The Impacts of Climate Change on Human Health: An Alarming Fact »

Dr. Abderrahmane Djoher[1], Pr. Ait Habouche-Mihoub Ouahiba[2]
[1]Senior lecturer (Phd). Faculty of Economics, Management and Business Sciences.
University of Mohamed BENAHMED Oran2. Algeria.
LARAFIT Laboratory. CEDIMES.
Mail: djoher.abderrahmane@gmail.com
[2] Professor; Faculty of Economics, Management and Business Sciences.
University of Mohamed BENAHMED Oran2. Algeria. LARAFIT Laboratory.
Mail: wmihoub12@gmail.com.

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Abstract:
In recent years, climate change has impacted on health in many ways, including deaths and illness from increasingly frequent extreme weather events such as heat waves, storms and floods, disruption of food systems, increases in zoonoses, food-borne, water-borne and vector-borne diseases, and mental health problems. The aim of this work is to shed light on climate change, its impacts and consequences on human health. In addition, current climate change compromises many of the social determinants of good human health, such as livelihoods equality and access to healthcare and social support structures, and so on.
Keywords: climate change, human health, health crises, environmental crises, epidemics, heatwave.
Résumé :
Ces dernières années, le changement climatique a des répercussions sur la santé de multiples façons, et entraîne notamment des décès et des maladies dus à des phénomènes météorologiques extrêmes de plus en plus fréquents, comme les vagues de chaleur, les tempêtes et les inondations, la perturbation des systèmes alimentaires, l'augmentation des zoonoses, des maladies d'origine alimentaire et à transmission hydrique ou vectorielle, ainsi que des problèmes de santé mentale. L'objectif de ce travail est de mettre la lumière sur le changement climatique, ces impacts et conséquence sur la santé humaine. De plus, le changement climatique actuel compromet de nombreux déterminants sociaux d'une bonne santé humaine, tels que les moyens de subsistance, l'égalité et l'accès aux soins de santé et aux structures de soutien social,…et autres.
Mots clés : Changement climatique, Santé humaine, crises sanitaires, crise environnementales, épidémie, canicule.

Introduction:

Climate change refers to all variations in climatic characteristics at a given location over time: warming or cooling. Certain froms of air pollution resulting from human activity can significantly alter the climate, leading to global warming. This can lead to major damage: rising sea levels, more extreme weather events (droughts, floods, cyclones, etc), destabilized forests, threat to freshwater resources, agricultural difficulties, desertification, reduced biodiversity, spread of tropical diseases, etc.

Climate change or climate disruption refers to lasting alteration in the statistical parameters of the Earth's global climate or its various regional climates. These changes may be due to external influences or to human activities[1]. Climate change represents a fundamental threat to human health. It affects the physical environment as well as all aspects of natural and human systems, including social and economic conditions and the functioning of health systems. It therefore has a multiplier effect that jeopardizes and threatens to reverse decades of progress in health.

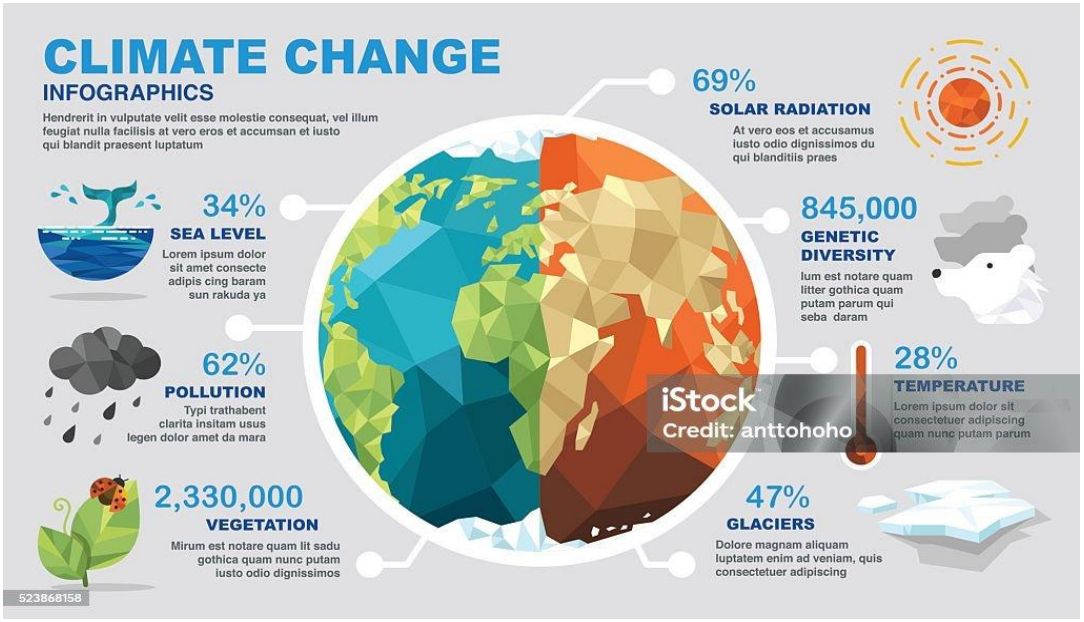

Figure 1: Climate change 2

As climate conditions change, we're seeing more frequent and intense weather and climate phenomena, including storms, extreme heat, floods, droughts and forest fires. These weather and climate hazards affect health both directly and indirectly, increasing the risk of death, non-communicable diseases, the emergence and spread of infectious diseases, and health emergencies. Climate change also has an impact on health workers and health infrastructures, and hampers the ability to achieve universal health coverage (UHC). More fundamentally, climate shocks and increasing stresses such as changing temperature and precipitation patterns, drought, flooding and sea-level rise are having a deleterious effect on the environmental and social determinants of physical and mental health. All aspects of health are affected by climate change, from air, water and soil quality to food systems and livelihoods. Further delays in global health, and contravene our collective commitments to guarantee the human right to health for all.

Indeed, the climate crisis threatens to undo the progress made over the last fifty years in development, global health and poverty reduction, and to further widen health inequalities between and within populations. It seriously threatens the achievement of universal health coverage in a number of ways, including by accentuating the existing burden of disease and exacerbating barriers to access to health services, often at a time when they are most needed. More than 930 million people (around 12% of the world's population) spend at least 10% of

[1] https://www.xpair.com/lexique/defiition/changement-climatique.htm

[2] https://www.istockphoto.com/fr/vectoriel/changement-climatique-infographies-gm523868158-92082625

their budget on healthcare. With most of the world's poorest people uninsured, health shocks and stresses already push around 100 million people into poverty every year, and the effect of climate change are only exacerbating this trend.

1- The effects of climate change on human health:

The climate is warming as a result of human activity. Massive use of fossil fuels (Coal, oil, natural gas), considerable changes in land use (deforestation, agricultural intensification, urbanization), overexploitation of living resources……all have the effect of modifying the composition of the atmosphere and reinforcing the natural greenhouse effect.

Figure 2: Climate change factors[3]

Global warming, which has been particularly marked since the 1950s, is largely the result of these man-made phenomena. It is a altering temperature and rainfall patterns, and thus the way ecosystems function. The impacts of global warming are set to continue and intensify into the 21st century, unless there is a significant reduction anthropogenic greenhouse gas emission. The consequences for the societies that live in these ecosystems, with which they have evolved over the millennia, will depend on their possibilities [4]and capacities to adapt to these environmental changes, which will be more or less significant depending on the speed and content of the mitigation and adaptation policies that are put in place.

Climate change is affecting human health in ways that are unprecedented in human evolution and history. Thermal stress, respiratory problems, allergies, bacterial and/or viral infections, skin cancers…much pathology are likely to emerge or evolve in their spatial and temporal distribution, incidence and intensity under the influence of climate change. The impacts of climate change can be direct, linked to the gradual rise in temperatures or the increased occurrence of extreme events (heat waves, droughts, floods, fires, etc.). But very often, they are indirect, acting through changes in the quality of the air we breathe, the quality of the water we absorb, or via the special and temporal evolution of pathogen viability zones (bacteria,

[3] https://www.1jour1actu.com/science-et-environnement/changement-climatique-des-solutions-existent

[4] Chantal Pacteau : Directrice de recherche au CNRS, directrice adjointe du Groupe d'intérêt scientifique « Climat, environnement, société » ; Et Sylvie Joussaume : Directrice de recherche au CNRS, directrice du Groupe d'intérêt scientifique « Climat, environnement, société ». Appréhender les impacts du changement climatique sur la santé ; P : 10 ; adsp n° 93 décembre 2015.

disease vectors, allergenic pollens). A third type of effect is linked to living conditions. In this respect, climate change can be seen as a factor in the vulnerability of populations, its effect being modulated by social conditions (malnutrition, economic inequalities, conflicts, etc.), by the state of health systems and the possibilities of access to these systems.

At present, climate change is having an impact on human health, and it remains difficult to accurately estimate the scale and impact of many climate-sensitive health risks. However, scientific progress is gradually enabling us to attribute increased morbidity and mortality to global warming, and to determine with greater precision the risks and magnitude of these health threats. These climate-sensitive health risks are disproportionately felt by the most vulnerable and disadvantaged, including women, children, ethnic minorities, poor communities, migrants or displaced people, elderly populations and people with underlying medical conditions. Climate change is the greatest threat to human health. The effects of climate change are already damaging health: air pollution, disease, extreme weather events, and forced displacement, pressure to produce or find sufficient food. Every year, environmental of disease, and extreme weather events increase the number of deaths, making it difficult for healthcare systems to keep up[5].

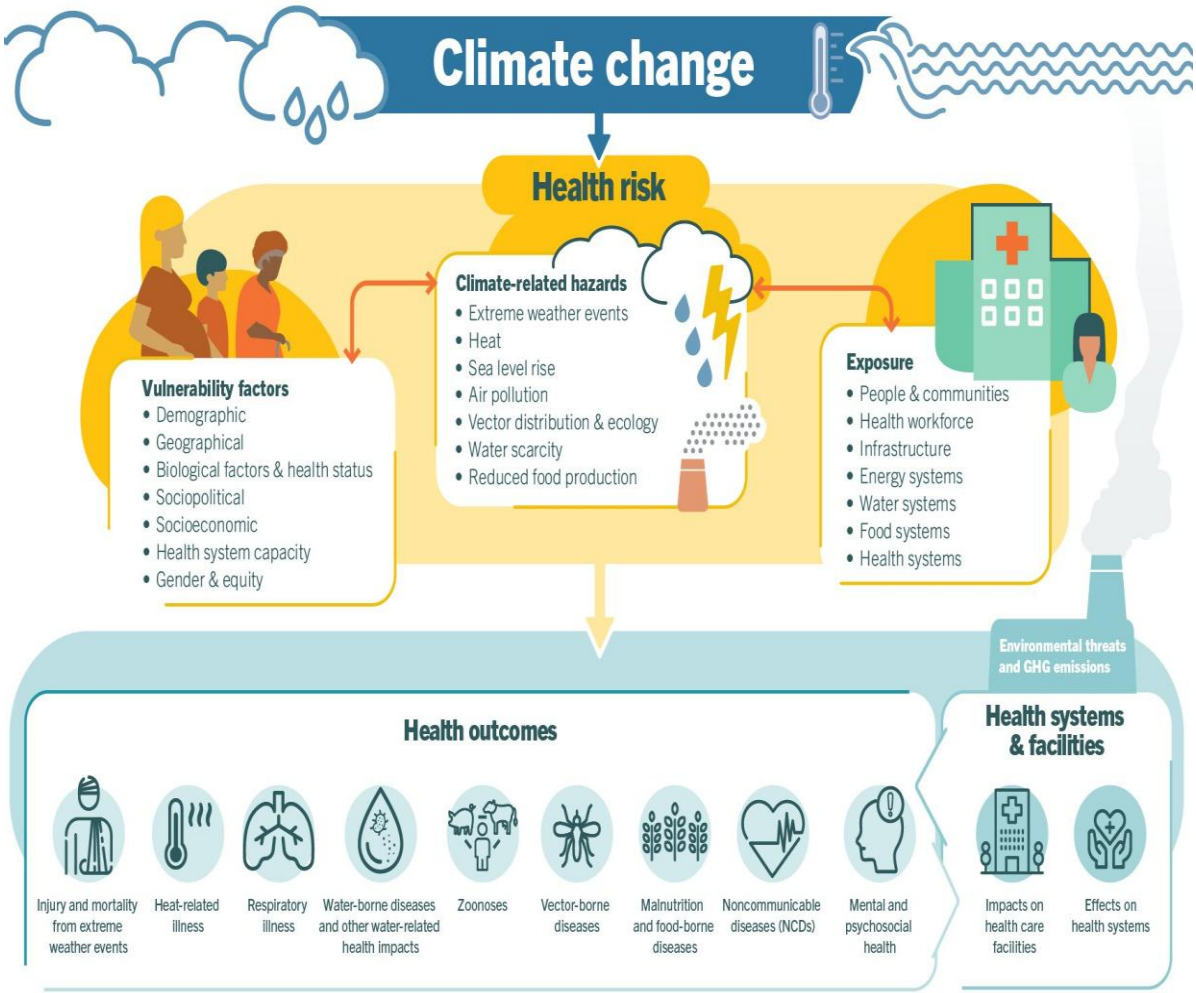

Figure 3: "Overview of climate-related health risks, exposure pathways and vulnerability factors"

[5] https://www.un.org/fr/climatechange/science/causes-effects-climate-change

Climate change has a direct and indirect impact on health, and is strongly influenced by environmental, social and public health determinants.[6] According to WHO data, 2 billion people have no access to drinking water and 600 million suffer from food-borne diseases every year, with 30% of food-borne deaths involving children under 5. Climatic stress factors increase the risk of water-borne and food-borne diseases. In 2020, 770 million people suffered from hunger, mainly in Africa and Asia. Climate change affects the availability, quality and diversity of food, exacerbating food and nutrition crises. Variations in temperature and precipitation favor the spread of vector-borne diseases. In the absence of preventive measures, the number of deaths due to these diseases, which currently stands at over 700,000 a year, is likely to rise.

Climate change induces both immediate mental health problems, such us anxiety and post-traumatic stress, and long-term disorders due to factors such as displacement and the dislocation of social cohesion. Recent research attributes 37% oh heat-related deaths to human-induce climate change. Heat-related deaths among people over 65 have risen by 70% in two decades. By 2020, 98 million more people were food insecure than the 1981-2010 average. WHO conservatively predicts an additional 250,000 annual deaths by the 2030s due to effects of climate change on diseases such as malaria and coastal flooding. However, modeling remains difficult, particularly when it comes to taking into account risks such as drought and migratory pressures.

In the short to medium term, the effects of climate change on health will be determined primarily by vulnerability of population, their resilience to the current pace of climate change, and the scale and pace of adaptation. In the longer term, the effects will increasingly depend on the extent to which transformative measure are take now to reduce emissions and avoid crossing dangerous temperature thresholds and potentially irreversible tipping points. While no one is immune to these risks, the people whose health is most affected by the climate crisis are those who contribute least to its causes and are least able to protect themselves and their families from it: people living in low-income or disadvantaged countries and communities.

2- The impact of climate change on human health:

Climate change is already a reality, the most emblematic marker of which is the rapid rise in temperatures. Many other environmental parameters are also affected: rising sea levels, frequency of certain extreme weather events, melting ice, ocean acidification,….The 2014 report by the Intergovernmental Panel on Climate Change (IPCC) notes that climate change impacts on natural and human systems are already observable in all region of the world. However, epidemiological studies have shown that certain health risks are affected by climate.[7]

The most direct health impact of climate change comes from global warming. The earth's average temperature rose by 0.85°C between 1880 and 2012. All climate models predict an increase in heatwaves over the coming decades. Worlwide, around 75% of "Hot" days observed since 1850 are attributable to climate change [8]. Future heatwaves can lead to rapid and massive

[6] https://www.who.int/fr/news-room/fact-sheets/detail/climate-change-and-health

[7]https://www.un.org/fr/chronicle/article/les-effets-du-rechauffement-climatique-sur-la-sante-les-pays-en-developpement-sont-les-plus

[8] Mathilde Pascal : Chargée de projet Air-Climat, Institut de veille sanitaire ; Impacts sanitaires observables, P : 20-21 ; adsp n° 93 décembre 2015.

excess mortality, with the peak in deaths occurring less than 48 hours after peak temperatures. In fact, the continuous improvement of this prevention is essential in the context of the climate change described above. The simultaneous increase in the number of vulnerable people due to an ageing population and growing urbanization further reinforces this need. Some authors consider that global warming could also have a positive impact, by reducing cold-related mortality. However, there is no consensus on this hypothesis. Although episodes of extreme cold are indeed less frequent, they continue to be observed. Adaptation to cold weather is highly dependent on behavior, and it is possible that a population accustomed to warmer climate will gradually lose its cold-prevention habits.

Moreover, recent epidemiological studies suggest that short- term temperature variability is an important determinant of mortality, even at moderate temperatures. Paradoxically, a warmer-than- normal winter could result in excess mortality, as could a colder-than-normal winter, as the population needs several weeks to adjust its behavior in the face of unusual temperatures. If this hypothesis were to be verified, the direct impact of temperature conditions on health would probably be broader than attributes to extreme temperature events alone. Rising temperatures can also impact health *through* interactions with air pollution. On the one hand, it has been established that higher temperatures favor the production of atmospheric ozone. On the other hand, several epidemiological studies highlight the synergistic effects of pollution (ozone and fine particles) and temperature on health. For example, in France, the impact of 10µg/m3 increase in PM2.5 fine particles on the relative risk of non-accidental death is higher in summer than in other seasons, and is also higher on very hot days.

Several hypotheses could explain this apparent synergy: more time spent outdoors when it's hot and therefore greater exposure to outdoor air pollution; temperature-dependent changes in atmospheric chemistry, leading to variations in the chemical composition of particles and therefore their toxicity; organisms becoming more vulnerable to the effects of air pollution caused by high temperatures, etc. Climate change may also have an impact in terms of the occurrence of certain extreme weather events such as floods, storms, forest fires and avalanches. Rising sea levels also increase the risk of marine submersion, particularly during storms. Between 1901 and 2010, sea levels rose by an average of 19cm worldwide, at a faster rate than during the previous two millennia.

The World Health Organization (WHO) reports that climate change is responsible for at least 150.000 deaths per year, a figure that is expected to double by 2030. Serious consequences of global warming include: infectious diseases. According to the IPCC, global warming will have repercussions on the health of populations living in tropical regions. In Africa, for example, rising temperatures favor the proliferation of mosquitoes, and populations will be more exposed to diseases such as malaria, dengue fever and other insect-borne infections. These effects are also felt in other countries. Cases of malaria have been reported in the USA, and in 2006 the UK recorded several cases of Legionnaires' disease – a lung infection caused by a bacterium that scientist attribute to global warming. According to the WHO, global warming will lead to an increase in insect-borne diseases in the UK and Europe. Countries such as Azerbaijan, Tajikistan and Turkey are probably already high-risk countries for malaria. However, the ability to adapt to temperature changes varies from region to region. Wealthy societies can make use of technological advances such as more powerful air conditioners and houses better

designed to block the heat. Developing countries, on the other hand, lack not only the know-how but also the resources and public health systems needed to prevent such outbreaks.

- **Heat waves:** Prolonged periods of abnormally high temperatures can also have serious effects on vulnerable populations, such as the elderly and the sick. This has already happened in Europe during the 2003 heat wave, which claimed around 35.000 lives. In a study carried out by the Hadley Center for Climate Prediction and Research in the UK, scientist used computer models to demonstrate that greenhouse gas emissions have increased the occurrence of heatwaves. The most common effects are hyperthermia or heat stroke, which can be fatal if left untreated. According to the IPCC, hot days and nights will become more frequent.
- **Loss of agricultural productivity:** Global warming could trigger droughts that could worsen living conditions, particularly in Africa. According the World Wildlife Fund, climate change could have a considerable impact on rainfall patterns, food security and water supplies for millions of people. According to the IPCC report, 75 to 250 million people living in Africa will no longer have access to an adequate water supply and will face food shortages, with a drop in agricultural productivity of around 50%. Rising temperatures could cause food shortages affecting 130 million people in Asia, with serious consequences for the African population.
- **Asthma and other respiratory illness:** People with heart problems are more vulnerable to rinsing temperatures, especially those already living in hot climates, as their cardiovascular system has to operate at a higher pressure level to keep body temperature at a normal level. High temperatures also increase ozone levels, which can damage lung tissue and cause complications for asthmatics and people with respiratory illnesses.

Scientists and environmental activists have pointed out that global warming is also a threat to national security, affecting food security and fostering conflicts over access to resources. At the UN Security Council debate on energy, security and climate, UK Foreign Secretary Margaret Beckett called global warming a security risk. Despite opposition from some Council members, such as the Russian Federation and China, she argued that climate change's impact on basic needs in poor countries could increase the risk of conflict. Similarly, Ugandan President Yoweri Museveni described climate change as "an act of aggression by the rich against the poor".

Many countries have realized the seriousness of the consequences, which is a positive development. The US Supreme Court has ordered the federal government to take action to regulate CO2 emissions. Demonstrations are taking place in many American cities, such as Boston and New York, to urge the government to reduce carbon dioxide emissions by 80% by 2050. In the United States, 1.300 events were organized under the banner of the "Step it Up 2007" association. In Australia, Sydney resident and businesses turned out the lights, a gesture to draw attention to global warming. Businesses, too, understand the need to implement environmentally-friendly measures. Global beverage group PepsiCo has announced its intention to purchase one billion kWh of renewable energy credits over the next three years. However, reducing the effects of global warming will not be possible without the commitment of the countries that emit the greatest quantities of greenhouse gases.

Here are 10 examples of the impact of climate change on the human body-some predictable, others more unexpected:[9]

- **Heat stress:** Record-breaking temperatures are set to become more frequent over the coming decades, as global temperatures reach or exceed 1.5 degrees Celsius. These heat waves already kill several million people every year. Combined with more frequent droughts, they also cause fatal fires. But heatwaves also have consequences for the heart. When temperatures are high, so are cardiac demands. The heart has pump harder and faster to redistribute and increase blood flow to the skin to cool the body. People with heart disease, whose hearts are weakened, are particularly at risk of heart failure and heat stroke in hot weather, as their organs struggle to function properly with the added stress.
- **Sleep disruption:** A 2022 study by Kelton Minor, from the Center for Social Data Science at the University of Copenhagen, reveals that rising temperatures due to climate change are significantly reducing the amount of sleep people around the world get. Kelton Minor collected data using sleep tracking bracelets on 47.000 people in 68 countries. "*Sleep is a time when our bodies restore and repair themselves"*. *"It's important for ou functioning and performance, but also for our mental well-being".* But when he measured participants' sleep, the researcher found that *"on warmer-than-average nights, people slept less"*. These shorter nights of sleep over an extended period of time end up having detrimental consequences on health. However, not everyone is affected equally by warming temperatures. "*Even if everyone is affected by this sleep burden people are affected unequally, and most of the burden falls on groups that have historically, and most of the burden falls on groups that have historically been either disadvantaged or vulnerable to heat in different ways".* These include *"the elderly, women and people living in low-income countries".*
- **Respiratory problems:** Ozone is a gas naturally present in the Earth's upper atmosphere, providing a shield against the sun's ultraviolet rays. Tropospheric ozone, which is dangerous to health, is produced when pollutants emitted by man-made sources such as cars or chemical plants react in the presence of sunlight. In Fact, the increase in tropospheric ozone and microparticles- the tiny solid and liquid particles floating in the air and produced by natural and artificial sources- leads to a reduction in lung function, particularly if a person is exposed to air pollution as a child. The main problems resulting from air pollution are asthma, Rhinosinusitis, chronic obstructive pulmonary disease and respiratory tract infections. What's more, on exceptionally hot days, which will become increasingly frequent in coming years, ground-level ozone levels can reach critical levels, increasing the risk of breathing ozone-contaminated air. This can lead to mild ailments such as coughing, or dangerous ones such as difficulty in breathing and an increase in the frequency of asthma attacks. In Canada, a woman became the first patient in the world to be diagnosed as suffering from *"climate change"* after developing breathing difficulties during a heat wave.
- **Kidney failure:** Dehydration due to exposure can damage the kidneys, which depend on water to help eliminate waste from our blood in the form of urine. When dehydration leads to excessive water loss, urine contains a higher concentration of minerals and waste product.

[9] https://fr.euronews.com/green/2022/07/18/quel-est-limpact-du-changement-climatique-sur-le-corps-humain

This can lead to the formation of crystals that can become kidney stones, negatively impacting kidney function and causing various painful symptoms such as nausea, lower back pain and difficulty in urinating. For the elderly, whose kidneys may already be failing, dehydration can be the last straw. There has also been a significant increase in cases of chronic renal failure in countries that regularly experience severe heat waves, such as India, Sri Lanka and Central America. A study published in Biomed Central systematic Reviews confirmed that these cases were linked to dehydration and heat stress due to global warming.

- **Worsening allergies:** with rising CO2 Levels, which have increased by 9% since 2005 and 31% since 1950, pollen counts are on the rise. This leads to a worsening of allergy and fever symptoms, such as sneezing, coughing, itchy eyes, headaches and earaches, which are key etiological factors.
- **Heart and circulatory disease:** When air pollutants pass into the bloodstream via the lungs and reach the heart, the risk of developing heart and circulatory disease increases as blood vessels, particles enter the bloodstream, making blood stickier and forcing the heart to work harder to pump through to body. The result can lead to a change in the structure of the heart, with the two lower chambers becoming larger and more dilated- a change often seen in the early stages of heart failure.
- **Infertility:** One of the lesser-known effects of air pollution is being studied by Dr GARETH Nye, senior lecturer in Anatomy and Physiology at the University of Chester, UK, who is investigating the impact of air pollution on fertility. A paper involving 18.000 couples in China found that people living with moderately high levels of micro-particle pollution had 20% higher risk of fertility. He describes another American study how air pollution also has an impact on egg maturation. With up to 30% of couples struggling to conceive for no recognized reason, it's more important than ever to consider air pollution as a possible cause.
- **Malnutrition:** Rinsing temperatures are accompanied by food shortages. This phenomenon is particularly noticeable in communities whose livelihoods depend on agriculture and fishing, such as those in the South. Changing rainfall patterns, rinsing ocean temperatures and extreme weather events are contributing to severe malnutrition in the developing world. Malnutrition leads to various health complications: heart disease, cancer, diabetes and growth disorders. And in more developed countries, food shortages, causes by climate change will lead to obesity and micronutrient malnutrition. A recent WHO study already points to a drop in food production in many of the world's poorest regions, by up to 50% by 2020 in some African countries. These effects will be exacerbated by rising sea levels, and the contamination of water reserves and farmland.[10]

[10] WHO (2014) *Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s*. Geneva: World Health Organization

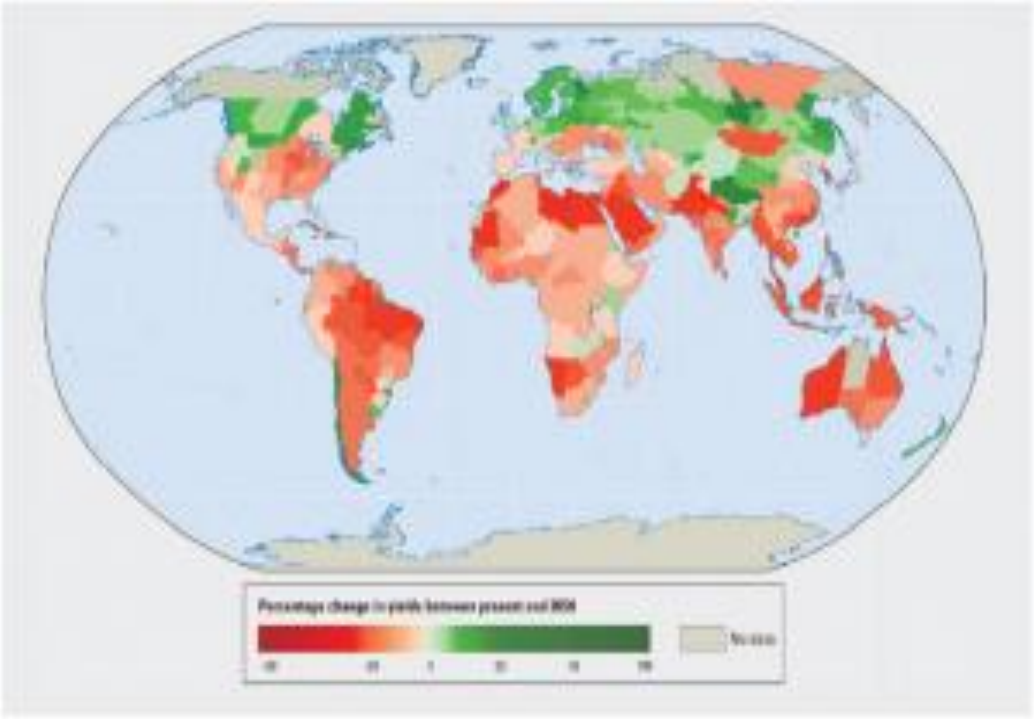

Figure N°4: Global impacts of climate change (horizon 2050) on crop productivity based on simulation recorded between 1994 and 2010. Source: after Wheeler &Von Braun, 2013.

In the longer term, climate change is likely to increase the variability of crop yields from one year to the next. This is likely to push up food prices, even as annual demand for agricultural produce rises.

- **Mental health:** It's not just physical health that is affected by climate change. In the wake of global catastrophes such as forest fires, floods or hurricanes, mental health problems are only getting worse. After Hurricane Katarina 2005, one of the worst disasters in American history, it was found that at least 90% of the 8000 patients treated following Katarina suffered from long-term anxiety. If a person is faced with food insecurity, the loss of all their possessions and the death of people they love, they will undoubtedly suffer in years to come from the trauma they have endured which can lead to post-traumatic stress disorder (PTSD) and even suicide. Eco-anxiety is also on the rise, particularly among young people who feel discouraged by the prospects of their future world. A global study published in 2021 found that concerned about climate change, and 56% said they thought humanity was doomed. They felt their future couldn't be positive, but there was nothing they could do about it.[11]

- **Microplastics in our bodies:** Microplastics, very small pieces of plastic debris found in the environment, are found in the human body. They were found for the first time in human blood-plastic used to make beverage bottles, packaging and shopping bags. Scientists fear that these nanoparticles could reach our organs via the bloodstream. According to research, babies have 15 times more microplastics in their stools than adults, probably ingested from plastic dummies and microplastics in carpets. Research is underway to determine the effects of microplastics on human health.

[11] Steve Simpson, professor of Marine Biology and Global Change at yhe University of Bristol. 2021.

3- The impact of climate change in human health:

➢ **Health consequences:** Climate change affects health both directly (heat waves, extreme weather events) and indirectly (forced migration, longer periods spent outdoors, increased use of cooling system, etc.). According to the WHO, climate change could cause an additional 250.000 deaths every year from 2030 onwards, due to malnutrition, malaria, diarrhea and heat waves. The health costs resulting directly from climate change are estimated at 2 to 4 billion dollars per year by 2030.

➢ **Direct consequences:** The Heat waves cause dehydration, heatstroke and exhaustion, all of which have detrimental effect on health. They lead to an increase in mortality and morbidity, particularly in vulnerable categories (infants and young children, the elderly and high-level athletes). The scorching summer of 2023 resulted in some 20,000 to 30,000 additional deaths in Europe from cardiovascular and/or pulmonary disease. If heat waves continue to increase in frequency and intensity, it is to be feared that the number of premature deaths will also rise over the coming decades. Extreme weather events such as floods, storms, fires and droughts also have a direct impact on health. Floods, which affect millions of people in Europe every year, can result in drowning, heart attacks, injuries, infections, psychosocial consequences and more. Due to climate change, these extreme events are likely to increase in frequency and intensity in the future.

➢ **Indirect consequence:** But the indirect consequences of climate change are probably even more important:

- **Water supply and food production:** the risk of water shortages and reduced agricultural yields could lead to dehydration and malnutrition.
- **Increase in the number of vector-borne disease due to the** growing spread of their vectors: Ticks, Mosquitoes, Sandflies, etc. Changes in the length of seasons, rainfall, humidity and temperature can increase the spread and survival of vectors and pathogens. Lyme disease transmitted by Ticks, this disease is currently on the increase in central Europe and the Baltic States. Climate change is considered to be the main cause of the spread of certain tick species in Northern Europe.

With global warming, the Ixodes tick is moving further. However, it has not yet been proven whether this also contributes to an increase in the number of cases of disease.

❖ **Dengue:** a viral disease transmitted by mosquitoes;

❖ **Bilharziosis (Schistosomiasis):** a disease that uses aquatic mollusks as intermediate hosts;

❖ **Malaria:** with the expansion of the range of mosquitoes that spread this disease, it cannot be ruled out that malaria could spread north of the Mediterranean.

➢ **Risks linked to deteriorating water quality (through increased growth of toxic bacteria and algae) and food poisoning:** many diseases are contracted through contaminated food or water (Cholera and dysentery). Rising water temperatures can encourage the growth of bacteria or algae responsible for food poisoning. In the event of heavy rainfall, pathogens can be released or water contaminated by overflowing sewers. Reduced water flow in summer can increase the risk of bacterial and chemical contamination. Temperatures-sensitive infectious diseases such as food-borne infections (Salmonella sp. and others) are likely to increase.

➢ **Increased concentration of ground-level ozone in summer (Respiratory problems):** it is estimated that excessive exposure to ground-level ozone is responsible for

almost 20,000 premature deaths every year in Europe. A recent European study used a computer model to stimulate the impact of climate change on air quality in 2010, and compared it with 1990 (the reference year). According to the researchers, climate change will lead to higher ozone peaks in large parts of Western Europe, resulting more illnesses and deaths every day.

- **Increased allergic disorders:** rising temperatures not only extend the pollination period, but also encourage the development of certain allergic and invasive plants such as ragweed. Higher temperatures combined with less rainfall at the time of pollen dispersal lead to higher concentrations of pollen in the air during the high season[12].

The consequences for health will certainly not be the same for everyone. As health and well-being are closely linked to socio-economic factors (income, housing, employment, education, lifestyle, etc), the effects of climate change are likely to amplify health inequalities (within and between countries), increase the vulnerability of low-income groups and certain groups such as children, people working outdoors, the elderly or the sick. Some positive effects are also possible, such as a slight reduction in cold-related mortality in certain regions, but these will be largely outweighed by the scale and severity of the negative effects.

- **Global warming favors the spread of diseases:**

The spread of infectious diseases is one of the first health consequences of climate change that populations will have to face in the coming years. According to the IPCC (Intergovernmental Panel on Climate Change), this spread will have the greatest impact on tropical regions, particularly Africa, where rising temperatures are already encouraging the proliferation of Mosquitoes. At a time when many countries in tropical regions lack the means and resources to optimize their public health systems, the populations of these developing countries are likely to experience a sharp increase in cases of Malaria, Dengue fever and other infectious diseases transmitted by insects. These regions, which are least responsible for climate change, are bearing the full brunt of the consequences, and are likely to see an increase in the number of deaths. But the spread of diseases is not limited to tropical countries. According to the WHO, the spread of diseases caused by rising temperatures will affect a large part of the planet, including the European continent[13].

- **Heat waves affect the most vulnerable populations:**

According to scientists, the average global temperature has risen by more than 1°C in a century, mainly due to rinsing greenhouse gas emissions. This rise in temperature translates into long, hot spells which, coupled with rising ozone concentrations in the atmosphere, have a significant impact on the population. Under these conditions, the most vulnerable people, such as the elderly, children or the sick, can suffer from allergies, asthma, hyperthermia or heatstroke. When temperatures and humidity level rise, the human body overheats and can no longer cool itself due to moisture-saturated air. According to the latest IPCC report, heatwaves are set to become increasingly frequent, especially in cities where warming is amplified by the phenomenon of heat absorption by concrete. Scientists predict a 4°C rise in average

[12] https://climat.be/changements-climatiques/consequences/sante

[13] https://www.visiondumonde.fr/je-m-informe/actualites-et-blog/nos-actualites/l-impact-des-changements-climatiques-sur-la-sante/

temperatures by 2100 in various parts of the world, threatening a large proportion of the population with heat stress[14].

4- Who actions to tackle climate change:

WHO's response to these challenges is structured around the main objectives:[15]

- **Promote measures that both reduce carbon emissions and improve health:** support a rapid and equitable transition to a clean energy economy; ensure that health is at the heart of climate change mitigation policy; accelerate the adoption of mitigation measures that deliver the greatest health benefits; and mobilize the strength of the health community to drive policy change and build public support.
- **Build better, more climate-resilient and environmentally sustainable healthcare systems:** ensure basic services, environmental sustainability and climate resilience as core elements of CSU and primary healthcare (PHC); help healthcare systems make the leap to cheaper, more reliable and cleaner solutions, while decarbonizing those with high emissions; and integrate climate resilience and environmental sustainability into investments in healthcare services, including healthcare workforce capacity.
- **Protect health from the wide range of climate change impacts:** assess health vulnerabilities and develop health plans; integrate climate risks and implement climate-informed surveillance and response systems for key risks, such as extreme heat and infectious diseases; support resilience and adaptation in health-determining sectors such as water and food; and close the financing gap for adaptation and health resilience.
- **Leadership and advocacy:** WHO plays a leading role in highlighting the health implications of climate change, with the aim of putting health at the heart of climate policies, including through the United Nations Framework Convention on Climate Change (UNFCCC). In partnership with leading health organizations, health professionals and civil society, WHO is working to integrate climate change into health priorities such as the CSU, and to achieve carbon neutrality by 2030.
- **Evidence and monitoring:** WHO, with its network of global experts, provides summaries of global evidence, supports countries in their assessments and monitors' progress. The focus is on deploying effective policies and improving access to knowledge and data.
- **Capacity-building and country support:** Through WHO offices, support is provided to ministries of health, with an emphasis on cross-sector collaboration, updated guidance, practical training, and support for project preparation and implementation, as well as for securing climate and health funding.

To avoid catastrophic health effects and prevent millions of deaths linked to climate change, the world must limit the rise in temperature to 1.5°C. Past emissions have already made a certain level of global temperature rise and other climate changes inevitable. However, global warming of 1.5°C is not considered risk-free; every additional tenth of a degree of warming will have serious consequences for people's lives and health.

[14] Idem.

[15] https://www.who.int/fr/news-room/fact-sheets/detail/climate-change-and-health

Conclusion:

Between 2030 and 2050, climate change is expected to generate almost 300,000 additional deaths per year, by increasing child malnutrition and undernutrition, insect-borne diseases, diarrhea and heat-related stress. The potential influences of these changes on health are therefore multiple and interlinked. Added to this damage are the migrations of populations fleeing profound changes in their living environment: reduced agricultural yields, flooding, rising sea levels... Nearly 250 million "climate refugees" are expected by 2050. We all remember the excess mortality in Europe during the heatwave of summer 2003, when 70,000 deaths were recorded in August alone. The effects of climate on infectious diseases are more complex. However, entomologists are convinced that the expansion of hot, humid zones across the globe will increase virus-carrying insect populations tenfold. Finally, the economic impacts of climate change speak for themselves: the estimated cost of direct damage to health is between 2 and 4 billion dollars a year by 2030.

Global temperatures have risen by around 0.85°C over the last 130 years. This increase is essentially due to the rise in greenhouse gases. Over the past 25 years, the rate of increase has accelerated, with a warming rate of over 0.18°C per decade. Sea levels are rising, glaciers are melting and rainfall patterns are changing. In addition to these factual events, global climate change is more complex to measure and is manifested, among other things, by extreme weather events (drought, floods, heat waves) that are increasing in intensity and frequency. Apart from a few rare effects of climate change that could be considered positive (e.g. lower winter mortality in temperate zones), these appear to be deleterious to health. A case in point is the negative impact of climate change on yields of most crops. In their fifth assessment report, the members of the IPCC (Intergovernmental Panel on Climate Change) note numerous periods of very rapid increases in food and cereal prices, following extreme climatic events (giant fires, storms, floods).

This has a major impact on the poorest populations, who find it extremely difficult to buy food. A 2009 report published by the British journal The Lancet had identified climate change as the greatest global threat to public health in the 21st century. On Thursday November 29, 2018, The Lancet published the second edition of its "Lancet Countdown" report dedicated to the health aspects of climate change. The result of collaboration between 27 academic institutions, UN and intergovernmental agencies from every continent, this document reveals the "unacceptable" risk to the current and future health of populations worldwide, as a result of climate change. As a result, the effects of climate change are already perceptible today, and projections for the future represent a potentially catastrophic risk to human health on a scale that is difficult to accept. Finally, the effects of global warming on human health come on top of the effects of changes linked to globalization (demographic change, social change, economic activity).

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