BRIEFING
Requested by the ENVI committee

European Parliament

Impacts of climate change and air pollution on the health of the EU population

KEY FINDINGS

- One in every eight deaths in the European Union (EU) is attributable to environmental factors.
- The effects of climate change on human health are harmful and health risks will increase over time.
- Prompt and decisive action to reduce greenhouse gas (GHG) emissions sufficiently to keep the temperature increase below 2°C above the pre-industrial level could significantly reduce health risks.
- Elderly people, people with medical conditions, children and socially disadvantaged communities are at greater risk of climate change related health problems.
- Heat waves constitute the deadliest extreme weather event in Europe. Urban populations are more exposed to extreme heat due to the heat island effect.
- Climate change increases health risks from infectious diseases, especially vector- and water-borne diseases.
- Air pollution is the biggest environmental threat to health in Europe, with more than 400,000 deaths.

As 13% of deaths in the EU 28 Member States (EU-28) were attributable to the environment in 2012,[1] it is clear that the effects of climate change are having tangible consequences for the European population. Its pace and intensity could thus lead to increasing health risks accross the EU. Globally, temperatures have already risen by 1°C above pre-industrial levels and a temperature increase of more than 2°C would lead to even greater health risks, especially for vulnerable populations such as the elderly and children. There is therefore an urgent need for integrated strategies for adaptation and mitigation. Adaptation is aimed at reducing the climate change's negative effects as well as at taking advantage of any opportunities that it creates, whereas mitigation strategies' objective is to tackle the cause of climate change while minimising its possible impacts and potentially offering health (co)benefits.

Heat-related effects on health

1. An unequal distribution of the heat-related health risk among the European population

Heat waves are associated with increased premature mortality and morbidity. The elderly, infants and young children, people with pre-existing health problems, as well as those in hospitals and nursing homes are particularly vulnerable to heat. In 2018 there were 31 million additional heatwave exposures in the EU.[2] The

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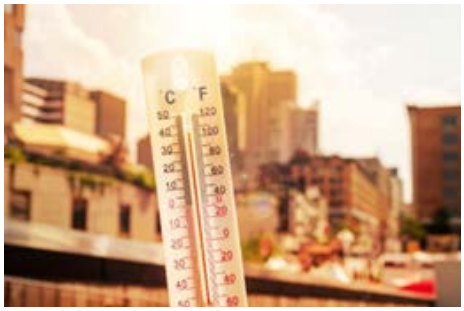
zones most at risk are the Iberian Peninsula and the south of France as these are the areas where the highest number of hot days have been observed. According to an analysis by the European Commission, an increase in temperature of more than 2°C above pre-industrial levels by 2100 would cause 132,000 additional annual heat-related deaths in the EU, compared to only 58,000 if the temperature rises less than 2°C.[3]



The European population is particularly at risk due to the high proportion of elderly people living in urban areas, who are becoming increasingly vulnerable. Cities are indeed more affected by temperature increases than rural areas due to heat island effects and some European major towns such as Bucharest, Madrid and Zagreb could experience temperature increases of 4 to 7°C. Human-induced climate change has been estimated to have increased the risk of heat-related mortality by ~70% in central Paris and ~20% in London during the 2003 heatwave.[4]

2. The elderly: stakes and adaptation strategies for a particularly vulnerable population

People aged 65 and over are projected to make up 31% of the EU-27 population by 2100 (up from 20% in 2019), almost half of whom will be over 80 years of age.[5] Residents of retirement homes, because of their age and medical condition(s), constitute a population particularly exposed to heat risk, especially considering that the heat-related vulnerability of this age group has constantly increased over the last couple of decades.[6] A German study shows that an ambient temperature above 26°C is associated with an increased risk of mortality for long term facilites residents, with an additional risk of up to 62% above 34°C.[7] As the European population ages, the demand for retirement home housing will increase (an estimated 500,000 additionnal beds will be needed by 2030).[8] A survey carried out in 11 European countries by private investors estimates that the demand for housing for the elderly has a potential growth of 5.5% per year and that one in three European elderly would consider moving into adapted accomodation.[9] As the majority of the EU building stock was built before 1980, with 35% of existing buildings being more than 50 years old, 75% of the building stock is nowadays energy inefficient.[10] As they house a fragile population, nursing homes therefore require renovation work, as the need for cooling and the risk of overheating increases with the rise in ambient temperature. Research on housing under a Mediterranean climate shows that window blinds, increased thermal insulation and reduced infiltration have the greatest effect in terms of reducing total energy demand.[11] Renovating nursing homes is thereby not only an effective adaptation measure adressing health risks linked to global warming, but also a mitigation measure to make the building stock nearly zero-energy by 2050, as targeted by the Energy Performance of Buildings Directive.[12]

Infectious diseases

1. Climate change as one of the drivers of the EU's increasing infectious disease threat

Infectious disease spread is driven by many factors, including social, economic and environmental conditions as well as access to health care. The geographical and seasonal distribution of many vector organisms and infectious agents is particularly affected by climatic conditions and might result in the establishment of diseases currently not present on the continent. The strategy for adapting to the development of infectious diseases in Europe needs therefore to be closely monitored in relationship to climate change.

a. Antimicrobial resistance

Studies show that increased temperature is one of the factors causing increased antibiotic resistance in bacteria such as *Escherichia coli*.[13] Antimicrobial resistance (AMR) is estimated to cause 33,000 deaths per

year in the EU.[14] Addressing the threat of AMR in consideration of climate change is therefore necessary in order to reduce AMR's risk to the EU population.

b. Vector-borne diseases

Vector-borne diseases are transmitted by arthropods, mosquitoes, or sandflies. A comparison of the 1.5°C and 2°C scenarios reveals that the risks of some vector-borne diseases are expected to increase further at higher temperatures, partly due to changes in geographical distribution, as higher temperatures allow vectors to spread to new locations previously unfamiliar to them and survive colder seasons.[15] In 2018, West Nile virus infections, which can lead to neurological damage, have been reported in 11 EU Member States and the notification rate for locally acquired cases was eight times higher than the previous year's rate.[16] Distribution changes can be expected to be broadly similar for some other vectors and pathogens such as *A. Albopictus* mosquitoes, vectors of chikungunya and dengue fever. Data show that their distribution has been steadily increasing since the 1950s and projections estimate that southern and then western Europe will provide climatically favourable habitat in the coming decades.[17]

2. Case study : *Vibrio* infections in the Baltic area

Vibrio bacteria normally grow in warm marine environments, as a sea surface temperature above 16°C is necessary for the development of the bacteria.[18] These bacteria can lead to various forms of infection in humans, such as gastroenteritis, wound or ear infections and septicaemia following the consumption of raw or undercooked shellfish or exposure to seawater. Immunocompromised people and elderly are particularly at risk and the infection can be life threatening if an early diagnosis and appropriate treatment is not given.

The Baltic coastline, which encompasses 8 European countries, is an area at high risk, as the share of the coast suitable for *Vibrio* has increased by 31% since the 1980s. In 2017, 107 days of the year were suitable for *Vibrio* development: this figure is the highest ever recorded and is double the 1980s baseline.

Vibrio infections therefore represent a significant public health issue for the EU and the further development of appropriate adaptation strategies is necessary. First of all, risk assessment needs to be strengthened to support the Vibrio Map Viewer, which predicts the environmental suitability of coastal waters by making case notification mandatory and centralising data among the EU Member States. A better assessment will enhance the delivery of adapted prevention messages, especially towards vulnerable populations, as well as enable the implementation of temporary interdiction measures to access affected areas.

Environmental toxicity

1. The health impact of air pollution

a. Air pollution: the greatest environmental threat to the EU

Air pollution is the greatest environmental threat to health in Europe, with more than 400,000 premature deaths due to air pollution every year in the EU.[19] Ischemic heart disease, stroke, chronic obstructive pulmonary disease, cancer and respiratory infections are the main causes of death attributed to air pollution. Air pollution is also a factor of neurological disorders, asthma, diabetes and obesity. Fine particles with a diameter of 2.5 µm or less (PM2.5) are one of the most dangerous pollutants for health. In 2018, premature deaths in 28 EU Member States were attributable to fine particles (PM2.5) for 379,000 deaths, ozone exposure accounted for 19,400 cases and Nitrogen dioxide (NO_2) exposure for 54,000.[19]

Europeans are not affected in the same way. Eastern Europe is more impacted by high levels of PM2.5 emissions due to its higher emission rates. NO_2 concentrations are the highest in the most densely populated areas and are linked to local sources such as traffic, domestic and industrial emissions. Ozone is

formed under the effect of light and sunlight and therefore affects the warmest and sunniest regions, resulting in a north-south division. The most sensitive to the health effects of air pollution are children, pregnant women, the elderly and people with pre-existing health problems. As people of lower socio-economic status live, work and go to school in places with poorer air quality, they are also more vulnerable than the rest of the population.

b. The cost of air pollution

An estimated annual saving of €5.2 billion would be achieved from the difference in air pollution by PM2.5 in the EU between 2015 and 2016, but at the levels of anthropogenic PM2.5 pollution in 2016, there would still be a total average annual health cost to the EU population of €129 billion. The highest costs are generally found in the most populated countries. Hungary, Romania and Poland are expected to experience the greatest average life lost per person (more than 8 months per person), with an EU average of 5-7 months.[20]

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1 Healthy environment, healthy lives: how the environment influences health and well-being in Europe, EEA Report No 21/2019, https://www.eea.europa.eu/publications/healthy-environment-healthy-lives.

2 The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate, Watts, Nick et al. *The Lancet*, Vol 394.

3 Milner, J, Harpham, Colin & Taylor, Jonathon & Davies, Mike & Quéré, Corinne & Haines, Andy & Wilkinson, Paul. The Challenge of Urban Heat Exposure under Climate Change: An Analysis of Cities in the Sustainable Healthy Urban Environments (SHUE) database. 2017.

4 Mitchell, D. et al. Attributing human mortality during extreme heatwaves to anthropogenic climate change, *Environmental Research Letters*. 2016.

5 Population structure and ageing: paste and future ageing trends in the EU, Eurostat, 2020, [internet] available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Population_structure_and_ageing#Past_and_future_population_ageing_trends_in_the_EU.

6 Ciscar JC, Feyen L, Ibarreta D, Soria A et al . Climate impacts in Europe. Final report of PESETA II project. 2018.

7 Jochen Klenk, Clemens Becker, Kilian Rapp, Heat-related mortality in residents of nursing homes, *Age and Ageing*, Volume 39, Issue 2, March 2010, Pages 245–252, https://doi.org/10.1093/ageing/afp248.

8 European Nursing Homes Report, Overview of the European Nursing Homes Market, Cushman & Wakefield France, 2019.

9 Elderlycare and housing demand in the EU Golden opportunities, but mind the cultural gap, Edse Dantuma, ING economics department, May 2019, available on the internet: https://think.ing.com/uploads/reports/ING_-_Elderly_care_and_housing_demand_in_the_EU_-_May_2019_1.pdf.

10 Buildings Performance Institute Europe (BPIE). 97% of Buildings in the EU Need to Be Upgraded, Factsheet; Buildings Performance Institute Europe: Brussels, Belgium, 2017.

11 Víctor Pérez-Andreu, Carolina Aparicio-Fernández, Ana Martínez-Ibernón, José-Luis Vivancos, Impact of climate change on heating and cooling energy demand in a residential building in a Mediterranean climate, Energy, Volume 165, Part A, 2018, https://doi.org/10.1016/j.energy.2018.09.015.

12 Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. OJ L 156/75, European Union, 2018, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L0844&from=EN.

13 MacFadden DR, McGough SF, Fisman D, Santillana M and Brownstein JS Antibiotic resistance increases with local temperature. Nature Climate Change, 2018.

14 Cassini A, Högberg LD, Plachouras D, Quattrocchi A, Hoxha A, Simonsen GS, et al. Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level mod-elling analysis. *Lancet Infect Dis*. 2019.

15 Antonio DC, Sanseverino I, Pozzoli L and Lettieri T. Toward climate change impact: vectors carrying viral infection. *JRC Technical Reports*. 2018.

16 European Centre for Disease Prevention and Control. West Nile virus infection. In: ECDC. Annual epidemiological report for 2018. Stockholm: ECDC; 2019.

17 The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. Watts, Nick et al. *The Lancet*, Volume 394.

18 Daniels NA. Vibriovulnificus oysters: pearls and perils. *Clinical Infectious Diseases* 2011.

19 Healthy environment, healthy lives: how the environment influences health and well-being in Europe, EEA Report No 21/2019.

20 The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate, Watts, Nick et al. *The Lancet*, Vol 394.

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