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**Manuscript title:** Re: The Carbon Footprint of Single-Use Flexible Cystoscopes compared to Reusable Cystoscopes. Methodological flaws led to the erroneous conclusion that single-use is “better”

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Hogan et al. recently concluded that the carbon footprint of a single-use flexible cystoscope (2.41 kg CO₂; Ambu®aScope™ 4Cysto) was lower than reusable equivalents (4.23 kg CO₂; Olympus® SD Flexible Cysto-Nephro videoscope (CYF-VA2)).(1) We raise two serious methodological concerns that reverse that conclusion.

Sterilisation accounted for 83% of the carbon footprint of the reusable cystoscope, on the assumption that “the Olympus ETD-Double™ can reprocess up to 3 cystoscopes per cycle, with a cycle consuming 10.5 kW of electricity, equating to 10.5 kg of CO₂ cycle or 3.5 kg of CO₂ (IQR 0) per case.’(1) Conversion factors published by UK government(2) estimate one kWh UK electricity is associated with 0.29 kg CO₂e (carbon dioxide equivalents, although we note accounting of carbon dioxide/CO₂ only by Hogan et al).(1) The generation of 10.5 kg CO₂/cycle therefore implies approximately 36 kWh electricity, indicating a sterilisation cycle of 3.4 hours (at 10.5 kW). This seems improbable, given the duration of the Olympus ETD-Double™ cycle is reported elsewhere at 35 minutes,(3) (and is 45 minutes/ cycle at our local sterile services department, personal communication). Power consumption of 10.5 kW for 35 minutes converts to energy use of 6.13 kWh, equating to 1.78 kg CO₂e/ cycle or 0.59 kg CO₂e/ cystoscope. Assuming other parameters from the study are accurate,(1) this indicates total 1.35 kg CO₂ per use of a reusable cystoscope.

Our second concern is the assumption by Hogan et al. that manufacture of the single-use cystoscope generated 8.51 kg CO₂ per kg of scope,(1) citing Davis et al.(4). In fact Davis et al.(4) estimated 3.83 kg CO₂ for manufacture of a 300 g single-use ureteroscope, equating to 12.8 kg CO₂e per kg of scope (50% higher). Using this conversion factor, manufacture of the 158 g single-use cystoscope would generate just over 2 kg CO₂, resulting in total carbon footprint of 3.09 kg CO₂ (assuming other study parameters are correct).(1)

Amending these two parameters means that use of a single-use cystoscope would generate 3.09 kg CO₂, more than double the 1.35 kg CO₂ for the reusable equivalent.

Errors in analysis of single-use versus disposable scopes are not unique to this paper. A previous study by Sørensen and Grüttner suggested the carbon footprint of a reusable bronchoscope (unnamed brand) was 2.9 kg CO₂e/ use, higher than a single-use bronchoscope (Ambu® aScopeTM 4 broncho) at 1.6 kg CO₂e.(5) Authors acknowledged that if two or more reusable bronchoscopes were processed together, the carbon footprint became lower than
single-use equivalents, indicating the best approach to reduce carbon footprint of bronchoscopes is to use reusable versions sterilised in batches rather than singularly, but Sørensen and Grüttner omitted such modelling from the main analysis. We are also aware of companies perpetuating unfounded ideas that reusable endoscopes pose an infection risk (as a means for product promotion), and we highlight here the robust standards and systems in the UK to sterilise endoscopes.(6)

There is increasing demand for evidence on the environmental impact of products used in healthcare settings. However, the planet cannot wait for us to carbon footprint everything, and we must act based on the general principle derived from a previous review (7): that reusable medical equipment is associated with a lower carbon footprint than single-use. Single-use endoscopes perpetuate the continued destruction of our planet and simply should not be used, (except in the most extenuating circumstances) no matter how “convenient” they may seem.
Author Disclosure Statement

The authors have no conflicts of interest to declare.

Funding information

No funding was received for this article.

References