EDUCATION FOR SUSTAINABLE HEALTHCARE

A curriculum for the UK

Endorsed by the Medical Schools Council

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The need for an ESH curriculum

The climate and ecosystem crisis is the greatest threat to health

Global environmental changes caused by human activities are already causing deaths and ill health. Heatwaves, storms and floods are increasingly frequent and severe including in the UK, and around the world there is reduced food and water security, increased risk of infectious diseases, and deteriorating air quality. Associated with these changes are mental health impacts and reducing economic and social stability. Strong action from all sectors of society is urgently needed both to limit the crisis and to respond to the adverse impacts. The provision of healthcare is, itself, a leading contributor to global heating and environmental degradation, responsible for around 5% of greenhouse gas emissions in the UK. Health professionals are well placed to understand the science and communicate the threat to health, and must be educated to understand the urgency and scale of the issues and how to act to address them in professional life and clinical practice.

Definitions

Education for Sustainable Healthcare

The *AMEE Consensus Statement on Planetary health and education for sustainable healthcare* defines Education for Sustainable Healthcare (ESH) as the process of equipping current and future health professionals with the knowledge, values, confidence and capacity to provide environmentally sustainable services through health professions education (AMEE Consensus statement Shaw et al., 2021)

Sustainable healthcare

Sustainable healthcare: focuses on the improvement of health and better delivery of healthcare, rather than late intervention in disease, with resulting benefits to patients and to the environment on which human health depends, thus serving to provide high-quality healthcare now without compromising the ability to meet the health needs of the future (Tun 2019, p.1176. Definition adopted by AMEE)

Planetary Health

Planetary health is a solutions-oriented, transdisciplinary field and social movement focused on analysing and addressing the impacts of human disruptions to Earth's natural systems on human health and all life on Earth (Planetary Health Alliance). Human activity has caused or contributed to mass extinctions of plant and animal species, polluted the oceans and altered the atmosphere, with these lasting effects forming a risk to our own continued existence. An understanding of planetary health provides the foundation for ESH.

Healthcare damages the environment

In the UK and around the globe, healthcare is a major cause of environmental damage from greenhouse gas (GHG) emissions, resource depletion and clinical, chemical and plastic waste. Healthcare professionals and the public are becoming concerned and more aware of the need for concrete approaches to action to address sustainability in all healthcare activities and decisions.

The GMC mandates learning on the climate crisis

Education for Sustainable Healthcare is a mandatory requirement of the medical regulator (the General Medical Council) in *Outcomes for graduates*. This requirement is emphasised in a letter from the GMC's Chief Executive and Registrar, Charlie Massey, on 22 November 2021:

"Mandating continuing professional development on the climate crisis

"Our education and training framework for medical schools and other providers seeks to raise awareness and understanding of the impact of climate change. For example, our Outcomes for Graduates framework requires newly qualified doctors to be able to apply the principles, methods and knowledge of population health and the improvement of health and sustainable healthcare to medical practice.

"Similarly, the Generic Professional Capabilities say that doctors in training must demonstrate awareness of basic principles of global health including governance, health systems and global health risks."

Demand from medical students is rising

Medical students are increasingly interested in learning how to practise in a sustainable way, and to communicate the need for sustainable healthcare to colleagues and patients. There are growing numbers of student societies at various medical schools focussing on the ecosystem crisis, and the international student-led Planetary Health Report Card ([PHRC](), [metrics]()) has provided momentum and practical suggestions for medical schools and faculties to implement sustainability measures and address sustainability across curricula.

Medical schools are embedding ESH in curriculum

Medical schools are engaging with the need to address the climate and ecosystem crisis in preparing medical students for their professional roles. Challenges in implementation include the need for training the trainers on integrating ESH into their material, finding where this fits within an already overcrowded medical curriculum, and signposting the many resources that are already available. As this is a new paradigm, with a cross-cutting and interdisciplinary nature that can benefit learning in every medical discipline, we hope this document goes some way to providing a curriculum that is applicable to the various curricular structures of the UK medical schools, and potentially further afield.

Frameworks and resources reviewed in developing this curriculum

In formulating this curriculum we have drawn on the work of a number of international and national organisations including:

General Medical Council (Outcomes for graduates)

AMEE (Consensus Statement on Planetary health and education for sustainable healthcare)

World Health Organization (WHO)

NHS Net Zero commitment (Greener NHS, Net Zero NHS)

Academy of Medical Royal Colleges (AoMRC, guide for doctors)

Planetary Health Alliance (PHA, education framework)

Global Consortium on Climate and Health Education (GCCHE, resources)

Health Care Without Harm (HCWH, health care's climate footprint)

Centre for Sustainable Healthcare (CSH, education)

UK Health Alliance on Climate Change (UKHACC, report)

Kate Raworth Doughnut Economics

Lancet Commission on Planetary Health, EAT-Lancet Commission on Food, Planet, Health

Lancet Countdown on health and climate change (2021 report)

Planetary Health Report Card (PHRC, metrics, literature review)

Approaches to curriculum delivery and assessment

Integration into curriculum

As Education for Sustainable Healthcare is mandatory new learning, core delivery of the essentials is needed. Discrete teaching may be necessary to establish understanding of fundamental concepts of sustainability and planetary health, ideally beginning from early in the course. Given the urgency of the deepening crisis and demand for this topic from the student perspective, core education could include student selected components or projects where all the students are selecting study topics in this area. Motivated students may additionally wish to explore specific aspects in greater depth as part of more wide-ranging student selected options.

Sustainability can be incorporated quickly into curricula by embedding into existing teaching sessions across all subjects and specialties. Overall learning can benefit through integrating ESH into existing modules, as ESH ties into a wide range of topics. Highlighting the environmental connections can enhance learning, as students often have some baseline

knowledge. A clinical focus is important to establish the relevance of sustainability to health outcomes and the role of the doctor, authentically presenting real-world problems with real consequences, and using participatory learning to focus on solutions.

Suitable modes of teaching include a blend of lectures, small group sessions, virtual learning, and during communications and clinical skills sessions. Concrete examples can come from the local context such as the impact of floods on the local community, or healthcare services' carbon footprinting, energy use or waste management. In the clinical environment sustainability can be included as an aspect of a case to discuss, through sustainable quality improvement activity, or using examples from specific specialties as set out later in this document.

In this way the ESH curriculum can be integrated longitudinally throughout the medical school years, highlighting the risks that environmental degradation poses to the different body systems and developing learning through all the specialties and encompassing environmental and medical ethics, medical sociology, public health and global health. The categories of learning are therefore not distinct but often integrative, collaborative across disciplines, and active and experiential on the part of the learner, and they reinforce and deepen with spiral inclusion.

It is particularly important to employ a systems thinking approach. Sustainable healthcare broadens the focus from managing pathology at the point of presentation, such as within a hospital setting, to addressing the upstream determinants of health and disease which are negatively influenced by human actions. This may involve unlearning a familiar framing of medicine, concerning only the current clinical encounter, and developing a broader understanding of health to inform a change of perspective in clinical practice.

Faculty development

This curriculum document aims to show how ESH can be embedded into the programme where it is being delivered by 'non experts' in this area. Discursive and interactive learning in small groups and through case-based problem solving are ways in which educators can develop familiarity with the subject at the same time as delivering teaching, and co-production of new learning with students can be a stimulating and practicable solution.

There is a growing body of knowledge, literature and resources for ESH, some of which are signposted in this document. Organisations such as the World Health Organization, Planetary Health Alliance and Centre for Sustainable Healthcare have online resources that are free to access, and hold remote courses and lecture series.

Both learners and faculty can be affected by eco-anxiety, solastalgia and climate grief, and ESH sessions may bring this to the fore. Schools should acknowledge that people need to be supported as they understand and personally respond to the challenging reality of our current situation, and signpost how to access pastoral support that respects the reality, scale and urgency of the existential crisis.

Assessment

ESH learning is applicable throughout the *MLA content map*. For instance the MLA emphasises knowledge of ethical issues, quality improvement, psychological principles and social and population health, together with professional capabilities in promoting health and preventing disease, ethical responsibilities for equality, communication for person-centred clinical management, and rational use of investigations and prescribing to avoid over-use. Sustainable healthcare is, essentially, good medical practice and incorporates reflective practice, complexity and systems thinking. ESH requires higher-order complex learning, which involves developing perspectives, shared values, advocacy and leadership, to ensure future clinical practice that benefits the patient, is sustainable for the healthcare system and protects the environment which is our life support system.

ESH is challenging to assess by conventional means, and the modes of summative assessment commonly used such as single best answer questions and OSCEs have limitations in evaluating the required ESH learning. It is desirable to test awareness of the upstream determinants of health and preventable causes of disease in every clinical case scenario, and to assess clinical competence through a sustainability lens. In addition to specific factual knowledge and sustainable clinical decision making, assessment can include communication skills such as sustainability related information giving, short answer questions to demonstrate deeper learning, academic written assignments or poster presentations, portfolio assessment of engagement with ESH and reflective pieces, and engagement in discussions. Formative assessment can have a significant role to play. More creative outreach activities such as communicating the importance to health of environmental sustainability, an active lifestyle, and contact with nature, at local schools and in the community, can also be valuable. Students should learn strategies for taking an environmental or exposure history, and to have conversations with patients about the health effects of the climate crisis and health benefits of a biosphere-friendly lifestyle. The patient consultation should elicit and respect the patient's priorities, recognise health inequalities and can tie in with prevention and health promotion. When dealing with clinical complexities and uncertainties, over-medicalisation should be avoided, such as for patients approaching the end of life. Students entering placements may notice unsustainable practices and should be supported if they wish to explore solutions, and encouraged to disseminate any practical solutions that are developed.

The large range of areas of ESH content should be aligned with a coherent programme of assessment across the course.

The following pages set out the learning as items, although there is much interconnection.

Key foundations of Education for Sustainable Healthcare

Planetary Health

Planetary boundaries framework of earth systems that support life on earth including human life and civilisation

Biodiversity and the dynamic relationships within ecosystems that create the foundations for all life such as air, water and food

Strong versus weak sustainability models comprising Environment, Society and Economy

Doughnut economic model – social foundation of UN Sustainable Development Goals, ecological ceiling of environmental degradation and potential tipping points in Earth's natural systems

Climate change as the greatest threat to human health (WHO, Lancet Commissions); inseparable from biodiversity crisis and structural inequalities (IPCC AR6 WGII, IPBES)

Science of climate change; greenhouse gases and carbon footprinting

Difference between weather and climate; relationship of chemical and particulate air pollution to climate change; oceans and health

Adverse effects on health and environment of novel chemical entities; toxins and other pollutants such as plasticizers, fertilisers, pesticides

Legal frameworks – UK Climate Change Act, the Paris Agreement, UNFCCC and NDCs

Mitigation actions and health co-benefits; adaptation to a changing climate; resilience of health systems

Importance of Indigenous knowledge and value systems as essential components of planetary health solutions

Urgency, scale and time-based nature of the solutions

Health inequalities, environmental equity and ethical medical practice

Environment as a determinant of health; environmental decline and climate breakdown exacerbating existing social inequalities in health and in healthcare

Amplified vulnerability of sections of population to: food insecurity, water insecurity, heat stress morbidity and mortality; unequal access to green and blue space; forced displacement of populations through conflict over resources

Unequal access to healthcare both across high income countries, and in low- and middle-income countries (LMIC)

The healthcare industry as big business e.g. 19.7% of US GDP; need for universal health coverage (Sustainable Development Goals, human right to access healthcare)

Concepts of environmental injustice, with impacts worst on those who have contributed least to ecosystem crisis such as low-income countries, Indigenous populations, those currently protecting biodiversity, environmental refugees, children, women and elderly, low socio-economic class, homeless populations

Intersection between environmental injustice and other forms of structural injustice; intersectionality or overlapping disadvantage such as those based on gender, ethnicity, colonialism, disability, age, location and income

Intergenerational equity e.g. the Well-being of Future Generations (Wales) Act 2015; student perspective on cross-generational health equity, interspecies equity; dilemma of harm to the patient of the future through provision of healthcare now

Ethical issues with current clinical practice linking to environment, cost, and patient safety: the burden of care on patients (GMC Outcomes for graduates 6e)

Transparency and patients' preferences; 'too much medicine'; shared decision making

Supplier induced demand and private healthcare systems leading to over investigation and treatment; low value healthcare and Choosing Wisely

Environmental and patient harm through defensive medical practice denying the patient the right to fully informed consent (over-investigation and over-treatment), with overmedicalisation leading to environmental harms (pollution of air, contamination of water, toxins in soil); link between defensive medicine and physician burnout

Ethical procurement in medical supply chains; working conditions such as child labour in production of disposable surgical instruments; modern slavery in medical glove production

Building climate resilient health systems; emergency disaster risk

Health benefits of action to avert the planetary crisis

Opportunities and benefits of a more sustainable and preventative approach

- how policies to reduce GHG emissions toward a zero carbon economy could also improve health:
  housing insulation; transport systems prioritising cycling, walking and public transport (active transport); food systems; industry and employment
- mental health benefits of climate solutions:
  active travel; green space expansion; reduced air pollution from clean energy
- health benefits to individuals:
  of a low carbon lifestyle; moving to a plant-based diet; to children from fewer cars, social aspects of play

Organisational sustainability policies - NHS Green Plan

Movements such as Choosing Wisely, Realistic Medicine and Prudent Healthcare countering the trend to industrialisation of healthcare

Green, blue and social prescribing – health and environmental co-benefits of non-pharmaceutical management such as exercise or yoga classes for type 2 diabetes, social group activities such as gardening for mental health conditions, lower air pollution active transport such as bicycle schemes for obesity, evidence for physical activity

Natural regeneration and biodiversity - boosting immune system, microbiome and wellbeing; reduction of pandemic risk by stopping deforestation

Need for transformation of global food systems (WHO) to reduce malnutrition, biodiversity loss and climate change, reduce adverse health impacts from chemical pollutants such as pesticides and fertilisers, tackle antimicrobial resistance, reduce food waste and improve food security

Benefits of reduced meat consumption in cardiovascular disease, cancer, dementia and all-cause mortality

Health impacts of the climate and ecosystem crisis

Harms to health from environmental degradation

Highlight throughout, inequalities and disproportionate effects of environmental and social determinants of health on disadvantaged groups; doughnut economics model; acceleration of adverse environmental changes

Increasing heat

Heat related illness and death, cardiovascular failure, perinatal vulnerability

Mechanisms of heat related morbidity such as cytotoxicity, hyper or hypo-coagulation, BP dysregulation, heart rate dysregulation and arrythmia, organ ischaemia

Heatwaves and the negative health effects of moderate and extreme heat; increased mortality rates in 'urban heat islands' during heatwaves, and the need for well-designed urban green space and blue (water) space

Heatwave plans and their limitations given most excess heat deaths occur at temperatures below triggering of warnings

Increased risks in the old, young, those with pre-existing conditions, ill or homeless, also tourists, those fasting, attending large events and outdoor workers including agricultural

Extreme weather events and wildfires

Injuries, fatalities, mental health effects and displacement/mass migration effects; widespread, pervasive impacts on people and the natural world from increasingly frequent and intense heatwaves, droughts, wildfires, storms and floods

Flooding causing persistent mental health impacts, and physical health problems related to flooding of homes, injuries; patient groups who are particularly vulnerable; advising patients on safe clean-up; disruption of healthcare provision

Health impacts of drought via water quantity, quality, hygiene, food security, loss of livelihood

Deranged weather patterns risking food insecurity, food poverty and malnutrition/obesity; risk to Water, Sanitation and Hygiene (WASH) infrastructure; burden of diarrhoeal disease influenced by precipitation changes and flooding

Wildfire smoke increasing local air pollution and affecting regional air quality: eye and respiratory tract irritation, reduced lung function, bronchitis, exacerbation of asthma and heart failure, premature death

Air pollution

Air pollution from particulate matter and chemical toxicity (and increasing allergens) affecting all organ systems of the body

Legal frameworks for air quality, excess deaths through weak policy, air pollution death certification

Relationship of planetary science to air quality and pollution from industries such as farming and agriculture, coal, transport, healthcare

Acute and chronic health conditions associated with air pollution such as hypertension, coronary artery disease, congestive heart failure, arrhythmias, infections, dermatitis, respiratory allergies, asthma, COPD, lung and other cancers; in utero and child lung growth

Exacerbations of asthma and other respiratory diseases

Water pollution and water scarcity

Sources of clean water, usage of water as drink, for agriculture, crop growth, food production, other industries; pollution of rivers and water courses

Water scarcity causing crop failure, livestock loss, destruction of wildlife habitats, wildfires, increased dust and inhaled pollutants

Cholera and other water-borne diseases affected by temperature and precipitation

Food supply and safety

Reliance of food production on the water, soils and pollination provided by a healthy natural world; need for protection of wild places and wildlife as species increasingly face extinction, linking to the health impacts of loss of biodiversity

Lancet commission on the Global Syndemic of Obesity, Undernutrition, and Climate Change

Food as medicine, healthy diet as prevention for chronic health problems such as diabetes, heart disease, cancers, stroke and depression

Benefits of plant based diet to health and planet

Harmful effects of food systems on the environment through e.g. climate change, biodiversity loss, pollution; and on health through e.g. unhealthy diets, meat consumption, antimicrobial resistance, increased pandemic risk

Problems of excess and waste; inequalities in availability and price of healthy food

Link between food security in UK and geopolitical stability affected by droughts, famines, conflicts, humanitarian crises

Food-borne diseases such as campylobacter, salmonella and enteric viruses replicating faster at warmer temperatures

Infectious diseases

Human activity as a driver of disease emergence, through climate and ecosystem disruption, human demographics, land-system change and encroachment on habitats, deforestation and wildlife trade, international commerce and travel

Reduction of risk of pandemic emergence/ spillover from wildlife to people through: protection of nature and biodiversity; reduction in deforestation, wildlife trade, and intensive livestock rearing; protection of Indigenous land rights

Increased risk of food and water-borne disease with climate breakdown

Changing distribution and ecology of zoonotic and vector-borne diseases, with disrupted climate (rainfall and temperature) exacerbating malaria, dengue, Lyme disease, chikungunya and various forms of encephalitis

Interconnections between human, animal and ecosystem health (One Health approach); use of antibiotics in farming; principles of antimicrobial stewardship to reduce antimicrobial resistance

Non-communicable diseases (see also by specialism)

Interrelated pathways through which global environmental changes affect non-communicable disease risk:
energy source and use, air pollution, and climate change; urbanisation; food, nutrition, and agriculture; chemical contamination; biodiversity loss

Systems thinking approach to how to minimise impact of climate and ecosystem crisis on non-communicable diseases (NCD)

Social factors including physical and mental health effects of violent conflict and forced migration through complex and context-specific risks; the multiple health impacts of refugee status

Impact of loss of medicinal plants, such as oncology drugs derived from nature

Noise as a cause of preventable death on a similar scale to air pollution

Importance of household insulation, linking energy efficiency and poverty with cold homes and excess winter deaths

Positive impact of green space on: mental health, cardiovascular morbidity, obesity, diabetes and pregnancy outcomes through psychological relaxation and stress alleviation, increased physical activity, reduced exposure to air pollutants, noise and excess heat

Sample topics for medical sciences/preclinical courses

[see also other sections as relevant; and Emory paper for other examples]

- intact ecosystem as the foundation of health
- environmental aspects of the natural history of disease
- biosphere health in preventative medicine
- changing burden of infectious disease through climate change and habitat loss
- impact of food systems on metabolic health
- health and environmental benefits of a plant-rich diet, low in processed meat
- heat stress impacting on emotional state, mental, cardiorespiratory, and renal function
- effect of air quality and environmental pollutants on circulation and breathing, skin conditions and cancers, reproductive health and dementia

Additional impacts by medical specialism

The health impacts of anthropogenic global environmental changes are pervasive and increasing. The following are indicative examples grouped by speciality for utility, but are not intended to be complete or exclusive to any specialty and should be used in conjunction with the generic impacts.

Medicine

Impacts of climate change on cardiovascular/ endocrine/ respiratory health (including increased allergens)

Deaths from fossil fuel emissions from traffic and industrial power generation

Environmental risk factors in development of cancer – relationship of toxicology to oncology

Temperature regulation at various life stages and risks such as cerebrovascular accident

Health co-benefits in many non-communicable diseases from a plant-based diet, access to green space and physical activity

How sustainability policies can improve outcomes in cardiovascular/ endocrine/ respiratory health/ dementia and mental health

Geratology - rational prescribing and deprescribing to reduce side effects, improve patient safety and quality of life; impact of polypharmacy on patient and environment; social prescribing to support energy efficiency with household insulation for cold homes

Dermatology - changing prevalence and severity of atopy and infectious skin conditions with temperature increase; changing patterns of skin cancer

ENT - impact of climate change on allergens and allergic rhinitis; air pollution and sleep disordered breathing

Ophthalmology - increased incidence of tractional retinal detachment, age-related macular degeneration and glaucoma, and links to cataract and infections through increasing UV radiation exposure, rising air pollution and warmer drier conditions; resource and carbon intensity of eye health services through consumables, energy consumption and travel requirements

Rheumatology - association of pollution (especially particulate matter) with rheumatological manifestation of conditions such as systemic lupus erythematosus, rheumatoid arthritis, multiple sclerosis; effects of increased temperatures and heatwaves on rheumatological disease activity; effects of spread of disease vectors on diseases such as Lyme, chikungunya

Neurology - temperature extremes as risk factors for acute cerebrovascular accident; heat exposure and pollution as risk factors for cerebrovascular disease; the need to quantify risk of neurotoxicity from chemical pollutants such as per- and polyfluoroalkyl substances (PFAS) and 'novel entities'

General Practice and community care

The role of the GP in protecting and improving the health of populations

The individual primary care encounter as viewed through the wider lens of communities and planet

Relationship of the principles of primary, secondary and tertiary prevention of disease to the principles of sustainable healthcare

Person-centred care, and how lower-resource use pathways can have better clinical outcomes

Communication with patients about healthier living, environmental exposures, self-care, sustainable approaches to medications, while expressing sensitivity to patients' priorities

Positive impact of sustainable practices on health inequalities e.g. social prescribing, deprescribing, breastfeeding if desired, increasing access to green spaces

Use of low GHG (dry powder or soft mist) inhalers where clinically appropriate in preference to high GHG (metered dose) inhalers and other measures to reduce the carbon footprint of respiratory care

Appropriate planning for and adaptation of primary care premises, purchasing, processes, and waste management e.g. Green Impact for Health [Toolkit](#)

How clinical [practices](#) can reduce carbon footprint, costs and waste, whilst improving care quality

Emergency care

Wider biopsychosocial context of presenting symptoms

Consideration of best setting for accessing care/learning self-care

Effective lean pathways of care for people presenting to emergency department

Mindful diagnostic workup and only where necessary

Early discussion with senior colleagues to expedite appropriate discharge

Women's, reproductive, perinatal and paediatric health

Greater [vulnerability](#) of women to climate impacts, including food insecurity, family planning and sexual health, exploitation and gender based violence

Vulnerability of pregnant women to extreme heat due to reduced thermoregulation and altered cardiopulmonary physiology, and to household and industry-related environmental toxins such as air pollution and pesticides

Links [between](#):
- higher temperatures during pregnancy and premature birth, risk of later obesity, increased paediatric admissions

- wildfires and birth defects

- air pollution and reduced fertility, premature birth, low birth weight and stillbirth

Links between rising sea levels, salinity of water and crops and pre-eclampsia e.g. in the Sundarbans delta area

Nitrous oxide in Entonox as a potent greenhouse gas

Environmental impacts of caesarean delivery compared with normal delivery

Personal, financial and environmental consequences of unmet needs for contraceptive and family planning services, and global challenges to providing access to contraception; impact of growth in consumption and population on finite resources

Paediatrics and child health

Greater vulnerability of children to climate and environmental risks due to immaturity, rapid development and dependence

Effects of pollution such as compromised brain and lung development and function, worsened asthma and other respiratory disease

Multiple overlapping environmental risks including poor air quality, unsafe drinking water, lack of handwashing facilities, household air pollution from fuels for lighting, cooking and heating (RCPCH position statement)

Greater risks to the young from exposure to water scarcity, heatwaves, vector-borne diseases, cyclones, river and coastal flooding

Psychiatry

Direct and indirect mental health impacts of the climate and ecological emergency:

Prolonged mental health impacts of flooding (and displacement) in the UK

Increased suicide rates and mental health admissions with increasing temperature

Globally, mental health effect of heatwaves, cyclones, floods, hurricanes and droughts together with sea-level rise, wildfires, insecure food systems – causing livelihood losses, uncertainty and, in the longer term, forced migration (RCPsych position statement)

Psychological dimensions of the climate and ecological crisis:
Climate grief, eco-anxiety, solastalgia as reactions to reality, distinct from anxiety and depression seen in other contexts

Importance of contact with nature to mental and physical health and quality of life

Mental health benefits of climate solutions (walking and cycling for commuting, green space expansion, reduced air pollution from clean energy)

Social prescribing – opportunities for arts and creativity, befriending, physical activity, accessing green spaces, learning new skills

Surgery and Anaesthetics

Operating theatres as a resource intensive area of hospitals requiring large volumes of consumables and energy utilisation

Major carbon hotspots in surgical operations such as the procurement of consumables, electricity use and anaesthetic gases

Importance of questioning operating theatre culture, to avoid opening or requesting items until they are clearly required, unnecessary packaging and single use items RCS Eng bulletin

Labour rights abuses and child labour in single-use item supply chains of surgical masks, gloves and instruments

Waste as a significant logistical and environmental challenge, although contributing only 0.1% of the total NHS carbon footprint

Global warming potential of total intravenous anaesthesia (TIVA) several orders of magnitude lower than other modes of anaesthesia; GWP of volatile anaesthetic gas desflurane 20 times that of sevoflurane

Global health

Effect of global environmental changes on local health and wellbeing, including unequal health impacts of climate change globally such as:
- heat-related mortality and morbidity
- wildfires from heatwaves
- flooding, drought and water scarcity
- agricultural production losses leading to malnutrition and stunting
- potential for collapse in human societies leading to conflict and mass displacement

Determinants of health models, Sustainable Development Goals, Doughnut economic model

Global syndemic of obesity, undernutrition, and climate change

The influence of environmental changes on ecological niches for human pathogens, increasing epidemics from diseases spread by insects and other animals

Differences in access to healthcare and family planning, impacting maternal and child health

Educating girls as the single most effective way of reducing population rise

Impacts of ecosystem crisis on healthcare systems

Impact of environmental change on the functioning of health and social systems
- damage to health infrastructure
- effects on funding structures of healthcare
- effects on efficient use of healthcare resources
- disruption of healthcare delivery

Impacts of extreme weather events on ability to provide healthcare locally e.g. flooded facilities, local Trust crisis measures

The impacts of healthcare on our environment

Healthcare as a major contributor to the ecosystem crisis, environmental and carbon footprint of healthcare systems globally and nationally

Variation by region or country in environmental impact of healthcare delivery

International agreements for creating sustainable health systems - COP 26 Health Programme

Environmental impact of healthcare activity
- by NHS activity type, dominated by medicines, medical equipment and other supply chain
- GP/community, secondary, tertiary care

Over-medicalisation: causes and adverse effects of over-investigation, over-diagnosis, over-treatment on environment, health system and patients (patient safety, iatrogenic harm, adverse health outcomes)

Deprescribing and social prescribing as efficient and mindful sustainable healthcare actions in daily clinical practice

Medical waste – understanding waste hierarchy, waste disposal systems and resulting pollutants, difference between waste and wastefulness

Connections between other transformations happening in healthcare related to IT, telemedicine, workforce, and governance, and the rapid decarbonisation of healthcare

Greener NHS (net zero commitment) and synergy of environmentally beneficial approaches with improved health at personal and population level

Scope of research on environmental sustainability in healthcare

Sustainable clinical practice

Principles of sustainable clinical practice

The principles of sustainable clinical practice (framework of the Centre for Sustainable Healthcare for approaching clinical management Mortimer, 2010, Gandhi et al., 2020):
1. Prevention
2. Patient empowerment
3. Lean pathways of care
4. Low-carbon alternatives
5. Operational resource use

These principles encompass the following:

Reducing the incidence and severity of disease to decrease the amount and intensity of care required

Shared decision making, patient-centred care. Using patient decision aids such as NICE guidance for patients in choosing care e.g. on benefits of diet and physical activity vs statins; choice of inhalers and greenhouse gas impact of dry powder inhalers versus metered dose inhalers

Following GMC guidance 2020 on decision making and consent which requires finding out what matters to the patient, and stating clearly the option to take no action

Ensuring appropriate care and avoiding unnecessary investigations and treatments to optimise the use of resources

Minimising polypharmacy, awareness of the environmental impact of pharmaceuticals, non-pharmacological management of conditions

Avoiding duplication of services to minimise waste, energy and travel by coordinating care

Encouraging change through individual practice, influencing healthcare organisations, and contributing to standards and policy

Actions to reduce the environmental impact of medical practice

Quality improvement

The application of principles of sustainable quality improvement activities, such as CSH SusQI framework, in improving both patient care and environmental, financial and social impact of clinical practice

Development of strategies for reducing the carbon footprint of health care delivery

How sustainability measures can be directly instigated e.g. in primary care settings or in hospitals

Social prescribing

The range of non-medical options that could be available to healthcare professionals when a person has needs that are related to socioeconomic and psychosocial issues

Referral of patients to a link worker, to co-design a non-clinical social prescription to improve their health and wellbeing

NHS Net Zero commitment

The NHS Net Zero report and targets, critical analysis of the policies

Carbon and ecological footprint of the NHS; scope 1, 2 and 3 emissions; procurement

The waste generated by the healthcare system, where this is disposed of, and the pollutants produced

Medical leadership and differentiating between clinical practice and organisational processes to conserve resources and minimise waste

Working with others/ interdisciplinary working to incorporate carbon neutrality into decision making processes

Professionalism, leadership and achieving structural change

Professional competencies in planetary health

Understanding the unique contribution that health professionals can make to promote social transformation and planetary health to avert the ecosystem crisis

Dealing with complexity and using systems thinking to minimise the impacts of the climate and ecosystem crisis

Promotion of planetary health values, and ability as medical educators to provide inspiration for planetary stewardship

'Eco-ethical leadership as an integrated approach centred around sustainability, values, collaboration, justice, advocacy and, if need be, activism'

Advocacy for intergenerational justice as exemplified by The Well-being of Future Generations (Wales) Act 2015

Ability to identify opportunities with every patient for disease prevention and take appropriate action

Understanding that holistic patient centred care can be more satisfying and rewarding than practising defensive medicine, while reducing the risk of burnout for the practitioner

Communicating sustainability values

Understanding that care for our environment is essential for the health and wellbeing for our patients, ourselves, families, friends and colleagues

Environmental and social determinants of health, health benefits of a green economy, doughnut economic model of social and planetary boundaries

Effective communication methods and tools for conveying the challenges and solutions of planetary health to diverse audiences including stakeholders and organisations

Communication skills to educate colleagues, policymakers and patients (Real, Urgent and Now guide)

An appreciation for the importance of listening

Patient specific communication strategies for conversations on

- the risks of the climate and ecological crisis
- taking an environmental history or exposure history
- promoting healthy alternatives to over-medicalisation, over-investigation and over-treatment

Identifying where disruption of Earth's natural systems may contribute to ill health and ability to communicate to authorities to advocate for action

Promoting organisational change

Appreciation of the importance of the student voice, growing into doctor as professional to advocate and drive social and policy change

Challenging existing power structures that often perpetuate overuse of resources and exacerbate inequalities

The need for a shift in focus from crisis management to prevention of problems to achieve sustainability in healthcare (e.g. 14-fold return on public health interventions)

Leadership and advocacy skills to move healthcare from a historical disease intervention model to a preventative life course approach

Advocacy on specific areas in need of structural change:

- Systems of transport to promote active travel, lower pollution and reduce ill health

- Urban/community design to prioritise public health e.g. influencing authorities and institutions on waste and toxin management, lowering noise levels, protecting biodiversity and providing green spaces

- Food systems toward healthy plant based foods to address the multiple health and environmental impacts of foods, including food waste and water use

- Models of healthcare delivery and incentivisation, promoting holistic and primary care, and the health benefits of lifestyle medicine and low carbon lifestyles

The need for systems change along with individual action – although personal steps to lower individuals' own carbon footprint are highlighted by commercial interests as the solution to the planetary crisis, and changes in consumption patterns are necessary, focus on these must not be allowed to divert attention from the urgency of bringing about policy level systemic change.

Further resources

We have provided hyperlinks to some educational resources at the relevant points in this document; these are intended to be helpful but are in no way prescriptive or exhaustive. Below are some resources which are more generally relevant:

Centre for Sustainable Healthcare Priority Learning Outcomes referenced by GMC *Outcomes for Graduates 2015* and reproduced in full in the appendix

Planetary Health Alliance education framework, learning objectives

New England Journal of Medicine climate impacts by medical specialty click on arrow

Royal Society of Medicine: Health and climate change series of webinars and bibliography

Greener Practice sustainability in general practice, guide to inhaler prescribing

NHS Green Plan

Faculty of Public Health Resources on Sustainable Development and Climate Change

British Psychological Society Clinical Psychology Forum

BMJ too much medicine

Cochrane Sustainable Healthcare: evidence for action on too much medicine

the art of medicine: planetary health

Intergovernmental Platform for Biodiversity and Ecosystem Services IPBES report

Intergovernmental Panel on Climate Change IPCC AR6 II climate impacts report

National Ocean Service NOAA

The 1.5C Health Report synthesis of health content of IPCC SR1.5

Environmental sustainability of healthcare services review of research

Sustainable general practice BMA GPC England Policy Document

Emory medical students' Climate and health learning objectives for preclinical medical education - see Table 1

Health Coaching NHSE/I guide

Climate Psychology Alliance https://www.climatepsychologyalliance.org/

Authorship

This curriculum was developed through a series of consultations, discussions and review processes. The Medical Schools Council hosted a special conference for all UK medical schools in October 2021 on Education for Sustainable Healthcare and Planetary Health, and the Education Leads Advisory Group of the MSC reviewed and endorsed the curriculum in April 2022.

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Appendix

CSH Learning Outcomes for ESH as referenced in GMC *Outcomes for graduates 2015*

1. Describe how the environment and human health interact at different levels

Doctor as scholar and scientist

- Outline the dependence of human health on global and local ecological systems, which supply essentials such as air, water and a stable climate.
- Discuss the contribution of human activity and population size to global environmental changes such as climate change, biodiversity loss and resource depletion.
- Describe the mechanisms by which human health is affected by environmental change, for example through changes in disease vectors, exposure to extreme weather, migration and reduced food security.
- Describe features of a health-promoting local environment, in community and healthcare settings, to include access to green spaces, clean air and an active travel infrastructure.

2. Demonstrate the knowledge and skills needed to improve the environmental sustainability of health systems

Doctor as practitioner

- Define the concept of environmental sustainability.
- Explain how trends in demographics, technology, climate and resource availability may affect our ability to provide healthcare into the future.
- Describe, with examples, the different types of environmental impact resulting from healthcare provision, and how these may be measured.
- Identify ways to improve the environmental sustainability of health systems - in individual practice, in health service management, and in the design of care systems.
- Identify potential synergies between policies and practices that promote environmental sustainability and those that promote health.

3. Discuss how the duty of a doctor to protect and promote health is shaped by the dependence of human health on the local and global environment.

Doctor as professional

- Explain how the health impacts of environmental change are distributed unequally within and between populations and the disparity between those most responsible and those most affected by change.
- Recognise and articulate personal values concerning environmental sustainability, given the relationship between the environment and the health of current and future generations.
- Discuss ethical tensions between allocating resources to individual patients and protecting the environment upon which the health of the wider community depends.
- Demonstrate awareness of organisational sustainability policies and the legal frameworks for reducing carbon emissions.

The above outcomes were originally mapped to *Tomorrow's Doctors*, and their relationship to the current version can be characterised as follows:

Mapping of the CSH Learning Outcomes to *Outcomes for graduates 2018*

PLO 1, 'Describe how the environment and human health interact at different levels', relates to *Outcomes 3 - Professional knowledge* in global health and public health.

PLO 2, 'Demonstrate the knowledge and skills needed to improve the environmental sustainability of health systems', involves leadership and quality improvement as in *Outcomes 1 - Professional values and behaviours*.

PLO 3, 'Discuss how the duty of a doctor to protect and promote health is shaped by the dependence of human health on the local and global environment,' concerns *Outcomes 1 - Professional values and behaviours* relating to ethics, justice, and professionalism.