

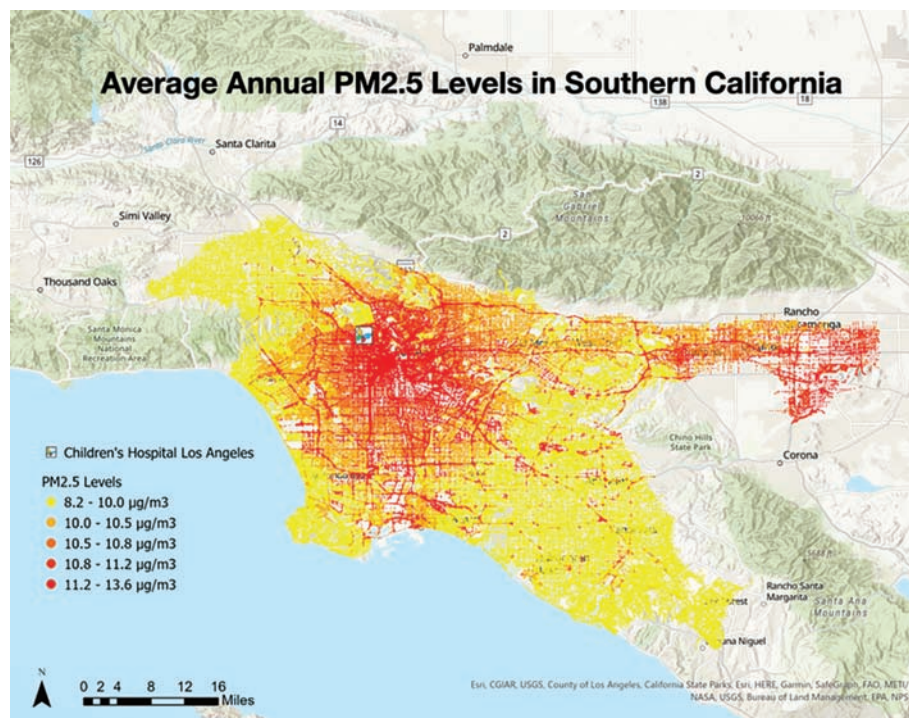
Advancing Research in Air Quality, Climate-Related Health Effects, and Patient Safety

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The increasing recognition of climate-related health effects and adverse environmental exposures underscores the urgency of addressing their impact on public health (*Environ Health Perspect* 2017;125:094501). Factors such as air quality, extreme temperature fluctuations, and wildfires are taking a toll on individuals and communities by elevating respiratory problems, worsening chronic illnesses, and increasing the use of health care resources (*Int J Environ Res Public Health* 2023;20:1937; *Int J Environ Res Public Health* 2022;19:1241). These negative consequences disproportionately affect vulnerable populations, including children, the elderly, individuals with disabilities, minorities, and those with lower incomes (*Annu Rev Public Health* 2021;42:293-315). Consequently, the issue of climate-related health effects becomes intertwined with health equity concerns. As health care professionals and researchers grapple with studying and mitigating the escalating health impacts of climate change and environmental hazards, it is crucial for anesthesiologists to consider how climate and adverse environmental conditions, particularly poor air quality, might affect perioperative patient safety.

Patient safety, air quality, and adverse environmental exposures

Anesthesiologists have long been at the forefront of patient safety, implementing systematic interventions to ensure the well-being of patients during the perioperative journey (*BMJ* 2000;320:785-8). Anesthesiologists' leadership in patient safety reflects their ability to adapt to evolving circumstances, lead diverse teams, embrace innovative technologies, and expand their expertise beyond the OR. Now, the time has come for anesthesiologists to push the boundaries of advancing patient safety once again through exploring the potential risks of air quality, environmental exposures, and climate-related health effects in the perioperative setting. Given previous research indicating the association between poor air quality and asthma development and exacerbation, it raises the question: could poor air quality also pose a risk for perioperative respiratory adverse events? While the answer may be yes, further research is needed.



Example of average annual particulate matter levels in the Los Angeles region using hyperlocal spatial data, in collaboration with industry partners in FAER-funded research.

Anesthesiology is only beginning to delve into the role of environmental exposures, especially poor air quality, in the perioperative context. Notably, the rising frequency and intensity of wildfires have created a unique opportunity to investigate the effects of extremely poor air quality on the respiratory system (*Int J Environ Res Public Health* 2023;20:1937; *Int J Environ Res Public Health* 2022;19:1241). For instance, a recent retrospective study found that pediatric patients with preexisting respiratory risk factors were more likely to experience respiratory adverse events during general anesthesia amid the same time of a wildfire (*Anesthesiology* 2022;137:543-54). However, the potential risks of poor air quality in non-wildfire conditions remain largely unexplored, even though ambient air quality can significantly vary based on patients' geographic locations and proximity to sources of pollution, such as highways, industrial zones, and areas with limited air circulation. Conducting epidemiological studies on air quality exposure, encompassing factors like variation, intensity, and duration of exposure, is essential to better comprehend the potential impact of poor air quality on perioperative respiratory adverse events.

Research funding and support to investigate the patient safety risks associated with

environmental exposures, air quality, and climate effects is pivotal for advancing the field of anesthesiology and perioperative medicine. The Foundation for Anesthesia Education and Research (FAER) and the Anesthesia Patient Safety Foundation (APSF) have taken the initiative to recognize environmental exposures and patient safety as a critical area for development. Through collaborative funding in the form of the cosponsored APSF-FAER Mentored Research Training Grant, FAER and APSF have funded a prospective study focused on understanding the influence of air quality on pediatric perioperative respiratory adverse events during elective surgery. Their support has enabled us to use innovative spatial data science methodology and hyperlocal air quality data to understand the ambient air quality exposure of healthy children undergoing general anesthesia at Children's Hospital Los Angeles. Preliminary findings have revealed significant variations in air quality exposure among children, with the top quartile experiencing three to four times more exposure to poor air quality measures than the bottom quartile. Utilizing a multidisciplinary approach encompassing patient safety research methods, environmental exposure science, and spatial data science, this variation in air quality exposure presents a



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natural opportunity to investigate its association with perioperative respiratory adverse events in children.

Innovative partnerships are essential for future research

Delivering high-quality, effective, equitable, and safe perioperative care goes beyond the confines of the OR and hospital walls. It extends into the broader context of understanding the intersection of social and environmental determinants that affect patients and their communities (*JAMA* 2022;327:2385; *Ann Glob Health* 2015;81:445-58). Recognizing the impact of climate-related health effects and adverse environmental exposures, particularly poor air quality, necessitates a multifaceted approach that breaks down traditional disciplinary boundaries and unites diverse fields of expertise. To achieve this, innovative research and multidisciplinary partnerships of anesthesiologists, environmental science experts, spatial data scientists, patient safety specialists, community leaders, nonprofit organizations, industry stakeholders, and government bodies will be essential. Moreover, the financial and strategic support of organizations such as FAER, APSF, and societies within our specialty will be crucial in enabling the exploration of the environment's impact on patients and patient safety in an ever-changing world. As we confront the challenges posed by a changing climate and the environment on health, anesthesiologists have a unique opportunity to lead the way in advancing research in air quality, climate-related health effects, and patient safety. ■

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