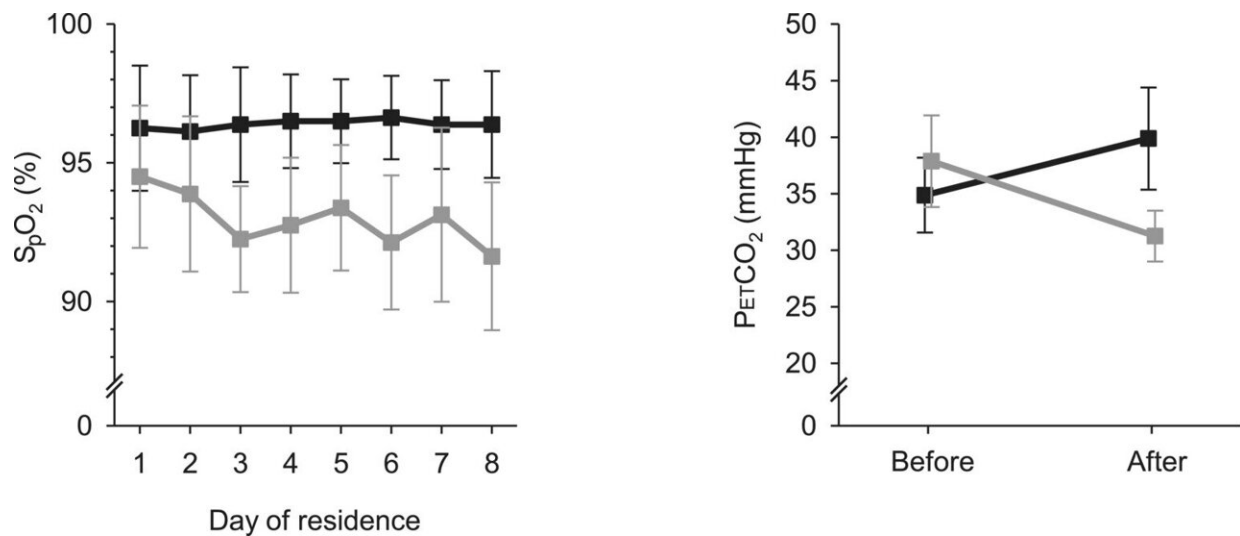


High altitude training shows promise for patients ahead of surgery

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Effect of residential exposure on oxygenation and end-tidal carbon dioxide. S_pO₂ and end-tidal partial pressure of carbon dioxide (P_{ET}CO₂) are shown. Black, normoxic week; gray, hypoxic week. Error bars indicate SD. Credit: *Anaesthesia* (2023). DOI: 10.1111/anae.16158

A randomized trial of eight volunteers spent a week exposed to reduced oxygen levels that simulated high altitude in a residential hypoxia facility, to see if breathing less oxygen could benefit their physical health.

The study was conducted by researchers from King's College London,

Royal Melbourne Hospital, Oxford University Hospitals NHS Foundation Trust, Beth Israel Deaconess Medical Center and the University of Limerick.

Many patients waiting to have major surgery have low levels of fitness, high BMI, sedentary lifestyles or anemia, which are associated with higher rates of complications and deaths after surgery. Anesthetists are currently trying to develop more effective means of improving patients' fitness before operations, known as prehabilitation, to reduce this possibility.

Altitude training is known to improve fitness and lead to higher blood levels (hemoglobin, which carries [oxygen](#) in the body) in athletes through exposure to reduced [oxygen levels](#) (hypoxia), which are similar to the conditions passengers experience during an airline flight. In athletes, a low-oxygen environment stimulates an increase in hemoglobin to carry more oxygen throughout the body, enabling them to perform better in low-altitude environments.

Researchers questioned whether exposure to simulated [high altitude](#) could benefit [older people](#) who face a risk of complications ahead of surgery, introducing the concept of "altitude prehabilitation." To test this, they recruited eight sedentary volunteers with an average age of 64 to spend two weeks living in the National Altitude Training Center in Ireland, a "hypoxic house" in which oxygen levels in the air are tightly controlled.

The article, "Potential for using simulated altitude as a means of prehabilitation: a physiology study," is [published](#) in *Anaesthesia*.

During one week, the house contained normal air, while during the other week the oxygen levels were mildly reduced (similar to conditions during an airline flight, equivalent to approximately 2,438 m or 8,000

ft). Volunteers underwent cardiopulmonary exercise tests before and after each week-long exposure.

The researchers found that simulated high altitude stimulated a large increase in hemoglobin in participants but led to no major changes in their aerobic fitness. This increase in hemoglobin could be clinically beneficial ahead of surgery.

In practice, small scale hypoxic canopies could be provided to patients to use while sleeping for the weeks leading up to their surgery. The use of hypoxic technology is also already widespread, as hypoxic rooms or tents are available at high-end gyms and in professional sports clubs, and similar hypoxic air systems are used to prevent fires on an industrial scale, such as in warehouses and library archives. In health care settings, hospitals could create small or large hypoxic spaces for patients ahead of surgery, as the technology is available.

"We know that athletes can use hypoxic canopies over their bed to simulate altitude exposure and that altitude can induce performance benefits after two to three weeks even in people who are extremely fit. We were interested in whether this approach could also benefit [older patients](#) ahead of [major surgery](#), who due to [sedentary lifestyles](#) and low levels of fitness, are more at risk of negative postoperative outcomes," said lead author Professor Thomas Smith, a consultant anesthetist and head of aerospace medicine research at King's.

"While this study suggests that simulated altitude exposure may have potential advantages for older and sedentary patients, further studies are needed to explore this for home-based altitude prehabilitation."

More information: L. A. Brown et al, Potential for using simulated altitude as a means of prehabilitation: a physiology study, *Anaesthesia* (2023). [DOI: 10.1111/anae.16158](https://doi.org/10.1111/anae.16158)

Provided by King's College London

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