Environment-Conscious Imaging

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The month of April marks the Earth hour and the vow to save the Mother Earth from pollution and greenhouse effects. Environment-related disasters—heatwaves, wildfires, floods, hurricanes—are ever-increasing in frequency, severity, and consequences. As healthcare professionals, we are under the ethical obligation to "do no harm", either to the human patient or to the environment.

It is time to realise how the healthcare service delivery, particularly high-tech medical imaging contributes to environmental damage that needs to be acknowledged and restricted to judicious use. Man-made radiation contributes to 15% of the overall radiation burden. Yet, medical diagnostic imaging may have marked environmental consequences by both carbon emissions and producing toxic wastes.[1]

According to the World Bank and 'Healthcare Without Harm' estimates, healthcare was responsible for 2.6 billion metric tons of CO_2 emissions globally in 2011—roughly 5% of the world's total, mostly coming from the high-tech healthcare sectors in the U.S, Australia, England, and Canada.[2]

Radiology services utilise a wide range of imaging modalities, each with pros and cons for diagnosing specific diseases, but also by having varying carbon footprints. Medical imaging alone is estimated to be responsible for around 10% of healthcare-related emissions—approximately 0.5-1% of global emissions, mostly coming from CT scans and MRI scanners.[3] While environmental consequence is often not the main determinant of imaging algorithm selection, understanding their environmental effect can guide future healthcare delivery and planning.

Among the various radiologic modalities, ultrasound generally has the lowest emissions, except when it utilises the sulphur hexafluoride (a very potent greenhouse gas) microbubbles as a contrast agent. A typical conventional abdominal ultrasound produces about 0.5 kg CO_2 equivalent to (CO_2e), whereas a CT scan of the abdomen generates about 9.2 kg, and an MRI scan produces about 17.5 kg CO_2.

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Some more complex imaging procedures can exceed 30 kg CO_2e. MRI scans require strong magnetic fields (typically 1.5 or 3 Tesla), demanding significant energy.[4] Data about nuclear medicine imaging, including SPECT and PET and hybrid imaging such as PET CT or PET MR, are limited, but expected to be in the high carbon emission spectrum. Their limited availability appears to limit their environmental harm as well.

Contrast agents used in diagnostic imaging also present environmental challenges. Iodinated contrast media (ICM), primarily used in CT scans, are excreted in urine and have been detected in water systems worldwide. Although considered safe in clinical use, these agents can form toxic by-products when exposed to disinfectants in water systems. Current wastewater treatments are unable to fully remove ICM and their derivatives.[5]

Gadolinium-based contrast agents (GBCAs), used in MRI scans, are another concern. Gadolinium is a rare earth metal with a rising environmental footprint due to both mining and water contamination. Though GBCAs are stable and mostly excreted within 30 hours, they have been found in drinking water and may pose risks to aquatic ecosystems requiring forward planning.[6] The long-term implications of their accumulation in marine environments are not yet known.

MRI scanners also rely heavily on liquid helium—about 2,000 litres per machine—to cool their superconducting magnets. Helium is a non-renewable natural resource formed over geological timescales, and while some systems can recover and reuse it, many cannot. Newer, low-field MRI systems (0.25 to 1.0 Tesla) use far less energy and do not require helium, offering a more sustainable option.[7]

Technology has certainly brought some relief as well. The replacement of screen-film radiography with digital radiography has restricted the silver and rare earth metals containing wastes derived from conventional radiographic screens and films. Filmless radiology has reduced the use of paper and harmful polyester plastic bases. AI tools in imaging are expected to become more efficient over time, but currently add to the overall energy demand.

Improvements in logistics can help, such as using mobile scanners in local communities or implementing teleradiology to reduce unnecessary travel and resources. In-person educational events, though valuable, may not always justify the environmental cost of long-distance travel—especially when high-quality virtual learning and sharing platforms are available.

Promoting environmental awareness in healthcare, supporting institutional sustainability efforts, and ensuring health-promotion campaigns reach everyone are critical challenges ahead. Decarbonising healthcare without compromising patient outcomes demands a combination of systemic change and smaller, focused efforts—such as rethinking imaging practices.

Lastly, imaging often leads to further and sometimes unnecessary imaging. Ambiguous findings or incidental discoveries can prompt additional scans. Defensive medicine practices to save the healthcare providers from potential litigation, often result in more imaging to rule out serious disease. It is time to re-assess whether resources should shift toward disease prevention and health promotion, rather than relying solely on high-tech imaging to diagnose disease in minute detail.

The Earth and her environment is calling for being saved. Let us practise sustainable healthcare by focusing on prevention and judicious use to restrict the already incurred harm.

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