Supplementary files

Supplementary File 1. Search strategies

PubMed (via National Library of Medicine) (n=727)

("Carbon Footprint"[Mesh] OR "Greenhouse Gases"[Mesh] OR "Carbon footprint"[tiab] OR "Carbon emissions"[tiab] OR "Carbon emission"[tiab] OR "Carbon dioxide"[tiab] OR "Carbon equivalent"[tiab] OR "Dioxide equivalent"[tiab] OR "Environmentally friendly"[tiab] OR "Greenhouse gas"[tiab] OR "Greenhouse gases"[tiab])
AND
("Delivery of Health Care"[Mesh] OR "Medicine"[Mesh] OR "Health care"[tiab] OR Healthcare[tiab] OR Medical[tiab] OR Medicine[tiab] OR Surgery[tiab] OR Surgical[tiab] OR Hospital[tiab])
AND
(Reduce[tiab] OR Reduction[tiab] OR Reduced[tiab])
AND
(Implementation[tiab] OR Promoting[tiab] OR Promote[tiab] OR Promotion[tiab] OR Changes[tiab] OR Change[tiab] OR Estimates[tiab] OR Estimated[tiab] OR Cost[tiab] OR Costs[tiab])
AND
(“randomized controlled trial”[pt] OR “controlled clinical trial”[pt] OR randomized[tiab] OR randomised[tiab] OR randomly[tiab] OR trial[tiab] OR Crossover[tiab] OR "Comparative Study"[pt] OR "Evaluation Study"[pt] OR "Epidemiologic Studies"[Mesh] OR “case-control studies”[Mesh] OR “Cohort Studies”[Mesh] OR “case control”[tiab] OR Cohort[tiab] OR “Follow up”[tiab] OR Observational[tiab] OR Longitudinal[tiab] OR Prospective[tiab] OR Retrospective[tiab] OR Compared[tiab] OR “cross sectional”[tiab] OR “Cross-Sectional Studies”[Mesh] OR Evaluated[tiab] OR Impact[tiab] OR Analysis[tiab] OR Statistics[tiab])

Embase (via Elsevier) search strategy (n=865)

("Carbon Footprint"/exp/mj OR "greenhouse gas"/exp/mj OR "Carbon footprint":ti,ab OR "Carbon emissions":ti,ab OR "Carbon emission":ti,ab OR "Carbon dioxide":ti,ab OR "Carbon equivalent":ti,ab OR "Dioxide equivalent":ti,ab OR "Environmentally friendly":ti,ab OR "Greenhouse gas":ti,ab OR "Greenhouse gases":ti,ab)
AND
("health care delivery"/exp/mj "Health care":ti,ab OR Healthcare:ti,ab OR Medical:ti,ab OR Medicine:ti,ab OR Surgery:ti,ab OR Surgical:ti,ab OR Hospital:ti,ab)
AND
(Reduce:ti,ab OR Reduction:ti,ab OR Reduced:ti,ab)
AND
(Implementation:ti,ab OR Promoting:ti,ab OR Promote:ti,ab OR Promotion:ti,ab OR Changes:ti,ab OR Change:ti,ab OR Estimates:ti,ab OR Estimated:ti,ab OR Cost:ti,ab OR Costs:ti,ab)
AND
(random* OR factorial OR crossover OR placebo OR blind OR blinded OR assign OR assigned OR allocate OR allocated OR 'crossover procedure'/exp OR 'double-blind procedure'/exp OR 'randomized controlled trial'/exp OR 'single-blind procedure'/exp OR 'epidemiology'/exp OR 'controlled study'/exp OR 'cohort analysis'/exp OR "case control":ti,ab OR Cohort:ti,ab OR "Follow up":ti,ab OR Observational:ti,ab OR longitudinal:ti,ab OR Prospective:ti,ab OR retrospective:ti,ab OR "cross sectional":ti,ab OR 'Cross-Sectional Studies'/exp OR Investigated:ti,ab OR Analysis:ti,ab OR Statistics:ti,ab OR Data:ti,ab)

Cochrane CENTRAL (via Wiley) search strategy (n=276)

(Note: WHO trials search was done via Cochrane CENTRAL)

([mh "Carbon Footprint"] OR [mh "Greenhouse Gases"] OR "Carbon footprint":ti,ab OR "Carbon emissions":ti,ab OR "Carbon emission":ti,ab OR "Carbon dioxide":ti,ab OR "Carbon equivalent":ti,ab OR "Dioxide equivalent":ti,ab OR "Environmentally friendly":ti,ab OR "Greenhouse gas":ti,ab OR "Greenhouse gases":ti,ab)
AND
([mh "Delivery of Health Care"] OR [mh Medicine] OR "Health care":ti,ab OR Healthcare:ti,ab OR Medical:ti,ab OR Medicine:ti,ab OR Surgery:ti,ab OR Surgical:ti,ab OR Hospital:ti,ab)
AND
(Reduce:ti,ab OR Reduction:ti,ab OR Reduced:ti,ab)
AND
(Implementation:ti,ab OR Promoting:ti,ab OR Promote:ti,ab OR Promotion:ti,ab OR Changes:ti,ab OR Change:ti,ab OR Estimates:ti,ab OR Estimated:ti,ab OR Cost:ti,ab OR Costs:ti,ab)

Web of Science (via Clarivate) search strategy (n=1012)

("Carbon Footprint" OR "Greenhouse Gases" OR "Carbon footprint" OR "Carbon emissions" OR "Carbon emission" OR "Carbon dioxide" OR "Carbon equivalent" OR "Dioxide equivalent" OR "Environmentally friendly" OR "Greenhouse gas" OR "Greenhouse gases")
AND
("Delivery of Health Care" OR Medicine OR "Health care" OR Healthcare OR Medical OR Medicine OR Surgery OR Surgical OR Hospital)
AND
(Reduce OR Reduction OR Reduced)
AND
(Implementation OR Promoting OR Promote OR Promotion OR Changes OR Change OR Estimates OR Estimated OR Cost OR Costs)
AND
("randomized controlled trial" OR "controlled clinical trial" OR randomized OR randomised OR randomly OR trial OR Crossover OR "Comparative Study" OR "Evaluation Study" OR "Epidemiologic Studies" OR "case-control studies" OR "Cohort Studies" OR "case control" OR Cohort OR "Follow up" OR Observational OR Longitudinal OR Prospective OR Retrospective OR Compared OR "cross sectional" OR "Cross-Sectional Studies" OR Evaluated OR Analysis)

Pickles K, *et al. BMJ EBM* 2024; 29:300–312. doi: 10.1136/bmjebm-2023-112707

Supplementary File 2. Excluded studies at full-text screening

Ineligible intervention

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Ineligible study design

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No comparison group

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Supplementary File 3. Summary of the characteristics of studies awaiting classification

Characteristics		Number (n = 25)	Studies awaiting classification
Type of study	Uncontrolled before-after	21	Alyeddin,[1] Benness & Doane,[2] Boyle,[3] Carta,[4] Danby(a),[5] Danby(b),[6] DeJong,[7] Forde,[8] Hickman & Molyneux,[^9] Hirst,[10] Jameson & Young,[11] Kirkman,[12] Lawson & Baxter,[13] Nash,[14] Patel,[^15] Ribes Iborra,[16] Roome,[17] Self & Eveleigh,[18] Tucker,[19] Wayne,[20] Wilson & Clark[21]
	Quality improvement	2	Jandu,[22] Rose[^23]
	Interrupted time series	1	Kim[24]
	Not reported	1	Aung[25]
Country	UK	19	Alyeddin,[1] Boyle,[3] Carta,[4] Danby(a),[5] Danby(b),[6] Forde,[8] Hickman & Molyneux,[^9] Hirst,[10] Jameson & Young,[11] Jandu,[22] Kirkman,[12] Lawson & Baxter,[13] Nash,[14] Roome,[17] Rose,[^23] Self & Eveleigh,[18] Tucker,[19] Wayne,[20] Wilson & Clark[21]
	USA	2	Patel,[^15] Aung[25]
	Australia	1	Benness & Doane[2]
	Netherlands	1	DeJong[7]
	Spain	1	Ribes Iborra[16]
	Not reported	1	Kim[24]
Year of publication	2010-2015	1	Patel,[^15]
	2016-2020	8	Boyle,[3] Danby(a),[5] Danby(b),[6] Hickman & Molyneux,[^9] Jandu,[22] Lawson & Baxter,[13] Self & Eveleigh,[18] Wayne,[20]
	2021-2023	16	Alyeddin,[1] Aung,[25] Benness & Doane,[2] Carta,[4] DeJong,[7] Forde,[8] Hirst,[10] Jameson & Young,[11] Kim,[24] Kirkman,[12] Nash,[14] Ribes Iborra,[16] Roome,[17] Rose,[^23] Tucker,[19] Wilson & Clark[21]
Intervention target	Anaesthesia	17	Alyeddin,[1] Benness and Doane,[2] Boyle,[3] Carta,[4] Danby(a),[5] Danby(b),[6] Forde,[8] Hickman & Moyneux,[9] Hirst,[10] Jameson & Young,[11] Kim,[24] Kirkman,[12] Lawson & Baxter,[13] Patel,[^15] Self & Eveleigh,[18] Tucker,[19] Wilson & Clark[21]
	Waste disposal	2	DeJong,[7] Jandu[22]
	Unnecessary tests &/or treatments	2	Aung,[25] Nash[14]
	Surgical sterilization	1	Ribes Iborra[16]

	Avoidable hospital admissions	1	Rose^[23]
	Inhalers	1	Roome[17]
	Healthcare service provision (home enteral tube feeding service)	1	Wayne[20]
Intervention type, according to EPOC taxonomy	Education	14	Aung,[25] Benness & Doane,[2] Boyle,[3] Carta,[4] DeJong,[7] Hickman & Molyneux,^[9] Jandu,[22] Jameson & Young,[11] Kirkman,[12] Nash,[14] Roome,[17] Self & Eveleigh,[18] Tucker,[19] Wayne[20]
	Audit & feedback	8	Carta,[4] Danby(a),[5] Danby(b),[6] Hickman & Molyneux,^[9] Jameson & Young,[11] Nash,[14] Patel,^[15] Wilson & Clark[21]
	Reminders	5	Carta,[4] Hickman & Molyneux,^[9] Hirst,[10] Jameson & Young,[11] Roome[17]
	Local consensus processes	1	Kim[24]
	Environmental restructuring	11	Boyle,[3] Danby(b),[6] DeJong,[7] Forde,[8] Jandu,[22] Kirkman,[12] Lawson & Baxter,[13] Ribes Iborra,[16] Roome, Tucker,[19] Wayne,[20]
	Information and communication technology	1	Alyeddin[1]
	Site of service delivery	1	Rose^[23]
Outcomes	Carbon or GHG emissions	17	Benness & Doane,[2] Boyle,[3] Carta,[4] Danby(a),[5] Danby(b),[6] DeJong,[7] Hickman & Molyneux,^[9] Hirst,[10] Kim,[24] Kirkman,[12] Lawson & Baxter,[13] Nash,[14] Roome,[17] Rose^, Self & Eveleigh,[18] Tucker,[19] Wayne[20]
	Financial costs	8	Benness & Doane,[2] Boyle,[3] DeJong,[7] Hirst,[10] Kirkman,[12] Nash,[14] Self & Eveleigh,[18] Wilson & Clark[21]
	Effectiveness	20	Alyeddin,[1] Benness & Doane,[2] Boyle,[3] Carta,[4] Danby(a),[5] Danby(b),[6] DeJong,[7] Forde,[8] Hirst,[10] Jameson & Young,[11] Kim,[24] Kirkman,[12] Nash,[14] Patel,^[15] Ribes Iborra,[16] Roome,[17] Rose,^[23] Self & Eveleigh,[18] Tucker,[19] Wilson & Clark[21]
	Not reported	2	Jandu,[22] Aung[25]

EPOC Effective Practice and Organisation of Care; GHG Greenhous Gas
We are unable to confirm eligibility of these studies since all are conference abstracts
^ Authors have confirmed that study results have not been published

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Supplementary File 4. Characteristics of included studies (detailed)

Author, year, country Target of intervention	Study design and timing	Setting	Participants/cases/units	Intervention Intervention time period and duration
Ang 2023, Singapore Anaesthesia	Uncontrolled before-after Before: October 2020 to April 2021 After: September 2021 to April 2022	All anaesthetic cases within a large tertiary teaching hospital in Singapore (1200 beds)	Anaesthesia clinicians including theatre nurses and allied healthcare professionals. Approximately 25,000 general anaesthesia cases per year.	3 Plan-Do-Study-Act (PDSA) cycles to reduce departmental desflurane usage PDSA cycle 1: April-May 2021 PDSA cycle 2: May-June 2021 PDSA cycle 3: July-August 2021
Carter 2019, UK Anaesthesia	Uncontrolled before-after[1] Before: first month before intervention (Sept 2016) After: Oct 2016 to Mar 2017	Anaesthesia department All surgeries performed under general anaesthesia within 1 teaching hospital in North London (over 800 beds)	All anaesthetist consultants and trainees; Data collected from 10-13 theatres; Theatre activity ranges between 1100-1600 cases per month)	Phased interventions to increase use of low-flow anaesthesia and encourage isoflurane use 6 months (Sept 2016 to Mar 2017)
Chambrin 2023, France Anaesthesia	Retrospective* interrupted time series Before: Jan 2015-Dec 2017 After: Jan 2018-Feb 2020	4 hospitals with surgical activity of the Hospices Civils de Lyon (90,000 surgical procedures per year)	641 anaesthesia providers including anaesthesiology nurses, anaesthesiologists and residents	Implementation of sustainable anaesthesia groups (set up in Jan 2018) to decrease the GHG emissions related to inhaled halogenated anaesthetic use. Intervention duration 18 months (Jan 2018 to Jun 2019)

Epstein 2016, USA Anaesthesia	Uncontrolled before-after Before: 8 x 4 weeks before May 2014 After: 8 x 4 weeks after May 2014	Anaesthesia department (all surgeries performed under general anaesthesia) within 1 hospital in USA	Anaesthesiologists, nurse anaesthetists, and anaesthesiology residents; 20,235 surgical cases total	Conversion to a nonreactive CO_2 absorbent to (1) reduce intraoperative Sevoflurane fresh gas flow (2) reduce Sevoflurane consumption (3) change cost (4) reduce wastage Conversion occurred over 'several weeks' after May 6 2014
Glenski 2020, USA Anaesthesia	Uncontrolled before-after Before: June 2018-May 2019 After: June 2019-Feb 2020	Anaesthesia department within Children's Mercy hospital (tertiary paediatric hospital) in Kansas City, Missouri, USA	33 anaesthesiologists (data collected from 19 operating suites, 2 cardiac catheterization laboratories, 2 MRI sites and 2 interventional radiology sites; 1574-1602 cases per month)	3 Plan-Do-Study-Act (PDSA) cycles over 6 months to increase use of low-flow anaesthesia and decrease sevoflurane use PDSA cycle 1: March 2019 PDSA cycle 2: June 2019 PDSA cycle 3: August 2019
Martinez Ruiz 2023, Spain Anaesthesia	Uncontrolled before-after Before 2017-2020 After: Not reported	Operating rooms within Cruces University Hospital (Barakaldo)	40 operating rooms, 11 surgical areas	Implemented anaesthetic gas capture technology (Contrafluran system) to absorb and recycle exhaled halogenated anaesthetic gases. Program established between April and October 2021.

Patel 2021, USA Anaesthesia	Uncontrolled before-after (phased) September-December 2018 Before: 30 days in September 2018 (n=304 cases) After Stage 1: 30 days in October 2018 (n=285 cases) After Stage 2: December 2018 (n=289 cases)	24 operating rooms within a large, urban academic health system in Midwestern United States	Participants assumed to be staff within anaesthesia department; including MDs, residents, CRNAs, nurse anaesthesia students.	2 stages of intervention. Stage 1. Provider education on sustainable use of inhaled anaesthetics delivered during department Grand Rounds. Stage 2. Desflurane vaporisers removed from anaesthetic machines in 19/24 operating rooms (6 weeks after education). Staff were permitted to request use of a desflurane vaporiser.
Pinder 2022, UK Anaesthesia	Uncontrolled before-after (phased) November 2021-May 2022 Before (stage 1): 12 cases After (interventional): Stage 2 – 8 cases Stage 3 – 8 cases Stage 4 – 8 cases	Labour ward of 3 hospitals: 1. St Mary's Hospital, Manchester, England (approx 9000 deliveries/year) 2.Wythenshawe Hospital, Manchester, England (approx 5000 deliveries/year 3. St John's Hospital, Livingston, Scotland (approx 3000 deliveries/year)	Consultant anaesthetists, specialty anaesthetic doctors and midwifery staff within the labour ward of the 3 hospitals	4 stages of interventions (by case rather than time period) to implement nitrous oxide catalytic destruction (cracking) in the maternity setting in order to decrease the GHG emissions of nitrous oxide in the ambient air. Stage 1: Baseline/usual care (no cracking equipment Stage 2: Cracking equipment with a mouthpiece and midwife education

				Stage 3: Cracking equipment with a facemask (Economy Maks) instead of mouthpiece. Modification to education Stage 4: Modification of the facemask and patient coaching
Richter 2020, Germany Anaesthesia	Uncontrolled before-after Before: 2017 After: 2018	Anaesthesiology department in a 515 bed county hospital in Germany split across 2 sites	40 medical staff within 6 surgical departments (n=10,588 cases before, n=10,268 cases after)	Desflurane vaporisers were removed from anaesthetic machines. Staff were permitted to request use of a desflurane vaporiser. Educational training. Implemented 'early 2018'
Tay 2013, Australia Anaesthesia	Prospective* before-after Before (manual phase): 12 weeks Jan – April 2011 After (automated phase): 12 weeks July-Oct 2011	6 operating theatres within a university teaching hospital (Northern Hospital) in Melbourne, Australia	All medical, nursing and technical anaesthesia staff; all patients undergoing elective and emergency surgery with a volatile agent general anaesthetic (n=1865 cases before, n=1810 cases after)	Replacement of manual control anaesthesia machines with automated control of end-tidal gases, to reduce volatile anaesthetic consumption cost and GHG emissions 2-month implementation phase (April-May 2011)
Wyssusek 2022, Australia Anaesthesia	Uncontrolled before-after Before: Jan 2016	22 operating theatres within a teaching hospital (Royal Brisbane and Women's Hospital) in Brisbane, Australia	Senior staff specialists educated registrar and resident doctors (approximately 28,000 surgeries and 10,000	Behavioural and system changes to reduce GHG emissions from inhaled anaesthetic agents.

	After: Jan 2016-Dec 2021		interventional procedures per year)	Interventions took place Jan 2016-Dec 2021 Desflurane vaporisers progressively removed from April 2021
Zuegge 2019, USA Anaesthesia	Uncontrolled before-after Before: 2012 fiscal year After: 2015 fiscal year	Anaesthesia department within a 592-bed academic medical centre in Wisconsin, USA	Participants assumed to be staff within anaesthesia department; n=28,957 cases (2012) n=31,779 cases (2015)	Multidisciplinary staff engagement and provider education on flow rate reduction and volatile agent choice to reduce environmental and financial impacts of anaesthesia Timing and duration of intervention not reported
Grimmond 2021, UK Waste disposal	Retrospective* uncontrolled before-after Before: 12 months prior to 1 July 2018 After: 1 Aug 2018 to 31 July 2019	UK NHS acute hospital trusts	40 UK NHS acute hospital trusts (baseline extrapolated from 17 trusts)	Conversion from single-use sharps containers to reusable sharps containers to reduce GHGs Intervention time period and duration unclear
Labib 2023, UK Waste disposal	Prospective* uncontrolled before-after Time period not reported Before: 25 consecutive laparoscopic appendicectomies	Plymouth NHS Trust (large teaching hospital), UK	Appendicectomy consultants, registrars and senior house officers in one UK NHS hospital trust	Revised laparoscopic appendicectomy surgical set to include reusable instruments, new reusable ports and removal of rarely used instruments Intervention time period and duration not reported

	After: 22 laparoscopic appendicectomies			
Neves 2022, Portugal Waste disposal	Uncontrolled before-after October 2021 – March 2022 Before: 4 weeks (185 endoscopic procedures) After: one-month post-intervention (178 endoscopic procedures) 4 months post-intervention (172 endoscopic procedures)	Portimao endoscopy unit of Algarve University Hospital Centre, Portugal	Entire endoscopy unit team including medical, nursing and auxiliary staff in one hospital	Team education of waste handling, recycling implementation and relocation of landfill and medical waste bins Intervention 1 (stage 2): 1-week intervention
Riedel 2011, USA Waste disposal	Uncontrolled before-after Before: 6 months Sept 2007 – March 2009 After: 6 months Sept 2008 – March 2009	148-bed acute care, short-term private hospital (Mercy Mt Airy Hospital) in Cincinnati, Ohio	Nurses, hospital managers, and medical staff (approx. 900 employees before and 800 employees after); 500 admissions before and after; 3250 emergency room visits before and 3100 after; 2900 outpatient visits before and after; 300 surgeries before and 250 after	Addition of single-stream recycling to the nonhazardous waste disposal practices to determine environmental and financial benefit Single-stream recycling implemented September 2008, duration not reported
Wormer 2013, USA Waste disposal	Uncontrolled before-after Timing and duration of before-after periods not reported	Operating rooms within Carolinas Medical Centre in Charlotte, North Carolina	Committee included members from the surgical staff, fellows, residents, research personnel, nursing, environment services, and administration	Implementation of a Green Operating Room Committee (GORC) (and Green OR Initiatives) to reduce waste and costs in operating rooms

				Intervention commenced in 2008, duration not reported
McAlister 2021, Australia Unnecessary testing	Retrospective* uncontrolled before-after Before: 1 September 2018 to 28 February 2019 After: 1 September 2019 to 29 February 2020	Division of Medicine at St George Hospital, Sydney	Participants assumed to be staff ordering pathology tests; all admissions under the care of a Division of Medicine consultant for 24 hours or longer, insured by Medicare, Department of Veterans Affairs, or compensation schemes (5,695 patients, 7,603 admissions)	Policy to reduce non-urgent pathology testing to 2 days/week Policy was implemented on 1 September 2019 and is ongoing
Regan 2018, UK Unnecessary testing	Uncontrolled before-after Before: 15 months pre-invention (Oct 2013 to Jan 2015) After: 32 months post-intervention (Jan 2015 to Aug 2017, Including 3-month intervention in early 2015)	Paediatric cardiology ward (Bear Ward) in Great Ormond Street Hospital, London	Two lead ward consultants, junior medical staff, the ward matron and senior nursing team in Bear Ward (no. staff not reported) – 8 high dependency beds and 18 ward beds; 7521 biochemistry tests ordered over 32-month follow-up	Phased interventions to reduce unnecessary requests for biochemistry blood tests 3-month period (Jan-March 2015)
Wang 2021, USA Unnecessary testing	Retrospective* before-after Before: 2 months (Sept-Oct 2015) After: 2 months (Sept-Oct 2016)	1 hospital (Yale-New Haven Hospital) in Connecticut, USA	Nurse practitioners, anaesthesiology residents, and anaesthesiologists within a preoperative hospital clinic; 298 American Society of Anaesthesiologist Class I-III patients undergoing elective spine surgery (n=144 before, n=154 after)	Implementation of a preoperative evaluation centre utilising telehealth screening and standardised testing guidelines to reduce unnecessary preoperative testing and clinic visits Process implemented January 2015 (duration not reported)

McCarthy 2014, UK Energy use	Uncontrolled before-after Before: March 2013 (1 week period) After: 18 months following initial audit in March 2013	University teaching hospital in Dublin, Ireland	Staff attending a single teaching session within radiology department	Education and audit and feedback to reduce energy use by turning off computers when not in use (e.g. overnight and on weekends) Initial audit occurred over 1 week in March 2013, not reported when education occurred

Intervention targets anaesthesia, waste disposal, unnecessary testing or energy use

*Only 4 studies explicitly stated they were retrospective and 2 studies stated they were prospective, the remainder did not specify

Pickles K, *et al. BMJ EBM* 2024; 29:300–312. doi: 10.1136/bmjebm-2023-112707

Supplementary File 5. TIDieR information available across studies

Study	1. Why (Rationale)	2. What (Materials)	3. What (Procedures)	4. Who (Intervention provider)	5. How (Modes of delivery)	6. Where (Location of intervention)	7. When and how much	8. Tailoring	9. Modifications	10. How well delivered^
Ang 2023[36]	√	~	√	√	~	√	~	~	X	X
Carter 2019[19]	√	~	√	√	√	√	√	X	√	X
Chambrin 2023[37]	√	√	√	~	√	√	√	X	X	~
Epstein 2016[20]	√	√	√	X	√	√	~	√	√	X
Glenski 2020[21]	√	~	√	X	√	√	√	X	√	~
Pinder 2022[28]	√	~	√	X	~	√	X	√	X	~
Patel 2021[42]	√	~	√	~	~	√	~	X	X	~
Martinez Ruiz 2023[26]	~	~	~	X	X	√	X	X	√	X
Richter 2020[43]	√	~	~	X	~	√	~	X	X	X
Tay 2013[31]	√	~	√	X	X	√	√	X	X	~

Wyssusek 2022[34]	√	√	√	√	√	√	~	√	X	~
Zuegge 2019[35]	√	√	√	~	√	√	√	√	X	X
Grimmond 2021[22]	√	~	~	X	X	√	X	X	X	X
Labib 2023[23]	√	√	~	X	X	√	X	√	X	X
Neves 2022[27]	√	~	~	√	~	√	~	X	X	~
Riedel 2011[30]	√	~	~	~	√	√	~	X	X	X
Wormer 2013[33]	√	~	~	~	~	√	X	X	X	X
McAlister 2021[24]	√	√	√	~	√	√	~	X	X	X
Regan 2018[29]	√	~	√	~	√	√	~	X	X	X
Wang 2021[32]	√	~	√	~	√	√	~	X	X	X
McCarthy 2014[25]	√	~	~	~	X	√	~	X	X	X

✓: reported; X: not reported; ~ partially reported

^ Rated reported if both planned and actual intervention adherence were described; rated partially reported if either element was described; rated not reported if neither element was described

Intervention targets anaesthesia, waste disposal, unnecessary testing or energy use
TIDieR: Template for Intervention Description and Replication

Supplementary File 6. Summary of reported outcomes

Study	Greenhouse gas emissions	Financial costs	Effectiveness	Other
Ang 2023	- CO2e (tonnes) saved per year	- US$ saved per year	- Desflurane usage (L) per month - % theatre cases using desflurane - Sevoflurane usage per month	
Carter 2019		- Change in total expenditure on volatile agents (6 months) *	- % theatres with fresh gas flow <1 L/min - Number bottles of each volatile agent (isoflurane, desflurane and sevoflurane) ordered per month	
Chambrin 2023	- Perioperative CO_2e over 100 years*	- Costs related to use of desflurane, sevoflurane and propofol per general anaesthesia (euros)	- Volume of desflurane (kg), sevoflurane (kg) and propofol (g) used per general anaesthesia	
Epstein 2016		- Difference in mean cost for the sum of sevoflurane and absorbent purchases for each of the 10 4-week intervals ($USD)	- Agent consumption of volatile anaesthesia - Fresh gas flow during intraoperative period - Fresh gas flow during volatile anaesthesia for each of sevoflurane, desflurane and isoflurane (ml/min)	
Glenski 2020	- $MTCO_2e$ per year		- Bottles sevoflurane/month - Anaesthetics performed per bottle of sevoflurane used/month	
Martinez Ruiz 2023	Before - CO2e estimated from usage of volatile/inhaled anaesthetics (g/hr) x their GWP After - CO2e assumed to be 0			

	- Verified gas capture by measuring volatile gas concentration in ambient air in all operating rooms			
Patel 2021	$MTCO_2e$ per fiscal year	-Cost savings per fiscal year (USD $) per volatile agent and in total	-Desflurane use (proportion of cases) -Desflurane use (minutes of use/case) -Desflurane use (average gas flow L/min)	
Pinder 2022			- Mean ambient nitrous oxide levels during final 30 minutes of uncomplicated labour	Acceptability: - Staff feedback survey
Richter 2020	- CO_2e per year (tonnes) - CO_2e per case (kg)		- Desflurane use (litres) - Sevoflurane use (litres)	
Tay 2013	- GWP_{100} (tonnes) - GWP_{100} per hour (kg) - CO_2 absorbent use (kg)	- Volatile agent cost per hour (AUD $) of inhalational general anaesthesia* - Volatile agent cost (AUD $) - CO_2 absorbent cost (AUD $)	- Bottles of each volatile agent (n, %)	
Wyssusek 2022	- CO_2e (tonnes) over 5 years from 2016 to 2021	- Annual expenditure (AUD $) of desflurane and sevoflurane	- Bottles of each volatile agent purchased per month	
Zuegge 2019	- CO_2e per case per fiscal year (kg)	- Cost savings per month (USD $) per volatile agent and in total	- Average number bottles of each volatile agent per month	
Grimmond 2021	- $MTCO_2e$ GWP* - Kg CO_2e/1000 fill line litres - Kg CO_2e/1000 patient activity episodes		- Weight polymer required (tonnes) - Containers incinerated - Weight plastic incinerated (tonnes) - Weight cardboard incinerated (tonnes) - Container exchanges	

Labib 2023	- CO_2e (kg) saved per appendicectomy	- Cost (pounds) saved per appendicectomy	- Median number disposable instruments used per case - Proportion of appendicectomies that did not require any disposable instruments	
Neves 2022	- CO_2e (kg) per one-month period from endoscopy waste stratified by waste type	- Waste processing expenses (Euro) per one-month period stratified by waste type	- Total waste (kg) per one-month period from endoscopy waste stratified by waste type	
Riedel 2011	- $MTCO_2e$ saved over 6 months	- Cost (US $) of total non-hazardous waste disposal by recycling (Cintas, cardboard, single-stream) and landfill (compactor and open top)	- Tonnage (US tonnes) of total waste by recycling (Cintas, cardboard, single-stream) and landfill (compactor and open top) - British thermal units (BTU) saved	
Wormer 2013	- CO_2e saved per year	- Cost savings ($/year) according to each initiative e.g. waterless scrub and in total	- % personnel using alcohol-based waterless scrub - Water saved (litres) - Recyclable waste (pounds) - Biohazardous waste (pounds)	
McAlister 2021	- CO_2e per admission	- Pathology cost per admission (AUD $)	- Number pathology collections per admission* - Pathology collections per patient day - Number admissions with no pathology collections	Harms: - Number in-hospital deaths
Regan 2018	- CO_2e saved across 32 months follow-up	- Expenditure (pounds) on biochemistry tests (per month, per year or across 32 months follow-up	- % test code 'C005' renal tests (deemed necessary) as a total biochemistry tests ordered	
Wang 2021	- Total mean emissions per patient (kg CO_2e) stratified by emissions source (testing, primary care provider in-person evaluation, pre-operative evaluation centre in-		- Mean number medical preoperative tests per 100 patients stratified by test type (complete blood count, chemistry panel, coagulation panel, chest X-ray, electrocardiogram, haemoglobin A1C,	

	person evaluation, telehealth consult and vehicular travel) and by whether deemed necessary or unnecessary		MRSA nasal swab and type and screen) and whether deemed necessary or unnecessary	
McCarthy 2014	- $MTCO_2e$ wasted per year	- $ USD wasted per year	- Number (%) desktop computers and Picture Archiving And Communications System left on overnight - Electrical energy (kWh) wasted/year	

Intervention targets anaesthesia, waste disposal, unnecessary testing or energy use

* Only three studies specified a primary outcome, of which only one was greenhouse gas emissions (global warming potential).

$MTCO_2e$ Metric Tons Carbon Dioxide Equivalent, GWP_{100} 100-year global warming potential, CO_2 Carbon Dioxide, CO_2e Carbon Dioxide Equivalent

Supplementary File 7. Rationale for risk of bias judgements

Study	Internal validity				External validity			
	Selection bias: representative?*	**Attrition bias: adequate?**	**Detection bias: blind/objective?**	**Confounding: adjustment?**	**Reporting bias: generalisable?**	**Reporting bias: adequate follow-up?**	**Reporting bias: well-defined, appropriate outcomes?**	**Analyses: appropriate?**
Ang 2023	>90% eligible population targeted **Likely** that all staff will have been exposed to the multicomponent interventions over the 6-month duration	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if potential confounding factors (e.g. duration of anaesthesia, casemix) remained constant during the study	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of all secondary outcomes Instrument validity: Method of measurement for GHG emissions not reported	Absolute differences are presented but no % change or pre-post values reported for GHG emissions or costs
Carter 2019	**Unlikely** that >90% of staff were targeted. Authors note a new intake of anaesthetic trainees during the intervention that were not targeted	Unclear if outcomes were assessed for >85% study group of interest. 1st spot audit was performed in 13 theatres but not reported how many theatres were audited during the follow-up 6 months	Unblinded objective outcome is unlikely to have detection bias	Unclear if all potentially confounding variables (e.g. duration of anaesthesia) remained constant during the study	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Primary and secondary outcomes well defined but did not include all appropriate outcomes (e.g. GHG emissions) Instrument validity: N/A	Absolute differences and % change are presented
Chambrin 2023	>90% eligible population targeted **Likely** that all providers were	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potentially confounding factors (seasonality of the data and number of general anaesthesia	Generalisable study setting /population (4 hospitals with surgical activity).	Length of follow up is reported and deemed to be appropriate to the research question	Primary and secondary outcomes well defined and appropriate	Statistical analysis conducted and deemed appropriate

	targeted by sustainable anaesthesia groups and information campaign			uses) adjusted for statistically	Study setting/population clearly described.		Instrument validity: calculated from purchase of anaesthetics (database)	
Epstein 2016	>90% eligible population targeted **Likely** that all staff were targeted b/c providers were targeted by personalised regular email.	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors explored in sensitivity analyses	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of primary outcome and did not include all appropriate outcomes (e.g. GHG emissions) Instrument validity: N/A	Statistical analysis conducted and deemed appropriate
Glenski 2020	>90% eligible population targeted **Likely** that all staff were targeted b/c the entire depatrment gathers around the huddle board	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors (e.g. anaesthetics performed /month) explored	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: Calculated from anaesthetics performed per bottled of sevoflurane used per month. Did not account for proportion of other gases such as desflurane.	Absolute differences and % change are presented but 7 straight data points above or below the mean is an unconventional measure of statistical significance
Martinez Ruiz 2023	>90% eligible population targeted	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely	Potential confounding factors (e.g. number/time of	Single site; unclear whether	Length of follow up is unclear b/c the 'after'	Outcome measurement instrument, units and	Minimal detail regarding analyses provided

	Likely all staff had access to the gas capture system as this was installed in all operating rooms		to have detection bias	anaesthetic use) not accounted for	generalisable study setting /population.	time period is not reported	data source were not defined a priori. Instrument validity: Measurement method and data source not reported	
Patel 2021	Unclear if >90% eligible population targeted. Unclear whether all staff were targeted by the removal of desflurane vaporisers from anaesthetic machines (19/24 operating rooms) All anaesthesia providers were unable to participate in the Grand Rounds presentation.	Outcome not assessed >85% study group of interest. Only first cases Mon-Fri. Outcome only assessed in 14.9% to 17.5% of total monthly cases.	Unblinded objective outcome is unlikely to have detection bias	Unclear if all potential confounding variables (e.g. surgery type and duration) remained constant during the study.	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of primary outcome. Instrument validity: Calculated from retrospective chart review and pharmacy records of desflurane use. Did not account for proportion of other inhalational agents.	Absolute differences are presented and % change can be inferred
Pinder 2022	>90% eligible population targeted. **Likely** that all staff and patients were targeted as interventions were implemented on a case-by-case basis	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors (e.g. amount of nitrous oxide used, door or window opening) not accounted for.	Three sites; unclear whether generalisable because study population (patients) not described.	Length of follow up is unclear b/c the 'after' time periods is not reported	Outcomes appropriate but unclear reporting of primary outcome and did not include all appropriate outcomes (e.g. GHG emissions) Instrument validity: N/A	Statistical analysis conducted and deemed appropriate

Richter 2020	>90% eligible population targeted **Likely** all staff were targeted by the removal of desflurane vaporisers from anaesthetic machines	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if all potential confounding variables (e.g. possible change in anaesthetic duration, type of surgery) remained constant during the study	One hospital across two sites; unclear whether generalisable because study population (patients) not described.	Length of follow up is unclear b/c the intervention commencement is unclear ('early 2018')	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: Calculated from amount of each volatile agent used. Did not account for duration of anaesthesia.	Absolute difference and % change are presented
Tay 2013	Unclear if >90% eligible population targeted Preparation and education delivered to 'all' medical, nursing and technical aneasthesia staff but no description of whether or how this was achieved/targeted	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if all potential confounding variables (e.g. choice of volatile agent) remained constant during the study	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Primary and secondary outcomes well defined and appropriate Instrument validity: calculated from bottles of each volatile agent used per hour of general anaesthesia	Statistical analysis conducted and deemed appropriate
Wyssusek 2022	>90% eligible population targeted **Likely** that all staff were targeted b/ec education was undertaken on an individual basis during supervised theatre time.	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors (e.g. number/time of anaesthetic use) not accounted for	Single site; unclear whether generalisable study setting /population	Length of follow up is unclear b/c the before and after time periods are not reported	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: Calculated from number of bottles of each volatile agent purchased per month (but not used). Did	Absolute difference and % change are presented

							not account for number of cases/duration of anaesthesia.	
Zuegge 2019	>90% eligible population targeted. **Likely** that all staff were targeted b/c a variety of mechanisms were used including regular communication, vaporiser labels, and new employee training	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if all potential confounding variables (e.g. possible increase in total IV or regional anaesthetic usage, type of surgery) remained constant during the study	Single site; unclear whether generalisable study setting /population.	Length of follow up is unclear b/c the intervention timing and duration is not reported	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: Calculated from number of bottles of each volatile agent purchased per month (but not used). Did not account for hours of general anaesthesia.	Absolute differences and % change are presented
Grimmond 2021	>90% eligible population targeted **Likely** all staff had access to the reusable sharps containers as this was a system wide intervention	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors explored in sensitivity analyses	Generalisable study setting /population (40 UK NHS acute hospital trusts). Study setting/population clearly described.	Length of follow up is reported and deemed to be appropriate to the research question Probably appropriate given intervention time period was unclear	Primary and secondary outcomes well defined and appropriate Instrument validity: LCA – process based attributional	Absolute differences and % change are presented
Labib 2023	>90% eligible population targeted **Likely** that all staff had access to the revised surgical set	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if potential confounding factors (e.g. number of appendicectomies performed) remained constant during the study	Single site; unclear whether generalisable study setting /population	Length of follow up is unclear b/c it's reported in terms of cases rather than time	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: LCA of disposable and reusable items	Statistical analysis conducted and deemed appropriate.

Neves 2022	>90% eligible population targeted **Likely** that all staff were targeted b/c there was 100% staff participation in educational meetings	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potentially confounding factors (e.g. number endoscopies, sedation type) were statistically analysed and found to be similar across control and intervention.	Single site; unclear whether generalisable study setting /population	Length of follow up is reported and deemed to be appropriate to the research question	Primary and secondary outcomes well defined and appropriate Instrument validity: Calculated from weight of endoscopic landfill and medical regulated waste	Statistical analysis conducted and deemed appropriate.
Riedel 2011	>90% eligible population targeted. **Likely** that all staff were targeted b/c the education was provided to each unit in each shift and posters in staff lounges. Lots of different mechanisms to publicise single stream recycling	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potentially confounding factors (e.g. waste generation and facility operations) were statistically analysed and found to be similar across control and intervention.	Generalisable study setting /population. Study setting/population clearly described.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: calculated from tonnage of each waste stream (billing records)	Absolute differences are presented but no % change or pre-post values reported
Wormer 2013	No information about the target(s) of the intervention **Unlikely** that >90% of staff were targeted.	Undefined a priori outcomes and therefore unlikely the outcome was assessed in >85% of the study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors (e.g. volume of hospital activity, time) not accounted for.	Single site; unclear whether generalisable study setting /population.	Length of follow up is probably inappropriate because positive findings were extrapolated over one year with no time frames provided.	Undefined a priori outcomes (no measurement instruments defined) Instrument validity: Measurement method and data source not reported	Minimal detail regarding analyses provided
McAlister 2021	>90% eligible population targeted **Likely** that all staff were informed about policy change	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potentially confounding factors (e.g. age, sex, NWAU19, type of admission, admission length,	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Primary and secondary outcomes well defined and appropriate	Statistical analysis conducted and deemed appropriate

	- The policy was communicated via department meetings, staff orientations, and strategic placement of posters in areas frequented by junior doctors.			within-admission correlation) adjusted for statistically.			Instrument validity: LCA – process based consequential (based on previous study)	
Regan 2018	>90% eligible population targeted. **Likely** that all staff were targeted by attempts to educate all staff, displaying posters and logos and cartoon based stickers fixed onto computer screens	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Potential confounding factors (e.g. bed occupancy or patients' diagnoses, comorbidities or clinical status) not accounted for.	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: calculated from cost of biochemistry tests ordered by the hospital	Mean differences are presented but no statistical analysis is conducted
Wang 2021	>90% eligible population targeted. **Likely** that all staff were aware b/c the new process was implemented after staff education through faculty meetings, emails, and office staff meetings in the spine clinic.	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if lower proportion of ASA Class III patients post intervention may have influenced study results	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported and deemed to be appropriate to the research question	Outcomes appropriate but unclear reporting of primary outcome Instrument validity: LCA – using prices for services and patient travel distance	Statistical analysis conducted and deemed appropriate
McCarthy 2014	No information about the target(s) of the intervention	Outcome assessed >85% study group of interest	Unblinded objective outcome is unlikely to have detection bias	Unclear if all potential confounding variables (e.g. time, number of staff)	Single site; unclear whether generalisable study setting /population.	Length of follow up is reported but inappropriate length	Outcomes appropriate but unclear reporting of primary outcome	Absolute differences and % change are presented

	Unlikely that >90% of staff were given results of the audit at a single teaching session.			remained constant during the study		for a single, simple intervention	Instrument validity: calculated from electrical energy consumed (power meter)	

Intervention targets anaesthesia, waste disposal, unnecessary testing or energy use
* Pertains to participants targeted

Supplementary File 8. Summary of intervention effects for financial costs

Study	Outcome	Intervention type(s)	Measurement method and data source	Effect estimate (%)	P value	Vote count
Ang 2023	USD$ saved per year	- Education - Organisational culture change - Reminders - Equipment to promote total intravenous anaesthesia - Care pathway	Not reported	Not estimable	N/A	Beneficial
Carter 2019	Costs of volatile agents over 6 months (units not reported)	- Removal sevoflurane vaporisers - Audit & feedback - Education - 'Low flow' reminder board	Estimated from number of bottles of volatile agents ordered per month using spending figures from pharmacy	25% reduction	N/A	Beneficial
Chambrin 2023	Costs of use of anaesthetics per case (euros)	- Sustainable anaesthesia groups - Education - Reminders	Desflurane, sevoflurane and propofol monthly purchase from hospital database	29% reduction	p<0.01	Beneficial
Epstein 2016	Mean cost for sevoflurane and absorbent for 10 x 4-week intervals ($USD)	- Change carbon dioxide absorbers - Audit & feedback	Volatile agent consumption based on costs from hospital invoices	Not estimable	P=0.81	Null effect
Patel 2021	Cost savings per FY (USD$)	- Education - Removal of desflurane vaporisers	Pharmacy purchasing data for inhalational agents (per FY)	21% reduction	N/A	Beneficial
Tay 2013	Volatile agent cost per hour (AUD $)	- Automated control of anaesthetics - Education	Costs of volatile agent bottles from pharmacy records	27% reduction	p=0.0243	Beneficial
Wyssusek 2022	Anaesthetic costs from 2016 to 2021 (AUD $)	- Education - Audit & feedback - Removal of desflurane vaporisers - Automated control of anaesthetics	Pharmacy purchasing records of desflurane and sevoflurane	58% reduction	N/A	Beneficial

		- Default low fresh gas flow settings				
Zuegge 2019	Cost savings per month (USD $)	- Multidisciplinary staff engagement - Empowering local champions - Education - Vaporiser labels	Purchasing records of anaesthetic volatile agents and average costs per bottle	Not estimable	N/A	Beneficial
Labib 2021	Cost saved per case (pounds)	- Revise appendicectomy surgical set to add reusable and remove rarely used instruments	Audit of instrument use during appendicectomies using unit prices from procurement team	63% reduction	N/A	Beneficial
Neves 2022	Waste processing expenses per month (Euro)	- Education - Audit & feedback - Recycling	Calculated from weight of landfill and regulated medical waste weighed daily	38% reduction	p=0.012	Beneficial
Riedel 2011	Cost of waste disposal over 6 months (USD $)	- Addition of single-stream recycling - Education	Cost of nonhazardous waste disposal using billing records	26% reduction	N/A	Beneficial
Wormer 2013	Cost savings per year (USD $)	- Green Operating Room Committee - Alcohol-based waterless scrub - Recycling and reusing - Education - Initiative to turn off equipment not in use - Donations of unused surgical items	Downstream costs per year were projected. Methods of estimation or data source not reported.	Not estimable	N/A	Beneficial
McAlister 2021	Pathology cost per patient day (AUD $)	- Policy to reduce non-urgent pathology testing - Education	Admission and pathology billing records	16% reduction	p<0.001	Beneficial
Regan 2018	Cost saving on biochemistry tests per year (£)	- Education - Reminder stickers - Audit & feedback - Incentives	Cost data of biochemistry tests ordered	23% reduction	N/A	Beneficial
McCarthy 2014	USD $ wasted per year	- Education - Audit & feedback	Cost of electrical energy (power meters) based on computers and PACS left on when not used	Not estimable	N/A	Null effect

Intervention targets anaesthesia, waste disposal, unnecessary testing or energy use
Effect estimates reported at end of intervention or closest point

PACS: Picture Archiving and Communication System

Supplementary File 9. Summary of intervention effects for effectiveness

Study	Outcome	Intervention type(s)	Measurement method/Data source	Effect estimate (% change), p value	Vote count
Ang 2023	- Monthly median desflurane use - % cases not using desflurane	- Education - Organisational culture change - Reminders - Equipment to promote total intravenous anaesthesia - Care pathway	- Pharmacy records	- 61% reduction desflurane use - 80% reduction in theatre cases using desflurane	Beneficial
Carter 2019	- Number bottles of volatile agent (isoflurane, desflurane & sevoflurane) ordered per month - % theatres with flow gas rate <1L/min	- Removal sevoflurane vaporisers - Audit & feedback - Education - 'Low flow' reminder board	- Pharmacy - Monthly audit	- 18% reduction in volatile agents - 108% increase in use of low flow anaesthesia	Beneficial
Chambrin 2023	- Volume of desflurane (kg), sevoflurane (kg) and propofol (g) used per general anaesthesia	- Sustainable anaesthesia groups - Education - Reminders	Anaesthesia order databases of each hospital	- 96% reduction in desflurane ($p<0.01$) - 39% increase in sevoflurane ($p<0.01$) - 12% increase in propofol ($p=0.20$)	Beneficial
Epstein 2016	- Intraoperative flow gas flow (FGF) for each volatile agent - Consumption (ml/min) of each volatile agent	- Change carbon dioxide absorbent - Audit & feedback	Calculated by anaesthesia machine and by weighing vaporisers	- 24% reduction intraoperative FGF for sevoflurane cases ($p<10^{-5}$) - 13% reduction in sevoflurane - 8% reduction in desflurane	Beneficial
Glenski 2020	- Anaesthetics performed per bottle of sevoflurane used per month	- Change carbon dioxide absorbers - Low flow Wizard software - Education	Administrative staff (anaesthetic cases) and pharmacy	25% increase	Beneficial

		- Audit & feedback - Reminders - Daily huddle board	(sevoflurane bottles used)		
Patel 2021	-Desflurane use (% of cases) -Desflurane use (minutes of use/case) -Desflurane use (average gas flow L/min)	- Education - Removal of desflurane vaporisers	Pharmacy records and retrospective chart review	-96% reduction in % cases -95% reduction in mins of use -6% increase in average gas flow	Beneficial (reported by study authors)
Pinder 2022	- Median ambient nitrous oxide concentration in the 30 minutes before delivery	- Nitrous oxide cracking equipment - Staff & patient education	Infrared N2O detector configured to log readings every 6 minutes	Met criteria for special cause variation - 71% reduction from stage 1 (baseline) to stage 2 - No change from to stage 2 to stage 3 - 81% reduction from stage 3 to stage 4	Beneficial
Richter 2020	- Desflurane and sevoflurane use (litres)	- Removal of desflurane vaporisers - Education	Pharmacy records	- 94% reduction in desflurane - 27% increase in sevoflurane	Beneficial
Tay 2013	- Bottles of each volatile agent (n, %)	- Automated control of anaesthetics - Education	Tracked electronically by pharmacy	- 5.8% reduction in desflurane - 5.6% increase in sevoflurane - No change in isoflurane	Beneficial
Wyssusek 2022	- Bottles of each volatile agent	- Education - Audit & feedback - Removal of desflurane vaporisers - Automated control of anaesthetics - Default low fresh gas flow settings	Pharmacy purchasing records	- 96% reduction in desflurane - 6% increase in sevoflurane - 35% reduction in combined desflurane and sevoflurane combined	Beneficial
Zuegge 2019	- Average number bottles of each volatile agent per month	- Multidisciplinary staff engagement - Empowering local champions - Education - Vaporiser labels	Purchasing records of the hospital	- 55% reduction in desflurane - 16% increase in sevoflurane - 3% reduction in isoflurane	Beneficial

Grimmond 2021	- Weight polymer required, plastic incinerated and cardboard boxes (tonnes) and containers incinerated	- Convert from single-use to reusable sharps containers	Measured in 17 trusts and extrapolated to 40 trusts	- 76% reduction in polymer - 97% reduction in plastic incinerated - 97% reduction in cardboard boxes - 97% reduction in containers incinerated	Beneficial
Labib 2023	- Median number of disposable instruments per case	- Revise appendicectomy surgical set to add reusable and remove rarely used instruments	Audit forms completed by theatre staff	- 75% reduction (p<0.00001)	Beneficial
Neves 2022	- Total waste (kg) per one-month period from endoscopy waste stratified by waste type	- Education - Audit & feedback - Recycling	Waste separated into landfill and medical waste and weighed daily	- Nonsignificant increase in landfill (p=0.059) - 41% reduction in medical waste (p=0.010) - Increase in recycled paper (p=0.001) and plastic (p=0.007)	Beneficial
Riedel 2011	- Tonnage (US tonnes) of total waste by recycling (Cintas, cardboard, single-stream) and landfill (compactor and open top)	- Addition of single-stream recycling - Education	Billing records from recycling company	- 44.7% reduction in landfill waste - 10.3% increase in recycling waste	Beneficial
Wormer 2013	- % personnel using alcohol-based waterless scrub - Water saved (litres) - Recyclable waste (pounds) - Biohazardous waste (pounds)	- Green Operating Room Committee - Alcohol-based waterless scrub solutions - Recycling and reusing - Education - Initiative to turn off equipment not in use - Donations of unused surgical items	Not reported	- 58% increase in staff using alcohol-based waterless scrub - water saved not estimable - recyclable waste not estimable - 75% reduction in biohazardous waste	Beneficial
McAlister 2021	- Pathology collections per admission - Pathology collections per patient day	- Policy to reduce non-urgent pathology testing	Admission and pathology data	10% reduction in rate of pathology collections (p<0.001)	Beneficial

		- Education			
Regan 2018	- % of simpler C005 renal tests out of total biochemical tests	- Education - Reminder stickers - Audit & feedback - Incentives	Number and type of biochemistry tests ordered	32% reduction in % of unnecessary combined biochemistry tests	Beneficial
Wang 2021	- Mean number medical preoperative tests per 100 patients stratified by test type (complete blood count, chemistry panel, coagulation panel, chest X-ray, electrocardiogram, haemoglobin A1C, MRSA nasal swab and type and screen) and whether deemed necessary or unnecessary	- Telehealth implementation - Established guideline - Education	Electronic health records	- 52% reduction in unnecessary CXRs (p<0.001) - 29% reduction in unnecessary urinalysis (p=0.004) - Nonsignificant reduction in unnecessary electrocardiogram (p=0.088) - Nonsignificant reduction in unnecessary MRSA nasal swab (p=0.086) - Nonsignificant increase in unnecessary haemoglobin (p=0.25) - 46% increase in unnecessary blood tests (p=0.018) - 24% increase in unnecessary chemistry panel (p=0.035) - 11% increase in unnecessary coagulation panel (p=0.027) - 121% increase in unnecessary type and screen (p<0.001)	Inconsistent effect on unnecessary preoperative tests

McCarthy 2014	- % desktop computers left on overnight - % PACS workstations left on overnight	- Education - Audit & feedback	Observation during re-audit	- 5.2% reduction in desktop computers left on overnight - 4.2% increase in PACS workstations left on overnight	Null effect (reported by study authors)

Intervention targets anaesthesia, waste disposal, unnecessary testing or energy use
Effect estimates reported at end of intervention or closest point
PACS; Picture Archiving and Communication System