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Greener Operations: a James Lind Alliance Priority Setting Partnership on environmentally sustainable peri-operative practice

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Title page

Greener Operations: a James Lind Alliance Priority Setting Partnership on environmentally sustainable peri-operative practice

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Abstract

Objectives: To agree the 'top 10' research priorities for environmentally sustainable peri-operative practice.

Design: surveys and literature review; final consensus workshop using a nominal group technique.

Setting: UK-based.

Participants: healthcare professionals, patients, carers, and the public.

Outcome measures: initial survey- suggested research questions; interim survey- shortlist of 'indicative' questions (the 20 most frequently nominated by patients, carers and the public, and healthcare professionals); final workshop- ranked research priorities.

Results: initial survey- 1,926 suggestions by 296 respondents, refined into 60 indicative questions. Interim survey- 325 respondents. Final workshop- 21 participants agreed the 'top 10':

- How can more sustainable reusable equipment safely be used during and around the time of an operation?
- How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?
- How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?
- Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?
- How can the amount of waste generated during and around the time of an operation be minimised?
- How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?
- What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?
- How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?
- How can environmental sustainability be incorporated into the organisational management of operating theatres?
- What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g., PPE, drapes, clean air ventilation)?

Conclusions: a broad range of 'end-users' have identified research priorities for sustainable peri-operative care.

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Strengths and Limitations of this Study

- We have defined the top 10 research priorities according to healthcare professionals, patients, carers, and members of the public, in an important and expanding area of health research.
- To our knowledge, this is the first research priority setting partnership in any field of sustainable healthcare.
- Patients, carers, and members of the public comprised 21% of survey respondents overall, a smaller proportion than in many priority setting partnerships. This may have been because of the online methods used (due in part to the COVID-19 pandemic) or the novel subject matter.
- The James Lind Alliance process is consensus-based, transparent, and includes measures to ensure that patient, carer and public opinions are represented.
- The scope of our work was limited to 'care provided from or in the secondary care setting to patients who may benefit from surgical management' so does not include the full patient journey; more sustainability-focussed priority setting partnerships would be beneficial in the future.

Original Protocol of the Study

See <https://www.jla.nihr.ac.uk/documents/greener-operations-sustainable-peri-operative-practice-ppsp-protocol/27106>

Data Availability Statement

An engagement summary (detailing the participation in each stage of the work), and a data template (detailing the indicative questions, including a representative sample of initial suggestions) will be made available on the James Lind Alliance website (<https://www.jla.nihr.ac.uk/priority-setting-partnerships/greener-operations-sustainable-perioperative-practice/>). The results of the literature review are included in this paper as an appendix.

Funding Statement

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Competing Interests Statement

CS is a co-opted member of the Association of Anaesthetists Environment and Sustainability Committee. He has received travel expenses from the Association of Anaesthetists, the Centre for Sustainable Healthcare and Health Education England to attend professional meetings to speak on sustainable healthcare. He is a member of the SBRI Healthcare 'Delivering a Net Zero NHS' competition funding panel. YH is a co-founder of Green Health Wales. CL is a member of the Health Education England North East and North Cumbria Faculty of Sustainable Healthcare and the Intensive Care Society Sustainability Group. DM has accepted consulting fees from Bausch and Lomb

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3 and Nuffield Health, and honoraria for education provided to Wilderness Medical Training. SMK is
4 the chairperson of the Association of Anaesthetists Environment and Sustainability Committee. VP is
5 vice chairperson of the Royal College of Surgeons of England Sustainability in Surgery Group. TR is an
6 independent participant in the OneTogether programme. DJ is the budget holder for account
7 managed within MFT Charity used to fund Greener Operations. The other authors have no
8 competing interests to declare.
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Introduction

It is increasingly recognised that healthcare, as a resource-intensive industry, makes a significant contribution to environmental harms such as global warming and pollution.¹ In turn, these environmental harms contribute to ill health, thereby creating an increased demand for healthcare services.² In the UK, National Health Service trusts are recognised as an ‘anchor institutions’, large organisations that influence the health and wellbeing of their communities not only through providing healthcare – but through practices in procurement, employment, community engagement and environmental responsibility.³ Recently, healthcare systems, educational regulators and professional societies have begun to issue guidelines and implement plans aiming to mitigate the carbon footprint and ecological impacts of healthcare.⁴⁻⁹ This rapid expansion of interest in the area is both necessary and welcome but presents its own challenges. Though there are several high-impact measures that should be urgently implemented (e.g., decarbonisation of electricity production),⁴ it is universally acknowledged that achieving sustainable healthcare will require research and innovation.⁴⁻⁶

Between 220 and 344 million operations are thought to be performed worldwide every year,¹⁰ a number which will increase as the Lancet Commission on Global Surgery target of 5,000 operations per 100,000 population is approached.¹¹ The peri-operative journey, from initial consultation to surgery and then discharge from hospital and recovery, is a complex process that involves many groups of hospital staff. Operations are known to be among the most resource-intensive healthcare interventions;¹² each operating theatre creates over two tonnes of solid waste per year,¹³ and a single operation can generate a ‘carbon footprint’ equivalent to driving more than 2,000 miles.¹⁴ Peri-operative practice therefore represents a significant opportunity to make healthcare more environmentally sustainable. This opportunity has not gone unrecognised, and recent years have seen a proliferation in research funding, fellowship posts, and publications relating to sustainability in the peri-operative period.¹⁵⁻¹⁷

Noting the increasing interest in research relating to sustainability in peri-operative practice, we felt that this represented an ideal subject for a James Lind Alliance (JLA) Priority Setting Partnership (PSP), in order to direct and inform future research.

The JLA is a not-for-profit organisation, founded to address evidence uncertainties in specific areas of research through collaboration between patients, carers and clinicians.¹⁸ Using an ‘open-to all’ survey-based approach the JLA seeks to engage the ‘end users’ of research to help direct funding to the areas of greatest need, thereby minimising biases caused by financial or purely scientific research motives. Since its founding in 2004, it has facilitated more than 140 PSPs, developing a robust methodology to identify the ‘top 10’ research priorities in a given subject area.¹⁹

In 2019, we were successful in our application to the JLA to run ‘Greener Operations’, a PSP which aimed to identify the top 10 unanswered research questions connected to environmentally sustainable peri-operative practice, as defined by an expansive group of patients, carers, members of the public and healthcare workers. We believe this to be the first PSP to be conducted in any field of sustainable healthcare.

Methods

The Greener Operations PSP was conducted according to the standard JLA methodology by a team comprising project leads, information specialists, a multidisciplinary steering group composed of

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3 healthcare professionals and patient and public representative, and a James Lind Alliance advisor.²⁰
4 The PSP was supported by partner organisations involved or interested in peri-operative care, such
5 as professional associations, royal colleges, and patient groups. As this was a patient and public
6 involvement project, based on surveys which were available to all on a voluntary basis, research
7 ethics committee approval was not required.²⁰ Potential participants were provided with an
8 explanation of what each phase of the project involved, including how the data would be used, as
9 described below.
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14 ***Setting up the priority setting partnership***

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16 Following approval of charitable funding, the PSP was established in August 2020 by the project
17 leads. Two information specialists were appointed, to be responsible for managing the surveys and
18 data analysis, and an advisor was assigned by the JLA. Partner organisations, responsible for
19 promoting the PSP and ensuring that surveys reached as wide an audience as possible, were
20 recruited by the project leads by email contact with organisational representatives. The steering
21 group was formed by inviting expressions of interest from individuals linked to the partner
22 organisations (e.g., members of environmental or peri-operative committees or working groups). We
23 aimed to recruit a wide range of healthcare professionals involved in peri-operative practice,
24 including surgeons, anaesthetists, nurses, operating department practitioners and pharmacists. In
25 addition, the steering group included non-clinical professionals involved in sustainability, and
26 individuals with lived experience of undergoing surgery who could represent patients' interests.
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30 Because of ongoing COVID-19 pandemic and a desire to minimise the environmental impacts of the
31 project itself, it was agreed by the steering group that all meetings would be held online. The
32 meetings were chaired by the JLA advisor, and conducted using a video-conferencing platform
33 (Zoom, Zoom Video Communications, Inc, San Jose, California, USA).
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38 ***Defining scope***

39 At the initial meeting of the steering group, the study protocol and scope of the PSP were
40 confirmed.²¹ Though we recognised that the complete perioperative journey often commences and
41 ends in the community, for pragmatic reasons we defined 'peri-operative practice' as that provided
42 from or in the secondary care setting to patients who may benefit from surgical management,
43 including:
44
45

- 46 • pre-operative assessment and optimisation (e.g. pre-operative clinic)
- 47 • counselling and shared decision-making (including on decisions regarding the
- 48 appropriateness of surgery, and different approaches to peri-operative management)
- 49 • pre and postoperative hospital care (including outpatient, ambulatory, virtual and inpatient
- 50 care)
- 51 • intra-operative management (including surgical and anaesthetic techniques)
- 52 • both clinical (e.g. surgical and anaesthetic techniques) and non-clinical (e.g. energy, water,
- 53 waste management and recycling) aspects
- 54 • the implementation of these practices within organisations and departments
- 55 • achieving positive peri-operative outcomes
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Care beyond the early post-operative period (e.g. prolonged rehabilitation), broader aspects of environmental sustainability, and non-UK practice were excluded, along with questions relating to denying management of illness purely on the basis of environmental sustainability.

Gathering uncertainties

An initial online survey (SurveyMonkey, Momentive, San Mateo, California, USA) was used to invite patients, carers, healthcare professionals, and members of the public to suggest evidence uncertainties connected with sustainable peri-operative care. Respondents were asked to state, via free-text boxes, what questions they felt needed to be answered by future research to help make peri-operative practice more environmentally sustainable. To help respondents to consider the full scope of the peri-operative patient journey, we asked them to consider the pre-, intra- and postoperative phases, and also invited any further suggestions. In addition to suggested questions, demographic data were collected. After a pilot within the steering group, the initial survey was launched online on 10th May 2021, and disseminated through partner organisations, the project website, and social media, using a web link and quick response (QR) code. Demographic data were routinely reviewed to consider whether the survey was successfully reaching all stakeholder groups. The survey remained open for 17 weeks, until 31st August 2021.

Data processing

After closing the survey, the raw data were downloaded for processing and analysis. To maintain data integrity and facilitate cross checking, each respondent was assigned a unique code number, with each individual response assigned a sub-code. Suggestions were assessed independently by the information specialists to determine whether they were in-scope or out-of-scope, based on the criteria in the PSP protocol. Where both information specialists agreed that a suggestion was out of scope, that suggestion was not analysed further. Suggestions that did not clearly fall in or out of scope were kept for further analysis, to ensure potentially relevant suggestions were not missed.

To aid with analysis, suggestions were categorised into themes by the information specialists based on subject matter. The themes and suggestions were then reviewed by members of the steering group to form a list of indicative questions, agreed by consensus. Suggestions that were deemed to be similar were combined to form a single indicative question; others that were deemed to be too broad were split into separate questions. Each in-scope suggestion was allocated to a minimum of one appropriate indicative question to ensure all data were kept in the analysis.²⁰ The steering group then cross-checked the list of indicative questions with the individual suggestions to ensure that the meaning of the suggestions was captured appropriately.

Literature review

A literature review was undertaken to identify if any of the indicative questions had already been answered by currently available research. Following standard JLA principles, questions were categorised as having been answered 'completely', 'partially', or 'not at all'.²⁰ For a question to be deemed 'answered completely', a relevant, up-to-date and reliable systematic review or national clinical guideline that addressed the question would be required. For each indicative question, we worked with our healthcare library to search relevant databases (EMBASE, CINAHL, Medline and the

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Cochrane Database of Systematic Reviews; see Appendix 1), and reviewed guidelines from the National Institute for Health and Care Excellence, the Scottish Intercollegiate Guidelines Network, and relevant Royal Colleges and professional associations. In addition, members of the steering group who were members of professional organisations checked if there were any guidelines ‘in press’. The findings of the literature review were reviewed by the steering group who decided whether any questions could be deemed to be answered completely. Questions that had some evidence available that did not meet the criteria for being completely answered were classified as partially answered, and these questions, along with the unanswered ones, were taken forward into the interim survey.

Interim priority setting

A second online survey (SurveyMonkey, Momentive, San Mateo, California, USA) was used to rank the long list of indicative questions to generate a shortlist of the most important questions that could then be discussed at the final prioritisation workshop. Respondents were presented with the indicative questions, displayed in a random order unique to each respondent, and asked to select the 10 questions they felt were most important. In addition, routine demographic data were collected. The survey was open for six weeks from 19th April to 30th May 2022. Following this, the raw data were analysed to identify the questions selected the most frequently. To moderate the influence of unequal numbers of respondents from different backgrounds, equal weighting was given to questions selected by healthcare professionals, and those selected by respondents who classified themselves as patients, carers or members of the public. The 20 questions most frequently selected by these two groups were taken forward to the final priority setting workshop

Final priority setting workshop

The final priority setting workshop was a one-day in-person event, conducted according to a nominal group technique,²² chaired and facilitated by a team of advisors from the JLA. Respondents to the interim survey were invited to express an interest in participating in the workshop, and invitations were made using a purposive approach in order to promote a balanced group in terms of background (healthcare professional or patient, carers or member of the public). Participants were asked, in advance, to consider the importance of the questions for discussion. The JLA advisors allocated participants to three small groups of up to 10 people, aiming for a diverse mix of backgrounds in each group. The process comprised five phases:²⁰

1. Small group discussions: participants listed the three questions they felt were most important for research, and the three that they felt were least important. These were recorded by the facilitator, and an opportunity for further discussion and clarification was provided.
2. First round of small group ranking: in the same groups, the facilitator laid out the questions, printed on cards, in rough groupings: those which were thought to be most important by group members, those thought to be least important, and those not mentioned or where there was divergence of views. Group participants then prioritised all of the questions by moving the cards into rank order. The ranking scores of the interim survey were made available to participants at this phase, to assist with ranking decisions.
3. Plenary review: the ranking agreed by each group was entered into a spreadsheet, and assigned a value (highest rank = 1, second highest = 2, etc). These ranks were combined by

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3 addition to create an aggregate ranked list. The aggregate ranks were presented to all
4 workshop participants in plenary, with an opportunity for discussion.

- 5
6 4. Second round of small group ranking: participants were allocated to new groups by the JLA
7 advisors, aiming to maintain a balance of backgrounds and expose participants to a different
8 range of views. These new groups discussed and revised the aggregate ranked list, again by
9 moving cards positioned to reflect the rank order.
- 10
11 5. Final plenary review: as per phase 3, the small group scores were entered into a
12 spreadsheet, and combined by addition. The aggregate ranking was presented to all
13 workshop participants in plenary, with the cards laid out in order. The ranking was discussed
14 in plenary group, in order to agree the final ranking.

15
16 The final workshop discussions were chaired by trained JLA advisers to ensure that no one group or
17 individual dominated the decision making. The aim was to reach agreement by consensus at the end
18 of each phase, with decisions made by majority vote if consensus could not be reached.

21 22 **Patient and Public Involvement**

23
24 How was the development of the research question and outcome measures informed by patients'
25 priorities, experience, and preferences?

- 26
27 • Four members of the steering group were patient and public representatives, who
28 contributed to the development of the protocol for the PSP.

29
30 How did you involve patients in the design of this study?

- 31
32 • The patient and public members participated fully in all duties of the steering group,
33 including the design of the surveys, and the definition and wording of the indicative
34 questions.

35
36 Were patients involved in the recruitment to and conduct of the study?

- 37
38 • The patient and public representatives participated in developing the recruitment strategy,
39 liaising with partner organisations, producing explanatory documents and analysing the
40 study data.

41
42 How will the results be disseminated to study participants?

- 43
44 • In addition to this paper, we have produced a short video explaining the process and
45 outcomes, uploaded the results to the James Lind Alliance website, shared the findings via
46 social media, and will work with our patient and public representatives to produce a plain
47 English summary document.

48 49 50 51 **Results**

52
53 Two hundred and ninety-six individuals responded to the initial survey, of whom 230 (77.7%)
54 classified themselves as healthcare professionals, 40 (13.5%) as members of the public, 21 (7.1%) as
55 patients, and three (1.0%) as carers. Two (0.7%) did not state their background. Of the healthcare
56 professionals, most were doctors (142; 61.7%), with nurses (23; 10%) and pharmacists (10; 4.3%) the
57 next largest groups. Detailed demographics are displayed in table 1.

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Respondents to the initial survey suggested 1,926 uncertainties for research. After initial review, we removed 309 suggestions agreed to be out-of-scope. After thematic categorisation of the remaining 1,617 suggestions, 78 themes were identified. This was further consolidated to 60 indicative questions by steering group consensus.

The literature review revealed that none of the indicative questions had been completely answered by currently available research. Members of the steering group who were part of professional bodies confirmed there were no relevant upcoming guidelines from their respective organisations that would answer the questions. Twenty-three questions were found to be partially answered by the available evidence. Therefore, all 60 indicative questions were included in the interim survey.

Three hundred and twenty-five individuals responded to the interim survey, of whom 254 (78.2%) classified themselves as healthcare professionals, 45 (13.8%) as members of the public, 19 (5.8%) as patients, and two (0.6%) as carers. Five (1.5%) did not state their background. Of the healthcare professionals, most were doctors (172; 67.7%), with operating department practitioners (20; 7.9%) and nurses (16; 6.3%) the next largest groups. Detailed demographics are displayed in table 1.

	Initial Survey	Interim Survey
Total responses	296	325
Gender		
Woman (including trans woman)	171 (57.8%)	187 (57.5%)
Man (including trans man)	110 (37.2%)	122 (37.5%)
Non-binary	4 (1.4%)	0 (0%)
Prefer not to say	8 (2.7%)	7 (2.2%)
Other	1 (0.3%)	4 (1.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Age		
Under 18	0 (0%)	0 (0%)
18-25	5 (1.7%)	7 (2.2%)
26-40	84 (28.6%)	139 (42.8%)
41-60	139 (47.3%)	130 (40.0%)
61-80	57 (19.4%)	38 (11.7%)
Over 80	3 (1.0%)	0 (0%)
Prefer not to say	6 (2.0%)	6 (1.9%)
Question skipped	2 (0.7%)	5 (1.5%)
Ethnic group		
White	230 (77.7%)	258 (79.4%)
Asian or Asian British	34 (11.5%)	33 (10.1%)
Black, African Caribbean or Black British	3 (1.0%)	2 (0.6%)
Mixed or Multiple Ethnic Groups	6 (2.0%)	13 (4.0%)
Other ethnic group	3 (1.0%)	3 (0.9%)
Prefer not to say	18 (6.1%)	11 (3.4%)
Question skipped	2 (0.7%)	5 (1.5%)
Region		
North West England	82 (27.7%)	115 (35.4%)
North East England	35 (11.8%)	31 (9.5%)
West Midlands	12 (4.1%)	21 (6.5%)
East Midlands	17 (5.7%)	14 (4.3%)
London	33 (11.1%)	28 (8.6%)
South West England	18 (6.1%)	19 (5.8%)
South East England	52 (17.6%)	43 (13.2%)

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Scotland	9 (3.0%)	14 (4.3%)
Wales	18 (6.1%)	6 (1.8%)
Northern Ireland	2 (0.7%)	4 (1.2%)
Outside UK	7 (2.4%)	18 (5.5%)
Prefer not to say	9 (3.0%)	7 (2.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Background		
Patient	21 (7.1%)	19 (5.8%)
Carer	3 (1.0%)	2 (0.6%)
Member of the public	40 (13.5%)	45 (13.8%)
Healthcare Professional	230 (77.7%)	254 (78.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Profession (if healthcare professional)		
Advanced practitioner	2 (0.9%)	4 (1.6%)
Anaesthesia associate	4 (1.7%)	2 (0.8%)
Dentist	2 (0.9%)	2 (0.8%)
Doctor	142 (61.7%)	172 (67.7%)
Healthcare Assistant	4 (1.7%)	0 (0%)
Nurse	23 (10.0%)	16 (6.3%)
Operating department practitioner	7 (3.0%)	20 (7.9%)
Non-clinical role	3 (1.3%)	6 (2.4%)
Midwife	0 (0%)	4 (1.6%)
Paramedic	1 (0.4%)	0 (0%)
Perfusionist	1 (0.4%)	0 (0%)
Pharmacist	10 (4.3%)	1 (0.4%)
Physiotherapist	2 (0.9%)	0 (0%)
Porter	1 (0.4%)	0 (0%)
Radiographer	0 (0%)	1 (0.4%)
Other	15	24 (9.4%)
Question skipped	13 (5.7%)	2 (0.8%)

Table 1: demographic details of respondents to the initial and interim Greener Operations surveys

The number of selections for each question was ranked separately according to whether respondents were healthcare professionals, or patients, carers and members of the public. A fractional ranking technique (tied ranks being assigned the mean of the ranking positions) was used to identify the 20 highest-ranked questions for each group, 14 of which were common to both groups (table 2). This led to 25 questions progressing into the final prioritisation workshop.

Question	Healthcare Professional Interim Rank	Patient, Carer and Public Interim Rank	Combined Interim Rank
What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	1	1.5	1
Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	3	1.5	2
How can the amount of waste generated during and around the time of an operation be minimised?	2	3.5	3
What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g., PPE, drapes, clean air ventilation)?	4	3.5	4
How much recyclable waste generated during an operation is being appropriately recycled?	5	5.5	5

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How do we define and avoid low-benefit or unnecessary operations?	12	7	6
How can more sustainable reusable equipment safely be used during and around the time of an operation?	16	5.5	7
How do we measure the carbon footprint of an operation?	14	10	8
How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	12	13	9.5
How can energy usage within an operating theatre be safely reduced?	8	17	9.5
How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?	10	17	11
How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	9	21	12.5
Can alternative, more environmentally sustainable, methods of disposal be used for waste that is generated during and around the time of an operation?	6	24	12.5
How can environmental sustainability be incorporated into the organisational management of operating theatres?	15	17	14.5
What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?	22	10	14.5
What is the most sustainable way of providing equipment packs for an operation?	19.5	13	16.5
What is the most sustainable way to sterilise equipment used during an operation?	19.5	13	16.5
Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	27.5	10	18
How can the waste of drugs be avoided during and around the time of an operation?	21	17	19
How can drug syringes be used better to reduce their environmental impact?	12	26.5	20
How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?	38.5	8	22
What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	7	40.5	23.5
How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	35	17	26
What are the barriers to using more sustainable anaesthetic practices?	18	40.5	28.5
How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?	17	50.5	32

Table 2: highest-ranked indicative questions in the interim survey. Left column, healthcare professionals; mid column, patients, carers and members of the public; right column, combined rank. The top 20 questions for each group are highlighted in green. The combined rank (used for data organisation only) was calculated by adding the two rank scores, then ranking the added scores.

A total of 21 individuals attended the final prioritisation workshop, of whom eight classified themselves as patients, carers or members of the public, and 13 as healthcare professionals. The healthcare professionals comprised three surgeons, one operating department practitioner, five anaesthetists, one medical student, one foundation doctor, one optometrist, and one sustainability officer. Three of the patient, carer and public representatives were also members of the Greener

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Operations steering group. We noted that four of the patient, carer and public representatives had worked in healthcare at some point in their careers. Five observers from stakeholder organisations (e.g., the National Institute for Health and Care Research, Greener NHS) and the Greener Operations project leads and information specialists were present but did not take part in the prioritisation discussions. The 25 indicative questions were ranked, and the top 10 priorities for research into sustainable peri-operative practice were agreed (table 3). All decisions were reached by consensus, with no majority votes required.

Rank	Question
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 (obtain) 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 practices 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 (e.g., different types of general, regional and local anaesthesia) 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 (e.g., PPE, drapes, clean air ventilation)?
11	How do we measure the carbon footprint of an operation?
12	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?
13	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?
14	How can the waste of drugs be avoided during and around the time of an operation?
15	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?
16	How do we define and avoid low-benefit or unnecessary operations?
17	How can energy usage within an operating theatre be safely reduced?
18	What are the barriers to using more sustainable anaesthetic practices?
19	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?
20	Can alternative, more environmentally sustainable, methods of disposal be used for waste that is generated during and around the time of an operation?
21	What is the most sustainable way of providing equipment packs for an operation?
22	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?
23	How much recyclable waste generated during an operation is being appropriately recycled?
24	What is the most sustainable way to sterilise equipment used during an operation?
25	How can drug syringes be used better to reduce their environmental impact?

Table 3: Ranked research priorities from the final Greener Operations Priority setting workshop. The 'Top 10' are highlighted in green.

Discussion

The Greener Operations PSP has identified the top 25 research priorities for sustainable peri-operative practice, with an emphasis on the top 10. This provides a robust basis for end-user

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3 focussed research into mitigating the environmental impacts of a resource-intensive area of
4 healthcare at a time of climate crisis.⁴ Despite a recent increase in the number of publications into
5 sustainable healthcare in the peri-operative period,²² this remains a relatively under-investigated
6 area - as indicated by our literature review that revealed no 'completely answered' indicative
7 questions. Though there are established sustainability measures that are already being implemented
8 at scale, research will be required to understand how a fully sustainable healthcare system can be
9 achieved.⁴ Furthermore, implementation research will be required to identify how to achieve some
10 of the behavioural elements (e.g., changes in practice) that have been identified as important but
11 not yet integrated into practice. The top 10 research priorities relate to research uncertainties across
12 multiple areas of research interest, including implementation (priorities 1 and 3), manufacturing and
13 supply (priority 2), management (priorities 4 and 9), waste (priorities 1 and 5), surgery (priority 6),
14 anaesthesia (priority 7), medical ethics (priority 8), economics (priority 8 and 9) and infection control
15 (priority 10). This both underlines the interdisciplinary relevance of the PSP and highlights the
16 complexity of the sustainability challenge faced by healthcare.²³

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21 Our PSP had an above average overall number of suggestions in the primary survey (1,926,
22 compared to the mean of 1,723),²⁴ with each respondent contributing more than six suggestions on
23 average. This is likely to be representative of the enthusiasm for this area of study amongst the
24 participants. Whilst the JLA process aims to engage a broad range of respondents, it is not
25 uncommon for PSPs to have an imbalance in the background of survey respondents.²⁵⁻²⁸ Our PSP had
26 a preponderance of healthcare professional respondents, with 78.2% fitting into this category across
27 both surveys. Our use of internet-based approaches e.g., social media and online surveys, may have
28 contributed to the imbalance of respondents, as the likelihood of having had an operation (therefore
29 feeling more informed to comment on the peri-operative process) increases with age, whereas
30 internet usage is inversely proportional to age.^{29,30} Methods to address this such as in-person or
31 paper surveys (e.g., made available at patient encounters such as clinics as in other PSPs) were not
32 feasible for our project given the restrictions on social contact owing to the COVID-19 pandemic at
33 the time of the work. However, we are confident that the overall results were representative of both
34 healthcare and non-healthcare groups, because the JLA methodology controls for imbalances in
35 survey response numbers, and also because the results of the interim survey showed strong
36 alignment in priorities between both groups (Table 2). This was further strengthened through active
37 patient, carer and public participation in the final workshop.

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42 The Greener Operations priorities should provide a valuable resource for researchers and funders.
43 Based on our literature review, we are confident that none of the identified research priorities have
44 been completely answered by existing research. However, some priorities have attracted a
45 significant research effort in recent years and have therefore been partially answered. In particular,
46 the 'carbon footprints' of various anaesthetic agents, disposable and re-usable instruments,
47 infection control supplies, and PPE (relating to priorities 1, 7 and 10) have been investigated.³¹⁻³⁵
48 Here, there is an increasing amount of coherent data on climate impacts (i.e., 'carbon footprints'),
49 but other aspects (e.g., the ecotoxic effects of plastic waste and / or drug and metabolite disposal)
50 remain under-investigated.³⁵ Furthermore, sustainable peri-operative care is an area of current
51 innovation, and new developments may render current concepts rapidly outdated.^{36,37} Nevertheless,
52 experts in the field who are aware of the current literature may consider some questions outside the
53 Greener Operations rankings to be of greater priority than some of those within. The PSP process
54 should not be seen to diminish the value of this expertise. Rather, it adds insight into what the end
55 users of research – patients, carers, public and clinicians – perceive to be important about
56 environmentally sustainable peri-operative care. The priority questions are intentionally broad in
57 scope, and we encourage researchers to draw on them in the development of projects. Of note,
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there appears to be an increasing number of funding calls relevant to this topic area, which we hope will be maintained in the future.^{36,38}

Greener Operations has identified the top 10 research priorities for sustainable peri-operative care as agreed by a wide range of healthcare professionals, patients, carers and members of the public. Our project has explored a priority area for healthcare and identified a diverse range of research topics for exploration and innovation that will benefit both the NHS and healthcare outside the UK.⁴ We hope that our work will be of use to researchers and funders, as part of an urgent and universal effort to achieve high-quality healthcare with minimal environmental harm. Greener Operations is the first PSP undertaken by the JLA in sustainable healthcare and, to our knowledge, the first research priority setting exercise carried out in any field of sustainable healthcare. In addition to agreeing priority research areas for investigation, we have demonstrated that a PSP focussed on sustainable healthcare is feasible. Given the pressing nature of the climate crisis, we hope that colleagues in other fields will draw on our experience to conduct further sustainability-related PSPs.

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substantial contributions to the conception and design of the work and the analysis and interpretation of data as a member of the Steering Group but does not meet the ICMJE criteria for authorship; the authors thank him for his valuable contributions to the work.

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	Indicative Question	College Guideline?	Related NICE/SIGN in area?	Sustainability NICE/SIGN?	Cochrane / EMBASE / CINAHL / Medline	Completely Answered	Partially Answered	Unanswered
1	How can care after an operation be optimised to minimise the use of resources and creation of waste whilst providing good care?		NG180 - perioperative care	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.37757/MR2021.V23.N3.9 • http://dx.doi.org/10.1016/j.ijso.2020.11.016 • http://dx.doi.org/10.1136/bmjopen-2021-050806 • http://dx.doi.org/10.1055/s-0040-1708834 • http://dx.doi.org/10.1213/ANE.0000000000003942 • https://dx.doi.org/10.1016/j.jcin.2018.04.042 • https://dx.doi.org/10.21614/chirurgia.112.5.546 		X	
2	Which aspects of care before and after an operation can be provided in the community in a more sustainable way?							X
3	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?							X
4	Can the supply of medicines after an operation be optimised to minimise waste?							X

1 2 3 4 5 6 7 8 9 10 11 12	5	How does living a 'greener' lifestyle affect recovery after an operation?		<ul style="list-style-type: none"> • NG70 - Air pollution • NG90 – Physical Activity and the Environment • PH41 – Walking and Cycling • QS183 – Encouraging Physical Activity in the community • PH54 – Exercise and referral schemes • PH13 – Physical Activity in the Workplace 	No				X
13 14 15 16 17 18 19 20 21 22 23 24 25	6	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g. PPE, drapes, clean air ventilation)?				<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/TA.0000000000003073 • https://dx.doi.org/10.1017/ice.2020.379 			X
26 27 28 29 30 31 32 33 34 35 36 37 38	7	What effect does pre-habilitation (e.g., changes in physical activity, lifestyle and diet before an operation) have on the environmental impact of undergoing an operation?				<ul style="list-style-type: none"> • https://dx.doi.org/10.1513/AnnalsATS.202002-183OC • https://dx.doi.org/10.1136/bmjopen-2021-050806 • https://dx.doi.org/10.1097/CIN.0000000000000708 			X
39 40 41 42 43	8	What are the relative environmental impacts of the							X

1	different elements of care delivered before an operation?							
2								
3								
4								
5								
6	9	How can investigations before an operation be used more efficiently?	NG45 – Routine preoperative tests for elective surgery	No	<ul style="list-style-type: none"> • https://doi.org/10.37757/MR2021.V23.N3.9 		X	
7								
8								
9								
10	10	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?			<ul style="list-style-type: none"> • https://doi.org/10.1093/bjs/znab362.049 • https://doi.org/10.1016/J.JAMCOLLSURG.2021.07.258 • https://doi.org/10.1289/EHP8666 • https://doi.org/10.1016/j.amjsurg.2018.07.021 • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
11								
12	11	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	NHS Supply Chain Strategy - https://www.supplychain.nhs.uk/sustainability/climate-change-energy-and-ghg-emissions/		<ul style="list-style-type: none"> • https://doi.org/10.1016/S0140-6736(20)31142-9 • https://dx.doi.org/10.1017/dmp.2020.283 		X	
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36	12	What drives effective sustainable innovation in manufacturing of equipment and medical	NHS Supply Chain Strategy - https://www.supplychain.nhs.uk/sustainability/climate-change-energy-and-ghg-emissions/		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.scitotenv.2021.151128 • https://doi.org/10.1289/EHP8666 • https://dx.doi.org/10.1016/j.icjq.2021.06.010 • https://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1016/j.ejvs.2017.03.014 		X	
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38								
39								
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43								
44								
45								
46								

1	supplies used							
2	during and							
3	around the time							
4	of an							
5	operation?							
6								
7								
8	13	What			<ul style="list-style-type: none"> • http://dx.doi.org/10.1093/ndt/gfab113.008 • http://dx.doi.org/10.1289/EHP8666 • http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 • http://dx.doi.org/10.1016/j.icjq.2021.06.010 • http://dx.doi.org/10.1016/j.amjoto.2020.102719 • http://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1016/j.amjsurg.2018.07.021 • https://dx.doi.org/10.1111/ans.13856 • https://dx.doi.org/10.1093/bjs/znab362.049 		X	
9	13	What						
10	13	alternative,						
11	13	more						
12	13	sustainable,						
13	13	materials can						
14	13	replace plastic						
15	13	packaging and						
16	13	equipment used						
17	13	during and						
18	13	around the time						
19	13	of an						
20	13	operation?						
21	14	How can the			<ul style="list-style-type: none"> • https://dx.doi.org/10.1289/EHP8666 • https://doi.org/10.1016/j.icjq.2021.06.010 		X	
22	14	emission of						
23	14	greenhouse						
24	14	gases and air						
25	14	pollutants						
26	14	associated with						
27	14	an operation be						
28	14	reduced?						
29	15	How and when			<ul style="list-style-type: none"> • http://dx.doi.org/10.1016/j.resconrec.2019.104560 			X
30	15	is it appropriate						
31	15	to discuss the						
32	15	environmental						
33	15	impacts of care						
34	15	during and						
35	15	around the time						
36	15	of an operation						
37	15	with patients?						
38	16	How can more			<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.eururo.2022.01.027 • http://dx.doi.org/10.1093/ndt/gfab113.008 • http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 • http://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1111/ans.13856 		X	
39	16	sustainable						
40	16	reusable						
41	16	equipment						
42	16	safely be used						
43	16	during and						

1	around the time of an operation?							
2								
3								
4								
5								
6	17	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?			<ul style="list-style-type: none"> • http://dx.doi.org/10.1289/EHP8666 • http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 • https://dx.doi.org/10.1111/ans.13856 • https://doi.org/10.1101/2021.03.10.21253268 		X	
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18	18	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?						X
19								
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21								
22								
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25								
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29								
30	19	What is the most sustainable way of providing equipment packs for an operation?			<ul style="list-style-type: none"> • http://dx.doi.org/10.1016/j.jcjq.2021.06.010 		X	
31								
32								
33								
34								
35								
36								
37	20	What is the most sustainable way to sterilise equipment used			<ul style="list-style-type: none"> • https://doi.org/10.1093/bja/aex098 		X	
38								
39								
40								
41								
42								

1	during an operation?							
2	21 How do we measure and compare the environmental impacts of the different ways of performing the same operation (e.g., keyhole and open surgery)?							X
3								
4								
5								
6								
7								
8	22 How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?							X
9								
10								
11								
12								
13								
14	23 What is the role of virtual consultations in reducing the environmental impact associated with undergoing an operation?				• https://dx.doi.org/10.7861/fhj.2020-0080		X	
15								
16								
17								
18								
19								
20	24 How can the amount of waste generated during and around the time of an operation be minimised?	Association of Anaesthetists - Anaesthetic waste: safe and sustainable disposal			• https://dx.doi.org/10.1016/j.icjq.2021.06.010 • https://dx.doi.org/10.1016/j.eururo.2022.01.027 • https://dx.doi.org/10.1016/j.scitotenv.2021.151128 • https://dx.doi.org/10.1097/SLA.0000000000003951		X	
21								
22								
23								
24								
25								
26	25 Can alternative, more environmental				• https://dx.doi.org/10.1007/s10163-020-01123-1			X
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1	y sustainable							
2	methods of							
3	disposal be							
4	used for waste							
5	that is							
6	generated							
7	during and							
8	around the time							
9	of an							
10	operation?							
11	26	How much						X
12	recyclable							
13	waste							
14	generated							
15	during an							
16	operation is							
17	being							
18	appropriately							
19	recycled?							
20	27	How do we						X
21	minimize the							
22	amount of							
23	water used for							
24	'scrubbing up'							
25	(handwashing)							
26	for an							
27	operation?							
28	28	What can						X
29	healthcare							
30	organisations							
31	learn from							
32	healthcare							
33	systems in							
34	other countries							
35	about							
36	sustainable							
37	surgical							
38	pathways?							
39	29	How can we						X
40	reduce the							
41	environmental							
42	impact of							

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1		nitrous oxide used in healthcare?							
2									
3	30	How do we define and avoid low-benefit or unnecessary operations?				<ul style="list-style-type: none"> https://dx.doi.org/http://dx.doi.org/10.1136/bmj.k5120 			X
4									
5									
6									
7									
8									
9	31	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?							X
10									
11									
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25	32	What are the barriers to using more sustainable anaesthetic practices?							X
26									
27									
28									
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31	33	What role does re-cycling inhaled anaesthetics have in reducing the environmental impact of inhaled anaesthesia?							X
32									
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41	34	What is the environmental	NG180 - perioperative care	No					X
42									
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1	impact of							
2	different forms							
3	of pain relief for							
4	an operation?							
5	35	How do we						X
6	measure and	compare the						
7	short- and long-	term						
8	environmental	impacts of						
9	surgical and	non-surgical						
10	treatments for	the same						
11	condition?							
12								
13								
14								
15								
16								
17	36	What is the			https://dx.doi.org/10.1053/j.jfas.2020.08.007		X	
18	environmental	impact of using			https://dx.doi.org/10.1097/NUR.0b013e31824590e6			
19	day case	surgical			https://doi.org/10.1016/j.jcjq.2021.06.010			
20	pathways	compared to						
21	inpatient	pathways?						
22								
23								
24								
25								
26	37	What is the role						X
27	of community-	based care in						
28	reducing the	environmental						
29	impact of	operations?						
30								
31								
32								
33	38	Is it more						X
34	environmentally	sustainable						
35	and safe for	patients to have						
36	more of their	early post-						
37	operative care	at home						
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1		compared to hospital?							
2									
3	39	How can the waste of drugs be avoided during and around the time of an operation?							X
4									
5									
6									
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9									
10	40	How can drug syringes be used better to reduce their environmental impact?				<ul style="list-style-type: none"> • https://dx.doi.org/10.3390/ijerph19031381 			X
11									
12									
13									
14									
15									
16	41	What is the most environmentally sustainable way to deliver oxygen in the post-operative period?							X
17									
18									
19									
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22									
23									
24	42	What are the most environmentally sustainable and effective methods of surgical wound care (e.g., dressings, wound cleaning)?	MTG59 – Plus Sutures for preventing surgical site infection	No					X
25									
26									
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36	43	What are the sustainable and effective alternatives to carbon dioxide used in laparoscopic (keyhole				<ul style="list-style-type: none"> • https://dx.doi.org/10.4103/jmas.JMAS_130_20 • https://dx.doi.org/10.1002/14651858.CD009569.pub3. • https://doi.org/10.1289/EHP8666. 		X	
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1		surgery of the abdomen) surgery?						
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4	44	What is the most environmentally sustainable way to provide nutrition for patients undergoing operations?	NG180 - Perioperative care	No				X
5								
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13	45	What is the most environmentally sustainable method of providing written information to patients?						X
14								
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23	46	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?	PH6 – Behavioural Change – general approaches	No			X	
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35	47	What are the best ways to educate patients, and their carers, about sustainable healthcare?	PH6 – Behavioural Change – general approaches	No			X	
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1	before an operation?							
2								
3	48	What is the most sustainable way for healthcare professionals to store and (appropriately) share clinical information?	NG94 - Emergency and acute medical care in over 16s: service delivery and organisation	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.jident.2021.103737 			X
4								
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12	49	How can energy usage within an operating theatre be safely reduced?			<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.amjsurg.2018.07.021 • https://doi.org/10.1016/j.accpm.2021.100907 • https://doi.org/10.1016/j.jciq.2021.06.010 		X	
13								
14								
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17	50	What is the most environmentally sustainable way to maintain a patient's body temperature during an operation?	<ul style="list-style-type: none"> • CG65 – Hypothermia, prevention and management in adults undergoing surgery 2016 • Medical Technologies guidance 31 – Humiguard 	No			X	
18								
19								
20								
21								
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27	51	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?			<ul style="list-style-type: none"> • https://doi.org/10.1289/EHP8666 • https://doi.org/10.1016/j.jciq.2021.06.010 • https://dx.doi.org/10.1097/SLA.0000000000002712 		X	
28								
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35	52	How can care packages which aim to enable rapid recovery from surgery (e.g., ERAS) affect the environmental	NG180 - perioperative care	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/SLA.0000000000003878 		X	
36								
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1		impact of an operation?						
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3	53	How can waste from medical gas cylinders be reduced?						X
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5	54	What effect do standards, guidelines and quality improvement initiatives have on the environmental impact of operations?			<ul style="list-style-type: none"> • https://doi.org/10.1016/j.eururo.2022.01.027 • https://dx.doi.org/10.1097/SLA.0000000000002712 • https://doi.org/10.1289/EHP8666 • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
6								
7	55	What is the most sustainable method to launder clothing worn when delivering care around an operation?						X
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17	56	How do we measure the carbon footprint of an operation?			<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
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26	57	How can the different types of environmental impacts (e.g., global warming, waste, resource utilisation) associated with care during and around the time of an operation						X
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1		be prioritised and balanced against one another?							
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4	58	What is the most sustainable way to provide lighting in the operating theatre?							X
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12	59	How can environmental sustainability be incorporated into the organisational management of operating theatres?							X
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21	60	How can the provision and administration of medicines to patients undergoing operations be made more environmentally sustainable?							X
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Appendix: Search strategies by question.

	Question	Search Strategy
1	How can care after an operation be optimised to minimise the use of resources and creation of waste whilst providing good care?	1 ((Postop* or "post op*" or periop* or "peri op*" or post-surgery) adj6 care).ti,ab. 2 Postoperative Care/ 3 1 or 2 4 (optimis* or optimiz* or enhance* or improve* or better or best).ti,ab. 5 3 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ 9 6 or 7 or 8 10 5 and 9 11 limit 10 to (yr="2017 -Current" and (meta analysis or "systematic review")) 12 limit 11 to english language
2	Which aspects of care before and after an operation can be provided in the community in a more sustainable way?	1 ((Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery) adj6 care).ti,ab. 2 ((before or prior) adj2 (surgery or operation)).ti,ab. 3 (after adj2 (surgery or operation)).ti,ab. 4 (following adj2 (surgery or operation)).ti,ab. 5 2 or 3 or 4 6 care.ti,ab. 7 5 and 6 8 Preoperative Care/ 9 Postoperative Care/ 10 ("pre-operative investigations" or pre-habilitation).ti,ab. 11 ("post operative" adj3 rehabilitation).ti,ab. 12 (postop adj3 rehabilitation).ti,ab. 13 1 or 7 or 8 or 9 or 10 or 11 or 12 14 exp Community Health Services/ 15 (community or "general practice" or GP or "district nurse*" or "remote clinic" or "remote clinics" or "one-stop clinic" or "one-stop clinics").ti,ab. 16 exp Community Health Nursing/

		<p>17 14 or 15 or 16 18 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 19 Carbon Footprint/ or Environmental Pollution/ 20 (transport* or travel*).ti,ab. 21 18 or 19 or 20 22 13 and 17 and 21 23 limit 22 to (yr="2017 -Current" and (meta analysis or "systematic review"))</p>
3	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 (following adj2 (surgery or operation)).ti,ab. 4 Postoperative Care/ 5 ((surgery or operation) adj4 (recover* adj3 period*)).ti,ab. 6 Postoperative Period/ 7 1 or 2 or 3 or 4 or 5 or 6 8 Rehabilitation/ 9 exp Self-Help Devices/ 10 ((medical or therap* or rehabilitat* or mobility or mobile) adj5 (aid* or device* or equipment)).ti,ab. 11 8 or 9 or 10 12 (recycl* or reusable or reuse or reutilis* or reutiliz* or reusing or reused).ti,ab. 13 "repeated use".ti,ab. 14 "repeatedly using".ti,ab. 15 "using again".ti,ab. 16 "used again".ti,ab. 17 "use again".ti,ab. 18 "repeated utiliz*".ti,ab. 19 "repeated utilis*".ti,ab. 20 Recycling/ or Equipment reuse/ 21 12 or 13 or 14 or 15 or 18 or 19 or 20 22 7 and 11 and 21 23 limit 22 to (yr="2017 -Current" and (meta analysis or "systematic review"))</p>
4	Can the supply of medicines after an operation be optimised to minimise waste?	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 (following adj2 (surgery or operation)).ti,ab. 4 Postoperative Care/</p>

		<p>5 ((surgery or operation) adj4 (recover* adj3 period*)).ti,ab.</p> <p>6 Postoperative Period/ 7 1 or 2 or 3 or 4 or 5 or 6 8 (medicine* or medication* or drug* or prescription*).ti,ab.</p> <p>9 Medicine/mt, og [Methods, Organization & Administration]</p> <p>10 exp Pharmaceutical Preparations/ 11 Self Medication/ 12 exp Prescriptions/ 13 8 or 9 or 10 or 11 or 12 14 7 and 13 15 (optimis* or optimiz* or enhance* or improve* or better or best).ti,ab. 16 14 and 15 17 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 18 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 19 Carbon Footprint/ or Environmental Pollution/ 20 17 or 18 or 19 21 16 and 20 22 limit 21 to (yr="2017 -Current" and (meta analysis or "systematic review"))</p>
5	How does living a 'greener' lifestyle affect recovery after an operation?	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 Postoperative Period/ 4 (following adj2 (surgery or operation)).ti,ab. 5 1 or 2 or 3 or 4 6 ((affect* or effect* quality or facilitate or aid or help* or assist* or benefit* or speed* or improve or advantag*) adj5 recover*).ti,ab. 7 5 and 6 8 (green* adj5 (life or "life style*" or lifestyle* or existence or living)).ti,ab. 9 (vegan* or vegetarian* or vegetable*).ti,ab. 10 diet, vegetarian/ or diet, vegan/ 11 ((less or reduc* or limit* or omit* or exclud*) adj4 meat*).ti,ab. 12 vegetarians/ or vegans/</p>

		<p>13 (exercis* or active or activit* or fit or fitness or walk* or running or swim* or gym or sport*).ti,ab.</p> <p>14 exp Exercise/</p> <p>15 8 or 9 or 10 or 11 or 12 or 13 or 14</p> <p>16 7 and 15</p> <p>17 (sustainab* or environment* or green* or "carbon footprint").ti,ab.</p> <p>18 Carbon Footprint/ or Environmental Pollution/</p> <p>19 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>20 17 or 18 or 19</p> <p>21 16 and 20</p> <p>22 limit 21 to (yr="2017 -Current" and (meta analysis or "systematic review"))</p>
6	<p>What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g. PPE, drapes, clean air ventilation)?</p>	<p>1 ipc.ti,ab.</p> <p>2 exp Infection Control/ or Surgical Wound Infection/</p> <p>3 (infection adj4 (rate* or incidenc* or occur* or reduc* or improv* or avoid* or prevent* or control*)).ti,ab.</p> <p>4 1 or 2 or 3</p> <p>5 exp Surgical Procedures, Operative/</p> <p>6 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>7 Operating Rooms/</p> <p>8 5 or 6 or 7</p> <p>9 (clean adj2 air).ti,ab.</p> <p>10 ventilat*.ti,ab.</p> <p>11 Ventilation/</p> <p>12 Surgical Drapes/</p> <p>13 Personal Protective Equipment/</p> <p>14 PPE.ti,ab.</p> <p>15 "personal protective equipment".ti,ab.</p> <p>16 (gloves or gown* or mask* or apron* or hat or hats* or "safety glasses" or goggles or shields).ti,ab.</p> <p>17 exp Surgical Attire/</p> <p>18 ((eye or face or hand or respiratory or body or hearing) adj1 protection).ti,ab.</p> <p>19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18</p> <p>20 4 and 8 and 19</p> <p>21 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>22 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p>

		<p>23 Carbon Footprint/ or Environmental Pollution/ 24 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 25 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 26 21 or 22 or 23 or 24 or 25 27 20 and 26 28 limit 27 to (yr="2017 -Current" and (meta analysis or "systematic review")) 29 limit 28 to english language</p>
<p>7</p>	<p>What effect does pre-habilitation (e.g., changes in physical activity, lifestyle and diet before an operation) have on the environmental impact of undergoing an operation?</p>	<p>1 exp Preoperative Exercise/ or exp Preoperative Period/ 2 prehabilitation.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 "preoperative exercise".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 life style/ or exp healthy lifestyle/ 5 "lifestyle intervention*".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 6 exp Diet, Healthy/ 7 "diet intervention*".mp. 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 sustainab*.ti,ab. 10 environment* impact.ti,ab. 11 carbon footprint*.ti,ab. 12 resource* reduc*.ti,ab. 13 "green* energy*".ab,ti. 14 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti. 15 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or</p>

		<p>"single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*).ti,ab. 16 exp Renewable Energy/ 17 exp Carbon Footprint/ 18 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 20 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 21 Surgical Procedures, Operative/ 22 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery).ti,ab. 23 20 or 21 or 22 24 8 and 19 and 23 25 limit 24 to (yr="2017 -Current" and systematic reviews)</p>
8	<p>What are the relative environmental impacts of the different elements of care delivered before an operation?</p>	<p>1 exp Environment/ 2 "carbon footprint* ".ti,ab. 3 "Environmental impact".ti,ab. 4 1 or 2 or 3 5 exp Preoperative care/ 6 (prehabilitation or pre-habilitation).ti,ab. 7 (preoperative and (Clinic* or Scan* or investigat* or radiology)).ti,ab. 8 5 or 6 or 7 9 4 and 8 10 limit 9 to yr="2017 -Current" 11 limit 10 to "systematic review"</p>
9	<p>How can investigations before an operation be used more efficiently?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact.ti,ab. 3 carbon footprint*.ti,ab. 4 resource* reduc*.ti,ab. 5 "green* energy*".ab,ti. 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti. 7 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*).ti,ab 8 exp Renewable Energy/ 9 exp Carbon Footprint/ 10 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10</p>

		<p>12 exp Preoperative Care/ or exp Preoperative Period/ 13 blood test.mp. or exp Hematologic Tests/ 14 exp Tomography, X-Ray Computed/ or exp Magnetic Resonance Imaging/ 15 exp X-Rays/ 16 exp Electrocardiography/ 17 exp Diagnostic Tests, Routine/ 18 "pre-operative test* ".ab,ti. 19 "preoperative test* ".ab,ti. 20 "Pre-operative scan* ".ab,ti. 21 "preoperative scan* ".ab,ti. 22 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 23 11 and 12 and 22 71 24 limit 23 to yr="2017 -Current" 17 25 limit 24 to ("middle aged (45 plus years)" and "systematic review") 0</p>
<p>10</p>	<p>Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?</p>	<p>1 operat*.mp. and (theatre* or theater*).ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 operat* suite*.ti,ab. 3 patient pathway*.ti,ab. 4 staffing level*.ti,ab. 5 (theatre or theater).mp. and equipment*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 6 (operation* or surgical).mp. and equipment*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 7 (operation* or surgical).mp. and instrument*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word,</p>

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		<p>rare disease supplementary concept word, unique identifier, synonyms]</p> <p>8 day surger*.ti,ab.</p> <p>9 Operating Rooms/</p> <p>10 Operating Rooms/mt, og [Methods, Organization & Administration] 3240</p> <p>11 "Personnel Staffing and Scheduling"/</p> <p>12 Surgical Equipment/</p> <p>13 Surgical Instruments/</p> <p>14 day surger*.mp.</p> <p>15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14</p> <p>16 sustainab*.ti,ab.</p> <p>17 environment* impact.ti,ab.</p> <p>18 carbon footprint*.ti,ab.</p> <p>19 resource* reduc*.ti,ab.</p> <p>20 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti.</p> <p>21 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>22 sustainability.mp.</p> <p>23 environment/ or carbon footprint/</p> <p>24 Environmental Pollution/ or Waste Management/</p> <p>25 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24</p> <p>26 operation*.ti,ab.</p> <p>27 surger*.ti,ab.</p> <p>28 General Surgery/</p> <p>29 operation.mp.</p> <p>30 26 or 27 or 28 or 29</p> <p>31 15 and 25 and 30</p> <p>32 limit 31 to (english language and "systematic review" and last 5 years) 22</p>
11	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p>

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2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]

3 Surgical Procedures, Operative/
4 Postoperative Care/
5 1 or 2 or 3 or 4

6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]

7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
8 Carbon Footprint/ or Environmental Pollution/
9 Product Packaging/
10 surgical Instruments/
11 Recycling/
12 Waste Management/
13 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.
14 6 or 7 or 8
15 9 or 10 or 11 or 12 or 13
16 health* organi?ation*.ti,ab.
17 Health Maintenance Organizations/ or Health Planning Organizations/
18 16 or 17
19 procur*.ti,ab.
20 (purchas* or obtain*).ti,ab.
21 "Equipment and Supplies, Hospital"/ or Durable Medical Equipment/
22 (Equipment or Supplies or medicine*).ti,ab.
23 19 or 20
24 Pharmaceutical Preparations/
25 21 or 22 or 24
26 5 and 14 and 15 and 23 and 25
27 limit 26 to (english language and yr="2017 -Current")

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3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46	12 What drives effective sustainable innovation in manufacturing of equipment and medical supplies used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>3 Surgery/ 4 Postoperative care/ 5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 8 Carbon Footprint/ or Pollution/ 9 6 or 7 or 8</p> <p>10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 11 Packaging/ or Surgical equipment/ or Recycling/ or Waste Management/ 12 10 or 11</p> <p>13 (Equipment and Supplies, Hospital).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word] (10)</p> <p>14 devices/ or medical device/ 15 (Equipment or Supplies or medicine*).ti,ab. 16 13 or 14 or 15 17 manufacture.ti,ab. 18 manufacture {Including Related Terms} 19 manufacturing/ 20 16 or 17 or 19 21 sustainable innovat*.ti,ab. 22 9 or 21</p>

		<p>23 (preoperative or perioperative).ti,ab. 24 preoperative evaluation/ 25 perioperative period/ 26 5 or 23 or 24 or 25 27 12 and 20 and 22 and 26 28 limit 27 to (english language and "systematic review" and yr="2017 -Current")</p>
13	<p>What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure* or "operating room" or theatre).ab,ti. 2 Surgery/ or Operating Rooms/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or carbon footprint* or green* energy or ((wast* or resource*) and (minimiz* or minimis* or reduc*))).ab,ti. 5 Carbon Footprint/ 6 Environmental Pollution/ 7 Recycling/ or Waste Management/ 8 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 9 Packaging/ or Surgical instruments/ 10 4 or 5 or 6 11 7 or 8 or 9 12 3 and 10 and 11 13 limit 12 to (yr="2017 -Current" and english) 14 limit 13 to "systematic review"</p>
14	<p>How can the emission of greenhouse gases and air pollutants associated with an operation be reduced?</p>	<p>1 (greenhouse gas* or air pollut* or greenhouse effect* or carbon footprint or (environment* and impact*)).ti,ab. 2 Greenhouse Effect/ or Air Pollution/ or Greenhouse Gas/ or Air Pollutant/ 3 1 or 2 4 (Nitrous Oxide or Ethyl Chloride or Desflurane or Sevoflurane or Isoflurane or volatile ane?sthe*).ti,ab. 5 ((low flow or minimal-flow) and ane?sthe*).ti,ab. 6 Anesthetics, Inhalation/ 7 4 or 5 or 6 8 (Operation* or Surger* or Surgical or Procedure*).ti,ab. or Surgery/ 9 3 and 7 and 8 10 limit 9 to (yr="2017 -Current" and "systematic review")</p>

15	How and when is it appropriate to discuss the environmental impacts of care during and around the time of an operation with patients?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Environmental Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>6 Surgical Procedures, Operative/</p> <p>7 5 or 6</p> <p>8 ((discuss* or inform* or educat* or consider* or talk* or conversation* or engag* or decid* or decision*) adj4 patient*).ti,ab.</p> <p>9 Patient Education as Topic/ or Decision Making, Shar</p> <p>10 8 or 9</p> <p>11 4 and 7 and 10</p> <p>12 limit 11 to (yr="2017 -Current" and "systematic review")</p>
16	How can more sustainable reusable equipment safely be used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical or Procedure* or Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery).ti,ab.</p> <p>2 Surgical Procedures, Operative/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>5 Carbon Footprint/ or Environmental Pollution/</p> <p>6 4 or 5</p> <p>7 ((recycl* or reusable or reuse*) adj4 (equipment* or item* or instrument*)).ti,ab.</p> <p>8 Surgical Instruments/ or Recycling/ or Waste Management/</p> <p>9 7 or 8</p> <p>10 3 and 6 and 9</p> <p>11 (safe* or steril* or infect* or contaminat* or uncontaminat* or decontaminat* or clean* or sanitary or hygiene* or aseptic or disinfect* or uninfected*).ti,ab.</p> <p>12 10 and 11</p> <p>13 limit 12 to (yr="2017 -Current" and "systematic review")</p>

17	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?	<p>1 (Sustainab* or "carbon footprint*" or "green* energy" or (environment* and impact*)).ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal*) adj4 (pack* or equipment* or item* or instrument*)) and ((plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*))).ti,ab.</p> <p>6 Packaging/ or Surgical equipment/ or Recycling/ or Waste Management/</p> <p>7 5 or 6</p> <p>8 (Operation* or Surger* or Surgical or Procedure*).ti,ab. or surgery/</p> <p>9 (compar* or collate* or contrast* or measure* or calculate* or evaluate*).ti,ab.</p> <p>10 4 and 7 and 8 and 9</p> <p>11 limit 10 to ("systematic review" and yr="2017 -Current")</p>
18	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>6 Surgery/</p> <p>7 5 or 6</p> <p>8 ((teach* or educat* or encourag* or inform*) adj4 (staff or doctor* or surgeon* or practitioner* or professional*)).ti,ab.</p> <p>9 4 and 7 and 8</p> <p>10 limit 9 to (yr="2017 -Current" and "systematic review")</p>
19	What is the most sustainable way of providing equipment packs for an operation?	<p>1 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or equipment* or instrument*) adj4 (pack* or kit* or container*)).ti,ab.</p> <p>2 Packaging/</p> <p>3 1 or 2</p> <p>4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>5 Surgery/</p> <p>6 4 or 5</p>

		<p>7 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>8 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>9 Carbon Footprint/ or Pollution/</p> <p>10 7 or 8 or 9</p> <p>11 3 and 6 and 10</p> <p>12 limit 11 to (yr="2017 -Current" and "systematic review")</p>
20	<p>What is the most sustainable way to sterilise equipment used during an operation?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>2 exp Surgical Procedures, Operative/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>5 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>6 4 or 5</p> <p>7 3 and 6</p> <p>8 (sterilis* or steriliz* or disinfect* or decontam*).ti,ab.</p> <p>9 exp Sterilization/</p> <p>10 8 or 9</p> <p>11 ("surgical tool*" or "surgical equipment*" or surgical instrument*).ti,ab.</p> <p>12 7 and 10 and 11</p>
21	<p>How do we measure and compare the environmental impacts of the different ways of performing the same operation (e.g., keyhole and open surgery)?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>2 exp Surgical Procedures, Operative/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>5 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>6 4 or 5</p> <p>7 3 and 6</p> <p>8 ("Laparoscopic surger*" or "Minimally Invasive" or keyhole or "key hole" or "micro surger*").ti,ab.</p> <p>9 laparoscopic surgery/</p> <p>10 8 or 9</p> <p>11 7 and 10</p> <p>12 ("open surger*" or "aggressive surg*" or "invasive").ti,ab.</p> <p>13 open surgery/</p> <p>14 12 or 13</p> <p>15 11 and 14</p> <p>16 (method* or approach* or version* or "different way").ti,ab.</p>

		<p>17 15 and 16 18 limit 17 to (human and english language and "systematic review" and yr="2017 - 2022")</p>
22	<p>How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 6 4 or 5 7 3 and 6 8 "environmental impact*".ti,ab. 9 7 and 8 10 Postoperative Complications/ 11 Treatment Outcome/ 12 ("clinical outcome*" or "surg* outcome*" or "treatment outcome").ti,ab. 13 10 or 11 or 12 14 ("financial cost" or "monetary cost" or "triple bottom line" or "financing cost").ti,ab. 15 "CO2 equivalent*".ti,ab. 16 14 or 15 17 9 and 13 and 16 (0)</p>
23	<p>What is the role of virtual consultations in reducing the environmental impact associated with undergoing an operation?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 ("virtual consultat*" or "online consult*" or "remote consult").ti,ab. 9 exp Telemedicine/ and exp "Referral and Consultation"/ 10 8 or 9 11 7 and 10 12 limit 11 to (english language and systematic reviews and last 5 years) 13 "travel to".ti,ab. 14 "remote attendance".ti,ab.</p>

		15 13 or 14 16 12 and 15
24	How can the amount of waste generated during and around the time of an operation be minimised?	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 exp Medical Waste/ 9 waste*.ti,ab. 10 8 or 9 11 7 and 10 12 ("Reduce*" or Reuse* or Recycle* or "re use*").ti,ab. 13 exp Recycling/ 14 12 or 13 15 11 and 14 16 limit 15 to (english language and systematic reviews and last 5 years)
25	Can alternative, more environmentally sustainable methods of disposal be used for waste that is generated during and around the time of an operation?	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 exp Medical Waste/ 9 waste*.ti,ab. 10 8 or 9 11 7 and 10 12 (incinerat* or landfill or "land fill" or dispose*).ti,ab. 13 11 and 12 14 limit 13 to (english language and systematic reviews and last 5 years)
26	How much recyclable waste generated during an operation is being appropriately recycled?	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.

		<p>3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 exp Medical Waste/ 9 waste*.ti,ab. 10 8 or 9 11 7 and 10 12 ("Reduce*" or Reuse* or Recycle* or "re use*").ti,ab. 13 exp Recycling/ 14 12 or 13 15 11 and 14 16 limit 15 to (english language and systematic reviews and last 5 years) 17 (generat* or create* or make).ti,ab. 18 16 and 17</p>
27	<p>How do we minimize the amount of water used for 'scrubbing up' (handwashing) for an operation?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 3 and 6 7 ("scrubbing up" or handwashing or "hand disinfect*").ti,ab. 8 (hand* adj3 wash*).ti,ab. 9 exp Hand Disinfection/ 10 8 or 9 or 10 11 7 and 11 12 limit 12 to (english language and systematic reviews and last 5 years)</p>
28	<p>What can healthcare organisations learn from healthcare systems in other countries about sustainable surgical pathways?</p>	<p>1 ("healthcare organisation*" or "health care organisation*" or "healthcare organization*" or "health care organization*").ti,ab. 2 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 3 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 4 2 or 3 5 1 and 4 6 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 7 (pathway* or "path way*").ti,ab. 8 6 and 7</p>

		<p>9 5 and 8 10 limit 9 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
29	How can we reduce the environmental impact of nitrous oxide used in healthcare?	<p>1 ((Sustainab* or "environment* impact*" or "carbon footprint*" or "green* energy" or (waste or resource*)) and (minimiz* or reduc*)).ti,ab. 2 Carbon Footprint/ 3 Medical Waste/ or Waste Management/ 4 1 or 2 or 3 5 "nitrous oxide".ti,ab. 6 Nitrous Oxide/ 7 5 or 6 8 4 and 7 9 ("health care" or healthcare).ti,ab. 10 "Delivery of Health Care"/ 11 9 or 10 12 8 and 11 13 limit 12 to (english language and yr="2017 - 2022" and "systematic review")</p>
30	How do we define and avoid low-benefit or unnecessary operations?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 ("low benefit*" or "low benefit surger*" or "low benefit operat*").ti,ab. 5 ("Operative versus non operative*" or "non operative versus operative*" or "operative" or "non operative").ti,ab. 6 4 and 5 7 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 8 Surgical Procedures, Operative/ 9 7 or 8 10 ("non surg*" or "non operat*" or "conservative management").ti,ab. 11 9 and 10 12 ("shared decision making" or "shared-decision making").ti,ab. 13 3 and 6 and 11 and 12 14 limit 13 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
31	What is the environmental impact of different anaesthetic	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p>

	<p>techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?</p>	<p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 ("anaesthe* technique*" or "anesthe* technique*" or "anaesthe* method*" or "anesthe* method*" or "method* of anaesth*" or "method* of anesthe*").ti,ab. 5 3 and 4 6 ("general anaesthe*" or "general anesthe*").ti,ab. 7 ("regional anaesthe*" or "regional anesthe*").ti,ab. 8 ("local anaesthe*" or "local anesthe*").ti,ab. 9 6 or 7 or 8 10 5 and 9 11 ("volatile versus total intravenous anaesthe*" or "volatile versus total intravenous anesthe*").ti,ab. 12 ("volatile anaesthe*" or "volatile anesthe*").ti,ab. 13 ("total intravenous anaesthe*" or "total intravenous anesthe*").ti,ab. 14 11 or 12 or 13 15 10 and 14 16 Surgical Procedures, Operative/ 17 15 and 16 18 limit 17 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
32	<p>What are the barriers to using more sustainable anaesthetic practices?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 ("Problem* with reduc*" or "barrier* with reduc*" or "barrier* to reduc*" or "aim to reduc*" or "need to reduc*").ti,ab. 5 ("volatile anaesthe*" or "volatile anesthe*").ti,ab. 6 4 and 5 7 3 and 6</p>
33	<p>What role does re-cycling inhaled anaesthetics have in reducing the environmental impact of inhaled anaesthesia?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 recycl*.ti,ab. 5 ("anaesthe*" or "anesthe*").ti,ab. 6 ("inhal*" or "gas*").ti,ab. 7 5 and 6 8 3 and 4 and 7</p>

		<p>9 Anesthesia/ 10 8 and 9 11 limit 10 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
34	<p>What is the environmental impact of different forms of pain relief for an operation?</p>	<p>1 epidural analgesia/ 2 (epidural adj3 (Oral or intravenous or regional or neuraxial)).ab,ti. 3 carbon footprint/ 4 environmental impact/ 5 "Sustainab*".ab,ti. 6 (environment* adj3 impact*).ab,ti. 7 "carbon footprint* ".ab,ti. 8 "green energy".ab,ti. 9 (hospital adj3 (waste or resource*)).ab,ti. 10 (surg* adj3 (waste or resource*)).ab,ti. 11 (operative adj3 (waste or resource*)).ab,ti. 12 (Analgesi* adj3 (waste or resource*)).ab,ti. 13 ("pain relief" adj3 (waste or resource*)).ab,ti. 14 Medical Waste/ (1409) 15 Waste Management/ or Medical Waste Disposal/ 16 (minimiz* or minimis* or reduc*).ab,ti. 17 1 or 2 18 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 19 15 or 16 20 17 and 18 and 19 21 limit 20 to (yr="2016 - 2022" and "systematic review")</p>
35	<p>How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?</p>	<p>1 exp Surgical Procedures, Operative/ 2 ((surg* or operat*) adj3 (procedure* or treatment*)).ab,ti. 3 1 or 2 4 exp Therapeutics/ 5 (non-surg* adj3 (therap* or treatment*)).ab,ti. 6 4 or 5 7 exp Environmental Monitoring/ 8 Carbon Footprint/ 9 "environment* adj3 sustainab*".ab,ti. 10 (environment* adj3 impact*).ab,ti. 11 "carbon footprint".ab,ti. 12 "green energy".ab,ti. 13 exp Renewable Energy/ 14 "renewable energy".ab,ti. 15 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14</p>

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		16 3 and 6 and 15 17 limit 16 to (yr="2017 - 2022" and "systematic review")
36	What is the environmental impact of using day case surgical pathways compared to inpatient pathways?	1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (environment* adj3 (impact or management or protect*)).ab,ti. 6 "renewable energy".ab,ti. 7 "recycl*".ab,ti. 8 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 9 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 10 "zero waste".ab,ti. 11 "Conservation of Natural Resources"/ 12 Carbon Footprint/ 13 exp Environmental Monitoring/ 14 environmental impact/ 15 exp Medical Waste Disposal/ 16 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 17 Ambulatory Surgical Procedures/ 18 (day adj3 surg*).ab,ti. 19 (ambulatory adj3 surg*).ab,ti. 20 (outpatient* adj3 surg*).ab,ti. 21 17 or 18 or 19 or 20 22 (inpatient adj3 surg*).ab,ti. 23 16 and 21 and 22 24 limit 23 to (yr="2017 -Current" and "systematic review")
37	What is the role of community-based care in reducing the environmental impact of operations?	1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. (5521) 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/

		<p>14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 exp Surgical Procedures, Operative/ 18 exp General Surgery/ 19 (surg* adj3 (procedure* or treatment* or therap*)).ab,ti. 20 18 or 19 21 exp Community Health Services/ 22 (community adj3 (care or service*)).ab,ti. 23 21 or 22 24 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 25 20 and 23 and 24 26 limit 25 to (yr="2017 - 2022" and "systematic review")</p>
38	Is it more environmentally sustainable and safe for patients to have more of their early post-operative care at home compared to hospital?	<p>1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/ 14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 18 Postoperative Care/ 19 exp Hospitalization/ 20 18 and 19 21 (postoperat* adj3 "hospital care").ab,ti. 22 (post-operat* adj3 "hospital care").ab,ti. 23 (post-surg* adj3 "hospital care").ab,ti. 24 20 or 21 or 22 or 23 25 Postoperative Care/ 26 Home Care Services/</p>

		<p>27 (postoperat* adj3 home).ab,ti. 28 (post-operat* adj3 home).ab,ti. 29 (post-surg* adj3 home).ab,ti. (7) 30 (home adj3 (surg* adj3 recover*)).ab,ti. 31 25 and 26 32 27 or 28 or 29 or 30 or 31 33 exp Patient Safety/ 34 (patient* adj3 safety).ab,ti. 35 33 or 34 36 17 and 24 and 32 and 35</p>
39	How can the waste of drugs be avoided during and around the time of an operation?	<p>1 exp Perioperative Period/ 2 "perioperat*".ab,ti. 3 1 or 2 4 (waste adj3 (drug or an?esthetic* or medic* or pharmac*)).ab,ti. 5 Medical Waste/ 6 4 or 5 7 exp Waste Management/ 8 Medical Waste Disposal/ 9 (waste adj3 (management or dispos* or reduc*)).ab,ti. 10 7 or 8 or 9 11 3 and 6 and 10 12 limit 11 to (yr="2017 - 2022" and "systematic review")</p>
40	How can drug syringes be used better to reduce their environmental impact?	<p>1 "Sustainab*".ab,ti. 2 "carbon footprint*".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/ 14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 Syringes/ 18 "syringe*".ab,ti. 19 17 or 18</p>

		<p>20 1 or 2 or 3 or 4 or 6 or 7 or 12 or 13 or 14 or 15</p> <p>21 5 or 9 or 10 or 11 or 16</p> <p>22 19 and 20 and 21</p> <p>23 limit 22 to (yr="2017 - 2022" and "systematic review")</p>
41	What is the most environmentally sustainable way to deliver oxygen in the post-operative period?	<p>1 sustainab*.ti,ab.</p> <p>2 environment* impact*.ti,ab.</p> <p>3 carbon footprint*.ti,ab.</p> <p>4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab.</p> <p>5 environmental protection/</p> <p>6 carbon footprint/</p> <p>7 environmental impact/</p> <p>8 "human impact (environment)"/ or environment/</p> <p>9 waste management/</p> <p>10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9</p> <p>11 oxygen*.ti,ab.</p> <p>12 oxygen deliver*.ti,ab.</p> <p>13 oxygen admin*.ti,ab.</p> <p>14 oxygen/ad [Drug Administration]</p> <p>15 oxygen/</p> <p>16 oxygen delivery device/</p> <p>17 11 or 12 or 13 or 14 or 15 or 16</p> <p>18 (post op* or postop*).ti,ab.</p> <p>19 postop* period.ti,ab.</p> <p>20 post op* period.ti,ab.</p> <p>21 postoperative care/</p> <p>22 18 or 19 or 20 or 21</p> <p>23 10 and 17 and 22</p> <p>24 limit 23 to (english language and last 5 years)</p>
42	What are the most environmentally sustainable and effective methods of surgical wound care (e.g., dressings, wound cleaning)?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word,</p>

		<p>protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>10 exp Product Packaging/</p> <p>11 exp Wound Healing/</p> <p>12 exp Bandages/</p> <p>13 10 or 11 or 12</p> <p>14 9 and 13</p> <p>15 5 and 14</p> <p>16 limit 15 to (yr="2017 -Current" and "systematic review")</p>
43	<p>What are the sustainable and effective alternatives to carbon dioxide used in laparoscopic (keyhole surgery of the abdomen) surgery?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 exp Laparoscopy/</p> <p>10 exp Minimally Invasive Surgical Procedures/</p> <p>11 exp Carbon Dioxide/</p> <p>12 gas* free*.ti,ab.</p> <p>13 9 or 10</p>

		<p>14 co2.ti,ab. 15 11 or 12 or 14 16 13 and 15 17 8 and 16 (18 limit 17 to (yr="2017 -Current" and "systematic review")</p>
44	<p>What is the most environmentally sustainable way to provide nutrition for patients undergoing operations?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 2 or 3 5 1 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 1 or 6 8 4 and 7 9 Enteral Nutrition/ or Nutrition Assessment/ or Nutrition Therapy/ or Nutrition Policy/ 10 exp Food Service, Hospital/ 11 exp "Conservation of Natural Resources"/ 12 11 and food*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 13 exp Food/ 14 9 or 10 or 12 or 13 15 8 and 14 16 limit 15 to (yr="2017 -Current" and "systematic review")</p>
45	<p>What is the most environmentally sustainable method of providing written information to patients?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject</p>

		<p>heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 exp Communication/</p> <p>10 exp "Appointments and Schedules"/</p> <p>11 9 and 10</p> <p>12 patient information*.ti,ab.</p> <p>13 patient communication*.ti,ab.</p> <p>14 email*.ti,ab.</p> <p>15 paperwork*.ti,ab.</p> <p>16 exp Letter/</p> <p>17 12 or 13 or 14 or 15 or 16</p> <p>18 7 and 17</p> <p>19 limit 18 to (yr="2017 -Current" and "systematic review")</p> <p>20 3 and 18</p>
46	<p>What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 "Educat*".ti,ab.</p> <p>5 exp Health Knowledge, Attitudes, Practice/</p> <p>6 4 or 5</p> <p>7 ("health* professional*" or "health* work*" or "health* provider*").ti,ab.</p> <p>8 ("pre-operative care" or "post-operative care").ti,ab.</p> <p>9 Surgical Procedures, Operative/</p> <p>10 8 or 9</p> <p>11 3 and 6 and 7 and 10</p>

		12 limit 11 to (english language and humans and yr="2017 - 2022" and "systematic review")
47	What are the best ways to educate patients, and their carers, about sustainable healthcare before an operation?	<p>1 Sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 exp environmental sustainability/ 7 carbon footprint/ 8 renewable energy/ 9 pollution/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 11 sustainable healthcare.ti,ab. 12 patient* education.ti,ab. 13 patient education/ or health education/ 14 caregiver/ 15 (carer* or caregiver*).ti,ab. 16 12 or 13 or 14 or 15 17 preop*.ti,ab. 18 (preop* and (care or period)).ti,ab. 19 (pre op* and (care or period)).ti,ab. 20 preoperative evaluation/ or preoperative period/ 21 17 or 18 or 19 or 20 22 10 and 11 and 16 and 21 23 10 or 11 24 16 and 21 and 23 25 limit 24 to (english language and "systematic review" and yr="2017 -Current")</p>
48	What is the most sustainable way for healthcare professionals to store and (appropriately) share clinical information?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 resource* reduc*.ti,ab. 6 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 7 environmental pollut*.ti,ab. 8 (reuse or reusable).ti,ab. 9 environmental pollution/ or environmental monitoring/ 10 Renewable Energy/ 11 Carbon Footprint/ 12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11</p>

		<p>13 clinical information.ti,ab. 14 ((clinical or operative or medical) and record*).ti,ab. 15 Medical Records/ 16 13 or 14 or 15 17 "Information Storage and Retrieval"/ 18 (Information and (Store or storage or share or sharing or Retriev*).ti,ab. 19 ((paper or physical) and record*).ti,ab. 20 Medical Records Systems, Computerized/ or Electronic Health Records/ 21 electronic record*.ti,ab. 22 17 or 18 or 19 or 20 or 21 23 ((health or healthcare or health care) and (personnel or professional*).ti,ab. 24 (doctor* or surgeon* or nurs* or AHP* or allied health professional*).ti,ab. 25 exp Health Personnel/ 26 23 or 24 or 25 27 12 and 16 and 22 and 26 28 limit 27 to (english language and yr="2017 -Current" and "systematic review")</p>
<p>49</p>	<p>How can energy usage within an operating theatre be safely reduced?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 resource* reduc*.ti,ab. 6 ((waste or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 7 environmental pollut*.ti,ab. 8 (reuse or reusable).ti,ab. 9 environmental pollution/ or environmental monitoring/ (144759) 10 Renewable Energy/ 11 Carbon Footprint/ 12 environmental impact.ti,ab. 13 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 14 energy usage.ti,ab. 15 energy consumption.ti,ab. 16 exp Energy-Generating Resources/ 17 14 or 15 or 16 18 operat* theatre*.ti,ab. 19 operat* theater*.ti,ab. 20 Operating Rooms/</p>

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		<p>21 Operat* Room*.ti,ab. 22 operating theatre light*.ti,ab. 23 operating theater light*.ti,ab. 24 operating room* light*.ti,ab. 25 operating theatre ventilat*.ti,ab. 26 operating theater ventilat*.ti,ab. 27 operating room ventilat*.ti,ab. 28 air conditioning/ or heating/ or life support systems/ or lighting/ or temperature/ or ventilation/ 29 (air conditioning or heat* or life support system*).ti,ab. 30 ((medical or operating) and equipment).ti,ab. 31 exp "Equipment and Supplies, Hospital"/ 32 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 33 13 and 17 and 32 34 limit 33 to (english language and yr="2017 -Current" and "systematic review")</p>
50	<p>What is the most environmentally sustainable way to maintain a patient's body temperature during an operation?</p>	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 Surgical Procedures, Operative/ 4 Surgical Procedures, Operative/ 5 1 or 2 or 3 or 4 6 1 or 2 or 3 or 4 or 5 7 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 8 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 9 Carbon Footprint/ or Environmental Pollution/</p>

		<p>10 7 or 8 or 9</p> <p>11 patient* body temperature*.ti,ab.</p> <p>12 body temperature*.ti,ab.</p> <p>13 Body Temperature/</p> <p>14 11 or 12 or 13</p> <p>15 force* air warm* device*.ti,ab.</p> <p>16 Body Temperature Regulation/ or Intraoperative Complications/</p> <p>17 underbod* warmer*.ti,ab.</p> <p>18 fluid warmer*.ti,ab.</p> <p>19 patient* warmer*.ti,ab.</p> <p>20 reflective blanket*.ti,ab.</p> <p>21 15 or 16 or 18 or 19 or 20</p> <p>22 5 and 10 and 14 and 21</p> <p>23 limit 22 to (english language and yr="2017 -Current" and "systematic review")</p> <p>24 5 and 10 and 14</p> <p>25 limit 24 to (english language and yr="2017 -Current" and "systematic review")</p> <p>26 14 or 21</p> <p>27 5 and 10 and 26</p> <p>28 limit 27 to (english language and yr="2017 -Current" and "systematic review")</p>
51	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p> <p>4 Postoperative care/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-</p>

		<p>heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>8 Carbon Footprint/ or Environmental Pollution/</p> <p>9 6 or 7 or 8</p> <p>10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>11 Product Packaging/</p> <p>12 Surgical Instruments/</p> <p>13 Recycling/</p> <p>14 Waste Management/</p> <p>15 10 or 11 or 12 or 13 or 14</p> <p>16 repair*.ti,ab.</p> <p>17 15 or 16</p> <p>18 ((medical or surg*) and (equipment or device* or instrument*)).ti,ab.</p> <p>19 disposable equipment/ or exp "equipment and supplies, hospital"/</p> <p>20 exp Surgical Instruments/</p> <p>21 exp Surgical Equipment/</p> <p>22 18 or 19 or 20 or 21</p> <p>23 5 and 9 and 17 and 22</p> <p>24 limit 23 to (english language and yr="2017 -Current" and "systematic review")</p>
52	How can care packages which aim to enable rapid recovery from surgery (e.g., ERAS) affect the environmental impact of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p> <p>4 Surgical Procedures, Operative/</p>

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6 1 or 2 or 3 or 4 or 5
7 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
8 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
9 Carbon Footprint/ or Environmental Pollution/
10 7 or 8 or 9
11 patient* body temperature*.ti,ab.
12 body temperature*.ti,ab.
13 Body Temperature/
14 11 or 12 or 13
15 force* air warm* device*.ti,ab.
16 Body Temperature Regulation/ or Intraoperative Complications/
17 underbod* warmer*.ti,ab.
18 fluid warmer*.ti,ab. (
19 patient* warmer*.ti,ab.
20 reflective blanket*.ti,ab.
21 15 or 16 or 18 or 19 or 20
22 5 and 10 and 14 and 21
23 limit 22 to (english language and yr="2017 -Current" and "systematic review")
24 5 and 10 and 14
25 limit 24 to (english language and yr="2017 -Current" and "systematic review")
26 14 or 21
27 5 and 10 and 26
28 limit 27 to (english language and yr="2017 -Current" and "systematic review")
29 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
30 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word,

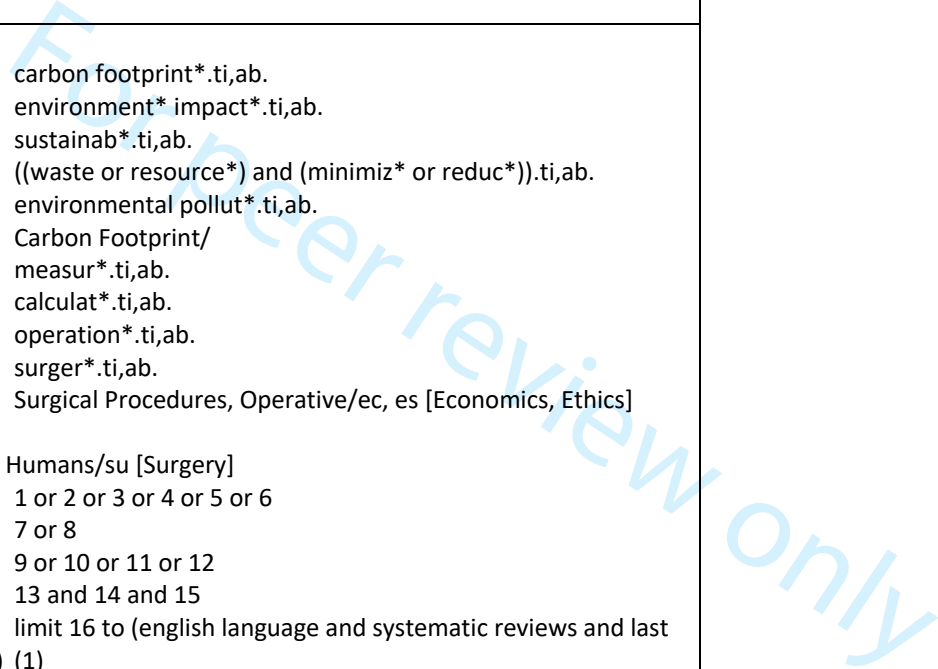
		<p>protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>31 Surgical Procedures, Operative/ 32 Postoperative Care/ 33 29 or 30 or 31 or 32 34 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>35 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 36 Carbon Footprint/ or Environmental Pollution/ 37 34 or 35 or 36 38 rapid recover*.ti,ab. 39 ((surg* or operat*) and recover*).ti,ab. 40 38 or 39 41 care package*.ti,ab. 42 ERAS.ti,ab. 43 Enhanced Recovery after Surgery.ti,ab. 44 41 or 42 or 43 45 33 and 37 and 40 and 44 46 limit 45 to (english language and yr="2017 -Current" and "systematic review") 47 postoperative recover*.ti,ab. 48 post operative recover*.ti,ab. 49 Postoperative Care/ 50 40 or 47 or 48 or 49 51 33 and 37 and 44 and 50 52 limit 51 to (english language and yr="2017 -Current" and "systematic review")</p>
53	How can waste from medical gas cylinders be reduced?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word,</p>

		<p>keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/ 4 Carbon Footprint/ or Environmental Pollution/ 5 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 6 Product Packaging/ 7 Surgical Instruments/ or Recycling/ or Waste Management/ 8 Postoperative Care/ 9 1 or 2 or 3 or 8 10 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 11 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 12 4 or 10 or 11 13 5 or 6 or 7 14 medical gas cylinder*.ti,ab. 15 cylinder*.ti,ab. 16 gas cylinder*.ti,ab. 17 14 or 15 or 16 18 9 and 12 and 13 and 17</p>
54	<p>What effect do standards, guidelines and quality improvement initiatives have on the environmental impact of operations?</p>	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 Surgical Procedures, Operative/ 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word,</p>

		<p>protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 Postoperative Care/ 5 1 or 2 or 3 or 4 6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ (20296) 9 6 or 7 or 8 10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. (8527) 11 Product Packaging/ 12 Surgical Instruments/ 13 Recycling/ or Waste Management/ 14 10 or 11 or 12 or 13 15 (standard* or policy or policies or guideline*).ti,ab. 16 Reference Standards/ 17 policy/ 18 Practice Guideline/ or Guideline/ or Guideline Adherence/ 19 Quality Improvement/ 20 quality improve* initiative*.ti,ab. 21 15 or 16 or 17 or 18 or 19 or 20 22 5 and 9 and 14 and 21 23 limit 22 to (english language and yr="2017 -Current" and "systematic review")</p>
55	<p>What is the most sustainable method to launder clothing worn when delivering care around an operation?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 environmental pollut*.ti,ab. 7 Health Services Accessibility/ 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 (launder* or laundry).ti,ab.</p>

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		<p>10 (wash* and clothe*).ti,ab. 11 Surgical Attire/ or Clothing/ 12 (operation* and care).ti,ab. 13 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 14 9 or 10 or 11 15 12 or 13 16 8 and 14 and 15 17 limit 16 to (english language and yr="2017 -Current" and "systematic review")</p>
56	How do we measure the carbon footprint of an operation?	<p>1 carbon footprint*.ti,ab. 2 environment* impact*.ti,ab. 3 sustainab*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 environmental pollut*.ti,ab. 6 Carbon Footprint/ 7 measur*.ti,ab. 8 calculat*.ti,ab. 9 operation*.ti,ab. 10 surger*.ti,ab. 11 Surgical Procedures, Operative/ec, es [Economics, Ethics] 12 Humans/su [Surgery] 13 1 or 2 or 3 or 4 or 5 or 6 14 7 or 8 15 9 or 10 or 11 or 12 16 13 and 14 and 15 17 limit 16 to (english language and systematic reviews and last 5 years) (1)</p>
57	How can the different types of environmental impacts (e.g., global warming, waste, resource utilisation) associated with care during and around the time of an operation be prioritised and balanced against one another?	<p>1 environment* impact*.ti,ab. 2 sustainab*.ti,ab. 3 carbon footprint*.ti,ab. 4 environmental pollut*.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 global warming.ti,ab. 7 Environment/ 8 Global Warming/ or Environmental Pollution/ 9 Sustainable Development/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9</p>



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58	What is the most sustainable way to provide lighting in the operating theatre?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 green* energy.ti,ab. 6 Sustainable Development/ or Global Health/ 7 Carbon Footprint/ or Greenhouse Effect/ 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 light*.ti,ab. 10 light* source*.ti,ab. 11 Light/ 12 Lighting/</p>

		<p>13 9 or 10 or 11 or 12 14 operating theatre*.ti,ab. 15 operating theater*.ti,ab. 16 operating room*.ti,ab. 17 operating suite*.ti,ab. 18 Operating Rooms/ 19 14 or 15 or 16 or 17 or 18 20 8 and 13 and 19 21 limit 20 to (english language and systematic reviews and last 5 years)</p>
59	How can environmental sustainability be incorporated into the organisational management of operating theatres?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 green* energy.ti,ab. 6 Sustainable Development/ 7 environment/ or carbon footprint/ 8 Environmental Pollution/ 9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 10 organi?ation* manag*.ti,ab. 11 organi?ation* admin*.ti,ab. 12 organisational management.mp. 13 organizational management.mp. 14 organisation* admin*.mp. 15 10 or 11 or 12 or 13 or 14 16 operating theatre*.ti,ab. 17 operating theater*.ti,ab. 18 operating room*.ti,ab. 19 operating suite*.ti,ab. 20 Operating Rooms/ 21 16 or 17 or 18 or 19 or 20 22 9 and 15 and 21 23 limit 22 to (english language and yr="2017 -Current" and systematic reviews</p>
60	How can the provision and administration of medicines to patients undergoing operations be made more environmentally sustainable?	<p>1 ((provision or adminis*) and medicine*).ti,ab. 2 ((manufactur* or deliver* or stor*) and medicine*).ti,ab. 3 medicine*.mp. and prescri*.ti,ab. 4 prescription drug/ or prescription/ 5 1 or 2 or 3 or 4</p>

1		6	operation*.ti,ab.
2		7	surger*.ti,ab.
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4			peri op*).ti,ab.
5		9	perioperative medicine/ or perioperative period/
6		10	surgery/
7		11	6 or 7 or 8 or 9 or 10
8		12	sustainab*.ti,ab.
9		13	environment* impact*.ti,ab.
10		14	((waste or resource*) and (minimiz* or reduc*)).ti,ab.
11		15	carbon footprint*.ti,ab.
12		16	environment/ or environmental impact/
13		17	carbon footprint/
14		18	12 or 13 or 14 or 15 or 16 or 17
15		19	5 and 11 and 18
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17			5 years)

Peer review only

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Greener Operations: a James Lind Alliance Priority Setting Partnership to define research priorities in environmentally sustainable peri-operative practice through a structured consensus approach

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Title page

Greener Operations: a James Lind Alliance Priority Setting Partnership to define research priorities in environmentally sustainable peri-operative practice through a structured consensus approach

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Abstract

Objectives: To agree the 'top 10' research priorities for environmentally sustainable peri-operative practice.

Design: surveys and literature review; final consensus workshop using a nominal group technique.

Setting: UK-based.

Participants: healthcare professionals, patients, carers, and the public.

Outcome measures: initial survey- suggested research questions; interim survey- shortlist of 'indicative' questions (the 20 most frequently nominated by patients, carers and the public, and healthcare professionals); final workshop- ranked research priorities.

Results: initial survey- 1,926 suggestions by 296 respondents, refined into 60 indicative questions. Interim survey- 325 respondents. Final workshop- 21 participants agreed the 'top 10':

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 (obtain) 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 practices 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 (e.g., different types of general, regional and local anaesthesia) 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 (e.g., PPE, drapes, clean air ventilation)?

Conclusions: a broad range of 'end-users' have identified research priorities for sustainable peri-operative care.

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Strengths and Limitations of this Study.

- The James Lind Alliance process is consensus-based, transparent, and includes measures to ensure that patient, carer and public opinions are represented.
- Patients, carers, and members of the public comprised 21% of survey respondents overall, a smaller proportion than in many priority setting partnerships. This may have been because of the online methods used (due in part to the COVID-19 pandemic) or the novel subject matter.
- We ensured that 'healthcare professional' and 'patient, carer and public' priorities were given equal weighting at the interim priority setting stage.
- The scope of our work was limited to 'care provided from or in the hospital setting to patients who may benefit from surgical management' so does not include the full patient journey; future sustainability-focussed priority setting partnerships would be beneficial.
- In common with all Priority Setting Partnerships, our methodology relied on active and voluntary participation, so it is possible that self-selection bias may have affected the results

Original Protocol of the Study

See <https://www.jla.nihr.ac.uk/documents/greener-operations-sustainable-peri-operative-practice-ppp-protocol/27106>

Data Availability Statement

All data relevant to the study are included in the article or uploaded as supplementary information. A data sheet, detailing the 60 indicative questions and including a representative sample of initial suggestions is available on the James Lind Alliance website at <https://www.jla.nihr.ac.uk/priority-setting-partnerships/greener-operations-sustainable-perioperative-practice/>

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Competing Interests Statement

CS is a co-opted member of the Association of Anaesthetists Environment and Sustainability Committee. He has received travel expenses from the Association of Anaesthetists, the Centre for Sustainable Healthcare and Health Education England to attend professional meetings to speak on sustainable healthcare. He is a member of the SBRI Healthcare 'Delivering a Net Zero NHS' competition funding panel. YH is a co-founder of Green Health Wales. CL is a member of the Health Education England North East and North Cumbria Faculty of Sustainable Healthcare and the Intensive Care Society Sustainability Group. DM has accepted consulting fees from Bausch and Lomb and Nuffield Health, and honoraria for education provided to Wilderness Medical Training. SMK is the chairperson of the Association of Anaesthetists Environment and Sustainability Committee. VP is vice chairperson of the Royal College of Surgeons of England Sustainability in Surgery Group. TR is an independent participant in the OneTogether programme. DJ is the budget holder for account

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managed within MFT Charity used to fund Greener Operations. The other authors have no competing interests to declare.

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Introduction

It is increasingly recognised that healthcare, as a resource-intensive industry, makes a significant contribution to environmental harms such as global warming and pollution.¹ In turn, these environmental harms contribute to ill health, thereby creating an increased demand for healthcare services.² In the UK, National Health Service trusts are recognised as an ‘anchor institutions’, large organisations that influence the health and wellbeing of their communities not only through providing healthcare – but through practices in procurement, employment, community engagement and environmental responsibility.³ Recently, healthcare systems,⁴ professional societies,^{5,6} and educational regulators⁷⁻⁹ have begun to issue guidelines and implement plans aiming to mitigate the carbon footprint and ecological impacts of healthcare. This rapid expansion of interest in the area is both necessary and welcome but presents its own challenges. Though there are several high-impact measures that should be urgently implemented (e.g., decarbonisation of electricity production),⁴ it is universally acknowledged that achieving sustainable healthcare will require research and innovation.⁴⁻⁶

Between 220 and 344 million operations are thought to be performed worldwide every year,¹⁰ a number which will increase as the Lancet Commission on Global Surgery target of 5,000 operations per 100,000 population (approximately 30% higher than at present) is approached.¹¹ The peri-operative journey, from initial consultation to surgery and then discharge from hospital and recovery, is a complex process that involves many groups of hospital staff. Operations are known to be among the most resource-intensive healthcare interventions;¹² each operating theatre creates over two tonnes of solid waste per year,¹³ and a single operation can generate a ‘carbon footprint’ equivalent to driving more than 2,000 miles.¹⁴ Peri-operative practice therefore represents a significant opportunity to make healthcare more environmentally sustainable. This opportunity has not gone unrecognised, and recent years have seen a proliferation in research funding, fellowship posts, and publications relating to sustainability in the peri-operative period.¹⁵⁻¹⁷

Noting the increasing interest in research relating to sustainability in peri-operative practice, we felt that this represented an ideal subject for a James Lind Alliance (JLA) Priority Setting Partnership (PSP), in order to direct and inform future research.

The JLA is a not-for-profit organisation, founded to address evidence uncertainties in specific areas of research through collaboration between patients, carers and clinicians.¹⁸ Using an ‘open-to all’ survey-based approach the JLA seeks to engage the ‘end users’ of research to help direct funding to the areas of greatest need, thereby minimising biases caused by financial or purely scientific research motives. Since its founding in 2004, it has facilitated more than 140 PSPs, developing a robust methodology to identify the ‘top 10’ research priorities in a given subject area.¹⁹

In 2019, we were successful in our application to the JLA to run ‘Greener Operations’, a PSP which aimed to identify the top 10 unanswered research questions connected to environmentally sustainable peri-operative practice, as defined by an expansive group of patients, carers, members of the public and healthcare workers. We believe this to be the first PSP to be conducted in any field of sustainable healthcare.

Methods

The Greener Operations PSP was conducted according to the standard JLA methodology by a team comprising project leads (consultant surgeon DJ and consultant anaesthetist CS) information

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3 specialists (anaesthesia research fellows HN and MCS), a multidisciplinary steering group composed
4 of healthcare professionals and patient and public representatives, and a James Lind Alliance advisor
5 (JG).²⁰ The PSP was supported by partner organisations involved or interested in peri-operative care,
6 such as professional associations, royal colleges, and patient groups. Potential participants were
7 provided with an explanation of what each phase of the project involved, including how the data
8 would be used, as described below. Written consent was not requested from participants.
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11 12 13 **Ethics Approval Statement**

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15 As this was a patient and public involvement project, based on surveys which were available to all on
16 a voluntary basis, research ethics committee approval was not required.²⁰
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19 20 **Setting up the priority setting partnership**

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22 Following approval of charitable funding, the PSP was established in August 2020 by the project
23 leads. Two information specialists were appointed, to be responsible for managing the surveys and
24 data analysis, and an advisor was assigned by the JLA. Partner organisations (detailed in
25 Acknowledgements), responsible for promoting the PSP and ensuring that surveys reached as wide
26 an audience as possible, were recruited by the project leads by email contact with organisational
27 representatives. The steering group was formed by inviting expressions of interest from individuals
28 linked to the partner organisations (e.g., members of environmental or peri-operative committees or
29 working groups). We aimed to recruit a wide range of healthcare professionals involved in peri-
30 operative practice, including surgeons, anaesthetists, nurses, operating department practitioners
31 and pharmacists. In addition, the steering group included non-clinical healthcare professionals
32 involved in sustainability (a manager, an educator, and a sustainability officer), and individuals with
33 lived experience of undergoing surgery who could represent patients' interests.
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37 Because of ongoing COVID-19 pandemic and a desire to minimise the environmental impacts of the
38 project itself, it was agreed by the steering group that all meetings would be held online. The
39 meetings were chaired by the JLA advisor, and conducted using a video-conferencing platform
40 (Zoom, Zoom Video Communications, Inc, San Jose, California, USA).
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43 44 **Defining scope**

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46 At the initial meeting of the steering group, the study protocol and scope of the PSP were
47 confirmed.²¹ Though we recognised that the complete perioperative journey often commences and
48 ends in the community, for pragmatic reasons we defined 'peri-operative practice' as being provided
49 from or in the hospital setting to patients who may benefit from surgical management, including:
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- 51 • pre-operative assessment and optimisation (e.g. pre-operative clinic)
- 52 • counselling and shared decision-making (including on decisions regarding the
- 53 appropriateness of surgery, and different approaches to peri-operative management)
- 54 • pre and postoperative hospital care (including outpatient, ambulatory, virtual and inpatient
- 55 care)
- 56 • intra-operative management (including surgical and anaesthetic techniques)
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- both clinical (e.g. surgical and anaesthetic techniques) and non-clinical (e.g. energy, water, waste management and recycling) aspects
- the implementation of these practices within organisations and departments
- achieving positive peri-operative outcomes

Care beyond the early post-operative period (e.g. prolonged rehabilitation), broader aspects of environmental sustainability, and non-UK practice were considered out-of-scope, along with questions relating to denying management of illness purely on the basis of environmental sustainability.

Gathering uncertainties

An initial online survey (SurveyMonkey, Momentive, San Mateo, California, USA) was used to invite patients, carers, healthcare professionals, and members of the public to suggest evidence uncertainties connected with sustainable peri-operative care. Respondents were asked to state, via free-text boxes, what questions they felt needed to be answered by future research to help make peri-operative practice more environmentally sustainable. To help respondents to consider the full scope of the peri-operative patient journey, we asked them to consider the pre-, intra- and postoperative phases, and also invited any further suggestions. In addition to suggested questions, demographic data were collected. After a pilot within the steering group, the initial survey was launched online on 10th May 2021, and disseminated through partner organisations (see Acknowledgements), the project website, and social media, using a web link and quick response (QR) code. Demographic data were routinely reviewed to consider whether the survey was successfully reaching all stakeholder groups. The survey remained open for 17 weeks, until 31st August 2021.

Data processing

After closing the survey, the raw data were downloaded for processing and analysis. To maintain data integrity and facilitate cross checking, each respondent was assigned a unique code number, with each individual response assigned a sub-code. Suggestions were assessed independently by the information specialists to determine whether they were in-scope or out-of-scope, based on the criteria in the PSP protocol. Where both information specialists agreed that a suggestion was out of scope, that suggestion was not analysed further. Suggestions that did not clearly fall in or out of scope were kept for further analysis, to ensure potentially relevant suggestions were not missed.

To aid with analysis, suggestions were categorised into themes by the information specialists based on subject matter. The themes and suggestions were then reviewed by members of the steering group to form a list of indicative questions, agreed by consensus. Suggestions that were deemed to be similar were combined to form a single indicative question; others that were deemed to be too broad were split into separate questions. Each in-scope suggestion was allocated to a minimum of one appropriate indicative question to ensure all data were kept in the analysis.²⁰ The steering group then cross-checked the list of indicative questions with the individual suggestions to ensure that the meaning of the suggestions was captured appropriately.

Literature review

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1
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3 A literature review was undertaken to identify if any of the indicative questions had already been
4 answered by currently available research. Following standard JLA principles, questions were
5 categorised as having been answered 'completely', 'partially', or 'not at all'.²⁰ For a question to be
6 deemed 'answered completely', a relevant, up-to-date and reliable systematic review or national
7 clinical guideline that addressed the question would be required. If no relevant reviews or guidelines
8 were found, the question would be deemed 'not at all' answered. If reviews or guidelines were
9 identified that didn't meet the criteria for 'completely' answering the question (e.g., only partly
10 relevant or with clear methodological concerns) the question would be deemed 'partially answered'.
11 For each indicative question, we worked with a healthcare librarian (OS) to search relevant
12 databases (EMBASE, CINAHL, Medline and the Cochrane Database of Systematic Reviews; see
13 Appendix, Table A1), and reviewed guidelines from the National Institute for Health and Care
14 Excellence, the Scottish Intercollegiate Guidelines Network, and relevant Royal Colleges and
15 professional associations. In addition, members of the steering group who were members of
16 professional organisations checked if there were any guidelines 'in press'. The findings of the
17 literature review were reviewed by the steering group who decided whether any questions could be
18 deemed to be answered completely. Questions that had some evidence available that did not meet
19 the criteria for being completely answered were classified as partially answered, and these
20 questions, along with the unanswered ones, were taken forward into the interim survey.

21 22 23 24 25 26 27 **Interim priority setting**

28
29 A second online survey (SurveyMonkey, Momentive, San Mateo, California, USA) was used to rank
30 the long list of indicative questions to generate a shortlist of the most important questions that
31 could then be discussed at the final prioritisation workshop. Respondents were presented with the
32 indicative questions, displayed in a random order unique to each respondent, and asked to select
33 the 10 questions they felt were most important. In addition, routine demographic data were
34 collected. The survey was open for six weeks from 19th April to 30th May 2022. Following this, the
35 raw data were analysed to identify the questions selected the most frequently. To moderate the
36 influence of unequal numbers of respondents from different backgrounds, equal weighting was
37 given to the overall question rankings from the healthcare professionals, and the overall rankings
38 from respondents who classified themselves as patients, carers or members of the public. The 20
39 questions most frequently selected by these two groups were taken forward to the final priority
40 setting workshop

41 42 43 44 45 46 **Final priority setting workshop**

47
48 The final priority setting workshop aimed to rank the priorities taken forward from the interim
49 priority setting stage, to identify the top 10 priorities. It was a one-day in-person event, conducted
50 according to a nominal group technique,²² chaired and facilitated by a team of advisors from the JLA.
51 Respondents to the interim survey were invited to express an interest in participating in the
52 workshop, and invitations were made using a purposive approach in order to promote a balanced
53 group in terms of background (healthcare professional or patient, carers or member of the public).
54 Participants were asked, in advance, to consider the importance of the questions for discussion. The
55 JLA advisors allocated participants to three small groups of up to 10 people, aiming for a diverse mix
56 of backgrounds in each group. The process comprised five phases:²⁰

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1. Small group discussions: participants listed the three questions they felt were most important for research, and the three that they felt were least important. These were recorded by the facilitator, and an opportunity for further discussion and clarification was provided.
 2. First round of small group ranking: in the same groups, the facilitator laid out the questions, printed on cards, in rough groupings: those which were thought to be most important by group members, those thought to be least important, and those not mentioned or where there was divergence of views. Group participants then prioritised all of the questions by moving the cards into rank order. The ranking scores of the interim survey were made available to participants at this phase, to assist with ranking decisions.
 3. Plenary review: the ranking agreed by each group was entered into a spreadsheet, and assigned a value (highest rank = 1, second highest = 2, etc). These ranks were combined by addition to create an aggregate ranked list. The aggregate ranks were presented to all workshop participants in plenary, with an opportunity for discussion.
 4. Second round of small group ranking: participants were allocated to new groups by the JLA advisors, aiming to maintain a balance of backgrounds and expose participants to a different range of views. These new groups discussed and revised the aggregate ranked list, again by moving cards positioned to reflect the rank order.
 5. Final plenary review: as per phase 3, the small group scores were entered into a spreadsheet, and combined by addition. The aggregate ranking was presented to all workshop participants in plenary, with the cards laid out in order. The ranking was discussed in plenary group, in order to agree the final ranking.

The final workshop discussions were chaired by trained JLA advisers to ensure that no one group or individual dominated the decision making. The aim was to reach agreement by consensus at the end of each phase, with decisions made by majority vote if consensus could not be reached.

Patient and Public Involvement

How was the development of the research question and outcome measures informed by patients' priorities, experience, and preferences?

- Four members of the steering group were patient and public representatives, who contributed to the development of the protocol for the PSP.

How did you involve patients in the design of this study?

- The patient and public members participated fully in all duties of the steering group, including the design of the surveys, and the definition and wording of the indicative questions.

Were patients involved in the recruitment to and conduct of the study?

- The patient and public representatives participated in developing the recruitment strategy, liaising with partner organisations, producing explanatory documents and analysing the study data.

How will the results be disseminated to study participants?

- In addition to this paper, we have produced a short video explaining the process and outcomes, uploaded the results to the James Lind Alliance website, shared the findings via

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social media, and will work with our patient and public representatives to produce a plain English summary document.

Results

Two hundred and ninety-six individuals responded to the initial survey, of whom 230 (77.7%) classified themselves as healthcare professionals, 40 (13.5%) as members of the public, 21 (7.1%) as patients, and three (1.0%) as carers. Detailed demographics are displayed in table 1.

Respondents to the initial survey suggested 1,926 uncertainties for research. After initial review, we removed 309 suggestions agreed to be out-of-scope. After thematic categorisation of the remaining 1,617 suggestions, 78 themes were identified. This was further consolidated to 60 indicative questions by steering group consensus.

The literature review revealed that none of the indicative questions had been completely answered by currently available research (Appendix Table A2). Members of the steering group who were part of professional bodies confirmed there were no relevant upcoming guidelines from their respective organisations that would answer the questions. Twenty-three questions were found to be partially answered by the available evidence. Therefore, all 60 indicative questions were included in the interim survey.

Three hundred and twenty-five individuals responded to the interim survey, of whom 254 (78.2%) classified themselves as healthcare professionals, 45 (13.8%) as members of the public, 19 (5.8%) as patients, and two (0.6%) as carers. Detailed demographics are displayed in table 1.

	Initial Survey	Interim Survey
Total responses	296	325
Gender		
Woman (including trans woman)	171 (57.8%)	187 (57.5%)
Man (including trans man)	110 (37.2%)	122 (37.5%)
Non-binary	4 (1.4%)	0 (0%)
Prefer not to say	8 (2.7%)	7 (2.2%)
Other	1 (0.3%)	4 (1.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Age		
Under 18	0 (0%)	0 (0%)
18-25	5 (1.7%)	7 (2.2%)
26-40	84 (28.6%)	139 (42.8%)
41-60	139 (47.3%)	130 (40.0%)
61-80	57 (19.4%)	38 (11.7%)
Over 80	3 (1.0%)	0 (0%)
Prefer not to say	6 (2.0%)	6 (1.9%)
Question skipped	2 (0.7%)	5 (1.5%)
Ethnic group		
White	230 (77.7%)	258 (79.4%)
Asian or Asian British	34 (11.5%)	33 (10.1%)
Black, African Caribbean or Black British	3 (1.0%)	2 (0.6%)
Mixed or Multiple Ethnic Groups	6 (2.0%)	13 (4.0%)
Other ethnic group	3 (1.0%)	3 (0.9%)

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Prefer not to say	18 (6.1%)	11 (3.4%)
Question skipped	2 (0.7%)	5 (1.5%)
Region		
North West England	82 (27.7%)	115 (35.4%)
North East England	35 (11.8%)	31 (9.5%)
West Midlands	12 (4.1%)	21 (6.5%)
East Midlands	17 (5.7%)	14 (4.3%)
London	33 (11.1%)	28 (8.6%)
South West England	18 (6.1%)	19 (5.8%)
South East England	52 (17.6%)	43 (13.2%)
Scotland	9 (3.0%)	14 (4.3%)
Wales	18 (6.1%)	6 (1.8%)
Northern Ireland	2 (0.7%)	4 (1.2%)
Outside UK	7 (2.4%)	18 (5.5%)
Prefer not to say	9 (3.0%)	7 (2.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Background		
Patient	21 (7.1%)	19 (5.8%)
Carer	3 (1.0%)	2 (0.6%)
Member of the public	40 (13.5%)	45 (13.8%)
Healthcare Professional	230 (77.7%)	254 (78.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Profession (if healthcare professional)		
Advanced practitioner	2 (0.9%)	4 (1.6%)
Anaesthesia associate	4 (1.7%)	2 (0.8%)
Dentist	2 (0.9%)	2 (0.8%)
Doctor	142 (61.7%)	172 (67.7%)
Healthcare Assistant	4 (1.7%)	0 (0%)
Nurse	23 (10.0%)	16 (6.3%)
Operating department practitioner	7 (3.0%)	20 (7.9%)
Non-clinical role	3 (1.3%)	6 (2.4%)
Midwife	0 (0%)	4 (1.6%)
Paramedic	1 (0.4%)	0 (0%)
Perfusionist	1 (0.4%)	0 (0%)
Pharmacist	10 (4.3%)	1 (0.4%)
Physiotherapist	2 (0.9%)	0 (0%)
Porter	1 (0.4%)	0 (0%)
Radiographer	0 (0%)	1 (0.4%)
Other	15	24 (9.4%)
Question skipped	13 (5.7%)	2 (0.8%)

Table 1: demographic details of respondents to the initial and interim Greener Operations surveys

The number of selections for each question was ranked separately according to whether respondents were healthcare professionals, or patients, carers and members of the public. A fractional ranking technique (tied ranks being assigned the mean of the ranking positions) was used to identify the 20 highest-ranked questions for each group, 14 of which were common to both groups (table 2). This led to 25 questions progressing into the final prioritisation workshop.

Question	Healthcare Professional Interim Rank	Patient, Carer and Public Interim Rank	Combined Interim Rank
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1	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	1	1.5	1
2				
3	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	3	1.5	2
4				
5	How can the amount of waste generated during and around the time of an operation be minimised?	2	3.5	3
6				
7	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g., PPE, drapes, clean air ventilation)?	4	3.5	4
8				
9	How much recyclable waste generated during an operation is being appropriately recycled?	5	5.5	5
10				
11	How do we define and avoid low-benefit or unnecessary operations?	12	7	6
12				
13	How can more sustainable reusable equipment safely be used during and around the time of an operation?	16	5.5	7
14				
15	How do we measure the carbon footprint of an operation?	14	10	8
16				
17	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	12	13	9.5
18				
19	How can energy usage within an operating theatre be safely reduced?	8	17	9.5
20				
21	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?	10	17	11
22				
23	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	9	21	12.5
24				
25	Can alternative, more environmentally sustainable, methods of disposal be used for waste that is generated during and around the time of an operation?	6	24	12.5
26				
27	How can environmental sustainability be incorporated into the organisational management of operating theatres?	15	17	14.5
28				
29	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?	22	10	14.5
30				
31	What is the most sustainable way of providing equipment packs for an operation?	19.5	13	16.5
32				
33	What is the most sustainable way to sterilise equipment used during an operation?	19.5	13	16.5
34				
35	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	27.5	10	18
36				
37	How can the waste of drugs be avoided during and around the time of an operation?	21	17	19
38				
39	How can drug syringes be used better to reduce their environmental impact?	12	26.5	20
40				
41	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?	38.5	8	22
42				
43	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	7	40.5	23.5
44				
45	How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	35	17	26
46				
47	What are the barriers to using more sustainable anaesthetic practices?	18	40.5	28.5
48				
49	How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?	17	50.5	32
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Table 2: highest-ranked indicative questions in the interim survey. Left column, healthcare professionals; mid column, patients, carers and members of the public; right column, combined

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rank. The top 20 questions for each group are highlighted in green. The combined rank (used for data organisation only) was calculated by adding the two rank scores, then ranking the added scores.

A total of 21 individuals attended the final prioritisation workshop, of whom eight classified themselves as patients, carers or members of the public, and 13 as healthcare professionals. The healthcare professionals comprised three surgeons, one operating department practitioner, five anaesthetists, one medical student, one foundation doctor, one optometrist, and one sustainability officer. Three of the patient, carer and public representatives were also members of the Greener Operations steering group. We noted that four of the patient, carer and public representatives had worked in healthcare at some point in their careers. Five observers from stakeholder organisations (e.g., the National Institute for Health and Care Research, Greener NHS) and the Greener Operations project leads and information specialists were present but did not take part in the prioritisation discussions. The 25 indicative questions were ranked, and the top 10 priorities for research into sustainable peri-operative practice were agreed (table 3). All decisions were reached by consensus, with no majority votes required.

Rank	Question
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 (obtain) 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 practices 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 (e.g., different types of general, regional and local anaesthesia) 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 (e.g., PPE, drapes, clean air ventilation)?
11	How do we measure the carbon footprint of an operation?
12	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?
13	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?
14	How can the waste of drugs be avoided during and around the time of an operation?
15	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?
16	How do we define and avoid low-benefit or unnecessary operations?
17	How can energy usage within an operating theatre be safely reduced?
18	What are the barriers to using more sustainable anaesthetic practices?
19	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?
20	Can alternative, more environmentally sustainable, methods of disposal be used for waste that is generated during and around the time of an operation?
21	What is the most sustainable way of providing equipment packs for an operation?
22	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?
23	How much recyclable waste generated during an operation is being appropriately recycled?
24	What is the most sustainable way to sterilise equipment used during an operation?

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25	How can drug syringes be used better to reduce their environmental impact?
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Table 3: Ranked research priorities from the final Greener Operations Priority setting workshop. The 'Top 10' are highlighted in green.

Discussion

The Greener Operations PSP has identified the top 25 research priorities for sustainable peri-operative practice, with an emphasis on the top 10. This provides a robust basis for end-user focussed research into mitigating the environmental impacts of a resource-intensive area of healthcare at a time of climate crisis.⁴ Despite a recent increase in the number of publications into sustainable healthcare in the peri-operative period,²² this remains a relatively under-investigated area - as indicated by our literature review that revealed no 'completely answered' indicative questions. Though there are established sustainability measures that are already being implemented at scale (e.g., anaesthetic gas mitigation, reusable surgical drapes), research will be required to understand how a fully sustainable healthcare system can be achieved.⁴ Furthermore, implementation research will be required to identify how to achieve some of the behavioural elements (e.g., changes in practice) that have been identified as important but not yet integrated into practice. The top 10 research priorities relate to research uncertainties across multiple areas of research interest, including implementation (priorities 1 and 3), manufacturing and supply (priority 2), management (priorities 4 and 9), waste (priorities 1 and 5), surgery (priority 6), anaesthesia (priority 7), medical ethics (priority 8), economics (priority 8 and 9) and infection control (priority 10). This both underlines the interdisciplinary relevance of the PSP and highlights the complexity of the sustainability challenge faced by healthcare.²³

Our PSP had an above average overall number of suggestions in the primary survey (1,926, compared to the mean of 1,723),²⁴ with each respondent contributing more than six suggestions on average. This is likely to be representative of the enthusiasm for this area of study amongst the participants. Whilst the JLA process aims to engage a broad range of respondents, it is not uncommon for PSPs to have an imbalance in the background of survey respondents.²⁵⁻²⁸ Our PSP had a preponderance of healthcare professional respondents, with 78.2% fitting into this category across both surveys. Our use of internet-based approaches e.g., social media and online surveys, may have contributed to the imbalance of respondents, as the likelihood of having had an operation (therefore feeling more informed to comment on the peri-operative process) increases with age, whereas internet usage is inversely proportional to age.^{29,30} Methods to address this such as in-person or paper surveys (e.g., made available at patient encounters such as clinics as in other PSPs) were not feasible for our project given the restrictions on social contact owing to the COVID-19 pandemic at the time of the work. However, we are confident that the overall results were representative of both healthcare and non-healthcare groups, because the JLA methodology controls for imbalances in survey response numbers, and also because the results of the interim survey showed strong alignment in priorities between both groups (Table 2). This was further strengthened through active patient, carer and public participation in the final workshop. In common with all PSPs, our methodology relied on active and voluntary participation, it is possible that self-selection bias may have affected the results, for example by emphasising the views of 'environmentally conscious' individuals who may have been more motivated to be involved.

The Greener Operations priorities should provide a valuable resource for researchers and funders. Based on our literature review, we are confident that none of the identified research priorities have been completely answered by existing research. However, some priorities have attracted a

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3 significant research effort in recent years and have therefore been partially answered. In particular,
4 the 'carbon footprints' of various anaesthetic agents, disposable and re-usable instruments,
5 infection control supplies, and PPE (relating to priorities 1, 7 and 10) have been investigated.³¹⁻³⁵
6 Here, there is an increasing amount of coherent data on climate impacts (i.e., 'carbon footprints'),
7 but other aspects (e.g., the ecotoxic effects of plastic waste and / or drug and metabolite disposal)
8 remain under-investigated.³⁵ Furthermore, sustainable peri-operative care is an area of current
9 innovation, and new developments may render current concepts rapidly outdated.^{36,37} Nevertheless,
10 experts in the field who are aware of the current literature may consider some questions outside the
11 Greener Operations rankings to be of greater priority than some of those within. The PSP process
12 should not be seen to diminish the value of this expertise. Rather, it adds insight into what the end
13 users of research – patients, carers, public and clinicians – perceive to be important about
14 environmentally sustainable peri-operative care. The priority questions are intentionally broad in
15 scope, and we encourage researchers to draw on them in the development of projects. Of note,
16 there appears to be an increasing number of funding calls relevant to this topic area, which we hope
17 will be maintained in the future.^{36,38}
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24 **Conclusion**

25 Greener Operations has identified the top 10 research priorities for sustainable peri-operative care
26 as agreed by a wide range of healthcare professionals, patients, carers and members of the public.
27 Our project has explored a priority area for healthcare and identified a diverse range of research
28 topics for exploration and innovation that will benefit both the NHS and healthcare outside the UK.⁴
29 We hope that our work will be of use to researchers and funders, as part of an urgent and universal
30 effort to achieve high-quality healthcare with minimal environmental harm. Greener Operations is
31 the first PSP undertaken by the JLA in sustainable healthcare and, to our knowledge, the first
32 research priority setting exercise carried out in any field of sustainable healthcare. In addition to
33 agreeing priority research areas for investigation, we have demonstrated that a PSP focussed on
34 sustainable healthcare is feasible. Given the pressing nature of the climate crisis, we hope that
35 colleagues in other fields will draw on our experience to conduct further sustainability-related PSPs,
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57 College of Nursing Perioperative Forum, Royal College of Ophthalmologists, Royal College of
58 Surgeons of Edinburgh, Royal College of Surgeons of England, Society for Cardiothoracic Surgery in
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Appendix – Evidence Checking

Table A1: Search strategies by question. CINAHL = Cumulative Index to Nursing and Allied Health Literature.

	Question	Search Strategy: Cochrane, Embase, CINAHL and Medline.
1	How can care after an operation be optimised to minimise the use of resources and creation of waste whilst providing good care?	1 ((Postop* or "post op*" or periop* or "peri op*" or post-surgery) adj6 care).ti,ab. 2 Postoperative Care/ 3 1 or 2 4 (optimis* or optimiz* or enhance* or improve* or better or best).ti,ab. 5 3 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ 9 6 or 7 or 8 10 5 and 9 11 limit 10 to (yr="2017 -Current" and (meta analysis or "systematic review")) 12 limit 11 to english language
2	Which aspects of care before and after an operation can be provided in the community in a more sustainable way?	1 ((Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery) adj6 care).ti,ab. 2 ((before or prior) adj2 (surgery or operation)).ti,ab. 3 (after adj2 (surgery or operation)).ti,ab. 4 (following adj2 (surgery or operation)).ti,ab. 5 2 or 3 or 4 6 care.ti,ab. 7 5 and 6 8 Preoperative Care/ 9 Postoperative Care/ 10 ("pre-operative investigations" or pre-habilitation).ti,ab. 11 ("post operative" adj3 rehabilitation).ti,ab. 12 (postop adj3 rehabilitation).ti,ab. 13 1 or 7 or 8 or 9 or 10 or 11 or 12 14 exp Community Health Services/ 15 (community or "general practice" or GP or "district nurse*" or "remote clinic" or "remote clinics" or "one-stop clinic" or "one-stop clinics").ti,ab. 16 exp Community Health Nursing/ 17 14 or 15 or 16 18 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 19 Carbon Footprint/ or Environmental Pollution/ 20 (transport* or travel*).ti,ab. 21 18 or 19 or 20 22 13 and 17 and 21 23 limit 22 to (yr="2017 -Current" and (meta analysis or "systematic review"))

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23</p>	<p>3 How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?</p>	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 (following adj2 (surgery or operation)).ti,ab. 4 Postoperative Care/ 5 ((surgery or operation) adj4 (recover* adj3 period*)).ti,ab. 6 Postoperative Period/ 7 1 or 2 or 3 or 4 or 5 or 6 8 Rehabilitation/ 9 exp Self-Help Devices/ 10 ((medical or therap* or rehabilitat* or mobility or mobile) adj5 (aid* or device* or equipment)).ti,ab. 11 8 or 9 or 10 12 (recycl* or reusable or reuse or reutilis* or reutiliz* or reusing or reused).ti,ab. 13 "repeated use".ti,ab. 14 "repeatedly using".ti,ab. 15 "using again".ti,ab. 16 "used again".ti,ab. 17 "use again".ti,ab. 18 "repeated utiliz*".ti,ab. 19 "repeated utilis*".ti,ab. 20 Recycling/ or Equipment reuse/ 21 12 or 13 or 14 or 15 or 18 or 19 or 20 22 7 and 11 and 21 23 limit 22 to (yr="2017 -Current" and (meta analysis or "systematic review"))</p>
<p>24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42</p>	<p>4 Can the supply of medicines after an operation be optimised to minimise waste?</p>	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 (following adj2 (surgery or operation)).ti,ab. 4 Postoperative Care/ 5 ((surgery or operation) adj4 (recover* adj3 period*)).ti,ab. 6 Postoperative Period/ 7 1 or 2 or 3 or 4 or 5 or 6 8 (medicine* or medication* or drug* or prescription*).ti,ab. 9 Medicine/mt, og [Methods, Organization & Administration] 10 exp Pharmaceutical Preparations/ 11 Self Medication/ 12 exp Prescriptions/ 13 8 or 9 or 10 or 11 or 12 14 7 and 13 15 (optimis* or optimiz* or enhance* or improve* or better or best).ti,ab. 16 14 and 15 17 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 18 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 19 Carbon Footprint/ or Environmental Pollution/</p>

		20	17 or 18 or 19
		21	16 and 20
		22	limit 21 to (yr="2017 -Current" and (meta analysis or "systematic review"))
5	How does living a 'greener' lifestyle affect recovery after an operation?	1	(Postop* or "post op*" or post-surgery).ti,ab.
		2	(after adj2 (surgery or operation)).ti,ab.
		3	Postoperative Period/
		4	(following adj2 (surgery or operation)).ti,ab.
		5	1 or 2 or 3 or 4
		6	((affect* or effect* quality or facilitate or aid or help* or assist* or benefit* or speed* or improve or advantag*) adj5 recover*).ti,ab.
		7	5 and 6
		8	(green* adj5 (life or "life style*" or lifestyle* or existence or living)).ti,ab.
		9	(vegan* or vegetarian* or vegetable*).ti,ab.
		10	diet, vegetarian/ or diet, vegan/
		11	((less or reduc* or limit* or omit* or exclud*) adj4 meat*).ti,ab.
		12	vegetarians/ or vegans/
		13	(exercis* or active or activit* or fit or fitness or walk* or running or swim* or gym or sport*).ti,ab.
		14	exp Exercise/
		15	8 or 9 or 10 or 11 or 12 or 13 or 14
		16	7 and 15
		17	(sustainab* or environment* or green* or "carbon footprint").ti,ab.
		18	Carbon Footprint/ or Environmental Pollution/
		19	((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab.
		20	17 or 18 or 19
		21	16 and 20
		22	limit 21 to (yr="2017 -Current" and (meta analysis or "systematic review"))
6	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g. PPE, drapes, clean air ventilation)?	1	ipc.ti,ab.
		2	exp Infection Control/ or Surgical Wound Infection/
		3	(infection adj4 (rate* or incidenc* or occur* or reduc* or improv* or avoid* or prevent* or control*).ti,ab.
		4	1 or 2 or 3
		5	exp Surgical Procedures, Operative/
		6	(Operation* or Surger* or Surgical or Procedure*).ti,ab.
		7	Operating Rooms/
		8	5 or 6 or 7
		9	(clean adj2 air).ti,ab.
		10	ventilat*.ti,ab.
		11	Ventilation/
		12	Surgical Drapes/
		13	Personal Protective Equipment/
		14	PPE.ti,ab.
		15	"personal protective equipment".ti,ab.
		16	(gloves or gown* or mask* or apron* or hat or hats* or "safety glasses" or goggles or shields).ti,ab.

		<p>17 exp Surgical Attire/ 18 ((eye or face or hand or respiratory or body or hearing) adj1 protection).ti,ab. 19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 20 4 and 8 and 19 21 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 22 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 23 Carbon Footprint/ or Enviornmental Pollution/ 24 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 25 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 26 21 or 22 or 23 or 24 or 25 27 20 and 26 28 limit 27 to (yr="2017 -Current" and (meta analysis or "systematic review")) 29 limit 28 to english language</p>
7	<p>What effect does pre-habilitation (e.g., changes in physical activity, lifestyle and diet before an operation) have on the environmental impact of undergoing an operation?</p>	<p>1 exp Preoperative Exercise/ or exp Preoperative Period/ 2 prehabilitation.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 "preoperative exercise".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 life style/ or exp healthy lifestyle/ 5 "lifestyle intervention*".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 6 exp Diet, Healthy/ 7 "diet intervention*".mp. 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 sustainab*.ti,ab. 10 environment* impact.ti,ab. 11 carbon footprint*.ti,ab. 12 resource* reduc*.ti,ab. 13 "green* energy*".ab,ti. 14 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti. 15 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 16 exp Renewable Energy/ 17 exp Carbon Footprint/ 18 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18</p>

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		<p>20 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 21 Surgical Procedures, Operative/ 22 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery).ti,ab. 23 20 or 21 or 22 24 8 and 19 and 23 25 limit 24 to (yr="2017 -Current" and systematic reviews)</p>
8	<p>What are the relative environmental impacts of the different elements of care delivered before an operation?</p>	<p>1 exp Environment/ 2 "carbon footprint* ".ti,ab. 3 "Environmental impact".ti,ab. 4 1 or 2 or 3 5 exp Preoperative care/ 6 (prehabilitation or pre-habilitation).ti,ab. 7 (preoperative and (Clinic* or Scan* or investigat* or radiology)).ti,ab. 8 5 or 6 or 7 9 4 and 8 10 limit 9 to yr="2017 -Current" 11 limit 10 to "systematic review"</p>
9	<p>How can investigations before an operation be used more efficiently?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact.ti,ab. 3 carbon footprint*.ti,ab. 4 resource* reduc*.ti,ab. 5 "green* energy*".ab,ti. 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti. 7 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab 8 exp Renewable Energy/ 9 exp Carbon Footprint/ 10 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 12 exp Preoperative Care/ or exp Preoperative Period/ 13 blood test.mp. or exp Hematologic Tests/ 14 exp Tomography, X-Ray Computed/ or exp Magnetic Resonance Imaging/ 15 exp X-Rays/ 16 exp Electrocardiography/ 17 exp Diagnostic Tests, Routine/ 18 "pre-operative test* ".ab,ti. 19 "preoperative test* ".ab,ti. 20 "Pre-operative scan* ".ab,ti. 21 "preoperative scan* ".ab,ti. 22 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 23 11 and 12 and 22 71</p>

		24 limit 23 to yr="2017 -Current"
		25 limit 24 to ("middle aged (45 plus years)" and "systematic review")
10	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	<p>1 operat*.mp. and (theatre* or theater*).ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 operat* suite*.ti,ab.</p> <p>3 patient pathway*.ti,ab.</p> <p>4 staffing level*.ti,ab.</p> <p>5 (theatre or theater).mp. and equipment*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>6 (operation* or surgical).mp. and equipment*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 (operation* or surgical).mp. and instrument*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>8 day surger*.ti,ab.</p> <p>9 Operating Rooms/</p> <p>10 Operating Rooms/mt, og [Methods, Organization & Administration] 3240</p> <p>11 "Personnel Staffing and Scheduling"/</p> <p>12 Surgical Equipment/</p> <p>13 Surgical Instruments/</p> <p>14 day surger*.mp.</p> <p>15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14</p> <p>16 sustainab*.ti,ab.</p> <p>17 environment* impact.ti,ab.</p> <p>18 carbon footprint*.ti,ab.</p> <p>19 resource* reduc*.ti,ab.</p> <p>20 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti.</p> <p>21 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>22 sustainability.mp.</p> <p>23 environment/ or carbon footprint/</p> <p>24 Environmental Pollution/ or Waste Management/</p> <p>25 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24</p> <p>26 operation*.ti,ab.</p> <p>27 surger*.ti,ab.</p> <p>28 General Surgery/</p> <p>29 operation.mp.</p> <p>30 26 or 27 or 28 or 29</p>

		<p>31 15 and 25 and 30</p> <p>32 limit 31 to (english language and "systematic review" and last 5 years) 22</p>
11	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/ 4 Postoperative Care/ 5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>8 Carbon Footprint/ or Environmental Pollution/ 9 Product Packaging/ 10 surgical Instruments/ 11 Recycling/ 12 Waste Management/ 13 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>14 6 or 7 or 8</p> <p>15 9 or 10 or 11 or 12 or 13</p> <p>16 health* organi?ation*.ti,ab.</p> <p>17 Health Maintenance Organizations/ or Health Planning Organizations/ 18 16 or 17</p> <p>19 procur*.ti,ab.</p> <p>20 (purchas* or obtain*).ti,ab.</p> <p>21 "Equipment and Supplies, Hospital"/ or Durable Medical Equipment/ 22 (Equipment or Supplies or medicine*).ti,ab.</p> <p>23 19 or 20</p> <p>24 Pharmaceutical Preparations/ 25 21 or 22 or 24</p> <p>26 5 and 14 and 15 and 23 and 25</p>

		27 limit 26 to (english language and yr="2017 -Current")
12	What drives effective sustainable innovation in manufacturing of equipment and medical supplies used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>3 Surgery/</p> <p>4 Postoperative care/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>8 Carbon Footprint/ or Pollution/</p> <p>9 6 or 7 or 8</p> <p>10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>11 Packaging/ or Surgical equipment/ or Recycling/ or Waste Management/</p> <p>12 10 or 11</p> <p>13 (Equipment and Supplies, Hospital).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word] (10)</p> <p>14 devices/ or medical device/</p> <p>15 (Equipment or Supplies or medicine*).ti,ab.</p> <p>16 13 or 14 or 15</p> <p>17 manufacture.ti,ab.</p> <p>18 manufacture {Including Related Terms}</p> <p>19 manufacturing/</p> <p>20 16 or 17 or 19</p> <p>21 sustainable innovat*.ti,ab.</p> <p>22 9 or 21</p> <p>23 (preoperative or perioperative).ti,ab.</p> <p>24 preoperative evaluation/</p> <p>25 perioperative period/</p> <p>26 5 or 23 or 24 or 25</p> <p>27 12 and 20 and 22 and 26</p> <p>28 limit 27 to (english language and "systematic review" and yr="2017 -Current")</p>

13	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical or Procedure* or "operating room" or theatre).ab,ti.</p> <p>2 Surgery/ or Operating Rooms/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or carbon footprint* or green* energy or ((wast* or resource*) and (minimiz* or minimis* or reduc*))).ab,ti.</p> <p>5 Carbon Footprint/</p> <p>6 Environmental Pollution/</p> <p>7 Recycling/ or Waste Management/</p> <p>8 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>9 Packaging/ or Surgical instruments/</p> <p>10 4 or 5 or 6</p> <p>11 7 or 8 or 9</p> <p>12 3 and 10 and 11</p> <p>13 limit 12 to (yr="2017 -Current" and english)</p> <p>14 limit 13 to "systematic review"</p>
14	How can the emission of greenhouse gases and air pollutants associated with an operation be reduced?	<p>1 (greenhouse gas* or air pollut* or greenhouse effect* or carbon footprint or (environment* and impact*)).ti,ab.</p> <p>2 Greenhouse Effect/ or Air Pollution/ or Greenhouse Gas/ or Air Pollutant/</p> <p>3 1 or 2</p> <p>4 (Nitrous Oxide or Ethyl Chloride or Desflurane or Sevoflurane or Isoflurane or volatile ane?sthe*).ti,ab.</p> <p>5 ((low flow or minimal-flow) and ane?sthe*).ti,ab.</p> <p>6 Anesthetics, Inhalation/</p> <p>7 4 or 5 or 6</p> <p>8 (Operation* or Surger* or Surgical or Procedure*).ti,ab. or Surgery/</p> <p>9 3 and 7 and 8</p> <p>10 limit 9 to (yr="2017 -Current" and "systematic review")</p>
15	How and when is it appropriate to discuss the environmental impacts of care during and around the time of an operation with patients?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Environmental Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>6 Surgical Procedures, Operative/</p> <p>7 5 or 6</p> <p>8 ((discuss* or inform* or educat* or consider* or talk* or conversation* or engag* or decid* or decision*) adj4 patient*).ti,ab.</p> <p>9 Patient Education as Topic/ or Decision Making, Shar</p> <p>10 8 or 9</p> <p>11 4 and 7 and 10</p> <p>12 limit 11 to (yr="2017 -Current" and "systematic review")</p>

16	How can more sustainable reusable equipment safely be used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical or Procedure* or Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery).ti,ab.</p> <p>2 Surgical Procedures, Operative/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>5 Carbon Footprint/ or Environmental Pollution/</p> <p>6 4 or 5</p> <p>7 ((recycl* or reusable or reuse*) adj4 (equipment* or item* or instrument*)).ti,ab.</p> <p>8 Surgical Instruments/ or Recycling/ or Waste Management/</p> <p>9 7 or 8</p> <p>10 3 and 6 and 9</p> <p>11 (safe* or steril* or infect* or contaminat* or uncontaminat* or decontaminat* or clean* or sanitary or hygiene* or aseptic or disinfect* or uninfected*).ti,ab.</p> <p>12 10 and 11</p> <p>13 limit 12 to (yr="2017 -Current" and "systematic review")</p>
17	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?	<p>1 (Sustainab* or "carbon footprint*" or "green* energy" or (environment* and impact*)).ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal*) adj4 (pack* or equipment* or item* or instrument*)) and ((plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*))).ti,ab.</p> <p>6 Packaging/ or Surgical equipment/ or Recycling/ or Waste Management/</p> <p>7 5 or 6</p> <p>8 (Operation* or Surger* or Surgical or Procedure*).ti,ab. or surgery/</p> <p>9 (compar* or collate* or contrast* or measure* or calculate* or evaluate*).ti,ab.</p> <p>10 4 and 7 and 8 and 9</p> <p>11 limit 10 to ("systematic review" and yr="2017 -Current")</p>
18	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>6 Surgery/</p> <p>7 5 or 6</p> <p>8 ((teach* or educat* or encourag* or inform*) adj4 (staff or doctor* or surgeon* or practitioner* or professional*)).ti,ab.</p> <p>9 4 and 7 and 8</p> <p>10 limit 9 to (yr="2017 -Current" and "systematic review")</p>
19	What is the most sustainable way of providing equipment packs for an operation?	<p>1 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or equipment* or instrument*) adj4 (pack* or kit* or container*)).ti,ab.</p>

		<p>2 Packaging/ 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgery/ 6 4 or 5 7 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 8 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 9 Carbon Footprint/ or Pollution/ 10 7 or 8 or 9 11 3 and 6 and 10 12 limit 11 to (yr="2017 -Current" and "systematic review")</p>
20	<p>What is the most sustainable way to sterilise equipment used during an operation?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 6 4 or 5 7 3 and 6 8 (sterilis* or steriliz* or disinfect* or decontam*).ti,ab. 9 exp Sterilization/ 10 8 or 9 11 ("surgical tool*" or "surgical equipment*" or surgical instrument*).ti,ab. 12 7 and 10 and 11</p>
21	<p>How do we measure and compare the environmental impacts of the different ways of performing the same operation (e.g., keyhole and open surgery)?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 6 4 or 5 7 3 and 6 8 ("Laparoscopic surger*" or "Minimally Invasive" or keyhole or "key hole" or "micro surger*).ti,ab. 9 laparoscopic surgery/ 10 8 or 9 11 7 and 10 12 ("open surger*" or "aggressive surg*" or "invasive").ti,ab. 13 open surgery/ 14 12 or 13 15 11 and 14 16 (method* or approach* or version* or "different way").ti,ab. 17 15 and 16 18 limit 17 to (human and english language and "systematic review" and yr="2017 - 2022")</p>

22	How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 6 4 or 5 7 3 and 6 8 "environmental impact*".ti,ab. 9 7 and 8 10 Postoperative Complications/ 11 Treatment Outcome/ 12 ("clinical outcome*" or "surg* outcome*" or "treatment outcome*").ti,ab. 13 10 or 11 or 12 14 ("financial cost" or "monetary cost" or "triple bottom line" or "financing cost*").ti,ab. 15 "CO2 equivalent*".ti,ab. 16 14 or 15 17 9 and 13 and 16 (0)</p>
23	What is the role of virtual consultations in reducing the environmental impact associated with undergoing an operation?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 ("virtual consultat*" or "online consult*" or "remote consult*").ti,ab. 9 exp Telemedicine/ and exp "Referral and Consultation"/ 10 8 or 9 11 7 and 10 12 limit 11 to (english language and systematic reviews and last 5 years) 13 "travel to".ti,ab. 14 "remote attendance".ti,ab. 15 13 or 14 16 12 and 15</p>
24	How can the amount of waste generated during and around the time of an operation be minimised?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 exp Medical Waste/ 9 waste*.ti,ab.</p>

1		10 8 or 9
2		11 7 and 10
3		12 ("Reduce*" or Reuse* or Recycle* or "re use*").ti,ab.
4		13 exp Recycling/
5		14 12 or 13
6		15 11 and 14
7		16 limit 15 to (english language and systematic reviews and last 5 years)
8	25	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
9		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
10		3 1 or 2
11		4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
12		5 Surgical Procedures, Operative/
13		6 4 or 5
14		7 3 and 6
15		8 exp Medical Waste/
16		9 waste*.ti,ab.
17		10 8 or 9
18		11 7 and 10
19		12 (incinerat* or landfill or "land fill" or dispose*).ti,ab.
20		13 11 and 12
21		14 limit 13 to (english language and systematic reviews and last 5 years)
22	26	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
23		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
24		3 1 or 2
25		4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
26		5 Surgical Procedures, Operative/
27		6 4 or 5
28		7 3 and 6
29		8 exp Medical Waste/
30		9 waste*.ti,ab.
31		10 8 or 9
32		11 7 and 10
33		12 ("Reduce*" or Reuse* or Recycle* or "re use*").ti,ab.
34		13 exp Recycling/
35		14 12 or 13
36		15 11 and 14
37		16 limit 15 to (english language and systematic reviews and last 5 years)
38		17 (generat* or create* or make).ti,ab.
39		18 16 and 17
40	27	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
41		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
42		3 1 or 2

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1		4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
2		5 Surgical Procedures, Operative/
3		7 3 and 6
4		8 ("scrubbing up" or handwashing or "hand disinfect").ti,ab.
5		9 (hand* adj3 wash*).ti,ab.
6		10 exp Hand Disinfection/
7		11 8 or 9 or 10
8		12 7 and 11
9		13 limit 12 to (english language and systematic reviews and last 5 years)
10	28	1 ("healthcare organisation*" or "health care organisation*" or "healthcare organization*" or "health care organization").ti,ab.
11		2 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
12		3 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab.
13		4 2 or 3
14		5 1 and 4
15		6 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
16		7 (pathway* or "path way*").ti,ab.
17		8 6 and 7
18		9 5 and 8
19		10 limit 9 to (english language and humans and yr="2017 - 2022" and "systematic review")
20	29	1 ((Sustainab* or "environment* impact*" or "carbon footprint*" or "green* energy" or (waste or resource*)) and (minimiz* or reduc*).ti,ab.
21		2 Carbon Footprint/
22		3 Medical Waste/ or Waste Management/
23		4 1 or 2 or 3
24		5 "nitrous oxide".ti,ab.
25		6 Nitrous Oxide/
26		7 5 or 6
27		8 4 and 7
28		9 ("health care" or healthcare).ti,ab.
29		10 "Delivery of Health Care"/
30		11 9 or 10
31		12 8 and 11
32		13 limit 12 to (english language and yr="2017 - 2022" and "systematic review")
33	30	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
34		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab.
35		3 1 or 2
36		4 ("low benefit*" or "low benefit surger*" or "low benefit operat*").ti,ab.
37		5 ("Operative versus non operative*" or "non operative versus operative*" or "operative" or "non operative").ti,ab.
38		6 4 and 5
39		7 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
40		8 Surgical Procedures, Operative/
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		<p>9 7 or 8</p> <p>10 ("non surg*" or "non operat*" or "conservative management").ti,ab.</p> <p>11 9 and 10</p> <p>12 ("shared decision making" or "shared-decision making").ti,ab.</p> <p>13 3 and 6 and 11 and 12</p> <p>14 limit 13 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
31	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 ("anaesthe* technique*" or "anesthe* technique*" or "anaesthe* method*" or "anesthe* method*" or "method* of anaesth*" or "method* of anesthe*").ti,ab.</p> <p>5 3 and 4</p> <p>6 ("general anaesthe*" or "general anesthe*").ti,ab.</p> <p>7 ("regional anaesthe*" or "regional anesthe*").ti,ab.</p> <p>8 ("local anaesthe*" or "local anesthe*").ti,ab.</p> <p>9 6 or 7 or 8</p> <p>10 5 and 9</p> <p>11 ("volatile versus total intravenous anaesthe*" or "volatile versus total intravenous anesthe*").ti,ab.</p> <p>12 ("volatile anaesthe*" or "volatile anesthe*").ti,ab.</p> <p>13 ("total intravenous anaesthe*" or "total intravenous anesthe*").ti,ab.</p> <p>14 11 or 12 or 13</p> <p>15 10 and 14</p> <p>16 Surgical Procedures, Operative/</p> <p>17 15 and 16</p> <p>18 limit 17 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
32	What are the barriers to using more sustainable anaesthetic practices?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 ("Problem* with reduc*" or "barrier* with reduc*" or "barrier* to reduc*" or "aim to reduc*" or "need to reduc*").ti,ab.</p> <p>5 ("volatile anaesthe*" or "volatile anesthe*").ti,ab.</p> <p>6 4 and 5</p> <p>7 3 and 6</p>
33	What role does re-cycling inhaled anaesthetics have in reducing the environmental impact of inhaled anaesthesia?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 recycl*.ti,ab.</p> <p>5 ("anaesthe*" or "anesthe*").ti,ab.</p> <p>6 ("inhal*" or "gas*").ti,ab.</p> <p>7 5 and 6</p> <p>8 3 and 4 and 7</p> <p>9 Anesthesia/</p>

		10 8 and 9 11 limit 10 to (english language and humans and yr="2017 - 2022" and "systematic review")
34	What is the environmental impact of different forms of pain relief for an operation?	1 epidural analgesia/ 2 (epidural adj3 (Oral or intravenous or regional or neuraxial)).ab,ti. 3 carbon footprint/ 4 environmental impact/ 5 "Sustainab*".ab,ti. 6 (environment* adj3 impact*).ab,ti. 7 "carbon footprint* ".ab,ti. 8 "green energy".ab,ti. 9 (hospital adj3 (waste or resource*)).ab,ti. 10 (surg* adj3 (waste or resource*)).ab,ti. 11 (operative adj3 (waste or resource*)).ab,ti. 12 (Analgesi* adj3 (waste or resource*)).ab,ti. 13 ("pain relief" adj3 (waste or resource*)).ab,ti. 14 Medical Waste/ (1409) 15 Waste Management/ or Medical Waste Disposal/ 16 (minimiz* or minimis* or reduc*).ab,ti. 17 1 or 2 18 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 19 15 or 16 20 17 and 18 and 19 21 limit 20 to (yr="2016 - 2022" and "systematic review")
35	How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	1 exp Surgical Procedures, Operative/ 2 ((surg* or operat*) adj3 (procedure* or treatment*)).ab,ti. 3 1 or 2 4 exp Therapeutics/ 5 (non-surg* adj3 (therap* or treatment*)).ab,ti. 6 4 or 5 7 exp Environmental Monitoring/ 8 Carbon Footprint/ 9 "environment* adj3 sustainab*".ab,ti. 10 (environment* adj3 impact*).ab,ti. 11 "carbon footprint".ab,ti. 12 "green energy".ab,ti. 13 exp Renewable Energy/ 14 "renewable energy".ab,ti. 15 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 16 3 and 6 and 15 17 limit 16 to (yr="2017 - 2022" and "systematic review")
36	What is the environmental impact of using day case surgical pathways compared to inpatient pathways?	1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti.

		<p>3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (environment* adj3 (impact or management or protect*)).ab,ti. 6 "renewable energy".ab,ti. 7 "recycl*".ab,ti. 8 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 9 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 10 "zero waste".ab,ti. 11 "Conservation of Natural Resources"/ 12 Carbon Footprint/ 13 exp Environmental Monitoring/ 14 environmental impact/ 15 exp Medical Waste Disposal/ 16 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 17 Ambulatory Surgical Procedures/ 18 (day adj3 surg*).ab,ti. 19 (ambulatory adj3 surg*).ab,ti. 20 (outpatient* adj3 surg*).ab,ti. 21 17 or 18 or 19 or 20 22 (inpatient adj3 surg*).ab,ti. 23 16 and 21 and 22 24 limit 23 to (yr="2017 -Current" and "systematic review")</p>
<p>37</p>	<p>What is the role of community-based care in reducing the environmental impact of operations?</p>	<p>1 "Sustainab*".ab,ti. 2 "carbon footprint*".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. (5521) 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/ 14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 exp Surgical Procedures, Operative/ 18 exp General Surgery/ 19 (surg* adj3 (procedure* or treatment* or therap*)).ab,ti. 20 18 or 19</p>

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1		21 exp Community Health Services/
2		22 (community adj3 (care or service*)).ab,ti.
3		23 21 or 22
4		24 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
5		25 20 and 23 and 24
6		26 limit 25 to (yr="2017 - 2022" and "systematic review")
7	38	1 "Sustainab*".ab,ti.
8	Is it more environmentally sustainable and safe for	2 "carbon footprint* ".ab,ti.
9	patients to have more of their early post-operative	3 "green energy".ab,ti.
10	care at home compared to hospital?	4 (waste adj3 (hospital or medical or surgical)).ab,ti.
11		5 (minimiz* or minimis* or reduc*).ab,ti.
12		6 (environment* adj3 (impact or management or protect*)).ab,ti.
13		7 "renewable energy".ab,ti.
14		8 "recycl*".ab,ti.
15		9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti.
16		10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti.
17		11 "zero waste".ab,ti.
18		12 "Conservation of Natural Resources"/
19		13 Carbon Footprint/
20		14 exp Environmental Monitoring/
21		15 environmental impact/
22		16 exp Medical Waste Disposal/
23		17 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
24		18 Postoperative Care/
25		19 exp Hospitalization/
26		20 18 and 19
27		21 (postoperat* adj3 "hospital care").ab,ti.
28		22 (post-operat* adj3 "hospital care").ab,ti.
29		23 (post-surg* adj3 "hospital care").ab,ti.
30		24 20 or 21 or 22 or 23
31		25 Postoperative Care/
32		26 Home Care Services/
33		27 (postoperat* adj3 home).ab,ti.
34		28 (post-operat* adj3 home).ab,ti.
35		29 (post-surg* adj3 home).ab,ti. (7)
36		30 (home adj3 (surg* adj3 recover*)).ab,ti.
37		31 25 and 26
38		32 27 or 28 or 29 or 30 or 31
39		33 exp Patient Safety/
40		34 (patient* adj3 safety).ab,ti.
41		35 33 or 34
42		36 17 and 24 and 32 and 35

39	How can the waste of drugs be avoided during and around the time of an operation?	<p>1 exp Perioperative Period/ 2 "perioperat*".ab,ti. 3 1 or 2 4 (waste adj3 (drug or an?esthetic* or medic* or pharmac*)).ab,ti. 5 Medical Waste/ 6 4 or 5 7 exp Waste Management/ 8 Medical Waste Disposal/ 9 (waste adj3 (management or dispos* or reduc*)).ab,ti. 10 7 or 8 or 9 11 3 and 6 and 10 12 limit 11 to (yr="2017 - 2022" and "systematic review")</p>
40	How can drug syringes be used better to reduce their environmental impact?	<p>1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/ 14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 Syringes/ 18 "syringe*".ab,ti. 19 17 or 18 20 1 or 2 or 3 or 4 or 6 or 7 or 12 or 13 or 14 or 15 21 5 or 9 or 10 or 11 or 16 22 19 and 20 and 21 23 limit 22 to (yr="2017 - 2022" and "systematic review")</p>
41	What is the most environmentally sustainable way to deliver oxygen in the post-operative period?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 environmental protection/ 6 carbon footprint/ 7 environmental impact/</p>

1		8 "human impact (environment)"/ or environment/
2		9 waste management/
3		10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
4		11 oxygen*.ti,ab.
5		12 oxygen deliver*.ti,ab.
6		13 oxygen admin*.ti,ab.
7		14 oxygen/ad [Drug Administration]
8		15 oxygen/
9		16 oxygen delivery device/
10		17 11 or 12 or 13 or 14 or 15 or 16
11		18 (post op* or postop*).ti,ab.
12		19 postop* period.ti,ab.
13		20 post op* period.ti,ab.
14		21 postoperative care/
15		22 18 or 19 or 20 or 21
16		23 10 and 17 and 22
17		24 limit 23 to (english language and last 5 years)
18	42	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
19		2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance
20		word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept
21		word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
22		3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title,
23		abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
24		word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
25		concept word, unique identifier, synonyms]
26		4 2 or 3
27		5 1 and 4
28		6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
29		7 1 or 6
30		8 4 and 7
31		9 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or
32		plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or
33		instrument*).ti,ab.
34		10 exp Product Packaging/
35		11 exp Wound Healing/
36		12 exp Bandages/
37		13 10 or 11 or 12
38		14 9 and 13
39		15 5 and 14
40		16 limit 15 to (yr="2017 -Current" and "systematic review")

43	What are the sustainable and effective alternatives to carbon dioxide used in laparoscopic (keyhole surgery of the abdomen) surgery?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 exp Laparoscopy/</p> <p>10 exp Minimally Invasive Surgical Procedures/</p> <p>11 exp Carbon Dioxide/</p> <p>12 gas* free*.ti,ab.</p> <p>13 9 or 10</p> <p>14 co2.ti,ab.</p> <p>15 11 or 12 or 14</p> <p>16 13 and 15</p> <p>17 8 and 16 (</p> <p>18 limit 17 to (yr="2017 -Current" and "systematic review")</p>
44	What is the most environmentally sustainable way to provide nutrition for patients undergoing operations?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 Enteral Nutrition/ or Nutrition Assessment/ or Nutrition Therapy/ or Nutrition Policy/</p> <p>10 exp Food Service, Hospital/</p> <p>11 exp "Conservation of Natural Resources"/</p> <p>12 11 and food*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p>

		<p>13 exp Food/ 14 9 or 10 or 12 or 13 15 8 and 14 16 limit 15 to (yr="2017 -Current" and "systematic review")</p>
45	<p>What is the most environmentally sustainable method of providing written information to patients?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 2 or 3 5 1 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 1 or 6 8 4 and 7 9 exp Communication/ 10 exp "Appointments and Schedules"/ 11 9 and 10 12 patient information*.ti,ab. 13 patient communication*.ti,ab. 14 email*.ti,ab. 15 paperwork*.ti,ab. 16 exp Letter/ 17 12 or 13 or 14 or 15 or 16 18 7 and 17 19 limit 18 to (yr="2017 -Current" and "systematic review") 20 3 and 18</p>
46	<p>What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 "Educat*".ti,ab. 5 exp Health Knowledge, Attitudes, Practice/ 6 4 or 5 7 ("health* professional*" or "health* work*" or "health* provider*").ti,ab. 8 ("pre-operative care" or "post-operative care").ti,ab. 9 Surgical Procedures, Operative/ 10 8 or 9 11 3 and 6 and 7 and 10 12 limit 11 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>

47	What are the best ways to educate patients, and their carers, about sustainable healthcare before an operation?	<p>1 Sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 exp environmental sustainability/ 7 carbon footprint/ 8 renewable energy/ 9 pollution/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 11 sustainable healthcare.ti,ab. 12 patient* education.ti,ab. 13 patient education/ or health education/ 14 caregiver/ 15 (carer* or caregiver*).ti,ab. 16 12 or 13 or 14 or 15 17 preop*.ti,ab. 18 (preop* and (care or period)).ti,ab. 19 (pre op* and (care or period)).ti,ab. 20 preoperative evaluation/ or preoperative period/ 21 17 or 18 or 19 or 20 22 10 and 11 and 16 and 21 23 10 or 11 24 16 and 21 and 23 25 limit 24 to (english language and "systematic review" and yr="2017 -Current")</p>
48	What is the most sustainable way for healthcare professionals to store and (appropriately) share clinical information?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 resource* reduc*.ti,ab. 6 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 7 environmental pollut*.ti,ab. 8 (reuse or reusable).ti,ab. 9 environmental pollution/ or environmental monitoring/ 10 Renewable Energy/ 11 Carbon Footprint/ 12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 13 clinical information.ti,ab. 14 ((clinical or operative or medical) and record*).ti,ab. 15 Medical Records/ 16 13 or 14 or 15 17 "Information Storage and Retrieval"/</p>

		<p>18 (Information and (Store or storage or share or sharing or Retrieval*)).ti,ab. 19 ((paper or physical) and record*).ti,ab. 20 Medical Records Systems, Computerized/ or Electronic Health Records/ 21 electronic record*.ti,ab. 22 17 or 18 or 19 or 20 or 21 23 ((health or healthcare or health care) and (personnel or professional*)).ti,ab. 24 (doctor* or surgeon* or nurs* or AHP* or allied health professional*).ti,ab. 25 exp Health Personnel/ 26 23 or 24 or 25 27 12 and 16 and 22 and 26 28 limit 27 to (english language and yr="2017 -Current" and "systematic review")</p>
49	How can energy usage within an operating theatre be safely reduced?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 resource* reduc*.ti,ab. 6 ((waste or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 environmental pollut*.ti,ab. 8 (reuse or reusable).ti,ab. 9 environmental pollution/ or environmental monitoring/ (144759) 10 Renewable Energy/ 11 Carbon Footprint/ 12 environmental impact.ti,ab. 13 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 14 energy usage.ti,ab. 15 energy consumption.ti,ab. 16 exp Energy-Generating Resources/ 17 14 or 15 or 16 18 operat* theatre*.ti,ab. 19 operat* theater*.ti,ab. 20 Operating Rooms/ 21 Operat* Room*.ti,ab. 22 operating theatre light*.ti,ab. 23 operating theater light*.ti,ab. 24 operating room* light*.ti,ab. 25 operating theatre ventilat*.ti,ab. 26 operating theater ventilat*.ti,ab. 27 operating room ventilat*.ti,ab. 28 air conditioning/ or heating/ or life support systems/ or lighting/ or temperature/ or ventilation/ 29 (air conditioning or heat* or life support system*).ti,ab. 30 ((medical or operating) and equipment).ti,ab. 31 exp "Equipment and Supplies, Hospital/"</p>

		<p>32 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31</p> <p>33 13 and 17 and 32</p> <p>34 limit 33 to (english language and yr="2017 -Current" and "systematic review")</p>
50	<p>What is the most environmentally sustainable way to maintain a patient's body temperature during an operation?</p>	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p> <p>4 Surgical Procedures, Operative/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 1 or 2 or 3 or 4 or 5</p> <p>7 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>8 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>9 Carbon Footprint/ or Environmental Pollution/</p> <p>10 7 or 8 or 9</p> <p>11 patient* body temperature*.ti,ab.</p> <p>12 body temperature*.ti,ab.</p> <p>13 Body Temperature/</p> <p>14 11 or 12 or 13</p> <p>15 force* air warm* device*.ti,ab.</p> <p>16 Body Temperature Regulation/ or Intraoperative Complications/</p> <p>17 underbod* warmer*.ti,ab.</p> <p>18 fluid warmer*.ti,ab.</p> <p>19 patient* warmer*.ti,ab.</p> <p>20 reflective blanket*.ti,ab.</p> <p>21 15 or 16 or 18 or 19 or 20</p> <p>22 5 and 10 and 14 and 21</p> <p>23 limit 22 to (english language and yr="2017 -Current" and "systematic review")</p> <p>24 5 and 10 and 14</p> <p>25 limit 24 to (english language and yr="2017 -Current" and "systematic review")</p> <p>26 14 or 21</p> <p>27 5 and 10 and 26</p> <p>28 limit 27 to (english language and yr="2017 -Current" and "systematic review")</p>

51	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p> <p>4 Postoperative care/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>8 Carbon Footprint/ or Environmental Pollution/</p> <p>9 6 or 7 or 8</p> <p>10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>11 Product Packaging/</p> <p>12 Surgical Instruments/</p> <p>13 Recycling/</p> <p>14 Waste Management/</p> <p>15 10 or 11 or 12 or 13 or 14</p> <p>16 repair*.ti,ab.</p> <p>17 15 or 16</p> <p>18 ((medical or surg*) and (equipment or device* or instrument*)).ti,ab.</p> <p>19 disposable equipment/ or exp "equipment and supplies, hospital"/</p> <p>20 exp Surgical Instruments/</p> <p>21 exp Surgical Equipment/</p> <p>22 18 or 19 or 20 or 21</p> <p>23 5 and 9 and 17 and 22</p> <p>24 limit 23 to (english language and yr="2017 -Current" and "systematic review")</p>
52	How can care packages which aim to enable rapid recovery from surgery (e.g., ERAS) affect the environmental impact of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p>

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4 Surgical Procedures, Operative/
5 1 or 2 or 3 or 4
6 1 or 2 or 3 or 4 or 5
7 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title,
abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
concept word, unique identifier, synonyms]
8 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
9 Carbon Footprint/ or Environmental Pollution/
10 7 or 8 or 9
11 patient* body temperature*.ti,ab.
12 body temperature*.ti,ab.
13 Body Temperature/
14 11 or 12 or 13
15 force* air warm* device*.ti,ab.
16 Body Temperature Regulation/ or Intraoperative Complications/
17 underbod* warmer*.ti,ab.
18 fluid warmer*.ti,ab. (
19 patient* warmer*.ti,ab.
20 reflective blanket*.ti,ab.
21 15 or 16 or 18 or 19 or 20
22 5 and 10 and 14 and 21
23 limit 22 to (english language and yr="2017 -Current" and "systematic review")
24 5 and 10 and 14
25 limit 24 to (english language and yr="2017 -Current" and "systematic review")
26 14 or 21
27 5 and 10 and 26
28 limit 27 to (english language and yr="2017 -Current" and "systematic review")
29 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance
word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept
word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
30 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title,
abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
concept word, unique identifier, synonyms]
31 Surgical Procedures, Operative/
32 Postoperative Care/
33 29 or 30 or 31 or 32
34 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title,
abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
concept word, unique identifier, synonyms]

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		<p>35 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 36 Carbon Footprint/ or Environmental Pollution/ 37 34 or 35 or 36 38 rapid recover*.ti,ab. 39 ((surg* or operat*) and recover*).ti,ab. 40 38 or 39 41 care package*.ti,ab. 42 ERAS.ti,ab. 43 Enhanced Recovery after Surgery.ti,ab. 44 41 or 42 or 43 45 33 and 37 and 40 and 44 46 limit 45 to (english language and yr="2017 -Current" and "systematic review") 47 postoperative recover*.ti,ab. 48 post operative recover*.ti,ab. 49 Postoperative Care/ 50 40 or 47 or 48 or 49 51 33 and 37 and 44 and 50 52 limit 51 to (english language and yr="2017 -Current" and "systematic review")</p>
53	How can waste from medical gas cylinders be reduced?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 Surgical Procedures, Operative/ 4 Carbon Footprint/ or Environmental Pollution/ 5 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 6 Product Packaging/ 7 Surgical Instruments/ or Recycling/ or Waste Management/ 8 Postoperative Care/ 9 1 or 2 or 3 or 8 10 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 11 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 12 4 or 10 or 11 13 5 or 6 or 7 14 medical gas cylinder*.ti,ab.</p>

		<p>15 cylinder*.ti,ab. 16 gas cylinder*.ti,ab. 17 14 or 15 or 16 18 9 and 12 and 13 and 17</p>
54	<p>What effect do standards, guidelines and quality improvement initiatives have on the environmental impact of operations?</p>	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 Surgical Procedures, Operative/ 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 Postoperative Care/ 5 1 or 2 or 3 or 4 6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ (20296) 9 6 or 7 or 8 10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. (8527) 11 Product Packaging/ 12 Surgical Instruments/ 13 Recycling/ or Waste Management/ 14 10 or 11 or 12 or 13 15 (standard* or policy or policies or guideline*).ti,ab. 16 Reference Standards/ 17 policy/ 18 Practice Guideline/ or Guideline/ or Guideline Adherence/ 19 Quality Improvement/ 20 quality improve* initiative*.ti,ab. 21 15 or 16 or 17 or 18 or 19 or 20 22 5 and 9 and 14 and 21 23 limit 22 to (english language and yr="2017 -Current" and "systematic review")</p>
55	<p>What is the most sustainable method to launder clothing worn when delivering care around an operation?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab.</p>

		<p>6 environmental pollut*.ti,ab. 7 Health Services Accessibility/ 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 (launder* or laundry).ti,ab. 10 (wash* and clothe*).ti,ab. 11 Surgical Attire/ or Clothing/ 12 (operation* and care).ti,ab. 13 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 14 9 or 10 or 11 15 12 or 13 16 8 and 14 and 15 17 limit 16 to (english language and yr="2017 -Current" and "systematic review")</p>
56	How do we measure the carbon footprint of an operation?	<p>1 carbon footprint*.ti,ab. 2 environment* impact*.ti,ab. 3 sustainab*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 environmental pollut*.ti,ab. 6 Carbon Footprint/ 7 measur*.ti,ab. 8 calculat*.ti,ab. 9 operation*.ti,ab. 10 surger*.ti,ab. 11 Surgical Procedures, Operative/ec, es [Economics, Ethics] 12 Humans/su [Surgery] 13 1 or 2 or 3 or 4 or 5 or 6 14 7 or 8 15 9 or 10 or 11 or 12 16 13 and 14 and 15 17 limit 16 to (english language and systematic reviews and last 5 years) (1)</p>
57	How can the different types of environmental impacts (e.g., global warming, waste, resource utilisation) associated with care during and around the time of an operation be prioritised and balanced against one another?	<p>1 environment* impact*.ti,ab. 2 sustainab*.ti,ab. 3 carbon footprint*.ti,ab. 4 environmental pollut*.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 global warming.ti,ab. 7 Environment/ 8 Global Warming/ or Environmental Pollution/ 9 Sustainable Development/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 11 (operation* and care).ti,ab. 12 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 13 patient care.ti,ab.</p>

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		<p>14 (operation* and care).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>15 Perioperative Care/ 16 Postoperative Care/ 17 11 or 12 or 13 or 14 or 15 or 16</p> <p>18 prioritis*.mp. or balanc*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>19 prioritiz*.mp. or balanc*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>20 rank*.ti,ab. 21 prioritise.mp. 22 prioritize*.mp. 23 18 or 19 or 20 or 21 or 22 24 10 and 17 and 23 25 limit 24 to (english language and systematic reviews and last 5 years)</p>
58	What is the most sustainable way to provide lighting in the operating theatre?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 green* energy.ti,ab. 6 Sustainable Development/ or Global Health/ 7 Carbon Footprint/ or Greenhouse Effect/ 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 light*.ti,ab. 10 light* source*.ti,ab. 11 Light/ 12 Lighting/ 13 9 or 10 or 11 or 12 14 operating theatre*.ti,ab. 15 operating theater*.ti,ab. 16 operating room*.ti,ab. 17 operating suite*.ti,ab. 18 Operating Rooms/ 19 14 or 15 or 16 or 17 or 18 20 8 and 13 and 19 21 limit 20 to (english language and systematic reviews and last 5 years)</p>
59	How can environmental sustainability be incorporated into the organisational management of operating theatres?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab.</p>

		<p>4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 green* energy.ti,ab. 6 Sustainable Development/ 7 environment/ or carbon footprint/ 8 Environmental Pollution/ 9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 10 organi?ation* manag*.ti,ab. 11 organi?ation* admin*.ti,ab. 12 organisational management.mp. 13 organizational management.mp. 14 organisation* admin*.mp. 15 10 or 11 or 12 or 13 or 14 16 operating theatre*.ti,ab. 17 operating theater*.ti,ab. 18 operating room*.ti,ab. 19 operating suite*.ti,ab. 20 Operating Rooms/ 21 16 or 17 or 18 or 19 or 20 22 9 and 15 and 21 23 limit 22 to (english language and yr="2017 -Current" and systematic reviews</p>
60	How can the provision and administration of medicines to patients undergoing operations be made more environmentally sustainable?	<p>1 ((provision or adminis*) and medicine*).ti,ab. 2 ((manufactur* or deliver* or stor*) and medicine*).ti,ab. 3 medicine*.mp. and prescri*.ti,ab. 4 prescription drug/ or prescription/ 5 1 or 2 or 3 or 4 6 operation*.ti,ab. 7 surger*.ti,ab. 8 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 9 perioperative medicine/ or perioperative period/ 10 surgery/ 11 6 or 7 or 8 or 9 or 10 12 sustainab*.ti,ab. 13 environment* impact*.ti,ab. 14 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 15 carbon footprint*.ti,ab. 16 environment/ or environmental impact/ 17 carbon footprint/ 18 12 or 13 or 14 or 15 or 16 or 17 19 5 and 11 and 18 20 limit 19 to (english language and "systematic review" and last 5 years)</p>

Table A2: Results of the literature review of indicative questions. NICE = National Institute for Health and Care Excellence; SIGN = Scottish Intercollegiate Guidelines Network; CINAHL = Cumulative Index to Nursing and Allied Health Literature.

	Indicative Question	National Professional Guideline?	Related NICE/SIGN guideline in area?	Sustainability mentioned in NICE/SIGN guideline?	Cochrane / Embase / CINAHL / Medline	Completely Answered	Partially Answered	Unanswered
1	How can care after an operation be optimised to minimise the use of resources and creation of waste whilst providing good care?	No	NG180 - perioperative care	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.37757/MR2021.V23.N3.9 • http://dx.doi.org/10.1016/j.ijso.2020.11.016 • http://dx.doi.org/10.1136/bmjopen-2021-050806 • http://dx.doi.org/10.1055/s-0040-1708834 • http://dx.doi.org/10.1213/ANE.0000000000003942 • https://dx.doi.org/10.1016/j.jcin.2018.04.042 • https://dx.doi.org/10.21614/chirurgia.112.5.546 		X	
2	Which aspects of care before and after an operation can be provided in the community in a more sustainable way?	No	No					X
3	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?	No	No					X
4	Can the supply of medicines after an operation be optimised to minimise waste?	No	No					X

1 2 3 4 5 6 7 8 9 10 11	5	How does living a 'greener' lifestyle affect recovery after an operation?	No	<ul style="list-style-type: none"> • NG70 - Air pollution • NG90 – Physical Activity and the Environment • PH41 – Walking and Cycling • QS183 – Encouraging Physical Activity in the community • PH54 – Exercise and referral schemes • PH13 – Physical Activity in the Workplace 	No				X
12 13 14 15 16 17 18 19 20 21 22	6	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g. PPE, drapes, clean air ventilation)?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/TA.0000000000003073 • https://dx.doi.org/10.1017/ice.2020.379 			X
23 24 25 26 27 28 29 30 31 32 33 34	7	What effect does pre-habilitation (e.g., changes in physical activity, lifestyle and diet before an operation) have on the environmental impact of undergoing an operation?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1513/AnnalsATS.202002-183OC • https://dx.doi.org/10.1136/bmjopen-2021-050806 • https://dx.doi.org/10.1097/CIN.0000000000000708 			X
35 36 37 38 39 40 41 42	8	What are the relative environmental impacts of the different elements of care delivered before an operation?	No	No					X

1 2 3 4	9	How can investigations before an operation be used more efficiently?	No	NG45 – Routine preoperative tests for elective surgery	No	<ul style="list-style-type: none"> • https://doi.org/10.37757/MR2021.V23.N3.9 		X	
5 6 7 8 9 10 11 12	10	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	No	No		<ul style="list-style-type: none"> • https://doi.org/10.1093/bjs/znab362.049 • https://doi.org/10.1016/J.JAMCOLLSURG.2021.07.258 • https://doi.org/10.1289/EHP8666 • https://doi.org/10.1016/j.amjsurg.2018.07.021 • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
13 14 15 16 17 18 19 20 21 22 23 24	11	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	NHS Supply Chain Strategy - https://www.supplychain.nhs.uk/sustainability/climate-change-energy-and-ghg-emissions/			<ul style="list-style-type: none"> • https://doi.org/10.1016/S0140-6736(20)31142-9 • https://dx.doi.org/10.1017/dmp.2020.283 		X	
25 26 27 28 29 30 31 32 33 34	12	What drives effective sustainable innovation in manufacturing of equipment and medical supplies used during and around the time of an operation?	NHS Supply Chain Strategy - https://www.supplychain.nhs.uk/sustainability/climate-change-energy-and-ghg-emissions/			<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.scitotenv.2021.151128 • https://doi.org/10.1289/EHP8666 • https://dx.doi.org/10.1016/j.jcjq.2021.06.010 • https://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1016/j.ejvs.2017.03.014 		X	

13	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	No	No	<ul style="list-style-type: none"> • http://dx.doi.org/10.1093/ndt/gfab113.008 • http://dx.doi.org/10.1289/EHP8666 • http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 • http://dx.doi.org/10.1016/j.jcjq.2021.06.010 • http://dx.doi.org/10.1016/j.amjoto.2020.102719 • http://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1016/j.amjsurg.2018.07.021 • https://dx.doi.org/10.1111/ans.13856 • https://dx.doi.org/10.1093/bjs/znab362.049 		X	
14	How can the emission of greenhouse gases and air pollutants associated with an operation be reduced?	No	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1289/EHP8666 • https://doi.org/10.1016/j.jcjq.2021.06.010 		X	
15	How and when is it appropriate to discuss the environmental impacts of care during and around the time of an operation with patients?	No	No	<ul style="list-style-type: none"> • http://dx.doi.org/10.1016/j.resconrec.2019.104560 			X
16	How can more sustainable reusable equipment safely be used during and around the time of an operation?	No	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.eururo.2022.01.027 • http://dx.doi.org/10.1093/ndt/gfab113.008 • http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 • http://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1111/ans.13856 		X	
17	How can we compare the environmental impacts of reusable and single-use equipment used during and around	No	No	<ul style="list-style-type: none"> • http://dx.doi.org/10.1289/EHP8666 • http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 • https://dx.doi.org/10.1111/ans.13856 • https://doi.org/10.1101/2021.03.10.21253268 		X	

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5	18	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	No	No				X
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17	19	What is the most sustainable way of providing equipment packs for an operation?	No	No		• http://dx.doi.org/10.1016/j.jcjq.2021.06.010		X
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21	20	What is the most sustainable way to sterilise equipment used during an operation?	No	No		• https://doi.org/10.1093/bja/aex098		X
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28	21	How do we measure and compare the environmental impacts of the different ways of performing the same operation (e.g., keyhole and open surgery)?	No	No				X
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38	22	How should the environmental impact of an operation be weighed against	No	No				X
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1		its clinical outcomes and financial costs?							
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3	23	What is the role of virtual consultations in reducing the environmental impact associated with undergoing an operation?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.7861/fhj.2020-0080 		X	
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11	24	How can the amount of waste generated during and around the time of an operation be minimised?	Association of Anaesthetists - Anaesthetic waste: safe and sustainable disposal	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.icig.2021.06.010 • https://dx.doi.org/10.1016/j.eururo.2022.01.027 • https://dx.doi.org/10.1016/j.scitotenv.2021.151128 • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
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19	25	Can alternative, more environmentally sustainable methods of disposal be used for waste that is generated during and around the time of an operation?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1007/s10163-020-01123-1 			X
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30	26	How much recyclable waste generated during an operation is being appropriately recycled?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1186/s13063-017-2034-0 			X
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37	27	How do we minimize the amount of water used for 'scrubbing up'?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.wneu.2020.12.137 			X
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	(handwashing) for an operation?							
28	What can healthcare organisations learn from healthcare systems in other countries about sustainable surgical pathways?	No	No		• https://dx.doi.org/10.12968/bjon.2017.26.22.1230			X
29	How can we reduce the environmental impact of nitrous oxide used in healthcare?	No	No		• https://dx.doi.org/10.1002/14651858.CD013441.pub2			X
30	How do we define and avoid low-benefit or unnecessary operations?	No	No		• https://dx.doi.org/http://dx.doi.org/10.1136/bmj.k5120			X
31	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	No	No					X
32	What are the barriers to using more sustainable anaesthetic practices?	No	No					X
33	What role does recycling inhaled anaesthetics have in reducing the	No	No					X

1		environmental impact of inhaled anaesthesia?							
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3	34	What is the environmental impact of different forms of pain relief for an operation?	No	NG180 - perioperative care	No				X
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9	35	How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	No	No					X
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20	36	What is the environmental impact of using day case surgical pathways compared to inpatient pathways?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1053/j.ifas.2020.08.007 • https://dx.doi.org/10.1097/NUR.0b013e31824590e6 • https://doi.org/10.1016/j.icjq.2021.06.010 		X	
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28	37	What is the role of community-based care in reducing the environmental impact of operations?	No	No					X
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34	38	Is it more environmentally sustainable and safe for patients to have more of their early post-operative care at home compared to hospital?	No	No					X
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1	39	How can the waste of drugs be avoided during and around the time of an operation?	No	No					X
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6	40	How can drug syringes be used better to reduce their environmental impact?	No	No		• https://dx.doi.org/10.3390/ijerph19031381			X
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13	41	What is the most environmentally sustainable way to deliver oxygen in the post-operative period?	No	No					X
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19	42	What are the most environmentally sustainable and effective methods of surgical wound care (e.g., dressings, wound cleaning)?	No	MTG59 – Plus Sutures for preventing surgical site infection	No				X
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27	43	What are the sustainable and effective alternatives to carbon dioxide used in laparoscopic (keyhole surgery of the abdomen) surgery?	No	No		• https://dx.doi.org/10.4103/jmas.JMAS_130_20 • https://dx.doi.org/10.1002/14651858.CD009569.pub3 • https://doi.org/10.1289/EHP8666		X	
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37	44	What is the most environmentally sustainable way to provide nutrition for patients	No	NG180 - Perioperative care	No				X
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3	45	What is the most environmentally sustainable method of providing written information to patients?	No	No				X
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10	46	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?	No	PH6 – Behavioural Change – general approaches	No			X
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19	47	What are the best ways to educate patients, and their carers, about sustainable healthcare before an operation?	No	PH6 – Behavioural Change – general approaches	No			X
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26	48	What is the most sustainable way for healthcare professionals to store and (appropriately) share clinical information?	No	NG94 - Emergency and acute medical care in over 16s: service delivery and organisation	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.ident.2021.103737 		X
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34	49	How can energy usage within an operating theatre be safely reduced?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.amjsurg.2018.07.021 • https://doi.org/10.1016/j.accpm.2021.100907 • https://doi.org/10.1016/j.jciq.2021.06.010 		X
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1	50	What is the most environmentally sustainable way to maintain a patient's body temperature during an operation?	No	• CG65 – Hypothermia, prevention and management in adults undergoing surgery 2016 • Medical Technologies guidance 31 – Humiguard	No			X	
2	51	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	No	No		<ul style="list-style-type: none"> • https://doi.org/10.1289/EHP8666. • https://doi.org/10.1016/j.icjq.2021.06.010 • https://dx.doi.org/10.1097/SLA.0000000000002712 		X	
3	52	How can care packages which aim to enable rapid recovery from surgery (e.g., ERAS) affect the environmental impact of an operation?	No	NG180 - perioperative care	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/SLA.0000000000003878 		X	
4	53	How can waste from medical gas cylinders be reduced?	No	No					X
5	54	What effect do standards, guidelines and quality improvement initiatives have on the environmental impact of operations?	No	No		<ul style="list-style-type: none"> • https://doi.org/10.1016/j.eururo.2022.01.027 • https://dx.doi.org/10.1097/SLA.0000000000002712 • https://doi.org/10.1289/EHP8666. • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
6	55	What is the most sustainable method to launder clothing worn when delivering	No	No					X

1		care around an operation?						
2	56	How do we measure the carbon footprint of an operation?	No	No		• https://dx.doi.org/10.1097/SLA.0000000000003951		X
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6	57	How can the different types of environmental impacts (e.g., global warming, waste, resource utilisation) associated with care during and around the time of an operation be prioritised and balanced against one another?	No	No				X
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21	58	What is the most sustainable way to provide lighting in the operating theatre?	No	No				X
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26	59	How can environmental sustainability be incorporated into the organisational management of operating theatres?	No	No				X
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34	60	How can the provision and administration of medicines to patients undergoing operations be made more	No	No				X
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For peer review only

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For peer review only

BMJ Open

Greener Operations: a James Lind Alliance Priority Setting Partnership to define research priorities in environmentally sustainable peri-operative practice through a structured consensus approach

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Secondary Subject Heading:	Anaesthesia, Evidence based practice, Patient-centred medicine, Research methods
Keywords:	ANAESTHETICS, GYNAECOLOGY, INTENSIVE & CRITICAL CARE, OBSTETRICS, SURGERY

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Title page

Greener Operations: a James Lind Alliance Priority Setting Partnership to define research priorities in environmentally sustainable peri-operative practice through a structured consensus approach

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Abstract

Objectives: To agree the 'top 10' research priorities for environmentally sustainable peri-operative practice.

Design: surveys and literature review; final consensus workshop using a nominal group technique.

Setting: UK-based.

Participants: healthcare professionals, patients, carers, and the public.

Outcome measures: initial survey- suggested research questions; interim survey- shortlist of 'indicative' questions (the 20 most frequently nominated by patients, carers and the public, and healthcare professionals); final workshop- ranked research priorities.

Results: initial survey- 1,926 suggestions by 296 respondents, refined into 60 indicative questions. Interim survey- 325 respondents. Final workshop- 21 participants agreed the 'top 10':

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 (obtain) 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 practices 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 (e.g., different types of general, regional and local anaesthesia) 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 (e.g., PPE, drapes, clean air ventilation)?

Conclusions: a broad range of 'end-users' have identified research priorities for sustainable peri-operative care.

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Strengths and Limitations of this Study.

- The James Lind Alliance process is consensus-based, transparent, and includes measures to ensure that patient, carer and public opinions are represented.
- Patients, carers, and members of the public comprised 21% of survey respondents overall, a smaller proportion than in many priority setting partnerships. This may have been because of the online methods used (due in part to the COVID-19 pandemic) or the novel subject matter.
- We ensured that 'healthcare professional' and 'patient, carer and public' priorities were given equal weighting at the interim priority setting stage.
- The scope of our work was limited to 'care provided from or in the hospital setting to patients who may benefit from surgical management' so does not include the full patient journey; future sustainability-focussed priority setting partnerships would be beneficial.
- In common with all Priority Setting Partnerships, our methodology relied on active and voluntary participation, so it is possible that self-selection bias may have affected the results

Original Protocol of the Study

See <https://www.jla.nihr.ac.uk/documents/greener-operations-sustainable-peri-operative-practice-ppsp-protocol/27106>

Data Availability Statement

All data relevant to the study are included in the article or uploaded as supplementary information. A data sheet, detailing the 60 indicative questions and including a representative sample of initial suggestions is available on the James Lind Alliance website at <https://www.jla.nihr.ac.uk/priority-setting-partnerships/greener-operations-sustainable-perioperative-practice/>

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Competing Interests Statement

CS is a co-opted member of the Association of Anaesthetists Environment and Sustainability Committee. He has received travel expenses from the Association of Anaesthetists, the Centre for Sustainable Healthcare and Health Education England to attend professional meetings to speak on sustainable healthcare. He is a member of the SBRI Healthcare 'Delivering a Net Zero NHS' competition funding panel. YH is a co-founder of Green Health Wales. CL is a member of the Health Education England North East and North Cumbria Faculty of Sustainable Healthcare and the Intensive Care Society Sustainability Group. DM has accepted consulting fees from Bausch and Lomb and Nuffield Health, and honoraria for education provided to Wilderness Medical Training. SMK is the chairperson of the Association of Anaesthetists Environment and Sustainability Committee. VP is vice chairperson of the Royal College of Surgeons of England Sustainability in Surgery Group. TR is an independent participant in the OneTogether programme. DJ is the budget holder for account

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managed within MFT Charity used to fund Greener Operations. The other authors have no competing interests to declare.

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Introduction

It is increasingly recognised that healthcare, as a resource-intensive industry, makes a significant contribution to environmental harms such as global warming and pollution.¹ In turn, these environmental harms contribute to ill health, thereby creating an increased demand for healthcare services.² In the UK, National Health Service trusts are recognised as an ‘anchor institutions’, large organisations that influence the health and wellbeing of their communities not only through providing healthcare – but through practices in procurement, employment, community engagement and environmental responsibility.³ Recently, healthcare systems,⁴ professional societies,^{5,6} and educational regulators⁷⁻⁹ have begun to issue guidelines and implement plans aiming to mitigate the carbon footprint and ecological impacts of healthcare. This rapid expansion of interest in the area is both necessary and welcome but presents its own challenges. Though there are several high-impact measures that should be urgently implemented (e.g., decarbonisation of electricity production),⁴ it is universally acknowledged that achieving sustainable healthcare will require research and innovation.⁴⁻⁶

Between 220 and 344 million operations are thought to be performed worldwide every year,¹⁰ a number which will increase as the Lancet Commission on Global Surgery target of 5,000 operations per 100,000 population (approximately 30% higher than at present) is approached.¹¹ The peri-operative journey, from initial consultation to surgery and then discharge from hospital and recovery, is a complex process that involves many groups of hospital staff. Operations are known to be among the most resource-intensive healthcare interventions;¹² each operating theatre creates over two tonnes of solid waste per year,¹³ and a single operation can generate a ‘carbon footprint’ equivalent to driving more than 2,000 miles.¹⁴ Peri-operative practice therefore represents a significant opportunity to make healthcare more environmentally sustainable. This opportunity has not gone unrecognised, and recent years have seen a proliferation in research funding, fellowship posts, and publications relating to sustainability in the peri-operative period.¹⁵⁻¹⁷

Noting the increasing interest in research relating to sustainability in peri-operative practice, we felt that this represented an ideal subject for a James Lind Alliance (JLA) Priority Setting Partnership (PSP), in order to direct and inform future research.

The JLA is a not-for-profit organisation, founded to address evidence uncertainties in specific areas of research through collaboration between patients, carers and clinicians.¹⁸ Using an ‘open-to all’ survey-based approach the JLA seeks to engage the ‘end users’ of research to help direct funding to the areas of greatest need, thereby minimising biases caused by financial or purely scientific research motives. Since its founding in 2004, it has facilitated more than 140 PSPs, developing a robust methodology to identify the ‘top 10’ research priorities in a given subject area.¹⁹

In 2019, we were successful in our application to the JLA to run ‘Greener Operations’, a PSP which aimed to identify the top 10 unanswered research questions connected to environmentally sustainable peri-operative practice, as defined by an expansive group of patients, carers, members of the public and healthcare workers. We believe this to be the first PSP to be conducted in any field of sustainable healthcare.

Methods

The Greener Operations PSP was conducted according to the standard JLA methodology as summarised in Figure 1, by a team comprising project leads (consultant surgeon DJ and consultant

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3 anaesthetist CS) information specialists (anaesthesia research fellows HN and MCS), a
4 multidisciplinary steering group composed of healthcare professionals and patient and public
5 representatives, and a James Lind Alliance advisor (JG).²⁰ The PSP was supported by partner
6 organisations involved or interested in peri-operative care, such as professional associations, royal
7 colleges, and patient groups. Potential participants were provided with an explanation of what each
8 phase of the project involved, including how the data would be used, as described below. Written
9 consent was not requested from participants.
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14 ***Ethics Approval Statement***

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16 As this was a patient and public involvement project, based on surveys which were available to all on
17 a voluntary basis, research ethics committee approval was not required.²⁰
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21 ***Setting up the priority setting partnership***

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23 Following approval of charitable funding, the PSP was established in August 2020 by the project
24 leads. Two information specialists were appointed, to be responsible for managing the surveys and
25 data analysis, and an advisor was assigned by the JLA. Partner organisations (detailed in
26 Acknowledgements), responsible for promoting the PSP and ensuring that surveys reached as wide
27 an audience as possible, were recruited by the project leads by email contact with organisational
28 representatives. The steering group was formed by inviting expressions of interest from individuals
29 linked to the partner organisations (e.g., members of environmental or peri-operative committees or
30 working groups). We aimed to recruit a wide range of healthcare professionals involved in peri-
31 operative practice, including surgeons, anaesthetists, nurses, operating department practitioners
32 and pharmacists. In addition, the steering group included non-clinical healthcare professionals
33 involved in sustainability (a manager, an educator, and a sustainability officer), and individuals with
34 lived experience of undergoing surgery who could represent patients' interests.
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38 Because of ongoing COVID-19 pandemic and a desire to minimise the environmental impacts of the
39 project itself, it was agreed by the steering group that all meetings would be held online. The
40 meetings were chaired by the JLA advisor, and conducted using a video-conferencing platform
41 (Zoom, Zoom Video Communications, Inc, San Jose, California, USA).
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45 ***Defining scope***

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47 At the initial meeting of the steering group, the study protocol and scope of the PSP were
48 confirmed.²¹ Though we recognised that the complete perioperative journey often commences and
49 ends in the community, for pragmatic reasons we defined 'peri-operative practice' as being provided
50 from or in the hospital setting to patients who may benefit from surgical management, including:
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- 53 • pre-operative assessment and optimisation (e.g. pre-operative clinic)
- 54 • counselling and shared decision-making (including on decisions regarding the
55 appropriateness of surgery, and different approaches to peri-operative management)
- 56 • pre and postoperative hospital care (including outpatient, ambulatory, virtual and inpatient
57 care)
- 58 • intra-operative management (including surgical and anaesthetic techniques)
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- both clinical (e.g. surgical and anaesthetic techniques) and non-clinical (e.g. energy, water, waste management and recycling) aspects
- the implementation of these practices within organisations and departments
- achieving positive peri-operative outcomes

Care beyond the early post-operative period (e.g. prolonged rehabilitation), broader aspects of environmental sustainability, and non-UK practice were considered out-of-scope, along with questions relating to denying management of illness purely on the basis of environmental sustainability.

Gathering uncertainties

An initial online survey (SurveyMonkey, Momentive, San Mateo, California, USA) was used to invite patients, carers, healthcare professionals, and members of the public to suggest evidence uncertainties connected with sustainable peri-operative care. Respondents were asked to state, via free-text boxes, what questions they felt needed to be answered by future research to help make peri-operative practice more environmentally sustainable. To help respondents to consider the full scope of the peri-operative patient journey, we asked them to consider the pre-, intra- and postoperative phases, and also invited any further suggestions. In addition to suggested questions, demographic data were collected. After a pilot within the steering group, the initial survey was launched online on 10th May 2021, and disseminated through partner organisations (see Acknowledgements), the project website, and social media, using a web link and quick response (QR) code. Demographic data were routinely reviewed to consider whether the survey was successfully reaching all stakeholder groups. The survey remained open for 17 weeks, until 31st August 2021.

Data processing

After closing the survey, the raw data were downloaded for processing and analysis. To maintain data integrity and facilitate cross checking, each respondent was assigned a unique code number, with each individual response assigned a sub-code. Suggestions were assessed independently by the information specialists to determine whether they were in-scope or out-of-scope, based on the criteria in the PSP protocol. Where both information specialists agreed that a suggestion was out of scope, that suggestion was not analysed further. Suggestions that did not clearly fall in or out of scope were kept for further analysis, to ensure potentially relevant suggestions were not missed.

To aid with analysis, suggestions were categorised into themes by the information specialists based on subject matter. The themes and suggestions were then reviewed by members of the steering group to form a list of indicative questions, agreed by consensus. Suggestions that were deemed to be similar were combined to form a single indicative question; others that were deemed to be too broad were split into separate questions. Each in-scope suggestion was allocated to a minimum of one appropriate indicative question to ensure all data were kept in the analysis.²⁰ The steering group then cross-checked the list of indicative questions with the individual suggestions to ensure that the meaning of the suggestions was captured appropriately.

Literature review

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3 A literature review was undertaken to identify if any of the indicative questions had already been
4 answered by currently available research. Following standard JLA principles, questions were
5 categorised as having been answered 'completely', 'partially', or 'not at all'.²⁰ For a question to be
6 deemed 'answered completely', a relevant, up-to-date and reliable systematic review or national
7 clinical guideline that addressed the question would be required. If no relevant reviews or guidelines
8 were found, the question would be deemed 'not at all' answered. If reviews or guidelines were
9 identified that didn't meet the criteria for 'completely' answering the question (e.g., only partly
10 relevant or with clear methodological concerns) the question would be deemed 'partially answered'.
11 For each indicative question, we worked with a healthcare librarian (OS) to search relevant
12 databases (EMBASE, CINAHL, Medline and the Cochrane Database of Systematic Reviews; see
13 Appendix, Table A1), and reviewed guidelines from the National Institute for Health and Care
14 Excellence, the Scottish Intercollegiate Guidelines Network, and relevant Royal Colleges and
15 professional associations. In addition, members of the steering group who were members of
16 professional organisations checked if there were any guidelines 'in press'. The findings of the
17 literature review were reviewed by the steering group who decided whether any questions could be
18 deemed to be answered completely. Questions that had some evidence available that did not meet
19 the criteria for being completely answered were classified as partially answered, and these
20 questions, along with the unanswered ones, were taken forward into the interim survey.

21 22 23 24 25 26 27 **Interim priority setting**

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29 A second online survey (SurveyMonkey, Momentive, San Mateo, California, USA) was used to rank
30 the long list of indicative questions to generate a shortlist of the most important questions that
31 could then be discussed at the final prioritisation workshop. Respondents were presented with the
32 indicative questions, displayed in a random order unique to each respondent, and asked to select
33 the 10 questions they felt were most important. In addition, routine demographic data were
34 collected. The survey was open for six weeks from 19th April to 30th May 2022. Following this, the
35 raw data were analysed to identify the questions selected the most frequently. To moderate the
36 influence of unequal numbers of respondents from different backgrounds, equal weighting was
37 given to the overall question rankings from the healthcare professionals, and the overall rankings
38 from respondents who classified themselves as patients, carers or members of the public. The 20
39 questions most frequently selected by these two groups were taken forward to the final priority
40 setting workshop

41 42 43 44 45 46 **Final priority setting workshop**

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48 The final priority setting workshop aimed to rank the priorities taken forward from the interim
49 priority setting stage, to identify the top 10 priorities. It was a one-day in-person event, conducted
50 according to a nominal group technique,²² chaired and facilitated by a team of advisors from the JLA.
51 Respondents to the interim survey were invited to express an interest in participating in the
52 workshop, and invitations were made using a purposive approach in order to promote a balanced
53 group in terms of background (healthcare professional or patient, carers or member of the public).
54 Participants were asked, in advance, to consider the importance of the questions for discussion. The
55 JLA advisors allocated participants to three small groups of up to 10 people, aiming for a diverse mix
56 of backgrounds in each group. The process comprised five phases:²⁰

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1. Small group discussions: participants listed the three questions they felt were most important for research, and the three that they felt were least important. These were recorded by the facilitator, and an opportunity for further discussion and clarification was provided.
 2. First round of small group ranking: in the same groups, the facilitator laid out the questions, printed on cards, in rough groupings: those which were thought to be most important by group members, those thought to be least important, and those not mentioned or where there was divergence of views. Group participants then prioritised all of the questions by moving the cards into rank order. The ranking scores of the interim survey were made available to participants at this phase, to assist with ranking decisions.
 3. Plenary review: the ranking agreed by each group was entered into a spreadsheet, and assigned a value (highest rank = 1, second highest = 2, etc). These ranks were combined by addition to create an aggregate ranked list. The aggregate ranks were presented to all workshop participants in plenary, with an opportunity for discussion.
 4. Second round of small group ranking: participants were allocated to new groups by the JLA advisors, aiming to maintain a balance of backgrounds and expose participants to a different range of views. These new groups discussed and revised the aggregate ranked list, again by moving cards positioned to reflect the rank order.
 5. Final plenary review: as per phase 3, the small group scores were entered into a spreadsheet, and combined by addition. The aggregate ranking was presented to all workshop participants in plenary, with the cards laid out in order. The ranking was discussed in plenary group, in order to agree the final ranking.

The final workshop discussions were chaired by trained JLA advisers to ensure that no one group or individual dominated the decision making. The aim was to reach agreement by consensus at the end of each phase, with decisions made by majority vote if consensus could not be reached.

Patient and Public Involvement

How was the development of the research question and outcome measures informed by patients' priorities, experience, and preferences?

- Four members of the steering group were patient and public representatives, who contributed to the development of the protocol for the PSP.

How did you involve patients in the design of this study?

- The patient and public members participated fully in all duties of the steering group, including the design of the surveys, and the definition and wording of the indicative questions.

Were patients involved in the recruitment to and conduct of the study?

- The patient and public representatives participated in developing the recruitment strategy, liaising with partner organisations, producing explanatory documents and analysing the study data.

How will the results be disseminated to study participants?

- In addition to this paper, we have produced a short video explaining the process and outcomes, uploaded the results to the James Lind Alliance website, shared the findings via

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social media, and will work with our patient and public representatives to produce a plain English summary document.

Results

Two hundred and ninety-six individuals responded to the initial survey, of whom 230 (77.7%) classified themselves as healthcare professionals, 40 (13.5%) as members of the public, 21 (7.1%) as patients, and three (1.0%) as carers. Detailed demographics are displayed in table 1.

Respondents to the initial survey suggested 1,926 uncertainties for research. After initial review, we removed 309 suggestions agreed to be out-of-scope. After thematic categorisation of the remaining 1,617 suggestions, 78 themes were identified. This was further consolidated to 60 indicative questions by steering group consensus.

The literature review revealed that none of the indicative questions had been completely answered by currently available research (Appendix Table A2). Members of the steering group who were part of professional bodies confirmed there were no relevant upcoming guidelines from their respective organisations that would answer the questions. Twenty-three questions were found to be partially answered by the available evidence. Therefore, all 60 indicative questions were included in the interim survey.

Three hundred and twenty-five individuals responded to the interim survey, of whom 254 (78.2%) classified themselves as healthcare professionals, 45 (13.8%) as members of the public, 19 (5.8%) as patients, and two (0.6%) as carers. Detailed demographics are displayed in table 1.

	Initial Survey	Interim Survey
Total responses	296	325
Gender		
Woman (including trans woman)	171 (57.8%)	187 (57.5%)
Man (including trans man)	110 (37.2%)	122 (37.5%)
Non-binary	4 (1.4%)	0 (0%)
Prefer not to say	8 (2.7%)	7 (2.2%)
Other	1 (0.3%)	4 (1.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Age		
Under 18	0 (0%)	0 (0%)
18-25	5 (1.7%)	7 (2.2%)
26-40	84 (28.6%)	139 (42.8%)
41-60	139 (47.3%)	130 (40.0%)
61-80	57 (19.4%)	38 (11.7%)
Over 80	3 (1.0%)	0 (0%)
Prefer not to say	6 (2.0%)	6 (1.9%)
Question skipped	2 (0.7%)	5 (1.5%)
Ethnic group		
White	230 (77.7%)	258 (79.4%)
Asian or Asian British	34 (11.5%)	33 (10.1%)
Black, African Caribbean or Black British	3 (1.0%)	2 (0.6%)
Mixed or Multiple Ethnic Groups	6 (2.0%)	13 (4.0%)
Other ethnic group	3 (1.0%)	3 (0.9%)

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Prefer not to say	18 (6.1%)	11 (3.4%)
Question skipped	2 (0.7%)	5 (1.5%)
Region		
North West England	82 (27.7%)	115 (35.4%)
North East England	35 (11.8%)	31 (9.5%)
West Midlands	12 (4.1%)	21 (6.5%)
East Midlands	17 (5.7%)	14 (4.3%)
London	33 (11.1%)	28 (8.6%)
South West England	18 (6.1%)	19 (5.8%)
South East England	52 (17.6%)	43 (13.2%)
Scotland	9 (3.0%)	14 (4.3%)
Wales	18 (6.1%)	6 (1.8%)
Northern Ireland	2 (0.7%)	4 (1.2%)
Outside UK	7 (2.4%)	18 (5.5%)
Prefer not to say	9 (3.0%)	7 (2.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Background		
Patient	21 (7.1%)	19 (5.8%)
Carer	3 (1.0%)	2 (0.6%)
Member of the public	40 (13.5%)	45 (13.8%)
Healthcare Professional	230 (77.7%)	254 (78.2%)
Question skipped	2 (0.7%)	5 (1.5%)
Profession (if healthcare professional)		
Advanced practitioner	2 (0.9%)	4 (1.6%)
Anaesthesia associate	4 (1.7%)	2 (0.8%)
Dentist	2 (0.9%)	2 (0.8%)
Doctor	142 (61.7%)	172 (67.7%)
Healthcare Assistant	4 (1.7%)	0 (0%)
Nurse	23 (10.0%)	16 (6.3%)
Operating department practitioner	7 (3.0%)	20 (7.9%)
Non-clinical role	3 (1.3%)	6 (2.4%)
Midwife	0 (0%)	4 (1.6%)
Paramedic	1 (0.4%)	0 (0%)
Perfusionist	1 (0.4%)	0 (0%)
Pharmacist	10 (4.3%)	1 (0.4%)
Physiotherapist	2 (0.9%)	0 (0%)
Porter	1 (0.4%)	0 (0%)
Radiographer	0 (0%)	1 (0.4%)
Other	15	24 (9.4%)
Question skipped	13 (5.7%)	2 (0.8%)

Table 1: demographic details of respondents to the initial and interim Greener Operations surveys

The number of selections for each question was ranked separately according to whether respondents were healthcare professionals, or patients, carers and members of the public. A fractional ranking technique (tied ranks being assigned the mean of the ranking positions) was used to identify the 20 highest-ranked questions for each group, 14 of which were common to both groups (table 2). This led to 25 questions progressing into the final prioritisation workshop.

Question	Healthcare Professional Interim Rank	Patient, Carer and Public Interim Rank	Combined Interim Rank
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1	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	1	1.5	1
2				
3	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	3	1.5	2
4				
5	How can the amount of waste generated during and around the time of an operation be minimised?	2	3.5	3
6				
7	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g., PPE, drapes, clean air ventilation)?	4	3.5	4
8				
9	How much recyclable waste generated during an operation is being appropriately recycled?	5	5.5	5
10				
11	How do we define and avoid low-benefit or unnecessary operations?	12	7	6
12				
13	How can more sustainable reusable equipment safely be used during and around the time of an operation?	16	5.5	7
14				
15	How do we measure the carbon footprint of an operation?	14	10	8
16				
17	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	12	13	9.5
18				
19	How can energy usage within an operating theatre be safely reduced?	8	17	9.5
20				
21	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?	10	17	11
22				
23	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	9	21	12.5
24				
25	Can alternative, more environmentally sustainable, methods of disposal be used for waste that is generated during and around the time of an operation?	6	24	12.5
26				
27	How can environmental sustainability be incorporated into the organisational management of operating theatres?	15	17	14.5
28				
29	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?	22	10	14.5
30				
31	What is the most sustainable way of providing equipment packs for an operation?	19.5	13	16.5
32				
33	What is the most sustainable way to sterilise equipment used during an operation?	19.5	13	16.5
34				
35	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	27.5	10	18
36				
37	How can the waste of drugs be avoided during and around the time of an operation?	21	17	19
38				
39	How can drug syringes be used better to reduce their environmental impact?	12	26.5	20
40				
41	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?	38.5	8	22
42				
43	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	7	40.5	23.5
44				
45	How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	35	17	26
46				
47	What are the barriers to using more sustainable anaesthetic practices?	18	40.5	28.5
48				
49	How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?	17	50.5	32
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Table 2: highest-ranked indicative questions in the interim survey. Left column, healthcare professionals; mid column, patients, carers and members of the public; right column, combined

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rank. The top 20 questions for each group are highlighted in green. The combined rank (used for data organisation only) was calculated by adding the two rank scores, then ranking the added scores.

A total of 21 individuals attended the final prioritisation workshop, of whom eight classified themselves as patients, carers or members of the public, and 13 as healthcare professionals. The healthcare professionals comprised three surgeons, one operating department practitioner, five anaesthetists, one medical student, one foundation doctor, one optometrist, and one sustainability officer. Three of the patient, carer and public representatives were also members of the Greener Operations steering group. We noted that four of the patient, carer and public representatives had worked in healthcare at some point in their careers. Five observers from stakeholder organisations (e.g., the National Institute for Health and Care Research, Greener NHS) and the Greener Operations project leads and information specialists were present but did not take part in the prioritisation discussions. The 25 indicative questions were ranked, and the top 10 priorities for research into sustainable peri-operative practice were agreed (table 3). All decisions were reached by consensus, with no majority votes required.

Rank	Question
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 (obtain) 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 practices 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 (e.g., different types of general, regional and local anaesthesia) 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 (e.g., PPE, drapes, clean air ventilation)?
11	How do we measure the carbon footprint of an operation?
12	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?
13	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?
14	How can the waste of drugs be avoided during and around the time of an operation?
15	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?
16	How do we define and avoid low-benefit or unnecessary operations?
17	How can energy usage within an operating theatre be safely reduced?
18	What are the barriers to using more sustainable anaesthetic practices?
19	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?
20	Can alternative, more environmentally sustainable, methods of disposal be used for waste that is generated during and around the time of an operation?
21	What is the most sustainable way of providing equipment packs for an operation?
22	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?
23	How much recyclable waste generated during an operation is being appropriately recycled?
24	What is the most sustainable way to sterilise equipment used during an operation?

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25	How can drug syringes be used better to reduce their environmental impact?
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Table 3: Ranked research priorities from the final Greener Operations Priority setting workshop. The 'Top 10' are highlighted in green.

Discussion

The Greener Operations PSP has identified the top 25 research priorities for sustainable peri-operative practice, with an emphasis on the top 10. This provides a robust basis for end-user focussed research into mitigating the environmental impacts of a resource-intensive area of healthcare at a time of climate crisis.⁴ Despite a recent increase in the number of publications into sustainable healthcare in the peri-operative period,²² this remains a relatively under-investigated area - as indicated by our literature review that revealed no 'completely answered' indicative questions. Though there are established sustainability measures that are already being implemented at scale (e.g., anaesthetic gas mitigation, reusable surgical drapes), research will be required to understand how a fully sustainable healthcare system can be achieved.⁴ Furthermore, implementation research will be required to identify how to achieve some of the behavioural elements (e.g., changes in practice) that have been identified as important but not yet integrated into practice. The top 10 research priorities relate to research uncertainties across multiple areas of research interest, including implementation (priorities 1 and 3), manufacturing and supply (priority 2), management (priorities 4 and 9), waste (priorities 1 and 5), surgery (priority 6), anaesthesia (priority 7), medical ethics (priority 8), economics (priority 8 and 9) and infection control (priority 10). This both underlines the interdisciplinary relevance of the PSP and highlights the complexity of the sustainability challenge faced by healthcare.²³

Our PSP had an above average overall number of suggestions in the primary survey (1,926, compared to the mean of 1,723),²⁴ with each respondent contributing more than six suggestions on average. This is likely to be representative of the enthusiasm for this area of study amongst the participants. Whilst the JLA process aims to engage a broad range of respondents, it is not uncommon for PSPs to have an imbalance in the background of survey respondents.²⁵⁻²⁸ Our PSP had a preponderance of healthcare professional respondents, with 78.2% fitting into this category across both surveys. Our use of internet-based approaches e.g., social media and online surveys, may have contributed to the imbalance of respondents, as the likelihood of having had an operation (therefore feeling more informed to comment on the peri-operative process) increases with age, whereas internet usage is inversely proportional to age.^{29,30} Methods to address this such as in-person or paper surveys (e.g., made available at patient encounters such as clinics as in other PSPs) were not feasible for our project given the restrictions on social contact owing to the COVID-19 pandemic at the time of the work. However, we are confident that the overall results were representative of both healthcare and non-healthcare groups, because the JLA methodology controls for imbalances in survey response numbers, and also because the results of the interim survey showed strong alignment in priorities between both groups (Table 2). This was further strengthened through active patient, carer and public participation in the final workshop. In common with all PSPs, our methodology relied on active and voluntary participation, it is possible that self-selection bias may have affected the results, for example by emphasising the views of 'environmentally conscious' individuals who may have been more motivated to be involved.

The Greener Operations priorities should provide a valuable resource for researchers and funders. Based on our literature review, we are confident that none of the identified research priorities have been completely answered by existing research. However, some priorities have attracted a

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3 significant research effort in recent years and have therefore been partially answered. In particular,
4 the 'carbon footprints' of various anaesthetic agents, disposable and re-usable instruments,
5 infection control supplies, and PPE (relating to priorities 1, 7 and 10) have been investigated.³¹⁻³⁵
6 Here, there is an increasing amount of coherent data on climate impacts (i.e., 'carbon footprints'),
7 but other aspects (e.g., the ecotoxic effects of plastic waste and / or drug and metabolite disposal)
8 remain under-investigated.³⁵ Furthermore, sustainable peri-operative care is an area of current
9 innovation, and new developments may render current concepts rapidly outdated.^{36,37} Nevertheless,
10 experts in the field who are aware of the current literature may consider some questions outside the
11 Greener Operations rankings to be of greater priority than some of those within. The PSP process
12 should not be seen to diminish the value of this expertise. Rather, it adds insight into what the end
13 users of research – patients, carers, public and clinicians – perceive to be important about
14 environmentally sustainable peri-operative care. The priority questions are intentionally broad in
15 scope, and we encourage researchers to draw on them in the development of projects. Of note,
16 there appears to be an increasing number of funding calls relevant to this topic area, which we hope
17 will be maintained in the future.^{36,38}
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24 **Conclusion**

25 Greener Operations has identified the top 10 research priorities for sustainable peri-operative care
26 as agreed by a wide range of healthcare professionals, patients, carers and members of the public.
27 Our project has explored a priority area for healthcare and identified a diverse range of research
28 topics for exploration and innovation that will benefit both the NHS and healthcare outside the UK.⁴
29 We hope that our work will be of use to researchers and funders, as part of an urgent and universal
30 effort to achieve high-quality healthcare with minimal environmental harm. Greener Operations is
31 the first PSP undertaken by the JLA in sustainable healthcare and, to our knowledge, the first
32 research priority setting exercise carried out in any field of sustainable healthcare. In addition to
33 agreeing priority research areas for investigation, we have demonstrated that a PSP focussed on
34 sustainable healthcare is feasible. Given the pressing nature of the climate crisis, we hope that
35 colleagues in other fields will draw on our experience to conduct further sustainability-related PSPs,
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52 Anaesthetic and Recovery Nurses Association, British Association of Day Surgery, Centre for
53 Perioperative Care, Centre for Sustainable Healthcare, College of Operating Department
54 Practitioners, Faculty of Intensive Care Medicine, Green Health Wales, Greener Anaesthesia and
55 Sustainability Project, Health Innovation Manchester, Intensive Care Society, Perioperative Care
56 Collaboration, Prevent Breast Cancer, Regional Anaesthesia UK, Royal College of Anaesthetists, Royal
57 College of Nursing Perioperative Forum, Royal College of Ophthalmologists, Royal College of
58 Surgeons of Edinburgh, Royal College of Surgeons of England, Society for Cardiothoracic Surgery in
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Author's contributions:

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3 **Caption for figure:**
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5 **Figure 1:** overview of the Greener Operations James Lind Alliance Priority Setting Partnership
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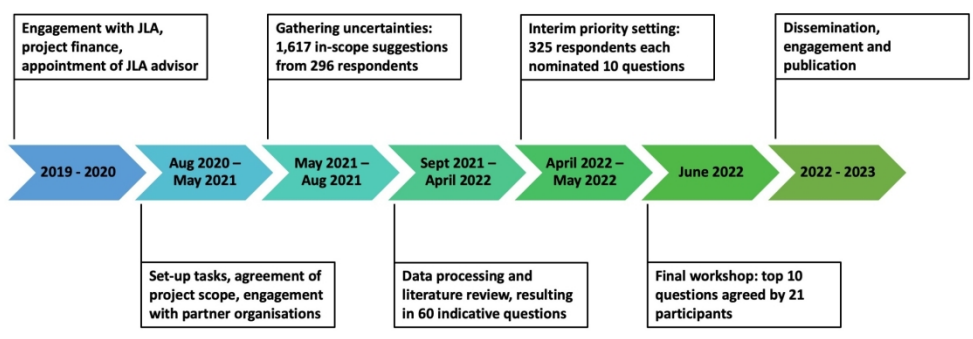


Figure 1: overview of the Greener Operations James Lind Alliance Priority Setting Partnership process

316x112mm (200 x 200 DPI)

Appendix – Evidence Checking

Table A1: Search strategies by question. CINAHL = Cumulative Index to Nursing and Allied Health Literature.

	Question	Search Strategy: Cochrane, Embase, CINAHL and Medline.
1	How can care after an operation be optimised to minimise the use of resources and creation of waste whilst providing good care?	1 ((Postop* or "post op*" or periop* or "peri op*" or post-surgery) adj6 care).ti,ab. 2 Postoperative Care/ 3 1 or 2 4 (optimis* or optimiz* or enhance* or improve* or better or best).ti,ab. 5 3 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ 9 6 or 7 or 8 10 5 and 9 11 limit 10 to (yr="2017 -Current" and (meta analysis or "systematic review")) 12 limit 11 to english language
2	Which aspects of care before and after an operation can be provided in the community in a more sustainable way?	1 ((Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery) adj6 care).ti,ab. 2 ((before or prior) adj2 (surgery or operation)).ti,ab. 3 (after adj2 (surgery or operation)).ti,ab. 4 (following adj2 (surgery or operation)).ti,ab. 5 2 or 3 or 4 6 care.ti,ab. 7 5 and 6 8 Preoperative Care/ 9 Postoperative Care/ 10 ("pre-operative investigations" or pre-habilitation).ti,ab. 11 ("post operative" adj3 rehabilitation).ti,ab. 12 (postop adj3 rehabilitation).ti,ab. 13 1 or 7 or 8 or 9 or 10 or 11 or 12 14 exp Community Health Services/ 15 (community or "general practice" or GP or "district nurse*" or "remote clinic" or "remote clinics" or "one-stop clinic" or "one-stop clinics").ti,ab. 16 exp Community Health Nursing/ 17 14 or 15 or 16 18 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 19 Carbon Footprint/ or Environmental Pollution/ 20 (transport* or travel*).ti,ab. 21 18 or 19 or 20 22 13 and 17 and 21 23 limit 22 to (yr="2017 -Current" and (meta analysis or "systematic review"))

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23</p>	<p>3 How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?</p>	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 (following adj2 (surgery or operation)).ti,ab. 4 Postoperative Care/ 5 ((surgery or operation) adj4 (recover* adj3 period*)).ti,ab. 6 Postoperative Period/ 7 1 or 2 or 3 or 4 or 5 or 6 8 Rehabilitation/ 9 exp Self-Help Devices/ 10 ((medical or therap* or rehabilitat* or mobility or mobile) adj5 (aid* or device* or equipment)).ti,ab. 11 8 or 9 or 10 12 (recycl* or reusable or reuse or reutilis* or reutiliz* or reusing or reused).ti,ab. 13 "repeated use".ti,ab. 14 "repeatedly using".ti,ab. 15 "using again".ti,ab. 16 "used again".ti,ab. 17 "use again".ti,ab. 18 "repeated utiliz*".ti,ab. 19 "repeated utilis*".ti,ab. 20 Recycling/ or Equipment reuse/ 21 12 or 13 or 14 or 15 or 18 or 19 or 20 22 7 and 11 and 21 23 limit 22 to (yr="2017 -Current" and (meta analysis or "systematic review"))</p>
<p>24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42</p>	<p>4 Can the supply of medicines after an operation be optimised to minimise waste?</p>	<p>1 (Postop* or "post op*" or post-surgery).ti,ab. 2 (after adj2 (surgery or operation)).ti,ab. 3 (following adj2 (surgery or operation)).ti,ab. 4 Postoperative Care/ 5 ((surgery or operation) adj4 (recover* adj3 period*)).ti,ab. 6 Postoperative Period/ 7 1 or 2 or 3 or 4 or 5 or 6 8 (medicine* or medication* or drug* or prescription*).ti,ab. 9 Medicine/mt, og [Methods, Organization & Administration] 10 exp Pharmaceutical Preparations/ 11 Self Medication/ 12 exp Prescriptions/ 13 8 or 9 or 10 or 11 or 12 14 7 and 13 15 (optimis* or optimiz* or enhance* or improve* or better or best).ti,ab. 16 14 and 15 17 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 18 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 19 Carbon Footprint/ or Environmental Pollution/</p>

		20	17 or 18 or 19
		21	16 and 20
		22	limit 21 to (yr="2017 -Current" and (meta analysis or "systematic review"))
5	How does living a 'greener' lifestyle affect recovery after an operation?	1	(Postop* or "post op*" or post-surgery).ti,ab.
		2	(after adj2 (surgery or operation)).ti,ab.
		3	Postoperative Period/
		4	(following adj2 (surgery or operation)).ti,ab.
		5	1 or 2 or 3 or 4
		6	((affect* or effect* quality or facilitate or aid or help* or assist* or benefit* or speed* or improve or advantag*) adj5 recover*).ti,ab.
		7	5 and 6
		8	(green* adj5 (life or "life style*" or lifestyle* or existence or living)).ti,ab.
		9	(vegan* or vegetarian* or vegetable*).ti,ab.
		10	diet, vegetarian/ or diet, vegan/
		11	((less or reduc* or limit* or omit* or exclud*) adj4 meat*).ti,ab.
		12	vegetarians/ or vegans/
		13	(exercis* or active or activit* or fit or fitness or walk* or running or swim* or gym or sport*).ti,ab.
		14	exp Exercise/
		15	8 or 9 or 10 or 11 or 12 or 13 or 14
		16	7 and 15
		17	(sustainab* or environment* or green* or "carbon footprint").ti,ab.
		18	Carbon Footprint/ or Environmental Pollution/
		19	((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab.
		20	17 or 18 or 19
		21	16 and 20
		22	limit 21 to (yr="2017 -Current" and (meta analysis or "systematic review"))
6	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g. PPE, drapes, clean air ventilation)?	1	ipc.ti,ab.
		2	exp Infection Control/ or Surgical Wound Infection/
		3	(infection adj4 (rate* or incidenc* or occur* or reduc* or improv* or avoid* or prevent* or control*).ti,ab.
		4	1 or 2 or 3
		5	exp Surgical Procedures, Operative/
		6	(Operation* or Surger* or Surgical or Procedure*).ti,ab.
		7	Operating Rooms/
		8	5 or 6 or 7
		9	(clean adj2 air).ti,ab.
		10	ventilat*.ti,ab.
		11	Ventilation/
		12	Surgical Drapes/
		13	Personal Protective Equipment/
		14	PPE.ti,ab.
		15	"personal protective equipment".ti,ab.
		16	(gloves or gown* or mask* or apron* or hat or hats* or "safety glasses" or goggles or shields).ti,ab.

		<p>17 exp Surgical Attire/ 18 ((eye or face or hand or respiratory or body or hearing) adj1 protection).ti,ab. 19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 20 4 and 8 and 19 21 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 22 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 23 Carbon Footprint/ or Enviornmental Pollution/ 24 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 25 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 26 21 or 22 or 23 or 24 or 25 27 20 and 26 28 limit 27 to (yr="2017 -Current" and (meta analysis or "systematic review")) 29 limit 28 to english language</p>
7	<p>What effect does pre-habilitation (e.g., changes in physical activity, lifestyle and diet before an operation) have on the environmental impact of undergoing an operation?</p>	<p>1 exp Preoperative Exercise/ or exp Preoperative Period/ 2 prehabilitation.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 "preoperative exercise".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 life style/ or exp healthy lifestyle/ 5 "lifestyle intervention*".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 6 exp Diet, Healthy/ 7 "diet intervention*".mp. 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 sustainab*.ti,ab. 10 environment* impact.ti,ab. 11 carbon footprint*.ti,ab. 12 resource* reduc*.ti,ab. 13 "green* energy*".ab,ti. 14 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti. 15 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 16 exp Renewable Energy/ 17 exp Carbon Footprint/ 18 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 19 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18</p>

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		<p>20 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 21 Surgical Procedures, Operative/ 22 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery).ti,ab. 23 20 or 21 or 22 24 8 and 19 and 23 25 limit 24 to (yr="2017 -Current" and systematic reviews)</p>
8	<p>What are the relative environmental impacts of the different elements of care delivered before an operation?</p>	<p>1 exp Environment/ 2 "carbon footprint* ".ti,ab. 3 "Environmental impact".ti,ab. 4 1 or 2 or 3 5 exp Preoperative care/ 6 (prehabilitation or pre-habilitation).ti,ab. 7 (preoperative and (Clinic* or Scan* or investigat* or radiology)).ti,ab. 8 5 or 6 or 7 9 4 and 8 10 limit 9 to yr="2017 -Current" 11 limit 10 to "systematic review"</p>
9	<p>How can investigations before an operation be used more efficiently?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact.ti,ab. 3 carbon footprint*.ti,ab. 4 resource* reduc*.ti,ab. 5 "green* energy*".ab,ti. 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti. 7 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab 8 exp Renewable Energy/ 9 exp Carbon Footprint/ 10 Product Packaging/ or Surgical Instruments/ or Recycling/ or Waste Management/ 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 12 exp Preoperative Care/ or exp Preoperative Period/ 13 blood test.mp. or exp Hematologic Tests/ 14 exp Tomography, X-Ray Computed/ or exp Magnetic Resonance Imaging/ 15 exp X-Rays/ 16 exp Electrocardiography/ 17 exp Diagnostic Tests, Routine/ 18 "pre-operative test* ".ab,ti. 19 "preoperative test* ".ab,ti. 20 "Pre-operative scan* ".ab,ti. 21 "preoperative scan* ".ab,ti. 22 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 23 11 and 12 and 22 71</p>

		24 limit 23 to yr="2017 -Current"
		25 limit 24 to ("middle aged (45 plus years)" and "systematic review")
10	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	<p>1 operat*.mp. and (theatre* or theater*).ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 operat* suite*.ti,ab.</p> <p>3 patient pathway*.ti,ab.</p> <p>4 staffing level*.ti,ab.</p> <p>5 (theatre or theater).mp. and equipment*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>6 (operation* or surgical).mp. and equipment*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 (operation* or surgical).mp. and instrument*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>8 day surger*.ti,ab.</p> <p>9 Operating Rooms/</p> <p>10 Operating Rooms/mt, og [Methods, Organization & Administration] 3240</p> <p>11 "Personnel Staffing and Scheduling"/</p> <p>12 Surgical Equipment/</p> <p>13 Surgical Instruments/</p> <p>14 day surger*.mp.</p> <p>15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14</p> <p>16 sustainab*.ti,ab.</p> <p>17 environment* impact.ti,ab.</p> <p>18 carbon footprint*.ti,ab.</p> <p>19 resource* reduc*.ti,ab.</p> <p>20 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ab,ti.</p> <p>21 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>22 sustainability.mp.</p> <p>23 environment/ or carbon footprint/</p> <p>24 Environmental Pollution/ or Waste Management/</p> <p>25 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24</p> <p>26 operation*.ti,ab.</p> <p>27 surger*.ti,ab.</p> <p>28 General Surgery/</p> <p>29 operation.mp.</p> <p>30 26 or 27 or 28 or 29</p>

		<p>31 15 and 25 and 30 32 limit 31 to (english language and "systematic review" and last 5 years) 22</p>
11	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 Surgical Procedures, Operative/ 4 Postoperative Care/ 5 1 or 2 or 3 or 4 6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ 9 Product Packaging/ 10 surgical Instruments/ 11 Recycling/ 12 Waste Management/ 13 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 14 6 or 7 or 8 15 9 or 10 or 11 or 12 or 13 16 health* organi?ation*.ti,ab. 17 Health Maintenance Organizations/ or Health Planning Organizations/ 18 16 or 17 19 procur*.ti,ab. 20 (purchas* or obtain*).ti,ab. 21 "Equipment and Supplies, Hospital"/ or Durable Medical Equipment/ 22 (Equipment or Supplies or medicine*).ti,ab. 23 19 or 20 24 Pharmaceutical Preparations/ 25 21 or 22 or 24 26 5 and 14 and 15 and 23 and 25</p>

		27 limit 26 to (english language and yr="2017 -Current")
12	What drives effective sustainable innovation in manufacturing of equipment and medical supplies used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>3 Surgery/</p> <p>4 Postoperative care/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>8 Carbon Footprint/ or Pollution/</p> <p>9 6 or 7 or 8</p> <p>10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>11 Packaging/ or Surgical equipment/ or Recycling/ or Waste Management/</p> <p>12 10 or 11</p> <p>13 (Equipment and Supplies, Hospital).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word] (10)</p> <p>14 devices/ or medical device/</p> <p>15 (Equipment or Supplies or medicine*).ti,ab.</p> <p>16 13 or 14 or 15</p> <p>17 manufacture.ti,ab.</p> <p>18 manufacture {Including Related Terms}</p> <p>19 manufacturing/</p> <p>20 16 or 17 or 19</p> <p>21 sustainable innovat*.ti,ab.</p> <p>22 9 or 21</p> <p>23 (preoperative or perioperative).ti,ab.</p> <p>24 preoperative evaluation/</p> <p>25 perioperative period/</p> <p>26 5 or 23 or 24 or 25</p> <p>27 12 and 20 and 22 and 26</p> <p>28 limit 27 to (english language and "systematic review" and yr="2017 -Current")</p>

13	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical or Procedure* or "operating room" or theatre).ab,ti.</p> <p>2 Surgery/ or Operating Rooms/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or carbon footprint* or green* energy or ((wast* or resource*) and (minimiz* or minimis* or reduc*))).ab,ti.</p> <p>5 Carbon Footprint/</p> <p>6 Environmental Pollution/</p> <p>7 Recycling/ or Waste Management/</p> <p>8 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>9 Packaging/ or Surgical instruments/</p> <p>10 4 or 5 or 6</p> <p>11 7 or 8 or 9</p> <p>12 3 and 10 and 11</p> <p>13 limit 12 to (yr="2017 -Current" and english)</p> <p>14 limit 13 to "systematic review"</p>
14	How can the emission of greenhouse gases and air pollutants associated with an operation be reduced?	<p>1 (greenhouse gas* or air pollut* or greenhouse effect* or carbon footprint or (environment* and impact*)).ti,ab.</p> <p>2 Greenhouse Effect/ or Air Pollution/ or Greenhouse Gas/ or Air Pollutant/</p> <p>3 1 or 2</p> <p>4 (Nitrous Oxide or Ethyl Chloride or Desflurane or Sevoflurane or Isoflurane or volatile ane?sthe*).ti,ab.</p> <p>5 ((low flow or minimal-flow) and ane?sthe*).ti,ab.</p> <p>6 Anesthetics, Inhalation/</p> <p>7 4 or 5 or 6</p> <p>8 (Operation* or Surger* or Surgical or Procedure*).ti,ab. or Surgery/</p> <p>9 3 and 7 and 8</p> <p>10 limit 9 to (yr="2017 -Current" and "systematic review")</p>
15	How and when is it appropriate to discuss the environmental impacts of care during and around the time of an operation with patients?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Environmental Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>6 Surgical Procedures, Operative/</p> <p>7 5 or 6</p> <p>8 ((discuss* or inform* or educat* or consider* or talk* or conversation* or engag* or decid* or decision*) adj4 patient*).ti,ab.</p> <p>9 Patient Education as Topic/ or Decision Making, Shar</p> <p>10 8 or 9</p> <p>11 4 and 7 and 10</p> <p>12 limit 11 to (yr="2017 -Current" and "systematic review")</p>

16	How can more sustainable reusable equipment safely be used during and around the time of an operation?	<p>1 (Operation* or Surger* or Surgical or Procedure* or Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*" or post-surgery).ti,ab.</p> <p>2 Surgical Procedures, Operative/</p> <p>3 1 or 2</p> <p>4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>5 Carbon Footprint/ or Environmental Pollution/</p> <p>6 4 or 5</p> <p>7 ((recycl* or reusable or reuse*) adj4 (equipment* or item* or instrument*)).ti,ab.</p> <p>8 Surgical Instruments/ or Recycling/ or Waste Management/</p> <p>9 7 or 8</p> <p>10 3 and 6 and 9</p> <p>11 (safe* or steril* or infect* or contaminat* or uncontaminat* or decontaminat* or clean* or sanitary or hygiene* or aseptic or disinfect* or uninfected*).ti,ab.</p> <p>12 10 and 11</p> <p>13 limit 12 to (yr="2017 -Current" and "systematic review")</p>
17	How can we compare the environmental impacts of reusable and single-use equipment used during and around the time of an operation?	<p>1 (Sustainab* or "carbon footprint*" or "green* energy" or (environment* and impact*)).ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal*) adj4 (pack* or equipment* or item* or instrument*)) and ((plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*))).ti,ab.</p> <p>6 Packaging/ or Surgical equipment/ or Recycling/ or Waste Management/</p> <p>7 5 or 6</p> <p>8 (Operation* or Surger* or Surgical or Procedure*).ti,ab. or surgery/</p> <p>9 (compar* or collate* or contrast* or measure* or calculate* or evaluate*).ti,ab.</p> <p>10 4 and 7 and 8 and 9</p> <p>11 limit 10 to ("systematic review" and yr="2017 -Current")</p>
18	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 Carbon Footprint/ or Pollution/</p> <p>4 1 or 2 or 3</p> <p>5 (Operation* or Surger* or Surgical or Procedure*).ti,ab.</p> <p>6 Surgery/</p> <p>7 5 or 6</p> <p>8 ((teach* or educat* or encourag* or inform*) adj4 (staff or doctor* or surgeon* or practitioner* or professional*)).ti,ab.</p> <p>9 4 and 7 and 8</p> <p>10 limit 9 to (yr="2017 -Current" and "systematic review")</p>
19	What is the most sustainable way of providing equipment packs for an operation?	<p>1 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or equipment* or instrument*) adj4 (pack* or kit* or container*)).ti,ab.</p>

		<p>2 Packaging/ 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgery/ 6 4 or 5 7 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 8 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 9 Carbon Footprint/ or Pollution/ 10 7 or 8 or 9 11 3 and 6 and 10 12 limit 11 to (yr="2017 -Current" and "systematic review")</p>
20	<p>What is the most sustainable way to sterilise equipment used during an operation?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 6 4 or 5 7 3 and 6 8 (sterilis* or steriliz* or disinfect* or decontam*).ti,ab. 9 exp Sterilization/ 10 8 or 9 11 ("surgical tool*" or "surgical equipment*" or surgical instrument*).ti,ab. 12 7 and 10 and 11</p>
21	<p>How do we measure and compare the environmental impacts of the different ways of performing the same operation (e.g., keyhole and open surgery)?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*).ti,ab. 6 4 or 5 7 3 and 6 8 ("Laparoscopic surger*" or "Minimally Invasive" or keyhole or "key hole" or "micro surger*).ti,ab. 9 laparoscopic surgery/ 10 8 or 9 11 7 and 10 12 ("open surger*" or "aggressive surg*" or "invasive").ti,ab. 13 open surgery/ 14 12 or 13 15 11 and 14 16 (method* or approach* or version* or "different way").ti,ab. 17 15 and 16 18 limit 17 to (human and english language and "systematic review" and yr="2017 - 2022")</p>

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17</p>	<p>22 How should the environmental impact of an operation be weighed against its clinical outcomes and financial costs?</p>	<p>1 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 2 exp Surgical Procedures, Operative/ 3 1 or 2 4 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 5 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 6 4 or 5 7 3 and 6 8 "environmental impact*".ti,ab. 9 7 and 8 10 Postoperative Complications/ 11 Treatment Outcome/ 12 ("clinical outcome*" or "surg* outcome*" or "treatment outcome*").ti,ab. 13 10 or 11 or 12 14 ("financial cost" or "monetary cost" or "triple bottom line" or "financing cost*").ti,ab. 15 "CO2 equivalent*".ti,ab. 16 14 or 15 17 9 and 13 and 16 (0)</p>
<p>18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33</p>	<p>23 What is the role of virtual consultations in reducing the environmental impact associated with undergoing an operation?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 ("virtual consultat*" or "online consult*" or "remote consult*").ti,ab. 9 exp Telemedicine/ and exp "Referral and Consultation"/ 10 8 or 9 11 7 and 10 12 limit 11 to (english language and systematic reviews and last 5 years) 13 "travel to".ti,ab. 14 "remote attendance".ti,ab. 15 13 or 14 16 12 and 15</p>
<p>34 35 36 37 38 39 40 41 42</p>	<p>24 How can the amount of waste generated during and around the time of an operation be minimised?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 (Operation* or Surger* or Surgical or Procedure*).ti,ab. 5 Surgical Procedures, Operative/ 6 4 or 5 7 3 and 6 8 exp Medical Waste/ 9 waste*.ti,ab.</p>

1		10 8 or 9
2		11 7 and 10
3		12 ("Reduce*" or Reuse* or Recycle* or "re use*").ti,ab.
4		13 exp Recycling/
5		14 12 or 13
6		15 11 and 14
7		16 limit 15 to (english language and systematic reviews and last 5 years)
8	25	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
9		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
10		3 1 or 2
11		4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
12		5 Surgical Procedures, Operative/
13		6 4 or 5
14		7 3 and 6
15		8 exp Medical Waste/
16		9 waste*.ti,ab.
17		10 8 or 9
18		11 7 and 10
19		12 (incinerat* or landfill or "land fill" or dispose*).ti,ab.
20		13 11 and 12
21		14 limit 13 to (english language and systematic reviews and last 5 years)
22	26	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
23		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
24		3 1 or 2
25		4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
26		5 Surgical Procedures, Operative/
27		6 4 or 5
28		7 3 and 6
29		8 exp Medical Waste/
30		9 waste*.ti,ab.
31		10 8 or 9
32		11 7 and 10
33		12 ("Reduce*" or Reuse* or Recycle* or "re use*").ti,ab.
34		13 exp Recycling/
35		14 12 or 13
36		15 11 and 14
37		16 limit 15 to (english language and systematic reviews and last 5 years)
38		17 (generat* or create* or make).ti,ab.
39		18 16 and 17
40	27	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
41		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
42		3 1 or 2

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1		4 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
2		5 Surgical Procedures, Operative/
3		7 3 and 6
4		8 ("scrubbing up" or handwashing or "hand disinfect").ti,ab.
5		9 (hand* adj3 wash*).ti,ab.
6		10 exp Hand Disinfection/
7		11 8 or 9 or 10
8		12 7 and 11
9		13 limit 12 to (english language and systematic reviews and last 5 years)
10	28	1 ("healthcare organisation*" or "health care organisation*" or "healthcare organization*" or "health care organization*").ti,ab.
11		2 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
12		3 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
13		4 2 or 3
14		5 1 and 4
15		6 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
16		7 (pathway* or "path way*").ti,ab.
17		8 6 and 7
18		9 5 and 8
19		10 limit 9 to (english language and humans and yr="2017 - 2022" and "systematic review")
20	29	1 ((Sustainab* or "environment* impact*" or "carbon footprint*" or "green* energy" or (waste or resource*)) and (minimiz* or reduc*)).ti,ab.
21		2 Carbon Footprint/
22		3 Medical Waste/ or Waste Management/
23		4 1 or 2 or 3
24		5 "nitrous oxide".ti,ab.
25		6 Nitrous Oxide/
26		7 5 or 6
27		8 4 and 7
28		9 ("health care" or healthcare).ti,ab.
29		10 "Delivery of Health Care"/
30		11 9 or 10
31		12 8 and 11
32		13 limit 12 to (english language and yr="2017 - 2022" and "systematic review")
33	30	1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.
34		2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
35		3 1 or 2
36		4 ("low benefit*" or "low benefit surger*" or "low benefit operat*").ti,ab.
37		5 ("Operative versus non operative*" or "non operative versus operative*" or "operative" or "non operative").ti,ab.
38		6 4 and 5
39		7 (Operation* or Surger* or Surgical or Procedure*).ti,ab.
40		8 Surgical Procedures, Operative/
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		<p>9 7 or 8</p> <p>10 ("non surg*" or "non operat*" or "conservative management").ti,ab.</p> <p>11 9 and 10</p> <p>12 ("shared decision making" or "shared-decision making").ti,ab.</p> <p>13 3 and 6 and 11 and 12</p> <p>14 limit 13 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
31	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 ("anaesthe* technique*" or "anesthe* technique*" or "anaesthe* method*" or "anesthe* method*" or "method* of anaesth*" or "method* of anesthe*").ti,ab.</p> <p>5 3 and 4</p> <p>6 ("general anaesthe*" or "general anesthe*").ti,ab.</p> <p>7 ("regional anaesthe*" or "regional anesthe*").ti,ab.</p> <p>8 ("local anaesthe*" or "local anesthe*").ti,ab.</p> <p>9 6 or 7 or 8</p> <p>10 5 and 9</p> <p>11 ("volatile versus total intravenous anaesthe*" or "volatile versus total intravenous anesthe*").ti,ab.</p> <p>12 ("volatile anaesthe*" or "volatile anesthe*").ti,ab.</p> <p>13 ("total intravenous anaesthe*" or "total intravenous anesthe*").ti,ab.</p> <p>14 11 or 12 or 13</p> <p>15 10 and 14</p> <p>16 Surgical Procedures, Operative/</p> <p>17 15 and 16</p> <p>18 limit 17 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>
32	What are the barriers to using more sustainable anaesthetic practices?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 ("Problem* with reduc*" or "barrier* with reduc*" or "barrier* to reduc*" or "aim to reduc*" or "need to reduc*").ti,ab.</p> <p>5 ("volatile anaesthe*" or "volatile anesthe*").ti,ab.</p> <p>6 4 and 5</p> <p>7 3 and 6</p>
33	What role does re-cycling inhaled anaesthetics have in reducing the environmental impact of inhaled anaesthesia?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>3 1 or 2</p> <p>4 recycl*.ti,ab.</p> <p>5 ("anaesthe*" or "anesthe*").ti,ab.</p> <p>6 ("inhal*" or "gas*").ti,ab.</p> <p>7 5 and 6</p> <p>8 3 and 4 and 7</p> <p>9 Anesthesia/</p>

1 2		10 8 and 9 11 limit 10 to (english language and humans and yr="2017 - 2022" and "systematic review")
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	34 What is the environmental impact of different forms of pain relief for an operation?	1 epidural analgesia/ 2 (epidural adj3 (Oral or intravenous or regional or neuraxial)).ab,ti. 3 carbon footprint/ 4 environmental impact/ 5 "Sustainab*".ab,ti. 6 (environment* adj3 impact*).ab,ti. 7 "carbon footprint* ".ab,ti. 8 "green energy".ab,ti. 9 (hospital adj3 (waste or resource*)).ab,ti. 10 (surg* adj3 (waste or resource*)).ab,ti. 11 (operative adj3 (waste or resource*)).ab,ti. 12 (Analgesi* adj3 (waste or resource*)).ab,ti. 13 ("pain relief" adj3 (waste or resource*)).ab,ti. 14 Medical Waste/ (1409) 15 Waste Management/ or Medical Waste Disposal/ 16 (minimiz* or minimis* or reduc*).ab,ti. 17 1 or 2 18 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 19 15 or 16 20 17 and 18 and 19 21 limit 20 to (yr="2016 - 2022" and "systematic review")
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41	35 How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	1 exp Surgical Procedures, Operative/ 2 ((surg* or operat*) adj3 (procedure* or treatment*)).ab,ti. 3 1 or 2 4 exp Therapeutics/ 5 (non-surg* adj3 (therap* or treatment*)).ab,ti. 6 4 or 5 7 exp Environmental Monitoring/ 8 Carbon Footprint/ 9 "environment* adj3 sustainab*".ab,ti. 10 (environment* adj3 impact*).ab,ti. 11 "carbon footprint".ab,ti. 12 "green energy".ab,ti. 13 exp Renewable Energy/ 14 "renewable energy".ab,ti. 15 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 16 3 and 6 and 15 17 limit 16 to (yr="2017 - 2022" and "systematic review")
42 43	36 What is the environmental impact of using day case surgical pathways compared to inpatient pathways?	1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti.

		<p>3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (environment* adj3 (impact or management or protect*)).ab,ti. 6 "renewable energy".ab,ti. 7 "recycl*".ab,ti. 8 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 9 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 10 "zero waste".ab,ti. 11 "Conservation of Natural Resources"/ 12 Carbon Footprint/ 13 exp Environmental Monitoring/ 14 environmental impact/ 15 exp Medical Waste Disposal/ 16 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 17 Ambulatory Surgical Procedures/ 18 (day adj3 surg*).ab,ti. 19 (ambulatory adj3 surg*).ab,ti. 20 (outpatient* adj3 surg*).ab,ti. 21 17 or 18 or 19 or 20 22 (inpatient adj3 surg*).ab,ti. 23 16 and 21 and 22 24 limit 23 to (yr="2017 -Current" and "systematic review")</p>
<p>37</p>	<p>What is the role of community-based care in reducing the environmental impact of operations?</p>	<p>1 "Sustainab*".ab,ti. 2 "carbon footprint*".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. (5521) 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/ 14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 exp Surgical Procedures, Operative/ 18 exp General Surgery/ 19 (surg* adj3 (procedure* or treatment* or therap*)).ab,ti. 20 18 or 19</p>

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1		21 exp Community Health Services/
2		22 (community adj3 (care or service*)).ab,ti.
3		23 21 or 22
4		24 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
5		25 20 and 23 and 24
6		26 limit 25 to (yr="2017 - 2022" and "systematic review")
7	38	1 "Sustainab*".ab,ti.
8	Is it more environmentally sustainable and safe for	2 "carbon footprint* ".ab,ti.
9	patients to have more of their early post-operative	3 "green energy".ab,ti.
10	care at home compared to hospital?	4 (waste adj3 (hospital or medical or surgical)).ab,ti.
11		5 (minimiz* or minimis* or reduc*).ab,ti.
12		6 (environment* adj3 (impact or management or protect*)).ab,ti.
13		7 "renewable energy".ab,ti.
14		8 "recycl*".ab,ti.
15		9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti.
16		10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti.
17		11 "zero waste".ab,ti.
18		12 "Conservation of Natural Resources"/
19		13 Carbon Footprint/
20		14 exp Environmental Monitoring/
21		15 environmental impact/
22		16 exp Medical Waste Disposal/
23		17 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
24		18 Postoperative Care/
25		19 exp Hospitalization/
26		20 18 and 19
27		21 (postoperat* adj3 "hospital care").ab,ti.
28		22 (post-operat* adj3 "hospital care").ab,ti.
29		23 (post-surg* adj3 "hospital care").ab,ti.
30		24 20 or 21 or 22 or 23
31		25 Postoperative Care/
32		26 Home Care Services/
33		27 (postoperat* adj3 home).ab,ti.
34		28 (post-operat* adj3 home).ab,ti.
35		29 (post-surg* adj3 home).ab,ti. (7)
36		30 (home adj3 (surg* adj3 recover*)).ab,ti.
37		31 25 and 26
38		32 27 or 28 or 29 or 30 or 31
39		33 exp Patient Safety/
40		34 (patient* adj3 safety).ab,ti.
41		35 33 or 34
42		36 17 and 24 and 32 and 35

39	How can the waste of drugs be avoided during and around the time of an operation?	<p>1 exp Perioperative Period/ 2 "perioperat*".ab,ti. 3 1 or 2 4 (waste adj3 (drug or an?esthetic* or medic* or pharmac*)).ab,ti. 5 Medical Waste/ 6 4 or 5 7 exp Waste Management/ 8 Medical Waste Disposal/ 9 (waste adj3 (management or dispos* or reduc*)).ab,ti. 10 7 or 8 or 9 11 3 and 6 and 10 12 limit 11 to (yr="2017 - 2022" and "systematic review")</p>
40	How can drug syringes be used better to reduce their environmental impact?	<p>1 "Sustainab*".ab,ti. 2 "carbon footprint* ".ab,ti. 3 "green energy".ab,ti. 4 (waste adj3 (hospital or medical or surgical)).ab,ti. 5 (minimiz* or minimis* or reduc*).ab,ti. 6 (environment* adj3 (impact or management or protect*)).ab,ti. 7 "renewable energy".ab,ti. 8 "recycl*".ab,ti. 9 (waste adj3 (minimis* or minimiz* or reduc* or recycl*)).ab,ti. 10 (pollut* adj3 (minimis* or minimiz* or reduc*)).ab,ti. 11 "zero waste".ab,ti. 12 "Conservation of Natural Resources"/ 13 Carbon Footprint/ 14 exp Environmental Monitoring/ 15 environmental impact/ 16 exp Medical Waste Disposal/ 17 Syringes/ 18 "syringe*".ab,ti. 19 17 or 18 20 1 or 2 or 3 or 4 or 6 or 7 or 12 or 13 or 14 or 15 21 5 or 9 or 10 or 11 or 16 22 19 and 20 and 21 23 limit 22 to (yr="2017 - 2022" and "systematic review")</p>
41	What is the most environmentally sustainable way to deliver oxygen in the post-operative period?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 environmental protection/ 6 carbon footprint/ 7 environmental impact/</p>

		<p>8 "human impact (environment)"/ or environment/ 9 waste management/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 11 oxygen*.ti,ab. 12 oxygen deliver*.ti,ab. 13 oxygen admin*.ti,ab. 14 oxygen/ad [Drug Administration] 15 oxygen/ 16 oxygen delivery device/ 17 11 or 12 or 13 or 14 or 15 or 16 18 (post op* or postop*).ti,ab. 19 postop* period.ti,ab. 20 post op* period.ti,ab. 21 postoperative care/ 22 18 or 19 or 20 or 21 23 10 and 17 and 22 24 limit 23 to (english language and last 5 years)</p>
42	<p>What are the most environmentally sustainable and effective methods of surgical wound care (e.g., dressings, wound cleaning)?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 2 or 3 5 1 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 1 or 6 8 4 and 7 9 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 10 exp Product Packaging/ 11 exp Wound Healing/ 12 exp Bandages/ 13 10 or 11 or 12 14 9 and 13 15 5 and 14 16 limit 15 to (yr="2017 -Current" and "systematic review")</p>

43	What are the sustainable and effective alternatives to carbon dioxide used in laparoscopic (keyhole surgery of the abdomen) surgery?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 exp Laparoscopy/</p> <p>10 exp Minimally Invasive Surgical Procedures/</p> <p>11 exp Carbon Dioxide/</p> <p>12 gas* free*.ti,ab.</p> <p>13 9 or 10</p> <p>14 co2.ti,ab.</p> <p>15 11 or 12 or 14</p> <p>16 13 and 15</p> <p>17 8 and 16 (</p> <p>18 limit 17 to (yr="2017 -Current" and "systematic review")</p>
44	What is the most environmentally sustainable way to provide nutrition for patients undergoing operations?	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab.</p> <p>2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>4 2 or 3</p> <p>5 1 and 4</p> <p>6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>7 1 or 6</p> <p>8 4 and 7</p> <p>9 Enteral Nutrition/ or Nutrition Assessment/ or Nutrition Therapy/ or Nutrition Policy/</p> <p>10 exp Food Service, Hospital/</p> <p>11 exp "Conservation of Natural Resources"/</p> <p>12 11 and food*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p>

		<p>13 exp Food/ 14 9 or 10 or 12 or 13 15 8 and 14 16 limit 15 to (yr="2017 -Current" and "systematic review")</p>
45	<p>What is the most environmentally sustainable method of providing written information to patients?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 2 or 3 5 1 and 4 6 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 1 or 6 8 4 and 7 9 exp Communication/ 10 exp "Appointments and Schedules"/ 11 9 and 10 12 patient information*.ti,ab. 13 patient communication*.ti,ab. 14 email*.ti,ab. 15 paperwork*.ti,ab. 16 exp Letter/ 17 12 or 13 or 14 or 15 or 16 18 7 and 17 19 limit 18 to (yr="2017 -Current" and "systematic review") 20 3 and 18</p>
46	<p>What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?</p>	<p>1 (Sustainab* or (environment* and impact*) or "carbon footprint*" or "green* energy").ti,ab. 2 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 3 1 or 2 4 "Educat*".ti,ab. 5 exp Health Knowledge, Attitudes, Practice/ 6 4 or 5 7 ("health* professional*" or "health* work*" or "health* provider*").ti,ab. 8 ("pre-operative care" or "post-operative care").ti,ab. 9 Surgical Procedures, Operative/ 10 8 or 9 11 3 and 6 and 7 and 10 12 limit 11 to (english language and humans and yr="2017 - 2022" and "systematic review")</p>

47	What are the best ways to educate patients, and their carers, about sustainable healthcare before an operation?	<p>1 Sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 exp environmental sustainability/ 7 carbon footprint/ 8 renewable energy/ 9 pollution/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 11 sustainable healthcare.ti,ab. 12 patient* education.ti,ab. 13 patient education/ or health education/ 14 caregiver/ 15 (carer* or caregiver*).ti,ab. 16 12 or 13 or 14 or 15 17 preop*.ti,ab. 18 (preop* and (care or period)).ti,ab. 19 (pre op* and (care or period)).ti,ab. 20 preoperative evaluation/ or preoperative period/ 21 17 or 18 or 19 or 20 22 10 and 11 and 16 and 21 23 10 or 11 24 16 and 21 and 23 25 limit 24 to (english language and "systematic review" and yr="2017 -Current")</p>
48	What is the most sustainable way for healthcare professionals to store and (appropriately) share clinical information?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 resource* reduc*.ti,ab. 6 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 7 environmental pollut*.ti,ab. 8 (reuse or reusable).ti,ab. 9 environmental pollution/ or environmental monitoring/ 10 Renewable Energy/ 11 Carbon Footprint/ 12 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 13 clinical information.ti,ab. 14 ((clinical or operative or medical) and record*).ti,ab. 15 Medical Records/ 16 13 or 14 or 15 17 "Information Storage and Retrieval"/</p>

		<p>18 (Information and (Store or storage or share or sharing or Retrieval*)).ti,ab. 19 ((paper or physical) and record*).ti,ab. 20 Medical Records Systems, Computerized/ or Electronic Health Records/ 21 electronic record*.ti,ab. 22 17 or 18 or 19 or 20 or 21 23 ((health or healthcare or health care) and (personnel or professional*)).ti,ab. 24 (doctor* or surgeon* or nurs* or AHP* or allied health professional*).ti,ab. 25 exp Health Personnel/ 26 23 or 24 or 25 27 12 and 16 and 22 and 26 28 limit 27 to (english language and yr="2017 -Current" and "systematic review")</p>
<p>49</p>	<p>How can energy usage within an operating theatre be safely reduced?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 resource* reduc*.ti,ab. 6 ((waste or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 7 environmental pollut*.ti,ab. 8 (reuse or reusable).ti,ab. 9 environmental pollution/ or environmental monitoring/ (144759) 10 Renewable Energy/ 11 Carbon Footprint/ 12 environmental impact.ti,ab. 13 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 14 energy usage.ti,ab. 15 energy consumption.ti,ab. 16 exp Energy-Generating Resources/ 17 14 or 15 or 16 18 operat* theatre*.ti,ab. 19 operat* theater*.ti,ab. 20 Operating Rooms/ 21 Operat* Room*.ti,ab. 22 operating theatre light*.ti,ab. 23 operating theater light*.ti,ab. 24 operating room* light*.ti,ab. 25 operating theatre ventilat*.ti,ab. 26 operating theater ventilat*.ti,ab. 27 operating room ventilat*.ti,ab. 28 air conditioning/ or heating/ or life support systems/ or lighting/ or temperature/ or ventilation/ 29 (air conditioning or heat* or life support system*).ti,ab. 30 ((medical or operating) and equipment).ti,ab. 31 exp "Equipment and Supplies, Hospital/"</p>

		<p>32 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31</p> <p>33 13 and 17 and 32</p> <p>34 limit 33 to (english language and yr="2017 -Current" and "systematic review")</p>
50	<p>What is the most environmentally sustainable way to maintain a patient's body temperature during an operation?</p>	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p> <p>4 Surgical Procedures, Operative/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 1 or 2 or 3 or 4 or 5</p> <p>7 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>8 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>9 Carbon Footprint/ or Environmental Pollution/</p> <p>10 7 or 8 or 9</p> <p>11 patient* body temperature*.ti,ab.</p> <p>12 body temperature*.ti,ab.</p> <p>13 Body Temperature/</p> <p>14 11 or 12 or 13</p> <p>15 force* air warm* device*.ti,ab.</p> <p>16 Body Temperature Regulation/ or Intraoperative Complications/</p> <p>17 underbod* warmer*.ti,ab.</p> <p>18 fluid warmer*.ti,ab.</p> <p>19 patient* warmer*.ti,ab.</p> <p>20 reflective blanket*.ti,ab.</p> <p>21 15 or 16 or 18 or 19 or 20</p> <p>22 5 and 10 and 14 and 21</p> <p>23 limit 22 to (english language and yr="2017 -Current" and "systematic review")</p> <p>24 5 and 10 and 14</p> <p>25 limit 24 to (english language and yr="2017 -Current" and "systematic review")</p> <p>26 14 or 21</p> <p>27 5 and 10 and 26</p> <p>28 limit 27 to (english language and yr="2017 -Current" and "systematic review")</p>

51	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p> <p>4 Postoperative care/</p> <p>5 1 or 2 or 3 or 4</p> <p>6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.</p> <p>8 Carbon Footprint/ or Environmental Pollution/</p> <p>9 6 or 7 or 8</p> <p>10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab.</p> <p>11 Product Packaging/</p> <p>12 Surgical Instruments/</p> <p>13 Recycling/</p> <p>14 Waste Management/</p> <p>15 10 or 11 or 12 or 13 or 14</p> <p>16 repair*.ti,ab.</p> <p>17 15 or 16</p> <p>18 ((medical or surg*) and (equipment or device* or instrument*)).ti,ab.</p> <p>19 disposable equipment/ or exp "equipment and supplies, hospital"/</p> <p>20 exp Surgical Instruments/</p> <p>21 exp Surgical Equipment/</p> <p>22 18 or 19 or 20 or 21</p> <p>23 5 and 9 and 17 and 22</p> <p>24 limit 23 to (english language and yr="2017 -Current" and "systematic review")</p>
52	How can care packages which aim to enable rapid recovery from surgery (e.g., ERAS) affect the environmental impact of an operation?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>3 Surgical Procedures, Operative/</p>

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4 Surgical Procedures, Operative/
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6 1 or 2 or 3 or 4 or 5
7 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title,
8 abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
9 word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
10 concept word, unique identifier, synonyms]
11 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab.
12 Carbon Footprint/ or Environmental Pollution/
13 7 or 8 or 9
14 patient* body temperature*.ti,ab.
15 body temperature*.ti,ab.
16 Body Temperature/
17 11 or 12 or 13
18 force* air warm* device*.ti,ab.
19 Body Temperature Regulation/ or Intraoperative Complications/
20 underbod* warmer*.ti,ab.
21 fluid warmer*.ti,ab. (
22 patient* warmer*.ti,ab.
23 reflective blanket*.ti,ab.
24 15 or 16 or 18 or 19 or 20
25 5 and 10 and 14 and 21
26 limit 22 to (english language and yr="2017 -Current" and "systematic review")
27 5 and 10 and 14
28 limit 24 to (english language and yr="2017 -Current" and "systematic review")
29 14 or 21
30 5 and 10 and 26
31 limit 27 to (english language and yr="2017 -Current" and "systematic review")
32 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance
33 word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept
34 word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
35 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title,
36 abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
37 word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
38 concept word, unique identifier, synonyms]
39 Surgical Procedures, Operative/
40 Postoperative Care/
41 29 or 30 or 31 or 32
42 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title,
43 abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading
44 word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary
45 concept word, unique identifier, synonyms]

		<p>35 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 36 Carbon Footprint/ or Environmental Pollution/ 37 34 or 35 or 36 38 rapid recover*.ti,ab. 39 ((surg* or operat*) and recover*).ti,ab. 40 38 or 39 41 care package*.ti,ab. 42 ERAS.ti,ab. 43 Enhanced Recovery after Surgery.ti,ab. 44 41 or 42 or 43 45 33 and 37 and 40 and 44 46 limit 45 to (english language and yr="2017 -Current" and "systematic review") 47 postoperative recover*.ti,ab. 48 post operative recover*.ti,ab. 49 Postoperative Care/ 50 40 or 47 or 48 or 49 51 33 and 37 and 44 and 50 52 limit 51 to (english language and yr="2017 -Current" and "systematic review")</p>
53	How can waste from medical gas cylinders be reduced?	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 3 Surgical Procedures, Operative/ 4 Carbon Footprint/ or Environmental Pollution/ 5 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. 6 Product Packaging/ 7 Surgical Instruments/ or Recycling/ or Waste Management/ 8 Postoperative Care/ 9 1 or 2 or 3 or 8 10 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 11 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 12 4 or 10 or 11 13 5 or 6 or 7 14 medical gas cylinder*.ti,ab.</p>

		<p>15 cylinder*.ti,ab. 16 gas cylinder*.ti,ab. 17 14 or 15 or 16 18 9 and 12 and 13 and 17</p>
54	<p>What effect do standards, guidelines and quality improvement initiatives have on the environmental impact of operations?</p>	<p>1 (Operation* or Surger* or Surgical).mp. or Procedure*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 2 Surgical Procedures, Operative/ 3 (Postop* or "post op*" or preop* or "pre op*" or periop* or "peri op*").mp. or post-surgery.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 4 Postoperative Care/ 5 1 or 2 or 3 or 4 6 (Sustainab* or (environment* and impact*) or "carbon footprint*").mp. or "green* energy".ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 7 ((wast* or resource*) and (minimiz* or minimis* or reduc*)).ti,ab. 8 Carbon Footprint/ or Environmental Pollution/ (20296) 9 6 or 7 or 8 10 ((recycl* or reusable or reuse or biodegradable or degradable or compostable or eco* or paper* or metal* or plastic* or single-use or "single use" or (individual* and wrap*)) adj4 (pack* or equipment* or item* or instrument*)).ti,ab. (8527) 11 Product Packaging/ 12 Surgical Instruments/ 13 Recycling/ or Waste Management/ 14 10 or 11 or 12 or 13 15 (standard* or policy or policies or guideline*).ti,ab. 16 Reference Standards/ 17 policy/ 18 Practice Guideline/ or Guideline/ or Guideline Adherence/ 19 Quality Improvement/ 20 quality improve* initiative*.ti,ab. 21 15 or 16 or 17 or 18 or 19 or 20 22 5 and 9 and 14 and 21 23 limit 22 to (english language and yr="2017 -Current" and "systematic review")</p>
55	<p>What is the most sustainable method to launder clothing worn when delivering care around an operation?</p>	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 green* energy.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab.</p>

		<p>6 environmental pollut*.ti,ab. 7 Health Services Accessibility/ 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 (launder* or laundry).ti,ab. 10 (wash* and clothe*).ti,ab. 11 Surgical Attire/ or Clothing/ 12 (operation* and care).ti,ab. 13 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 14 9 or 10 or 11 15 12 or 13 16 8 and 14 and 15 17 limit 16 to (english language and yr="2017 -Current" and "systematic review")</p>
56	How do we measure the carbon footprint of an operation?	<p>1 carbon footprint*.ti,ab. 2 environment* impact*.ti,ab. 3 sustainab*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 environmental pollut*.ti,ab. 6 Carbon Footprint/ 7 measur*.ti,ab. 8 calculat*.ti,ab. 9 operation*.ti,ab. 10 surger*.ti,ab. 11 Surgical Procedures, Operative/ec, es [Economics, Ethics] 12 Humans/su [Surgery] 13 1 or 2 or 3 or 4 or 5 or 6 14 7 or 8 15 9 or 10 or 11 or 12 16 13 and 14 and 15 17 limit 16 to (english language and systematic reviews and last 5 years) (1)</p>
57	How can the different types of environmental impacts (e.g., global warming, waste, resource utilisation) associated with care during and around the time of an operation be prioritised and balanced against one another?	<p>1 environment* impact*.ti,ab. 2 sustainab*.ti,ab. 3 carbon footprint*.ti,ab. 4 environmental pollut*.ti,ab. 5 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 6 global warming.ti,ab. 7 Environment/ 8 Global Warming/ or Environmental Pollution/ 9 Sustainable Development/ 10 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 11 (operation* and care).ti,ab. 12 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 13 patient care.ti,ab.</p>

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		<p>14 (operation* and care).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>15 Perioperative Care/ 16 Postoperative Care/ 17 11 or 12 or 13 or 14 or 15 or 16</p> <p>18 prioritis*.mp. or balanc*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>19 prioritiz*.mp. or balanc*.ti,ab. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]</p> <p>20 rank*.ti,ab. 21 prioritise.mp. 22 prioritize*.mp. 23 18 or 19 or 20 or 21 or 22 24 10 and 17 and 23 25 limit 24 to (english language and systematic reviews and last 5 years)</p>
58	What is the most sustainable way to provide lighting in the operating theatre?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab. 4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 green* energy.ti,ab. 6 Sustainable Development/ or Global Health/ 7 Carbon Footprint/ or Greenhouse Effect/ 8 1 or 2 or 3 or 4 or 5 or 6 or 7 9 light*.ti,ab. 10 light* source*.ti,ab. 11 Light/ 12 Lighting/ 13 9 or 10 or 11 or 12 14 operating theatre*.ti,ab. 15 operating theater*.ti,ab. 16 operating room*.ti,ab. 17 operating suite*.ti,ab. 18 Operating Rooms/ 19 14 or 15 or 16 or 17 or 18 20 8 and 13 and 19 21 limit 20 to (english language and systematic reviews and last 5 years)</p>
59	How can environmental sustainability be incorporated into the organisational management of operating theatres?	<p>1 sustainab*.ti,ab. 2 environment* impact*.ti,ab. 3 carbon footprint*.ti,ab.</p>

		<p>4 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 5 green* energy.ti,ab. 6 Sustainable Development/ 7 environment/ or carbon footprint/ 8 Environmental Pollution/ 9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 10 organi?ation* manag*.ti,ab. 11 organi?ation* admin*.ti,ab. 12 organisational management.mp. 13 organizational management.mp. 14 organisation* admin*.mp. 15 10 or 11 or 12 or 13 or 14 16 operating theatre*.ti,ab. 17 operating theater*.ti,ab. 18 operating room*.ti,ab. 19 operating suite*.ti,ab. 20 Operating Rooms/ 21 16 or 17 or 18 or 19 or 20 22 9 and 15 and 21 23 limit 22 to (english language and yr="2017 -Current" and systematic reviews</p>
60	How can the provision and administration of medicines to patients undergoing operations be made more environmentally sustainable?	<p>1 ((provision or adminis*) and medicine*).ti,ab. 2 ((manufactur* or deliver* or stor*) and medicine*).ti,ab. 3 medicine*.mp. and prescri*.ti,ab. 4 prescription drug/ or prescription/ 5 1 or 2 or 3 or 4 6 operation*.ti,ab. 7 surger*.ti,ab. 8 (((postop* or post op* or preop*) and pre op*) or periop* or peri op*).ti,ab. 9 perioperative medicine/ or perioperative period/ 10 surgery/ 11 6 or 7 or 8 or 9 or 10 12 sustainab*.ti,ab. 13 environment* impact*.ti,ab. 14 ((waste or resource*) and (minimiz* or reduc*)).ti,ab. 15 carbon footprint*.ti,ab. 16 environment/ or environmental impact/ 17 carbon footprint/ 18 12 or 13 or 14 or 15 or 16 or 17 19 5 and 11 and 18 20 limit 19 to (english language and "systematic review" and last 5 years)</p>

Table A2: Results of the literature review of indicative questions. NICE = National Institute for Health and Care Excellence; SIGN = Scottish Intercollegiate Guidelines Network; CINAHL = Cumulative Index to Nursing and Allied Health Literature.

	Indicative Question	National Professional Guideline?	Related NICE/SIGN guideline in area?	Sustainability mentioned in NICE/SIGN guideline?	Cochrane / Embase / CINAHL / Medline	Completely Answered	Partially Answered	Unanswered
1	How can care after an operation be optimised to minimise the use of resources and creation of waste whilst providing good care?	No	NG180 - perioperative care	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.37757/MR2021.V23.N3.9 • http://dx.doi.org/10.1016/j.ijso.2020.11.016 • http://dx.doi.org/10.1136/bmjopen-2021-050806 • http://dx.doi.org/10.1055/s-0040-1708834 • http://dx.doi.org/10.1213/ANE.0000000000003942 • https://dx.doi.org/10.1016/j.jcin.2018.04.042 • https://dx.doi.org/10.21614/chirurgia.112.5.546 		X	
2	Which aspects of care before and after an operation can be provided in the community in a more sustainable way?	No	No					X
3	How can we increase the reuse and recycling of equipment used for rehabilitation in the recovery period after an operation?	No	No					X
4	Can the supply of medicines after an operation be optimised to minimise waste?	No	No					X

1 2 3 4 5 6 7 8 9 10 11	5	How does living a 'greener' lifestyle affect recovery after an operation?	No	<ul style="list-style-type: none"> • NG70 - Air pollution • NG90 – Physical Activity and the Environment • PH41 – Walking and Cycling • QS183 – Encouraging Physical Activity in the community • PH54 – Exercise and referral schemes • PH13 – Physical Activity in the Workplace 	No				X
12 13 14 15 16 17 18 19 20 21 22	6	What are the most sustainable forms of effective infection prevention and control used around the time of an operation (e.g. PPE, drapes, clean air ventilation)?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/TA.0000000000003073 • https://dx.doi.org/10.1017/ice.2020.379 			X
23 24 25 26 27 28 29 30 31 32 33 34	7	What effect does pre-habilitation (e.g., changes in physical activity, lifestyle and diet before an operation) have on the environmental impact of undergoing an operation?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1513/AnnalsATS.202002-183OC • https://dx.doi.org/10.1136/bmjopen-2021-050806 • https://dx.doi.org/10.1097/CIN.0000000000000708 			X
35 36 37 38 39 40 41 42	8	What are the relative environmental impacts of the different elements of care delivered before an operation?	No	No					X

1 2 3 4	9	How can investigations before an operation be used more efficiently?	No	NG45 – Routine preoperative tests for elective surgery	No	<ul style="list-style-type: none"> • https://doi.org/10.37757/MR2021.V23.N3.9 		X	
5 6 7 8 9 10 11 12	10	Can more efficient use of operating theatres and associated practices reduce the environmental impact of operations?	No	No		<ul style="list-style-type: none"> • https://doi.org/10.1093/bjs/znab362.049 • https://doi.org/10.1016/J.JAMCOLLSURG.2021.07.258 • https://doi.org/10.1289/EHP8666 • https://doi.org/10.1016/j.amjsurg.2018.07.021 • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
13 14 15 16 17 18 19 20 21 22 23 24	11	How can healthcare organisations more sustainably procure (obtain) medicines, equipment and items used during and around the time of an operation?	NHS Supply Chain Strategy - https://www.supplychain.nhs.uk/sustainability/climate-change-energy-and-ghg-emissions/			<ul style="list-style-type: none"> • https://doi.org/10.1016/S0140-6736(20)31142-9 • https://dx.doi.org/10.1017/dmp.2020.283 		X	
25 26 27 28 29 30 31 32 33 34	12	What drives effective sustainable innovation in manufacturing of equipment and medical supplies used during and around the time of an operation?	NHS Supply Chain Strategy - https://www.supplychain.nhs.uk/sustainability/climate-change-energy-and-ghg-emissions/			<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.scitotenv.2021.151128 • https://doi.org/10.1289/EHP8666 • https://dx.doi.org/10.1016/j.jcjq.2021.06.010 • https://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 • https://dx.doi.org/10.1016/j.ejvs.2017.03.014 		X	

13	What alternative, more sustainable, materials can replace plastic packaging and equipment used during and around the time of an operation?	No	No	<ul style="list-style-type: none"> http://dx.doi.org/10.1093/ndt/gfab113.008 http://dx.doi.org/10.1289/EHP8666 http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 http://dx.doi.org/10.1016/j.jcjq.2021.06.010 http://dx.doi.org/10.1016/j.amjoto.2020.102719 http://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 https://dx.doi.org/10.1016/j.amjsurg.2018.07.021 https://dx.doi.org/10.1111/ans.13856 https://dx.doi.org/10.1093/bjs/znab362.049 		X	
14	How can the emission of greenhouse gases and air pollutants associated with an operation be reduced?	No	No	<ul style="list-style-type: none"> https://dx.doi.org/10.1289/EHP8666 https://doi.org/10.1016/j.jcjq.2021.06.010 		X	
15	How and when is it appropriate to discuss the environmental impacts of care during and around the time of an operation with patients?	No	No	<ul style="list-style-type: none"> http://dx.doi.org/10.1016/j.resconrec.2019.104560 			X
16	How can more sustainable reusable equipment safely be used during and around the time of an operation?	No	No	<ul style="list-style-type: none"> https://dx.doi.org/10.1016/j.eururo.2022.01.027 http://dx.doi.org/10.1093/ndt/gfab113.008 http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 http://dx.doi.org/10.1136/neurintsurg-2020-SNIS.56 https://dx.doi.org/10.1111/ans.13856 		X	
17	How can we compare the environmental impacts of reusable and single-use equipment used during and around	No	No	<ul style="list-style-type: none"> http://dx.doi.org/10.1289/EHP8666 http://dx.doi.org/10.1016/j.jamcollsurg.2021.07.258 https://dx.doi.org/10.1111/ans.13856 https://doi.org/10.1101/2021.03.10.21253268 		X	

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5	18	How can healthcare professionals who deliver care during and around the time of an operation be encouraged to adopt sustainable actions in practice?	No	No				X
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17	19	What is the most sustainable way of providing equipment packs for an operation?	No	No		• http://dx.doi.org/10.1016/j.jcjq.2021.06.010		X
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21	20	What is the most sustainable way to sterilise equipment used during an operation?	No	No		• https://doi.org/10.1093/bja/aex098		X
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28	21	How do we measure and compare the environmental impacts of the different ways of performing the same operation (e.g., keyhole and open surgery)?	No	No				X
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38	22	How should the environmental impact of an operation be weighed against	No	No				X
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1		its clinical outcomes and financial costs?						
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3	23	What is the role of virtual consultations in reducing the environmental impact associated with undergoing an operation?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.7861/fhj.2020-0080 		X
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11	24	How can the amount of waste generated during and around the time of an operation be minimised?	Association of Anaesthetists - Anaesthetic waste: safe and sustainable disposal	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.icig.2021.06.010 • https://dx.doi.org/10.1016/j.eururo.2022.01.027 • https://dx.doi.org/10.1016/j.scitotenv.2021.151128 • https://dx.doi.org/10.1097/SLA.0000000000003951 		X
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19	25	Can alternative, more environmentally sustainable methods of disposal be used for waste that is generated during and around the time of an operation?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1007/s10163-020-01123-1 		X
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30	26	How much recyclable waste generated during an operation is being appropriately recycled?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1186/s13063-017-2034-0 		X
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37	27	How do we minimize the amount of water used for 'scrubbing up'?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.wneu.2020.12.137 		X
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	(handwashing) for an operation?							
28	What can healthcare organisations learn from healthcare systems in other countries about sustainable surgical pathways?	No	No		<ul style="list-style-type: none"> https://dx.doi.org/10.12968/bjon.2017.26.22.1230 			X
29	How can we reduce the environmental impact of nitrous oxide used in healthcare?	No	No		<ul style="list-style-type: none"> https://dx.doi.org/10.1002/14651858.CD013441.pub2 			X
30	How do we define and avoid low-benefit or unnecessary operations?	No	No		<ul style="list-style-type: none"> https://dx.doi.org/http://dx.doi.org/10.1136/bmj.k5120 			X
31	What is the environmental impact of different anaesthetic techniques (e.g., different types of general, regional and local anaesthesia) used for the same operation?	No	No					X
32	What are the barriers to using more sustainable anaesthetic practices?	No	No					X
33	What role does recycling inhaled anaesthetics have in reducing the	No	No					X

1		environmental impact of inhaled anaesthesia?						
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3	34	What is the environmental impact of different forms of pain relief for an operation?	No	NG180 - perioperative care	No			X
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9	35	How do we measure and compare the short- and long-term environmental impacts of surgical and non-surgical treatments for the same condition?	No	No				X
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20	36	What is the environmental impact of using day case surgical pathways compared to inpatient pathways?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1053/j.ifas.2020.08.007 • https://dx.doi.org/10.1097/NUR.0b013e31824590e6 • https://doi.org/10.1016/j.icjq.2021.06.010 	X	
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28	37	What is the role of community-based care in reducing the environmental impact of operations?	No	No				X
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34	38	Is it more environmentally sustainable and safe for patients to have more of their early post-operative care at home compared to hospital?	No	No				X
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1	39	How can the waste of drugs be avoided during and around the time of an operation?	No	No					X
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6	40	How can drug syringes be used better to reduce their environmental impact?	No	No		• https://dx.doi.org/10.3390/ijerph19031381			X
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13	41	What is the most environmentally sustainable way to deliver oxygen in the post-operative period?	No	No					X
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19	42	What are the most environmentally sustainable and effective methods of surgical wound care (e.g., dressings, wound cleaning)?	No	MTG59 – Plus Sutures for preventing surgical site infection	No				X
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27	43	What are the sustainable and effective alternatives to carbon dioxide used in laparoscopic (keyhole surgery of the abdomen) surgery?	No	No		• https://dx.doi.org/10.4103/jmas.JMAS_130_20 • https://dx.doi.org/10.1002/14651858.CD009569.pub3 • https://doi.org/10.1289/EHP8666		X	
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37	44	What is the most environmentally sustainable way to provide nutrition for patients	No	NG180 - Perioperative care	No				X
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1		undergoing operations?						
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3	45	What is the most environmentally sustainable method of providing written information to patients?	No	No				X
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10	46	What are the best ways to educate healthcare professionals who provide care before, during and after operations, about sustainable healthcare?	No	PH6 – Behavioural Change – general approaches	No			X
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19	47	What are the best ways to educate patients, and their carers, about sustainable healthcare before an operation?	No	PH6 – Behavioural Change – general approaches	No			X
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26	48	What is the most sustainable way for healthcare professionals to store and (appropriately) share clinical information?	No	NG94 - Emergency and acute medical care in over 16s: service delivery and organisation	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.ident.2021.103737 		X
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34	49	How can energy usage within an operating theatre be safely reduced?	No	No		<ul style="list-style-type: none"> • https://dx.doi.org/10.1016/j.amjsurg.2018.07.021 • https://doi.org/10.1016/j.accpm.2021.100907 • https://doi.org/10.1016/j.icjq.2021.06.010 		X
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1	50	What is the most environmentally sustainable way to maintain a patient's body temperature during an operation?	No	• CG65 – Hypothermia, prevention and management in adults undergoing surgery 2016 • Medical Technologies guidance 31 – Humiguard	No			X	
2	51	Can equipment be recycled or repaired, instead of being disposed of, to reduce its environmental impact?	No	No		<ul style="list-style-type: none"> • https://doi.org/10.1289/EHP8666. • https://doi.org/10.1016/j.icjq.2021.06.010 • https://dx.doi.org/10.1097/SLA.0000000000002712 		X	
3	52	How can care packages which aim to enable rapid recovery from surgery (e.g., ERAS) affect the environmental impact of an operation?	No	NG180 - perioperative care	No	<ul style="list-style-type: none"> • https://dx.doi.org/10.1097/SLA.0000000000003878 		X	
4	53	How can waste from medical gas cylinders be reduced?	No	No					X
5	54	What effect do standards, guidelines and quality improvement initiatives have on the environmental impact of operations?	No	No		<ul style="list-style-type: none"> • https://doi.org/10.1016/j.eururo.2022.01.027 • https://dx.doi.org/10.1097/SLA.0000000000002712 • https://doi.org/10.1289/EHP8666. • https://dx.doi.org/10.1097/SLA.0000000000003951 		X	
6	55	What is the most sustainable method to launder clothing worn when delivering	No	No					X

1		care around an operation?						
2	56	How do we measure the carbon footprint of an operation?	No	No		• https://dx.doi.org/10.1097/SLA.0000000000003951		X
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6	57	How can the different types of environmental impacts (e.g., global warming, waste, resource utilisation) associated with care during and around the time of an operation be prioritised and balanced against one another?	No	No				X
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21	58	What is the most sustainable way to provide lighting in the operating theatre?	No	No				X
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26	59	How can environmental sustainability be incorporated into the organisational management of operating theatres?	No	No				X
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34	60	How can the provision and administration of medicines to patients undergoing operations be made more	No	No				X
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2	sustainable?							
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