



*Scientific Advice
Mechanism (SAM)*

Adaptation to Health Effects of Climate Change in Europe

*Group of Chief Scientific Advisors
Scientific Opinion No.9, June 2020*

**Independent
Expert
Report**



*Research and
Innovation*

Adaptation to Health Effects of Climate Change in Europe

Group of Chief Scientific Advisors

European Commission
Directorate-General for Research and Innovation
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EUROPEAN COMMISSION

Chief Scientific Advisors – SAM, EGE
INDEPENDENT SCIENTIFIC ADVICE FOR POLICY MAKING

Adaptation to **Health Effects of Climate Change** in Europe

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Brussels, 29 June 2020

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EXECUTIVE SUMMARY

The emission of anthropogenic greenhouse gases is the main driver of climate change. Without unprecedented action to reduce emissions the consequences of climate change within the coming decades are likely to be catastrophic.

Responding to climate change involves a two-pronged approach, including reducing the emissions of greenhouse gases (mitigation) and planning and acting to address those consequences of climate change that cannot be avoided (adaptation). For health impacts, adaptation is defined as 'designing, implementing, monitoring, and evaluating strategies, policies and programmes to manage the risks of climate-relevant health outcomes' (WHO 2014).

The EU is committed to the global fight against climate change. The European Green Deal is the EU's new growth strategy (2019-2024) which centres on the goal of achieving climate neutrality by 2050. The Green Deal intends to cut greenhouse gas emissions by at least 50% by 2030 compared to 1990 (up from the current target of 40%) as the EU's commitment to the Paris Agreement. The Paris agreement sets out to limit global warming to 'well below 2 °C', with the average temperature now already 1 °C above the average pre-industrial level. Even if these ambitious goals are fully achieved, some effects of climate change will be significant and inevitable.

Climate change is already having numerous negative consequences for health, which will get worse with the inevitable rises in temperature. As an example, annual fatalities from extreme heat could rise from 2,700 deaths/year today to ca. 30,000-50,000 by 2050 with the global warming of 1.5 °C and 2 °C, respectively, assuming present vulnerability to heat and without additional adaptation measures. Therefore health needs to be firmly integrated in climate change adaptation.

The EU has been pursuing its climate adaptation policy based on the 2013 EU Adaptation Strategy, amongst others, and most recently the proposed European Climate Law. The Climate Law also turns adaptation to the inevitable consequences of climate change into a legal obligation, calling for 'continuous progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change'. Under the 2013 Adaptation Strategy, a number of actions already address some climate-related anticipatory and preventive health concerns, for instance 'climate-proofing' infrastructure projects including flood management or building design. However, the integration of climate adaptation into EU policies has proven to be a very complex process, progress has been uneven as confirmed by the EC's own evaluation, and the 'health in all adaptation policies' approach has not yet become a major focus.

In public health policy the EU has mainly supporting competences, though it has a stronger mandate in the case of serious cross-border health threats. Through the work of the European Centre for Disease Prevention and Control (ECDC) and Copernicus Climate Change Service (C3S) some progress has been made in integrating climate-induced threats (such as climate-sensitive vector-borne infectious diseases or

extreme weather events) into the EU's common system of epidemiological surveillance, monitoring, early warning, preparedness and response planning.

Drawing upon a synthesis of scientific evidence including expert consultation, this independent scientific opinion aims to inform the EU's new Adaptation Strategy and EU health policies with recommendations aimed to limit risks as a result of climate-related health effects.

Recommendation 1: Integrate human health into all climate change adaptation policies

The integration of health aspects in all policies should take place across all sectors and governance levels affected by the climate change adaptation strategies and plans.

The EC should offer strategic direction and coordination for that integration across all governance levels (European, national, regional and local) taking into account international goals,

Moreover, we recommend strong support for policy learning across all policy sectors and governance levels, evidence-based assessment of adaptation actions, and closing evidence gaps.

Recommended policy actions:

- Promote synergies across all policy areas relevant to health, and increase the effort in integrating climate adaptation and health considerations into policies and standards, notably in:
 - land use (e.g. the role of health in urban, spatial and coastal planning)
 - building design, and infrastructures (e.g. for energy), such as supporting the incorporation of health-related climate-neutral, climate adaptation measures in building and infrastructure standards and codes
 - disaster management, water and food supply, including provision of safe water and healthy food
- Seek and prioritise synergies with climate mitigation actions and disaster risk reduction. Adaptation should not harm mitigation goals, or – in the very least – unavoidable trade-offs should be transparently accounted for. Embedding 'human health' as a key component of the EU adaptation strategy contributing to the Green Deal should be aligned with the Sustainable Development Goals and with the Sendai framework for disaster risk reduction.

- Use the entire mix of policy interventions available at the EU level in order to intensify adaptation efforts in general, and particularly the integration of health into climate adaptation. For instance:
 - embed health-related requirements into the guidance for national adaptation strategies and plans
 - targeted funding of adaptation projects, and projects supported by e.g. European structural and investment funds; examples of relevant local projects that could receive support include city-level risk assessment of urban heat islands, and ways to reduce them through planning measures, or local planning and risk assessment to identify areas with greater mosquito breeding potential
- Support policy learning, evidence-based assessment of adaptation actions, and closing evidence gaps; including fostering peer learning from ongoing and completed adaptation initiatives; rigorous evidence-based assessment of planned, ongoing and completed climate adaptation actions; and further research where important evidence gaps are identified.

Recommendation 2: Support the resilience of the health sector

The EU should use its complementary role in health policy to support the capacity and preparedness of the health sector in the EU to deal with climate change impacts, as part of broader disaster and emergency risk strategies, including surveillance, monitoring and assessment.

Recommended policy actions:

Strengthen the health sector itself:

- Support the education and training of personnel in the health and social care sector (for instance with regard to relevant risks and emergencies);
- Organise availability of critical components such as stocks of equipment, medicines, vaccines and testing capacity within Europe and support member states and other entities in acting towards such a goal in order to mitigate any health-care crises;
- Support improving basic infrastructure, and amend policies for building and design to include infrastructure adjustment, in relation to heat waves and other risks to health.

Infrastructure adjustments should be undertaken whilst considering energy costs and alternative cooling/heating solutions, capturing synergies supporting health systems in different ways.

Provide support to the health services by improved infrastructures at EU level by:

- Considering the creation of a disaster risk and climate change and health knowledge centre or coordinating mechanism that can interact with operational bodies of civil protection, policy makers, the health services and provide timely information to them;
- Extending capabilities of the EU to deal with cross-border threats, based on formal competence, in relation to for example infectious diseases, and reviewing ways for the EU to address international dimensions of health risks;
- Further developing the European climate adaptation platform Climate-ADAPT and Copernicus services and C3S, in particular in terms of health adaptation;
- Supporting surveillance, monitoring and assessment, as well as predictive modelling and early warning systems for climate-sensitive processes and diseases. This includes the integration of environmental and health (epidemiology) datasets, as well as interactions between environmental and health agencies and policy makers.

Recommendation 3: Design policies to support the most vulnerable social groups and geographical areas

Particular focus should be placed on reinforcing adaptation actions in geographical areas that are particularly vulnerable to health-relevant hazards resulting from climate change, such as heat waves, vector-borne infectious diseases, floods and droughts.

Socially just adaptation measures should aim to cater for the social groups that are the most vulnerable to climate-related health impacts.

Recommended policy actions:

- Seek synergies with health-related preventive adaptation policies, *e.g.*, in building and infrastructure design and with policies to support the resilience of the health sector in designing the policy interventions;
Examples include the design of elderly care homes (preventive measures), and dedicated measures for the elderly in heat-health plans and in preparedness for disease outbreaks;
- Support an understanding of multiple vulnerabilities and how this may impact groups (such as for instance chronic disease amongst elderly or socio-economically disadvantaged groups, in relation to heat waves);

- Promote the integration of socio-economic data sets into adaptation planning at all levels as it is likely to help in addressing social vulnerability to climate-related health impacts;
- Monitor the implementation progress and request thorough evidence-based assessment of all policies, with attention to vulnerable groups and areas;
- Support local policies and initiatives and promote peer learning and assessment for policy transfer and scaling-up potential. Relevant initiatives may include e.g. existing urban initiatives to identify groups that are socially vulnerable to climate change and to plan and implement socially just adaptation actions.



Introduction & Background

INTRODUCTION & BACKGROUND

1.1. Climate change is happening, and has consequences for health

Scientific evidence shows that the climate is changing, and that anthropogenic greenhouse gas emission is the main driver for the change. The average temperature has risen 1 °C above the pre-industrial level (IPCC 2018). With an average temperature of the European land area over the decade 2009-2018 of 1.7 °C above preindustrial level, the temperature increase in Europe has been faster than the global average (EEA Indicator Assessment¹). Without very significant mitigation efforts, a child born today may well experience a world that is 4 °C warmer than the long-term pre-industrial average (Watts et al. 2019).

Many consequences of climate change are known, such as the increase in heat waves or the increase in average temperature, although the magnitude and timing of those impacts are not necessarily known in advance (a known unknown). The risk associated with climate change events is determined by both the likelihood of an event as well as the projected impact. This means that not only the likely scenarios are associated with a high risk, but also the less likely, high impact scenarios (Sutton, 2018), such as a temperature increase above 4 °C. Therefore low-probability events may also be relevant for assessing the consequences of climate change. Climate change can also lead to unexpected high-impact events, as a consequence of the complexity and non-linearity of many processes involved, as well as to tipping points and compounded impacts². The IPCC has warned of tipping points for a long time. These are points beyond which changes may be irreversible, such as the possible loss of Greenland and West Antarctic ice sheets leading to an increase of sea waters levels of 1-2 m, or the thawing of the permafrost, which could lead to the re-emergence of diseases such as anthrax (Houwenhuyse 2017). Reaching these tipping points is considered more and more likely (IPCC 2018, Lenton et al. 2019).

The EU is committed to a global fight against climate change. The European Green Deal is a new strategy for making the EU's economy sustainable; it intends to turn climate and environment challenges into opportunities and to make the transition just and inclusive. The Green Deal includes a proposed European Climate Law that establishes a binding framework for achieving climate neutrality. It also addresses adaptation to the inevitable consequences of climate change, calling for 'continuous

¹ <https://www.eea.europa.eu/data-and-maps/indicators/global-and-european-temperature-9/assessment>

² An earlier opinion by the Group of Chief Scientific Advisors ('Science Advice to European Policy in a Complex World') is relevant in that respect, as it includes evidence, examples and recommendations on dealing with scientific uncertainties of various types in complex policy areas. https://ec.europa.eu/info/publications/scientific-advice-european-policy-complex-world_en

progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change'; turning adaptation to climate change into a legal obligation (see Ch. 2).

1.2. Impacts of climate change on human health

Climate change is already having negative effects on health and is undermining the 'right to health' cited in the Paris Agreement (WHO COP24). The IPCC 2014 report states, with very high confidence³, that climate change will exacerbate existing health problems, in particular from heat waves and fires, and diminished food production. Health consequences get worse with rising temperatures (IPCC 2018).

Climate change and human health are interconnected in a multitude of ways (see Figure 1.1.).

Examples of direct impacts of climate change with dramatic consequences for human health are the heat wave in 2003 (with 44.000 excess deaths in Europe (Kosatsky 2005)), the bushfires in Australia in 2019 (Yu et al. 2020), and the wildfires in Sweden, Portugal and Greece in 2018.

Human health is further adversely affected in indirect ways through ecosystem effects of climate change (EASAC 2019:1). These include loss of biodiversity, air pollution (see Box A), ocean acidification, or changes in wildlife behaviour due to habitat changes or degradation. These changes shift the range and activity patterns of disease vectors including ticks, mosquitoes, or bats (see also Box B on the COVID-19 pandemic and climate change (UNEP 2016)). Thus, the health of humans, animals, plants and ecosystems is connected and is often referred to as 'One Health'. 'One Health' in policy thinking translates to calls for bringing together policies in public health, animal health, plant health and the environment more closely.

Direct climate impacts such as heat waves and floods also have diverse socioeconomic effects, e.g., productivity loss, reduced access to other basic services, and food insecurity – which in turn exacerbate the negative effects on health (Watts et al. 2018b, 2019; WHO 2015). Climate change is among the key drivers of violent conflicts, migration, poverty and inequality, which amplify climate-related effects on health, and the vulnerability of certain regions and population groups to them (Expert Elicitation). These effects are illustrated in Figure 1.

Among these impacts, the IPCC 2014 report considers a) heat waves and fires, b) undernutrition in poor regions, c) lost work capacity and reduced labour productivity in vulnerable populations, and d) food-and waterborne and vector-borne, diseases the most severe effects of climate change on health.

³ The IPCC 2014 report provides for the first time a qualitative assessment in the form of a confidence statement ranging from very low (limited evidence and little agreement) to very high (robust evidence high agreement).

Climate change is also concurrent with, and partly driven by, other megatrends such as urbanisation and globalisation, which also have some adverse impacts on health e.g. by amplifying exposure or vulnerability to main climate-related hazards. For example, urban populations are among the groups that are vulnerable to climate change impacts such as heat waves (including through the 'urban heat island' effect) and vector-borne diseases (ECDC 2018; Semenza et al. (2018); WHO 2018; see also 3.1.). Unsustainable levels of greenhouse gas-emitting global transport are among the drivers of climate change; a compounding effect is that globalised transport links – in the absence of an adequate global disaster response – are among the factors contributing to the rapid spread of infectious diseases, as seen the case of the COVID-19 pandemic.

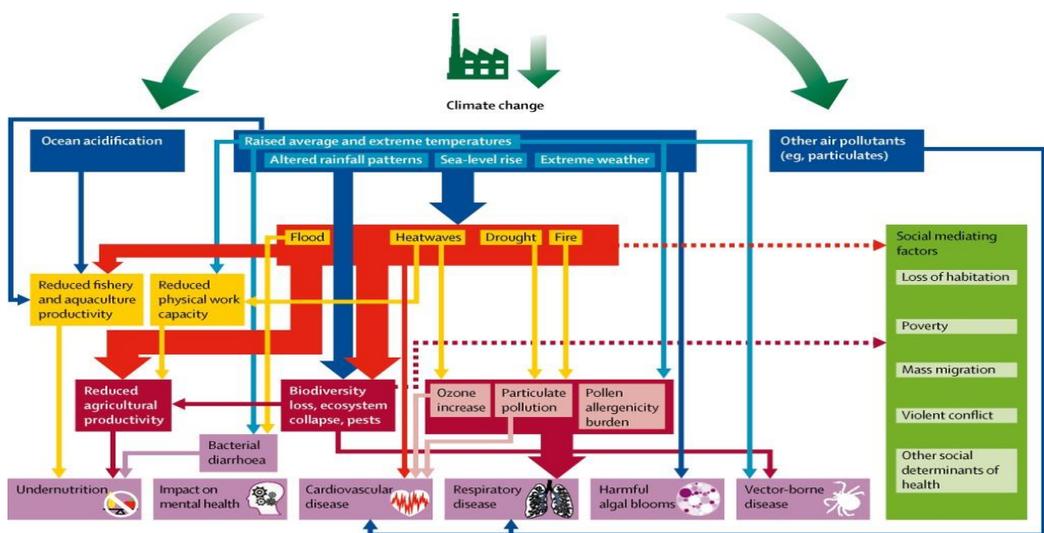


Figure 1. The pathways between climate change and human health (reproduced from Watts et al. 2018).

1.3. Supporting human health through adaptation to climate change

While climate change responses are often highlighted in terms of reducing the emissions of greenhouse gases (mitigation), a crucial part is taking actions to deal with those consequences of climate change that cannot be avoided (adaptation). For health impacts, adaptation is defined as 'designing, implementing, monitoring, and evaluating strategies, policies and programmes to manage the risks of climate-relevant health outcomes' (WHO 2014).

Achieving the goals of climate neutrality, while coping with the inevitable impacts of climate change, requires the capacity to influence, change and transform society in order to make it more resilient (Expert Elicitation). Placing human health in the centre of the transition towards societal resilience can bring large dividends, also for the economy (Watts et al. 2019).

Such a societal transformation requires public support, which relies also on emotional responses (JRC 2019). A focus on human health is likely to generate public support for these actions (as well as for mitigation policies). The experience of the COVID-19 pandemic shows that clear and consistent public messaging, underpinned by scientific evidence, has generally been met with public support for the necessary public health measures (Expert Elicitation).

The European health sector is, together with the social systems, of central importance for the response to climate change impacts on health. The health sector encompasses hospital activities, medical and dental care practices, and 'other human health activities' including those of midwives, physiotherapists, scientific or diagnostic laboratories, pathology clinics, residential health facilities, etc⁴.

The national health systems of European countries are varied, and reflect different societal and political choices. Nevertheless, the Council of the European Union named universality, access to good quality care, equity, and solidarity as common values⁵.

Public health expenditure amounts to about 15% of total government expenditure in the EU. The aging population, diet and lifestyle related conditions, and technological advances are drivers for an increase in spending, and maintaining the sustainability of health care spending is a challenge. The healthcare sector is also faced with challenges represented by unequal access to healthcare, competing fiscal pressures

⁴ The WHO defines a health system 'all organizations, people and actions whose primary intent is to promote, restore or maintain health'
<https://www.who.int/bulletin/volumes/87/11/08-059865/en/>

⁵ Council Conclusions on Common values and principles in European Union Health Systems (2006/C 146/01)
<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2006:146:0001:0003:EN:PDF>

and lack of information on value for money for investment in healthcare and long-term care systems⁶. The 2014 communication of the Commission on effective, accessible and resilient health systems (COM/2014/0215) calls for stable funding mechanisms, sound risk adjustment methods, good governance, strengthening of information flows, adequate costing and a health work force of adequate capacity in order to improve the resilience of health systems.

It is clear that the scale and intensity of climate adaptation will depend on what emission reductions are achieved and, consequently, the actual rise in temperature. Mostly, projections on health impacts as a result of climate change are based on the assumption that mitigation efforts that would keep the global temperature rise to 2 °C or less⁷. As an example of what the relatively positive scenario of a ≤ 2 °C rise means for human health, annual fatalities from extreme heat are estimated to rise from 2,700 deaths/year now to approximately 30,000 and 50,000 by 2050 with a temperature rise of 1.5 °C and 2 °C respectively (assuming present vulnerability without additional adaptation; PESETA IV 2020).

Without ambitious mitigation efforts, the world will experience warming of 3 °C or more in the coming decades, with impacts that will consequently be far more disruptive. With a warming of 3 °C, each year 90,000 Europeans could die annually from extreme heat (also assuming present vulnerability without additional adaptation) (Wheeler and Watts, 2018; PESETA IV 2020).

As a consequence, it is not sufficient to target adaptation only at any one specific scenario (e.g. the relatively optimistic 2 °C scenario). Instead, adaptation efforts need to be identified for broader temperature ranges, so that these measures can be scaled up or down.

Finally, there are limits to climate adaptation. In the event of extreme temperature changes, irreversible tipping points may be reached, limits to adaptation will probably be exceeded and parts of the planet will become uninhabitable for humans (IPCC 2014). Therefore, climate change adaptation must in no way be considered as a strategy that can replace mitigation, but as a necessary complement to mitigation.

1.4 The focus and approach of this scientific opinion

This scientific opinion focuses on the impacts of climate change on human health and the identification of actions that can be undertaken at EU level to support adaptation to impacts from climate change.

⁶ European Semester Thematic factsheet – Health Systems (2017)
https://ec.europa.eu/info/sites/info/files/file_import/european-semester_thematic-factsheet_health-systems_en_0.pdf

⁷ The adaptation goals of the Paris Agreement are linked to the agreements' mitigation goals aiming to limit temperature rise to 'well below 2°C'

As set out in the Scoping Paper (see Annex 1) the main request to the Group of Chief Scientific Advisors was:

Which adaptation measures could strengthen the resilience of the health sector in Europe in view of climate change? The Opinion will give special regard to vulnerable groups, regions and the urban environment, considering specifically impacts from vector-borne infectious diseases and heat and heat waves.

The scope of the opinion is limited to human health, albeit as seen within a broader physical and societal context. The main reason why animal and plant health were not included is that there are other initiatives on climate change and food safety or biodiversity (e.g. the project CLEFSA⁸, or the EU biodiversity strategy).

This opinion follows on our earlier work – specifically on ‘Carbon Capture and Utilisation’⁹, ‘New Techniques in Agricultural Biotechnology’¹⁰ and ‘Towards a Sustainable Food System’¹¹ where transformations related to climate change were already noted.

This scientific opinion draws upon evidence, knowledge and views gathered from expert elicitation and evidence reviews. The main input to the scientific opinion was provided by major international reports published recently, in particular the report of the European Academies Advisory Council (EASAC) ‘The imperative of climate action to protect human health in Europe’ of 2019. Additionally a complementary literature review ‘Adaptation to climate change-related health effects in Europe’ (SAM 2020) provided a summary of the international reports and literature on adaptation to health impacts from climate change published from 2015 to 2019. The scientific opinion also benefited from additional targeted consultations with experts during two expert workshops, a sounding board and a stakeholder meeting. For more information on the methodologies and the sources of information and evidence used to develop this Scientific Opinion, see Annex 2.

⁸ EFSA has initiated in 2017 a project on climate change as a driver of emerging risks for food and feed safety, plant, animal health and nutritional quality (CLEFSA).

⁹ https://ec.europa.eu/research/sam/pdf/sam_ccu_report.pdf

¹⁰ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/new-techniques-agricultural-biotechnology_en

¹¹ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/towards-sustainable-food-system_en

Box A. Climate change, air pollution and health

There is a strong link between climate change, air pollution and health. Over 90% of the world's urban population breathes polluted air, and outdoor and indoor air pollution cause 7 million death annually (WHO COP24).

The main air pollutants affecting health are:

- particulate matter from burning of fossil fuels and from fires;
- tropospheric ozone, which is produced by a reaction between oxides of nitrogen and volatile organic compounds, under the influence of sunlight;
- aeroallergens.

Mitigation is the key strategy for addressing climate change in general; it is important to reduce greenhouse gas emissions to a level that is a basis for subsequent establishment of the most cost-effective adaptation measures.

As greenhouse gases and air pollutants are typically emitted by the same sources, mitigation strategies that reduce greenhouse gas emissions or the use of fossil fuels typically also reduce emissions of pollutants, such as particulate matter (IPCC 2018).

In a more global context, reduction of the use of solid fuels for domestic use would greatly improve indoor air quality. In high-income countries the reduction the improvement of air quality can yield high economic and health gains.

Therefore, mitigation also has important direct co-benefits for health such as improved air quality. These health benefits are additional to the global health benefits that will flow from mitigation, such as reduced fatalities due to heat waves (EASAC 2019).

Box B. The COVID-19 pandemic and climate change

The Covid-19 pandemic illustrates the risk of emerging diseases and the stresses emerging diseases may place on the health sector. Even though COVID-19 itself is not considered to be a direct result of climate change, climate change will influence patterns of existing diseases, and there are also links between emerging infectious diseases such as COVID-19 and pressures on natural habitats, intensive agriculture and the meat trade.

COVID-19 is a zoonotic disease, i.e. one that is caused by a pathogen that has moved from animals to humans. The coronavirus causing it, SARS-COV2, is the seventh coronavirus known to infect humans (Andersen et al. 2020). It is a single stranded RNA virus that has close genetic similarity to bat viruses, suggesting that it emerged from a bat-borne virus, likely in late 2019.

Climate change and zoonotic diseases

Around 60% of all infectious diseases in humans are zoonotic (Woolhouse et al. 2005) as are 75% of all emerging infectious diseases (Taylor et al., 2001). Practices bringing animals and humans closer to each other increase the risk of transmission of pathogens.

Climate change can indirectly lead to emerging infectious diseases through changes in ecosystems, which also lead to changes in interactions between animals and humans. When discussing the impact of deforestation on coronaviruses, Afelt et al. wrote in 2018: 'The risk of emergence of a novel bat-CoV disease can therefore be envisioned'.

COVID-19 as a stress test for the health sector

The COVID-19 pandemic puts a massive strain on the health sector. Health services throughout Europe and the world are struggling to treat patients with staff stretched to the limit (and sometimes beyond), insufficient supplies of personal protection equipment and testing capabilities and lack of knowledge of the new disease. Coping with the pandemic has come at a high cost both to the health sector (staff falling ill, other pathologies not treated) and to society as a whole (lockdowns with all their shorter- and longer-term costs; many fatalities in elderly care).

The crisis induced by COVID-19 has many characteristics to be expected also from impacts of climate change on health. The pandemic arose rapidly, was foreseen but not known in specific terms (when, what, where), is a global phenomenon, has a disproportionate impact on vulnerable groups, may well be subject to compound effects (e.g. with heat waves) and the societal response is highly reliant on scientific advice.

The COVID-19 pandemic reveals needs of the health sector, as well as gaps and deficiencies. These should be assessed and conclusions drawn for future learning in the context of climate change and health.



Policy Context

THE POLICY CONTEXT

2.1. EU competence to act on climate and health

Climate action is a competence that the EU shares with the Member States as a part of the EU environmental policy¹². Under the Treaty of the Functioning of the European Union (TFEU), the EU shall contribute to 'promoting measures at international level to deal with regional or worldwide environmental problems, and in particular combating climate change'¹³.

Adaptation to climate change and its impact on human health concerns a wide range of EU policy areas other than climate and health, in which the EU competence for action is also mostly shared with the Member States. They include, inter alia, agriculture, fisheries¹⁴, environment, disaster and risk management, mobility and transport, energy, industry, the internal market (e.g. through European industrial standards), regional policy, and research and innovation. The EU strategy on adaptation to climate change aims to mainstream climate adaptation measures into these policies in a coherent way, and a new adaptation strategy is currently being prepared (see 2.3.).

In public health policy, the EU has mostly only supporting, coordinating and supplementary competences. Exceptions, for which the EU has stronger (i.e. shared) competence to act, include policies in animal and plant health which have an impact of human health, the safety of medicines and medical devices, and major cross-border health threats, including monitoring and early warning¹⁵.

On the basis of the latter aspects, the EU has set up a common system of epidemiological surveillance, monitoring, early warning, as well as preparedness and response planning in relation to serious cross-border threats to health of biological, chemical, environmental and other (known or unknown) origin (see 2.4.)¹⁶.

¹² Articles 191 to 193 of the Treaty on the Functioning of the European Union (TFEU). 'Shared competence' means that both the EU and the Member States may legislate in a given area, and that the Member States can legislate for the aspects of that policies where the EU has not exercised its competence (Article 2 of TFEU). Special provisions within the EU environmental policy apply to measures affecting town and country planning, land use (with the exception of waste management) and management of water resources, where the EU Council is the sole legislator (acting unanimously and after consulting the European Parliament).

¹³ Article 191 of TFEU.

¹⁴ With the exception of the conservation of marine biological resources, which is the exclusive competence of the EU (Article 3 of TFEU).

¹⁵ Articles 168 and 4(2)k of TFEU.

¹⁶ Decision 1082/2013/EU on serious cross-border threats to health.

2.2. Relevant international commitments

The EU and all its individual Member States are among parties of the United Nations Framework Convention on Climate Change (UNFCCC), agreed in 1992, which is the main international treaty on climate action.

The conference of the parties to UNFCCC (COP16 in 2010) decided to enhance global action on adaptation to climate change, e.g. by steering the formulation and implementation of national adaptation plans (NAPs)¹⁷. In the EU, it is the European Commission that provides guidance and coordination on NAPs developed by member states (see 2.3.).

In 2015, all UNFCCC parties adopted the Paris Agreement, which sets out a global, legally binding framework to limit global warming to 'well below 2 °C' and pursue efforts to limit it to 1.5 °C. The EU's current commitment under the Paris Agreement is to reduce greenhouse gas emissions by at least 40% by 2030 compared to 1990; the current (2019-2024) EC strategy aims to increase that ambition to at least 50% (see 2.3.).

The Paris Agreement also establishes 'the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the [previously set] temperature goal' (Article 7). The Agreement acknowledges the need to cooperate and enhance the understanding, action and support in different areas such as early warning systems, emergency preparedness and risk insurance. Cities and other sub-national authorities are invited to scale up their efforts and support actions to build resilience and decrease vulnerability to the adverse effects of climate change.

The World Health Organisation (Regional Office for Europe) was among the first international bodies to strongly advocate policies addressing the impact of climate change on human health. The EC endorsed the conclusions of a 'Commitment to Act' ('the Parma commitment') adopted in 2010 by all European WHO members, which included the need for the integration of health in all climate change mitigation and adaptation measures, policies and strategies at all levels and in all sectors¹⁸. The human health aspect was first considered in the 2009 EC White Paper on climate adaptation and its accompanying documents¹⁹ and then in the 2013 EU Adaptation Strategy (see 2.3.)

¹⁷ <https://unfccc.int/topics#:~:q=28deb0e5-7301-4c3f-a21f-8f3df254f2a4>

¹⁸ <http://www.euro.who.int/en/health-topics/environment-and-health/Climate-change/publications/2010/protecting-health-in-an-environment-challenged-by-climate-change-european-regional-framework-for-action/parma-declaration-on-environment-and-health>

¹⁹ White Paper. Adapting to climate change: Towards a European framework for action. COM(2009) 147/4.
https://ec.europa.eu/health/ph_threats/climate/docs/com_2009_147_en.pdf

Among major international commitments is the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), adopted in 2015 by the UN General Assembly. A number of the SDGs are strongly linked to preventing adverse impacts of climate change of climate health, including most obviously climate action (SDG 13) and good health and well-being (SDG 3), but also e.g. clean water and sanitation (SDG 6), and sustainable cities and communities (SDG 11). The EU has been active on mainstreaming SDGs into its policies, and in monitoring progress towards these goals²⁰.

Another relevant international agreement is the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework)²¹, endorsed by the UN General Assembly in 2015. It is a voluntary, non-binding agreement, which aims at 'substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries'. The framework recognises climate change as a major driver of disaster risk. It also explicitly calls for disaster risk reduction measures to be incorporated into climate adaptation policies (next to those related to poverty reduction, sustainable development, natural resource management, the environment, and urban development)²².

2.3. EU policies on climate adaptation and health

Climate action is at the heart of the European Green Deal, the European Commission's new growth strategy (2019-2024), the overall aim of which is to 'transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use'²³. The Green Deal communication states that to achieve these aims, 'it is essential to increase the value given to protecting and restoring natural ecosystems, to the sustainable use of resources and to improving human health'.

Regarding climate action, the main emphasis in the Green Deal is on mitigation, with the EC planning to present, by summer 2020, a plan to increase the EU's greenhouse gas emission reductions target for 2030 to at least 50%. The new European Climate Law proposed by the EC in early 2020 is meant as a key legislative tool in that respect.

The Green Deal also promises a new, 'more ambitious' EU strategy on adaptation to climate change (for late 2020 or 2021). Among the crucial aspects of the revised strategy, it lists 'strengthening the efforts on climate-proofing, resilience building, prevention and preparedness', and ensuring that 'investors, insurers, businesses,

²⁰ https://ec.europa.eu/info/strategy/international-strategies/sustainable-development-goals_en

²¹ <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

²² https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

²³ Communication from the Commission 'The European Green Deal'. COM(2019) 640 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX:52019DC0640>

cities and citizens are able to access data and to develop instruments to integrate climate change into their risk management practices’.

The new European Climate Law includes a dedicated article on adaptation which states that ‘Member States and the Union should enhance their adaptive capacity, strengthen resilience and reduce vulnerability to climate change, as provided for in Article 7 of the Paris Agreement, as well as maximise the co-benefits with other environmental policies and legislation’. It requires Member States to ‘develop and implement adaptation strategies and plans that include comprehensive risk management frameworks, based on robust climate and vulnerability baselines and progress assessments’.

In line with the overall vision, and informed by the evaluation of the 2013 Adaptation Strategy²⁴, the Commission is preparing a new EU Adaptation Strategy and, at the time of writing, has already published its ‘inception impact assessment’ report and launched a public consultation in May-June 2020²⁵.

The original objectives and main actions of the 2013 EU Adaptation Strategy have been:

- 1) Promoting adaptation measures by Member States by encouraging them to adopt comprehensive adaptation strategies. Instruments used were the direct targeted funding of local projects (particularly in vulnerable geographical areas) through the LIFE programme, and supporting adaptation in cities through the voluntary Covenant of Mayors initiative.
- 2) ‘Climate-proofing’ action at EU level i.e. mainstreaming climate adaptation measures into EU policies, including agriculture and forestry, maritime spatial planning and integrated coastal management, energy, disaster risk prevention and management, transport, research, health, the environment, land use planning (e.g. by promoting adaptation measures in urban land use, building layouts and natural resources management, cross-border management of floods; and trans-boundary coastal management, with emphasis on densely populated deltas and coastal cities), as well as infrastructure projects (e.g. by launching mandates for European standardisation organisations to start mapping industry-relevant standards in the area of energy, transport and buildings).
- 3) Better informed decision-making by addressing knowledge gaps about adaptation, and by further developing the information platform on European adaptation actions (Climate-ADAPT²⁶). The main knowledge gaps identified were: information on damage and adaptation costs and benefits; regional and local-level analyses and risk assessments; frameworks, models and tools to support decision-making

²⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013DC0216>

²⁵ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12381-EU-Strategy-on-Adaptation-to-Climate-Change>

²⁶ <https://climate-adapt.eea.europa.eu/eu-adaptation-policy/sector-policies/health>

and to assess the effectiveness of the various adaptation measures; and means of monitoring and evaluating past adaptation efforts.

The 2013 Strategy devotes some attention to vulnerable groups and areas, which is of relevance to public health. Vulnerable social groups identified in the strategy as requiring special attention are those which are 'already disadvantaged e.g. through poor health, low income, inadequate housing, lack of mobility. The areas identified as particularly vulnerable are the Mediterranean basin, mountain areas, densely populated floodplains, coastal zones, outermost regions and the Arctic. Additionally, the strategy highlights the fact that 'three quarters of the population of Europe live in urban areas, which are often ill-equipped for adaptation and are exposed to heat waves, flooding or rising sea levels'.

The policy response set out in the Strategy consists mainly of: (a) direct targeted funding for adaptation measures particularly in selected types of vulnerable areas (coastal areas, flood-prone areas, mountains and islands, areas threatened with desertification and forest fires, urban areas) through the LIFE programme, (b) promoting EU-wide vulnerability assessments. No specific actions were identified at the time for vulnerable social groups.

The 2013 Adaptation Strategy went through an evaluation (November 2018) including a public consultation (from December 2017 to March 2018). The analysis resulted in an evaluation report on lessons learned and reflections on improvements for future action.

The 2018 evaluation report noted concrete progress particularly on target directed funding of relevant adaptation projects²⁷. In 2014, the EC asked the European standardisation organisations to 'update standards for climate-resilient infrastructure in the transport, energy and building sectors'²⁸.

However, among 'lessons learned' the report acknowledges that integrating climate adaptation in infrastructures should be further strengthened, e.g. by 'prescribing climate proofing for any infrastructure funded by the EU, and particularly when the infrastructure is vital for emission reduction efforts'.

Accordingly, the EC's 2021-2027 EU budget proposal asks that 'a wider range of EU-funded infrastructure investments be climate-proof'.

With regard to mainstreaming of climate adaptation into the EU's legislative action, the evaluation report acknowledges the need for more effort in areas including coastal

²⁷ The EC report cites 60 adaptation-related projects funded through the LIFE programme with EUR 184 million since 2014, estimated to impact estimated to impact (through replication and transfer) an area equivalent to one quarter of the EU territory, and estimated to have produced societal benefits in society of ca. EUR 1.7 billion in 2014, i.e. four times the LIFE budget for that year.

²⁸ Commission Decision C(2014)3451

protection, green infrastructure and ecosystem-based adaptation measures, fisheries, international trade, private investment and insurance²⁹.

Regarding the governance structure, the evaluation report acknowledges that the strategy has been 'less effective' on monitoring the progress in implementing national adaptation plans, suggesting that a more streamlined process is needed for that purpose, and for facilitating peer learning.

The report also concedes slow and uneven progress at the local level (attributed *inter alia* to the presence or absence of national requirements for local adaptation plans) and called for greater commitment to that end at all governance levels (including better integration of local requirements into national and regional legal frameworks, e.g. in urban spatial and coastal planning), and greater assistance to the local policies.

Concerning knowledge gaps, the 2018 evaluation found 'a substantial increase of adaptation knowledge as a result of the Commission's efforts, notably through EU's research and innovation Framework Programmes and also through the European Climate Adaptation Platform (Climate-ADAPT)' but also acknowledged that 'none of the priority knowledge gaps have been closed and new gaps have emerged'.

In its conclusions, the report envisages a shift of focus towards integrating the inherent uncertainty of the existing knowledge into modelling and decision-making in a transparent fashion, and away from generating new knowledge towards applying existing knowledge 'to decision-making under uncertainty, particularly in economic sectors or regions that are potentially more vulnerable, such as agriculture in the Mediterranean regions or the European outermost regions'.

The evaluation report notes good progress on targeted direct funding focused on vulnerable geographical areas. Nonetheless, 'lessons learned' identified in the report include the need to 'better prepare geographical areas with specific environmental challenges, natural constraints or vulnerabilities with high exposure to climate change, such as the Outermost Regions'.

On vulnerable social groups, the EC evaluation report mainly charts possible future actions under 'lessons learned'. It recommends 'promoting the assessment and mapping of social vulnerability to climate-related events, as well as identifying and involving vulnerable groups for the design of fair adaptation policies at all relevant governance levels'. The instruments proposed for that purpose are for example to introduce the need to 'assess, plan, and carry out socially just adaptation in cities through EU funding programmes, e.g., helping to build capacity in municipalities so that they can design adaptation policies that are socially fair'. The report suggests using the study of the first local practices in cities across the EU as a point of departure (see Breil et al. 2018 for relevant case studies).

²⁹ Commission Staff Working Document 'Evaluation of the EU Strategy on adaptation to climate change' SWD(2018) 461 final <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018SC0461&from=EN>

The 2020 'inception impact assessment', which is the preliminary basis for revising the 2013 Adaptation Strategy charts the main strategic changes envisaged by the EC under the European Green Deal.

Policy actions that are suggested for expansion, compared to the 2013 strategy, include 'further mainstreaming of adaptation considerations in EU legislation and instruments, continuing to encourage resilience building in cities, closing further adaptation-relevant knowledge gaps, influencing public and private investments, including on nature-based solutions, promoting measures in support of a just adaptation, and financially supporting adaptation actions'.

Health (defined in line with the 'One Health' approach³⁰) is listed among policy areas singled out for the reinforced mainstreaming of climate adaptation, in addition to the water sector, insurance, agriculture, urban environments, oceans and disaster risk management and reduction.

The list of potential new actions of particular relevance to health includes:

- An observatory on social/health vulnerability to help identify health and social/distributional risks linked to climate change in early stages;
- Securing the health and wellbeing of European citizens through improved risk assessment and surveillance and enhanced preparedness of health and social services;
- An extended use of EU climate proofing guidance, aligned with the latest IPCC reports and scientific findings.

In addition, one of the four 'Green Deal missions', which are planned under the Horizon Europe research and innovation programme, concerns adaptation to climate change.

In the context of these considerations and processes, the European Commission is currently considering setting up a virtual EU observatory for climate change and health.

Within the EU public health policy, the main area of particular relevance to climate adaptation where the EU has a stronger (shared) competence to act major cross-border health threats, including monitoring and early warning (see 2.1.). Such health threats may be climate-induced as in the case of climate-sensitive vector-borne infectious diseases or extreme weather events.

In accordance with that competence, the EU established in 2004 the European Centre for Disease Prevention and Control (ECDC) with a mandate covering surveillance, detection and risk assessment of threats to human health from communicable diseases and outbreaks of unknown origin. The ECDC progressively took over the

³⁰ The 'One Health' approach is understood to encompass humans, animals and the environment.

epidemiological surveillance of communicable diseases and the operation of the Early Warning and Response System (EWRS), which has existed since 1998 but was operated by another network.

A policy document accompanying the 2013 EU Adaptation Strategy, devoted to (human, animal and plant) health aspects³¹, which charts possible future policy actions and tools in that area and also focuses on preparedness and early warning for climate-related health emergencies.

In line with that policy vision, in 2013, the EU set up a common system of epidemiological surveillance, monitoring, early warning, as well as preparedness and response planning in relation to serious cross-border threats to health of biological, chemical, environmental and other (unknown) origin³². The decision strengthened the role of the Health Security Committee (HSC) as a co-ordination body for the Member States' preparedness and response planning. It set up a network for the epidemiological surveillance of the communicable diseases³³, to be operated and coordinated by the ECDC. It also set up a revamped Early Warning and Response System (EWRS), tasked with rapid alerts on all types of serious cross-border threats to health.

The 2018 evaluation report on the Adaptation Strategy identifies the need for improvements in the area of health risks, notably reinforcing the links between public health and climate adaptation; it highlights specifically 'improv[ing] cross-sectoral cooperation on risk assessment and surveillance and ... increas[ing] the awareness and capacity of the health sector, including at local level, to address current and emerging climate-related health risks'.

The European Centre for Disease Prevention and Control (ECDC) has been active in anticipating and addressing the possible impact of climate change on communicable disease spread, including through the handbook 'Climate change and communicable diseases in the EU Member States'³⁴.

Funding under the third EU Health Programme (2014-2020) included among its thematic priorities 'Implementation of Union legislation on communicable diseases and other health threats, including those caused by biological and chemical incidents, environment and climate change'³⁵. The earlier EU Health Programme (2008-2013) funded projects dedicated to early warning and surveillance for specific health threats

³¹ Commission Staff Working Document 'Adaptation to climate change impacts on human, animal and plant health', SWD(2013) 136 final.

https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/swd_2013_136_en.pdf

³² Decision 1082/2013/EU on serious cross-border threats to health.

³³ The scope of the surveillance network also covers antimicrobial resistance and healthcare-associated infections related to communicable diseases

³⁴ https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/1003_TED_handbook_climatechange.pdf

³⁵ https://ec.europa.eu/health/sites/health/files/programme/docs/factsheet_healthprogramme2_014_2020_en.pdf

(e.g. cold spells, health effects of flooding, airborne allergens, ultraviolet radiation and vector borne and other human and animal infectious diseases)³⁶.

As an overall conclusion, developing connections between climate adaptation and health in the EU policies has so far focused strongly on integrating climate-related aspects into the elements of EU public health policy that concern the surveillance, preparedness, early warning and response to serious cross-border health threats (such as epidemics).

The converse process - integrating health (including its more general and preventive aspects) into the diverse policies affected by climate adaptation plans (as advocated e.g. by WHO) - has been recognised by the EU relatively early. Initially by endorsing the Parma declaration³⁷, followed more concretely by the assessment of policy options in collaboration with WHO (through the CEHAPIS project, the outcomes of which are found in the policy analysis accompanying the 2013 EU Adaptation Strategy)³⁸. A number of actions under the 2013 Adaptation Strategy (such as 'climate-proofing' infrastructure projects or in building design) did address some climate-related anticipatory and preventive health concerns. However, since the mainstreaming of climate adaptation into diverse EU policies has in itself proven a complex effort with uneven progress, as confirmed by the European Commission's own evaluation. Therefore the 'health in all adaptation policies' approach has not yet matured as a major focus (see 3.1. for implications and recommendations in that respect).

³⁶ https://ec.europa.eu/health/funding/key_documents_en#anchor1

³⁷ https://www.euro.who.int/_data/assets/pdf_file/0011/78608/E93618.pdf

³⁸ The 'Climate, Environment and Health Action Plan and Information System' (CEHAPIS) project provided an evaluation of policy options 'for a successful health adaptation to climate change and monitor trends'. Three areas for action have been identified: 1. Health intelligence and awareness on climate change and health; 2. Integration of climate change into health policies; 3. Integration of health into climate change related adaptation and mitigation policies. Results are extensively discussed in Commission Staff Working Document 'Adaptation to climate change impacts on human, animal and plant health', SWD(2013) 136 final.
https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/swd_2013_136_en.pdf



Recommendations

3. RECOMMENDATIONS

3.1. Integrate human health into all climate change adaptation policies

Health in all policies

Public health policy adaptation to climate change must include a preventive aspect (rather than only the aspect of disaster preparedness and risk reduction; see 3.2.). Moreover it should be considered in a range of other policies outside health policy through inter-sectoral governance (WHO 2018:53).

Land use planning (e.g. urban, spatial and coastal planning), housing and building design and infrastructures (such as power generation, drinking water and food supply, and transport), emerge as crucial areas for health-relevant anticipatory and preventive climate adaptation (Expert Elicitation, EASAC 2019:49). In these areas there are many synergies both with climate mitigation actions and with disaster risk reduction measures (WHO 2019).

There are calls by experts to go further by calling for 'health in all policies', i.e. for 'including health impact assessment in *all sectoral* climate change adaptation and mitigation initiatives, for example ... transport, energy, biodiversity' (EASAC 2019). This is also posited to include the EU food policy, with implications for the common agricultural policy³⁹ with implications for the Common Agricultural Policy (CAP). Using the forthcoming review and reform of the EU Adaptation Strategy for 'ensuring that health is a major focus' is recommended (ibid:47).

The WHO (2017) considers 'integrating health in all policies' one of the five fundamental components of public health adaptation to climate change, alongside the strengthening of health systems; primary health care; warning systems; action plans and preparedness, and monitoring and surveillance).

When approached at a broader inter-sectoral level, diverse mitigation and adaptation efforts can have large synergistic effects, enhance the understanding of trade-offs, and reduce the risk of disconnected adaptation policies working at cross-purposes (EASAC 2019:48).

³⁹ Pathways to a sustainable EU food system are the subject of the recent scientific opinion of the Group of Chief Scientific Advisors, which calls for 'a fully integrated strategy for achieving a sustainable food system' that must 'arise from a common, balanced set of environmental, social and economic sustainability goals' and charts out a stepwise approach, starting with mainstreaming that vision of a sustainable food system into all relevant (existing and planned) sectoral policies. https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/towards-sustainable-food-system_en

An example of synergy between climate mitigation and adaptation is the direct reduction of heat island effects of low-emission urban policies, which simultaneously reduce vulnerability to heat waves and climate-sensitive diseases due to improved air quality.

An illustration of a difficult trade-off that can be addressed through an integrated inter-sectoral approach is the issue of air conditioning. Air conditioning is a 'double-edged sword' (Watts et al. 2019:1851): on the one hand, it is estimated to significantly reduce heat wave-related mortality⁴⁰; on the other hand, it contributes to greenhouse gas emissions and air pollution, adds to peak electricity demand on hot days and aggravates the urban heat island effect (ibid). A broader approach – connecting different adaptation and mitigation measures, and seeking synergies between them – can involve e.g. passive building designs providing shade, insulation, thermal mass, natural cooling and ventilation, which can reduce the need for air conditioning, while energy-efficient appliances and the generation of electricity from non-fossil-fuel sources can reduce the harms conferred by using it.

With regard to **building infrastructure and housing standards**, key considerations include e.g. combining insulation and ventilation control improvements to increase efficiency of heating and cooling systems while reducing the health effects of moulds (EASAC 2019:36); changes in building design (orientation, layout, passive systems such as natural ventilation and cooling, thermal mass, external shutters) with the resulting reduction in energy consumption and a reduced need for the availability and use of air conditioning; storage and use of rain water for periods of poor precipitation (especially in drought-susceptible regions such as the Mediterranean); the use of window screens to keep out insects.

Attention must also be paid to climate adaptation of existing infrastructure and buildings (Expert Elicitation) – e.g. through fiscal incentives for and public funding of thermal insulation and cooling of older buildings, with priority given to the most synergistic methods such as cool roofs and façade greening (SAM 2020). Infrastructure and buildings in cooler regions may be more exposed to heat waves, since they have fewer provisions for cooling (Expert Elicitation).

Urban green spaces (such as parks, tree canopy cover, green or reflecting roofs and façades) are another important consideration as they combine mitigation and health-relevant adaptation effects. Using cool pavements (either reflective or permeable) is another measure for urban planning (PESETA IV 2020). They reduce the urban heat island effects (thus decreasing vulnerability to heat waves), improve air quality and microclimate, have positive effects on obesity and cardiovascular diseases, and have protective effects on mental health including clinical depression (EASAC 2019:37). However, inadvertent risks must be considered and reduced –

⁴⁰ It is estimated that in 2016 global air conditioning use reduced mortality by 23% on average compared with complete absence of air conditioning, reaching 66% in countries such as the USA, Japan and South Korea (Watts et al. 2019:1851-2).

examples include managing the risk of increase in disease vectors such as ticks or rodents (ibid), or avoiding the planting of tree species with pollen allergy risks or O₃ precursors (SAM 2020; Lohmus et al. 2015).

Another large impact on health is through changing **water** flows, such as floods, which may result in overflowing sewage, unsafe drinking water, or droughts which may threaten the availability of drinking water or water used for hygiene measures. Adaptation measures in water-related land use and infrastructure planning include e.g. increasing wetlands as defense against flooding while ensuring that they do not provide new habitats for disease vectors (EASAC 2019). For this reason, WHO suggests the need for 'building regulations and waste management infrastructure that are both environmentally sustainable and resistant to locally likely extreme events proposed' (WHO 2015). Land use planning and other relevant sectors also need to take into account multi-sectoral flood health risk management (WHO 2015, UN-ECE Protocol on Water and Health)

Another relevant long-term health consideration is **sustainable food and healthy nutrition**. The WHO calls for 'preventing hazardous conditions that could be further aggravated through climate change (such as unsafe water and food)'. It identifies healthy and sustainable diets, local sourcing of food (WHO 2017) and protecting nutrition and food security in a changing climate among important anticipatory and preventive measures⁴¹. The co-benefits of physical activity are also relevant (Expert Elicitation).

Transport infrastructures are also relevant to health, with large potential synergies between climate mitigation and adaptation. Accessible, efficient, decarbonised urban transport is a large mitigating factor due to its low greenhouse gas footprint; its health-relevant adaptive role is e.g. in decreasing population vulnerability by cutting air pollution and thus helping to prevent respiratory diseases. Aligning it well with the promotion of physical activity (i.e. of cycling as means of transport) also confers large health benefits (EASAC 2019:36).

The EU approach thus far has been a relatively early recognition of the general need to integrate health considerations into adaptation policies. However, integrating climate adaptation into other policies (though EU actions and in EU-supported national actions) is in itself work in progress that is encountering challenges (see 2.3. for the conclusions of the 2018 evaluation of the EU Adaptation Strategy and EASAC 2019). Hence, the idea of making health considerations a major focus of EU adaptation policies across all policy sectors has not yet developed as a fully-fledged approach

⁴¹ The food aspect links closely to the subject of the recent scientific opinion of the Group of Chief Scientific Advisors, 'Towards a sustainable food system', which calls for a food system for the EU based on a common, balanced set of environmental, social and economic sustainability goals (which include both climate and health aspects). https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/towards-sustainable-food-system_en

explicitly integrating long-term preventive aspects. Instead, it focuses mainly on connecting climate-related health threats to the EU surveillance, preparedness and early warning actions. This also applies to the objectives and actions being considered for the revised Adaptation Strategy that is under public consultation at the time of writing (see 2.3. for an extensive overview).

Multi-level governance and policy learning

In terms of the international governance of climate adaptation, we recommend aligning the strategy and policy more closely to the relevant Sustainable Development Goals (SDGs, with their 2030 Agenda) and the Sendai Framework on Disaster Risk Reduction (EASAC 2019:48-9, UNEP 2018, UNFCCC 2017; see Figure 2).

Considering composite SDG indicators for monitoring and assessment has been suggested (EASAC 2019). The European Commission's own evaluation report acknowledges the same among the 'lessons learned', stating that 'many of the indicators developed to monitor the progress on these global frameworks are highly relevant to adaptation'.

Since climate change effects in other regions have consequences for Europe (EASAC 2019) and the EU also has global commitments, a broader perspective on an EU climate-resilient health system also requires aligning relevant policies with global goals for sustainable development and for disaster risk reduction goals (EASAC 2019:48-9, UNEP 2018, UNFCCC 2017; see Figure 2). The EU's global role, particularly through its development aid policies, should include funding and support for countries in the global south in improving their climate change adaptation plans. That aid is a part of addressing global climate risks and impacts, and is therefore in the EU's direct interest as well (Expert Elicitation).

The WHO special report on public health and climate adaptation policies in the EU includes the conclusion that 'health protection to manage the risks of climate change needs to be strengthened and integrated at all governance levels' (WHO 2018:49). In line with this, the European Commission is currently providing guidance and coordination to Member States for their national adaptation plans and is additionally supporting regional and local adaptation actions directly, e.g. through direct targeted funding of local projects (see 2.3.).

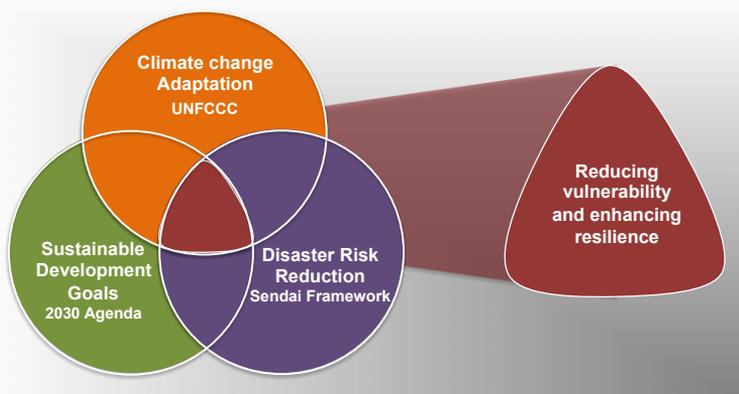


Figure 2. Integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework (*Adapted from UNFCCC 2017*)

Our earlier work on a sustainable food system for the EU⁴² offers transferable insights on the principles of good governance for a complex policy area, which can equally be applied to the EU climate adaptation governance while respecting the EU's treaty competences (see Ch.2.). These principles include 'boundary spanning' (as implemented e.g. by breaking silos between sectoral policies and levels of governance) and developing 'transformative capacity', by building learning, adaptability and flexibility into the governance model and by identifying relevant good practices and initiatives that may be scaled up or spread out.

The evidence synthesis 'cautions against the overoptimistic assumption that the inspiration which ... good practices offer, can automatically lead to successful upscaling or successful transfer to another local context' and therefore recommends 'facilitat[ing] the monitoring and assessment of [such] upscaling and transfer potential' (SAPEA 2020).

As a further caveat, evidence on the multi-level governance of mainstreaming climate adaptation across policies offers a cautionary conclusion that the above general principles should not be optimistically over-interpreted as an unproblematic recipe. First, how such mainstreaming really works is poorly understood and complex. While many policy approaches to mainstreaming see it as a linear sequence of capacity-building, learning and incorporation into policy, the process is in fact a non-linear patchwork of processes and approaches at supranational, national and local levels, each with specific and shared path dependencies. Second, existing disparities of power and resources between the different actors (e.g. EU/national/local;

⁴² https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/towards-sustainable-food-system_en

private/public) are likely to come into play and complicate the multi-level mainstreaming (cf. Ayers et al. 2014, Rauken et al. 2014, Uittenbroek et al. 2013).

Evidence-based assessment

The WHO report dedicated to policies in the EU calls for a faster uptake of relevant scientific evidence, particularly the assessment of social, economic and environmental consequences of adaptation measures. The report also concludes that 'impact, vulnerability and adaptation assessments must be better embedded in the EU action plans' (WHO 2018). This resonates with calls for 'continuing commitment to basic research to understand mechanisms of impact; longitudinal (long-term observational) data collection, with focus on vulnerable groups; research and modelling to characterise alternative scenarios and tipping points for impact assessments and co-benefits modelling; developing and improving indicators of exposure and vulnerability, evaluation of adaptation processes, resilience and greenhouse gas mitigation strategies' (EASAC 2019).

Recommendation 1: Integrate human health into all climate change adaptation policies

The integration of health aspects in all policies should take place across all sectors and governance levels affected by the climate change adaptation strategies and plans.

The EC should offer strategic direction and coordination for that integration across all governance levels (European, national, regional and local) taking into account international goals,

Moreover, we recommend strong support for policy learning across all policy sectors and governance levels, evidence-based assessment of adaptation actions, and closing evidence gaps.

Recommended policy actions:

- Promote synergies across all policy areas relevant to health, and increase the effort in integrating climate adaptation and health considerations into policies and standards, notably in:
 - land use (e.g. the role of health in urban, spatial and coastal planning)
 - building design, and infrastructures (e.g. for energy), such as supporting the incorporation of health-related climate-neutral, climate adaptation measures in building and infrastructure standards and codes

- disaster management, water and food supply, including provision of safe water and healthy food
- Seek and prioritise synergies with climate mitigation actions and disaster risk reduction. Adaptation should not harm mitigation goals, or – in the very least – unavoidable trade-offs should be transparently accounted for. Embedding 'human health' as a key component of the EU adaptation strategy contributing to the Green Deal should be aligned with the Sustainable Development Goals and with the Sendai framework for disaster risk reduction.
- Use the entire mix of policy interventions available at the EU level in order to intensify adaptation efforts in general, and particularly the integration of health into climate adaptation. For instance:
 - embed health-related requirements into the guidance for national adaptation strategies and plans
 - targeted funding of adaptation projects, and projects supported by e.g. European structural and investment funds; examples of relevant local projects that could receive support include city-level risk assessment of urban heat islands, and ways to reduce them through planning measures, or local planning and risk assessment to identify areas with greater mosquito breeding potential.

Support policy learning, evidence-based assessment of adaptation actions, and closing evidence gaps; including fostering peer learning from ongoing and completed adaptation initiatives; rigorous evidence-based assessment of planned, ongoing and completed climate adaptation actions; and further research where important evidence gaps are identified.

3.2. Support the resilience of the health sector

A climate-resilient health system is 'one that is capable to anticipate, respond to, cope with, recover from, and adapt to climate-related shocks, so as to bring sustained improvements in population health, despite an unstable climate' (WHO 2015).

Primary health care is a crucial actor. Watts et al. (2018a) state that 'The health sector should be at the forefront of adaptation efforts, ensuring health systems, hospitals, and clinics remain anchors of community resilience'.

However, health services throughout Europe are already pressed under current conditions of an aging population with increased survivability under chronic diseases. Long-term underinvestment in the health sector after the financial crisis of 2008 has reduced the resilience of the health sector (Legido-Quigley et al. 2020). This means

that the present system is not fully adapted even to present stresses, whilst climate change may place further stressors on the system.

Building resilience into the health sector with respect to climate change impacts should further be viewed in the context of more general rethinking of the health sector to face the challenges of an ageing population, rising health-care costs, difficulties in dealing with infectious diseases (i.e. COVID-19, antimicrobial resistance), health inequalities and the introduction of technological innovations like e-medicine and biotechnology-based treatments.

The subsidiarity principle means that health systems in Europe are to a large extent a national prerogative. European countries are individually responsible for organizing and delivering health services and medical care. The role of the EU is complementary, and supporting national endeavours in for example cross-border healthcare, cross-border health threats, pharmaceuticals and medical devices. The European Commission also supports the health sector financially through funding by the Health Programme, research funding, and cohesion policy (see also Ch.2.)

Although the role of the EU in strengthening the health sector is complementary to those of national and global levels it can contribute through cross-border coordination, evidence-gathering and monitoring, funding and disaster preparedness.

Increase the preparedness and general ability of the health sector

The preparedness of the health and social care systems is a crucial part of adaptation to climate change impacts on health. Preparedness is needed both for expected impacts, such as a general rise in temperature, as for processes or events that cannot be predicted with high certitude.

It is important to build social capital and resilience into systems and infrastructure (EASAC 2019). To some extent, preparedness deals with increasing the resources (funding, knowledge and skills, organisation) in the system, with an aim of building in redundancy or backup capacity. Health services such as hospitals and the ambulance service should be able to manage their additional workload during extreme events such as heatwaves. This also places a requirement on climate resilient health infrastructures – i.e. that they can manage under storms and flooding that may impact electricity and water supply, interrupt supply chains and transportation links - which at present are rare (see also section 3.1.2).

Adaptation relevant to climate change-related health effects may include anticipating and mitigating any alleviate disruptions to health service in relation to provisions of transport, electricity supply, medicine (such as potentially availability and production of medicine and alternative sources), the ability to detect and limit the spread of pathogens that may result from trade and transport patterns, and tackling vulnerabilities in e.g. water and sewage control provision to ensure these remain functional under extreme events. Knowledge of the consequences of climate change is incomplete in health practice. Therefore, the importance of better training in

environmental epidemiology and integration of climate change health issues in medical training was emphasized by experts (Expert Elicitation; EASAC 2019; Wheeler and Watts 2018). This includes for example training in environmental epidemiology (SAM 2020).

Provide support and information to health services

On the basis of the relatively recent development of climate change adaptation as an issue, there is a need to increase the development and application of provisions for support to health services on climate change and extreme events related information. This would include the analysis of research gaps, detection of risks, early warning systems, climate information services for health, heat-health early warning, epidemiological forecasting, and surveillance and control of climate sensitive infectious diseases.

The uncertainties associated with possible extreme climate change scenarios, non-linearities, tipping points and compounded effects, mean that it is difficult to foresee and prepare for all stresses to the health sector (EASAC 2019). Therefore, next to routine monitoring, also early warning mechanisms in case of unexpected and unpredicted scenarios and events are important.

Enhancement of epidemiological surveillance may include information on climatic and environmental conditions with integration of vector and reservoir surveillance, health risk assessments to inform adaptation (modelling, remote sensing, vulnerability mapping), forecasting readiness, and early detection (Expert Elicitation). Also, many European countries presently lack systematic monitoring, reporting and forecasting of pollen patterns (Expert Elicitation).

The integration of datasets is important for understanding the links between hazard, exposure, susceptibility and outcomes (EASAC 2019). For example, it would be useful to compare data from vector surveillance with climatologic information, and data from health surveillance and air quality.

The increasing pressure on health services may also require the development of innovative technologies (e.g. telemedicine) in order to ensure the provision of service, for instance also to groups who have limited accessibility to care, or for use during extreme events. There is potential for a more extended use of information tools (broader than only one area) and behavioural tools, such as long white clothing, drinking water, reducing activity at peak times, taking breaks, supporting sleeping quality, lower water use, etc.

Specific adaptation measures to support the resilience of the health sector for heat and heat waves, and for vector-borne diseases.

From the Expert Elicitation and literature review (SAM 2020), a number of measures emerge that would strengthen the health sector with respect to the specific impacts in the focus of this scientific opinion.

Specific measures for the adaptation to heat and heat waves:

- Support the national heat-health action plans and regional coordination in case of heat waves. These systems need to be able to rely on meteorological early warning systems;
- Take the potential impact of heat and heat waves on human health into account in building regulations and standards;
- Invest in the knowledge base for urban planning and the development of transport infrastructure regarding the impact on human health;
- Adopt work regulations to limit the exposure of workers to adverse conditions, especially outdoors, due to climate change. Special attention should be paid to vulnerable populations such as migrants and seasonal workers.

Specific measures for adaptation to changes in the distribution of vector-borne diseases:

- Enhance surveillance in specific geographic areas where infections are expected to expand, and integrate vector and reservoir surveillance into epidemiological surveillance;
- Organisations making climate observations should interact with those responsible for disease monitoring, as environmental and climatic conditions may be precursors of vector-borne diseases;
- Where relevant, rapid diagnostic tests for vector-borne diseases should be developed or improved;
- Develop action plans for a mix of control measures, such as control and/or eradication (taking into account unintended consequences) of vectors, vaccine development and vaccination campaigns, based on the best available evidence;
- Train medical staff to identify infectious diseases in previously untypical regions. Alert the public to the possible occurrence of such diseases and to possible protective measures;
- Better coordinate data collection and preventive measures at European, national and subnational level.

Recommendation 2: Support the resilience of the health sector

The EU should use its complementary role in health policy to support the capacity and preparedness of the health sector in the EU to deal with climate change impacts, as part of broader disaster and emergency risk strategies, including surveillance, monitoring and assessment.

Recommended policy actions:

Strengthen the health sector itself:

- Support the education and training of personnel in the health and social care sector (for instance with regard to relevant risks and emergencies).
- Organise availability of critical components such as stocks of equipment, medicines, vaccines and testing capacity within Europe and support member states and other entities in acting towards such a goal in order to mitigate any health-care crises;
- Support improving basic infrastructure, and amend policies for building and design to include infrastructure adjustment, in relation to heat waves and other risks to health;

Infrastructure adjustments should be undertaken whilst considering energy costs and alternative cooling/heating solutions, capturing synergies supporting health systems in different ways.

Provide support to the health services by improved infrastructures at EU level by:

- Considering the creation of a disaster risk and climate change and health knowledge centre or coordinating mechanism that can interact with operational bodies of civil protection, policy makers, the health services and provide timely information to them;
- Extending capabilities of the EU to deal with cross-border threats, based on formal competence, in relation to for example infectious diseases, and reviewing ways for the EU to address international dimensions of health risks;
- Further developing the European climate adaptation platform Climate-ADAPT and Copernicus services and C3S, in particular in terms of health adaptation.
- Supporting surveillance, monitoring and assessment, as well as predictive modelling and early warning systems for climate-sensitive processes and diseases. This includes the integration of environmental and health (epidemiology) datasets, as well as interactions between environmental and health agencies and policy makers.

3.3. Design policies to support the most vulnerable social groups and geographical areas

Health impacts are the combination of exposure to a hazard (e.g. extreme heat or an infectious disease) with vulnerability. Vulnerability is determined by individual factors such as age and health, as well as by social aspects such as socio-economic status (EEA 2018:16).

Older adults, children and those in poor health (e.g. with chronic diseases or taking certain medications) are identified across evidence sources (IPCC:2018, 'very high confidence'; EEA 2018) as those that tend to be more adversely affected by such environmental health hazards such as heat waves than the general population (i.e. they are more vulnerable). Further vulnerable groups that are identified include women (IPCC 2018, 'very high confidence'), particularly pregnant women (SAM 2020), and migrant workers and asylum seekers (Expert Elicitation).

Groups of lower socio-economic status (the unemployed, those on low incomes or with lower levels of education) also tend to be more negatively affected by environmental health hazards. This is a result of both their higher vulnerability and greater exposure – e.g. through occupation exposure such as – e.g. for people doing heavy labour outdoors, or in humid or poorly ventilated conditions (EEA 2018).

Different vulnerabilities may overlap. For example, poverty may interact with conditions such as old age, life-threatening and chronic diseases, using specific medication, dependence on care, poor conditions for children and pregnant women

There are large geographical areas within Europe that may suffer disproportionate impacts. For example the Mediterranean area and the northernmost areas of Europe are particularly vulnerable to the impacts of heat waves and climate-sensitive vector-borne diseases.

Vulnerable areas also include the urban environment, mainly due to the urban heat island (UHI) effect and the increased risks of the spread of vector-borne infectious diseases (SAM 2020; see also 3.1.2.).

However, vulnerabilities vary significantly between various social groups within the same cities (Expert Elicitation), and there are very pronounced differences between urban areas across European regions.

Regions with lower average socio-economic status and higher proportions of older adults in southern and south-eastern Europe experience greater exposure to ground-level ozone and heat (EEA 2018). Regions that are both relatively poorer and more polluted in terms of particulate matter (PM) are located mainly in eastern and south-eastern Europe (ibid), with air pollution constituting an exacerbating factor for climate-induced hazards (see Box A.). The link between socio-economic status and exposure to PM is also present at a local level (EEA 2018). Wealthier regions tend to have higher average levels of nitrogen dioxide (NO₂); however, it is still the poorer communities that tend to be exposed to higher local levels of NO₂ (ibid).

Some populations (e.g. poorer and elderly citizens inhabiting cities in the south-east Mediterranean area) may thus not only experience a combination of vulnerabilities, but also suffer from multiple and higher than average exposures e.g. to heat waves and outbreaks of infectious diseases (as anticipated by the WHO for the Covid-19 pandemic⁴³). These may coincide, with devastating impacts (Expert Elicitation).

While a review of adaptation measures in the Mediterranean area suggest generally high awareness of these hazards, since the region is already experiencing them, more needs to be done – for example, adaptation plans in urban design often lack specifics (SAM 2020).

Coastal areas and those prone to river floods suffer specific risks (PESETA IV 2020). In general, southern Europe is expected to be impacted relatively more than other parts of Europe, largely because of ‘changes in high-end temperatures and the spatial and temporal availability of water’ (PESETA IV 2020).

However, in northernmost areas of the globe or the Arctic, warming will be comparatively the highest (EASAC 2019), and it has been suggested that people living in such cooler regions may be more exposed to heat waves, considering that the building designs and infrastructures may have fewer provisions for cooling (Expert elicitation). Indigenous and local populations, for instance in the European Arctic region, are vulnerable because increased temperatures lead to unprecedented exposure to pathogens, as well as potential changes to lifestyle and diets, with likely negative effects on physical and mental health (SAM 2020; Jaakola 2017).

Available evidence on tailoring adaptation approaches to vulnerable groups is fairly limited. In the most general terms, the evidence review suggests that the issue seems addressed only as part of policies dealing with social and health inequalities (SAM 2020; Paavola 2017).

A more general recommendation for vulnerable groups (such as the elderly, low-income, disadvantaged populations, and those with chronic medical conditions) emerging from the evidence is to adopt a differentiated and context-dependent approach. Such an approach should rely on networks of local public, private and civil society groups for enhanced sensitivity to what constitutes appropriate and effective interventions that can be perceived as legitimate and trustworthy e.g. house visits, phone calls, text alerts (SAM 2020; Mees et al. 2015). In terms of health communication, concise language and clear visual aids are recommended, and educational approaches such as massive open online courses (MOOCs) are posited to hold promise for these groups (SAM 2020; Berteit et al. 2019).

Some further specific recommendations emerge from the evidence concerning the elderly, they are typically vulnerable to heat waves and show high mortality rates due

⁴³ <http://www.euro.who.int/en/health-topics/environment-and-health/pages/news/news/2020/5/preparing-for-a-long,-hot-summer-with-covid-19>

to exposure. As old age often overlaps with low income, cooling such as air conditioning tends to be less accessible and less affordable for that group. However, the elderly tend to exhibit behavioural and attitudinal patterns that aggravate their vulnerability. For instance, they tend not to respond to interventions used in the early warning system in ways generally expected of the population (SAM 2020); they also tend not to perceive climate change related risks as major threats (SAM 2020). Recommended approaches include mainly adapting the style of climate health communication (e.g. emphasizing protective actions instead of risk messages; SAM 2020, Åkerlöf et al. 2015).

The COVID-19 pandemic has illustrated both the disproportionate impact of the health crisis on vulnerable groups and the role of community social networks for vulnerable groups, and the need to adapt approaches to their behavioural patterns, under a health crisis (Expert Elicitation).

Concerning EU policy so far, the EU Adaptation Strategy already devotes some attention to vulnerable geographical areas, mainly through direct funding of adaptation measures in selected types of vulnerable areas (coastal areas, flood-prone areas, mountains and islands, areas threatened with desertification and forest fires, urban areas), promoting EU-wide vulnerability assessments. On vulnerable social groups, the European Commission's evaluation report mainly charts possible future actions (see 2.2. for details).

Recommendation 3: Design policies to support the most vulnerable social groups and geographical areas

Particular focus should be placed on reinforcing adaptation actions in geographical areas that are particularly vulnerable to health-relevant hazards resulting from climate change, such as heat waves, vector-borne infectious diseases, floods and droughts.

Socially just adaptation measures should aim to cater for the social groups that are the most vulnerable to climate-related health impacts.

Recommended policy actions:

- Seek synergies with health-related preventive adaptation policies, *e.g.*, in building and infrastructure design and with policies to support the resilience of the health sector in designing the policy interventions;
- Examples include the design of elderly care homes (preventive measures), and dedicated measures for the elderly in heat-health plans and in preparedness for disease outbreaks;
- Support an understanding of multiple vulnerabilities and how this may impact groups (such as for instance chronic disease amongst elderly or socio-economically disadvantaged groups, in relation to heat waves);
- Promote the integration of socio-economic data sets into adaptation planning at all levels as it is likely to help in addressing social vulnerability to climate-related health impacts;
- Monitor the implementation progress and request thorough evidence-based assessment of all policies, with attention to vulnerable groups and areas;
- Support local policies and initiatives and promote peer learning and assessment for policy transfer and scaling-up potential. Relevant initiatives may include *e.g.* existing urban initiatives to identify groups that are socially vulnerable to climate change and to plan and implement socially just adaptation actions).



Annexes

Annex 1 – Scoping Paper

Issue at stake

Scientific evidence demonstrates that global climate is changing. Anthropogenic emissions have largely contributed to global warming with a consequential increase in the adverse effects to human health, an increase in morbidity and mortality and amplification of health risks. Climate change requires societies to adapt to a range of challenges, including natural disasters and heat-related health effects, increased incidence of communicable and non-communicable diseases, and to the disproportionate effects on vulnerable populations. The impact of climate change on human health is going to vary according to geographic location, socioeconomic conditions and ecological settings.

Responding to climate change involves a two-pronged approach: reducing the emissions of greenhouse gases (greenhouse gases) (mitigation) and taking actions to help individuals, communities, organisations and natural systems to deal with those consequences of climate change that cannot be avoided (adaptation). Translating this in the context of health impacts, the World Health Organisation (WHO) defines adaptation as the process of 'designing, implementing, monitoring, and evaluating strategies, policies and programmes to manage the risks of climate-relevant health outcomes'.

The October 2018 International Panel on Climate Change (IPCC) special report on the impacts of global warming of 1.5°C underlines that climate-related risks to health will be far greater than expected. While every human being is in principle exposed to health risks of global warming, urban populations are at disproportionately higher risk of adverse health effects including sub-populations such as, children, the elderly, the poor and outdoor workers.

This and a number of other facts were also emphasised in the 2016 scientific assessment of the impacts of climate change on human health of the USA Global Change Research Programme, which describes the interaction of a number of climate impacts with underlying health, demographic and socioeconomic factors and was confirmed by the corresponding Fourth National Climate Assessment report (USGCRP 2018). Recently, the World Health Organisation (WHO 2017) Regional Office for Europe published a report entitled 'Protecting health in Europe from climate change: 2017 update' where it describes the current knowledge on impacts in different regions and populations and how appropriate adaptation measures will make the health sector resilient. The latter has been enforced in a recent WHO special report (WHO 2018) and the Lancet Countdown on health and climate change (Watts et al 2018).

From these reports, it may be concluded that both direct and indirect effects on health are expected from climate change:

- Direct impacts due to increased frequency and intensity of extreme events resulting in heat and cold waves, floods, storms, droughts, and wild fires.

- Indirect impacts such as climate change mediated ecological disruptions, altered risk of infectious diseases due to shifting patterns of distribution and abundance of pathogens, their vectors (such as mosquitoes, ticks) and their transmission dynamics; respiratory diseases due to decreased air quality (ground level ozone and particulate matter) with changing patterns in urban areas; new patterns of allergic conditions due to emergence of aeroallergens. The health effects may be exacerbated by compounding effects of high temperatures and air pollution, wild fires and dust storms.
- Socioeconomic and geopolitical dynamics such as migration responses, due to climate change induced migration, displacement of populations, and resettlement, as well as poverty aggravation, which may further amplify both direct and indirect climate-related health effects.

Taking into consideration the magnitude of exposures and the potential health impact, the Opinion will focus on major health threats emerging from climate change: temperature-dependent phenomena (e.g. global warming, heat and heat-waves) and vector-borne infectious diseases. Emphasis will be put on the impacts on health emerging from the co-occurrence of multiple interacting hazards (e.g., air pollution and heatwaves). Moreover, the health effects of the above threats are expected to be unevenly distributed across and within countries, regions, and more pronounced in urban areas and disproportionately affect vulnerable population groups. Therefore, the Opinion will predominantly explore the health effects on vulnerable population groups in an urban context. The co-benefits that may emerge from climate mitigation measures such as reducing emissions and the associated decrease of health risks will also be addressed.

The Opinion will focus on the impacts of climate change on human health and will identify adaptation gaps, their origin, characterisation and reason. As animal health in relation to food safety is addressed by other projects, the Opinion will address it only in the context of vector-borne diseases which can be transmitted from animals to humans

⁴⁴. The Opinion will inform the revision (and broadening) of the EU's climate change adaptation strategy with recommendations that may lead to reduction of risks from climate-related health effects.

Policy context

The Treaty of the Functioning of the European Union (TFEU) demands a high level of human health protection across Union policies and a complementary role of the Union

⁴⁴ EFSA has initiated in 2017 a project on climate change as a driver of emerging risks for food and feed safety; plant, animal health and nutritional quality (CLEFSA); possible synergies will be explored.

in supporting national health endeavours. The Decision No. 1082/2013/EU on serious cross-border threats to health ' ... lays down rules on epidemiological surveillance, monitoring, early warning of, and combating serious cross-border threats to health, including preparedness and response planning related to those activities, in order to coordinate and complement national policies ... '. The Decision addresses biological, chemical, environmental or other health threats, communicable or not, and defines the engagement of the European Centre for Disease Prevention and Control (ECDC) and the European Food Safety Authority (EFSA). ECDC, together with the WHO, EFSA and the European Environment Agency (EEA) are working on the identification of risks and vulnerabilities within Europe, as related to communicable and infectious diseases and food safety.

The European Commission (EC) Communication COM/2013/0216 'An EU Strategy on adaptation to climate change' recognises that the consequences of climate change are a global issue and of major relevance for Europe. With an average temperature of the European land area over the last decade (2002-2011) of 1.3°C above preindustrial level, the temperature increase in Europe has been faster than the global average. While mitigation remains a priority for the global community, the impact of climate change will increase in the coming decades because of the delayed impacts of past and current greenhouse gas emissions.

Therefore adaptation measures are needed to deal with the unavoidable climate impacts. The European Commission Communication aims at making the EU more climate-resilient by taking a coherent approach and providing for improved coordination. While it focuses on the economic consequences, it acknowledges that in health policy existing measures and systems in the Member States need to be adjusted to whatever new challenges climate change will bring. Further, many Member States identify health as a vulnerable sector for which more information is needed for developing targeted adaptation policies. Although many of the adaptation measures in the socio-economic context will indirectly address public health threats, the specific needs in public health have to be addressed in more detail. Particularly vulnerable populations, such as children, elderly, subpopulations with underlying medical conditions, and regions, such as the Mediterranean basin, coastal zones, densely populated floodplains and urban areas will need specific consideration.

The European Commission has published on 12 November 2018 a report to the European Parliament and the Council on the implementation of the above-mentioned Strategy. The report contains an analysis of the results in terms of lessons learned and reflections on improvements for future action. This report and the Scientific Advice Mechanisms' Opinion on Climate Change and Health will constitute valuable inputs for subsequent developments in the EU's adaptation strategy.

Request to the Group of Chief Scientific Advisors of the Scientific Advice Mechanism (SAM)

Responding to climate change involves a two-pronged approach: reducing the emissions of greenhouse gases (greenhouse gases) (mitigation) and taking actions to

help individuals, communities, organisations and natural systems to deal with those consequences of climate change that cannot be avoided (adaptation). Translating this in the context of health impacts, the World Health Organisation (WHO) defines adaptation as the process of 'designing, implementing, monitoring, and evaluating strategies, policies and programmes to manage the risks of climate-relevant health outcomes'.

The SAM Group of Chief Scientific Advisors will provide scientific advice based on existing evidence on the health impacts of climate change to inform future policy decisions in the field of adaptation. The Opinion will address the following question:

Which adaptation measures could strengthen the resilience of the health sector in Europe in view of climate change? The Opinion will give special regard to vulnerable groups, regions and the urban environment, considering specifically impacts from vector-borne infectious diseases and heat and heat waves.

The Opinion will give special regard to vulnerable groups, regions and the urban environment, considering specifically impacts from vector-borne infectious diseases and heat and heat waves.

The Opinion is restricted to human health, with a focus on Europe within a global context.

The Opinion will consider the evidence on the various health impacts and the effectiveness of adaptive measures, and possibilities for co-beneficial health gains of the integration of mitigation measures in a cross-sectoral comprehensive way. Based on this the opinion will propose policy recommendations for adaptation measures at EU level.

Further actors carrying out relevant work on climate change-related health aspects

- European academy networks through SAPEA (Science Advice for Policy by European Academies) and the wider scientific community
- The European Commission's Joint Research Centre (JRC)
- European Centre for Disease Prevention and Control
- European Food Safety Authority
- European Environmental Agency

Annex 2 – Methodology

Following their earlier work on vehicle CO₂ emissions⁴⁵, carbon capture and utilisation technologies⁴⁶ and transitioning toward a sustainable food system⁴⁷, the Group of Chief Scientific Advisors intended to provide scientific advice on the adaptations needed to make the health sector more resilient with respect to the impacts of climate change on health.

The Scientific Advisors instructed the SAM Secretariat to investigate major, relevant work in this area to help identify the aim and scope of such an advice and to avoid the duplication of existing analysis and advice. Close discussion with the European Academies Science Advisory Council (EASAC) team preparing their report 'The imperative of climate action to protect human health in Europe' were helpful in focusing the question to be investigated.

These investigations resulted in the writing of a Scoping Paper (Annex 1) in consultation with the College of Commissioners, setting out the request for advice. The Group of Chief Scientific Advisors agreed to take up the work as detailed in the Scoping Paper on 31 March 2019.

Three members of the group, Carina Keskitalo, Elvira Fortunato, and Nicole Grobert led the development of the scientific opinion on behalf of the Group of Chief Scientific Advisors, with final publication date June 2020.

The Scientific Advisors were aided by staff of the SAM Secretariat, which performed a comprehensive literature review, attended relevant conferences and meetings, and organised expert elicitation meetings. The SAM Secretariat assisted the Scientific Advisors in organising discussions with policy experts of the European Commission on the scientific evidence and policy relevance and an expert 'sounding board meeting' on the draft Scientific Opinion. A full list of experts and stakeholders can be found in Annex 3.

Finally, the SAM Secretariat aided the Scientific Advisors in convening a stakeholder meeting at which the preliminary and the areas under consideration for the Scientific Opinion were presented by the SAPEA Working Group chair and the Scientific Advisors, respectively.

This Scientific Opinion was thus informed by various sources of evidence, notably:

⁴⁵ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/light-duty-vehicle-real-drive-co2-emissions_en

⁴⁶ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/novel-carbon-capture-and-utilisation-technologies_en

⁴⁷ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/towards-sustainable-food-system_en

1. A comprehensive literature review (SAM 2020)
2. Two expert consultation meetings (on 7 June 2019 and 24 September 2020)
3. A sounding board meeting with scientific experts on draft recommendations and further considerations (on 27 April 2020)
4. A stakeholder meeting to hear views on aspects of feasibility, impacts on different groups and additional points for consideration (on 13 May 2020)
5. Major international reports published recently, in particular the EASAC report called 'The imperative of climate action to protect human health in Europe' of 2019 (EASAC 2019)

The literature review and meeting reports are published online⁴⁸.

⁴⁸ https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/adaptation-climate-change-related-health-effects_en

Annex 3 – List of experts and stakeholder representatives consulted

Adger	Neil	Professor Human Geography, University of Exeter
Andrade	Onelica	DG RTD C.3 Climate and planetary boundaries
Andrieu	Laurie	European Hospital Health Care Federation *
Berrang-Ford	Lea	Priestly International Centre for Climate
Bertollini	Roberto	SANTE SHEER Committee
Bojariu	Roxana	National Meteorological Administration, Bucharest
Castro	Rosa	FEAM
Chassagne	Olivier	DG Grow F.1 Industrial Strategy and Value Chains
Christophides	George	Imperial College London
Corritore	Elisa	FEAM
Duarte Santos	Filipe	University of Lisbon
Ebi	Kristie	Professor Global Health, Env. and Occ. Health Sciences, University of Washington
EGgen	Bernd	MetOffice, C3S
Fanos	Margherita	DG SANTE C3, Crisis management and preparedness in health
Fears	Robin	European Academies' Science Advisory Council (EASAC)
Fernández de Arróbye	Pablo	University of Cantabria
Feyen	Luc	DG JRC E.1 disaster Risk Management
Franco	Vicente	DG ENV C.3 Clean Air
Füssel	Hans Martin	European Environmental Agency (EEA)
Gallo	Giulio	DG SANTE *
Ghani	Meera	Ecolise *
Goodman	Patrick	Dublin Institute of Technology
Griffin	George Edward	President FEAM
Haines	Sir Andy	London School of Hygiene and Tropical Medicine
Hugas	Marta	EFSA *
Ibarreta	Dolores	DG JRC C.6 Economics of Climate Change, Energy and Transport
Imperiali	Olimpia	DG ECHO A.3 Security and Situational Awareness
Jaakkola	Jouni	University of Oulo
Karjalainen	Tuomo	DG RTD E.1 Healthy lives
Kendrovski	Vladimir	World Health Organization (WHO) European Centre for Environment and Health
Leitner	Markus	Umweltbundesamt *
Löffler	Peter	DG CLIMA A.3 Adaptation
Mandall Johnson	Dame Anne	University College London

Massay-Kosubek	Zoltan	European Public Health Alliance (EPHA):	*
Murray	Virginia	Public Health Service	
Mysiak	Jaroslav	Euro - Mediterranean Centre on Climate Change (CMCC)	
Nilsson	Maria	University of Umeå	
O'Connell	Emer	Public Health Service	
Philip	Wolfgang	DG SANTE C.3 Crisis Management and preparedness in health	
Poertner	Hans-O.	Alfred-Wegener-Institute, IPCC	*
Robinson	Tobin	European Food Safety Authority (EFSA)	
Santoro	Anna	DG JRC A.2 Work Programme	
Sauerborn	Rainer	University Hospital Heidelberg	
Schmoll	Oliver	WHO Regional Office for Europe	
Semenza	Jan	European Center for Disease Control	
Sinisi	Luciana	Institute for Environmental Protection and Research (ISPRA)	*
Stilianakis	Nikolaos	JRC F.7 Knowledge for Health and Consumer Safety	
Toussaint	Brigitte	DG JRC F.7 Knowledge for Health and Consumer Safety	
Van Cangh	Thomas	DG SANTE Assistant to Director-General	
Van Leeuwen	Remko	EGHRIN	*
Van Minnen	Jelle	PBL Netherlands Environmental Assessment Agency	*
Vardoulakis	Sotiris	University Edinburgh	
Watts	Nicholas	Executive Director of the Lancet Countdown, University College London	

** only involved in Stakeholder Meeting*

Annex 4 – References

Statements and evidence directly attributed to expert elicitation, judged to be supported by sufficient consensus and confidence among experts by the Chief Scientific Advisors, are highlighted with an '**Expert Elicitation**' reference in the text. Other references are listed below:

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Scientific evidence shows that the climate is changing largely as a result of anthropogenic greenhouse gas emission. Even if all countries adhere to their current commitments a rise of 3 °C is predicted. Climate change already has negative effects on health. The main impacts on health in Europe are from heat and heat-waves, changing patterns of infectious and vector-borne diseases, and from extreme disasters like floods and fires.

The need for making the health sector more resilient to risk at large has been illustrated not the least by the recent COVID-19 crisis. This opinion presents the challenges for the health sector caused by the need for adapting to the increased risks from climate change. The opinion recommends:

- the integration of health aspects in all policies, across all sectors and governance levels, affected by the climate change adaptation strategies and plans;
- supporting the capacity and preparedness of the health sector in the EU to deal with climate impacts, as part of broader disaster and emergency risk strategies, including surveillance, monitoring and assessment;
- designing policies to support the most vulnerable social groups and geographical areas.

Studies and reports

