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Introducing green innovation into clinical practice

How can surgeons help reduce medical waste in the workplace and work towards 'net zero'?

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A paradigm shift is required in the delivery and provision of surgical care if we are to achieve the National Health Service (NHS) 'net zero' greenhouse gas emissions targets by 2040.[1] With clear national targets,[2] there is both a political and clinical mandate for urgent action. Initiating meaningful change in healthcare environments is challenging and complicated by an ever increasing demand. Surgeons are, however, ideally placed to identify, collaborate and drive changes to achieve these ambitions.

A CARBON HOTSPOT

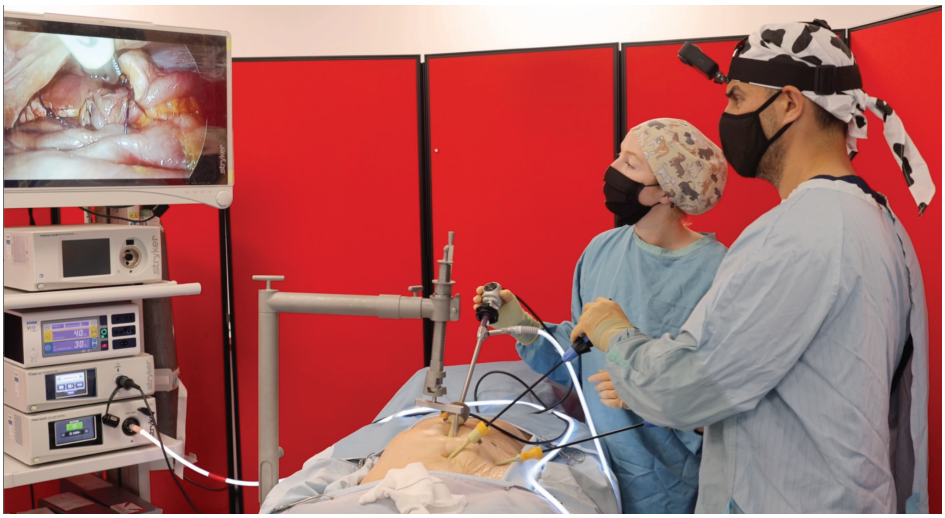
Green interventions across the healthcare spectrum are required but as one of the biggest contributors to the carbon footprint (NHS surgical procedures in England are estimated to use approximately 104kg CO_2e [carbon dioxide equivalents] per procedure),[3] surgery and operating theatres offer potential for delivering real improvements. The increase in minimally invasive procedures and the almost universal use of single-use equipment[4] consume vast quantities of CO^2 and generate enormous amounts of waste, most of which is incinerated.[5]

Recycling has a 50-fold lower carbon footprint than incineration, and interventions to recycle, biodegrade and reuse equipment demonstrate huge potential.[5-7] Nevertheless, prevention (both of patients requiring surgery and the reduction of equipment use) is the single most effective intervention.[2] As well as global shifts in practice, local interventions to streamline procedures can be immediately applicable and demonstrate a massive cumulative effect.

IDENTIFYING AREAS FOR CHANGE

The key to planning and implementing local interventions is close coordination with all stakeholders in patient care. Procurement and supply management teams are critical in determining feasibility and establishing carbon hotspots. Many trusts already have sustainability leads and groups of highly motivated doctors ready to effect change.

Figure 1 The retractor for abdominal insufflation-less surgery in use during a cadaveric demonstration



As much as two-thirds of theatre packaging is safe to be recycled.[6] However, waste pathways differ between trusts; consequently, recycling, biodegradable or reusable equipment interventions require the cooperation of trust waste managers as well as industry subcontractors.

It is imperative not only to target local procedural changes but also to challenge the global established cultural norms of practice. Operating theatre interventions (such as downtime heating, electricity and appliance use) require significant departmental engagement. Similarly, close integration with the anaesthetic teams, who have their independent 'green anaesthesia' mandates to reduce emissions, greatly aid the design of green interventions.

MEASURING OUTCOMES

It is important to establish the scale of each intervention's impact to determine the best areas of change. Tools provided by the Centre for Sustainable Healthcare, such as its SusQI (Sustainability in Quality Improvement) toolkit,[8] enable a rapid evaluation of resource hotspots. In order to demonstrate benefit and initiate change, it is often not necessary to accurately calculate the carbon footprint of the entire procedure, only the impact of the proposed interventions.

GLOBAL INNOVATION

Globally, innovation will drive sustainable change. One example is gas insufflation-less laparoscopic surgery (GILLS), a technique developed specifically to facilitate surgery without requiring energy intensive insufflators, their supporting equipment or disposable instruments.[9–13] While designed for use in low resource settings to improve access to laparoscopic surgery, the added environmental benefit is clear. The Leeds Global Health Research Group developed the retractor for abdominal insufflation-less surgery (RAIS) (Figure 1), a new surgical device aiming to accelerate GILLS through provision of equipment that is light in resources but compliant with standards.[14] GILLS is gaining an evidence base in India,[11] supported by a programme of training,[15] a registry to track usage and innovative technology like RAIS receiving regulatory approval. Wider delivery of GILLS

Figure 2 Rationalised equipment tray

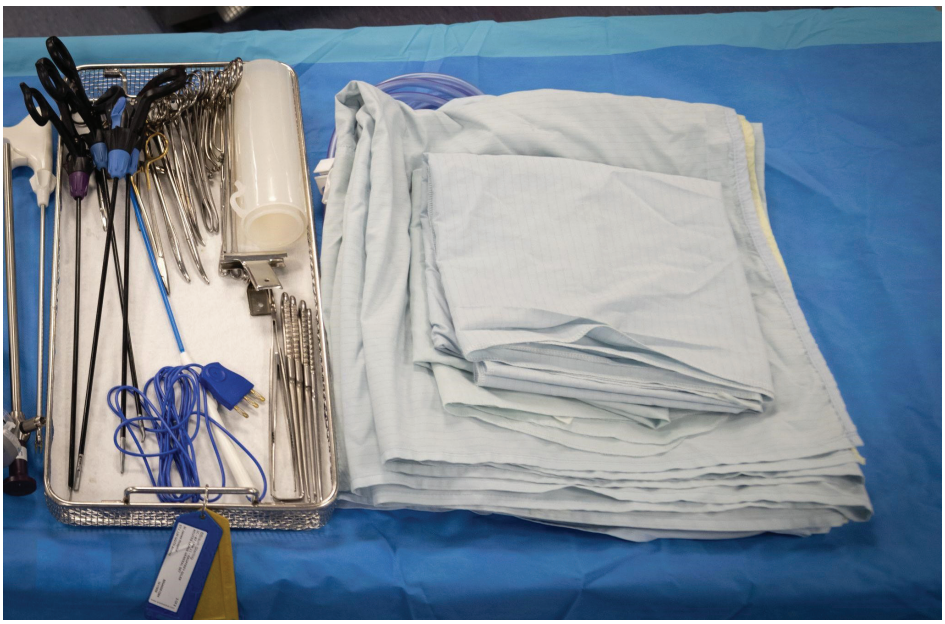
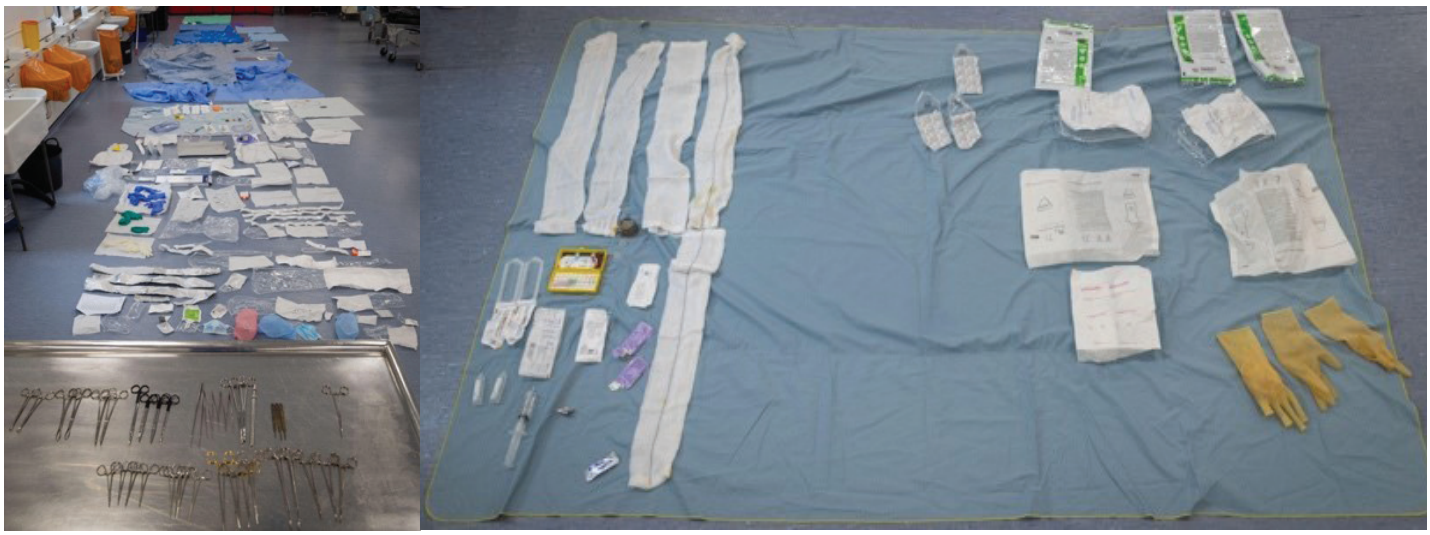


Figure 3 QR code for 360° video of procedure with interventions

Figure 4 Waste before and after interventions



through use of RAIS would expand global surgical access and contribute significantly towards the United Nations Sustainable Development Goals.[16]

THE GREEN SURGERY CHALLENGE: AN EXAMPLE OF LOCAL SUSTAINABLE CHANGE IN THEATRE

The Green Surgery Challenge was a collaborative national competition held in 2021. It was launched by the National Institute for Health Research Surgical MedTech Cooperative (together with The Royal College of Surgeons of England and the Royal College of Surgeons of Edinburgh) and coordinated by the Centre for Sustainable Healthcare. The competition was an opportunity for surgical teams to showcase ideas and practices that are less harmful to the environment and that build social sustainability. The team at Leeds Teaching Hospitals NHS Trust sought to develop a holistic approach to a green and sustainable laparoscopic appendicectomy. This project is an example of what is possible locally when surgical teams collaborate with all relevant stakeholders to produce a sustainable change.

The aim of the project was to reduce the carbon footprint of laparoscopic appendicectomy through four key areas: elimination of single-use gowns and drapes, perioperative catheterisation, rationalisation of the equipment tray to 49 items (Figure 2) and use of RAIS to eliminate CO_2. A cadaveric demonstration was performed, which involved a control and an intervention procedure. Both procedures were captured with video technology showing a 360° view from the aspect of the operating surgeon (Figure 3). Equipment use and waste was measured, and approximate carbon footprint calculations were carried out. The interventions saved an estimated 418.4kg CO_2e per operation, with use of the RAIS eliminating the need for insufflator gas accounting for 321kg CO_2e.

We accept that GILLS is unlikely to be adopted in the NHS. However, non-GILLS changes still save an estimated 7.48kg CO_2e per procedure. These are changes that can be implemented locally and put into practice immediately, and they are widely applicable. When considering 42,000 appendicectomies nationwide,[17] savings of up to 314 tonnes of CO_2e are achievable, which is the equivalent of driving a car from London to Edinburgh 212 times.

The real impact and success for Leeds came after the Green Surgery Challenge, where continued momentum and stakeholder engagement has meant the rationalised 'green tray', the preoperative micturition pathway, and reusable gowns and drapes are being introduced in the trust. A specific 'green appendicectomy' checklist has been produced and in time, the rationalised tray is planned to be an opt-out system.

Post-intervention evaluation confirmed there was widespread acceptance of reusable gowns and drapes, with many staff asking why the trust had ever moved away from them. Long-term costs and emissions for reusable gowns are significantly less than for their disposable alternatives. Numerous studies have demonstrated the superior environmental and financial outcomes of reusable options.[18,19] Despite concerns about infection control, the World Health Organization has stated that neither disposable nor reusable drapes and gowns pose a risk of significant harm.[20] One of the emergency theatres in Leeds is to become a sustainable theatre, with only reusable options to be used once the department procure enough to sustain this. In 2019, this theatre disposed of 6,386 gowns. If these are replaced, 7.2 tonnes of CO_2e can be saved in one theatre alone.

Not only are the above changes a step towards environmental sustainability but they have also proved cheaper for the trust, providing an attractive incentive. The rationalised instrument tray saves £22.91 per procedure in sterilisation alone. Annually, £9,600 and 740kg CO_2e could be saved.

Waste generation was 2,291g in the standard procedure compared with 515g following interventions (Figure 4). With disposal costing the trust £3.1 million in 2018–2019,[21] this could represent a significant financial saving.

CONCLUSIONS

This example shows that by making simple local changes as well as challenging established cultural practices, procedures can be improved to deliver sustainable change. The use of the RAIS to support GILLS results in a huge impact on carbon emissions. However, even minor changes demonstrate large environmental and financial savings. It is everyone's responsibility to minimise the catastrophic effects of climate change. Green innovation in collaboration with all stakeholders is needed to produce sustainable changes that are beneficial to the environment and, ultimately, our patients. How can you make a difference in your practice?

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