

Low Flow Anesthesia: More Than 200 Anesthesiologists and CRNAs Weigh In On Benefits, Challenges, and Opportunities

New research reveals that more than 90% of anesthesiologists and CRNAs believe low flow anesthesia will become a standard of care. Here's how hospital leaders can prepare for broader adoption, today.



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Background

Low flow anesthesia—a technique in which anesthetic gas flow is reduced to the lowest level consistent with safe patient care—has significant environmental, cost savings, and other benefits. Still, the practice, which has been widely utilized in Europe for several decades, has not yet been broadly adopted in the United States. A new survey of more than 200 U.S.-based anesthesiologists and CRNAs, however, reveals that may be changing—and quickly.

The research finds that many practicing U.S. anesthesia providers see high value in low flow anesthesia, they believe their organization is likely to push for greater adoption, and they say that the practice is likely to become a standard of care in the coming years. So what's driving the renewed interest and engagement in low flow anesthesia, and how quickly is the momentum going to pick up?

This research report, based on the survey findings as well as interviews with several anesthesia providers, has answers. Here you'll find a closer look at the survey findings, including why interest in low flow anesthesia is growing among anesthesiologists and CRNAs and why many believe utilization is poised to increase. The report also examines the barriers that have hindered broader utilization, and the strategies hospitals and health systems can employ to help their anesthesia providers overcome these challenges.

Research Methodology

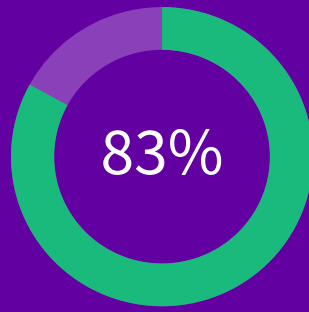
GE HealthCare commissioned healthcare consultancy Sage Growth Partners to research and develop this report. The double-blinded survey was conducted independently by Sage, which surveyed 215 anesthesiologists and CRNAs in February and March 2024. The research also included double-blinded qualitative interviews with hospital leaders and practicing anesthesiologists.

The survey participants represented a range of provider organizations, including anesthesia physician groups, academic medical centers, not-for-profit community hospitals, integrated delivery networks, and others.

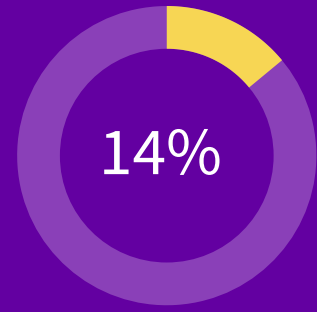
Key Findings:



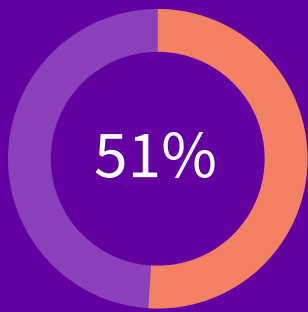
More than 90% of anesthesiologists and CRNAs believe low flow anesthesia is likely to become the “standard of care” within the next decade.



83% say broader adoption of low flow anesthesia would reduce anesthesia costs, and **74%** say it would support environmental sustainability efforts.



Still, only 14% say low flow anesthesia is currently administered in more than **90%** of cases within their organization.



More than half (51%) say their organization is working to increase adoption of low flow anesthesia, and an additional **18%** say their organization may consider doing so in the near future.*

Fewer than 10% of survey respondents say their organization has implemented technology that helps automate the administration of low flow anesthesia. Among respondents who say their organization has not implemented automation technology, 81% say it would help support broader utilization.**

Respondents whose organizations have implemented automation technology for low flow anesthesia say it:

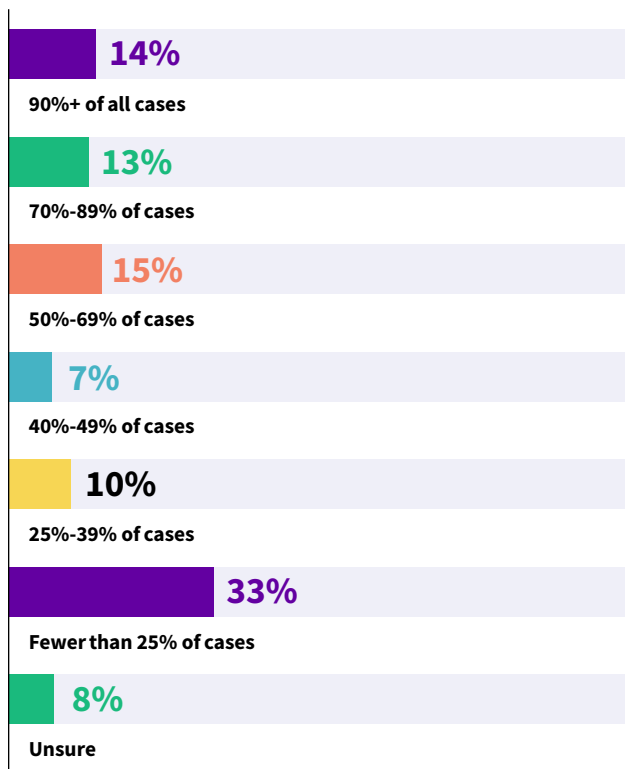
- ✓ Reduces the cognitive burden on providers
- ✓ Improves their ability to focus on patient monitoring rather than agent administration
- ✓ Reduces costs associated with anesthetic gases***

*n=170 | **n=197 | ***n=18

Low Flow: The Current State

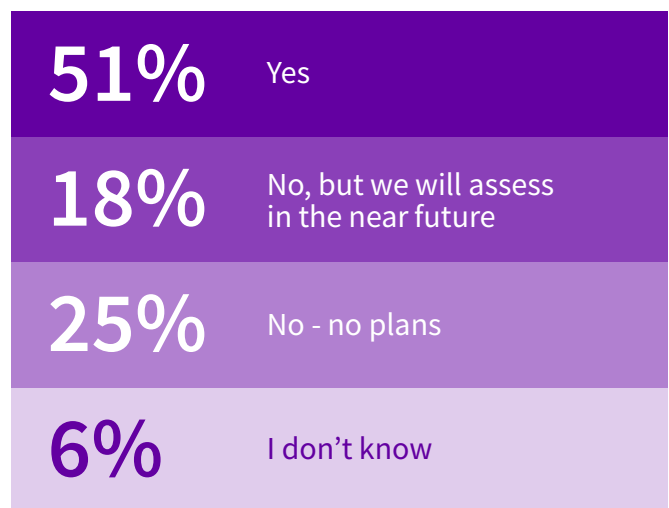
While low flow anesthesia has been around for decades, the survey shows that many U.S. anesthesiologists and CRNAs are not yet widely utilizing it. Within the survey, low flow anesthesia was defined as reducing gas flow to the lowest level consistent with equipment capabilities and safe and effective patient care (often resulting in mean fresh gas flow rates below 1 liter per minute). Based on this definition, only 14% of respondents say low flow anesthesia is administered in more than 90% of all cases within their organization. One out of every two respondents say low flow is administered in fewer than 50% of cases.

What percentage of your hospital's typical cases (excluding special circumstances) utilize low flow anesthesia?



Still, the survey findings indicate low flow utilization may increase over the next few years. Among survey respondents who indicate their organization is using low flow in fewer than 90% of all cases, more than half (51%) say their organization is working to increase adoption of low flow and an additional 18% say they their organization may consider initiatives to encourage broader adoption in the near future.

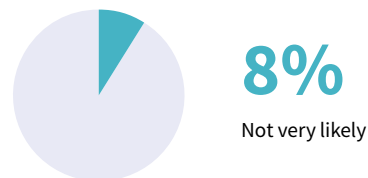
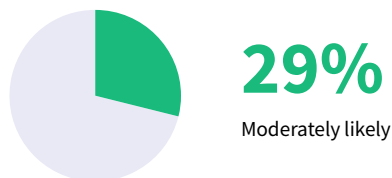
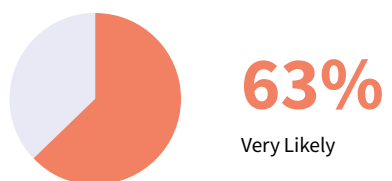
Is your organization working to increase adoption of low flow anesthesia? (asked to the 170 survey respondents who indicated low flow is used in less than 90% of cases)



“There’s an emerging concern around the environmental consequences of using [anesthetic gases],” says one anesthesiologist interviewed for this report who currently serves as the chief of anesthesiology at a regional medical center. “This has led—in the last few years—to more renewed interest in low flow anesthesia”[1].

Among survey respondents who say their organization is working to increase adoption of low flow anesthesia, most also stated that their organization is setting high goals related to system-wide low flow utilization rates. Fifty four percent say their organization hopes to reach the threshold of using low flow in 60% or more of all cases, and within that group, 33% say the goal is to use low flow in 90% or more of all cases.* Ultimately, this research shows that more than nine out of every ten anesthesia providers believe low flow is likely to become the “standard of care” within the next decade.

How likely is it that low flow anesthesia will be the “standard of care” 10 years from now?



*n=161

Low Flow: Benefits

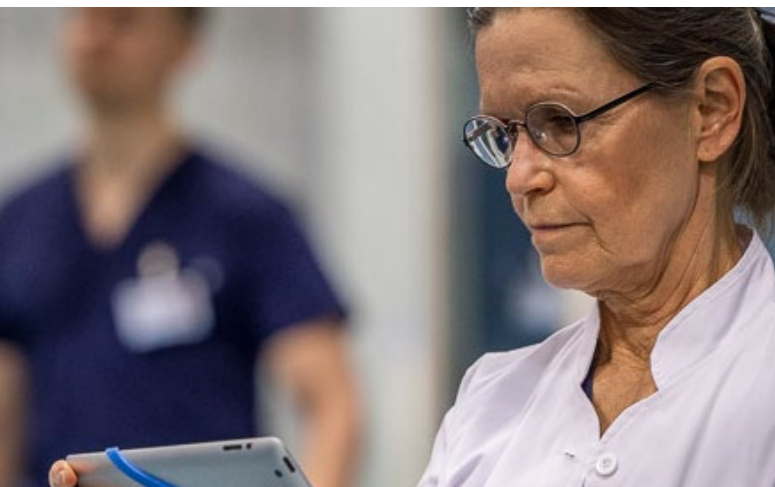
As noted, nearly 70% of survey respondents say their organization is either already working to increase adoption of low flow anesthesia or may consider doing so in the next few years. The research indicates a key driver of this momentum is increasing awareness among anesthesiology providers regarding the value of low flow anesthesia, both from an environmental and cost-savings impact.

On the cost-savings front, 83% of respondents say broader adoption of low flow anesthesia would reduce anesthesia costs at their organization.

“As we shift to looking at ways to make healthcare affordable, I think you will see a lot of traction in terms of [identifying] low-hanging fruit. Low flow anesthesia is very low-hanging fruit,” says a managing partner at an anesthesiology group and a practicing anesthesiologist at a not-for-profit hospital who was interviewed for this report. **“If health systems are really looking at ways to make themselves economically viable, low flow anesthesia makes a lot of sense”** [2].

Hospital Leaders Also See High Value in Low Flow Anesthesia

As understanding grows related to the cost-savings impact of low flow anesthesia among clinicians, a recent but separate survey of 100 hospital and health system C-suite leaders found a similar trajectory among these individuals. That survey found that 68% of C-suite leaders believe widespread adoption of low flow would reduce anesthesia costs at their organization [3].

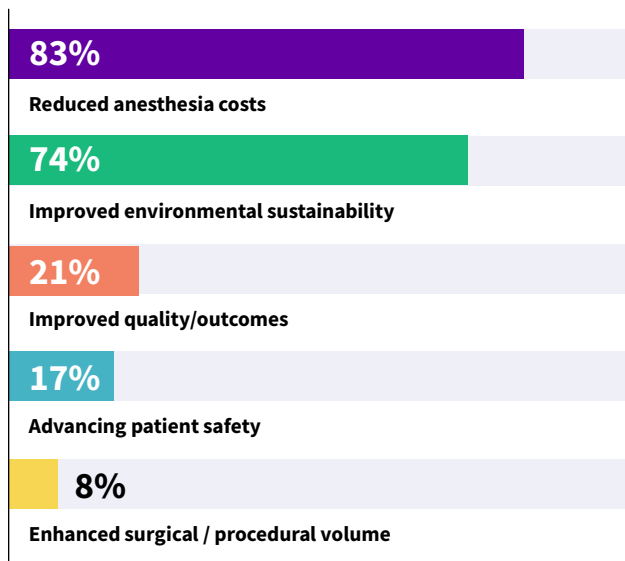


Results from organizations that have implemented low flow anesthesia, in fact, demonstrate significant cost reductions: [One evidence-based](#) project using simulated fresh gas flows of 1 liter per minute predicted a 48% reduction in the costs of anesthetics [4].

On the environmental front, 74% of anesthesia providers say low flow anesthesia would support sustainability initiatives. About the same percentage (76%) say achieving widespread adoption of low flow anesthesia would have a significant impact on their organization’s sustainability goals. Further, 50% say their organization is either already exploring how low flow anesthesia can advance their sustainability goals or may be launching such an initiative over the next 1-2 years.*

“What has really swung the pendulum [toward broader low flow adoption] is the sustainability piece,” says an academic anesthesiologist/ICU physician at a large academic medical center who was interviewed for this report. “The current generation is thinking a lot more than my generation did about what [anesthetic gases] mean to our overall global well-being” [5].

Which of the following benefits do you think more adoption of low flow anesthesia would provide your organization?

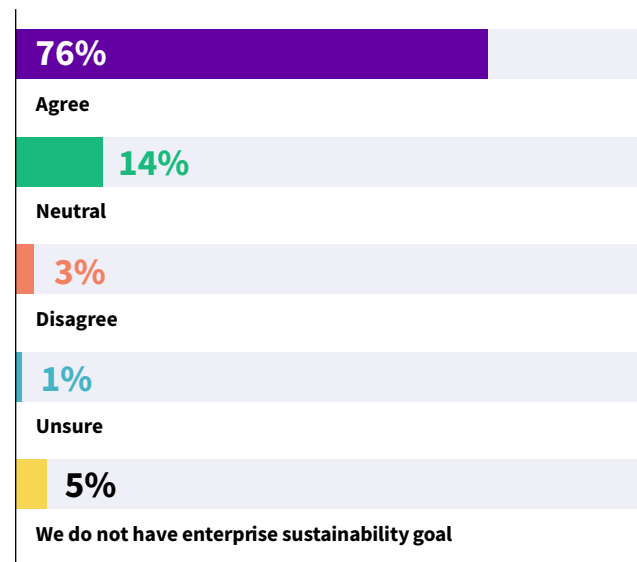


*n=213

Low flow anesthesia greatly reduces the amount of anesthetic agents (and therefore greenhouse gases) released into the atmosphere.

Research shows that operating rooms generate three to six times as much carbon as the rest of health systems [6], and anesthetic gases alone contribute 51% of direct emissions for any general surgical procedure [7].

How much do you agree that achieving widespread adoption of low flow anesthesia techniques can have a significant impact on your enterprise sustainability goals?



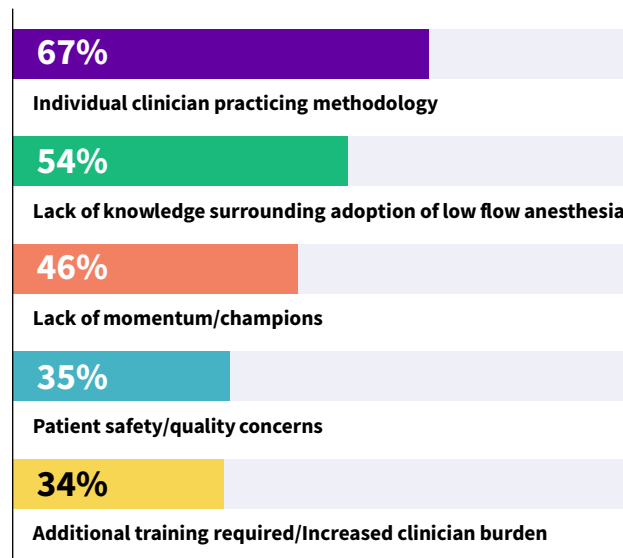
Low Flow: Encouraging Broader Adoption

Though most anesthesia providers surveyed for this report agree that low flow utilization is poised to increase, they also acknowledged that some key barriers could hinder momentum. These barriers include individual clinician preferences related to anesthesia administration, lack of knowledge among clinicians about low flow anesthesia, patient safety/quality concerns, and administration/training challenges.

In order to encourage wider adoption of low flow anesthesia, hospital and health system C-suite and perioperative leaders should implement strategies to help their anesthesia providers overcome these barriers, says Louise Keogh Weed, a hospital change management expert and principal of KW Facilitation who was interviewed for this report [8].

“With momentum increasing for low flow anesthesia, now is the time for C-suite and other executives to develop change management strategies that empower clinicians and anesthesia providers with adequate time and resources to expand low flow utilization. Without effective change management, leaders risk contributing to burnout, rather than building resilience,” notes Keogh Weed, who previously served as the faculty director of the “Advancing Leadership Strategies for Evolving Healthcare Executives” program in the Harvard T.H Chan School of Public Health Executive and Continuing Education Department and the faculty co-Director of “Managing Yourself and Leading Others in Healthcare” course at the Harvard Extension School Center for Professional Development.

Which of the following are the most significant barriers that slow the adoption of low flow anesthesia?



Addressing individual practicing methodology

Since broader utilization of low flow anesthesia will require many anesthesia providers to adopt a slightly different method of administration, hospital and clinical leaders should prepare for some trepidation and questions.

Only about 14% of anesthesia providers surveyed say their organization has tied quality or financial performance metrics to low flow anesthesia utilization. As more hospitals and health systems work to encourage broader adoption, that may increase. “I think within the next three to five years, leadership in our institution may [add performance metrics related to low flow utilization],” says one anesthesiologist who practices at an academic medical center. “More people are aware of it, more people are pushing for it” [9].

“Some of the people that have been practicing for many years that don’t really use low flow as much, they probably will be more hesitant, or it may just be a matter of habit that they don’t use it,” says one anesthesiologist interviewed for this piece, who practices at an academic medical center. “Without an incentive, without carrot-and-stick kinds of things, then it makes people less compliant” [10].

Hospital and clinical leaders should emphasize that low flow anesthesia is a priority for the organization, and they may want to consider tying financial incentives or quality metrics to it. Many organizations that are leading the charge toward low flow anesthesia may already be doing so.

In fact, one of the anesthesiologists interviewed for this report—whose organization has already achieved high low flow utilization rates—credits the performance metrics tied to low flow utilization as playing a key role in driving utilization at his organization. “We’re well into the mid 90s in terms of our departmental compliance with or adherence to low-flow anesthesia” [11].

Addressing lack of knowledge surrounding adoption of low flow anesthesia and lack of champions

C-suite and perioperative leaders should also implement multiple educational initiatives to ensure anesthesia providers understand the “why” behind efforts to increase utilization of low flow anesthesia. Keogh Weed notes that this is absolutely critical, adding that if the value and urgency is not clearly understood, engagement is likely to fall.

“One of our biggest challenges in change management is that everything we do in healthcare is important,” she says. “Everything impacts patient care. We want every aspect of the healthcare system to improve. And so it’s really hard to actually create space and we need that sense of urgency, we need that clarity of focus to be successful” [12].

“We have had several programs to provide the information to people to say, ‘Hey, these are the benefits,’ says one anesthesiologist whose academic medical center is working to encourage broader adoption of low flow anesthesia. “Not every single anesthesiologist is doing it, but in our teaching, we do encourage the use of low flow” [13].

The survey reveals, indeed, that more education related to the environmental benefits of low flow anesthesia—and the associated urgency in making incremental changes—may be helpful. Nearly three-quarters (72%) of survey participants answered incorrectly when asked: inhaled anesthetics account for what percentage of a hospital’s perioperative greenhouse gas footprint? According to the American Society of Anesthesiologists, the correct answer is 50% [14].

“A lot of people underestimate the amount of environmental impact that happens within the perioperative environment in general,” says one of the anesthesiologists interviewed for this report. “Inhalational gases are terrible for the ozone layer and they’re vented out into the atmosphere at the end of the day” [15].

Prior to starting a low flow anesthesia initiative, C-suite and perioperative leaders should ensure they have internal champions on board—at all levels—who are passionate about the value of low flow anesthesia, understand the need for it within the organization, and are well-respected among their peers.

“Within healthcare, we often talk about the need for internal champions when launching new initiatives, but we seldom actually make identifying them, coaching them, and spreading awareness through them—throughout an initial change process and beyond—a continual priority,” says Keogh Weed. “To increase the likelihood of success, the internal champions should span multiple roles, including anesthesiologists, CRNAs, other members of the surgical team, and various hospital leaders. Then, on an ongoing basis, this interdisciplinary team should meet to discuss the initiative, provide input on the process and goals, and discuss progress, challenges, and opportunities” [16].

Addressing patient safety and clinician impact concern

Concerns related to patient safety and quality, as well as clinician training and clinician burden, are other critical barriers that hospital and clinical leaders should address. While there is a clear solution for overcoming these barriers, it's first important to address what's driving these concerns among clinicians.

Administering low flow anesthesia—as it has traditionally been practiced—is more complex than administering higher fresh gas flows. When utilizing low flow anesthesia, clinicians must continuously adjust gas flows to ensure the correct mix of agent and oxygen is delivered. This creates additional strains on clinicians and, in some instances, may raise patient safety concerns.

The good news: Low flow automation technology can help address these barriers. A technology approved by the FDA in April 2022, but used in Europe for more than 10 years, is known as End-tidal Control* (Et Control). Anesthesia providers can use it to set targets for oxygen and anesthetic gases, and the software maintains those throughout surgery, as guided by the anesthesia professional to meet the needs of the patient. This greatly reduces the need for manual adjustments [17].

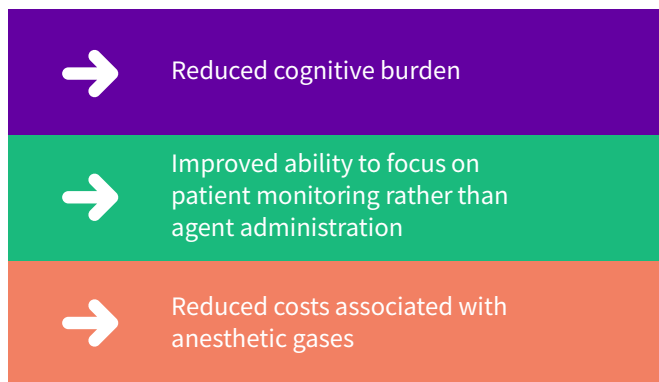
* Et Control is indicated for patients 18 years of age or older in the United States.

“It’s a patient safety tool. For us, that’s the biggest reason to put it on all of our machines and make it a standard. It makes giving care to patients safer,” says David Hovord, MB BChir, clinical assistant professor and a lead for U-M’s Green Anesthesia Initiative. “With this software, we just make one input at the start, and it does what it does and then we can focus entirely on getting the patient ready for the surgery to start” [18].



Currently, only 8% of the anesthesia providers surveyed say they have implemented automation technology, but those who have cite significant benefits—including benefits for patients, providers, and the health system as a whole.

These include:



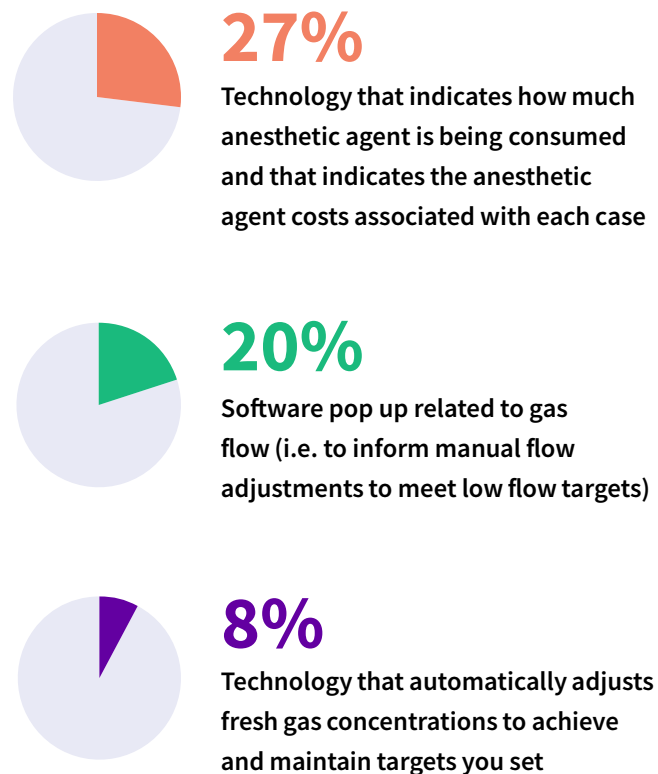
Among respondents who don't yet use automation technology for low flow anesthesia, 81% say the technology would help increase adoption rates.*

*n = 197

End-tidal Control earned FDA approval through a U.S.-based, multi-center, multi-year clinical trial that included over 200 patients. Over 80% of users said End-tidal Control is easier to use than manual fresh gas control, and that it required fewer adjustments to obtain the desired result. The trial also found that 98% of the time when using this feature, end tidal anesthetic concentration was within acceptable limits, compared to about 46% when not using End-tidal Control [19].

Beyond automation technologies, C-suite leaders and perioperative leaders should consider if there are other technologies that could support their clinicians in broader utilization of low flow anesthesia. Overall, the survey found that such technologies are extremely underutilized in the U.S. Only 27% of organizations use technology that indicates how much anesthetic agent is being consumed and the costs associated with each case, only 20% use software pop ups related to gas flow to inform manual adjustments to meet low flow targets, and fewer than 10% use automation technology. In total, more than half of respondents say their organization does not use any of these tools.

Does your organization use any of the following to encourage adoption of low flow anesthesia?



Conclusion

While low flow is not a new concept, this survey reveals that utilization is likely to ramp up in the U.S. over the coming years due to a variety of factors. Hospital and clinical leaders seeking to advance adoption of low flow anesthesia can help further drive adoption by:

- ➔ **Implementing effective change management strategies associated with the transition to low flow**
- ➔ **Focusing on the positive impacts of low flow and reassuring anesthesia providers that it can be administered safely**
- ➔ **Supporting anesthesia providers with technology that automates the administration of low flow anesthesia and reduces the clinician burden associated with low flow utilization**

Ultimately, this research shows that low flow utilization is poised to ramp up at hospitals and health systems across the country over the next few years—and with that increase in utilization, will come wide-ranging benefits. As one of the anesthesiologists interviewed for this piece stated, “Low flow anesthesia is one of those things where there’s very little downside” [20].

Still, increasing utilization will require prioritization by hospital and clinical leadership and a commitment to broaden awareness of the benefits among anesthesia providers.

“I need to win the hearts and minds of my clinicians if I want to drive a major change in practice,” says an anesthesiology leader who is working to increase utilization of low flow anesthesia at his organization. “Recognizing this, I very much work that way... I put out lots of educational materials. Believe me, all of my clinicians know that the right thing to do is low flow” [21].

Et Control is approved in the US via P210018 by US FDA.

The Case for Low Flow Automation Technology

Designed to complement the expertise of anesthesia providers in managing complex cases in the operating room, End-tidal Control software allows anesthesia providers to set targets for end-tidal oxygen and anesthetic agents. End-tidal Control automatically adjusts fresh gas concentrations to quickly achieve and maintain those targets, regardless of changes in the patient’s hemodynamic and metabolic status

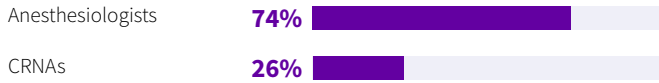
[Learn more about End-tidal Control.](#)



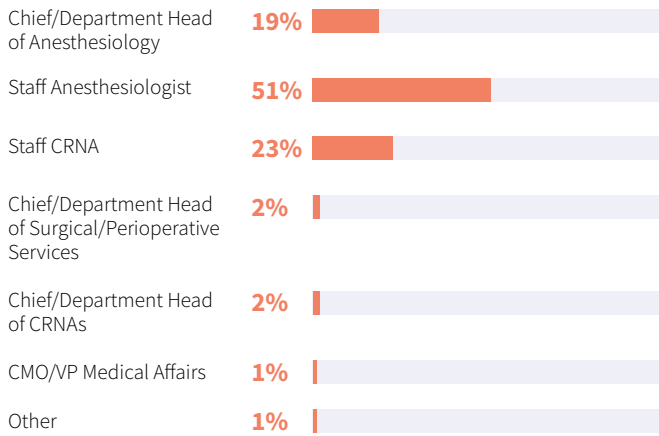
Research Demographics

All survey respondents were recruited independently by Sage Growth Partners and all research was double blinded.

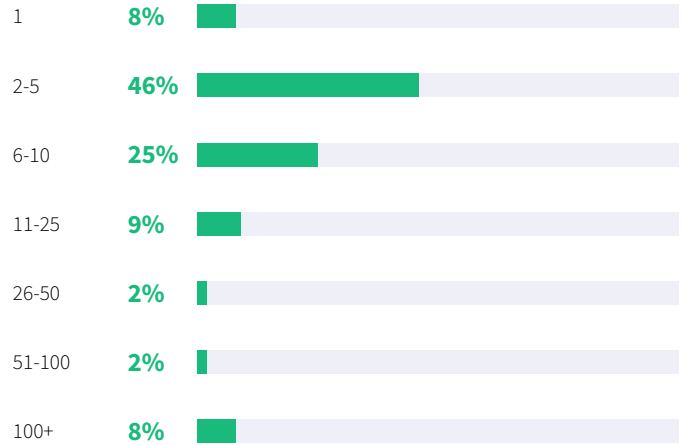
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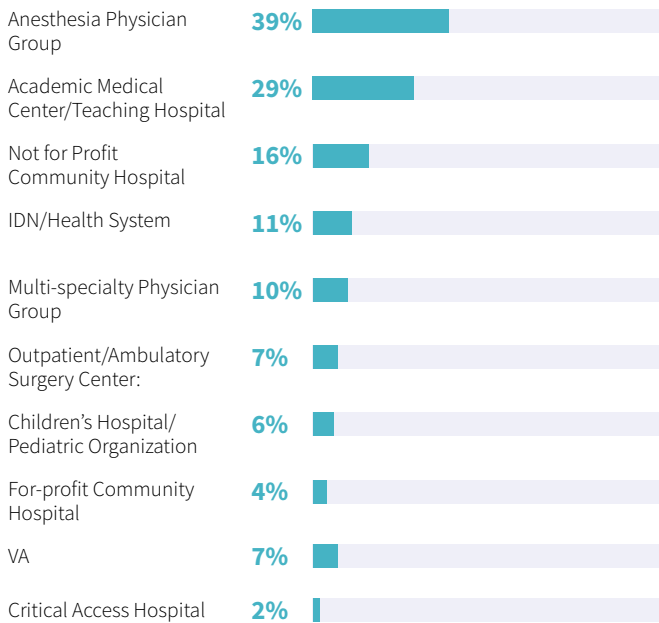
Title



Number of acute-care hospitals within organization



Organization type



Note: Some percentages included in this report may not add up to 100% due to rounding.

Sources

[1] Double blinded research interview conducted in February, 2024

[2] Double blinded research interview conducted in February, 2024

[3] Double blinded survey conducted independently by Sage Growth Partners in February and March 2024. 100 C-suite leaders participated in the survey.

[4] Evidence-based project: cost savings and reduction in environmental release with low flow anesthesia, AANA Journal, American Association of Nurse Anesthesiology

[5] Double blinded research interview conducted in February, 2024

[6] Operating rooms are the climate change contributor no one is talking about, American Association for the Advancement of Science <https://www.eurekalert.org/news-releases/951971>

[7] The impact of surgery on global climate: a carbon footprinting study of operating theaters in three health systems, The Lancet Planetary Health [https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(17\)30162-6/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(17)30162-6/fulltext)

[8] Research interview conducted in April 2024

[9] Double blinded research interview conducted in February, 2024

[10] Double blinded research interview conducted in February, 2024

[11] Double blinded research interview conducted in February, 2024

[12] Double blinded research interview conducted in February, 2024

[13] Double blinded research interview conducted in February 2024

[14] Reduce Carbon Footprint from Inhaled Anesthesia with New Guidance Published <https://www.asahq.org/about-asa/newsroom/news-releases/2022/06/reduce-carbon-footprint-from-inhaled-anesthesia-with-new-guidance-published>

[15] Double blinded research interview conducted in February, 2024

[16] Research interview conducted in April 2024

[17] Automation in anesthesia: first-ever technology for U.S. providers, GE HealthCare <https://clinicalview.gehealthcare.com/webinar/automation-anesthesia-first-ever-technology-us-providers>

[18] Green Anesthesia: New Software Reduces Surgery's Carbon Footprint By Up to 44% <https://www.gehealthcare.com/insights/article/green-anesthesia-new-software-reduces-surgery's-carbon-footprint-by-up-to-44>

[19] Refer to GE HealthCare Et Control Pivotal Study Report DOC2163005. When used as indicated, Et Control is as clinically safe as manual fresh gas control: <https://www.gehealthcare.com/-/jssmedia/gehc/us/images/products/anesthesia-delivery/aisys-cs2/redesign/whitepaper-etcontrol-arc-anesthesia-jb22327xx.pdf?rev=1&hash=8BC4481E4D2F46747C2418D8AE7707F9>

[20] Double blinded research interview conducted in February, 2024

[21] Double blinded research interview conducted in February, 2024

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