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Critical Care

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Climate change impacts: survival on, and of, intensive care

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The infection

'Greenhouse gases' [GHG] such as carbon dioxide (CO_2) transmit shortwave solar radiation, but trap heat energy. We are adding vast and ever-increasing quantities to our atmosphere - the equivalent of 57 billion tonnes of CO_2 (3×10^{25} litres) in 2024 alone [1]. Their concentrations are rising faster every year- CO_2 by 2.6 ppm/year, to a concentration of > 427 ppm (from a preindustrial baseline of 280ppm), now trapping the energy equivalent of 8 Hiroshima Bomb's/hour.

The pathophysiology

The oceans are gaining heat- in 2024, a (record) 16×10^{21} Joules was added to its top 2 km- enough to take 15 billion Olympic swimming pools from 0 ºC to 100 ºC [2]. The gaseous atmosphere is heating- to 1.6 ºC above preindustrial levels in 2024- at an accelerating rate [3]. Ice melt- 28 trillion tonnes lost between 1994 and 2017- is accelerating, rising 57% (from 0.8 to 1.2 trillion tonnes/year) since the 1990 s [4]. Sea level rise, now nearly 1 cm every 2 years from land ice melt and thermal ocean expansion, has accelerated, its rate doubling in recent decades [5].

We now face 'acceleration of these accelerations' from interacting positive feedback loops. Snow and ice melt means less to reflect light back into space, and more exposed dark soil/ocean to absorb heat. This adds an energy gain equivalent of an extra 100ppm atmospheric CO_2. Emissions of methane (83x as potent a GHG as CO_2 over its first 20 years) from (rebranded) 'Natural Gas', belching cows, rubbish tips and more, is now supplemented by release from melting permafrost, heated carbonate rocks and wetland fermentation, and its atmospheric clearance reduced by fires (tree bark microbiomes break it down; carbon monoxide extends its atmospheric half-life). Wildfires release (GHG) CO_2, and (atmospheric heating/glacier melting) black soot. Water vapour from ocean evaporation is a high-altitude GHG, and tundra/rainforest heating is leading to both becoming net CO_2 emitters [6]. Finally, the full force of global heating is being revealed as loss of (reflective) low-altitude cloud occurs (reviewed in [7]).

Abrupt and catastrophic changes are occurring to global weather systems. Polar heating (≤ 4x faster than the global average) is accelerating and moving the Northern Jet Stream, worsening Iberian droughts and Northern European flooding, and bringing even more extreme weather events. Collapse or severe slowing of the Atlantic Meridional Overturning Circulation (AMOC, transporting massive heat loads around the N hemisphere) is imminent. Massive sudden Arctic heating may soon accelerate these impacts and those on sea level (reviewed in [7]).

The symptoms

None can have failed to notice the increasingly frequent and severe extreme weather events (storms, heatwaves, droughts, floods, fires): up 83% between 1980 and 1999 and 2000–2019 [7]. Heatwave exposure is rising [8]. The land area affected by extreme drought annually has risen from 18 to 47% in only 50 years (reviewed in [7]).

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The prognosis without immediate intervention

Without immediate intervention, we will miss 'a rapidly closing window to secure a liveable future' [9]. Nearly 1/5th of the land area occupied by humans will face temperatures likely incompatible with survival. Vector-borne disease burden will increase. Food scarcity- and prices-will rise, the food industrywarning that, 'predictability of [food] supply…is not something we will be able to rely upon over the coming years' [10]. Economic collapse will accelerate that of society. Insurance actuaries warn that we soon face the loss of 50% of Global Domestic Product [11] and that "our economy may not exist at all" without immediate action [12]. Starvation, disease and economic collapse bring migration "of entire populations on a biblical scale", and war [13]. Collapse of the ecosystems upon which human survival depends soon follows, culminating in 'a mass extinction rivalling those in Earth's past" [14]. We are thus, 'on the brink of an irreversible climate disaster' with 'much of the very fabric of life on Earth is imperiled' [15].

The treatment

Just as for any disease, immediate treatment does not bring immediate cure. The longer we wait, the greater the chance of death. In this context, we must remember that immediate cessation of GHG emissions still sees global energy gain continuing: 1/5th of the CO_2 we emit today is present 33,000 years from now. So, too, will the damage we now inflict on our weather- and eco-systems will be permanent over geological timescales.

We must do what we intensivists do best: recognise and respond to a life-threatening emergency, doing what is both necessary and sufficient to be effective.

This means taking personal action. No 'moral offset' from our jobs can be applied. We must move our bank accounts and investments away from those which support fossil fuel use; move our power supplier to 100% renewable and electrify our domestic and transport use; use low-carbon transport (cycle/walk > mass transport >>>flying); eat a (local, seasonal) plant-based diet (meat in smaller portions less often, avoiding beef/lamb) if not a vegetarian or vegan one (given that 38% of emissions come from the food supply chain); and we must engage family, friends and colleagues to do the same.

We must act professionally, working with our employers and representative societies to deliver these same actions. We must advocate for public health interventions. Polluted air (power production, gas stoves/boilers, road transport); meat, dairy and and processed food based diets; and motorized (not active) transport drive both emissions and a vast burden of non-communicable disease. Active transport and plant-based diets are positively beneficial. Such shifts also reduce the emissions which derive from downstream healthcare.

And we must act politically, supporting those parties and policymakers who are prepared to take the required action.

The first responders

Inaction doesn't just threaten health, lives, healthcare systems or the economy which allows us to practice intensive care. It threatens our own survival and that of life on earth as we know it. Beyond all others, we who work in critical care are clever enough to diagnose a problem, moral enough to recognise the imperative to act, and experienced enough to understand what emergency action looks like.

Now is the time to take such action- for the sake of our patients, or our children, and ourselves.

If not us, then who? If not now, then when?

Author contributions

HM is solely responsible for the authorship of this manuscript.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Competing interests

I work extensively in the climate change space, Co-chair the Lancet Countdown on Health and Climate Change and run the charity-funded non-profit 'Real Zero' to try to leverage the healthcare economy in order to achieve reductions in greenhouse gas emissions. I do not see these as a conflic of interest, however, but report them for transparency purposes.

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