

# Environmental sustainability in ophthalmology

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The old stereotype of ophthalmologists assessing patients' vision in a dimly lit room through the application of algebraical equations and multiple lenses is out. Today, ophthalmologists have two primary skills: consultation and surgery. The practice of consultation (diagnosis) has undergone a radical change due to the advent of technology, resulting in more complete and less invasive examinations. Among these advancements, optical coherence tomography (OCT) (a transversal scan of the retina) serves as an ancillary tool that allows the early detection and better follow-up of a significant portion of ophthalmological diseases.

With regard to surgery (treatment), ophthalmologists focus on two key procedures: cataract surgery and the intravitreal injection of anti-vascular endothelial growth factor (VEGF) to combat exudative age-related macular degeneration and various other retinal vascular diseases.

As a result, in less than 20 years, it has become possible to improve visual acuity or prevent blindness, particularly in developed countries (1).

The goal is now to make this sustainable. Overall, healthcare emissions have accounted for between 4% and 5% (2,3) of all greenhouse gas emissions, surging up to 10% in the United States during the COVID crisis (4). Notably, in the UK, ophthalmology stands out as the highest volume specialty, constituting about 8% of hospital outpatient visits nationwide in 2018 (3). There were 47.5 million consultations in France in 2022 (5), so each day's ophthalmology practice plays a role in contributing to pollution.

Despite the crucial role of environmental sustainability, it seems that not all those involved in scientific publication, including readers, publishers, and editors, have shown an interest in the topic. Only 16 studies related to eye care and environmental sustainability have been published in the past 12 years (from 2009 and 2021) (3). It is also true that estimating the carbon costs for ophthalmological care is not as straightforward as it might seem. To provide some perspective, in a published manuscript, it was mentioned that an ophthalmological surgery in the UK produced greenhouse gas emissions equivalent to driving a passenger car for

500 km (3), whereas the output from an Indian healthcare setting was equivalent to driving the same car just 23 km (3).

So, the first step will be to establish a consensus and standardize the methodology for estimating carbon costs. If we consider that in France, approximately one million cataract surgeries were reimbursed in 2002, and about one-and-a-half million intravitreal injections (5), the gap between 500 km and 23 km for each procedure becomes all the more substantial.

## Disposable waste

The primary concern regarding waste lies in the unquantified (and irrational) risks associated with transmitting infection when using single-use disposable items at every step of day surgery or consultation. To gain a better understanding of the steps involved, we have to distinguish between material associated with surgery and the surgery itself.

Regarding the first category (pajamas, drapes, etc.) a potential solution could be to streamline their usage. Unfortunately, the COVID crisis has intensified the fear of contamination and led to the use of disposable materials.

Environmental sustainability in the context of cataract surgery poses a real challenge. Concern for the carbon footprint can clash with ethical considerations. In developed countries, a "custom pack" containing disposable instruments (weighing approximately 6 kg) is opened before each procedure, and at the conclusion of surgery, the custom pack, including the unused instruments, becomes waste.

However, there are several reasons why the solution for more sustainable surgery is not re-sterilization. Firstly, the costs in terms of energy, water pollution, transportation, and packaging, etc. are significant.

Furthermore, ophthalmological instruments are delicate and require frequent replacement. Sterilizable instruments are more than ten times more expensive. Organization—with more than 15 daily procedures per surgeon, there is a high risk of instrument loss.

There may also be some concerns regarding prospective studies validating more environmentally friendly procedures that involve fewer infection barriers. This might be perceived as conflicting with the primary Hippocratic principle of "first, do no harm."

I believe the solution lies in sustainability education, which should be implemented to achieve a significant reduction in greenhouse gas emissions.

Firstly, surgeons should consider introducing sustainability education into the curriculum and begin gathering information about the production sources (country and transportation) of instruments and medical devices. Secondly, nurses

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should provide information about the potential and unnecessary infection risks and advocate for turning off the lights in the operating theater when not needed. Thirdly, cleaning staff should be encouraged to sensitize individuals to proper waste disposal practices. Fourth, patients should be informed about the new procedures, potentially through patient associations acting as intermediaries.

A multidisciplinary medical approach is also necessary. The role of infectious disease specialists involves reclassifying cataract surgery as a “clean” procedure, given that there is no blood involved (as evidenced by the condition of surgical gloves after cataract extraction). This reclassification could lead to less need for some specific equipment, such as surgical gowns. It is also necessary to identify more vulnerable patients, a task for geriatric specialists or diabetologists.

Aesthetic aspects must also be taken into account, such as the speed and safety of the patient experience and minimizing waste. The toxicity of drugs and anesthetic gases is significant and requires careful and costly disposal.

Ophthalmology conferences represent another indirect yet important cost. In 2019, the “Congrès de la Société Française D’ophtalmologie” (France) was dedicated to “development durable” (Environmental sustainability) and including various topics, including contact lenses, refractive surgery, operating theaters, and glaucoma surgery. In 2023 the “Retina in Progress Meeting” was held, with the theme “Making Sustainability Mandatory.” The organization calculated that the conference generated 31 tons of CO<sub>2</sub> equivalent emissions, which were offset by the preservation of 50,000 m<sup>2</sup> of Amazon Forest.

Economics plays a crucial role in sustainability. The key principle is that sustainable practices must cost less than nonsustainable ones. All stakeholders need to play their role: supranational and national governments should implement tax regulations; pharmaceutical manufacturers and local hospitals alike must also participate. Mandatory certification may also be a viable option. Artificial intelligence may be able to offer new ways to reduce carbon footprint costs someday.

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