

News and Perspectives

Could Autonomous Oxygen Titration Help Patients—And Busy Care Teams—Breathe Easier?

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Abstract

For patients struggling to breathe, getting the right amount of oxygen depends on timely adjustments—which can be challenging in busy hospital settings. In this *News and Perspectives* article, JMIR Correspondent Jenna Congdon reports on promising autonomous oxygen titration technology, which may help free up both patients' breathing and clinicians' time.

Key Takeaways:

- Autonomous oxygen titration may improve oxygenation control and limit time spent in hyperoxemia or hypoxemia.
- By continuously adjusting oxygen, autonomous systems may reduce the need for frequent manual adjustments and potentially ease clinician workload. They may also slightly decrease overall oxygen consumption, which helps to conserve supplies.
- Broader implementation will require further study. Automated titration could have applications beyond acute inpatient care, including home oxygen, medical transport, and resource-limited or austere settings.

Along busy hospital halls, it's a common scene: a patient admitted for pneumonia or heart failure or even a routine surgery starts to feel short of breath. Soon, they're hypoxemic—meaning their blood oxygen level is low, a condition which occurred in [54% of intensive care unit patients in one study](#) sample.

A nurse or respiratory therapist may place them on oxygen for support, a very common treatment for hospitalized patients, but it can't simply be left at a fixed setting. The amount of oxygen that patient needs varies throughout the day as their condition fluctuates—meaning, their nurse or respiratory therapist has to assess their respiratory status and manually adjust their oxygen flow many times per shift.

The care team does their best to keep oxygen within a normal range, continuously balancing too little or too much oxygen—but, as in many hospitals, the need can be high and resources can be limited, so sometimes there's a lag. For that busy team and the patient just trying to breathe easy, new autonomous oxygen titration may offer a solution.

The Challenge of Keeping Oxygen Levels in Target Range

When receiving supplemental oxygen, patients may become hypoxic or even hyperoxic (too much oxygen in the blood) between assessments, particularly if [poor staffing levels or environmental constraints](#) make repeated assessment challenging.

Both hypoxemia and hyperoxemia carry risks: hypoxemia [may begin with subtle or no symptoms](#), but often progresses to [symptoms](#) ranging from mild shortness of breath to

life-threatening changes in consciousness and circulation. Hypoxemia during an inpatient hospital stay, for example, may contribute to [higher rates of in-hospital mortality](#). Hyperoxemia can progress to hyperoxia, an overabundance of oxygen in the body tissues. This may [result in](#) lung damage, oxygen toxicity, or tissue damage and has also been linked to [an increase in hospital mortality](#).

Autonomous oxygen titration that can respond continuously and automatically to real-time changes in patient oxygen saturation may help to prevent hypoxemia and hyperoxemia and mitigate these risks. The [Strategy to Avoid Excessive Oxygen Using Autonomous Oxygen Titration Intervention \(SAVE-O₂ AI\)](#) trial suggests that it could.

Autonomous Titration Improved Oxygenation Control

David J Douin, MD, an associate professor at the University of Colorado Anschutz, led the recent SAVE-O₂ AI trial to evaluate the efficacy of the [O2matic PRO100 device](#) for automated oxygen titration. Douin explains that the O2matic system, [and others like it](#), uses "...a pulse oximeter, and you connect the pulse oximeter to a patient. It can connect to any oxygen input source, and it uses a closed-loop autonomous titration system to titrate oxygen to whatever SpO₂ [blood oxygen level] target has been set by the clinician."

The study enrolled 300 hospitalized adults across 4 US hospitals who were receiving low-flow supplemental oxygen (1-10 L/min) to test the Danish-made device. Participants were randomized to either closed-loop autonomous oxygen titration or standard manual titration. Each patient's skin tone was objectively measured to adjust for [differences in pulse](#)

[oximetry function for different skin tones](#). Patients requiring higher levels of respiratory support, such as high-flow nasal oxygen or ventilation, were excluded.

Findings showed improvement in oxygenation control: patients in the autonomous group spent 85% of their time within their target normoxemia—normal blood oxygenation—range, compared to only 63% among those receiving usual care, and automated control significantly reduced time spent in both hypoxemia and hyperoxemia. Further research will need to evaluate whether automated titration directly reduces mortality or long-term clinical complications.

Beyond O₂: Potential Value for Clinician Workflow and Resource Management

Continuous automated oxygen titration may offer more than improved oxygenation control for patients—it may help to ease clinician workflow and conserve supplies. “Our primary goal was to improve the amount of time patients spent in a normoxemia range,” Douin says, “...and a secondary goal was to reduce total consumption of oxygen, which we think of as a ubiquitous resource in high-resource settings like the US or Canada, but [it] is not in many situations.”

While frequent, hands-on assessment remains a practice standard for medical professionals, the ability to delegate repetitive and time-consuming oxygen adjustments to an automated device has the potential to free clinicians to focus on more complex patient care. While systematic feedback from staff wasn’t part of this trial, Douin notes, “We got anecdotal feedback, but it was generally positive... folks felt comfortable giving [automated oxygen titration] to their patients.”

Autonomous oxygen titration may be useful in a variety of settings, such as for home use in patients with conditions such as chronic obstructive pulmonary disease (COPD) or heart failure or those who may need oxygen overnight. “So many people only need oxygen for exertion or while sleeping,” Douin says, “and this titration can really conserve oxygen in that environment as well.” By closely maintaining only the amount of oxygen needed from moment to moment, [less oxygen gets used overall](#).

Safety, Accountability, and Implementation

While, promisingly, only 4 participants of the SAVE-O₂ AI trial reported mild adverse outcomes—such as nose bleeds or discomfort—widespread clinical integration of autonomous

oxygen titration requires addressing safety and technical limitations.

Closed-loop devices rely fully on pulse oximetry input, making accurate readings and oversight critical. Inaccurate sensor readings from poor perfusion (reduced blood flow to the areas where oxygen saturation is being measured due to a drop in blood pressure, for example), motion artifacts, or the pulse oximetry device simply coming loose can result in too much or too little oxygen being administered by the device.

Because autonomous titration still operates within clinician-prescribed parameters rather than making independent medical judgments, it raises a question about who holds ultimate responsibility when things go wrong. Apportioning the shared responsibility and establishing clear accountability are a must for future implementation and Food and Drug Administration (FDA) clearance.

From Improved In-Hospital Oxygen Management to Broader Clinical Implementation

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David J Douin, MD

The SAVE-O₂ AI trial highlights the potential benefits of autonomous oxygen titration in reducing both hypoxemia and hyperoxemia and conserving resources.

Douin says of the device, “...it could be repurposed in health care transport environments, for austere environments, for low- and middle-income countries where resources such as medical oxygen are scarce... I think that there’s a pretty broad potential there to not only benefit patients but also benefit the health care systems.”

If or when autonomous O₂ titration devices meet FDA clearance requirements and begin to be included in common health care practice, robust clinical workflow policies must support its implementation to smoothly integrate with existing best practices.

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