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ENVIRONMENTAL SUSTAINABILITY IN ANESTHESIA PRACTICE

INTRODUCTION

- Climate change is defined as the world's greatest global health challenge of the 21st century . International organizations such as the Intergovernmental Panel on Climate Change call for fundamental and transformative change at every level of our personal and professional lives .
- According to the new United Nations (New York, New York) Intergovernmental Panel on Climate Change report, published on August 9, 2021, the scientific consensus is that there is still time to act, but immediate action is required and "demands strong and sustained reduction in carbon dioxide and other greenhouse gases."

INTRODUCTION

- A series of studies over the past half decade have revealed that the global environmental footprint of health care is significant; its contribution to total global greenhouse gas emissions (in carbon dioxide equivalents) is nearly 5%.
- These studies make it clear that clinicians and health care professionals have a vital role to play in tackling climate change, deemed by the World Health Organization (Geneva, Switzerland) as “the greatest threat to global health in the 21st century.”

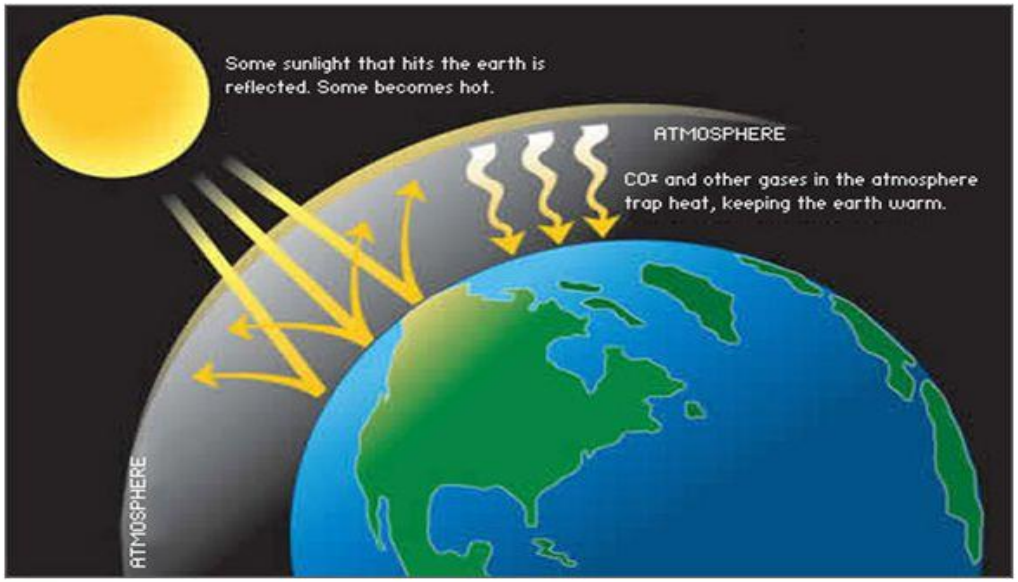
GREENHOUSE EFFECT

- The greenhouse effect is the trapping of heat from the Sun in the Earth's atmosphere. This has the effect of warming the Earth and making our planet hospitable to life. Without a greenhouse effect, the Earth would be very cold, about -18°C rather than our current average of 15°C. If life on Earth exists because there is a greenhouse effect, what is all the fuss about?
- About three-quarters of the greenhouse effect is due to water vapour in the form of clouds and moisture in the air, with carbon dioxide being the next most important gas. Over the past 200 years, additional carbon dioxide gas has been pumped into the atmosphere due to burning of fossil fuels and deforestation.
- Today, the concentration of carbon dioxide is approximately 28% greater than in the pre-industrial 18th century. Similarly, the other greenhouse gases have also increased because of human activities.

GREENHOUSE EFFECT

Talking about your Education

The Greenhouse Effect



Science

ENVIRONMENTAL SUSTAINABILITY

- Health care pollution itself harms public health and can indirectly increase the cost of health care by increasing the demand for services.
- Global warming affects human life and health in many ways: the essential elements of healthy living – drinking water, nutritious food, clean air are under threat.
- The healthcare sector significantly contributes to the climate crisis, accounting for over 4% of global CO2 emissions .
- Furthermore,healthcare practices lead to smog formation, acidification, the release of carcinogenic and non-carcinogenic air toxins, and waste production.

ENVIRONMENTAL SUSTAINABILITY

- As a highly technical, resource-intensive discipline, anesthesia practice accounts for a significant portion of healthcare's CO2 emissions .
- Additionally, 30% of daily medical waste is produced in operating rooms; anesthesia practice is responsible for approximately 25% of it, of which 40% is potentially recyclable.

ENVIRONMENTAL SUSTAINABILITY

- Although interest in environmental sustainability in anesthesia practice is growing, implementing sustainable practices still needs to overcome many barriers. This is a cause for concern,which invites us to reflect on how to systematically raise awareness and implement environmental sustainability in everyday work practice.
- The health implications associated with climate change are increasingly widespread. Climate change could undermine the progress made in global health for decades.
- Considering that healthcare professionals are leaders having an opportunity to influence changes at the local- and global levels,it is crucial to better understand their opinions and needs concerning the topic.

VOLATILE ANESTHETICS

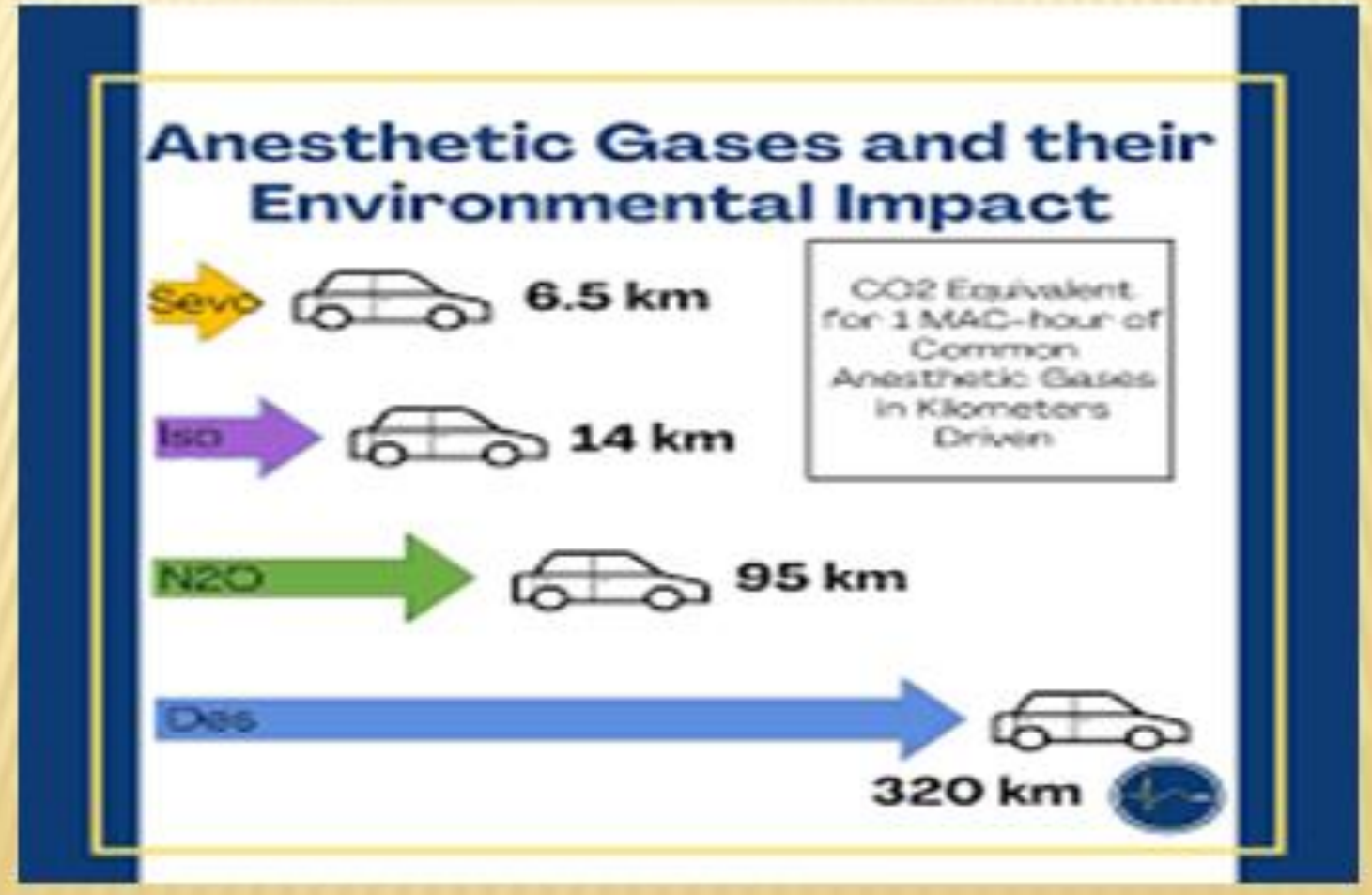
- With growing calls to address the significant role of anesthesia practice in exacerbating climate change, volatile anesthetics have received increased attention, primarily due to their potent greenhouse gas properties.
- These volatile anesthetics undergo minimal in vivo metabolism and are released into the troposphere with minimal changes, accounting for over 95% of their emissions .
- In particular, sevoflurane and desflurane persist in the troposphere for approximately 1.1 and 14 years, respectively. Inhaled anesthetics can account for 50% of perioperative emissions and 5% of hospital emissions .

SEVOFLURANE-AN HOUR'S OF THIS GAS WILL HAVE THE WARMING EFFECT OF 800–1,600G CO2, THE EQUIVALENT OF DRIVING 5–10KM.

USING 500ML OF NITROUS OXIDE EVERY MINUTE FOR A PROCEDURE LASTING AN HOUR WILL WARM THE ATMOSPHERE BY AN EQUIVALENT OF 16KG CO2. THAT IS THE SAME AS DRIVING A SMALL CAR 106KM. NITROUS OXIDE IS OFTEN USED IN LARGE VOLUMES AND REMAINS IN THE ATMOSPHERE FOR 110 YEARS, DURING WHICH IT CONTINUES TO HAVE A WARMING EFFECT.

REDUCING USE OF NITROUS OXIDE WOULD LEAD TO ONE OF THE MOST SIGNIFICANT REDUCTIONS IN ANAESTHESIA RELATED CO2E.

ENVIROMENTAL IMPACT OF ANESTHESIA



VOLATILE ANESTHETICS -RECOMMENDATIONS

- Reducing waste by decreasing excess fresh gas flows is one of the simplest ways to reduce pollution and facility costs, without affecting care quality.
- Recommendations include the utilization of low fresh gas flows, the avoidance of high-impact inhaled anesthetics (desflurane, nitrous oxide), the consideration of intravenous and regional techniques, and the investment in waste anesthetic gases trapping or destroying technology.
- But they are just one environmental consideration within the complex system of products and services that make up anesthesia practice.

PLASTIC DISPOSABLES

- Anesthesia and perioperative care, particularly in high-income nations, have become increasingly reliant on single-use plastic disposables from face masks through breathing circuits to IV giving sets.
- In the United States, it is estimated that operating rooms contribute approximately 30% of the 5 million tons of waste generated by hospitals annually. A quarter of the solid waste associated with surgery is likely to be of anesthesia origin, with plastics forming almost half of the total anesthetic waste volume.Plastic products have been massively used since the 1950s and are now recognized widely to be a major environmental burden.
- In the COVID-19 pandemic period, there was a huge production, consumption, and disposal of single-use plastics and high demand for plastic personal protective equipment (perceived as more “hygienic” than reusable alternatives) are likely to worsen the plastic pollution problem.

PLASTIC DISPOSABLES

- It is now time to seriously consider perioperative greening strategies that can help reduce the operating room plastic footprint and support a circular economy in which materials recirculate through closed loops of reuse, recycle, reprocess, and repurposing that maximize the product life cycle.
- The accumulation of plastic wastes during the pandemic also calls for research into new sterilization techniques and new methods for reprocessing personal protective equipment, such as pyrolyzing and gasification techniques that convert plastics into liquid or gaseous fuel, respectively.
- All physicians have an ethical obligation to provide care along the continuum of patient and planet health.

ENVIRONMENTAL SUSTAINABILITY IN ANAESTHESIA

- In recent years, numerous anesthesiology societies have published recommendations on how anesthesiologists can contribute to a reduction of the CO2 footprint .
- The World Federation of Societies of Anesthesiologists has outlined core principles to guide anesthesia providers in the transition to environmentally sustainable practice, including **choosing medications and equipment; minimizing waste and overuse of resources; and addressing environmental sustainability in education, research, quality improvement, and leadership activities .**

ENVIRONMENTAL SUSTAINABILITY IN ANAESTHESIA-SURVEY

- In the issue British Journal of Anaesthesia, 125 (5): 680e692 (2020), McGain et al. provide a detailed comparison of the carbon footprint of general, regional, and combined anesthesia for total knee replacement in Australia, using a small cohort of 10 patients per group.
- Aiming for a complete picture, they collected input data on anesthetic consumables, gases and drugs, and electricity for patient warming and the anesthesia machine. (In the general anesthesia group, sevoflurane or propofol was used, but no desflurane or nitrous oxide.)

SURVEY

- The investigators then conducted a Life Cycle Assessment to convert all of these input data into estimates of carbon footprint, with the hypothesis that spinal anesthesia would have the lowest impacts.
- Within each group, there were large variations in results stemming from case-by-case differences in how anesthesia was administered.
- Examining the relative contributions of each input reveals some important trade-offs and offers lessons for our own practices.
- First considering the anesthetic agents, sevoflurane was an important contributor but did not dominate results.

SURVEY

- For **general anesthesia**, sevoflurane contributed an average of 4.7 kg carbon dioxide equivalents (range, 2.7 to 8.6 kg carbon dioxide equivalents) or 35% of the total carbon footprint. (It should be noted that the contribution of inhalational gases would certainly have been higher if desflurane or nitrous oxide were used in the included cases.)
- Patients receiving **total intravenous anesthesia** were at the low end of the range of general anesthesia results. In the combined group, the contribution of sevoflurane was only 19% on average.
- The **spinal group** of course had zero contribution from inhaled anesthetics, but this relative carbon savings was more than offset (on average) by a large increase in emissions from washing and sterilization of surgical items (4.5 kg carbon dioxide equivalents) and the production of oxygen (2.8 kg carbon dioxide equivalents) for high-flow nasal cannula during locoregional anesthesia.

SURVEY

- Other considerations were more consistent across groups.
- Single-use items have received much attention and contributed a substantial 25% of the total carbon footprint, with slightly higher results for the combined group.
- Perhaps surprisingly, the next largest contributor was electricity for the patient warmer at approximately 20%, while pharmaceuticals were nearly 10% of the total across groups.

SURVEY

- What does this mean for clinical practice?
- Because of the large variations in results for each of the groups, the investigators were able to note practices that led to lower impacts. Some were specific to the anesthetic technique applied, such as using low-flow anesthesia or total intravenous anesthesia in general anesthesia or reducing oxygen flows when possible for spinal anesthesia.
- Other recommendations cut across all techniques, such as reducing single-use plastics or improving energy efficiency of patient warmers.
- The shift from single-use to reusable items has been a focus of multiple studies with results showing environmental and economic benefits in nearly every case.
- **Taking multiple actions to reduce emissions was found to be more beneficial than simply shifting to a different anesthetic technique**

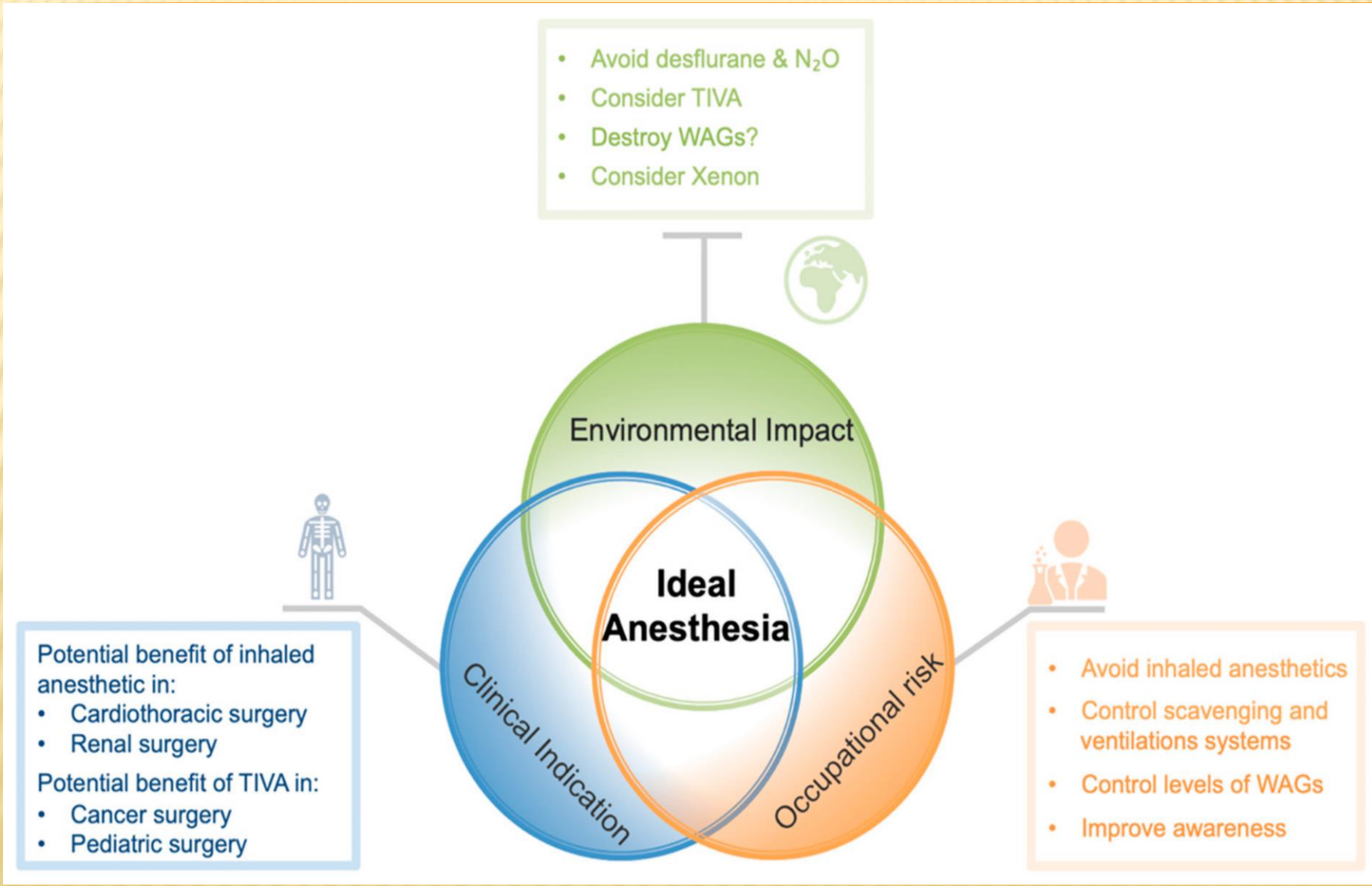
SURVEY

- Although the study expanded the boundaries of what is typically included in a clinical care Life Cycle Assessment, it is impossible to consider every possible input and permutation.
- Of particular note is the exclusion of heating, ventilation, and air conditioning systems and lighting systems, which are often a target of healthcare sustainability programs.
- Another important area is waste generation. Surgical and anesthesia procedures using mostly single-use items produce a significant amount of “medical trash,”
- The analysis from McGain et al. assumed that nonpharmaceutical waste is either recycled or landfilled, with little consequence for the results. If instead this waste were incinerated (and its carbon liberated), then its contribution to emissions would be much higher.

SURVEY-CONCLUSIONS

- The study by McGain et al. is a small, single-center, prospective, nonrandomized, observational, unblinded study with various limitations that make comparison between anesthetic groups and between countries uncertain. The authors included only 10 patients per group (“convenience sample”), and the study is clearly underpowered to compare the footprint of various anesthetic techniques.
- As such, this study doesn’t offer a definitive answer about which anesthetic method is the most detrimental to the climate, and it should not be misquoted to favor or reject the use of a specific anesthetic technique.
- What this study does offer is an interesting example of how clinical or cohort studies can be used for sustainability analysis (even with low numbers of included patients). As such, it shows a next step in a progression of research that has been slowly revealing different aspects of sustainability in clinical care.

IDEAL ANESTHESIA



CONCLUSION

- Anesthesia providers can implement sustainable changes without negatively influencing their perspective on the issue.

- In addition, sustainable initiatives have the potential to serve as a motivator and increase their consciousness of this global problem.

CONCLUSION

- Nevertheless, there is a need for personal and institutional education about sustainability, which would help to overcome existing barriers to achieving environmental goals.
- Patient safety always comes first - even though patient-related factors may not always allow the most environmentally friendly anesthesia choice to be made, greener anesthetics should only be used when clinically safe.
- One thing is evident by definition - global goals can only be achieved by working together.

CONCLUSION

There is no human health without planetary health.

Thank you