

Orthopaedic  
Research UK



# Environmental sustainability

in Orthopaedic Surgery  
and MSK Health 2024

In collaboration with



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# Introduction

As one of the largest areas of expenditure for the NHS, including 25% of the UK's surgical workload,<sup>1</sup> musculoskeletal (MSK) health has to be at the forefront of efforts to achieve a net zero NHS.

In this paper we summarise some initiatives across healthcare, and specifically within MSK health, to reduce its overall carbon footprint, and we share case studies on practical ways in which clinical teams are embracing more environmentally sustainable practices, whilst maintaining standards of care. Many of the case studies featured in this report were presented at the Sustainability in Orthopaedic Surgery Conference, co-hosted by the British Orthopaedic Trainees Association (BOTA) and Orthopaedic Research UK (ORUK).<sup>2</sup>

We conclude with an explanation of how ORUK and BOTA are aiming to contribute to improving the sustainability of the MSK sector as a whole.



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**25%**

of the of the UK's  
surgical workload  
relates to MSK Health

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<sup>1</sup> Briggs T. A national review of adult elective orthopaedic services in England. Getting it right first time. (2015).  
<sup>2</sup> Videos from the conference can be viewed at <https://app.medall.org/event-listings/bota-oruk-sustainability-in-orthopaedic-surgery-conference-2023>

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# Towards a net zero NHS

As with all major organisations, the NHS has committed to a significant reduction in its carbon footprint, which at 24.9 million tonnes CO<sub>2</sub>e represents around 4.6% of the nation's greenhouse gas emissions.<sup>3</sup> This has led to the NHS announcing a target to become net zero by 2045 with an interim 80% reduction by 2028-32.<sup>4</sup>

Achieving net zero over a timeframe of escalating demand for NHS services, especially from an aging population, will inevitably require a significant overhaul of procedures, process and working culture. An organisation that has been accused of being wasteful when it comes to resources will need to embrace the mantra of reduce, reuse, recycle.

Smarter planning, increasingly aided by AI, could help improve procurement and the allocation of resources and treatment locations. According to Professor Scarlett McNally, a Consultant Orthopaedic at East Sussex Healthcare NHS Trust and deputy director of the Centre for Perioperative Care, 'Streamlining care and processes at every stage improves patient outcomes, minimises costs and reduces carbon emissions.'<sup>5</sup> Treating people closer to their homes – or even within their homes, facilitated by digital-enabled care – could mean fewer and/or shorter car journeys. The use of online patient research platforms to replace in-person research, such as the *Arc Study* funded by ORUK, will also have a positive environmental impact by reducing the number of patient car journeys.

Operating theatres are particularly resource intensive. According to The Royal College of Surgeons of England, 'The carbon footprint of an operating department within a large UK hospital is estimated at 5,000 tonnes CO<sub>2</sub>e/year and a single operation at 150-250kg CO<sub>2</sub>e.'<sup>6</sup> It goes on to explain the reasons for this: 'Operating theatres, in particular, have a disproportionate environmental impact because of their energy-intensive processes, consumption of resources, use of volatile anaesthetic agents and production of waste. They are estimated to be three to six times more energy intensive than clinical wards and tend to produce approximately 50-70% of the total hospital waste.'<sup>7</sup>

**An operating department within a large UK hospital produces:**

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3 NHS. Delivering a 'Net Zero' National Health Service <https://www.england.nhs.uk/greenernhs/wp-content/uploads/sites/51/2020/10/delivering-a-net-zero-national-health-service.pdf> (Cited February 2021)

4 NHS. Delivering a 'Net Zero' National Health <https://www.scarlettmcnally.co.uk/document/lean-pathways-in-orthopaedics.pdf>

6 According to Royal College of Surgeons of England, Sustainability in Surgery Strategy 2021.

7 The Royal College of Surgeons of England's Sustainability in the Operating Theatre: A Guide to Good Practice. <https://www.rcseng.ac.uk/standards-and-research/standards-and-guidance/good-practice-guides/sustainability-in-operating-theatre/>

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Initiatives are underway to reduce the carbon footprint of surgery – for example, reusing surgical instruments, managing solid waste more efficiently and conserving water, including through the use of alcohol-based hand rub.

Last year saw the world's first net zero carbon operation undertaken by a team at Solihull Hospital. They achieved this milestone through the use of reusable gowns, drapes, and scrub caps, giving medications through the veins for general anaesthesia rather than using anaesthetic gases, minimising electricity use, recycling single-use equipment and 'clean' paper and plastic waste, and carefully managing their use of equipment. One of the consultant surgeons even ran to the hospital whilst the other cycled.<sup>8</sup>

Notwithstanding this achievement, and despite the best efforts of organisations such as The Royal College of Surgeons of England, until the carbon neutral operating theatre becomes commonplace, public health initiatives, disease prevention and non-surgical inventions will have to be the primary drivers of a more environmentally sustainable healthcare system. Helping some people avoid the need for hospital and in particular surgical intervention, alongside efforts to reduce the environmental impacts associated with surgery, is the only way to achieve net zero within the target timeframe.

Achieving a more environmentally sustainable NHS also requires behaviour change at all levels of the organisation. Ingrained practices need to be challenged. Simple, day-to-day behaviours such as turning off lights and reducing paper use need to become commonplace. **Initiatives such as the Carbon Literacy Toolkit for NHS – a free training resource for NHS organisations to engage their staff in national net zero policy and encourage low carbon actions across the NHS – are to be welcomed.**<sup>9</sup>

Decision makers, especially surgeons, need to be reassured that sustainable practices, far from leading to inferior outcomes, are actually superior. This will require further research on the impact of sustainability initiatives, such as the use of alcohol based surgical hand preparation, reusable drapes, different surgical techniques and operations, and anaesthetic choices. Not only in terms of the effect on the carbon footprint but on patient safety and clinical outcomes.



**Reducing**  
the carbon footprint of surgery

<sup>8</sup> [www.england.nhs.uk/greenernhs/whats-already-happening/university-hospitals-birmingham-a-world-first-in-carbon-net-zero-surgery/](http://www.england.nhs.uk/greenernhs/whats-already-happening/university-hospitals-birmingham-a-world-first-in-carbon-net-zero-surgery/)

<sup>9</sup> <https://carbonliteracy.com/toolkits/healthcare/>

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# Implications for the MSK sector

Treating the 'burden' of poor MSK health accounts for the third largest area of expenditure for the NHS.<sup>10</sup> Trauma and orthopaedic procedures account for 25% of UK's surgical workload,<sup>11</sup> around 1.2m procedures a year.<sup>12</sup>

MSK conditions account for one in seven of GP consultations<sup>13</sup> and 7.3% of hospital admissions (1.26 million finished admission episodes) in England.<sup>14</sup> Demand will only grow in an ageing society.

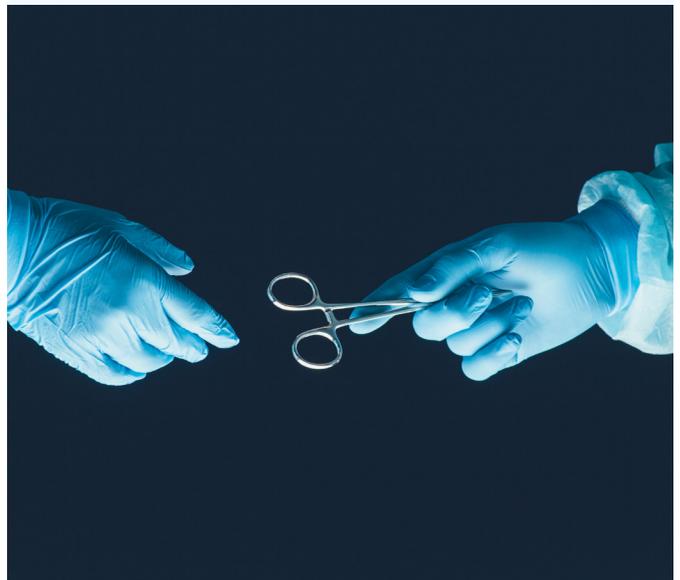
Given the relative scale and importance of the MSK sector, it has been at the forefront of the NHS' environmental sustainability initiatives, for example, programmes to improve the return rates for items such as walking sticks, wheelchairs and crutches – only around 22% of which are brought back by English hospital patients.<sup>15</sup>

**Orthopaedic surgeons have contributed to wider initiatives to improve practices within operating theatres, such as reducing single use equipment, implementing better planning processes to reduce the number of instruments that require sterilisation and reusing external fixation components.**

## CASE STUDY

**How Yeovil District Hospital reduced costs, improved efficiency, and made a difference in sustainability with surgical tray rationalisation.<sup>16</sup>**

The team led by Mr Oliver Donaldson reviewed instrument usage for the most common orthopaedic procedures to see what trays were being opened, what was duplicated and what was required. Their rationalisation work led to a 64% reduction in the number of surgical instrument trays (SITs), for example the number used for a dynamic hip screw procedure and basic arthroscopy reduced from 4 to 2 and 3 to 1 respectively. The team estimated that it costs around £35 to sterilise each surgical tray, plus the significant energy usage involved. It also reduced time spent opening and checking instruments. They estimated that the rationalisation could potentially save £180,000 over a three-year period.



<sup>10</sup> £5 billion in 2013-14, NHS England (2015)

<sup>11</sup> Briggs T. A national review of adult elective orthopaedic services in England. Getting it right first time. (2015).

<sup>12</sup> Hospital Episode Statistics, Admitted Patient Care, England – 2012-14. Accessed: 05/09/2021: <https://digital.nhs.uk/data-and-information/publications/statistical/hospital-admitted-patient-care-activity/hospital-episode-statistics-admitted-patient-care-england-2013-14>

<sup>13</sup> Jordan KP, Kadam UT, Hayward R, Porcheret M, Young C, Croft P. (2010). Annual consultation prevalence of regional musculoskeletal problems in primary care: an observational study. BMC Musculoskeletal Disorders, 11:144. DOI: 10.1186/1471-2474-11-144.

<sup>14</sup> NHS Digital. (2020). Hospital Admitted Patient Care Activity 2019– 20. Accessed 08 August 2021. <https://digital.nhs.uk/data-and-information/publications/statistical/hospital-admitted-patient-care-activity/2019-20>

<sup>15</sup> Data disclosed to the Press Association under the Freedom of Information Act, January 2019. The NHS Delivering a Net Zero National Health Service plan aims to expand existing walking aid refurbishment schemes, with 40% of all walking aids refurbished by 2025.

<sup>16</sup> <https://share.medall.org/videos/v-bota-oruk-sustainability-in-orthopaedic-surgery-2023-mr-donaldson>

## CASE STUDY

### Reducing levels of waste from total hip and knee arthroplasty (THA & TKA).<sup>17</sup>

Arthroplasty produces more surgical waste than other orthopaedic procedures. This study led by Mr Rohan Prakash, a NJR and BOA Sustainability Fellow, at the Royal Orthopaedic Hospital, Birmingham, showed how a typical hip replacement generates 15kg of waste and a knee replacement 17kg, of which only 2.9% and 4.5% respectively was recycled. A significant proportion of the waste (74.4% for THA and 69.2% for TKA) was categorised as hazardous. Other waste was incorrectly segregated, for example 50% of sterile blue wrap was incorrectly thrown into the hazardous waste bin. The level of hazardous waste was identified as a significant issue given the high temperatures required to dispose of this material. Hazardous Waste generates 569-1074 kg CO<sub>2</sub>e, compared to 21-65kg CO<sub>2</sub>e for recyclable waste; it also costs three times more to dispose.<sup>18</sup>

When the team actively intervened in the waste disposal procedures during a small scale test – essentially ensuring best practice during a small number of THA and TKA procedures – they were able to achieve reductions in hazardous waste of 17.2% and 21.1% for THA and TKA whilst levels of overall waste were also reduced by 6% and 13% for THA and TKA.

According to Mr Prakash, 'a 20% reduction in hazardous waste when extrapolated to the general population equates to 320,000 kg CO<sub>2</sub>e/year – the equivalent to a flight every day from London to New York' The next stage is a planned multi-centre study, although based on the initial research, Mr Prakash recommends:

- More diligent waste segregation to reduce that classified as hazardous waste
- All packaging should be to be recyclable
- Better labelling of medical supplies
- Improved awareness among the surgical team of the importance of correct waste disposal.



Whilst these incremental improvements to resource planning and allocation, and surgical procedures, are welcomed, they will not alone help the MSK health sector contribute significantly to the NHS' net zero ambitions. It requires even more research into improving bone, joint and muscle health and diagnosis and the pre-surgical treatment of common MSK conditions such as osteoporosis, especially where this reduces the need for surgical intervention.<sup>19</sup> It also requires a significant focus on improving the MSK health of the nation – keeping people fitter and more active for longer – this will have the added environmental benefit of encouraging more people to walk or cycle rather than use their cars for short journeys.

**If we can develop a healthier, more active nation, supported by improved prevention of common MSK ailments and smarter, faster diagnosis that facilitates pre-surgical intervention, we will not only deliver better patient outcomes, but a more environmentally sustainable health system.** This aligns with the view of the Academy of Medical Royal Colleges (AoMRC): 'A sustainable healthcare system maintains population health, reduces disease burden and minimises use of healthcare services.'<sup>20</sup>

<sup>17</sup> <https://app.medall.org/contents/v-bota-oruk-sustainability-in-orthopaedic-surgery-2023-mr-prakash>

<sup>18</sup> Rizan et al, 2021. <https://www.sciencedirect.com/science/article/abs/pii/S0959652620354925>

<sup>19</sup> More than 500,000 people receive hospital treatment for fragility fractures (fractures that occur from standing height or less) every year as a result of osteoporosis. Many of these could be prevented with earlier identification and intervention. (NHS England & National Osteoporosis Society, 2017 <https://www.england.nhs.uk/rightcare/wp-content/uploads/sites/40/2017/02/rightcare-susans-story-full-narrative.pdf>

<sup>20</sup> Academy of Medical Royal Colleges. Facing the future: Sustainability for the Medical Royal Colleges. <https://www.aomrc.org.uk/reports-guidance/facing-the-future-sustainability-for-mrc-1014/> (cited February 2021)

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# Implications for ORUK

ORUK's primary purpose is to use our funding to encourage breakthrough research and education programmes in bone, joint and muscle wellbeing and thereby reduce the burden of poor MSK health on individuals, workplaces and our health system.

By reducing the surgical and economic aspects of this 'burden', it will also make a significant contribution to reducing the long-term environmental impact associated with the treatment of people with poor MSK health.

**The focus on environmental sustainability aligns perfectly with ORUK's other strategic priorities, including:**

- Widening our focus beyond orthopaedics and especially orthopaedic surgery, to embrace the full range of MSK health.
- Investing in non-surgical, community-based interventions for people with poor MSK health, such as our award-winning ESCAPE-pain programme.
- Broadening the scope of our educational programmes to embrace the wider MSK community, including those focused on pre-surgical intervention, public health and disease prevention.



**In common with all organisations, ORUK is committed to reducing the carbon footprint of our activities. It will also play our part in supporting and encouraging the whole MSK health sector to become more environmentally sustainable. Its actions include:**

Ensuring that the research projects we fund adhere to sustainability best practices. We fully support the declared ambition of the National Institute for Health & Care Research that 'The health research endeavour must take appropriate steps to minimise greenhouse gas emissions from research activities.'<sup>21</sup> The NIHR Carbon Reduction Guidelines include practical actions for researchers including reducing the amount of travel undertaken by participants in clinical trials.

Supporting initiatives with a clear environmental sustainability focus. During the past 12 months we partnered with the BOTA on an programme to champion sustainability in orthopaedics which included a virtual conference exploring the latest advances in sustainability within orthopaedic surgery, plus seed fund for a sustainability research project. We have also funded the Arc Study, which is fully online research platform analysing the different lifestyle and health factors that may affect the outcomes of hip and knee replacements and requires no hospital visits.

Increasing the number of virtual educational programmes and events within our portfolio to reduce the amount of travelling required by delegates. This use of online activities has to be balanced with feedback from delegates that face-to-face events and educational programmes continue to be highly valued, especially when it comes to creating opportunities for informal networking.

Working with event venues to ensure that our face-to-face events are as sustainable as possible.

<sup>21</sup> <https://www.nihr.ac.uk/documents/the-nihr-carbon-reduction-guidelines/21685>

# Commentary from BOTA



## The British Orthopaedic Trainees Association is committed to supporting its trainees and working towards an environmentally more sustainable future alongside the BOA.

BOTA recognises that sustainable practice changes are needed throughout orthopaedics and with the annual Sustainability Conference aims to share experiences, practical advice and with ORUK support research endeavours for our membership. Orthopaedic trainees today will become future leaders and decision makers in the specialty and the NHS. It is a priority of not only BOTA but also the BOA to continue to work towards more sustainable systems in the NHS from an environmental standpoint, but also with regards workforce planning and wellbeing.

**BOTA will commit to improving and promoting sustainability in practice with the following actions:**

Continue to host the Sustainability in Orthopaedics Conference

Make sustainable choices for events hosted by the organisation, offering virtual and low-cost options to facilitate participation

Continue to utilise recyclable options in our promotional material

Continue to focus on supporting the wellbeing of orthopaedic trainees

Provide opportunity at the Sustainability in Orthopaedics Conference and the BOTA Congress for research into sustainability in Orthopaedics to be presented.

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