



2. Reducing need for surgical care

Section key points

- ◇ Prevention may reduce GHG emissions associated with the provision of surgical care, for example surgical conditions linked with obesity, dietary factors (including red and processed meat consumption), sedentary lifestyles, trauma, and exposure to cigarette smoke, alcohol, ultraviolet light, air pollution and human papilloma virus.
- ◇ Delivering the right care to the right patient, at the right time and place, and reducing unwarranted variation in surgical care can ensure that carbon emissions associated with surgery are optimised.
- ◇ Using shared decision-making and 'choosing wisely' principles may help empower patients to work alongside clinicians to ensure a given intervention is right for them.

2.1 Public health and prevention of surgical disorders

Prevention is one of the pillars of sustainable healthcare,⁷¹ and **prevention of surgical disorders** will reduce carbon emissions associated with such care provision.

Prevention of disease (or disease progression) can reduce carbon emissions through:

- ◇ Preventing disease occurrence, to reduce overall requirement for healthcare
- ◇ Preventing progression of diagnosed disease, or its complications, which may reduce frequency and intensity of healthcare intervention

Smoking, poor diet, physical inactivity, and harmful alcohol use are leading risk factors for ill health and premature mortality in the UK⁷² and globally.⁷³ Many of these risk factors are more prevalent in low- and middle- income countries, and among individuals living in socio-economic deprivation.⁷⁴ Some of the conditions caused by these **modifiable risk factors** may ultimately require surgery, and are at least in part preventable, for example:

Obesity

- ◇ Risk factor for osteoarthritis (and subsequent need for knee and hip replacement),⁷⁵ symptomatic gallstones (necessitating gallbladder removal),⁷⁶ and abdominal or inguinal hernia development (which may require repair).⁷⁷ These comprise some of the most common surgical procedures in the UK.⁷⁸ Obesity is also associated with increases in gastro-oesophageal reflux disease (which may be managed surgically), metabolic disorders such as diabetes, and respiratory diseases (obstructive sleep apnoea), in turn leading to rising numbers of bariatric procedures and complications after surgery. Obesity is also the second biggest modifiable risk factor for cancer in the UK, including uterine and oesophageal cancer.⁷⁹

Diet

- ◇ Foods associated with gastrointestinal diseases which may require surgical management include red and processed meat (associated with increased risk of colorectal cancer),⁸⁰ foods high in fat, refined sugar and fructose (associated with increased risk of gallstone formation),⁸¹ and saturated fats (associated with atherosclerotic disease).⁸² Conversely, high fibre foods and whole fruit are associated with reduced risk of diverticulitis.⁸³

Sedentary lifestyle

- ◇ Physical activity is associated with reduced risk of cancers including breast, colon, prostate cancer,⁸⁴ and cardiovascular disease.⁸⁵

Smoking

- ◇ Causally associated with 25% of all cancers and responsible for one-third of cancer deaths, including those which may involve surgical management, such as cancers of the upper aerodigestive tract, oesophagus, lung, urinary tract, pancreas, stomach and liver.⁸⁶ Smoking is also a major risk factor for cardiovascular disease which may require surgical intervention (e.g. coronary artery bypass surgery, abdominal aortic aneurysm repair, peripheral vascular bypass, lower limb amputation).⁸⁷

Alcohol

- ◇ 4% of global cancer diagnoses in 2020 were attributable to alcohol consumption, including cancers of the liver, breast, upper aerodigestive tract, oesophagus, colon and rectum.⁸⁸

Trauma

- ◇ Tackling interpersonal violence, and initiatives to reduce road traffic accidents, knife and gun crime will reduce surgical trauma.

Ultraviolet light

- ◇ Exposure to natural or artificial (tanning bed) ultraviolet light is the major risk factor for melanomatous and non-melanomatous skin cancer. In the USA, 1 in 4 people have used a sunbed, and there has been a 25 fold increase in rates of skin cancer over the last 100 years.⁸⁹ Educational strategies to minimise ultraviolet exposure have been shown to be effective, most notably in Australia.⁹⁰

Air pollution

- ◇ Air pollution affects a range of organ systems, including conditions which may require surgery, and may increase risk of appendicitis, cardiovascular disease, cataracts, Crohn's disease, and osteoporosis, as well as bladder, colorectal, gastric, kidney, and lung cancer.⁹¹

Human papillomavirus

- ◇ Human papillomaviruses are associated with one-third of infectious-agent related cancers, including cancer of the oropharynx, oesophagus, anogenital region, cervix, and breast.⁹² Vaccination reduces this risk.




Health professionals can play a role in advocating for health-promoting policies on the **wider determinants of health**, which include individual lifestyle factors, social and community networks, living and working conditions (including education, housing, and unemployment) alongside general socio-economic, cultural and environmental conditions.⁹³ These factors are drivers of health inequalities. Public health interventions can be introduced at population level (for example regulation or legislation or population level information campaigns), or by targeting individuals (e.g. weight management services) and communities at highest risk (informed by health needs assessments).

Alongside preventing disease, individual level behaviour changes are often also beneficial for carbon reduction, representing **co-benefits**, meaning there are benefits to both human and planetary health.⁹⁴ For example, shifting from fossil fuel-based transport to walking and cycling encourages physical activity which reduces risk of obesity, heart disease and other chronic conditions, whilst also reducing emissions. Healthy diets are also recognised to have significantly lower environmental impacts.⁹⁵ In particular, reducing red and processed meat consumption lowers risk of colorectal cancer,⁹⁰ whilst also resulting in a reduced dietary carbon footprint.⁹⁶

Screening programmes for earlier detection of disease may lead to less or lower intensity treatment, and so have the potential to reduce healthcare-related carbon emissions, including emissions related to elective surgery (such as earlier diagnosis of bowel or breast cancer) or emergency surgery (for example in aortic aneurysm management). However, screening programmes also mean that a number of healthy people undergo investigations, with some healthy people who do not have a disease going on to receive further investigation and/or treatment.⁹⁷ To date there are no comprehensive analyses of the impact of screening programmes on healthcare-related carbon emissions.

We acknowledge many unknowns in the relationship between prevention and sustainable healthcare, for example, how and to what extent prevention of disease or progression of disease for individuals may impact healthcare related carbon emissions over the life course of a given individual.

CASE STUDY: Identifying patients at high risk of fractures

Setting	Christie NHS Foundation Trust
Patients	Patients on acute oncology ward
Intervention	Use of FRAX assessment tool to evaluate fracture risk of patients, and provide preventative treatment (Adcal)
Outcome	 Prevention of hip fracture and subsequent surgery, prevention of interruptions to oncology treatment
	 ↓ 316 kg CO ₂ e / 100 patients (assuming 1 fracture prevented)
	 ↓ £3,500 / 100 patients (assuming 1 fracture prevented)

Patients with an oncology diagnosis are likely to be at higher risk of fragility fracture for several reasons. There is a lack of local and national guidance on bone protection in adult oncology patients.

In 2022, Tom Hicklin, Claire Higham, and Mohitraje Mankumare conducted a project to assess the impact of identifying and intervening on patients at high risk of fracture in an acute oncology ward at the Christie NHS Foundation Trust. The team used the FRAX Fracture Assessment tool (<https://frax.shef.ac.uk/FRAX/tool.aspx?country=1>) to estimate ten-year risk of hip fracture in an unselected group of oncology in-patients. They determined the workforce, environmental, and medication implications, and compared the environmental and financial cost of screening and subsequent treatment, with that of managing and treating a hip fracture.

The team modelled prevention using a calcium and vitamin D3 supplement, and estimated that for 100 patients treated, they could prevent 1 fracture per year, with projected annual carbon savings of 316 kgCO₂e and cost savings of £3,500.

Source: *Centre for Sustainable Healthcare*⁹⁸

2.2 Reducing unwarranted variation

There is evidence of **unwarranted variation** in healthcare, including medical expenditure, use of pharmaceuticals, use of investigations, location of surgery, and rates of surgery.

In a study from the USA, healthcare spending on hospitalised patients over the age of 65 was found to vary 1.4 fold between the highest and lowest quartile, with variation greater between clinicians than between hospitals, and no evidence of reduced 30-day mortality or readmission associated with higher spending.⁹⁹ Data from the European Union show large variations in the proportion of the population undergoing radiological investigation each year (e.g. 5% in Romania vs 35% in Austria),¹⁰⁰ and in the proportion of adults taking prescribed medication (e.g. 23% in Romania vs 62% in Croatia).¹⁰¹ There is also evidence of over-use of medication in low and middle-income countries.¹⁰²

Data on rates of surgical intervention evidence both over-use (surgery in cases where benefits do not outweigh risks) and under-use (where patients who would benefit do not receive surgery). For example, comparing matched populations, twice as many hip replacements are performed in some regions of the UK compared to others.¹⁰³

Substantial variation in surgical practice across the UK exists for a range of indicators, such as in the number of patients operated on per theatre session, how many pre- and postoperative appointments patients have, or whether procedures are performed as a day-case surgery or inpatient stay. Twice as many patients are admitted overnight for standard conditions in the lowest quartile of hospitals in England compared to the highest quartile.¹⁰⁴ There is also evidence of variation between private and public hospitals; a study in Australia found increased rates of obstetric intervention and neonatal morbidity in low-risk women in private hospitals.¹⁰⁵

The reasons underlying unwarranted variation are complex and multifactorial, and may include the 'inverse care law', whereby those most in need and suffering health inequalities are least likely to access healthcare.¹⁰⁶ Sustainable healthcare includes equitable access to (and provision of) healthcare. Tackling health inequalities and personalised care models taking into account diversity can optimise resource utilisation associated with surgical care. **Sustainable healthcare involves ensuring the right patients access the right care at the right time, in the right place, and that the associated carbon or other environmental burden of this care provision is necessary rather than avoidable.**

NHS England's **Getting It Right First Time** (GIRFT) program has worked with providers to understand unwarranted variation through analysing local data from the *Model Health System*, a dashboard that allows benchmarking of hospitals across the NHS, and clinically-led discussion with hospital teams to promote best practice across the system. This work is supported by a range of guidance and tools published by GIRFT; one of these tools which focuses on optimising day surgery rates contributed to a 20% shorter stay in orthopaedic settings and a 25% reduction in revision joint replacements.¹⁰⁷ Increased use of GIRFT day-case surgical pathways instead of inpatient surgery could help reduce healthcare-related carbon emissions. For example, if all hospitals not already in the upper quartile were able to achieve the upper quartile day-case rate for transurethral resection of bladder tumour (TURBT) in England, over 217 tonnes CO₂e could be saved per year (equivalent to powering 198 homes for 1 year).¹⁰⁸ This illustrates that carbon savings often go hand in hand with high quality patient care.

The newly launched GIRFT surgical hubs accreditation scheme includes two sustainability criteria within the core criteria: (1) having “an understanding of the Trust Green Plan and how this will affect the hub”; and (2) having “an awareness of and a plan to move towards The Green Theatre Checklist”.¹⁰⁹ The latter refers to the **Intercollegiate Green Theatre Checklist**, designed to facilitate surgical teams to bring about change (featured in Section 7).¹¹⁰

We acknowledge that the environmental impact of minimising unwarranted variation will depend on whether there is net under-use or over-use, which will vary by surgical condition, and requires further research. Ultimately such strategies should aim to reduce the environmental impact of the entire range of key health outcomes at the population level.

2.3 Cosmetic surgery

Cosmetic surgery has become commonplace in the UK, with over 31,000 surgical procedures performed in 2022,¹¹¹ and has caused debate about the ‘disorder’ that such surgery is treating. Patients undergoing cosmetic surgery are more likely to have anxiety or depression,¹¹² and one in ten have a psychiatric diagnosis of body dysmorphic disorder (which may not be recognised by surgeons).^{113–115} However, most patients who have had cosmetic surgery report improved psychological wellbeing,¹¹² but may be stigmatised and viewed by others as less attractive.¹¹⁶

In a survey of 2,000 British people, one in three participants had undergone or considered facial cosmetic surgery, rising to three quarters of those aged 18–24.¹¹⁷ Amongst these younger populations the top three factors influencing the decision to undergo facial cosmetic surgery were peers (45%), social media influencers (45%), or filters on social media picture apps such as *Snapchat* (41%).¹¹⁷ This raises questions on whether public health approaches targeted at improving social media literacy, mental health, and redefining cultural norms are a better approach to tackle the widespread and growing desire for cosmetic surgery.

2.4 Shared decision-making may reduce rates of surgery

It is important that clinicians work with patients to consider whether an operation is the best option for them through **shared decision-making**. ‘**Choosing Wisely**’ is an international initiative for shared decision-making, aiming to reduce unnecessary investigations, treatments, and procedures,¹¹⁸ where patients are presented with information including the natural history of their condition, conservative management, personalised risk of complications, and given opportunity to reflect before deciding the best approach for them (abbreviated to ‘**BRAN**’ – the **Benefits, Risks, Alternatives and what if Nothing were done**).¹¹⁹ ‘Realistic Medicine’ is another such initiative, seeking to empower patients and clinicians to have frank conversations about risks of healthcare procedures.¹²⁰ Trials of shared decision-making have found an average of one in five elective procedures were unwanted by the patient.¹²¹

Frailty and age are important factors to consider when evaluating personalised risk of complications. Two-thirds of people over 65 have multi-morbidity,¹²² and this age group represents almost half of patients having an operation requiring an anaesthetist.¹²³ A review found that frailty was associated with a four-fold increase in post-operative complications,¹²⁴ and a study of elective noncardiac surgical patients found 15% of patients decided against a planned

operation following review by a geriatrician.¹²⁵ That reluctance may be well-founded; a review found 14% of patients self-reported regret from undergoing surgery.¹²⁶ A study of 5.9 million patients undergoing major surgery in the US found an incidence of complications of 12.5%.¹²⁷ Surgery may also necessitate intensive care and the risk of this should be openly communicated. For example 25% of UK intensive care admissions follow elective surgery, and a further 18% follow emergency or urgent surgery.¹²⁸

Shared decision-making may be particularly important in the management of cancer, whether localised, advanced or metastatic. Such patients are vulnerable and deserve an honest appraisal of survival and treatment, and associated short- and long-term morbidity. Studies have found decision-regret by patients treated for localised prostate cancer,¹²⁹ or for advanced head and neck cancer.¹³⁰

In emergency care, non-surgical management may be considered where clinically appropriate. For some conditions, such as small abscesses (<1.5cm in maximal diameter), or uncomplicated appendicitis, the carbon footprint of medical treatment may be lower than operating. The decision will always be principally determined by clinical factors, but there may be instances where there are win-wins for patient outcomes and environmental impact. This will be context specific: if conservative management leads to a longer hospital stay, or increased risk of morbidity (including recurrence, readmission and/or subsequent surgery) then environmental harm may be greater. It is also important to note that while surgery is initially resource intensive, it may have a lower environmental impact in some chronic conditions. For example, one study found that after nine years the carbon footprint of surgery for gastro-oesophageal reflux disease was lower than that for medical treatment.¹³¹

Section recommendations

Recommendation	Short term	Long term	Stakeholders
<p>R2.1</p> <p>Support initiatives to prevent the need for surgical interventions (e.g. targeted towards reducing obesity, consumption of red and processed meat, smoking, and alcohol)</p>	<p>Identify modifiable risk factors during every patient encounter, have conversations and point patients in direction of further support and resources^{a,b}</p>	<p>Develop public health initiatives targeted at high-risk populations^c</p> <p>Shift resource allocation towards disease prevention, and initiatives that support equitable access of high-quality healthcare^d</p> <p>Develop wider initiatives encouraging green patient transport^e</p>	<p>Primary care clinicians^a</p> <p>Members of surgical and anaesthetic team^b</p> <p>Public health practitioners^c</p> <p>Policy makers^d</p> <p>Healthcare provider management teams^e</p>

<p>R2.2</p> <p>Reduce unwarranted variation in surgical care</p>	<p>Support initiatives which collect local data on variation and try to reduce it (e.g. Getting it Right First Time)^b</p>	<p>Improve understanding of unwarranted variation in surgical care,^{f,c} and develop initiatives to minimise this^{c,g}</p>	<p>Members of surgical and anaesthetic team^b</p> <p>Academics^f</p> <p>Public health practitioners^c</p> <p>Surgical leaders^g</p>
<p>R2.3</p> <p>Ensure that a given intervention is the best option for an individual patient</p>	<p>Use shared decision-making and ‘choosing wisely principles’ in every patient encounter, ensuring intervention is the right option for the individual patient^b</p>	<p>Support research on personalised medicine, to better understand likelihood of success and impact of a given intervention for an individual^d</p>	<p>Members of surgical and anaesthetic team^b</p> <p>Academics^d</p>