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Sustainability: **Sustainable healthcare**

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Module Learning Outcomes

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This e-learning module introduces the concepts of sustainability and sustainable healthcare, looking specifically at the various environmental impacts of healthcare, and what is currently being done globally and nationally to address these issues. At a local level, anaesthetists can help shape healthcare systems so that they not only provide social and economic value, but also protect the natural environment. One way in which we can do this is using Sustainable Quality Improvement (SusQI) methodology, which is also considered below.

Definitions

Sustainability

It is generally agreed that for anything to be sustainable it must satisfy social, economic and environmental factors. This is known as the **tripartite nature of sustainability.**

One of the best-known definitions of sustainability is from the Brundtland Report[1] referring specifically to sustainable development:

> **"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"**

However, this definition has been criticized for being too broad, and weak ecologically. Ideally, it is preferable to use the term **ecological sustainability**, which may be defined as:

> **"Economic and social development that protects and restores the natural environment and social equity"[2]**

Without this specific reference to the natural world, sustainable development becomes an oxymoron and tends to become shorthand for economic sustainability. This distinction is important, as it recognizes that human activity (including healthcare and economics) is a subsystem of the global ecosystem (see figure 1). Human health and survival are understood to be completely dependent on the presence of intact ecosystems and biodiversity.[3,4]

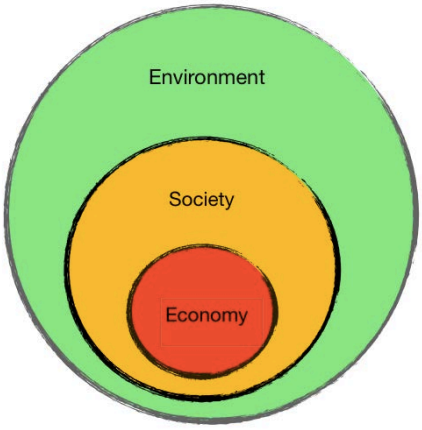


Figure 1: The tripartite nature of sustainability (adapted from Harding et al[5])

Sustainable healthcare

Current healthcare systems are anything but ecologically sustainable. They are responsible for multiple negative environmental impacts including greenhouse gas emissions, waste generation, air pollution, water consumption and pharmaceutical pollution,[6,7,8] and as a result are unwittingly contributing to human morbidity and mortality.

A genuinely sustainable healthcare system would not only meet immediate healthcare needs and promote population health with minimal financial costs, but also safeguard the health of future generations, by conserving natural resources and minimising ecological damage.[9]

Impact of healthcare

Carbon emissions

Since 2007, the NHS England Sustainable Development Unit (SDU) has monitored the carbon emissions of the health and social care sectors. SDU data from 2017 estimates NHS emissions to be 21.54 Megatonnes of CO2 equivalents (MtCO2e).[8] If these figures were representative of a country it would rank as the 87th largest contributor to global CO2e emissions out of 204 countries and territories![10] If we include the entire health and social care (HSC) sector, this figure is higher at 27.1 MtCO2e, which represents 6.3% of the carbon emissions of England.[8]

Carbon hotspots

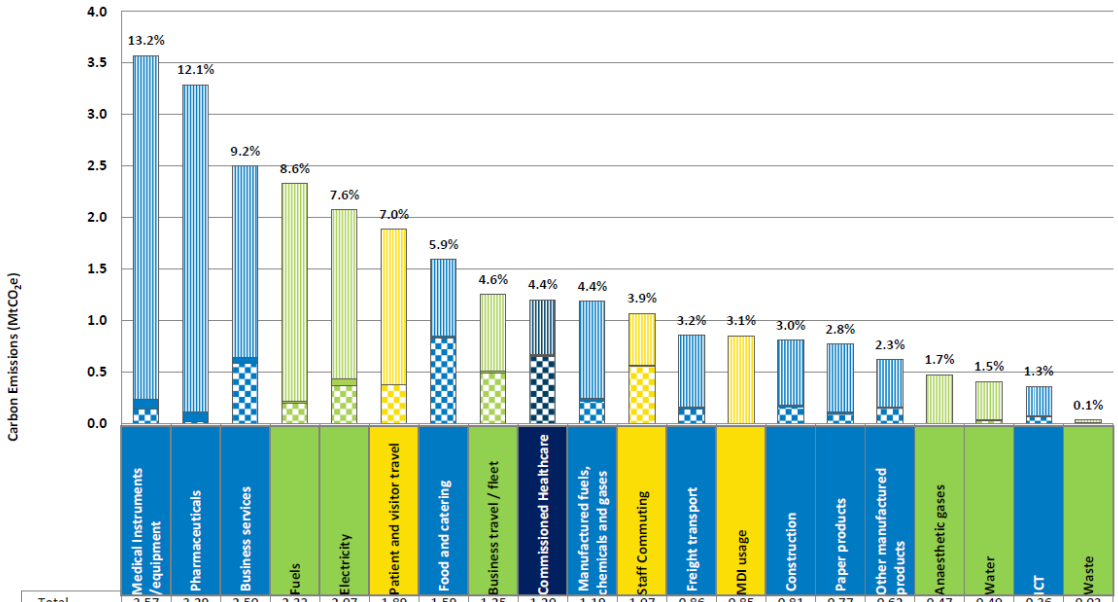
The SDU also identifies and reports on those areas within healthcare with the highest carbon emissions, known as **carbon hotspots.** [8, 11, 12] This is very useful, as it allows more effective targeting of mitigation efforts and allows us to track progress in these areas over time.

SDU data from 2012[12] suggested that the key carbon hotspots in health, public health and social care were:

- **Pharmaceuticals, medical devices and gases**
  - Accounted for 16% of the emissions
  - 9% relates to medical devices and equipment
  - **Gases used in anaesthetics account for 1.7% of the total overall carbon footprint and 5% of the entire acute care footprint (the vast majority of this is due to nitrous oxide)**
- **Energy**
  - Represented 15% of all emissions
  - Efforts at reduction include reducing energy usage, improving energy efficiency and increasing the amount of low carbon energy used
- **Travel and transport**
  - Accounted for 13% of all emissions
  - Includes staff travelling to work and to see service users, service users travelling to care sites and transport of goods

More recent data from 2017[8] suggests that the overall health and social care carbon footprint has decreased by 18.5% since 2007. The two largest hotspots were medical equipment and pharmaceuticals. Business services, energy and travel were again significant contributors. Metered dose inhalers, used in the treatment of asthma and chronic obstructive pulmonary disease also stood out as a targetable carbon hotspot, accounting for 3.1% of HSC emissions.

The graphic below in figure 2 illustrates how healthcare CO_2 emissions can be broken down (SDU data from 2017).[8]



	Medical Instruments /equipment	Pharmaceuticals	Business services	Fuels	Electricity	Patient and visitor travel	Food and catering	Business travel / fleet	Commissioned Healthcare	Manufactured fuels, chemicals and gases	Staff Commuting	Freight transport	MDI usage	Construction	Paper products	Other manufactured products	Anaesthetic gases	Water	ICT	Waste
Total	3.57	3.29	2.50	2.33	2.07	1.89	1.59	1.25	1.20	1.19	1.07	0.86	0.85	0.81	0.77	0.62	0.47	0.40	0.36	0.03
%	13.2%	12.1%	9.2%	8.6%	7.6%	7.0%	5.9%	4.6%	4.4%	4.4%	3.9%	3.2%	3.1%	3.0%	2.8%	2.3%	1.7%	1.5%	1.3%	0.1%
NHS	3.34	3.18	1.86	2.11	1.64	1.51	0.74	0.74	0.53	0.94	0.50	0.70	0.85	0.63	0.66	0.46	0.47	0.37	0.28	0.03
Public Health	0.10	0.09	0.05	0.02	0.06		0.02	0.02	0.02	0.03	0.02	0.02		0.02	0.02	0.01		0.01	0.01	0.00
Social Care	0.14	0.02	0.58	0.20	0.37	0.38	0.83	0.49	0.65	0.22	0.55	0.14		0.16	0.09	0.15		0.03	0.07	0.00

Figure 2: Health and Social Care carbon emissions detailed breakdown 2017 (source: SDU[8])

Given the urgent need to tackle climate change, there is an understandable focus on the carbon footprint of healthcare systems, however, it is important to understand that the impact of health and social care extends much more widely than this.

From a UK perspective, in 2017 the health and social care sector was responsible for the following:[8]

- 590,000 tonnes of waste, generated by NHS providers alone
- 5% of all road travel in England, leading to a £345m cost to society as a result of the mortality from the air pollution generated (3.5% attributable to the NHS)
- 10% of the country's economy and workforce
- A water footprint of 2.23 billion m^3, which would fill the equivalent of 1.1 million Olympic swimming pools!

In addition, **pharmaceutical pollution** is emerging as a major threat to human and ecosystem health.[7] Drug prescribing is the most common intervention in the NHS, resulting in medications entering wastewater systems via urine and inappropriate disposal into toilets and sinks.

However, wastewater treatment plants are inefficient at removing drugs, resulting in contamination of ecosystems and drinking water with bioactive chemicals such as hormones, antibiotics and antidepressants. This has negative consequences for aquatic life and human health and promotes antimicrobial resistance. [6,7]

The global climate impact of health and social care

In terms of carbon footprint, global healthcare emits 2000 $MtCO_2e$ per year. This represents 4.4% of all CO_2 emissions. In fact, if global healthcare represented a single country it would be the 5th largest emitter of greenhouse gases, and produces the equivalent emissions of 514 coal-fired power plants![13]

The United States and China are the two biggest emitters. When combined with the European Union they comprise 56% of the total health care carbon footprint. The United States healthcare sector produces 57 times more emissions per person than India, which is the seventh largest global contributor to healthcare emissions.[13]

Targets for emissions reduction and UK wide organisations

Global emissions reductions

In 2015, as part of the Paris Climate Agreement, nations pledged to limit global temperatures to 2°C above pre-industrial levels, and pursue efforts to further limit the rise to 1.5°C.[14]

In 2018, the Intergovernmental Panel on Climate Change (IPCC) warned that it was crucial to **limit global warming to 1.5°C** in order to keep the effects of climate change within relatively safe limits and avoid catastrophic changes.[15]

In order to stay below the 1.5°C threshold, no more than 420 $GTCO_2e$ can be released into the atmosphere. This is our global carbon budget. At the time of writing this module (2020), with the current rate of emissions, it is estimated that this budget will be exhausted in just over 7 years.[16]

It is clear that we need to achieve net zero CO_2 emissions (global anthropogenic CO_2 emissions balanced by anthropogenic CO_2 removals) as soon as possible. The IPCC report[15] outlines pathways that involve a 45% reduction in emissions by 2030, becoming **net zero by 2050.**

For a detailed description of international agreements please see the e-module within this series entitled *'International agreements'*.

The UK targets

In the UK we have a number of national and organisational drivers in place, aimed at addressing climate change and other environmental crises:

The Climate Change Act (2008)[17] sets out the UK's commitments to climate change mitigation between 2008 and 2050. It can be summarised as follows:

- A commitment to **reducing greenhouse gas emissions by 100% by 2050, from 1990 levels**
- Establishing committees on climate change that extend to devolved administrations
- Setting legally binding carbon budgets to act as stepping stones to the 2050 target

In 2009, in response to the climate crisis and the Climate Change Act (2008), the SDU published its **Carbon Reduction Strategy**[18], setting goals for the NHS. These aimed for a reduction in carbon emissions of 10% by 2015 and 34% by 2020. Although the 2015 target was exceeded, the current trajectory suggests that the target for 2020 of 34% may not be met.[8]

In recognition of the widespread detrimental environmental effects of healthcare, the **SDU** also supports transformations in several other key areas of impact:[8]

- **Plastics**
  - Limit plastic use and waste by engaging with suppliers, innovators and care providers
  - Identify areas where use of plastic can be avoided and, if this is not possible, to establish effective and safe re-use, recycling and disposal
- **Water**
  - Implement water and energy efficiency savings throughout the sector with transparent reporting of water use
- **Air Quality**
  - Identify targeted approaches and incentives to improve local health inequalities through action on air pollution

Furthermore, in addition to national legislation and leadership from the SDU, we also have drivers of environmental change embedded within key NHS policy documents:

The 2019 NHS Long Term Plan[19] outlines commitments to meeting the carbon targets in the UK Climate Change Act (2008), and to reducing air pollution and waste.

The NHS Standard Contract (clause 18) requires providers to maintain a sustainable development plan, minimise environmental impacts (specifically air pollution, greenhouse gas emissions, single use plastics and waste) and demonstrate progress in these areas in an annual report.[20]

Value in healthcare

Value in healthcare is simply a way of expressing how well a healthcare system meets its objectives. It can be defined as the **outcomes** of a process, relative to the **costs**.[21]

An ecologically sustainable approach broadens the definition of value. Costs include **environmental and social impacts**, not simply economic costs, giving what is referred to as a **triple bottom line**.[22] Outcomes refers to both individual patients and population outcomes.

Sustainable value can therefore be expressed as in figure 3 below:

$$\text{Value} = \frac{\text{Outcomes for patients and populations}}{\text{Environmental + social + financial impacts}}$$

(the 'triple bottom line')

Figure 3: Sustainable value in healthcare [22]

Principles of SusQI

It is important to appreciate that anaesthetists (and other health professionals) can help to shape ecologically sustainable healthcare systems at a local level. One tool for doing this that is gaining traction is **Quality Improvement.**

Quality improvement (QI) is the ongoing, systematic effort to improve patient outcomes and system performance.

You can find more information about QI as applied to anaesthetic practice at The Royal College of Anaesthetists QI Recipe Book,[23] which contains sections on Sustainable Quality Improvement.

For more information about QI as it relates to healthcare generally, the Institute for Healthcare Improvement is a good resource, which also offers free online courses.[24]

Sustainable Quality Improvement (SusQI) [22, 25] is a practical framework that extends the scope of QI to include:

- Ecological sustainability
- Adding social value
- A long-term perspective

Thus, **a SusQI project in Anaesthesia** would consist of 4 stages, which can be incorporated into existing QI methodologies:

- Set goals (e.g. minimising waste in operating theatres, instituting waste segregation streams and recycling)
- Study the system
- Design the improvement effort
- Measure impacts

The key difference with SusQI is in nature of the **improvement efforts** and the **impacts measured.**[25]

Improvements focus more on patient empowerment and self-care, prevention of disease, lean service delivery and low carbon alternatives.

Impacts would include not only clinical impacts and financial costs, but also social impacts and environmental impacts.

Ideally, when considering the environmental impacts of a system, one would calculate **total ecological footprint**, rather than simply estimating greenhouse gas emissions. However, we commonly see only carbon footprint reported, as this is much more easily quantifiable and reflects the current focus on the climate crisis.

References

1. WCED. Our Common Future. Oxford University Press, Oxford, 1987

2. Diesendorf M. Sustainability and sustainable development. In: D. Dunphy et al, ed. Sustainability: the Corporate Challenge of the 21st Century. Allen and Unwin: Sydney, 2000; 22-3

3. Millennium Ecosystem Assessment. Ecosystems and human well-being: synthesis. Island Press: Washington D.C., 2005

4. Chivian E, Bernstein A. How our health depends on biodiversity. 2010. Available from cbd.int/doc/health/health-biodiversity-hms-en.pdf (accessed 1st September 2015)

5. Harding R, Hendriks CM, Faruqi M. Environmental decision-making: exploring complexity and context. Sydney: The Federation Press, 2009; 29

6. Health Care Without Harm. Pharmaceutical pollution: FAQ. 2020. Available from noharm-europe.org/content/europe/pharmaceutical-pollution-faq (accessed 7th June 2020)

7. BIO Intelligence Service. Study on the environmental risks of medicinal products. Final report prepared for the Executive Agency for Health and Consumers. 2013

8. SDU. Reducing the use of resources in health and social care. 2018. Available from sduhealth.org.uk/policy-strategy/reporting/natural-resource-footprint-2018.aspx (accessed 28th February 2020)

9. SDU. What is sustainable health? 2020. Available from sduhealth.org.uk/policy-strategy/what-is-sustainable-health.aspx (accessed 22nd February 2020)

10. Muntean M, Guizzardi D, Schaaf E, et al. Fossil CO2 emissions of all world countries - 2018 report. 2018. Available from ec.europa.eu/jrc/en/publication/fossil-co2-emissions-all-world-countries-2018-report (accessed 7th June 2020)

11. SDU. Carbon Hotspots update for the health and social care sector in England 2015. 2016. Available from sduhealth.org.uk/policy-strategy/reporting/natural-resource-footprint-2018/carbon-hotspots.aspx (accessed 7th June 2020)

12. SDU. Module: carbon hotspots. 2014. Available from sduhealth.org.uk/areas-of-focus/carbon-hotspots.aspx (accessed 6th June 2020)

13. Health Care Without Harm. Health Care Climate Footprint Report. 2019. Available from noharm-europe.org/ClimateFootprintReport (accessed 6th June 2020)

14. UNFCCC. The Paris Agreement. 2015. Available from unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (accessed 7th June 2020)

15. IPCC. Global Warming of 1.5 ºC. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. 2018. Available from ipcc.ch/sr15/ (accessed 6th June 2020)

16. Mercator Research Institute on Global Commons and Climate Change. Remaining Carbon Budget. 2018. Available from mcc-berlin.net/en/research/co2-budget.html (accessed 6th June 2020)

17. UK Government. Climate Change Act 2008. Available from legislation.gov.uk/ukpga/2008/27/contents (accessed 7th June 2020)

18. SDU. Saving Carbon, Improving Health. 2009. Available from sduhealth.org.uk/policy-strategy/engagement-resources/nhs-carbon-reduction-strategy-2009.aspx (accessed 7th June 2020)

19. NHS. The NHS Long Term Plan. 2019. Available from longtermplan.nhs.uk/wp-content/uploads/2019/08/nhs-long-term-plan-version-1.2.pdf (accessed 6th June 2020)

20. NHS. NHS Standard Contract 2020/21. 2020. Available from england.nhs.uk/publication/full-length-nhs-standard-contract-2020-21-particulars-service-conditions-general-conditions (accessed 7th June 2020)

21. Porter ME. What Is Value in Health Care? New England Journal of Medicine 2010; 363: 2477-81

22. Mortimer F, Isherwood J, Wilkinson A, Vaux E. Sustainability in quality improvement: redefining value. Future Healthc J 2018; 5: 88-93

23. RCoA. Quality Improvement Book. Available from rcoa.ac.uk/safety-standards-quality/support-anaesthetic-departments/quality-improvement-book (accessed 24th May 2020)

24. Institute for Heathcare Improvement. Introduction to Quality Improvement. Available from ihi.org/education/IHIOpenSchool/Courses/Pages/qi102.aspx (accessed 24th May 2020)

25. Mortimer F, Isherwood J, Pearce M, Kenward C, Vaux E. Sustainability in quality improvement: measuring impact. Future Healthc J 2018; 5: 94-7

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