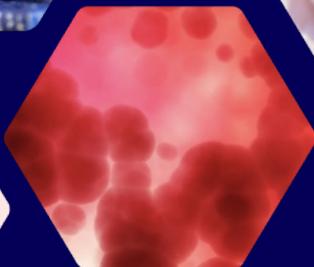


# Climate Health:

the impact of climate change on  
doctors and healthcare professionals

A call to action for the global health community



MedShr

Sharing Knowledge. Saving Lives.

## Authors



**Dr Asif Qasim**  
Founder and CEO MedShr



**Anya Parkhouse**  
Senior Medical Writer

## About MedShr

MedShr connects more than 2.5 million doctors and healthcare professionals through medical education and peer-to-peer learning, across all clinical specialties in 195 countries. Working in partnership with over 200 national and specialist medical societies, MedShr has a mission to improve patient care by supporting collaboration and democratising medical education.

In 2023 MedShr Global Health education programmes reached over one million doctors and healthcare professionals (HCPs) in low- and middle-income countries, providing free education in a wide range of topics from maternal and child health to malaria, sickle cell disease and HIV. The MedShr community also provides remote specialist support to HCPs in austere environments such as refugee camps and migrant centres, settings which are likely to see increased pressures due to the effects of climate change.

The MedShr platform is uniquely placed to reach doctors and HCPs both in the global south and in higher income countries, engaging clinicians in the emerging challenges of climate health and helping them to develop the knowledge and skills they will need to care for their patients.

For further information, press enquires or to arrange an interview please contact:

Janis Pereira Chief Engagement Officer, MedShr  
E-mail: [janis.pereira@medshr.net](mailto:janis.pereira@medshr.net)  
Tel: +44 7816 749340

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MedShr Ltd, Palliser House, Palliser Road, London, W14 9EB

# **Climate Health:** the impact of climate change on doctors and healthcare professionals

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**“A ruined planet cannot sustain human lives in good health.  
A healthy planet and healthy people are two sides of the same coin.”**  
**Dr. Margaret Chan, Executive Director of the World Health Organization**

This white paper addresses the effects of climate change on health and their impact on the needs of healthcare professionals to deliver effective care.

## 1. Summary

Populations around the world are already experiencing the impact of climate change through extreme weather events, flooding and heat. This is leading to major changes to healthcare demand and to the skills required by healthcare professionals (HCPs). The recent COP28 meeting reinforced global agreement for an urgent need to limit greenhouse gas emissions and accelerate moves to carbon neutrality, to avoid catastrophic and irreversible effects from climate change.

There is an emerging need to engage and educate HCPs around the effects of climate change and the demands that will be placed on them. We need to work collaboratively to ensure doctors and other HCPs have the knowledge and skills they need to care for their patients and the populations they serve.

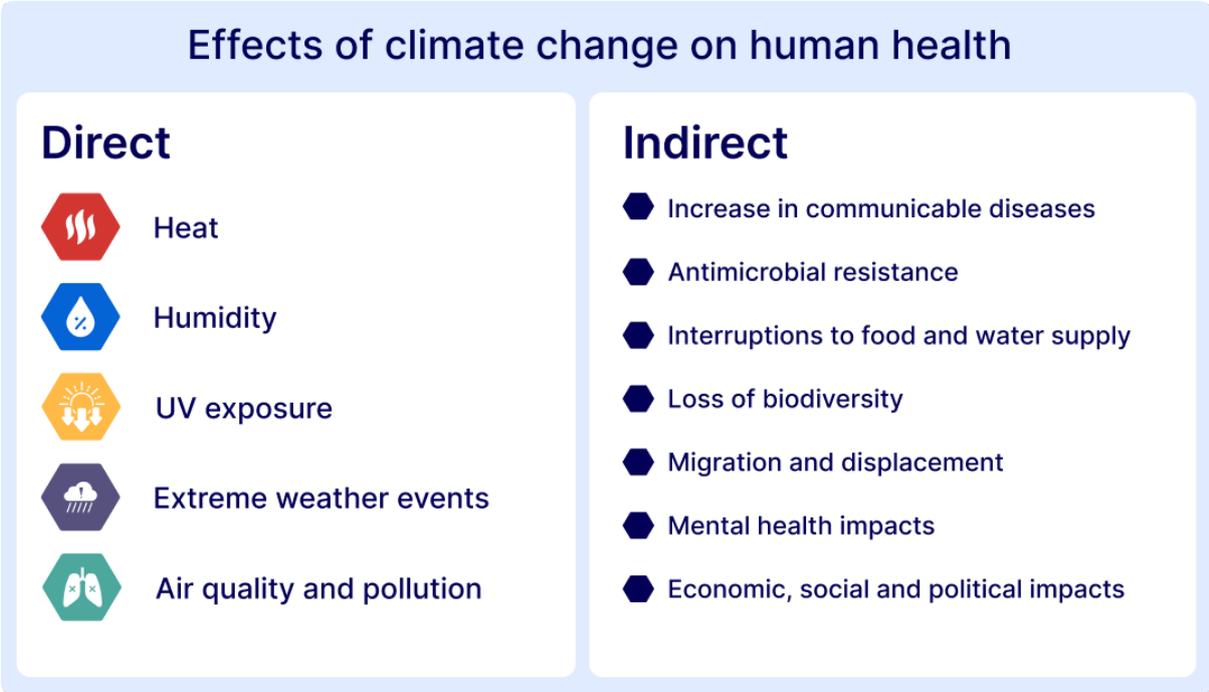


Figure 1. Effects of climate change on human health

## 2. Introduction

Climate change poses significant challenges to health and to the work of HCPs. A changing global climate impacts populations in multiple ways, with the effects often felt more keenly in parts of the world with higher healthcare demand and limited resources.

The impacts on human health are both direct and indirect, entangling with one another into a complex web of interdependencies. Assessing the impact of climate on our health is therefore challenging yet vital.

As HCPs, our lives are impacted along with the patients we care for and the communities in which we live. We need to develop new knowledge and skills so that we can respond and adapt to new and growing demands on our practice. We also need to face the growing challenges of deployment and addressing the healthcare needs of underserved communities, many of whom are facing the most significant effects of climate change.

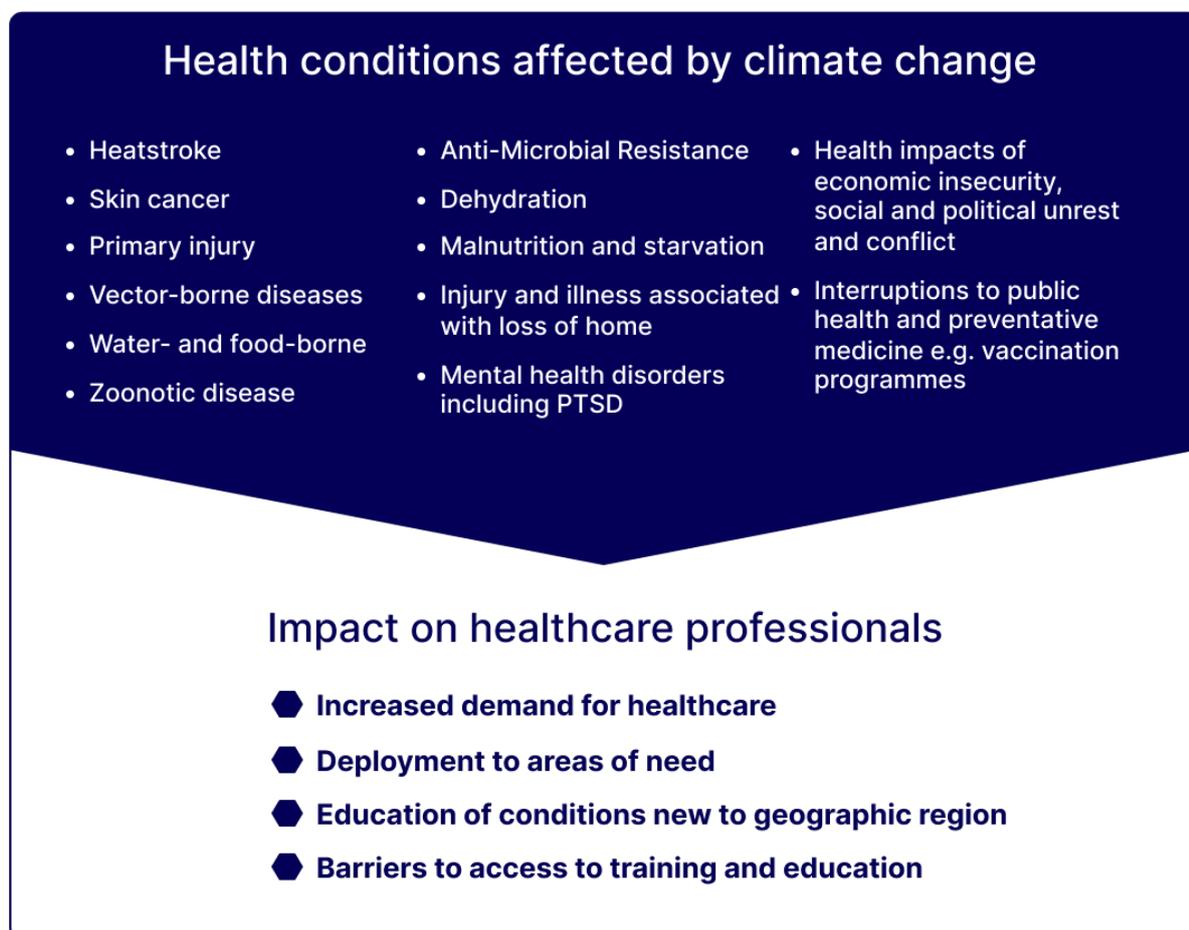


Figure 2. Health conditions affected by climate change.

### 3. Assessing the impact of climate change on health

Increasing temperatures, changing humidity levels and extreme weather events such as storms, floods and wildfires have disparate impacts on the human body and on the health of populations. In turn this impacts delivery of healthcare – creating new demands and challenges as to where, when and how it is delivered.<sup>1</sup>

Climate is a vast topic and the potential impacts on health are extensive. To evaluate the impact of climate change on HCPs, we first consider here some of the most potentially impactful effects. These are categorised as direct or indirect effects of climate change, whilst recognising that interrelations between these make this division imperfect.

### 4. Direct effects of climate change on health

#### 4.1. The effects of heat

Climate change driven by human activities is associated with increases in atmospheric temperatures and increasing frequency and intensity of heatwaves.<sup>2</sup> Exposure to high temperatures has widespread effects on the human body. Dissipation of heat becomes more difficult<sup>3</sup> and the usual processes of thermoregulation may eventually fail, resulting in heat stroke, injury to tissues and organs and in the most severe cases, mortality.<sup>4</sup>

Multiple examples of the impact of high temperatures are found in the literature. For example, heatwaves and exposure to high temperatures have been shown to be associated with increased risk of morbidity and mortality to a range of conditions including cardiovascular disease<sup>5</sup>, maternal health and neonatal outcomes.<sup>6</sup> Analysis of data from the United States between 2008 and 2017 showed extreme heat to be associated with higher all-cause mortality in adults.<sup>7</sup> High temperatures in Europe in the summer of 2022 are estimated to have led to over 60,000 heat-related deaths.<sup>8</sup>

Young children and the elderly are particularly at risk,<sup>4</sup> as are pregnant women<sup>3</sup> and people with pre-existing health conditions.<sup>9</sup> People working outside in high temperatures, especially over sustained periods, can also be at grave risk.<sup>10</sup> Lower income countries may be especially vulnerable due to reduced capacity to adapt to high temperatures (for example through adaptation to homes and work spaces such as installation of air conditioning).<sup>11</sup>

#### 4.2. Humidity and heat in combination

In addition to absolute temperature, the ability of the human body to thermoregulate is directly impacted by humidity levels. As humidity levels increase, the physiological process of sweating becomes less effective and the temperature at which the human body is able to sustain thermoregulation decreases.

The combination of heat and humidity is increasingly being recognised as an important measure of health risk<sup>12</sup> as well as indicating the threshold for survivability.<sup>13,14</sup> It can be measured through the 'wet bulb' temperature.<sup>13,14</sup> This is based on the temperature of a thermometer bulb that is covered in a saturated material – at its simplest, a wet cloth.<sup>13</sup> Under typical conditions, moisture evaporates from the wet cloth and cools the

thermometer. As humidity increases, evaporation is reduced. At 100% humidity, moisture cannot evaporate and the wet bulb temperature is equal to the air temperature.

A wet-bulb temperature of 35°C has been considered as the theoretical limit of physiological survival.<sup>13,14</sup> However, as this limit is based on a person in full health, in full shade and having unlimited drinking water whilst being completely inactive, in practice a lower wet-bulb temperature may represent a threat to life.<sup>14</sup> Whilst research into the theoretical limit of survival continues, it is of note that breaches of a wet-bulb temperature of 35°C have already been recorded with more widespread incidences predicted.<sup>15,16</sup>

### 4.3. The effects of UV exposure

Rates of skin cancer have increased globally in recent decades, with exposure to ultraviolet radiation recognised as the most important risk factor.<sup>17</sup> Although human behaviour is an important factor, including travel patterns and use of sunscreen, warmer temperatures and more frequent heatwaves as a result of climate change are likely to have increased overall exposure.<sup>18</sup>

### 4.4. Extreme weather events

As well as heatwaves, climate change is associated with an increased risk of extreme weather events including storms, floods, droughts and wildfires. Such events can have widespread effects and a direct impact on human health through primary injury or death. Over the longer-term, exacerbation of pre-existing conditions, mental health impacts including post-traumatic stress disorder (PTSD) and interruption to normal healthcare provision can lead to further morbidity and mortality. The scale and nature of impact varies regionally and a full review is outside the scope of this paper. As an example and for context, the US Government's National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information has reported that between 2016 and 2022, there were 122 events in the USA incurring a cost of at least \$1 billion including storms, wildfires, droughts, flooding, tornadoes and cyclones. In addition to the estimated \$1 trillion in damage, together these events resulted in at least 5,000 deaths.<sup>19</sup>

### 4.5. Air quality and pollution

The subject of air quality is an example of the interlinking between climate change impacts with widespread health effects, including an increased risk of respiratory and allergic disease. The WHO estimates that 99% of the entire global population breathes air that exceeds its air quality limits.<sup>20</sup> The burning of fossil fuels is the most significant contributory factor to climate change as well as the most significant direct cause of air pollution.<sup>21</sup>

Climate change has increased the frequency and severity of weather conditions that are conducive to outbreaks of wildfires.<sup>22</sup> Wildfires have an immediate and direct effect on the quality of air breathed by those in the vicinity as well as those further away. For example in 2023, wildfires in Canada burned more hectares of land than had ever been recorded in a single year.<sup>23</sup> The visible impact on air quality across the US was widely reported.<sup>24</sup> Data from the US Centers for Disease Control showed days with wildfire smoke were associated with a 17% increase in asthma-associated emergency department visits across the US.<sup>25</sup>

## 5. Indirect effects of climate change on health

### 5.1. Communicable diseases

Climate change affects multiple ecosystems and can lead to the proliferation of numerous infectious diseases.

#### Vector-borne diseases

Local and global climactic conditions have a direct effect on vectors (such as mosquitoes and ticks) and therefore the risks associated with vector-borne diseases. Changes in geographic distribution of vectors could lead to diseases that are commonly assumed to be 'tropical' in nature emerging in new locations. The protozoan parasite *Plasmodium falciparum* is the most common cause of malaria. Warm temperatures, humidity above 60% and pools of water, such as those left after heavy rainfall or flooding, provide ideal environments for the proliferation of *Anopheles* mosquitoes, the principal vector transmitting the parasite.<sup>26</sup> A clear example of this was seen following flooding in Pakistan in 2022, where cases increased significantly (see case study). Although much progress has been made in reducing the global burden of malaria,<sup>27</sup> climate change could create further opportunities for the proliferation of this disease in future years.

Other mosquito-borne diseases could also be seen with increasing frequency in new locations. In parts of Southern Europe, conditions could become more suitable for proliferation of diseases such as dengue and chikungunya, which are currently uncommon outside tropical and sub-tropical regions. Outbreaks of West Nile Virus have been reported in the US and in Europe.<sup>28</sup> Tick-borne diseases such as Lyme's disease have already been seen in increasing numbers in Europe, the US and Canada.<sup>28</sup> Whilst the causation of outbreaks is often multifactorial, climactic conditions play a crucial role in creating conditions conducive to disease spread.

#### Water- and food-borne diseases

Heavy rainfall and flooding create ideal conditions for the spread of water-borne diseases. Extreme weather events can also cause damage to water infrastructure, including water supply and sewage systems. It is not just weather that leads to inadequate sanitation, but climate change has the propensity to make already challenging situations worse.

One example is in the increased incidence of cholera, a bacterial disease transmitted through ingestion of contaminated water or food that causes acute and severe watery diarrhoea. Despite being preventable and treatable, the number of countries experiencing outbreaks of cholera increased in 2022 and 2023.<sup>29</sup> Outbreaks of cholera are associated not just with flooding but also with drought.<sup>30</sup>

As another example, warmer temperatures, high rainfall and humidity also provide ideal conditions for growth of *Leptospira* bacteria, the strain responsible for Leptospirosis (or Weil's disease) which can cause serious illness. Exposure to contaminated water can occur after both flooding and during drought, from use of contaminated water in agriculture or activities such as swimming.<sup>31</sup>

The effects of climate on food-borne disease are complex. Bacterial infections such as *Salmonella* may be directly affected by warmer weather supporting their proliferation. But the links between weather and our food supplies have many more complexities. Changing farming practices, such as keeping livestock indoors during periods of extreme heat or through choice of fertilisers, can present opportunities for pathogens to survive.

### Antimicrobial resistance (AMR)

Resistance to antimicrobial drugs is a substantial issue for all countries of the world. It is estimated that AMR contributed to almost 5 million deaths in 2019.<sup>32</sup> Further development and spread of AMR could not only hinder treatment of infectious disease, but also threaten the outcomes of surgery, childbirth and chemotherapy for cancer.

Overuse and misuse of antimicrobial agents in humans and animals as well as plants drives the development of resistant pathogens. Warm and humid conditions provide ideal environments for bacteria and other pathogens to flourish. Climate change could therefore drive increased demand for the use of antimicrobial agents. As described earlier, events linked to climate change have already driven increases in vector-, water- and food-borne diseases and this trend is predicted to continue. This is likely to lead to greater use of antimicrobial medicines,<sup>33</sup> creating more selection pressure favouring drug-resistant genotypes.

The threat of antimicrobial resistance and the link to climate change can be illustrated by considering malaria. The WHO currently recommends artemisinin combination therapy (ACT) for treatment of *Plasmodium falciparum* malaria, the most common form of malarial disease. Whilst ACT is currently generally effective, cases of resistance to the artemisinin component of therapy have been detected in South-East Asia and in Africa.<sup>27</sup> Should resistance become more widespread, efforts to tackle the global burden of malaria morbidity and mortality could be greatly impacted. As described previously, flooding led to a surge of cases of malaria in Pakistan. Rapid and accurate diagnosis and adherence to treatment regimens are key factors in limiting drug pressure and therefore development of resistance. This is much harder in the aftermath of an extreme weather event such as flooding.

Increasing pressure on crops and livestock due to climate change may also encourage increased use of antibiotics, with antibiotics in agriculture and aquaculture already recognised as significant contributors to antibiotic resistance.<sup>33</sup> Widespread antimicrobial resistance could in turn have a negative impact on productivity,<sup>34</sup> further encouraging greater use of antibiotics.

### Water and food supply

From a health perspective, inadequate water supply can lead to dehydration and death, with the risks significantly greater during heatwaves. Extreme weather events can cause damage to water supply and sewage systems. This increases risks of contamination and spread of water-borne disease as described above.

Adequate nutrition is a crucial determinant of good health. Shortages of certain food items can increase the chance of malnutrition and in the most severe circumstances, starvation. Although food security is a complex phenomenon with many contributory

factors, climate change plays a part in multiple ways through both direct and indirect effects.

The availability of food is fundamentally affected by climactic conditions. A changing climate plus extreme weather events such as drought and flooding can have a direct impact on food supply by limiting yields from both land and sea. Warmer weather may support increased growth of some crops in some locations, whilst hindering others.<sup>35</sup> Both outcomes can result in disruption as farming practices take time to adapt.

Many communities around the world rely in the ocean as a primary source of nutrition. As sea temperatures and acidity change, the prevalence and distribution of species is also changing,<sup>36</sup> impacting both nutrition and economies of affected populations.<sup>37,38</sup>

Food security depends on adequate supply and reliable supply chains. Interruptions can occur at any stage. For example, the Mississippi river in the USA is a key route for transport of numerous food crops. In recent years, both droughts and floods have limited transport along the river with a resultant impact on food prices.<sup>39</sup>

The effects of food insecurity vary by region. In some Pacific islands, reduced food security has resulted in increased consumption of processed food items, which in turn has been linked to an increase in obesity and associated health conditions.<sup>37</sup>

The health of planetary ecosystems from which all our food is derived is dependent on the biodiversity within them. A loss of biodiversity can be both a cause and effect of climate change. Ecosystems play a key role in limiting atmospheric carbon dioxide by acting as carbon sinks. As well as threatening food supply, loss of biodiversity within these ecosystems threatens their capacity to function in this way.<sup>40</sup>

## Migration and displacement

Climate change is both encouraging and enforcing migration and displacement of people. Whereas changing local climates may encourage some people with choice to seek more favourable climate conditions elsewhere, forced displacement following extreme weather events may incur movement of large numbers of people over short timeframes.

It is estimated that in 2022 there were 60.9 million internal displacements, referring to forced movement of a person within the borders of their own country. Of these, 32.6 million (53%) were due to natural disasters, more than the 28.3 million displaced due to conflict and violence. Of those displaced due to disasters, 98% were weather-related with the majority due to floods (19.2 million).<sup>41</sup>

Such events can have significant health impacts on individuals and communities. Loss of home and damage to infrastructure can cause significant physical and mental stress, impair delivery of healthcare services and lead to issues with food security. Suboptimal living conditions due to mass movement of people can also create conditions conducive to the spread of multiple communicable diseases.<sup>42</sup>

An example of the interlinking between the effects of climate change is illustrated by zoonoses, referring to diseases that can infect both humans and other animal species. Zoonotic diseases can be vector-, water- or food-borne or airborne.<sup>43</sup> Some of the effects of climate change on the incidence of diseases such as cholera and malaria have

been discussed above. Another mechanism by which zoonotic diseases can increase is through movement of people.<sup>44</sup> This can bring human populations into situations of closer proximity to animal populations, making transmission from animal species to humans more likely.

### Mental health impacts

With such multifactorial physical impacts, it would be remiss not to recognise the strain climate change can place on mental health and wellbeing. Injury, disease, displacement, food insecurity and loss as a result of rising temperatures, heatwaves and other extreme weather events can have a profound impact on mental health.<sup>45</sup> Though poor mental health has many causative factors, both the health and economic costs will need further evaluation and response as our climate continues to change.

### Economic, social and political impacts

Climate change can have multiple effects on a society and its structure, which in turn impacts the health of its population. As our societies adjust to new conditions and challenges, politics and policies can be impacted. Many regions of the world are facing challenges in dealing with migration. In countries most affected by climate change, scarcity of resources can trigger violence and conflict.

The economic health of a nation is inextricably linked to the physical health of its people.<sup>46</sup> Climate change creates economic impacts and in turn, economic costs can affect health outcomes as well as a society's ability to pay for healthcare. The costs of damage caused by extreme weather events may be borne at both individual and societal levels.

For an individual, the loss of personal and financial security following an extreme weather event can lead to poor health outcomes and lack of ability to pay for treatment. An example at a community level is illustrated by recent drought in the Amazon basin in the Autumn of 2023. Low water levels hindered the movement of large boats, affecting transport of people and goods and causing disruption to local economies.<sup>47</sup> The Federal Reserve Bank of Texas estimates that the summer heatwaves in 2023 may have reduced annual nominal GDP growth by as much as 1%, equivalent to \$24 billion.<sup>48</sup> Though these specific events have additional causative factors in terms of likelihood and damage incurred, predictions for increasing frequency of extreme weather events predict higher costs in the future.

## 6. The impact of climate change on healthcare professionals

**Climate change is creating new and changing healthcare needs<sup>1,46</sup> and affecting the practice of HCPs around the world. In order to adapt and respond appropriately, HCPs will need new knowledge, skills and resources. A key means to achieve this is through the democratisation of medical education. This means efficiently educating, upskilling and empowering HCPs globally.**

## 6.1. Identifying and addressing the educational gap

The impact of climate change on health is not a standard topic in medical school curricula<sup>49,50</sup> or in continuing medical education. Although some progress has been made in this area, there is a significant educational gap extending from medical students through to experienced physicians across all clinical specialties. This gap needs to be addressed through not only through changes to the curriculum, but also through continuing medical education for those who have already graduated.<sup>51</sup> This education must enable HCPs to develop the relevant skills needed to address the changing needs of their population, as well as contribute to the necessary healthcare system and service changes. This educational gap extends from public health physicians across all clinical specialties.

At a practical level, education and knowledge is needed for health conditions that previously may have been rare or almost unheard of in a region – from heat stress in Norway<sup>8,52</sup> to dengue in France.<sup>53,54</sup> Other conditions are seeing a sharp uptake in incidence which may require additional resourcing and upskilling, for example skin cancer.<sup>17,18</sup> Education on risk can help identify the most vulnerable during acute events such as heatwaves and over the longer term, for example those most likely to suffer respiratory disease due to long-term exposure to pollution.

Climate change is having significant impacts on migration and displacement. The education needed to care for and treat climate migrants also needs consideration<sup>51</sup> so that the skills of the healthcare workforce are aligned with the needs of their patients.

## 6.2. Information sharing

Doctors have a long history of peer-to-peer learning<sup>55,56</sup> through discussing clinical cases and sharing their experiences, especially on topics where published evidence and guidelines are lacking. In our online world, HCPs across the global medical community can be reached on a smartphone and cases shared from any location almost instantly. As a community, HCPs can learn from colleagues in remote or understaffed corners of the world and in turn, share information with them that may be helpful in treating conditions with which they may be unfamiliar. Information sharing networks also serve as crucial early warning systems, particularly for infectious diseases as well as in relation to natural disasters such as floods, droughts and storms.

## 6.3. Access to training and learning

Access to training and education is often challenging, particular in countries where resources are stretched and postgraduate medical education is limited or fragmented. These are also often locations where populations are most at risk from poor health outcomes, not least due to climate change<sup>37</sup> and with a background of low numbers of doctors and other HCPs. National and international medical congresses are a key method of learning and sharing information, but travel to such events comes at a cost that is not always affordable.

Remote learning and working increased dramatically through necessity during the COVID-19 pandemic. Although there has been a significant return to in-person learning,

the opportunities for remote working remain. Indeed, many international medical congresses now operate on a hybrid in-person and online format. The global healthcare workforce is knowledgeable and generally comfortable learning online. The vast collective experience of working and learning digitally has helped elucidate what processes work best. Online learning presents an opportunity to democratise access to medical education. Even where hospitals and healthcare providers lack computers and internet connections, individual HCPs can use their own devices and mobile internet to access learning. There is also scope to offer downloadable and offline digital content where connections are less reliable.

## 6.4. Deployment

Climate change is affecting where people can live and leading to significant population shifts, which in turn influences where doctors and other HCPs are required to live and work. More focus is needed on how to sustain provision of expertise in areas that are becoming increasingly difficult to inhabit, as well as deploying and training staff in response to emergencies such as extreme weather events and to support migrating and displaced people.

Some regions of the world are facing particularly stark risks from climate change. Rising sea levels pose an existential threat to the communities living on some Pacific islands.<sup>37,57</sup> In sub-Saharan Africa, communities have experienced floods and droughts, affecting food harvest and the spread of vector-borne and water-borne disease.<sup>30</sup> Many of these locations already have a shortage of doctors. According to the latest available figures, there are 0.66 medical doctors per 10,000 people in the Central African Republic and 1.58 per 10,000 in Vanuatu. In contrast, the figures for the United States and Switzerland are 35.55 and 44.43, respectively.<sup>58</sup> As well as trying to train and retain more doctors, those countries must also support extended roles for nurses and other HCPs as well as educating community health workers.

Climate change is likely to make a difficult situation worse. Our changing climate is affecting where people live – through choice or necessity – with expectations that more people will be affected in future years. In some regions at very high risk from climate change, many doctors already train overseas. Extreme weather events combined with a lack of resources at home may reduce their incentives to return.<sup>37,57</sup> These effects can also be seen within regions. In Australia, the Northern Territory already has low numbers of doctors. The extreme temperatures are already encouraging some of those to leave, whilst intensifying the health needs of the local population.<sup>59</sup>

As well as long-term staffing concerns, extreme weather events create immediate needs for healthcare resourcing. Such demands can be met both by deployment and training. In a crisis, practical skills are invaluable. In the US, following wildfires in 2020, booster courses were implemented for those treating burns, smoke and other injuries from heat.<sup>51</sup> Ideally, such training should take place in advance of events following identification of at-risk areas. Our climate does not always allow such forward-planning opportunities. Limits to the ability to deploy HCPs in adequate numbers to all areas where they are needed means that consideration should also be given to equipping non-professional HCPs with life-saving skills.

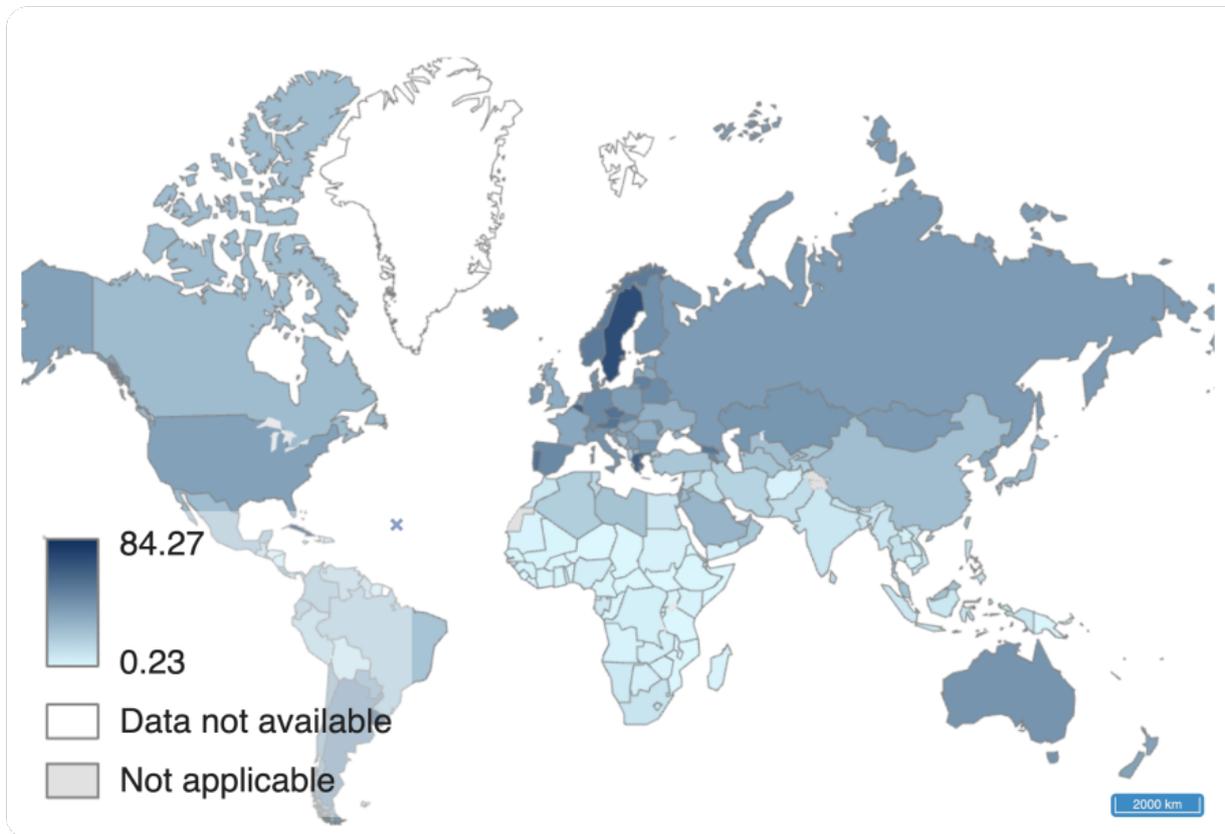


Figure 3. Medical doctors per 10,000 population<sup>58</sup>

### 6.5. Cost burden on healthcare and the relevance of geography

As the previous examples have shown, the interplay between geography and economy means the impact of climate change is not felt equally by all. There is also huge variability in the resilience of existing healthcare systems in dealing with both acute and long-term stresses.

Climate change increases the costs of providing healthcare; through dealing with morbidity and mortality from extreme weather events or rising temperatures, funding new deployments and providing appropriate training and retraining. The ability of governments to react in the short term to extreme weather events, as well as put in place mitigation against future events, varies enormously. For example, it is estimated that the United States spent over \$110 billion<sup>60</sup> in response to hurricane Katrina – more than the entire annual GDP of Angola.<sup>61</sup>

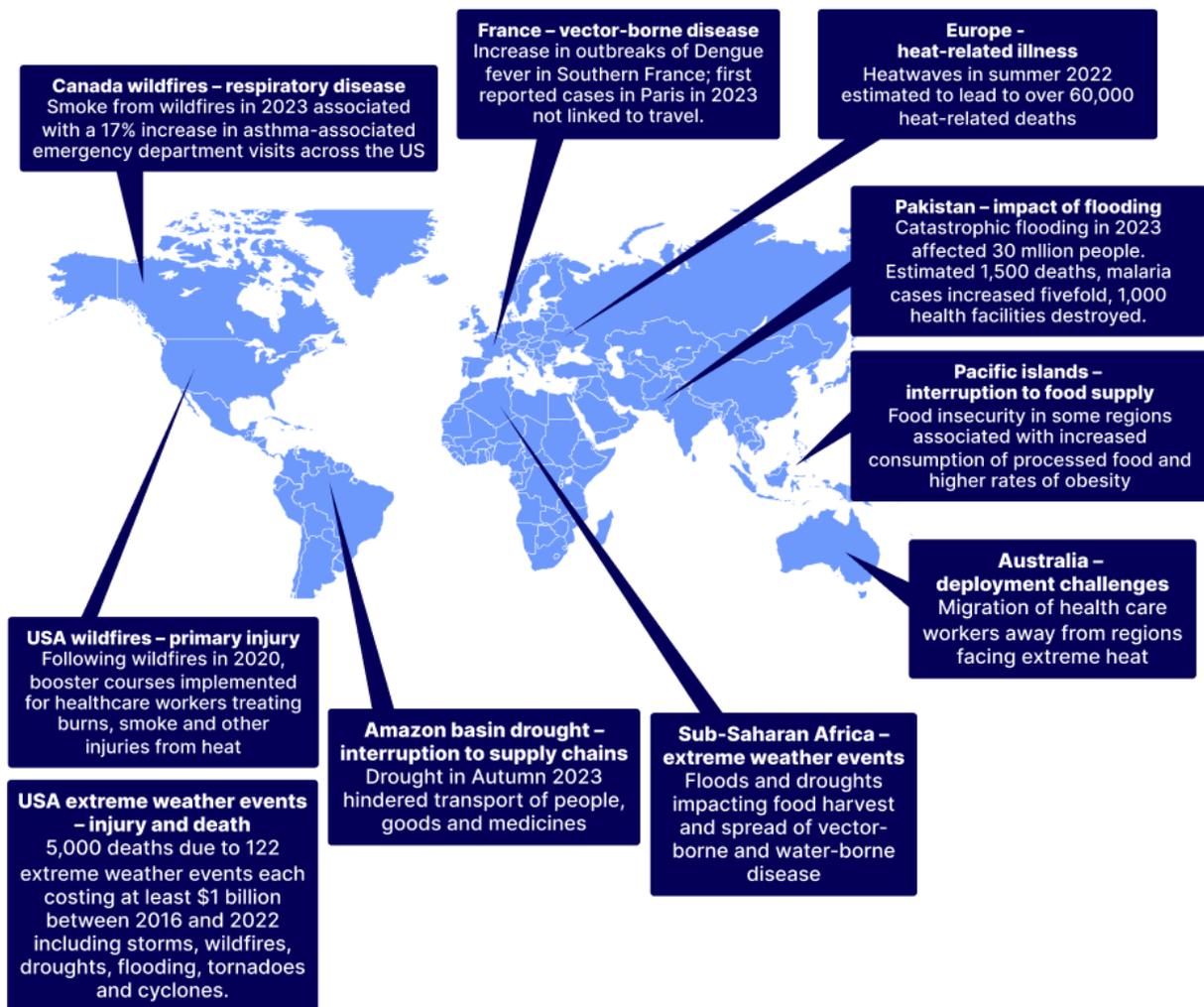


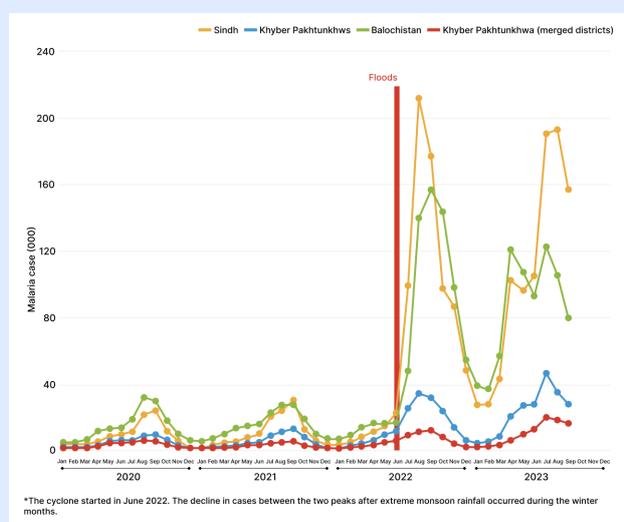
Figure 4. Global examples of the impact of climate change on health care workers.

## 7. Case study: the health effects of flooding in Pakistan

The multi-dimensional impacts of climate change on HCPs were demonstrated by floods in Pakistan in 2022. This put significant pressure on healthcare workers in the region, serving as a test of skills and capabilities and deployment to a region in need.

Extremely high levels of monsoon rainfall between June and August led to extensive and catastrophic flooding. It is estimated that over 30 million people were affected and nearly 1,500 people lost their lives.<sup>62</sup> In an attribution study, modelling suggested that climate change increased the rainfall intensity by up to 50%.<sup>62</sup>

The flooding caused direct impacts on health, including traumatic injuries and loss of life. Locally-based healthcare workers and their families were impacted alongside the patients they care for.



Disruption to the availability of basic needs of water, food and shelter led to dehydration, food shortages and malnutrition and interruptions to sanitation.<sup>63</sup> An estimated 1.7 million homes were destroyed<sup>62</sup> and the education and livelihoods of millions were impacted.

The aftermath of the flooding saw an increase in waterborne diseases including cholera and dysentery<sup>64</sup> as well as 2.1 million cases of malaria – a fivefold<sup>27</sup> increase compared to 2021.<sup>27</sup> The impact also reached neighbouring countries, with Iran experiencing an outbreak of

Figure 5. Reported malaria cases in Pakistan 2020-2023<sup>27</sup>

indigenous malaria cases following five years without local transmission. A significant proportion of these cases were considered to be imported from Pakistan following the flooding.<sup>27</sup> The physical damage caused by the floods severely impacted the capabilities of healthcare delivery, with over 1,000 health facilities destroyed and damage to over 6,000 km of roads. Disease prevention programmes were also interrupted, further increasing community healthcare needs.

The effects of the floods were exacerbated by regional vulnerabilities including poverty and socioeconomic factors, political and economic instability and features of the human settlements and infrastructure. The flooding serves as a real-life example of the impacts of an extreme weather event on human health, on healthcare and the interplay between events and effects in both the short and long term.

By the nature of the events, many of the figures collated to understand the scale of the impact of the floods are estimates and are incomplete. It is also important to consider that statistics on health impacts are built from the experiences of individuals. Whilst this can be quantified in numbers, consideration should also be given to the lived and personal experience of those affected.

## 8. Case study: developing knowledge of health conditions new to Paris

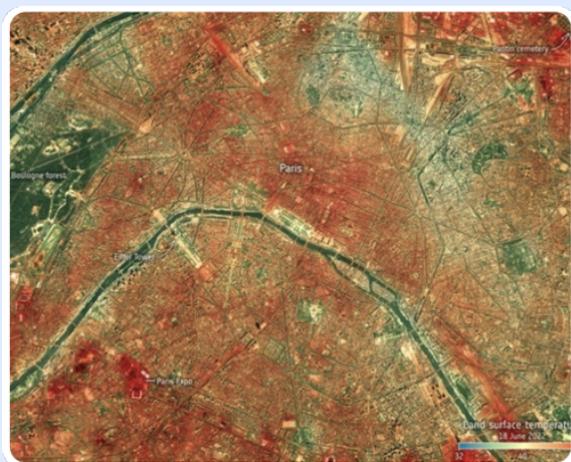
The impact of climate change on health and healthcare workers is being experienced across Europe in multiple ways. In Paris, two health conditions serve as examples of new knowledge required by healthcare workers in the area:

### Recognising dengue fever in Paris

Dengue fever is a mosquito-borne viral infection that is typically considered a tropical disease. In recent years it has been seen with increasing frequency in southern Europe, increasingly not associated with travel to endemic areas, but not usually as far north as Paris. Increased international travel combined with more stable mosquito populations, facilitated in part by climate change, is thought to be increasing the risk of dengue.<sup>27,65</sup>

Whilst case numbers remain low, early warning signs suggest that these risks could be realised to a greater extent in the future. Between May and October 2022, Southern France saw 65 autochthonous cases of dengue (i.e. of local origin rather than imported) – greater than the total of 48 cases observed between 2010 and 2021. The cases were from nine events and in seven of these, the primary imported case was not identified. There were also 217 imported cases which was a similar figure to the previous year.<sup>54</sup> In a more recent case report, three cases of dengue were reported in the Paris area in September and October 2023 in patients who had no relevant recent travel history.<sup>53</sup>

Physicians working in Paris would not normally expect to see dengue fever and suspicion as a cause would likely be low outside of endemic regions. The case reports and data from France emphasise the need for communication and education regarding these risks, enabling treating physicians to be alerted to new possible causes of disease in their locality. Identification of cases also forms part of the surveillance process that in turn will enable healthcare to better react to changing patterns of disease.



### Urban heat islands in Paris

Cities around the world are dealing with an increasing number of days each year of high temperatures. Urban areas are particularly at risk due to the 'urban heat island' effect. During a heatwave, built-up areas with more hard surfaces such as roads, pavements and buildings absorb more heat. They also retain more heat as it dissipates more slowly. Nearby areas with more trees, grass and other plants remain cooler. Within a city the differences can be stark, as shown in the image below captured in Paris during a heatwave in 2022 which shows differences in land-surface temperature between areas of more than 10°C.<sup>66</sup>

Figure 6. Land-surface temperature in Paris on 18 July 2022<sup>66</sup>

The impact can be particularly important at night. A fall in night-time temperatures normally gives the body a reprieve and an opportunity to cool. In France there were nearly 15,000 additional deaths due to heatwaves in the summer of 2003.<sup>67</sup> A study of people who passed away during that time in Paris compared the risk of those living in the city with those living in a nearby suburban area. The study found that mortality risk was significantly associated with higher minimum daytime temperatures and higher minimum night-time temperatures, both of which were higher in the city area.<sup>67</sup> From an HCP's point of view, there is a need to identify patients most at risk of extreme heat, whether due to age, co-morbidities or their home environment including its location.

## 9. Conclusion

Our lived environment has a fundamental effect on our health. Our climate is changing and as HCPs, we need to consider the impact this will have on ourselves, our patients and our work.

There are already immense challenges in global health, not least from infectious diseases, migration and conflict. Climate change will both introduce new challenges and make many existing ones worse. Through our knowledge, our experience and our behaviour we will need to adapt our own practices as well as support change elsewhere.

Too often debates about climate change have become overly partisan, driving divisions that can become unhelpful. Though the medical profession is clearly not immune to such divides,<sup>51</sup> we have an opportunity to lead by example. As far as is possible, medical education programmes should set aside rhetoric and focus on using the best evidence we have available to guide our decisions,<sup>68</sup> just as we employ the principles of evidence-based medicine in our everyday practice.

A parallel can be seen with smoking. In the 1960s, data began to emerge on the effects of smoking on health. Whilst our understanding of the effects of smoking on health continues to grow in depth and breadth, that smoking affects health is now considered an indisputable fact. The effects of smoking reach many parts of the medical school curriculum,<sup>69</sup> not least public health. The subject of climate change and health also needs to become part of the collective consciousness of the medical profession as well as the general public. This process begins with education and training.

We also need to consider the contribution the actions and processes of our own profession make to the processes driving climate change. In the UK, the NHS has become the world's first health service to commit to reaching carbon net zero through its *Greener NHS* programme.<sup>70</sup> This is encouraging progress but far more remains to be done. This is an important topic and will be discussed in more detail in a future paper.

Population health is inextricably linked to planetary health. As healthcare professionals, we are ideally placed to witness, understand and communicate the effect that our changing climate is having on our health. Education and sharing of knowledge on this topic are vital. There is an urgent need to galvanise governments, healthcare providers and medical organisations to respond to climate change.

## 11. Call to action

We call on the global healthcare community respond to Climate Health with three essential actions:

- 1 Engage** doctors and HCPs to improve understanding of the effects of climate change on the patients and public they care for.
- 2 Support** doctors and HCPs through education to develop the knowledge they require to respond to evolving healthcare demands due to climate change.
- 3 Empower** doctors and HCPs to share their knowledge and skills to democratise medical education and improve patient care.



**Dr Asif Qasim.**  
Founder and CEO



**Anya Parkhouse**  
Senior Medical Writer



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*“Climate change is intrinsically linked to public health, food and water security, migration, peace, and security. It is a moral issue. It is an issue of social justice, human rights and fundamental ethics. We have a profound responsibility to the fragile web of life on this Earth, and to this generation and those that will follow.”*

**General Ban Ki-moon**  
United Nations Secretary

*“Widespread scientific consensus exists that the world’s climate is changing. Some of these changes will likely include more variable weather, heat waves, heavy precipitation events, flooding, droughts, more intense storms, sea level rise, and air pollution. Each of these impacts could negatively affect public health.”*

**The U.S. Centers for Disease Control and Prevention.**

*“In addressing climate change by reducing emissions, we are preventing the worsening of health conditions around the world, and ... by improving so many different conditions that can be improved through climate measures – such as improving food and water, food security and water safety – we are actually improving health conditions.”*

**Christiana Figueres**  
Former Executive Secretary of the United Nations Framework Convention on Climate Change

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