Conflict of interest: J.S. has received honoraria for lectures and advisory boards from AbbVie, Leo Pharma, Eli Lilly, Novartis, Pfizer, Pierre Fabre and Sanofi-Genzyme. A.-S. D. has acted as a consultant and/or speaker for AbbVie, Lilly, Medac and Sanofi. D.S.-S. has acted as a consultant for Sanofi. M.J. has acted as a consultant for Sanofi. A.N. has acted as an investigator for AbbVie, Eli Lilly, Incyte, LEO Pharma, Novartis, and Sanofi and as a consultant for Pfizer Inc., AbbVie, Eli Lilly, Galderma, LEO Pharma, Novartis, Medac and Sanofi. A.N. has also been a speaker for AbbVie, Medac, Regeneron, LEO Pharma and Sanofi and participated on advisory boards for Pfizer Inc., AbbVie, LEO Pharma, Medac and Sanofi. M.T has acted as a consultant and/or speaker for Sanofi, AbbVie, Lilly and Medac. M.-C.F.L.B. has acted as a consultant for Sanofi. H.A. has acted as a consultant and/or speaker for Sanofi, Novartis, Lilly, AbbVie and Janssen. A.S has acted as a consultant for Sanofi. N.R.-P. has acted as a speaker for Sanofi. F.T. has been a consultant and speaker for Sanofi. M.V. has acted as a consultant for Sanofi. S.B. has acted as an investigator or speaker for Almirall, Sanofi-Genzyme, AbbVie, Novartis, Janssen, LEO Pharma, Pfizer, Eli Lilly and UCB Pharma.

Data availability: the data that support the findings of this study are available from the corresponding author upon reasonable request.

## Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:
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## Sustainability in skin cancer surgery

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Dear Editor, Carbon emissions ascribed to medical instruments account for one of the largest proportions of the National Health Service (NHS) carbon footprint.[1] Our aim was to evaluate the sustainable value of the main types of theatre packs used for skin surgery (single-use and reusable) based on their economic, environmental and social sustainability, and determine which is more sustainable for long-term use.

Data on the number and types of packs were collected over a 4-week period in 2019 in the Dermatology Department, University Hospital of Wales. The results were used to calculate a mean value for the number of times each pack type was used on an average week at the department. The calculations for the cost and carbon footprint of each pack type per week were based on those values accordingly. The price of the single-use packs was acquired from the manufacturing company and the cost of disposal was provided by the health board's waste management manager according to the pack weight and the waste treatment process (incineration). The cost of using the reusable packs was determined by the cost of the instruments, sterilization process, blue sterilization wrap disposal, and staffing (time taken to arrange the instruments post-procedure and transportation of packs to the sterilization unit). The carbon footprint resulting from the life cycle of each pack type was determined using published emissions factors for the production of the raw materials used to manufacture the components of the pack (i.e. instruments, plastic cover, plastic tray and gallipot) and for disposal. Additionally, the carbon footprint of the sterilization process for reusable packs was estimated using published data on water and electricity consumption.[2] Emissions from the transport of waste to the energy recovery facility were not included.

On average, 62 packs are used for skin surgery per week (14 single-use, 48 reusable). The cost of a single-use pack is £20·57 vs. £13·35 for a reusable pack (Figure 1a). The amount of greenhouse gas (GHG) emissions caused by the use of each single-use pack is 1·436 $kgCO_2eq$ (kilograms of $CO_2$ equivalents) compared with 1·121 $kgCO_2eq$ for a reusable one (Figure 1b). Extrapolating from the values obtained for the cost and GHG emissions of the two pack types, on the basis that 14 single-use and 48 reusable packs are used per week, the total amount of money spent on theatre packs is £974·22/week (£50 659·54/year) and the total carbon footprint generated is 73·903 $kgCO_2eq$/week (3842·932 $kgCO_2eq$/year). The figures presented here have been rounded and also include transport costs of the re-usable packs to the sterilization unit, calculated on a weekly or yearly basis and not per pack. A full breakdown of these figures is available from the corresponding author on request.

This study is the first to compare the sustainability of single-use and reusable packs for skin surgery, accounting for the costs and GHG emissions from the life cycle of each pack type. Measuring the carbon footprint of various elements of healthcare services should be integrated into service evaluations and quality improvement to sustain their delivery. In a 2018 report, medical instruments were identified as one of the biggest contributors to the NHS carbon footprint, comprising over 13% of its total emissions.[3] Therefore, opting for the most sustainable type of instruments minimizes the costs and associated GHG emissions. Our findings demonstrate that reusable packs are more sustainable due to their reduced cost and GHG emissions. If our department were to switch to using only reusable packs, it would lead to a saving of £101·03/week or £5253·55/year and lower the annual GHG emissions by ~6% (229·205 $kgCO_2eq$), which is equivalent to a 2-h flight. It is likely that this is an underestimate because sterilization energy data are from Australia, where coal provides most energy while our hospital sources energy from renewable sources.

Limitations include that this is a single-centre study and that the GHG emissions from the production and disposal of the packs were calculated using estimates of the instruments' weights and amounts of raw materials used to manufacture them, and empirical assumptions regarding the instruments' lifetimes. Consequently, the carbon footprint data for each pack type may be subject to a slight degree of imprecision. Furthermore, the patient outcomes and social sustainability of both pack types were not determined; however, a questionnaire has been piloted for this purpose and the pilot data will shape a larger study to address these objectives.

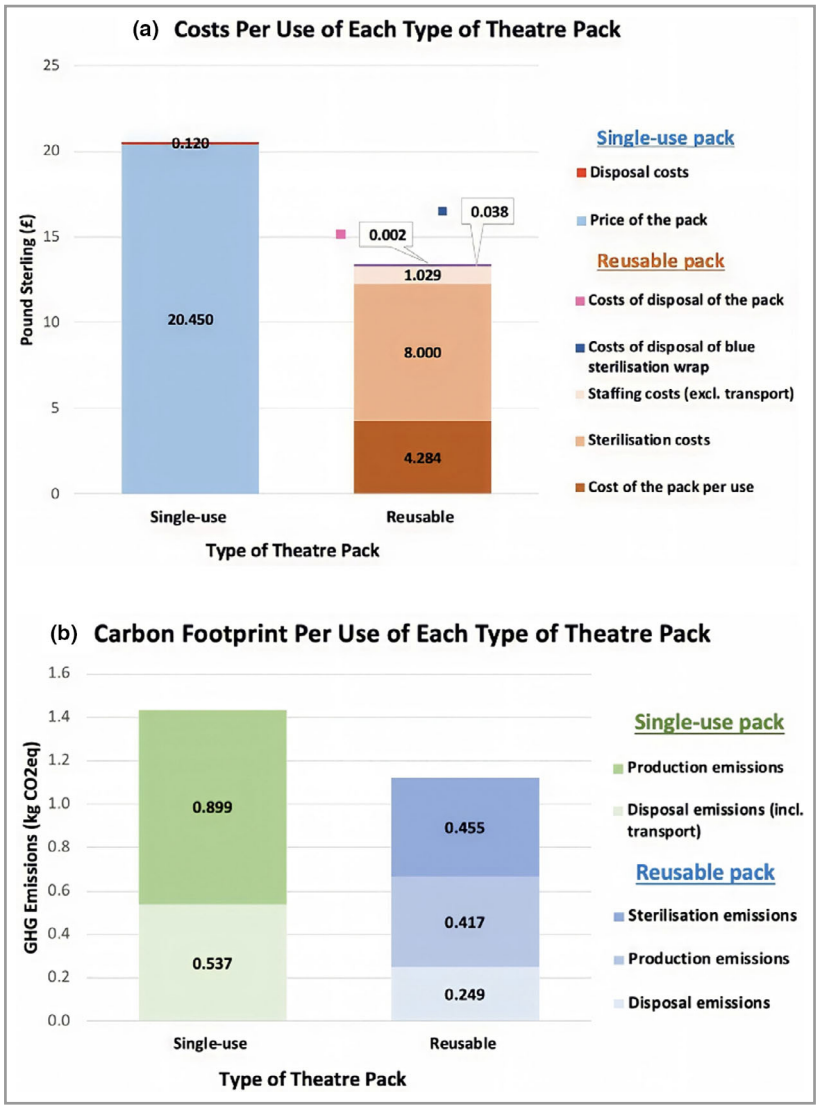


**Figure 1** (a) The costs associated with the use of each type of theatre pack. (b) The carbon footprint or GHG emissions caused by the use of each type of theatre pack. GHG, greenhouse gas; $CO_2$eq, carbon dioxide equivalents.

There is a dearth of research on the environmental sustainability of dermatology interventions and services despite the evolving threat of climate change. As reusable dermatology theatre packs were found to be more sustainable, greater benefits can be expected with a global shift to reusable packs for skin surgery. Further studies should explore the benefits and harms to patients and staff for both single-use and reusable packs for skin surgery.

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