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

Climate change and pathology – impact and actions

Climate change will have a wide ranging effect on global health and pathology services

Published: 26 March 2024 **Author:** Claire Gordon **Read time:** 10 Mins

In this article, Claire Gordon reflects on a UK Health Security Agency report that details the various impacts climate change may have on health, from exacerbating infectious diseases to the consequences of running sustainable pathology services.

Like it or not, humans have an impact on the environment

The UK Health Security Agency recently published its wide-reaching assessment on the potential effects of climate change on health in the UK.[1] The document is a sobering read that describes the possible adverse impacts on all aspects of health, from food security to infectious diseases to increased costs of living and the health effects of poverty.

Regardless of views on aetiology, the evidence that our climate is changing is hard to ignore. Objective evidence from climate monitoring indicates decade-to-decade variance in temperatures that will inevitably impact on delicate ecologies, even if climate sceptics wish to argue against the possibility of a long-term, upwards trajectory. The effects of those changes will be felt by current and future generations, and merit immediate mitigation and preparation. Health services, therefore, need to be adaptable to the impacts of ecological upset.

Climate and health

The effects of the interdependencies between humans and the environment may be direct – for example, hyper- or hypothermia as a result of temperature extremes – or may result from more complex interactions, such as increased temperatures allowing infectious disease vector survival beyond normal ranges, or human movement as a result of extreme weather events bringing humans into closer contact with pathogens.[2] Extreme weather may also affect health through economic loss and effect on food security.[3]

Climate is, however, not the only factor, with emissions, environmental destruction and pollution amplifying the effects of temperature changes. Air pollution, which is closely linked to carbon-dependence, is the most obvious example of environmental impact on health, with a clear correlation between high levels of particulate pollution and respiratory diseases.

The interdependence between the environment and human health is also seen very clearly in infectious diseases.

Climate and infectious diseases

A recent study by Mora et al. reported that, out of 286 known human infectious diseases, half are likely to be impacted by climate hazards.[4]

Temperature variance has several potential impacts for communicable diseases. For pathogens that survive in the environment, altered temperatures may make conditions more favourable and promote replication and transmission; for example, a rise in coastal water temperatures may increase the risk of waterborne infections, particularly *Vibrio spp.* (including *V. cholerae*). Human behaviour via direct pollutants and other factors causing changes to salinity may also increase the level of pathogenic organisms in seas and rivers.[5]

Vector-borne diseases require an environment conducive to the survival of the vector, a susceptible population and a handy infected host reservoir (including human reservoirs). There is increasing concern that rising temperatures in the northern hemisphere make conditions more favourable for the arthropod species responsible for the transmission of certain diseases. Coupled with other human behaviours, such as arrival of an infected human from overseas travel (e.g. for dengue), or displacement of animal reservoirs through importation of non-native animal species or environmental disturbances causing movement of hosts and their associated arthropods to new areas (e.g. West Nile virus, Crimean-Congo haemorrhagic fever), there is an amplified risk of the convergence of reservoirs, competent vectors and susceptible hosts in new regions.

Dengue fever is a sentinel for the effect of changing climate on the geographical distribution of a vector and the risk of concurrent spread of its associated diseases, particularly if travel and displacement bring a reliable supply of infected reservoirs into contact with a naïve population.

Europe has seen increasing numbers of autochthonous dengue infection. Dengue is transmitted between humans by the *Aedes aegypti* and *Aedes albopictus* mosquitoes. There is no animal reservoir and the risk of transmission is, therefore, very closely related to human behaviour. For *A. albopictus,* which is relatively hardy, human behaviour may be more important than climate change, with introductions via accidental importation related to the movement of goods such as tyres, and poor environmental management creating uncovered stagnant water pools that promote mosquito breeding.

The UK is not immune to this risk, although it is likely that it is some decades away.[6] Active surveillance for the species, reducing the need for importation of goods, reducing travel and reducing poorly managed waste may directly reduce the risk of *A. albopictus* becoming established in new habitats.

In contrast, *A. aegypti* requires higher, more tropical temperatures to survive and is more likely to be affected by increased temperatures permitting a more gradual, subtle and perhaps less easily controlled ingress into new adjacent territories.[6]

Any factor that brings humans into closer contact with animals and their environment may result in an increase in zoonotic and vector-borne diseases. This may be via movement of humans, for example unplanned displacements due to extreme weather events, or movement of wildlife reservoirs, either acutely due to floods and fires or insidiously as climate changes enable animals to range into previously hostile habitats made favourable by an increase in temperature.

Climate change and antimicrobial resistance (AMR) intersect dangerously. Both have been defined as wicked problems – problems of extreme complexity, implicating numerous and conflicting stakeholders, where efforts to solve may only, at best, minimise the negative effects.[7–9] The impact of AMR, where attributable mortality is predicted to outstrip the current leading causes of death by 2050,[10] is likely to be accelerated by climate change, owing to changes in infectious disease epidemiology and pressures on food systems. Increased infections will necessitate increased antimicrobial use, both in humans and animals.

The impact of climate change on pathology services

While pathology may be the science behind the cure, climate change, as a wicked problem, is evidently beyond the ability of pathologists to cure. However, as a wicked problem, it also requires a sustained, multisectoral and multilevel response – no sector is exempt.

The changing epidemiology of infections means that pathologists will need to be alert to unexpected diseases and aetiologies and must not discount hypotheses based on historical epidemiology. Similarly, transfusion and transplantation services will need to keep abreast of changing risks and expand infection screening accordingly.

Pathologists in the veterinary sector will also need to be aware, as the profile of potential pathogens may expand both for companion and livestock animals.

The pathology service response

Enumerate and report

Diagnostic pathology plays an important role in enumerating the causes of morbidity and mortality. Recognition and reporting of diseases potentially linked to climate change will help to give a granular understanding of attributable risks. Pathologists should be encouraged to indicate, where relevant, findings that may be related to environmental changes, so that the impact can be better tracked.

Pathology is the major source of data on disease epidemiology; therefore, it will become increasingly important to provide accurate diagnoses and attributions to ensure that the impact of the environment on health can be systematically recorded and monitored.

Understand the impact of pathology services on climate change

Healthcare generates a significant amount of carbon emissions in high-income countries. A substantial proportion of the healthcare budget is spent on pathology, so it is reasonable to infer that pathology services are responsible for a not insignificant proportion of national carbon emissions.[11]

Despite this, higher healthcare sector emissions do not equate to better, healthier lives; for example, modelling suggests that the United States of America generates more healthcare-associated emissions per person compared to other high-income countries, but has the 6th lowest healthy life expectancy – similar to that of South American countries where healthcare-associated emissions are several times lower.[3]

Pathology services should, therefore, seek to develop more sustainable pathways and procedures, including rational approaches to minimise unnecessary testing that generates unnecessary emissions and costs.

Consider our carbon footprint

The major sources of carbon emissions in pathology services are sampling and sample transportation.[11] Reducing the impact of pathology services on the climate starts at the pre-analytic stage, requiring better diagnostic stewardship to ensure that all tests are necessary, timely and informative.[12,13]

Unnecessary tests are a fact of life for many pathology services: daily monitoring of blood in stable patients, uninformative sputum samples, reflex examination of cosmetic excisions. Improved diagnostic stewardship would reduce the carbon footprint of pathology services, as well as reducing costs for health service users. Modelling indicates that even marginal improvements in individual efficiencies can accumulate to have measurable impacts.[14] Smart workflow systems to stratify testing and halt unnecessary tests once a positive diagnosis or parameter is reached should also be developed.

Integrate sustainability

Pathology services should engage with industry to develop more sustainable laboratories, reducing the waste from redundant equipment and procedures. Sustainability should be integrated in procurement pathways. Suppliers and manufacturers may need financial inducements; it is likely that they will improve practices only if purchasers favour those with better environmental practices.

One way to address this would be to include sustainability in procurement policies and tender processes. Procurement processes should assess the environmental impact of a new analyser or assay: can equipment be refurbished, repurposed or recycled? National associations could produce best practice guidelines and lobby to ensure that suppliers consider the impact of equipment updates.

The right to repair is now being introduced for domestic appliances; similarly, pathology suppliers must be mandated to ensure replaceable parts and upskilling of engineers, allowing updates to existing instruments rather than requiring whole-instrument replacement. National bodies could also have a role in coordinating and assuring the repurposing, renewing and donation of equipment. Transport systems should also be considered, with preference given to low-emission and carbon-neutral couriers.

Ownership and responsibility

Individually, it may be hard to see how reducing the occasional unnecessary sample or deferring the purchase of new equipment until absolutely necessary can have any impact, particularly given the carbon debt of other sectors, such as transport and manufacturing. This is the nature of a wicked problem: no one intervention can effect a cure. However, there is evidence that the accumulation of marginal gains, at country level and over time, can lead to meaningful change.[14] Sustained and concerted effort by all can, and will, make a difference.

References available on our website.

Meet the author

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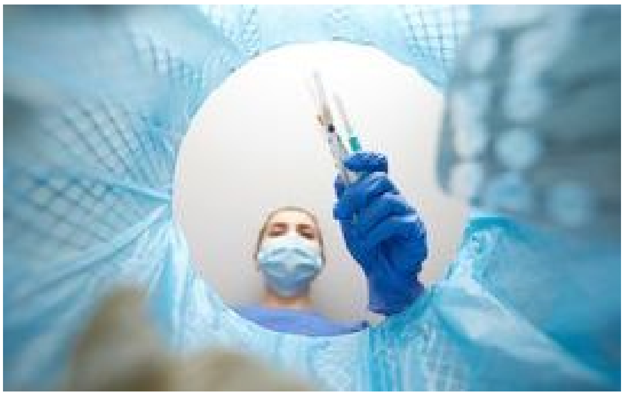

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