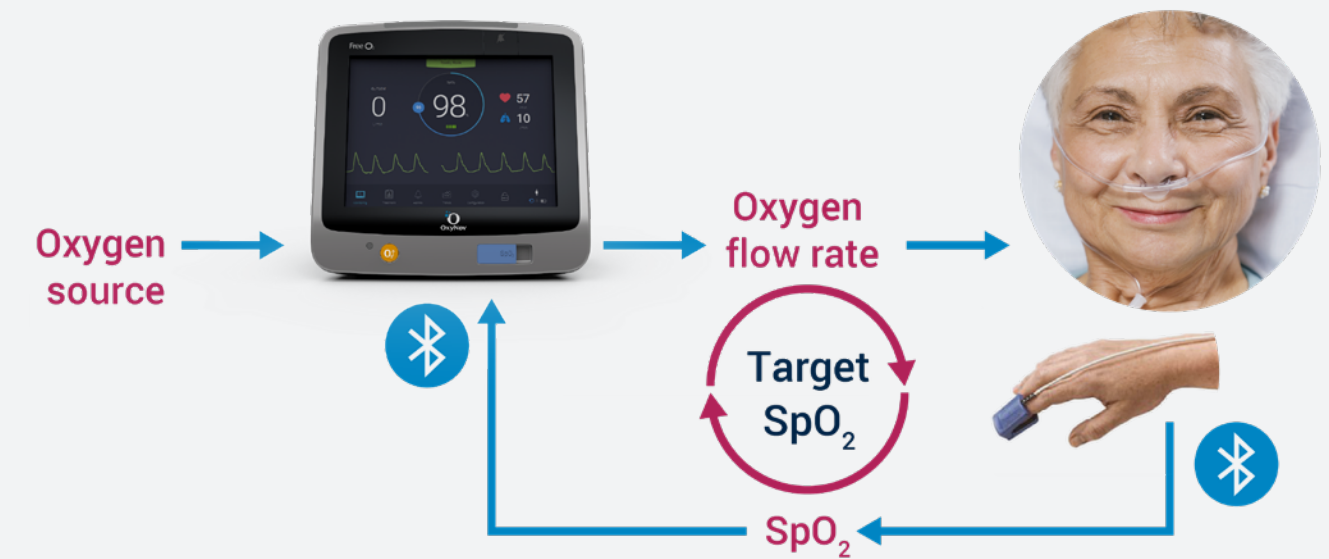
## A UNIQUE SOLUTION FOR AUTOMATED TITRATION AND WEANING

Regardless of the age of patients (newborn, child or adult) and their oxygen needs and response times, FreeO<sub>2</sub> automatically adjusts the oxygen flow rate required to maintain the target oxygenation set by the clinician, until the patient is fully weaned.

FreeO<sub>2</sub> operates on a closed loop and continuously adjusts the flow rate administered between 0 and 20 l/min (with or without humidification) based on blood oxygen saturation (SpO<sub>2</sub>).

Patients are therefore treated according to their needs, reducing the risks of complications relating to hypoxia and hyperoxia, and healthcare staff are able to implement all applicable clinical recommendations without difficulty.

Set your target SpO<sub>2</sub>, and FreeO<sub>2</sub> will automatically manage the oxygen flow rate titration and wean the patient.



## MEDICO-ECONOMIC BENEFITS AT EVERY STAGE OF TREATMENT

FreeO<sub>2</sub> has been devised and developed by clinicians mindful of the dangers of oxygen toxicity, who have witnessed the difficulties experienced by healthcare staff in correctly managing the numerous patients receiving oxygen therapy in routine clinical situations. FreeO<sub>2</sub> was subjected to a number of studies and clinical validation trials, involving more than 500 patients, prior to its industrialisation and market launch.

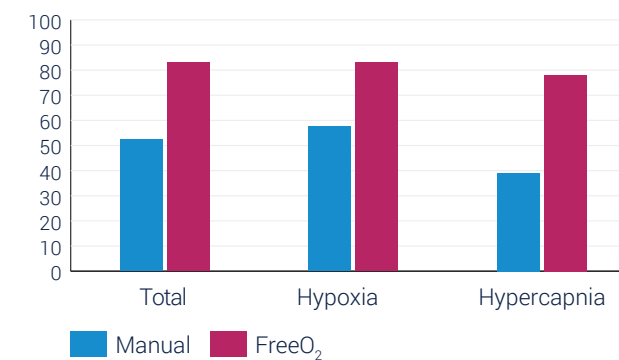
- Safer and more clinically effective oxygen therapy
- Far fewer complications relating to hypoxia and hyperoxia
- Significant reductions in the time spent in hospital and the costs of care

In the context of care for acute respiratory distress in emergency departments, FreeO<sub>2</sub> makes it possible to treat patients more effectively (assessed according to the time spent at the target SpO<sub>2</sub>), to limit complications relating to hypoxia and hyperoxia, to wean certain patients more quickly, and to avoid transferring patients to intensive care. Moreover, the study data points to a reduction in the workload of healthcare staff and greater compliance with clinical protocols.

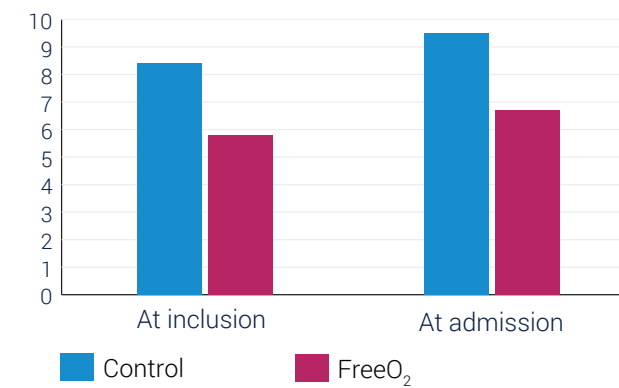
Tested in the context of care for patients hospitalised for an exacerbation of COPD so as to demonstrate the feasibility of automated titration and weaning, as well as remote monitoring from the nurses' station, FreeO<sub>2</sub> has made it possible to reduce the duration of hospital stays by around 30% (6.7 days compared with 9.5 days).

Assessed on COPD patients, in the context of walking endurance exercises, FreeO<sub>2</sub> results in more effective oxygenation and an effort endurance time significantly greater than that of the control group. Even when FreeO<sub>2</sub> delivered higher oxygen flow rates, no cases of hypercapnia occurred, as adjustments in relation to a target SpO<sub>2</sub> prevented the onset of hyperoxia.

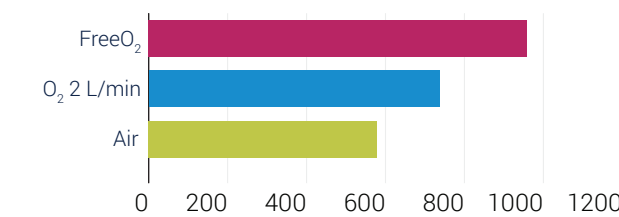
% of time spent at target SpO<sub>2</sub>



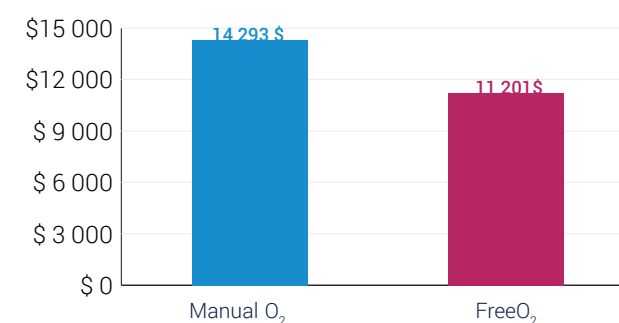
Duration of hospital stay (days)



Walking endurance (seconds)



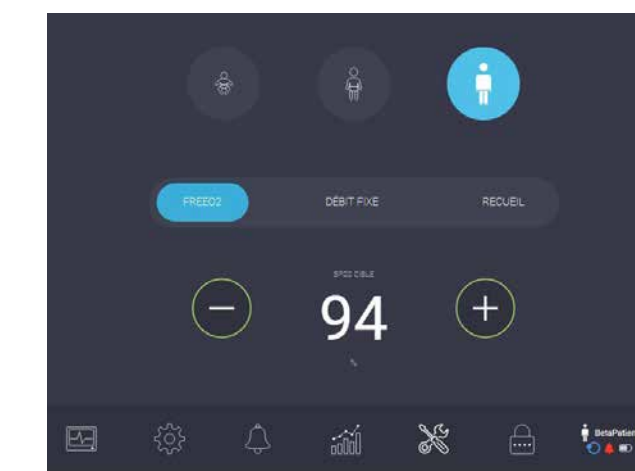
Cost per patient at 180 days (CAD)



## A VERSATILE, SIMPLE AND USER-FRIENDLY TOOL, INTENDED FOR ALL MEDICAL DEPARTMENTS IN HOSPITALS

FreeO<sub>2</sub> is suitable for all patients, from newborns to adults, breathing independently and requiring oxygen therapy. It offers a simple and user-friendly touch screen interface, enabling all healthcare staff to master the system with minimum delay. It takes just a few clicks to start, pause or resume treatment and to access all monitoring settings.

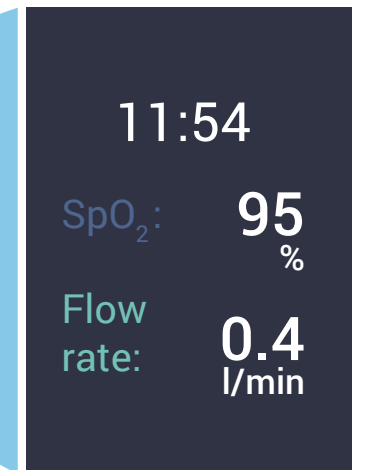
Oxygen therapy settings



Cardio-respiratory monitoring



Overview in graphical format



Continuous monitoring of oxygen therapy to ensure better oversight of patients' progress

FreeO<sub>2</sub> uses an oximeter worn continuously by the patient. The oximeter makes it possible to monitor and record conventional cardio-respiratory parameters and, following analysis of the plethysmographic signal, to extract other physiological parameters such as the respiratory rate. Continuous recording of these parameters, for which an overview can be shown in graphical format (up to 72 hours), offers access, at the patient's bedside, to essential information for decision-making, assessing a patient's progress and evaluating any necessary changes in the respiratory support provided.