The Royal College of Pathologists
Pathology: the science behind the cure

Sustainable pathology practice

A toolkit for climate-resilient diagnostics and clinical practice

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1 Context and background

Climate change is the greatest threat to human health and survival in the 21st century.[1] Its effects include:

- extreme weather events
- reduced food production (through soil loss, soil water availability and salt ingress; altered plant and animal pathogens; fishery loss; and drought, fire, flood and freezing)
- water and airborne pollution
- vector-borne disease
- socioeconomic effects that drive poverty, mass migration and war.[2]

Meanwhile, our negative impact on the natural environment – resulting in the rapid decline in biodiversity of animal and plant species – poses significant threats to human health and survival.[3,4] We have already breached 7 of the 9 planetary boundaries that are critical for maintaining the Earth's stability and resilience.[5]

Healthcare globally contributes around 5% of all greenhouse gas (GHG) emissions and around 10% of gross domestic product.[6,7] Action in healthcare, therefore, has the potential to leverage far greater decarbonisation in the global economy. The NHS has committed to delivering the world's first net-zero health service by 2045.[8] Pathology services contribute significantly to the environmental footprint of healthcare through high energy use (and thus fossil fuel emissions). Laboratories typically consume up to 10-times more energy than offices, due to constant refrigeration, ventilation and operation of high-throughput analysers. Meanwhile, pathology services generate substantial waste from single-use plastics, chemical reagents and biohazard materials.

The Royal College of Pathologists (RCPath), a professional membership organisation concerned with all matters relating to the science and practice of pathology, aspires to play its part in addressing these environmental threats. Pathologists are well-positioned to lead sustainable healthcare innovation by adopting greener practices, improving test appropriateness and advocating for environmentally responsible systems without compromising diagnostic quality. Many have roles outside the laboratory, such as patient-facing clinical care (haematology, microbiology), medical examiner roles or those who work with non-human animals (veterinary pathology). The RCPath thus seeks to collate

and disseminate examples of good sustainability practice in a living ‘toolkit’ and to educate and inspire its members to adopt these practices.

2 Purpose of this toolkit

This toolkit aims to reduce the environmental impact of pathology services while maintaining or improving clinical outcomes. It is relevant to laboratory professionals, pathologists, clinicians, sustainability officers, educators and commissioners. It provides guidance for:

- embedding sustainability into everyday pathology practice
- endorsing education, advocacy and collaboration to ensure that healthcare leaders continue to articulate the urgency of the climate crisis and support the medical profession to play its part in mitigating the impact wherever possible
- reducing personal/individual contributions to climate change.

3 Sustainable healthcare: core principles

Sustainable healthcare delivers high-quality, affordable care without damaging the environment.

4 guiding principles help healthcare practitioners participate in innovation, adoption and embedding of sustainable healthcare best practices.[9]

- **Prevention**: Avoiding unnecessary investigations and promoting health to reduce demand for diagnostics.
- **Lean pathways**: Streamlining diagnostic workflows to minimise waste and inefficiencies.
- **Low-carbon alternatives**: Prioritising procurement, equipment, chemicals and processes with lower environmental impact.
- **Patient empowerment**: Empowering patients to take a greater role in managing their own health and healthcare.

The 5 Rs principles of a circular economy should be embedded where possible.[10]

- **Reduce**: Can you do without the product?
- **Reuse**: Can you buy a reusable rather than single-use product?
- **Reprocessed**: Can you buy a reprocessed or refurbished product?
- **Renewable**: What is the product made of?
- **Recyclable**: Is the product recyclable?

Embedding the 5 Rs into pathology practice supports the 4 core principles of sustainable healthcare. Reducing unnecessary tests, consumables and energy use contributes to prevention and leaner diagnostic pathways by minimising waste and inefficiency. Reusing equipment and choosing reprocessed or refurbished products lowers embodied carbon and supports low-carbon alternatives without compromising safety or quality. Prioritising renewable materials, energy sources and sustainably manufactured products further reduces environmental impact across laboratory operations. Recycling remains an important final step when higher-value interventions are not possible.

Together, this hierarchy enables pathology services to deliver high-quality, efficient and environmentally responsible diagnostics, while protecting patient health and planetary wellbeing

Any individual or service should also support sustainability action in the broader ecosystem or organisation in which it sits (e.g. site, NHS trust, integrated care board, the NHS broadly).

Finally, **all individuals should try to integrate sustainable behaviours into their daily lives**. With 1.41 million healthcare workers in the UK, combined individual effort has real impact.

4 Applying the 4 principles of sustainable healthcare to laboratory practice

Delivery of sustainable pathology practice requires individuals, laboratory teams, institutions and industry partners to all work together.

4.1 Prevention

Up to 25% of diagnostic tests may be unnecessary or duplicative, causing avoidable environmental impacts, with most (70%) occurring before the sample arrives in the laboratory (e.g. needle, sample collection tube, nitrile gloves, swabs, plastic sample transport bags). Incidental findings cascade into further low-value investigations. Collaboration with clinicians is vital to develop appropriate use criteria, implement demand management strategies and support preventative care initiatives, along with regular feedback audit cycles.

Good practice examples

- Implement minimum retesting intervals as recommended in RCPath guidelines.[11]
- Utilise narrative reporting of results as a tool for reducing test requests, i.e. including patient story and clinical context into the report.[12]
- Add tests retrospectively onto samples already in the laboratory.
- Use sample racks instead of plastic bags in hospital and primary care settings.
- Optimise transportation routes and use low-carbon fleet vehicles or drones.
- For laboratories sending samples to external laboratory, promote the use of electronic test requests and results transfer, e.g. use of National Pathology Exchange (NPex), and consolidate the number of referral labs that are used.
- Implement recommendations of the Getting It Right First Time national report for pathology.[13]
- Contribute to educational activities for clinical users regarding good requesting practice and results interpretation.
- Ensure that advice and guidance for clinical users are clear and easily accessible.
- Consider disaggregating common testing profiles by identifying and removing tests of limited clinical value, such as urea and chloride in primary care.
- Promote best sample collection practice to maximise sample quality and minimise sample rejection, as outlined by Optimising Blood Testing in Secondary Care.[14]

4.2 Lean pathways

Lean pathways are efficient, streamlined diagnostic processes that minimise waste, avoid unnecessary steps and optimise resource use. They enhance patient care by delivering faster results, improving clinical outcomes and reducing environmental and financial costs.

Good practice examples

- Optimise test ordering by ensuring that test requests are appropriate, necessary and aligned with clinical guidelines to avoid low-value investigations.
- Streamline workflows by reviewing laboratory processes to eliminate unnecessary steps, consolidate batch runs and optimise use of high-energy equipment.
- Embrace digital solutions by expanding the use of digital pathology, virtual multidisciplinary team meetings and remote reporting to reduce transport emissions and speed up care.
- Integrate automation by applying artificial intelligence (AI) and machine learning tools to prioritise urgent samples, predict test needs and reduce unnecessary duplicate processing.
- Use data to drive change by regularly auditing and benchmarking pathology service metrics (turnaround time, duplication rates, resource use) to identify and sustain improvements.
- With clinical teams, codesign pathways that prioritise diagnostics, add true clinical value while minimising environmental impact.
- Practise routine equipment inspection and maintenance to ensure accuracy of diagnostic results and enhance equipment longevity.
- Consider incorporating RCPath minimum retesting guidelines into electronic prompts at the time of testing.[11]
- Monitor local requesting patterns, seeking to understand reasons for variation and use this to inform targeted improvement in decision support.
- Optimise sample volume instructions in ordering communication systems to reduce the number of sample collection tubes.
- Minimise the need for paper request forms and reporting.

- Use barcode labelling at source (collection point) to reduce relabelling in laboratories.
- Review numbers of spare samples received to optimise workflow and reduce waste.
- Proactively review processes and workflows to identify where consumables are being used unnecessarily.
- Proactively review processes and workflows to identify the appropriate reuse (or repurpose) of items previously considered single use.
- Prepare an accessible list of repair services for equipment.

The use of AI and digital tools in laboratories has environmental impacts, including energy consumption and resource demands; however, when implemented thoughtfully, they can improve efficiency, reduce waste, optimise workflows and support high-quality diagnostics. Responsible adoption – guided by appropriate oversight, ethical standards, data governance and sustainability principles – can ensure these technologies deliver clinical value while minimising environmental harm and supporting long-term sustainable laboratory practice.[15,16]

4.3 Low-carbon alternatives

Lower-carbon alternatives in pathology practice refer to approaches that reduce GHG emissions and environmental impact, while maintaining diagnostic accuracy, patient safety and clinical value. This includes sustainable procurement, reduced waste and single-use materials, energy-efficient equipment, and digital and workflow optimisation.

Good practice examples

- Choose consumables made from recycled or biodegradable materials, energy-efficient equipment and low-impact packaging.
- Use energy-efficient laboratory design and operations – e.g. energy-efficient freezers, fridges, centrifuges, biosafety cabinets, smart heating, ventilation and air conditioning systems, and LED lighting with automated controls.
- Select energy-efficient servers and cloud storage powered by renewables.
- Consolidate digital storage infrastructure and conduct regular audits to improve data storage energy efficiency.
- Standardise reagent reduction, recycling and waste segregation.

- Optimise protocols from sorting and disposal through to safe treatment, to minimise reagent volumes, recycle chemicals and strictly segregate waste (plastics, glass, hazardous waste).
- Review courier collection times and routes to minimise the environmental impact of sample transport while preserving sample quality.
- Implement a systematic inventory process to ensure efficient use of materials and reagents to reduce issues arising from insufficient funds and storage.
- Switching off biosafety cabinets when not in use (e.g. out of hours).
- Review need for low temperature freezers. Raise the temperature of ultra-low temperature freezers to −60 °C rather than −70 °C.[17]
- Ensure fridges/freezers are regularly cleared out and maintained.
- Ensure equipment is only turned on when necessary.
- Ensure that items are not being sent for autoclaving unnecessarily.
- Assess for opportunities to consolidate several tests into a reduced number of laboratory equipment.
- Liaise with procurement to ensure implementation of the NHS Net Zero Supplier Roadmap (or equivalent).[18]
- Liaise with procurement to find out if suppliers are completing the Evergreen Sustainable Supplier Assessment.[19]
- Ensure that laboratory equipment tenders incorporate power usage of the instrument(s) and the carbon footprint of reagents, including that of manufacture and transportation.
- Proactively review lab processes and workflows to identify opportunities to incorporate alternative products and services that meet technical requirements and are likely to have an overall lower environmental impact.
- Bulk order regularly used consumables to reduce deliveries and packaging (collaborating with other departments where possible)
- Implement a system to maintain an accessible inventory of stock and ensure ‘first in, first out’.

Incorporate green chemistry in pathology practice[20,21]

- Prioritise the use of less environmentally hazardous chemicals, solvents and formulations wherever possible, substituting with greener alternatives validated for equivalent diagnostic performance.
- Use smaller volumes of chemicals through protocol optimisation, minimising waste without compromising test quality.
- Implement closed-loop chemical recycling systems for solvents like alcohol and xylene in histopathology.
- Collaborate with suppliers committed to green chemistry innovation and sustainable manufacturing practices.
- Regularly review laboratory chemical inventories to phase out outdated or high-risk substances, ensuring compliance with environmental best practices.

4.4 Patient and staff empowerment

Pathology professionals can play a role in patient and staff empowerment by supporting accessible and transparent diagnostic processes. Clear communication of test purposes, results and implications helps patients and staff make informed decisions about their care.

- Increase the visibility of pathology in multidisciplinary care, including participation in case discussions and patient-facing materials, to enhance trust and engagement. Where appropriate, pathology services should support codesigned educational resources that demystify diagnostic processes.
- Digital tools that allow patients to view and understand their pathology results, such as patient portals, can empower individuals to engage with their health, monitor chronic conditions and participate in preventative care strategies.

5 Education, advocacy and collaboration

Education, advocacy and collaboration are essential to achieving sustainable healthcare because they build awareness, drive behaviour change, influence policy and enable coordinated system-wide action. Education equips healthcare professionals with the knowledge to practise sustainably; advocacy promotes institutional and policy reforms that reduce environmental harm; and collaboration fosters shared solutions across disciplines,

organisations and communities. Together, they accelerate progress toward net-zero healthcare while protecting patient health and planetary wellbeing.

Good practice examples

- Ensure all laboratory staff receive induction and refresher training on sustainability practices.
- Develop modules on sustainable laboratory operations for CPD, covering energy, waste and procurement.
- Encourage staff to propose green initiatives and participate in green teams or sustainability working groups.
- Pathologists can advocate for sustainable practices by joining hospital sustainability boards and influencing procurement policies.
- Collaborate with suppliers to assess life cycle impacts of reagents and instruments.
- Engage with national groups such as Greener NHS, the Centre for Sustainable Healthcare and sustainability/green groups within professional societies.

6 Sustainability initiatives for all staff

6.1 Energy and resource efficiency

- Turn off lights, monitors and other equipment when not in use.
- Enable energy-saving settings on computers and devices.
- Maximise natural lighting and ventilation where possible.
- Reduce unnecessary printing – use digital documents and e-signatures.
- Print double-sided if printing is essential.

6.2 Sustainable commuting

- Walk, cycle or use public transport to work whenever possible.
- Organise or join carpooling groups.
- Work remotely when appropriate and feasible to reduce travel emissions.

6.3 Waste reduction

- Set printers to default to black-and-white and double-sided.
- Recycle office waste properly (paper, plastics, electronics).
- Use refillable pens, notebooks made from recycled paper and other sustainable office supplies.
- Avoid single-use items (e.g. disposable cups, plastic cutlery) – bring reusable alternatives.

6.4 Sustainable purchasing

- Prioritise office supplies from environmentally responsible vendors.
- Choose products with minimal packaging or made from recycled materials.
- Advocate for contracts with green-certified suppliers (e.g. for catering, cleaning and IT services).

6.5 Digital sustainability

- Manage emails and files to reduce digital clutter (reducing storage saves energy).
- Unsubscribe from unnecessary mailing lists.
- Use lower-impact digital communication (e.g. video meetings only when necessary; prefer phone calls or emails for simple updates).

6.6 Wellbeing and green spaces

- Support the creation of green spaces in and around the office.
- Take walking meetings or breaks outdoors when possible.
- Encourage a culture of wellbeing that links human health with a healthy environment.

6.7 Sustainable diets

- Champion and support the implementation of plant-rich menus in the workplace, including staff canteens and patient menus through national initiatives such as Plants First Healthcare.

6.8 Culture and advocacy

- Join or establish a ‘green team’ or sustainability committee to monitor and evaluate progress on sustainability initiatives.
- Encourage colleagues to engage in sustainable practices through friendly reminders and workshops.
- Advocate for the organisation to embed sustainability into policies, procurement and operations.
- Support or participate in sustainability education and carbon literacy training.
- Embed environmental sustainability in quality improvement and audit process.
- Recognise employee contribution to sustainability initiative reviews and appraisals.
- Integrate sustainability progress into regular governance meetings and reporting cycles.

7 Incorporating personal sustainability into professional practice

Incorporating personal sustainability into professional practice is essential for embedding environmental responsibility into everyday decision-making and leadership. By aligning individual behaviours, values and choices with organisational sustainability goals, healthcare professionals can reduce environmental impact, model responsible practice, strengthen institutional culture and contribute meaningfully to NHS Net Zero and planetary health objectives.

Personal sustainability supports credibility, accountability and long-term system-wide change. This can be considered using the 4 Ps framework: Personal, Professional, Pathway-specific and Policy.[22]

Good practice examples

- Choose virtual or hybrid formats for meetings and events to reduce travel emissions.
- When in-person events are necessary, select venues accessible by public transport and with sustainability credentials.

- Encourage delegates and speakers to walk/cycle, use public transport (bus, train, ferry) and car share. Avoid flights wherever possible.
- Offer plant-based catering as the default option.
- Avoid single-use plastics, use reusable name badges, crockery and water stations instead of bottled water.
- Minimise printing by sharing agendas, materials and presentations digitally.
- Offsetting has limited effectiveness, but, where emissions from professional travel are unavoidable, compensate by investing in emission reductions.
- Incorporate sustainability as a standard agenda item in all meetings, including clinical governance or departmental planning.
- Lead by example: share your own sustainable practices to inspire colleagues and trainees.

8 How can RCPath members reduce their personal environmental impact?

It is important for RCPath members to reduce their personal environmental impact because individual actions reinforce professional responsibility, credibility and leadership in sustainable healthcare. By modelling environmentally responsible behaviours, members can help lower the carbon footprint of pathology, support RCPath and NHS sustainability commitments, and contribute to protecting patient health, public health and the wider environment.

Good practice examples

- Commit to and practice healthy lifestyle behaviours to support better physical and mental health and wellbeing, and for preventing chronic conditions.[23]
- Use active travel (walking, cycling) or public transport instead of driving.
- Adopt a plant-based diet that is centred around fruits, vegetables, whole grains, beans, nuts and seeds. This is in line with recommendations of the Eat Lancet Commission, 2025.[24]

- Minimise waste by reusing, recycling and avoiding single-use plastics.
- Choose renewable energy providers for your home, where available.
- Reduce energy use by switching off appliances and improving insulation.
- Divest personal finances (e.g. pensions, banking) from banks that invest in fossil fuel and animal agriculture companies.
- Support local biodiversity through planting, rewilding and gardening.
- Buy sustainably, supporting ethical brands and local suppliers.
- Limit air travel and offset carbon emissions when unavoidable.
- Share and advocate for sustainable living practices within your networks.

9 References

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Appendix 1 Laboratory accreditation schemes

- SPARKHub. Greener Clinical Labs audit tool. Available at: https://sparkhub.eu
- University College London. *LEAF – Laboratory Efficiency Assessment Framework.* Available at: www.ucl.ac.uk/sustainable/take-action/staff-action/leaf-laboratory-efficiency-assessment-framework
  - Developed by University College London's Sustainability Team, LEAF is an online green lab accreditation programme supporting sustainable and cost-effective lab management, teaching and research. It covers topics surrounding waste, water, energy, travel, research quality, purchasing and more. Baseline calculators are used to help users quantify the impact of their actions by comparing financial costs and carbon consumption before and after implementing sustainable practices. It was created for research laboratories but is now supporting diagnostic laboratories as well. Laboratories are awarded either a bronze, silver or gold level depending on how many sustainability actions they take.
- My Green Lab. *Sustainable science programs offered by My Green Lab*. Available at: https://mygreenlab.org/programs
- European Federation of Clinical Chemistry and Laboratory Medicine. *EFLM Committee "Green & Sustainable Laboratories"*. Available at: https://greenlabs.eflm.eu

Appendix 2 Resources

- Centre for Sustainable Healthcare
- The Royal College of Pathologists. *The College and Sustainability*. Available at: www.rcpath.org/resource-report/the-college-and-sustainability.html
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- National Institutes of Health. *NIH Solvent recycling program*. Available at: https://nems.nih.gov/environmental-programs/Documents/Solvent_Recovery.pdf
- Real Zero. *7 acts to save the world*. Available at: www.realzero.earth/7-acts-1
- Plants First Healthcare.
- UK Health Alliance on Climate Change. *Guide to implementing plant-based and sustainably sourced food*. Available at: https://ukhealthalliance.org/wp-content/uploads/HowTo-PPBF05.09.25updated.pdf
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