10 R's: Tips en Trics voor een groener OkA

Prof. Dr. An Teunkens

Anesthesie UZ Leuven

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UZ Leuven | Herestraat 49 B - 3000 Leuven | www.uzleuven.be tel. +32 16 33 22 11

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Why care as a physician/nurse?

Climate change is a public health threat!

Healthcare is a polluting business!

HEALTHCARE:

5% Total GHG emission

5% GHG hospital emission = ANESTHETIC GASES

50% Hospital waste = OR

25% OR waste = ANESTHESIA

0.1% of global CO_2 production

The environmental footprint of health care: a global assessment
Lenzen et al. Lancet Planet Health 2020; 4: e271-79

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A Climate Neutral Hospital

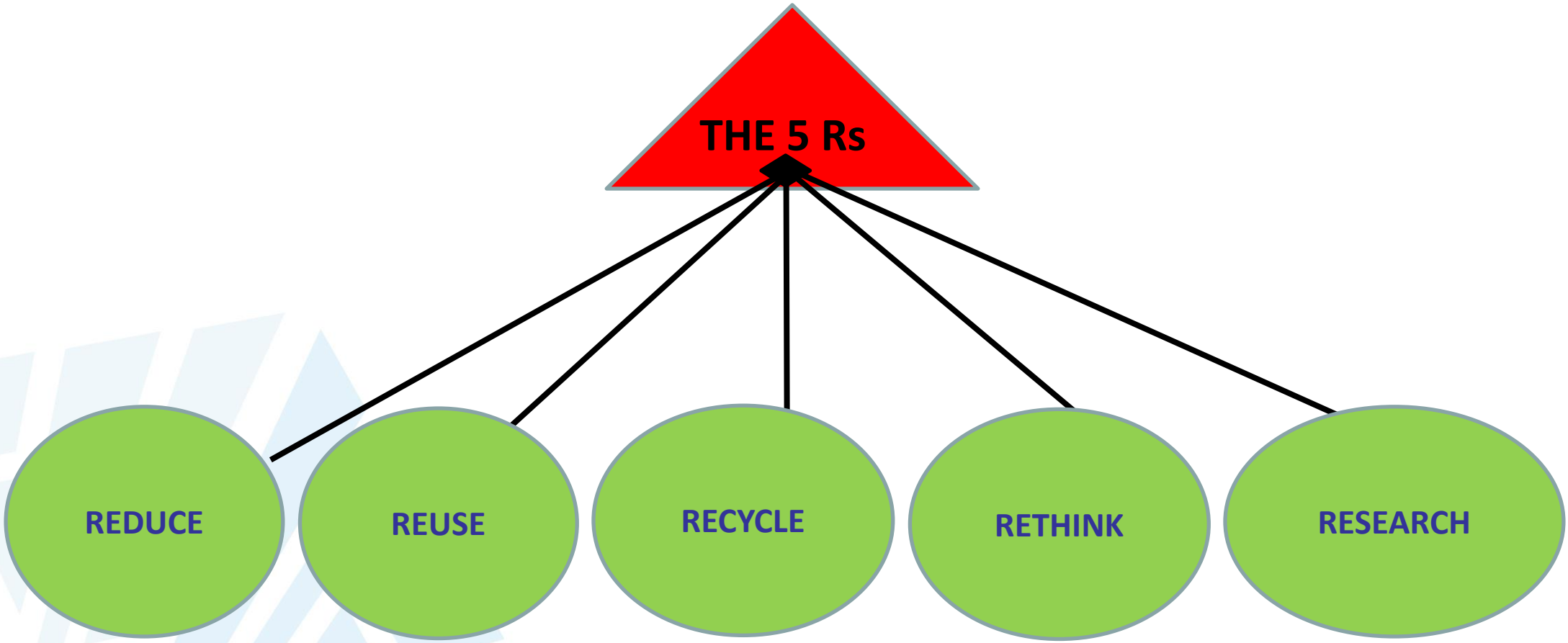
SCOPE 1

SCOPE 2

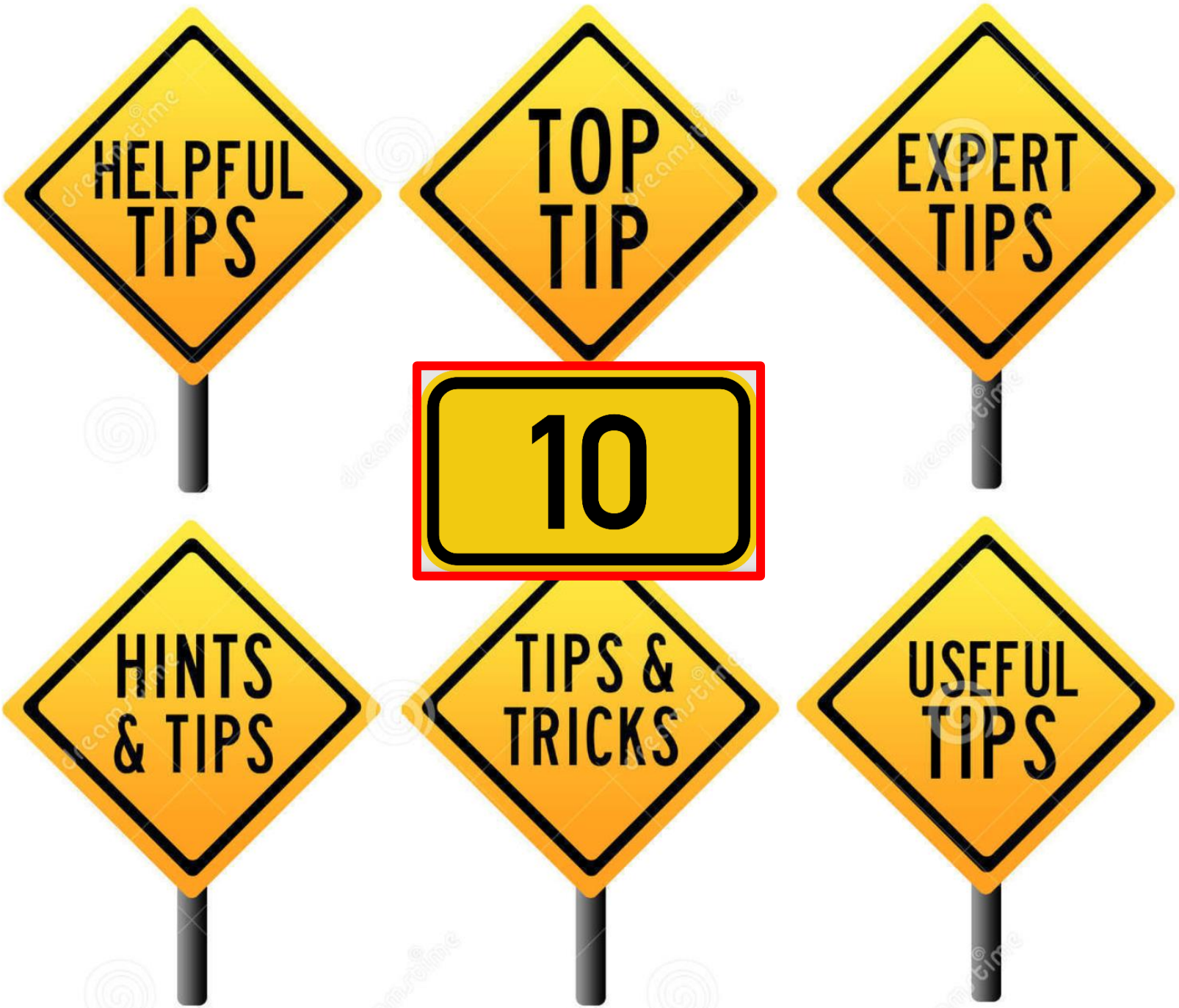
SCOPE 3

MSD

Greening the OR



Environmental sustainability in anaesthesia and critical care
McGain et al. BJA 2020, 125 (5): 680-692


HELPFUL TIPS
TOP TIP
EXPERT TIPS
10
HINTS & TIPS
TIPS & TRICKS
USEFUL TIPS

1. Responsibility

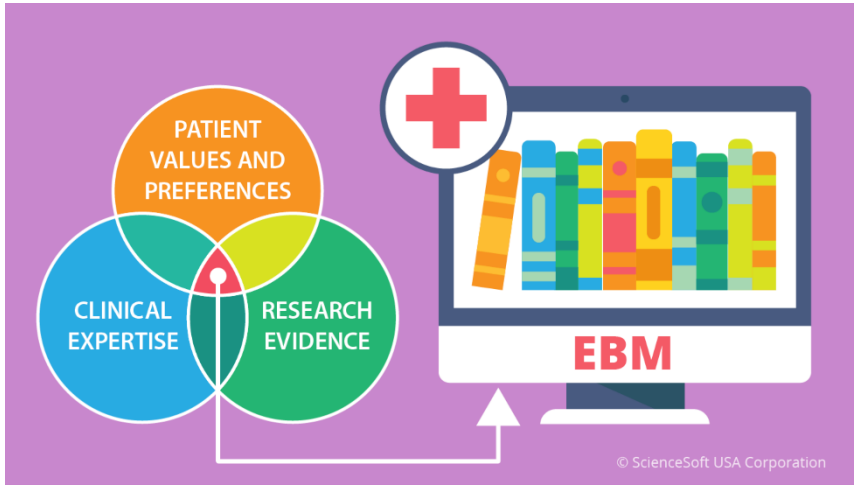
Safe and sustainable anesthesia/ OR

Ask yourselves: “What can we do to make the OR more sustainable?”

Take responsibility: “ACT to change”

2. Resist or Refuse

- Special offers, deals
- Do I need this?
- Will it improve care?
- Will it improve safety?
- Do patients need this?
- Is there a more sustainable alternative?



3. Reduce

- **Reduce waste:**
  - OR 50 % of hospital waste
  - 25% of OR waste is recyclable:
    - < 50% segregated appropriately
  - Recycling waste streams:
    - High-temperature incineration 1074 $kgCO_2e$
    - Recycling 21 $kgCO_2e$

3. Reduce

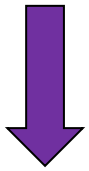
- **Sort out waste:**
  - Medical waste:
    - Only appropriate contents in sharp bins
    - Use non-infectious waste unless clear risk of infection
  - Glas
  - Paper
  - Plastic
  - PVC

3. Reduce

- **Think before you print**

- **Think before you open**
  - Medication
  - Materials:
    - NSG:
      - Inappropriate use in 50%
      - Non-intact skin, mucus membranes, body fluids
  - Fluids

3. Reduce

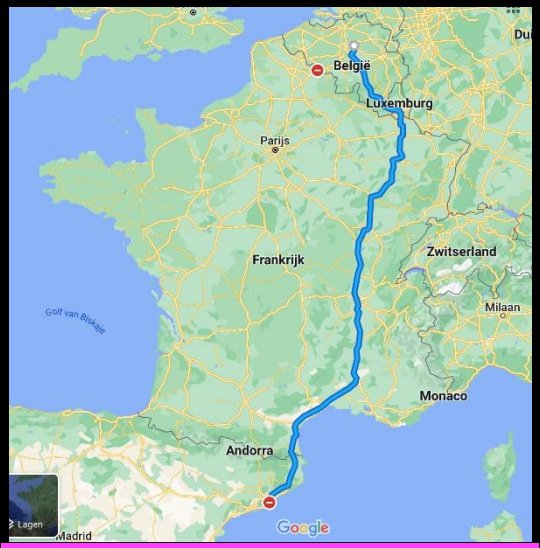
- **Greenhouse gas emissions** 
  - ~~Desflurane~~
  - ~~N_2O~~
  - Sevoflurane
  - Use IV anesthetics
  - Use LRA

The choice of anesthetic does matter

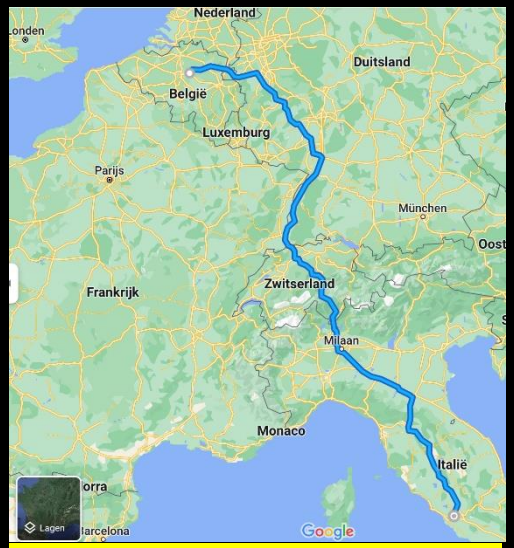
	GWP	Tropospheric lifetime
CO2	1	5-200
N_2O	289	114
SEVOFLURANE	440	5.2
ISOFLURANE	1800	2.6
DESFLURANE	6810	10

Ishizawa, Yumiko MD, MPH, PhD General Anesthetic Gases and the Global Environment, Anesthesia & Analgesia: January 2011 - Volume 112 - Issue 1 - p 213-217
doi: 10.1213/ANE.0b013e3181fe02c2

Driving equivalents of 7 hours anesthesia with…



Barcelona = Isoflurane



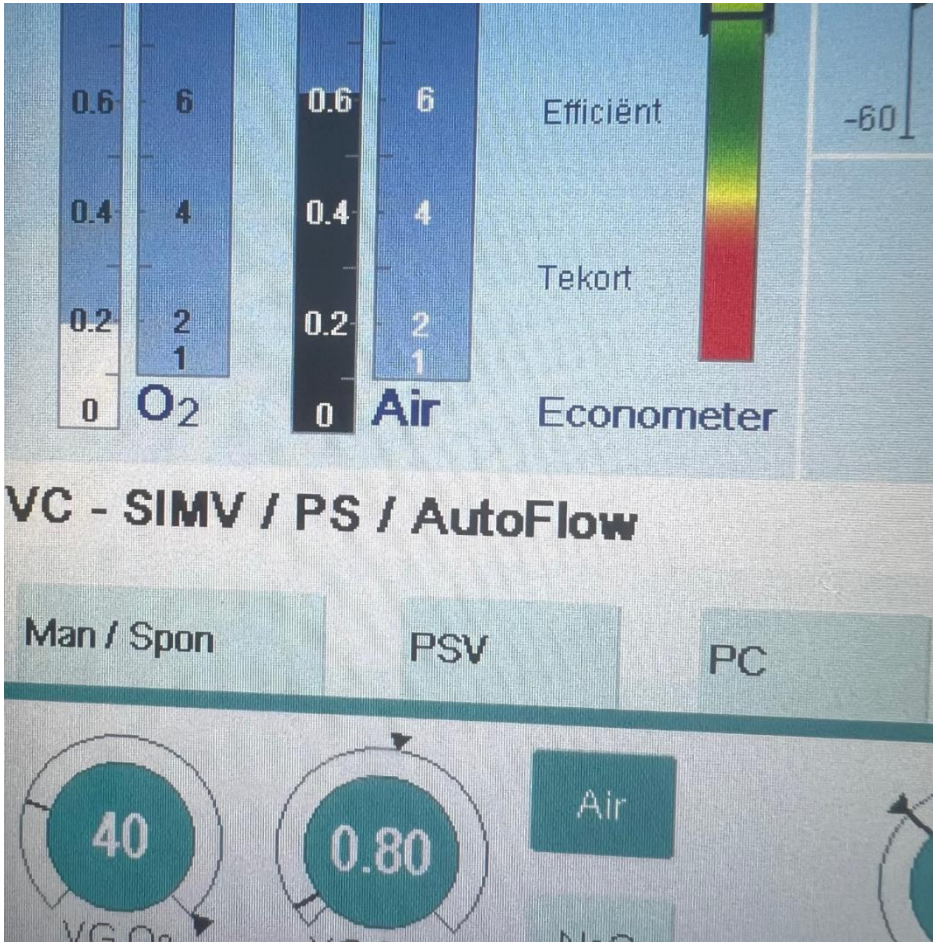
Rome = Sevoflurane

Asmara = Desflurane

Agent	O.5 Lmin^{-1} FGF	1 Lmin^{-1} FGF	2 Lmin^{-1} FGF
SEVOFLURANE 2%	780 km	1560 km	3120 km
ISOFLURANE 1.2%	681 km	1362 km	2724 km
DESFLURANE 6%	3820 km	7640 km	15280 km

3. Reduce

- **When using sevoflurane:**
  - Do not use sevoflurane during mask ventilation after a propofol induction
  - Stop flow while intubating or placing LMA



3. Reduce

- **When using sevoflurane:**
  - After intubation, start with 1L FGF and vaporizer at 8%: WASH IN
  - Lower FGF < 1L after washing in
  - Adjust vaporizer, FiO_2 guided by the gas analyzer
  - Adjust MAC to age
  - Use low flow target controlled anesthesia machines

3. Reduce

- **When using TIVA:**
  - Reduce propofol waste
  - FGF 5-6 L:
    - ↓ use of CO_2 absorber

3. Reduce

- **Energy consumption**
  - Cold water
  - Rub, don't scrub
  - Automatic/pedal-controlled water taps

3. Reduce

- **Energy consumption**
  - Turn down heating in unoccupied OR
  - Turn down ventilation in unoccupied OR
  - Turn down lights in unoccupied OR
  - Turn down computers in unoccupied OR
  - Unplug gas extraction in unoccupied OR

4. Reuse

- Single-use vs. reusable:
  - Risk of infection?
  - BSE epidemic 90': Creutzfeldt-Jacob disease
- **Single-use**
  - Production
  - Distribution
  - Out of stock
  - Short term saving
  - Biased information

4. Reuse

- **Reusable:**
  - Cleaning process
  - Sterilization
  - End of life
  - Fragility of device
  - Relocating jobs
- Veterinary use
- Lab use

4. Reuse

- BP cuffs
- Ecg cables
- Laryngoscope blades
- LMA
- Ventilation mask

4. Reuse

- Theatre hat:
  - Names and roles of the team
- Reusable gowns:
  - LCA: 1.1 kg CO_2 e/ gown
- Reusable drapes

4. Reuse

- **Volatile Capturing technology**
  - => veterinary use
  - Cost of canister
  - Adaptation of ventilator

5. Recycle

- “The use of waste itself as resources to make new materials and products”
- Paper
- Plastic => Granules => Toys
- Unused covers = > Granules => Toys

5. Recycle

- **CO_2 absorber:**
  - > 70% $Ca(OH)_2$: chalk
  - Fertilizer
  - Underground stabilizer for road works

6. Repair vs. Replace

- Repair if possible
- Replace what is not energy efficient
- Look for low-carbon alternatives
- Rebuild
- Renovate
- Recycle old equipment

7. Rethink

- Procedures
- Protocols:
  - Reduce preoperative investigations
  - Reorganize patient care pathways:
    - Virtual consultation
    - **Expand day case surgery**

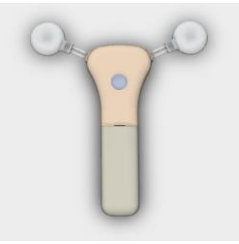
8. Review and Rationalize

- Surgical packs:
  - Essential vs. optional
- Instrument sets:
  - Smaller sets
  - Fewer sets
- Streamline surgeons' preference lists

9. Research

- Life cycle assessments of products
- E-health
- Telemonitoring
- Digital follow-up
- AI

CHECKPOINT CARDIO



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10. Reach out

- Share experiences
- Share ideas
- Share education
- Share knowledge
- Share insights
- Collaborate with industry

THE ROYAL COLLEGE OF SURGEONS OF EDINBURGH

Royal College of Surgeons of England
ADVANCING SURGICAL CARE

ROYAL COLLEGE OF PHYSICIANS AND SURGEONS OF GLASGOW

Intercollegiate Green Theatre Checklist

Below are a list of recommendations to reduce the environmental impact of operating theatres. All the relevant guidance and published evidence has been included in the Compendium of evidence, accessed via the QR code:

Anaesthesia

1	Consider local/regional anaesthesia where appropriate (with targeted O_2 delivery only if necessary)	■
2	Use TIVA whenever possible with high fresh gas flows (5-6 l) and, if appropriate, a low O_2 concentration	■
3	Limit Nitrous Oxide (N_2O) to specific cases only and if using: • check N_2O pipes for leaks or consider decommissioning the manifold and switching to cylinders at point of use; • introduce N_2O crackers for patient-controlled delivery.	■
4	If using inhalational anaesthesia: • use lowest global warming potential (sevoflurane better than isoflurane better than desflurane); • consider removing desflurane from formulary; • use low-flow target controlled anaesthetic machines; • consider Volatile Capture Technology.	■
5	Switch to reusable equipment (e.g. laryngoscopes, underbody heaters, slide sheets, trays)	■
6	Minimise drug waste (*"Don't open it unless you need it"*, pre-empt propofol use)	■

Preparing for Surgery

7	Switch to reusable textiles, including theatre hats, sterile gowns, patient drapes, and trolley covers	■
8	Reduce water and energy consumption: • rub don't scrub: after first water scrub of day, you can use alcohol rub for subsequent cases; • install automatic or pedal-controlled water taps.	■
9	Avoid clinically unnecessary interventions (e.g. antibiotics, catheterisation, histological examinations)	■

Intraoperative Equipment

10	REVIEW & RATIONALISE: • surgeon preference lists for each operation - separate essential vs. optional items to have ready on side; • single-use surgical packs - what can be reusable and added to instrument sets? what is surplus? (request suppliers remove these); • instrument sets - open only what and when needed, integrate supplementary items into sets, and consolidate sets only if it allows smaller/fewer sets (please see guidance).	■
11	REDUCE: avoid all unnecessary equipment (eg swabs, single-use gloves), *"Don't open it unless you need it"*	■
12	REUSE: opt for reusables, hybrid, or remanufactured equipment instead of single-use (e.g. diathermy, gallipots, kidney-dishes, light handles, quivers, staplers, energy devices)	■
13	REPLACE: switch to low carbon alternatives (e.g. skin sutures vs. clips, loose prep in gallipots)	■

After the Operation

14	RECYCLE or use lowest carbon appropriate waste streams as appropriate: • use domestic or recycling waste streams for all packaging; • use non-infectious offensive waste (yellow/black tiger), unless clear risk of infection; • ensure only appropriate contents in sharps bins (sharps/drugs); • arrange metals/battery collection where possible.	■
15	REPAIR: ensure damaged reusable equipment is repaired, encourage active maintenance	■
16	POWER OFF: lights, computers, ventilation, AGSS, temperature control when theatre empty	■

DISCLAIMER: These suggestions are based upon current evidence and broadly generisable, however, specific environmental impacts will depend upon local infrastructure and individual Trusts' implementation strategies.

Intercollegiate Green Theatre Scorecard. November 2022.

CONCLUSION

- Create awareness
- Collaborate
- Every little bit helps


This is one small step for a man, one giant leap for mankind.
Neil Armstrong
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