



8. Areas for future research and development

Section key points

- ◇ The James Lind Alliance 'Greener Operations' Priority Setting Partnership identified questions or topics that people want researchers to investigate, to help reduce the environmental impact of operations.
- ◇ Further research is needed to evaluate the role of surgical disease prevention, minimising unwarranted variation, de-adoption of low value care, and digital technologies, in relation to sustainable surgery.
- ◇ There is need to evaluate the relative contribution of different mitigation strategies to model how to achieve net zero surgical care, and understand the scale and requirements of resources change to facilitate transition to sustainable surgery.
- ◇ We need to understand how surgical care services can adapt to climate change.
- ◇ Research is needed on how to increase scale and spread of sustainable surgery innovations.

8.1 James Lind Alliance sustainable perioperative practice priority setting partnership

The James Lind Alliance (JLA) is a not-for-profit organisation that brings together patients, carers and clinicians in Priority Setting Partnerships (PSPs).²⁶⁴ The 'Greener Operations' PSP aimed to identify the questions or topics that people want researchers to investigate, to help reduce the environmental impact of operations.^{462,463} Through an iterative process the 'top ten' unanswered research questions⁴⁶² were identified.

Greener Operations research priorities

The top ten priorities were:

1. How can more sustainable reusable equipment safely be used during and around the time of an operation?
2. How can healthcare organisations more sustainably procure medicines, equipment and items used during and around the time of an operation?
3. How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?
4. Can more efficient use of operating theatres and associated practice reduce the environmental impact of operations?
5. How can the amount of waste generated during and around the time of an operation be minimised?
6. How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?
7. What is the environmental impact of different anaesthetic techniques used for the same operation?
8. How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?
9. How can environmental sustainability be incorporated into the organisational management of operating theatres?
10. What are the most sustainable forms of effective infection prevention and control used around the time of an operation?

These priorities can be used by funders and academics as a basis for research strategy.⁴⁶³

8.2 Wider research and innovation

This report synthesises evidence to date, and whilst the research field of sustainable surgical care is rapidly expanding, there are gaps in our knowledge requiring further research, which should be designed to inform real-world change in practice and policy.

The role of surgical disease prevention, minimising unwarranted variation, and de-adoption of low value care (ensuring carbon burden associated with surgery is necessary rather than avoidable) is an important area of future research. The process of digitising surgical care is currently unclear, and models need to include the growing awareness of carbon and water footprint associated with data centres. The emergence of artificial intelligence and its anticipated application within

healthcare settings needs careful evaluation, in particular where it may lead to over-diagnosis and therefore excessive use of healthcare and associated carbon.

Research can also be used to evaluate how best to enact interventions at national scale, taking into account different settings, such as urban, inner-city, rural, and coastal hospitals, seeking equitable access to sustainable surgical care.⁴⁶⁴ This should include evaluating the current capacity and future needs of reprocessing facilities (including decontamination, sterilisation, laundering, and repair sites) to facilitate the anticipated increased use of reusable equipment.

There is much heterogeneity in the conduct and reporting of environmental impact assessments for products within healthcare⁴⁵ and also methodological concerns for some published studies,³⁶¹ signalling a need for consensus on the conduct and the reporting of such assessments, improving their reliability and validity for informing policy and purchasing decisions. There is also a need to improve methods to quantify environmental impact of other mitigation strategies (for example, remote or digital care).⁴⁶⁵ We encourage industry to anticipate this, and to develop products and solutions that help meet the goal of net zero surgery, including a focus on reusable products. Alternative economic models of purchasing to support such a transition, such as servitisation, are also worthy of exploration.

Future research should also evaluate how surgical operating theatres and wider surgical care delivery facilities can adapt to climate change, including building resilience to withstand extreme weather events (for example the UK is particularly susceptible to flooding) and sea level rises.

Behavioural change research is required to identify challenges to transitioning to sustainable healthcare, and to understand how to overcome these.

Section recommendations

Recommendation	Short term	Long term	Stakeholders
<p>R8.1</p> <p>Conduct further research to evaluate ways to improve sustainability of surgical care</p>		<p>Design research questions targeted towards major contributors of environmental impact^a</p> <p>Develop targeted funding opportunities to support identified research gaps^b</p>	<p>Academics^a</p> <p>Research funders^b</p>