EcovaMed

Life Cycle Assessment

February 2026

Healthcare pathway carbon footprint: Key Findings and perspectives on Refractive Surgeries

Hôpital National des 15-20, France's leading public hospital dedicated to ophthalmology and vision disorders, has conducted an in-depth assessment of the carbon footprint of refractive eye surgery. This study, carried out in collaboration with Ecovamed and in line with the GHG Protocol, aims to better understand the environmental impact of refractive surgery and to identify concrete opportunities for environmental improvement.

Scope and approach

The assessment evaluates the cradle-to-grave carbon footprint of refractive surgery, meaning that all stages of the care pathway are considered: extraction of raw materials, manufacturing of medical devices, pharmaceuticals and equipment, energy and water use at the hospital, patient and staff transport, and end-of-life treatment of consumables and devices. The study focuses on one full day of refractive surgery at the Centre Laser Vision of Hôpital National des 15-20, with three widely used refractive surgery techniques being assessed:

- PKR (Photorefractive Keratectomy),
- SMILE (Small Incision Lenticule Extraction),
- LASIK (Laser-Assisted In Situ Keratomileusis).

Overall carbon footprint of a day of surgery

The total carbon footprint of one day of refractive surgery, for 8 patients, is estimated at 502 $kgCO_2eq$, with a relatively low uncertainty thanks to high-quality primary data. The main contributors are:

- Medical devices (31%), mainly due to the production and disposal of single-use consumables,
- Laser equipment (38%), including femtosecond and excimer lasers and their maintenance,
- Patient transport (10%),
- Followed by building-related impacts, energy use, and prescribed drugs.

These results highlight that the environmental impact of refractive surgery is driven primarily by equipment and consumables, rather than by direct energy or water consumption.

Comparison of refractive surgery techniques

When comparing the three surgical techniques, significant differences emerge:

- PKR: 46 ± 8 $kgCO_2eq$ per surgery
- SMILE: 65 ± 11 $kgCO_2eq$ per surgery
- LASIK: 72 ± 12 $kgCO_2eq$ per surgery

PKR has a 30–37% lower carbon footprint compared to SMILE and LASIK. This difference is mainly explained by the use of fewer single-use medical devices, and the use of only one laser (excimer), whereas LASIK requires both femtosecond and excimer lasers.

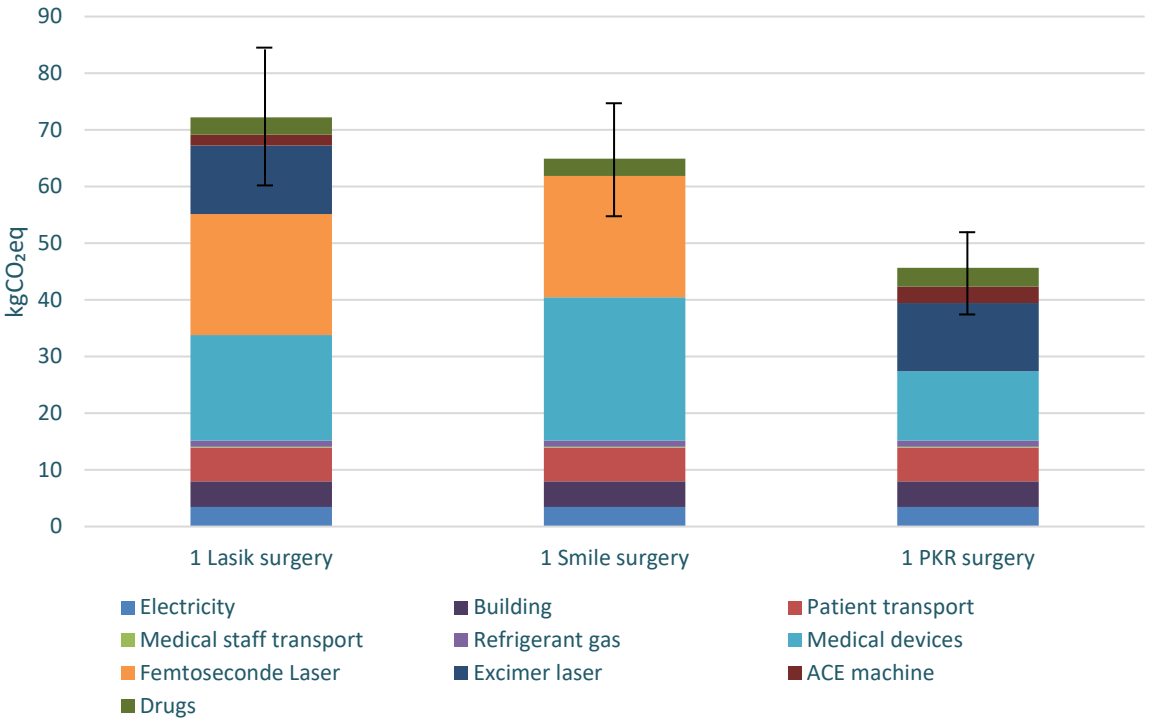

Figure 1 : carbon footprint comparison of different refractive surgeries (carbon footprint in $kgCO_2eq$/surgery).

Despite overlapping uncertainty ranges, the study confirms that PKR remains consistently less carbon-intensive due to shared emission sources across all techniques.

Putting results into perspective

To help interpret these figures, the study compares refractive surgery with common vision correction alternatives. The carbon footprint of one pair of glasses is estimated at approximately 10 $kgCO_2eq$. A LASIK surgery is therefore equivalent to about 7 pairs of glasses, SMILE to 6 pairs, and PKR to 5 pairs. For young patients who would otherwise replace glasses every two years, the environmental impact of surgery may be offset within 8 to 16 years.

The comparison is even more striking with daily disposable contact lenses, which have a much higher cumulative footprint over time. From a carbon perspective, considering one pair of lenses per day, refractive surgery can become environmentally advantageous after only 1 to 2 years of lens use, depending on the technique.

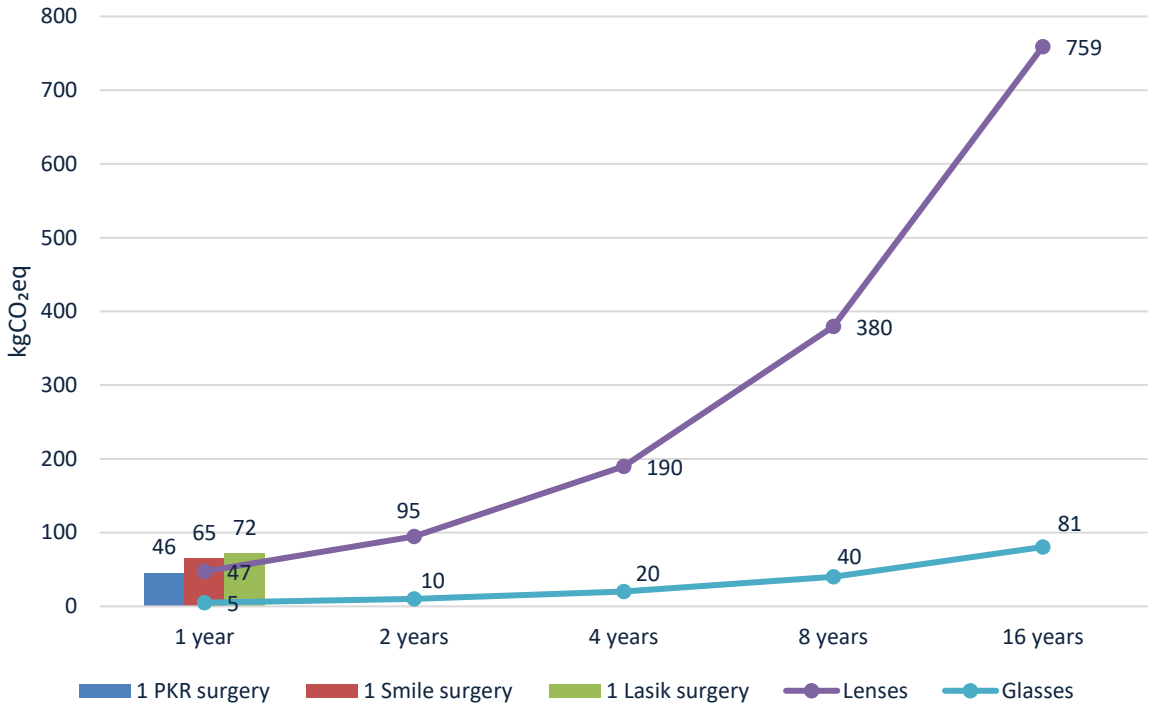

Figure 2 : carbon footprint comparison of refractive surgeries, lenses and glasses (carbon footprint in kgCO_2eq/year).

Key levers for reducing emissions

The study identifies several concrete opportunities to significantly reduce the carbon footprint of refractive surgery:

- Optimizing the use of medical devices: Reducing unnecessary consumables, increasing the use of reusable devices, or selecting suppliers with lower carbon footprints could substantially lower emissions.
- Improving equipment efficiency: Increasing the number of surgeries performed per laser each year would reduce the impact per procedure. Extending equipment lifetime and working with manufacturers to improve transparency and reduce emissions are key levers.
- Encouraging low-carbon patient transport: Promoting public transport for the outward journey and electric vehicles for return trips could significantly reduce transport-related emissions.

By combining these actions, the carbon footprint of a day of refractive surgery could potentially be reduced by up to 40%, without compromising quality of care or patient safety.

A step toward more sustainable ophthalmology

This assessment demonstrates that refractive surgery, like all medical activities, has a measurable environmental impact—but also that meaningful reductions are achievable. By better understanding emission drivers and working collaboratively with healthcare professionals, suppliers, and patients, refractive surgery can evolve toward a more sustainable model while continuing to deliver high-quality visual outcomes.

About Ecovamed

We are an innovative company created in 2020, with the ambition to contribute to sustainable health care. By relying on improved processs**, Ecovamed allows the healthcare industry and the chemical, polymer and biotechnology industries to efficiently assess the carbon footprint and LCA of their products**, which is the first step before setting greenhouse gases emission reduction plans. Ecovamed is also **supporting health professionals to eco-design healthcare pathways**. For more information on Ecovamed, visit www.ecovamed.com or contact us at contact@ecovamed.com**.**

Conflict of interest

Ecovamed provides services to the healthcare industry, including LCA and carbon footprint assessment of their products and support to reduce their greenhouse gas emissions. Ecovamed notably provides consulting services to medical device, pharmaceutical and equipment manufacturers.