

## **Can we make hand surgery carbon neutral?**

A few years ago, my 95 year-old Grandmother sought a referral for carpal tunnel syndrome. I was expecting a referral to a hand surgeon. Instead she took the bus to have an operation performed by a general practitioner in a local one stop clinic. Follow up was a paper outcome questionnaire via the post. She was delighted with the care, delivered so close to home.

In contrast, the care delivered by my training unit at the time went something like this: initial consultation; nerve conduction consult; further consultation to discuss procedure; pre-operative anaesthetic review; procedure (often under general anaesthesia); dressing clinic at one week but hand therapy at a different time; another consultation to check on progress and a further one at three months to discharge. All face-to-face and no outcomes collected.

At the time, I was most interested in the clinical differences. However, as climate change has come to the fore, I reflected on the stark differences in use of resources and the implications for the sustainability of hand surgery. Whilst these examples are at either end of a spectrum, they encapsulate many of the issues that need to be addressed to make hand surgery carbon neutral. Before offering solutions, we need to first understand the problem.

### **Why worry about carbon?**

Carbon is a fundamental building block of life. Combined with two oxygen atoms it forms carbon dioxide (CO<sub>2</sub>). This 'greenhouse gas' keeps the earth warm and habitable, rather than an icy wasteland. However, it is finely balanced. Climate records show that high atmospheric CO<sub>2</sub> levels are associated with higher average global temperatures. Atmospheric carbon dioxide levels are now at record highs owing to burning of fossil fuels. Sustained rises in average temperatures result in long term changes to the climate. The Independent Panel on Climate Change (IPCC) was set up in 1988. However, it took the best part of 30 years for the international community to take action. In 2015, most countries in the world signed the Paris Agreement with an aim of reducing carbon emissions. The United Kingdom is a signatory, making the Government obliged to meet the ambitious targets set in Paris. The NHS contributes around 4% of UK emissions so clearly has an important role to play, as outlined in, 'Delivering a 'Net Zero' National Health Service' (1,2).

### **What is 'carbon neutrality'?**

Before pronouncing on whether hand surgery can be carbon neutral, we need to understand what being 'carbon neutral' entails. In narrow terms, it is taken to mean net-zero carbon emissions, through balancing carbon emissions with removal of carbon. However, carbon is often used as a proxy for a range of 'greenhouse gases' that contribute to climate change. This wider set of emissions need to be considered when

aiming for carbon neutrality. The Greenhouse Gas Protocol (GHGP) (3) provides three scopes that provide a means for international comparison of emissions.

Scope 1 covers direct emissions from owned or directly controlled sources.

Scope 2 covers indirect emissions from generation of purchased energy e.g. electricity.

Scope 3 covers all other indirect emissions through the full supply chain.

### What is the carbon footprint of hand surgery?

It is difficult to estimate the carbon footprint of hand surgery. However, it is likely to mirror the footprint of the NHS. The NHS Net Zero Expert Panel identified additional emissions that fall outside of the three GHGP scopes but remain important when considering the total impact of the NHS. These emissions are considered within the NHS Carbon Footprint Plus (Figure 1).

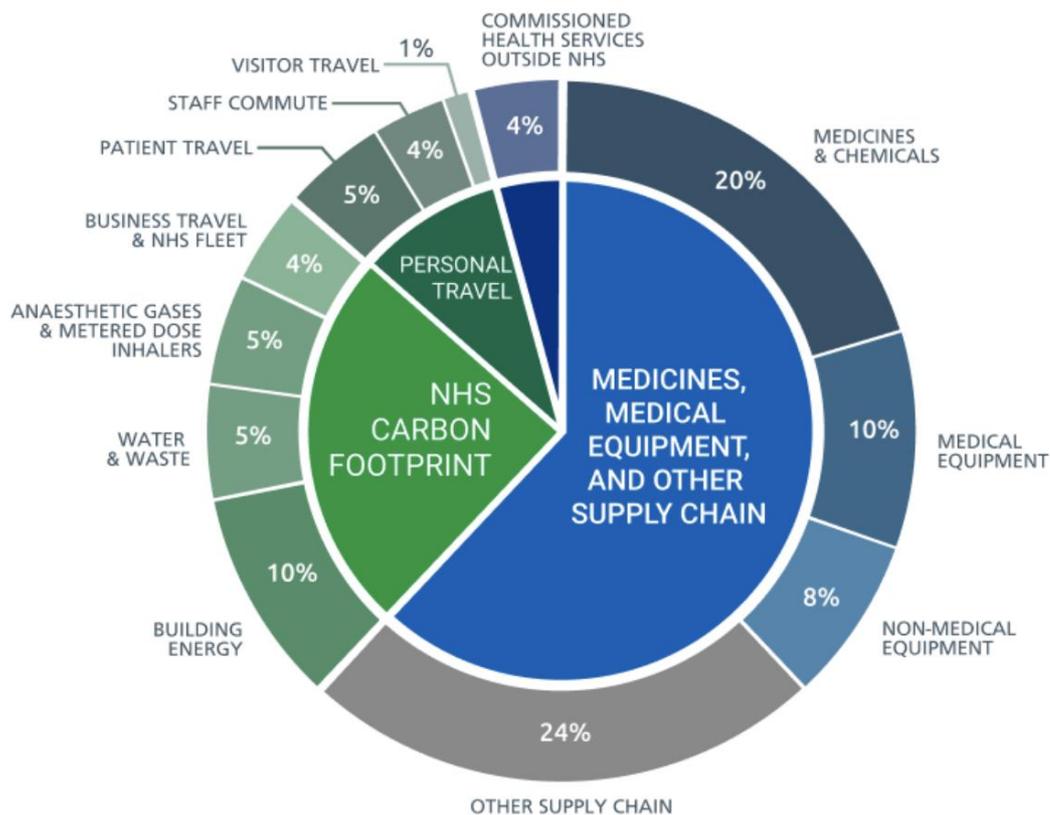


Figure 1 Sources of carbon emissions by proportion of NHS Carbon Footprint Plus (1)

### Carbon neutrality - if not now, when?

Once a carbon emission baseline is established, a target can be set to become carbon neutral. The NHS claims to have conducted the most sophisticated analysis of healthcare emissions in the world. It has set ambitious targets:

- By 2040 for the NHS Carbon Footprint to be net zero, with a 80% reduction by 2028 to 2032.
- By 2045 for the NHS Carbon Footprint Plus to be next zero, with an 80% reduction by 2036 to 2039.

Establishing a baseline for hand surgery will be an inexact science. Hospital Episode Statistics will provide a surrogate of activity and the Centre for Sustainable Healthcare could provide further methodology and calculators to support the process.

### **A manifesto for carbon neutral hand surgery**

Hand surgery is a small cog within the NHS machine. It can do its bit particularly on the direct emissions that hand surgeons and therapists can influence.

#### *Evidence based hand surgery*

One simple way to reduce carbon emissions from hand surgery, is not to do hand surgery. Whilst this sounds facetious, the variation in clinical decision making is well established (4). Some clinicians might offer an operation when others will continue watchful waiting. Research to develop a strong evidence base for hand surgery is fundamental to delivering high quality hand care as well as meeting the climate goals. In addition, the Get It Right First Time Initiative amongst others will work to reduce variability and spread good practice.

#### *Estates*

Building energy is the largest single contributor to the core NHS Carbon Footprint. A move away from energy intense settings to lower resource settings would likely have a big impact. One of the striking changes identified by the Reconstructive Surgery Trials Network COVID-19 Hand project was the move to virtual clinics, remote working and reduced use of main operating theatres. The NHS has estimated that moving appointments online saved 58,000,000 miles over the first three months of the COVID-19 pandemic. Whilst these changes might be hailed as a 'game changers', better evidence is needed. How many telephone calls delay the inevitable face-to-face review? Does operating in an outpatient room save carbon at the cost of surgical site infections?

#### *Travel and transport*

There is an element of personal responsibility coupled with employer attitude to sustainable transport. On this, I am guilty. My daily 41 mile commute of 46 minutes in an old 1.6 litre petrol car emits 14.6 kg CO<sub>2</sub>. The public transport option involves a 15 minute cycle, two trains and a further 10 minute cycle. This journey emits 5.6 kg CO<sub>2</sub> with the added bonus of working on the train and getting my heart rate over 100 but adds another 40 minutes to the journey. The latter emissions are the same as the consumption of eight toilet rolls or five paper back books. Initiatives such as the NHS Fleetcar scheme has had some success in moving employees into electric cars.

Beyond commuting, national and international conference travel is potentially a bigger problem. Online scientific meetings were very successful during COVID-19 and should continue to be used, at least in part.

Patient and visitor travel constitutes around 6% of emissions. Reducing the need to travel to hospital is often well received by patients. However, this shouldn't come at the expense of quality of care. Patients are often very capable of self-managing aspects of care, such as dressing changes. They need to be supported with high quality patient information. One advantage of face to face appointments is the ability to more clearly assess outcomes of treatment. The UK National Hand Registry should be better used to capture the outcomes of hand care that have been delivered with elements of remote follow up.

### *Anaesthetic gases*

The emissions related to anaesthetic gases are no laughing matter. They are thought to account for 1,286 ktCO<sub>2e</sub> annually in the NHS. Nitrous oxide alone contributes to a third of anaesthetic gas emissions and incredibly, one bottle of desflurane is equivalent to burning 440 kg of coal. Wide Awake Local Anaesthetic No Tourniquet surgery is well established but came to prominence during the COVID-19 pandemic when it played an important role in delivering hand trauma surgery without the need for anaesthetists or indeed a main operating theatre setting.

### *Supply chain, medical devices and consumables*

There are striking differences in the resource use for the same procedure at different hospitals (5,6,7). Taking carpal tunnel syndrome, Donald Lalonde and others have shown the potential for significant reduction in instrument and consumable use (8). Ideally low carbon alternatives should be chosen for instruments. Recycling is also an important element for addressing the extended carbon footprint. Current recycling levels are low with limited streaming of rubbish. An exemplar is the Karolinska Hospital in Sweden. Every last piece of packaging is recycled, such as the small piece of plastic and paper from a hypodermic needle.

### *Going digital*

My current Trust drives medical records 200 miles to have them scanned and digitised. This will soon come to an end with the advent of a new electronic health record system. Whilst the servers and other infrastructure needed for digital health innovation have a carbon footprint, this is outweighed by the benefits delivered by the systems. They have wide ranging applications from use of artificial intelligence and natural language processing to support remote patient follow up to use of augmented reality and virtual reality to support the delivery of surgical procedures.

## **Ten steps to hand surgery carbon neutrality**

1. Statement of intent. The BSSH needs to lay out its values and intentions when it comes to delivering sustainable hand surgery.
2. Climate change action starts at home. The BSSH needs to 'live low carbon' and address emissions related to activities it directly controls, such as the secretariat, committees and scientific / educational meetings and charitable investments.
3. Establish a baseline carbon footprint for hand surgery and ambitious trajectory with targets to meet 'hand surgery net zero'.
4. Promote research into sustainability and development of new patient pathways.
5. Set up a sustainable hand surgery fund to support innovative ideas addressing carbon emissions in hand surgery.
6. Sustainable working group – engage and advocate work with BAHT and other partners.
7. Reduce the need for hand surgery – prevention of hand injuries and support for early community based treatments.
8. Provide examples of decarbonised patient pathways for common hand procedures.
9. Promote the use of reusable instruments and recycling.
10. Develop high quality patient information to support early discharge and patient self management.

## Conclusions

Making hand surgery carbon neutral is possible. It will need a radical reappraisal of how hand care is delivered to meet patient needs. Research and innovation needs to be at the heart of this process. A strong evidence base will ensure the right patient gets the right procedure, at the right time, in the right setting. Innovation can support this process but also deliver new technologies to decarbonise care pathways.

My Grandmother, continues to be free of her carpal tunnel syndrome and enjoys planting trees. Whilst planting more trees is not the solution for hand surgery to meet 'net zero', it might provide a stress busting activity for overworked hand surgeons.

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Matthew D. Gardiner