Climate change and health: directions for policy

To: the ministers of Health, Welfare and Sport, Climate and Green Growth and Infrastructure and Water Management

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Contents

Summary

The climate is changing, and these changes are happening faster than previously assumed. Temperatures are rising, both periods of drought and periods of precipitation are increasing, and weather extremes such as heatwaves and extreme precipitation are becoming more frequent and more intense. Climate change has adverse effects on health.
The Health Council of the Netherlands and the Netherlands Scientific Climate Council have therefore jointly prepared this advisory report on their own initiative. The aim of this advisory report is to identify the health risks of climate change, examine how the government can better protect the population against these risks, and determine which groups should be prioritised in policy. The advisory report focuses both on the situation in European Netherlands and on the islands of Bonaire, Sint Eustatius and Saba, which together form the Caribbean part of the Netherlands (hereinafter: the Caribbean Netherlands). The temporary Committee on Climate Change and Health was established for this advisory report.

Health risks from climate change are increasing

Climate change is already leading to health risks, disease burden and mortality. Without measures, these risks will continue to increase. Some of the health risks result from known environmental factors. Climate change is exposing the population more frequently and for longer periods to higher temperatures, UV radiation, summer smog and pollen. Infectious disease risks are increasing, partly because a warmer and wetter climate is more favourable to the growth of pathogens, including in surface water, and to mosquitoes and ticks that transmit these diseases. Climate change is already estimated to cause 250 heat-related deaths each year. Without additional measures, this figure will be 3 to 6 times higher by around 2050, depending on the extent of climate change. This is only a small proportion of the total disease burden caused by climate change.
Broad estimates of the scale of other health effects of climate change show that these are also already substantial and will continue to increase. Health effects also have societal and economic consequences, such as loss of labour productivity, greater pressure on healthcare and rising healthcare costs.

Climate change leads to weather extremes, disasters and new health risks

Another part of the health risks caused by climate change results from weather extremes, such as extreme rainfall and heatwaves, and disasters, such as flooding and wildfires. These affect physical and mental health, both in the acute phase and in the longer term. Weather extremes are also becoming more extreme and more intense, leading to new situations and risks, such as simultaneous high exposure to heat and pollen, or extreme precipitation in unexpected locations. The warmer and wetter climate increases

the likelihood of new infectious diseases, for example because mosquitoes capable of transmitting new infectious diseases become established.

Climate change exacerbates unjust health inequalities

Some people are at greater risk of climate-related harm to health than others. This may be due to high susceptibility, as in young children and older people, or high exposure, as in people who work outdoors. People with limited capacity to adapt to or avoid health risks, or to recover from harm to health, are also at greater risk. It is this last group in particular whose health is coming under pressure due to climate change. Examples include tenants in poor-quality housing who cannot make their homes climate-resilient, or children in a hot school building.
These health risks are unjust because others are able to avoid them and because they contribute to widening health inequalities. From the perspective that everyone deserves equal opportunities for good health (the health equity perspective) this means that more or something different needs to be done for some people. The committee therefore prioritises this group in its policy recommendations.

Residents of the Caribbean Netherlands face greater health risks

The Caribbean Netherlands is among the regions most vulnerable to the effects of climate change worldwide. Rising temperatures in its warm climate lead to greater health risks than in the European Netherlands. There are also increasing health risks from both new and existing infectious diseases, such as dengue. Climate change is also manifesting itself in more severe hurricanes, heavy rainfall and flooding due to sea-level rise. This places additional strain on the healthcare system and on food and drinking water supplies, which are already under pressure. A relatively large proportion of people also live in unfavourable socioeconomic circumstances. As a result, high exposure to climate-related health risks contributes to unjust health inequalities.

Protect the population, especially high-risk groups

Climate change is leading to a new reality, with an increase in both known and new health risks. Current policy is not yet sufficiently designed or prepared for this. The committee recommends a structural policy approach to protecting the population against the health risks of climate change. This policy should focus on limiting exposure as far as possible to environmental factors such as heat, UV radiation, summer smog and pollen, preventing new and existing infectious diseases, and ensuring adequate preparedness for extreme weather conditions and disasters.

The committee makes three general recommendations that apply to all health policy in a changing climate:

1 **Implement structural and coherent policy to protect people from the health risks of climate change, now and in the future.**
Structural policy entails long-term allocation of responsibilities and funding. To achieve this, central government must take the lead and encourage and support local authorities, civil-society organisations and businesses. Coherent policy integrates multiple policy objectives and is developed jointly across policy areas and levels of government. When developing coherent policy, existing inter-departmental structures and other existing partnerships are preferred.

2 **Prioritise policy development for groups that find it difficult to adapt to or avoid health risks, or to recover from harm to their health.**
The aim of this policy is to make it possible and easy for people to adapt to increasing risks, avoid them, or recover from harm to their health; for example, by improving the physical living environment and social conditions. As a tool, the committee has developed a step-by-step plan for policy development on climate-related health risks, aimed at reducing unjust health inequalities.

3 **Prioritise policy development for residents of the Caribbean Netherlands.**
All policy recommendations apply with greater urgency to the Caribbean Netherlands.
Each relevant and responsible ministry is involved in national policy. It is essential that the ministries concerned enter into dialogue with the public entities and local parties to develop and implement policy that fits the local context.

Based on these general recommendations, the committee makes more specific recommendations for various policy domains, on which work can begin now.

4 **Make homes resilient to heat and other climate risks, starting with rental properties.**
Develop additional regulations for existing homes, make binding agreements with landlords, such as housing associations, for both existing and new homes, and support this with subsidies if appropriate.

5 **Make buildings used for education and long-term care resilient to heat and other climate risks.**
To this end, encourage owners of these buildings to make them more climate-resilient by setting standards or advisory values, providing subsidies, introducing a climate label, or providing information.

6 **Make neighbourhoods resilient to heat and other climate risks, starting with neighbourhoods where people face the highest health risks.**
This can be done by establishing urban greening standards, providing municipalities with funding for greening and water retention, removing regulations that hinder climate adaptation measures, or providing information to prevent potential health risks arising from these measures.

7 **Ensure that climate risks are better embedded in occupational health and safety policy.**

Do this through regulation, binding agreements with employers' and employees' organisations, or by encouraging employers to better identify climate-related risks and take action.

8 **Strengthen the knowledge base and monitoring to limit future health risks.**

To this end, fund and facilitate the monitoring of climate-related exposures and impacts, the detection of new and existing infectious diseases, research into the health effects of climate change, and research into the effectiveness of measures.

9 **Increase people's resilience to the health risks of climate change and support people who are less self-reliant.**

To this end, facilitate and encourage initiatives by local authorities and civil society organisations that help improve social structures and reach specific groups of people. This will strengthen both collective and individual resilience.

10 **Increase society's resilience by preparing emergency services and the healthcare sector for extreme weather events, disasters and new infectious diseases.**

To this end, support emergency services and the healthcare sector in their preparations, for example by establishing a joint standard for climate adaptation, stress tests, protocols, capacity and funding.

01
Introduction

1.1 Background

The climate is changing, and these changes are happening faster than previously assumed.[1,2] Climate change in the Netherlands is reflected, among other things, in rising temperatures and more extreme weather events.[3,4] Despite global efforts to limit warming, further climate change is expected.[5,6] Alongside its effects on nature and the economy, this has major effects on human health, with people who already experience health disadvantages being affected most severely.[7-10] The World Health Organization (WHO) describes climate change as a health crisis, due in part to an increase in heat stress, exposure to extreme weather conditions, risks to water and food security, the spread of infectious diseases and impacts on mental health.[9]

These effects are already noticeable in the Netherlands, including in its Caribbean part, and will continue to increase in the future. The health effects translate into a rise in disease burden, healthcare costs and reduced labour productivity.[11,12] At the same time, pressure on healthcare is increasing, because demand for care is rising while there is a shortage of healthcare workers. In the European Netherlands, rising demand is due to population growth, an ageing population and more treatment options.[13] In the Caribbean Netherlands, it is mainly due to population growth.[14] Healthcare availability is expected to decline in the future.[13]

In addition to pressure on healthcare, health inequalities are also a long-standing problem.[15] Not everyone has the same opportunities for health (health inequity). Climate change is leading to widening health inequalities worldwide.[9] In the Netherlands too, the health risks of climate change are expected to fall mainly on groups that already face higher health risks due to unfavourable socioeconomic circumstances.[12,16] In addition, the groups that contribute least to greenhouse gas emissions also have the fewest opportunities to adapt to or recover from the negative effects of climate change.[9] These inequalities in causes and consequences are characteristic of climate change. A targeted approach is therefore needed to reduce climate-related health inequalities, both from the perspective of climate justice and from the principle of health equity. (Figure 1, see the next page)

Effective prevention policy is needed to protect the population against the adverse effects of climate change on health. This need is the reason why the Health Council of the Netherlands and the Netherlands Scientific Climate Council (WKR) are issuing a joint advisory report on their own initiative. In this advisory report, the councils seek to further clarify the health risks posed by climate change, make policy recommendations to better protect the population against these risks, and indicate which population groups should be prioritised in policy. The advisory report

covers the entire policy remit of central government, including the Dutch islands of Bonaire, Sint Eustatius and Saba, which together form the Caribbean part of the Netherlands (hereinafter: the Caribbean Netherlands). The advisory report is intended to provide guidance for, among other things, the National Climate Adaptation Strategy (NAS), its associated implementation programmes and preventive health policy.

Health equity: everyone has equal opportunities for good health

Figure 1 Health equity

1.2 Committee and working methods

For the preparation of this advisory report, the Health Council of the Netherlands and the Netherlands Scientific Climate Council (WKR) established a temporary committee on Climate Change and Health. The composition of the committee is provided at the end of this advisory report.

In this advisory report, the committee builds on the Royal Netherlands Meteorological Institute (KNMI) climate scenarios, reports by the Netherlands Environmental Assessment Agency (PBL) on current and future climate risks in the Netherlands, and reports by the National Institute for Public Health and the Environment (RIVM) on the health risks of climate change.[3,11,12,17,18] In addition, international scientific and grey literature was taken into account, and experts were consulted. For the identification of risks in the Caribbean Netherlands, given the geographical proximity and many similarities, the committee consulted not only experts from the Caribbean Netherlands but also experts from the autonomous countries within the Kingdom of the Netherlands – Curaçao, Aruba and Sint Maarten – and drew on literature relating to the wider Caribbean region. The findings for the region were validated with local experts.

To gain insight into societal perspectives and experiences, the committee organised two roundtable discussions with representatives of various societal groups from the European Netherlands (see report on the roundtable meetings) and conducted interviews with representatives from the Caribbean Netherlands and the autonomous countries within the Kingdom. The names of all consulted experts are listed at the end of this advisory report.

1.3 Scope

This advisory report focuses on the current and future, positive and negative effects of climate change on human health in the European Netherlands and the Caribbean Netherlands. Effects on ecosystems, biodiversity, and water and food quality are included in this advisory report to the extent that they affect human health, for example because they influence the presence of pathogens.

The following are outside the scope of this advisory report:

- Climate scenarios, such as a shutdown of the Atlantic Meridional Overturning Circulation (AMOC), that fall outside the KNMI '23 scenarios.[3,19]
- The consequences of climate change for the economy, nature and culture. These have been assessed by the PBL.[11,17]
- The consequences of climate change for (global) security, and for financial and social stability, which also have indirect consequences for health. These have been analysed by the National Network of Safety and Security Analysts (ANV).[20]
- The health effects of mitigation measures aimed at reducing greenhouse gas emissions and addressing climate change. However, the report does indicate where adaptation and mitigation policies can reinforce each other to improve health.

1.4 Guide to the report

Chapter 2 describes the positive and negative health effects of climate change in the European Netherlands. Chapter 3 addresses high-risk groups. Chapter 4 describes the additional health effects and high-risk groups related to climate change in the Caribbean Netherlands. Chapter 5 sets out the committee's policy recommendations for both the European Netherlands and the Caribbean Netherlands.

02
The European Netherlands

In brief

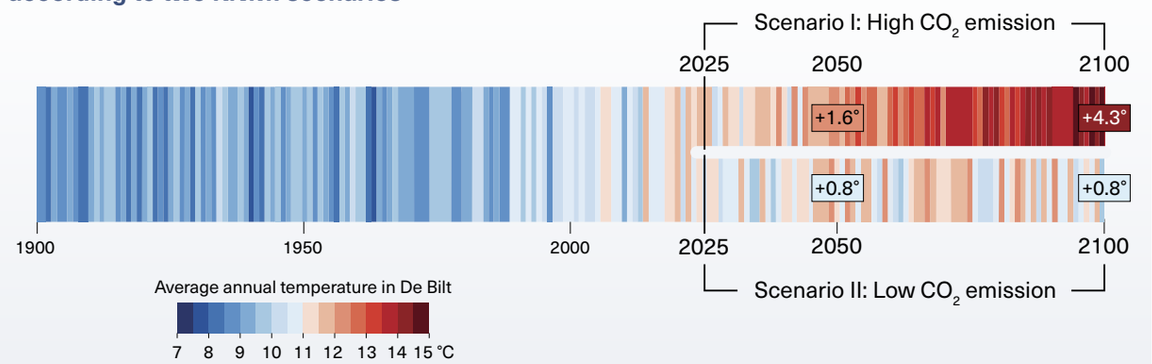
Climate change is increasingly leading to health risks. This is due to greater exposure to high temperatures, UV radiation, summer smog, pollen and infectious diseases. As almost the entire population is exposed to these factors, this contributes substantially to the disease burden. Climate change also leads to health risks as a result of extreme weather events and disasters, and to new risks from new infectious diseases and more severe weather extremes. Without measures, health risks, disease burden and the subsequent economic and societal impacts of climate change will continue to increase.

2.1 Climate change

The climate in the European Netherlands has already changed substantially. The annual average temperature is now more than 2°C higher than in 1900 and the amount of rainfall has increased by more than 20%.[3] Climate change is also evident in the increase in extreme weather events, such as heatwaves and extreme summer downpours. In the second half of the previous century, a heatwave occurred roughly once every 5 years.[21] Since 2000, this has been roughly once every 1 to 2 years.[21] The number of days with heavy rainfall, defined as at least 50 mm, has increased sharply, from 5 days a year in the second half of the previous century to around 9 days a year since the beginning of this century.

It is getting warmer in the Netherlands

Change in average annual temperature in De Bilt and projection* according to two KNMI scenarios



* Increase relative to the reference period 1991–2020; figures represent 30-year averages

Source: KNMI '23 climate scenarios

WKR/Gezondheidsraad

Figure 2 Average annual temperature and two climate scenarios for the future

For the future climate, the Royal Netherlands Meteorological Institute (KNMI) presents four scenarios. These scenarios are based on high or low greenhouse gas emissions, each combined with a wet or dry climate model.[3] Regardless of the scenario, temperatures will rise in the future, with more sunshine, drier summers,

wetter winters and more frequent extreme weather conditions. The extent of the increase differs by scenario. For example, by 2050, the national annual average temperature will be between 0.9 and 1.6°C higher than it is now, depending on the scenario (Figure 2). [3] In all scenarios, extreme weather conditions will not only occur more often but also become more extreme and more intense.[3] This will more often lead to new situations, such as extreme heat combined with drought, or large-scale surface water flooding or wildfires.4 For example, the probability of a prolonged heatwave after a long period of drought is currently once every 25 to 30 years. In the dry KNMI scenario for 2050, this will occur twice as often.[22] The likelihood of an uncontrollable wildfire is currently estimated at once a year, and climate change is increasing the risks of larger-scale fires with more serious consequences.[22]

A cloudburst resulting in surface water flooding occurs somewhere in the Netherlands every year, and climate change is increasing the likelihood of such extreme precipitation.[4]

2.2 Health risks

This section briefly describes the health risks of climate change, with a view on identifying starting points for preventive policy. A more detailed description of the current and future health risks of climate change can be found in the RIVM reports referred to above.[12,18]

2.2.1 Increasing exposures

Climate change affects multiple exposures, which in turn affect health (Figure 3). Climate change increases exposure to environmental factors such as heat, UV radiation, air pollution and pollen. Periods of exposure to these factors are not only becoming more frequent, but also increase in intensity and duration.[12] A heatwave (more than five consecutive summer days of 25°C or above, including three days of 30°C or above) now occurs almost every year. In 2018, there were two prolonged consecutive heatwaves, lasting 10 and 23 days, during which night-time temperatures also remained above 20°C for several days.[4,21] Without opportunities to cool down, this leads to prolonged exposure to heat. Due to higher average temperatures, there are more days on which people expose themselves to the sun and UV radiation, while solar radiation intensity and UV radiation are also increasing.[3,12]

Exposure to air pollution is also changing as a result of climate change. The formation of ozone (summer smog) is particularly dependent on weather conditions. The weather conditions that promote ozone formation (high solar radiation intensity, little wind and little rainfall) are becoming more common due to climate change. As a result, periods of summer smog may occur more often and be more intense. The net effect of climate change on particulate matter concentrations is uncertain. There are more fine particulates in warm, dry conditions with little wind. During periods of rainfall, by contrast, there will be less fine particulates in the air because it is washed out by rain.[23] Exposure to pollen is increasing because warming causes the pollen season to start earlier and last longer. Trees such as

birch produce pollen with more allergens at higher temperatures. Climate change is also making conditions more favourable for certain allergenic plant species, such as ragweed and olive.[12,24]

2.2.2 Health risks due to increasing exposures

Climate change is already contributing to health risks and disease burden in the Netherlands, and this contribution will continue to increase.[12,25,26] Disease burden is the amount of health loss caused by disease, expressed as the number of years of life lost plus the years lived with health problems. At present, around 860 people die prematurely each year due to heat, mainly during heatwaves. This mainly concerns older people and people in poorer health. Around one-third of this mortality is attributed to climate change.[12] Without additional measures, the annual number of heat-related deaths due to climate change is estimated to be three to six times higher by around 2050. (Table 1) In addition to climate change, population growth and ageing will also contribute to an increase in total heat-related mortality.[18]

The extent to which climate change contributes to additional mortality and disease burden through exposure to UV radiation, summer smog and pollen has only been estimated in broad terms. What is clear is that climate change is already contributing substantially to serious disease and mortality due to environmental exposures (Table 1). Exposure to UV radiation can lead to skin cancer and cataracts.[27,28] It is by far the leading cause of skin cancer, and the Netherlands is among the European

Climate change leads to health risks in various ways

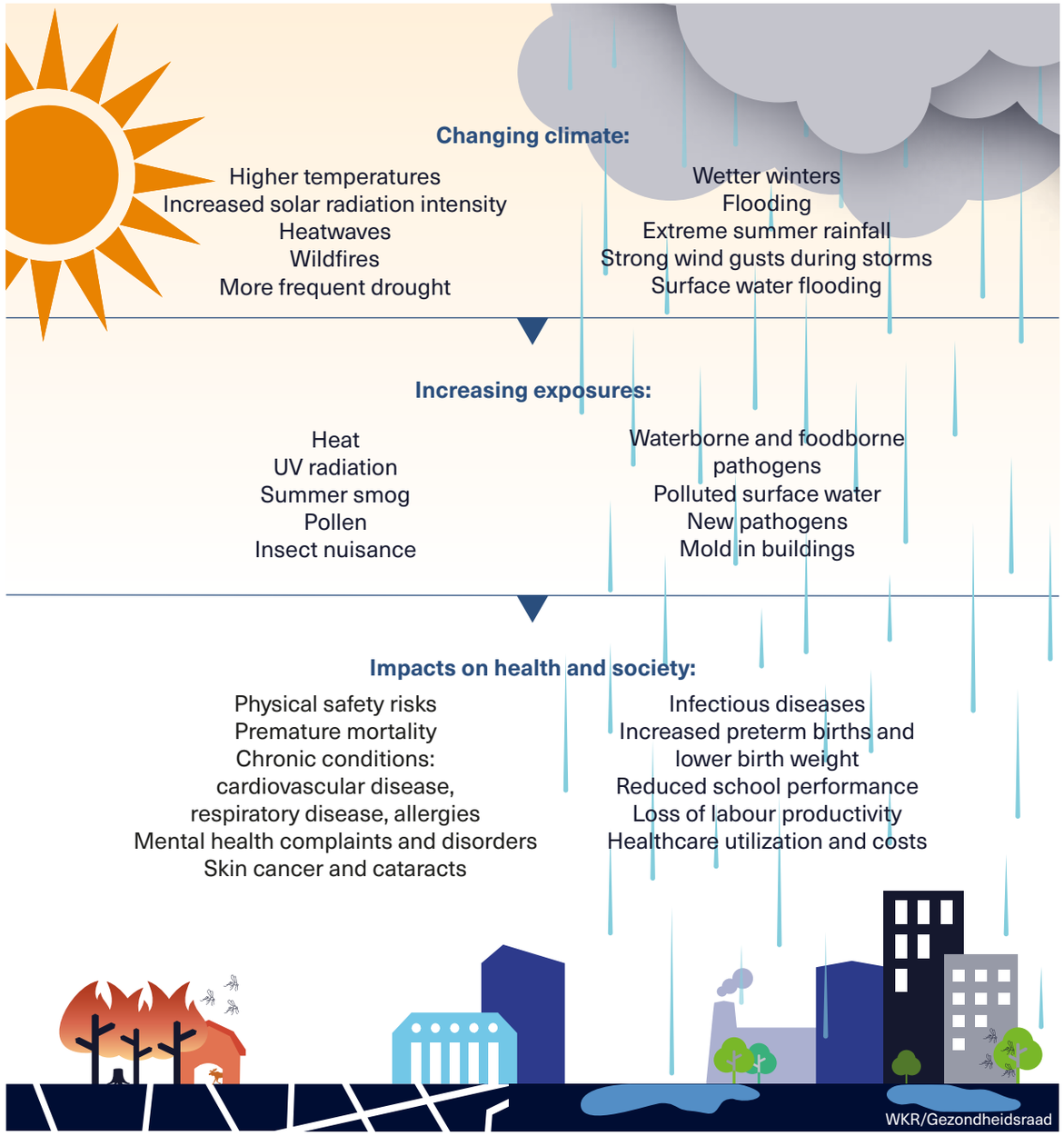


Figure 3 Climate change and health risks

countries with the highest rates of melanoma cases (the most serious form of skin cancer).[29] Because skin cancer mainly occurs later in life, population ageing will mean that the effect of climate change on skin cancer will be greater in the future than it is now.[18] Short-term exposure to summer smog can lead, in susceptible people, to premature mortality and emergency hospital admissions due to acute respiratory and cardiac symptoms.[30,31] An increase in the amount of pollen in the air leads to more allergies and more symptoms among people with hay fever.[12] Hay fever symptoms affect many people in the Netherlands.[12]

The extent to which health risks and disease burden will increase depends on the extent to which climate change continues.[18] In addition to climate change, other factors that determine these health effects also play a role, such as behaviour, policy measures and population composition.

Table 1 Disease and mortality from environmental exposures that increase as a result of climate change

Exposure	Current total and climate-related disease and mortality	Disease and mortality in 2050 due to future climate change[32]	
		Scenario: low CO_2 emissions, wetter climate	Scenario: high CO_2 emissions, drier climate
Heat	Total: Premature mortality: Current: around 860 premature deaths per year As a result of climate change: Premature mortality: around 250[18] More than 100,000 people with health complaints[12]	Total: around 2,300 premature deaths per year As a result of climate change: around 660 premature deaths	Total: around 3,700 premature deaths per year As a result of climate change: around 1,650 premature deaths
UV radiation	Skin cancer: 80,000 new diagnoses and 950 deaths per year[27] Cataracts: 231,000 new diagnoses per year[28] As a result of climate change: more than 100 deaths 10,000-100,000 cases of skin cancer[12]	+ More exposure due to more summer days, and an increase in UV radiation and solar radiation intensity	++ More exposure due to more summer days, and an increase in UV radiation and solar radiation intensity

Exposure	Current total and climate-related disease and mortality	Disease and mortality in 2050 due to future climate change[32]	
		Scenario: low CO_2 emissions, wetter climate	Scenario: high CO_2 emissions, drier climate
Summer smog (ozone)	Total: 2,980 premature deaths per year due to short-term exposure to ozone[31] As a result of climate change: more than 100 deaths More than 100,000 people with health complaints[12]	-/0 The frequency and intensity of short-term ozone peaks increase due to climate change; overall air quality improves	++ The frequency and intensity of short-term ozone peaks will increase significantly; background concentrations of ozone, fine particulates and nitrogen dioxide will increase sharply
Pollen	Total: 3.6 million hay fever patients, of whom 1.35 million have prescribed medication [12] As a result of climate change: More than 100,000 people with health complaints[12]	+ Climate change lengthens the pollen season and increases pollen concentrations	++ Climate change lengthens the pollen season and increases pollen concentrations

+ increase, ++ strong increase, - decrease, not quantified; 0 no change. The scenario with low CO_2 emissions and a wetter climate is referred to as the 'limited risk-increasing (BRV) scenario', and the scenario with high CO_2 emissions and a drier climate as the 'strong risk-increasing (SRV) scenario'. For a detailed description of the scenarios, see the RIVM report.[18]

In addition to causing serious illness and premature deaths, climate-sensitive environmental factors lead to health complaints that affect daily functioning. Health complaints related to heat, summer smog and pollen are common, and climate change is increasingly contributing to them. Exposure to heat can lead to symptoms of heat stress, such as headaches, fatigue and loss of concentration. These can significantly impair daily functioning.[11,31] Heat exposure can also result in reduced school performance, sleep disturbance, mental health complaints, and the exacerbation of suicidal and aggressive behaviour.[12,33-36] During prolonged periods of heat, almost half of people report that they have limited or poor opportunities to cool down in and around their homes.[37] Hay fever can also affect daily functioning. Of those with hay fever, 25% report that their symptoms severely or very severely limit their daily functioning.[12,38]

Recent Dutch research has also identified new health effects. For example, heat exposure has been shown to affect not only current but also future generations. Exposure to heat during pregnancy is associated with an increased risk of preterm birth and low birth weight.[39] In addition, combinations of exposures may give rise to new risks. For instance, in June 2023, a combination of heat, summer smog and high pollen concentrations occurred simultaneously.[40] Further research is currently being conducted into the health effects of such combined exposures.[41]

2.2.3 Infectious disease risks

Through its effects on ecosystems, a warmer and wetter climate affects exposure to pathogens and infectious disease risks. Climate change alters species' survival, reproductive cycles and geographical distribution. This affects the ecosystem as a

whole: some species may temporarily become dominant, new species may become established, and contact between species may change. This applies both to the pathogens themselves (viruses or bacteria) and to the vectors that carry them.

The risk of outbreaks, epidemics and pandemics is increasing worldwide.[42-44] In addition to climate change, increased travel and global population growth contribute to this.[44] The likelihood of an infectious disease new to the Netherlands being introduced is also increasing.[44,45] The European Netherlands is susceptible to new infectious diseases and zoonoses (diseases that can be transmitted from animals to humans) due to intensive livestock farming and high population density.[46] Of all the health risks of climate change, the likelihood of a new infectious disease is the most difficult to estimate, but the potential consequences are the greatest. The introduction of a new infectious disease into the Netherlands within 5 years is currently considered moderately likely.[47]

Since 2019, COVID-19 has made the largest contribution to the current disease burden of all infectious diseases, followed by influenza.[12,48] The picture of the current burden of infectious diseases is incomplete, partly because most are not notifiable and many are mild and do not prompt people to see a doctor.[49] It is uncertain whether viral infectious diseases, including influenza and COVID-19, will increase or decrease as a result of climate change (see 2.3).

Infectious diseases that contribute substantially to the disease burden and whose risk is increasing due to climate change include legionellosis and Lyme disease. The extent to which climate change contributes to the current disease burden of these infectious diseases is unknown.[12] The known current disease burden of vector-borne infectious diseases in the European Netherlands is almost entirely attributable to Lyme disease.[12] Lyme disease is transmitted by ticks, and climate change favours ticks. The number of diagnoses appears to have stabilised in recent years at around 25,000 per year.[49]

Climate change increases the risk of Legionella infections because warmer drinking water systems promote Legionella growth.[50,51] Legionella grows in warm water and is transmitted via airborne water droplets. The number of cases of pneumonia caused by Legionella has risen in recent years to around 500 domestically acquired infections per year, with the most notifications occurring during warm, wet summers.[48,52] There is no clear picture of the disease burden of waterborne infections other than Legionella. Records of swimming-related complaints show no trend over the years, but such complaints are often not reported.[53,54] The same applies to infections such as those caused by Vibrio bacteria in seawater, because these are usually mild.[53] Around 2 million people are estimated to contract a food-borne infectious disease each year, and in 2024 this led to 290 deaths.[55] Food can become contaminated through contact with contaminated water, or through the growth of pathogens on food, especially at higher temperatures.[18] The number of

food-related infections appears to be increasing again in recent years after a long period of decline, but it is unclear whether climate change plays a role in this.[55]

In the Netherlands, climate change is making conditions more favourable for certain waterborne, foodborne and vector-borne diseases.[18,45] As a result, the risks of such infectious diseases are increasing. Climate change favours ticks, the transmission of West Nile virus by native mosquitoes, and the establishment of the tiger mosquito in the Netherlands.[18] In addition to Lyme disease, ticks can transmit the tick-borne encephalitis virus. This virus can cause meningitis and has been detected in ticks in the Netherlands.[49] In 2024, there were 8 reported domestically acquired infections with the tick-borne encephalitis virus.[48] The tiger mosquito, which can transmit tropical infectious diseases such as dengue, chikungunya and Zika, is already being found frequently, and is expected to become permanently established at certain locations in the Netherlands within 2 to 5 years.[56] If the virus is introduced, for example via travellers, this could make local dengue outbreaks possible.
The number of confirmed dengue cases among travellers has increased in recent years.[48] West Nile virus and Usutu virus, which can also be transmitted to humans by mosquitoes, have long been circulating among birds and mosquitoes.[12,57] In 2020, eight people were found to have contracted West Nile virus in the Netherlands.
No known infections have occurred since then.[48] Dutch coastal waters have become more suitable for Vibrio bacteria. This leads to infection risks not only through bathing water, but also through the consumption of shellfish.[58-60]

Warming of surface water also creates better conditions for blue-green algae, waterborne bacteria that produce substances that can cause skin or gastrointestinal complaints.[53,54] As a result, water may become unsuitable for swimming and recreational use more often. A warmer and more humid climate is more favourable to mould growth. Little is known about the effects of current and future climate change on fungal infections. It is also unknown whether this affects exposure to fungi, for example through food or indoor air.

2.2.4 Extreme weather and disasters

Extreme weather events and the risk of disasters are increasing (see 2.1). Extreme weather events, such as heatwaves and heavy precipitation causing surface water flooding, and climate-related disasters, such as wildfires and floods, entail acute health and safety risks. They can also damage homes or affect the living environment and lead to long-term mental health problems.[61] Extreme weather events are not only becoming more frequent, but also more extreme and more intense. This will repeatedly lead to new situations and risks. For example, extreme weather can damage roads, energy infrastructure and/or digital infrastructure, leading to a cascade of other adverse effects, which will also make the health consequences more severe.[4,17]

In recent years, around 860 people in the Netherlands have died from heat each year (Table 1), mainly during heatwaves. For each heatwave, this ranges from around

100 to 1,000 premature deaths. The number depends on the duration and intensity of the heatwave, but also on other factors such as previous mortality from influenza and the measures taken.[4,12] Since 2010, mortality at high temperatures has decreased, possibly as a result of measures taken, including the National Heatwave Plan, and greater awareness.[62,63] However, due to rising temperatures and population ageing, the number of deaths from heat is expected to increase (Table 1).

Both the risk of flooding from rivers, for example, and the risk of surface water flooding due to intense precipitation locally are increasing. In 2023 and 2024, there were several episodes of intense precipitation that caused surface water flooding, including in Enschede.[64] Intense precipitation on a larger scale can also lead to river flooding, as happened in Limburg in 2021.[64] Cities in river areas are particularly vulnerable to flooding.[11] Urban areas in the west of the country appear to be vulnerable to intense precipitation.[11] In addition to acute safety risks, the risk of physical trauma (injuries), financial damage and possible cascade effects if infrastructure and the healthcare system are damaged, flooding and local surface water flooding are associated with physical and mental health risks.[65] Surface water can become contaminated during floods.[66] This brings infectious disease risks, usually involving mild gastrointestinal, respiratory, skin and wound infections.[67-69] Some infections can have more serious consequences, such as leptospirosis. The number of leptospirosis cases appears to have increased in recent years, possibly due to climate change.[48] Heavy rainfall and surface water flooding can cause water damage to homes, resulting in damp and mould problems.[64] Heavy rainfall also raises groundwater levels, which can contribute to mould problems. Damp and mould problems in homes were more common in 2024 than in 2021, possibly due to the high rainfall in 2023.[70] Damp and mould in homes can have long-term consequences for health.[71,72]

Wildfires are already common in the Netherlands, and climate change is increasing the risk of large wildfires.[17,73-75] An uncontrollable wildfire can cause dozens of deaths and directly affect several hundred people (through burns and respiratory complaints) or indirectly through physical or mental health effects.[75] In addition to acute safety risks, wildfires affect air quality.[8,76] This is not only due to wildfires in the Netherlands, but also, depending on the wind direction, to fires from much further afield. Wildfires account for around 10% of total mortality from fine particulates in the Netherlands.[8,76]

2.2.5 Mental health impacts

Experiencing extreme weather events or climate-related disasters can have mental as well as physical health effects. Physical and mental impacts may also interact and reinforce each other.[61] People affected by disasters often experience multiple problems, such as damage to their home, living or working environment, financial difficulties and health complaints.[61] More than half of adults who have experienced a disaster suffer from depression, and 30 to 40% experience post-traumatic stress

disorder (PTSD).[77] The most common long-term mental health problems are depression, anxiety and post-traumatic stress symptoms.[34,61,78] These may be accompanied by sleep disorders, suicidal thoughts, a reduced sense of self-worth and identity, and grief reactions. The physical and mental impacts can persist for months or years.[78-80]

Climate change can also affect mental health without individuals directly experiencing an extreme event. This includes concerns about potential loss of income or damage to building foundations, as well as the growing general threat of risks.[11,81] Much remains unknown about the extent to which the general threat of climate change leads to mental health problems. It is also unknown how many people in the Netherlands experience these symptoms. Research does show that 70% of young people are concerned about climate change.[82] However, due to a lack of comparative studies, it is not yet clear whether young people are more concerned than other groups or whether this concern has increased.[82]

2.3 Beneficial health effects

Climate change may also have beneficial effects on health. Models predict that cold-related mortality will decrease as a result of climate change.[18] These models do not take into account changes in the spread and transmission of infectious diseases. In the Netherlands, cold-related mortality is largely caused by viral infectious diseases. During cold weather, people spend more time indoors, where viral circulation is higher than outdoors.[83] Some studies suggest that certain (viral) infectious diseases may temporarily decrease.[84] Other studies predict that more variable weather conditions in autumn due to climate change will occur more often and contribute to an increase in influenza in winter.[85] Because it is uncertain whether climate change will increase or decrease the spread and transmission of infections in cold weather, its overall effect on mortality resulting from less cold weather is also uncertain.

A warmer climate may improve mood and encourage outdoor physical activity.[86,87] However, these potential benefits do not take into account that not only pleasant warm days but also hot days and extreme weather events will become more frequent.[3] UV radiation on the skin is beneficial for vitamin D production. Exposure of the face and hands to sunlight for 15-30 minutes is sufficient for this.[88] It is unclear whether climate change affects vitamin D status in the population.

2.4 Healthcare system

In the context of extreme weather events and emerging infectious disease risks, the capacity, accessibility and preparedness of the healthcare system and emergency services are essential. The COVID-19 pandemic showed that scaling up acute care capacity was a bottleneck and that the healthcare system as a whole came under considerable pressure.[89] Delayed care also had significant longer-term consequences.[90] In addition, extreme weather can directly affect healthcare institutions

and emergency services, thereby compromising accessibility. For example, heavy rainfall in Doetinchem led to unsafe conditions, requiring the temporary closure of access to the emergency department.[64] There are also risks to the supply of medical equipment and medicines, as well as to workforce availability.[91]

2.5 Societal and economic impacts

The increasing health risks associated with climate change also have societal and economic consequences.[92] Direct costs of harm to health include healthcare costs, the costs associated with years of life lost, and productivity losses.

A comprehensive overview of the health-related costs of climate change is lacking, but broad estimates put the costs associated with exposure to UV radiation and pollen as a result of climate change in the range of €100 million to €1 billion per year for each exposure.[12] For UV radiation, these costs mainly relate to healthcare expenditure for skin cancer and cataracts, which require costly specialist care.[12,13,28,93] For pollen exposure, costs mainly arise from sickness absence among people with pollen allergies, reduced labour productivity and associated economic losses.[12,18] There are no estimates of the economic impacts of heat, but here too the costs of productivity losses could be substantial if a large proportion of the population is affected. Heat exposure can lead to physical and mental complaints, poorer sleep and problems concentrating in a large share of the population.[12] Healthcare expenditure is already expected to increase significantly due to population ageing and rising demand for care: it is estimated that costs will almost double between 2022 and 2050, without taking into account the additional effects of climate change.[13]

03

Health inequalities and climate change

In brief

Some population groups face greater health risks from climate change than others. These include people with high susceptibility, high exposure, or limited capacity to adapt to or avoid health risks, or to recover from harm to health. It is this last group in particular whose health is coming under pressure due to climate change. For this group, the increased health risks caused by climate change are unjust because others are able to avoid them. In the committee's view, this group should be prioritised in policy.

3.1 High-risk groups

Health risks are unequally distributed across the population. In the Netherlands, health inequalities can be seen, for example, in differences in average healthy life expectancy. In 2024, life expectancy at birth was 2.8 years higher for women than for men, but women live on average 6.7 years longer with chronic diseases.[94] There are also substantial differences between education and income groups. For example, people with a university of applied sciences or university degree live on average five years longer, and 14 years longer in good health, than people with primary education or pre-vocational secondary education.[16] Differences in healthy life expectancy between income groups can be as high as 25 years. There are also major differences between municipalities and between neighbourhoods within the same city.[16,95,96] Life expectancy (in healthy years) is particularly low in large cities.[16]

In an earlier advisory report, the Health Council of the Netherlands developed guidance for identifying high-risk groups.[97] These are groups within the population who are at greater risk of physical or mental health problems than others. The guidance describes two different ways of identifying these groups: 1) high susceptibility or 2) high exposure. In the present advisory report, the committee adds a third: 3) limited capacity to adapt, avoid exposure or recover; see Figure 4.

Health inequalities are largely rooted in the circumstances that determine the extent to which people can adapt to or avoid health risks and recover from harm to health. Economic and social circumstances are major determinants of health.[98] Examples include the conditions in which people live and work, the conditions in which children and young people grow up and receive education, social contacts, work and income, the availability of healthy food, housing and basic services (drinking water, sanitation and energy) and (access to) means of transport.[98] These circumstances influence susceptibility to and exposure to health risks, but also determine

whether and how people can adapt to or avoid health risks, and how well they can recover.

Some groups are at higher risk

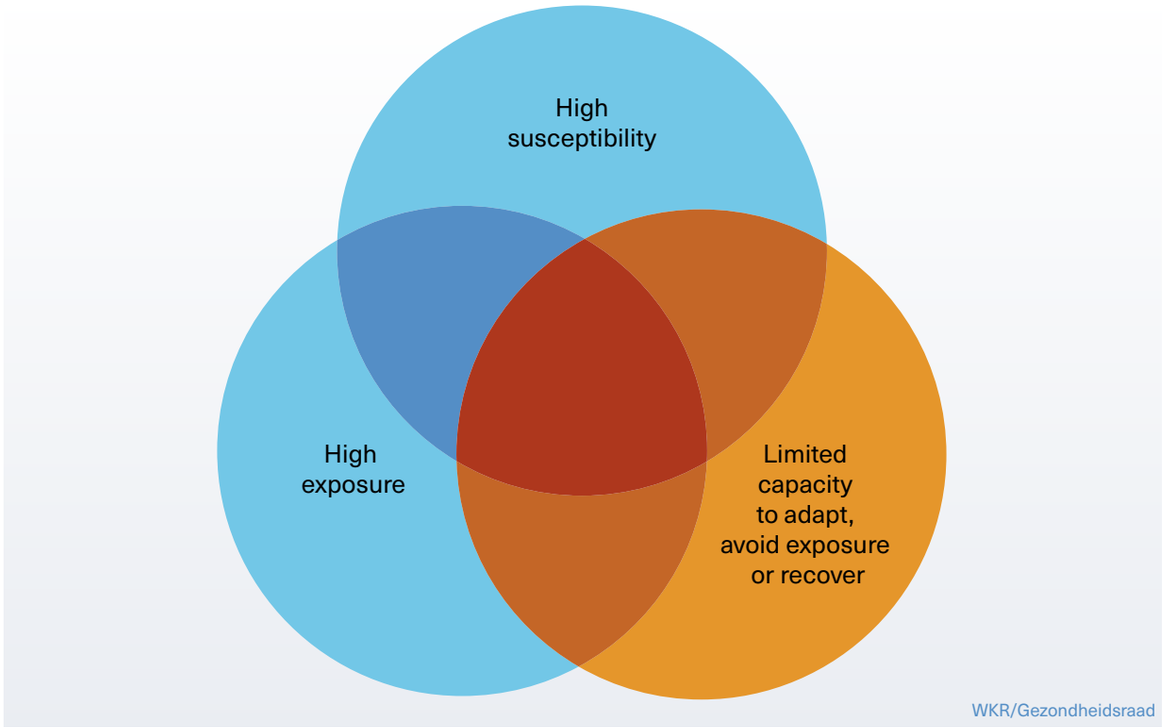


Figure 4 Factors that may lead to a higher risk

3.2 High-risk groups as a result of climate change

The health risks of climate change are greater for some groups in the Netherlands. The committee provides a number of examples below.

People with high susceptibility

For people with high susceptibility, the health effects are greater than for others at the same level of exposure. High susceptibility to health risks is mainly determined by individual characteristics.[97]

Babies and children, older people, pregnant women and people with chronic conditions have high susceptibility to many exposures, and this also applies to climate-related exposures.[12] These groups are also the most susceptible to the effects of heat. Some groups are more susceptible to conditions such as skin cancer and certain allergies due to genetic predisposition. The health effects of climate change will also be greater for people with existing physical or mental health problems, and for those using certain medicines.[12] It is difficult to predict which groups will be highly susceptible to new infectious diseases. In the case of COVID-19, for example, older people and medical high-risk groups proved highly susceptible to severe illness,[99] but other groups may be affected by new infectious diseases. People who have previously experienced an extreme weather event or disaster, either directly or through loved ones, may have become more mentally or physically susceptible as a result.[11,34]

People with high exposure

The level of exposure is strongly determined by the physical and social environment, for example by the place or circumstances in which someone lives, works or spends extended periods of time.[97]

Homes and places where people spend long periods, such as schools and long-term care facilities, are locations where a large share of exposure to environmental factors occurs. If these buildings are not climate-resilient, people are exposed to higher levels of heat, damp indoor environments or mould growth. More than half of people in the Netherlands live in a home at risk of overheating, including 2 million older people.[100] People living in rented homes more often experience heat-related problems than those living in owner-occupied homes.[37] People living in highly built-up urban neighbourhoods with little green space more often experience heat, both in their homes and in their immediate living environment.[37,100] People living in flood-plains and areas outside the dykes, or in urban areas vulnerable to extreme rainfall, are at greater risk of flooding and surface water flooding, which can lead to damp indoor environments and mould growth.[11]

Some occupational groups are increasingly exposed to existing or new health risks during their work. Agriculture and construction are considered high-risk sectors due to the physical effort required and the relatively high proportion of outdoor work.[101] Postal and parcel delivery workers, as well as workers in warm indoor environments due to high outdoor temperatures, may also experience heat stress.[102] Emergency responders and healthcare professionals are exposed to higher levels of various health risks during acute events, such as infectious disease outbreaks, wildfires or surface water flooding.[101]

Behaviour also plays a role in the level of exposure. In some cases, exposure can be avoided entirely or to some extent because people can adjust their behaviour themselves, for example when swimming in polluted water, sunbathing or exercising outdoors during hot periods.

People with limited capacity to adapt, avoid exposure or recover

Another high-risk group consists of people who are less able to adapt to or avoid high levels of exposure. People with limited ability to recover from harm to health also belong to this group. Existing vulnerabilities may be further reinforced, reducing their resilience to future climate events.[103]

Many climate-related exposures, such as heat and UV radiation, are inherently avoidable by changing the environment or adapting behaviour, but this is much less true for people who lack the opportunities and resources to do so. Climate-related exposures therefore place additional pressure on groups living in unfavourable social and economic circumstances.[98,103] Coping with health risks requires, among other things, a social network and financial resources, for example to buy sun blinds,

look after one another during a heatwave or repair a home after flooding. Some people are in an especially vulnerable position, leaving them barely able to protect themselves during periods of heat or extreme precipitation, such as homeless people and low-paid migrant workers in a dependent position.[104,105]

3.3 Unjust health inequalities

Climate change means that almost everyone in the Netherlands will face higher levels of exposure. People who are more susceptible to certain exposures face greater health risks. If they have sufficient opportunities to adapt, their risk will be reduced. However, when people with limited capacity to adapt, avoid exposure or recover are highly exposed, their health comes under particular pressure. Examples include tenants and people with physically demanding outdoor jobs, such as in construction and agriculture; see Boxes 1 and 2. These groups face high health risks due to avoidable exposure, while having little or no control over it themselves.
In principle, for example, heat in the home can be reduced by insulating the home. However, tenants do not always have the financial resources to do this, or may not be allowed to because the landlord does not permit self-installed measures. Adding greenery around the home can provide cooling, but tenants do not always have their own outdoor space. In some groups, high exposure and reduced capacity to adapt or avoid exposure coincide with higher susceptibility. This applies, for example, to older people who are more susceptible to heat, live in a hot home (high exposure), and are unable to seek cooling around their home (limited capacity to avoid exposure).

Social and economic circumstances are in many cases the cause of both higher exposures and more limited capacity to adapt and recover.[98] This means that people with limited capacity to adapt and recover are also more often relatively highly exposed. Because of the same social and economic circumstances, these people are also often exposed to multiple health risks. This also applies to climate-related exposures, for example, where people living in neighbourhoods with high levels of heat or a high risk of flooding are also exposed to heat and UV radiation at work.

If people find it difficult to adapt to or avoid health risks, or to recover from harm to health, while others are able to do so, they have avoidably reduced opportunities for good health. According to the principle of health equity, which the committee endorses, everyone deserves equal opportunities for good health, and these avoidable health risks are unjust.[98] For this reason, in its policy recommendations to protect the population against the health risks of climate change, the committee prioritises reducing avoidable health inequalities caused by climate change.

Box 1: Climate-related risks among tenants

Of the 7.9 million households in the Netherlands, an estimated 3.2 million rent their home.[70] Figures show clear health differences in the housing market. Tenants generally have poorer health and use more medication for lung diseases, cardiovascular disease, neuropsychiatric problems and sleep problems than owner-occupiers.[107] Tenants are also more often financially vulnerable.[108]

On top of this, there are risks related to the changing climate. Residents of rented homes more often report heat-related problems.[37] External solar shading is an effective way to prevent heat, but is often not installed due to the cost. Tenants are often unable to make their homes climate-resilient themselves because their financial situation does not allow it, they lack the skills or social contacts, or they have less control over adaptations to their home than owner-occupiers.[37,109] Tenants are also exposed to higher levels of unhealthy environmental factors than owner-occupiers.[107] These include factors such as noise nuisance and air pollution, which in themselves cause harm to health, but may also prevent tenants from cooling their homes by opening windows once it has cooled down outside. People in rented homes also have few options to find cooling around or in the immediate vicinity of their home.[37] Almost half of tenants are unable to keep their home pleasantly cool.[70] Among owner-occupiers, this applies to one-quarter to one-third.[70]

Tenants also face other climate-related health risks. Half of residents of rented homes are concerned about water-related problems.[110] This concerns not only flooded cellars and water ingress on the ground floor, but also flooding of balconies that causes water damage inside the home. Water damage to homes appears to occur more often in neighbourhoods with a lower socioeconomic status.[17] Thirty percent of tenants report damp or mould in their home, compared with 15% of owner-occupiers.[70]

Box 2: Climate-related risks among people with physically demanding jobs in agriculture and construction

In 2022, an estimated 570,000 people worked in construction and 198,000 in agriculture.[111] These people are relatively often required to perform physically demanding work.[112] It is estimated that almost one-quarter of absenteeism in the construction sector is work-related. Physically demanding work was the main cause of complaints in 30% of this work-related absence.[113] Work in construction and agriculture also often involves dangerous tasks, and workers are exposed to noise and hazardous substances.[112]

On top of this, there are risks related to the changing climate. Many work-related activities in construction and agriculture take place outdoors. As a result, people who work outdoors are increasingly exposed to heat and UV radiation.[114] Men are also less likely to use sun protection, and they are overrepresented in these sectors.[115] Climate change may increase the use of pesticides, bringing new risks.[116] The risk of infectious diseases is also increasing for people working in certain sectors, such as the risk of tick bites for people working in forestry, nature conservation and landscaping sectors.[117]

A substantial proportion of workers in both sectors are seasonal workers or migrant workers. Migrant workers in the Netherlands are in an unfavourable position.[104,105] They are highly dependent on their employer or an employment agency, not only to maintain their income, but also, in many cases, for housing and health insurance. This may deter them from raising concerns about unfavourable working conditions with their employer.[105]

The WHO warns that climate change is substantially widening health inequalities worldwide.[98,106] In the Netherlands too, climate change is expected to increase existing health inequalities. Dutch studies show, for example, that heat in and around homes particularly affects groups with limited capacity to adapt, avoid exposure or recover from harm to health.[37,39,107] Extreme heat during pregnancy more often results in babies with low birth weight and preterm births among people in a lower socioeconomic position.[39] People who have difficulty making ends meet, people living in highly urbanised areas or in environments with less greenery, and residents of rented homes more often experience heat-related problems.[37,107] On average, these people have fewer opportunities to adapt to or avoid heat in their home or neighbourhood, making the differences in exposure and the resulting health risks unjust.

The evaluation of the National Heatwave Plan shows that the health risks from heat are avoidable. Since 2010, mortality from high temperatures has decreased, possibly due to the National Heatwave Plan and greater awareness. The reduction in heat-related mortality is greatest among older people, women and people living in neighbourhoods with low socioeconomic status.[63] For climate-related exposures such as UV radiation and summer smog, no data are yet available on differences in exposure and health risks between socioeconomic groups in the Dutch context.

3.4 Step-by-step plan

The committee has developed a step-by-step plan to systematically identify groups that face greater health risks from climate change than others; see Table 2.
The committee pays particular attention to high-risk groups that find it difficult to avoid these health risks, while the risks are avoidable for others. Targeted policy is needed to reduce or prevent health risks for these groups. In developing the step-by-step plan, the committee drew on a number of relevant existing methodologies from the scientific and grey literature.[97,118-121] Chapter 5 includes an example of a completed step-by-step plan for heat.

The first part of the step-by-step plan identifies groups for whom higher health risks from climate change are expected. It also addresses whether these risks are avoidable and whether certain groups find it difficult to avoid high levels of exposure. This may also involve identifying underlying causes, such as income, housing, and the physical and social environment. Reducing existing and preventing future unjust health inequalities is an important consideration when prioritising policy.

The second part of the step-by-step plan provides guidance on defining and assessing policy options, with specific attention to reducing health inequalities by lowering health risks for high-risk groups. This requires policy that focuses on the social and physical living environment, with an integrated approach across multiple policy domains. In this advisory report, the committee elaborates this specifically for exposure to climate-

related health risks. In the step-by-step plan (steps 7 and 8), the committee sets out the basis for an integrated approach. Step 7 identifies the positive effects of policy measures aimed at health in other policy domains, and thus opportunities to address multiple societal challenges through a single measure. An example is the greening of neighbourhoods, which has beneficial effects on climate adaptation (water retention and heat reduction), quality of life, health and biodiversity.[11] Step 8 examines whether policy measures may have unintended side effects in other domains.

Answering the questions in the step-by-step plan requires scientific expertise and knowledge of policy implementation. This must be regularly reviewed to reflect current developments. Which groups are considered high-risk is determined by the interaction of changing factors, such as climate developments, policy measures and broader societal changes.

Normative considerations also play a role in answering the questions in the step-by-step plan. After all, choices are made about which groups are regarded as distinct, how much the risk must be increased for a group to be designated as high-risk, and which groups require additional protection on grounds of justice.[97] It is therefore important to include different perspectives when completing the step-by-step plan, particularly those of the high-risk groups themselves. For this advisory report, the committee held roundtable discussions with representatives of various potential high-risk groups; see the Report on the roundtable discussions.

Table 2 Step-by-step plan for identifying unjust health inequalities due to climate change and assessing policy advice.

Identifying unjust health inequalities due to climate change	
Selected health risk	
1.	What is the risk for the population as a whole, now and in the future?
2.	Are there groups that may face higher risks than others, now and in the future? Due to: • high susceptibility • high exposure • limited capacity to adapt, avoid exposure or recover from harm to health
3.	Are there high-risk groups with both avoidably high exposure and limited capacity to adapt, avoid exposure or recover from harm to health? Within these groups, are there also groups that are more susceptible to the risk?
4.	What policy options are available to reduce unjust health inequalities for this health risk? Select a policy objective for Part 2 of the step-by-step plan.
Assessing policy advice	
Selected policy objective	
5.	What policies are already in place to reduce the risk for the population as a whole and/or specifically to reduce unjust health inequalities?
6.	What is known about the effectiveness of these policies in reducing health risks? What additional policy is needed for the population as a whole and/or specifically to reduce unjust health inequalities?
7.	Are there any potential side effects of this policy that go beyond reducing health risks, and how can they be strengthened?
8.	Are there unintended negative side effects of this policy, and how can they be avoided? *If action is needed but adjustment is not possible, consider returning to step 6.*
9.	To what extent is the recommended policy the least intrusive[a] means of achieving the objective, and is it proportionate?[b] *If necessary, return to step 6.*
10.	What policy is recommended?

[a] Least intrusive: Is this the least intrusive policy needed to achieve the objective?

[b] Proportionate: Is the policy objective reasonably proportionate to the expected health gains and other positive effects?

04
The Caribbean Netherlands

In brief

For the Caribbean Netherlands, the health risks of climate change are greater than for European Netherlands. Because of the warm climate, increasing heat more often leads to serious health risks. The risk of infectious diseases, extreme weather and disasters is also already high, and is increasing due to climate change. Moreover, climate change increases health risks through direct and indirect effects on, among other things, food and drinking-water supplies and emergency services, including healthcare. At the same time, more people fall within high-risk groups.

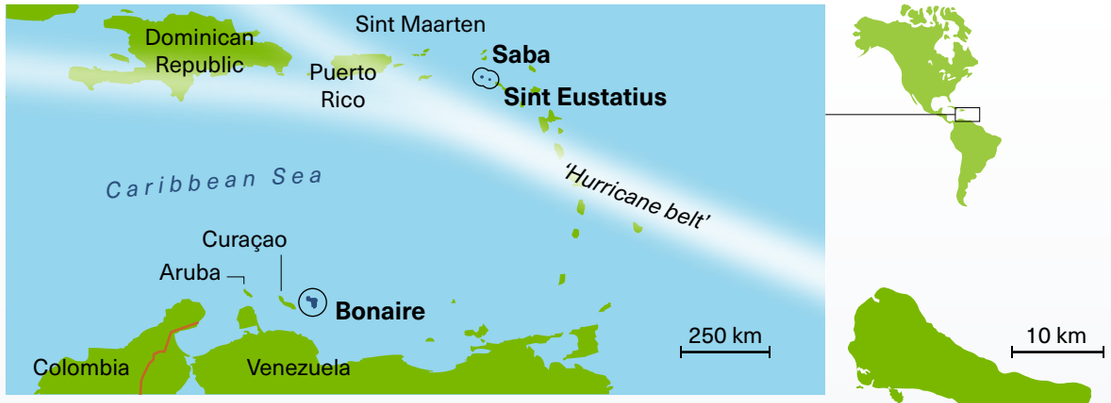
4.1 Climate change

This chapter focuses on the risks for the islands of Bonaire, Sint Eustatius and Saba, which together form the Caribbean part of the Netherlands. Many of the risks described in this chapter also apply to the nearby autonomous countries within the Kingdom of the Netherlands: Curaçao, Aruba and Sint Maarten. The Caribbean Netherlands is among the regions most vulnerable to the effects of climate change worldwide.[122-124] The already high temperatures and wind speeds are rising, and heavy precipitation is increasing. It is still unclear whether average rainfall will increase or decrease.[3]

The windward islands of Saba and Sint Eustatius, like Sint Maarten, lie in the hurricane belt (Figure 5). A hurricane currently passes these islands on average once every two years.[125] For Bonaire, which lies off the coast of Venezuela together with the other leeward islands, Aruba and Curaçao, this occurs on average once every 10 years.[125] In Saba and Sint Eustatius, climate change is increasing the likelihood of severe hurricanes.[3] It is unclear whether less severe tropical storms will also become more frequent.[126]

Bonaire is vulnerable to sea-level rise. As a result, around one-fifth of its land area is expected to be permanently submerged by 2050.[127] Healthy coral reefs and mangrove forests can protect Bonaire against rising sea levels.[128] However, coral is dying, and mangrove biodiversity is declining due to rising temperatures and ocean acidification.[129] As volcanic islands, Saba and Sint Eustatius are higher-lying than Bonaire and are therefore less vulnerable to sea-level rise. However, in combination with hurricanes or tropical storms, higher sea levels can lead to extreme water levels on all the islands, potentially causing flooding, saltwater intrusion and coastal erosion.[130] Heavy rainfall and flooding can cause landslides on all three islands.[128]

The Caribbean Netherlands: location, population and climate change



Population	Saba (The Bottom)	Sint Eustatius (Oranjestad)	Bonaire (Kralendijk)
Number of inhabitants (2025)	2,158	3,270	26,552
• Aged 65+	15.5%	14.7%	14.4%
• Number of tourists per year	5,700	5,800	171,000
Population projection for 2050	*2,100*	*3,500*	*38,300*
• Projection aged 65+	*25% (average across all three islands)*		

Climate change	Saba and Sint Eustatius	Bonaire
Average temperature 1991–2020	27.8˚C	28.5˚C
Projected temperature increase to 2050	*+0.8 to +1.3˚C*	*+0.8 to +1.3˚C*
Average precipitation 1991–2020	514 millimeter per year	1,034 mm per year
Projected change in precipitation to 2050	*-15 to 0%*	*-12 to +3%*
Sea-level rise	*+3 mm. per year*	*+4 mm. per year*
Hurricanes	Current: once every 2 years	Current: once every 10 years
Projection	More highest-category hurricanes	No change

Sources: CBS, KNMI

WKR/Gezondheidsraad

Figure 5 The Caribbean Netherlands

4.2 Health risks

The health risks of climate change for the European Netherlands also apply, in many cases, to the Caribbean Netherlands, including effects of exposure to heat and UV radiation and risks of infectious diseases. Many of these risks are already harming health. Climate change has increased these risks, and future climate change will further increase them. This section describes additional knowledge about the situation in the Caribbean Netherlands.

4.2.1 Increasing exposures

Temperatures and apparent temperatures are high year-round. Experts report that for a substantial part of the day, conditions outside cooled spaces are becoming 'unbearable' for an increasingly large part of the year. During the hurricane season, the leeward islands more often experience periods of calm due to interruption of the north-easterly trade winds, causing apparent temperatures to rise further. As a result of climate change and increasing heat, health risks occur more frequently and in more severe forms.[122,124,131,132] In addition to the direct effects of heat, persistent heat indirectly increases the risk of chronic diseases, because regular physical activity is one of the main factors in preventing and managing these diseases, and people are less physically active because of the heat.[124]

Climate change also leads to more air pollution. The expected increase in drought may lead to more dust, ozone and allergens in the air, particularly inland.[122,133] A drier

climate can contribute to a higher frequency of wildfires and spontaneous combustion at landfill sites, requiring people to be evacuated from their homes because of smoke and potentially hazardous substances.[133,134] Air conditioning is also being used increasingly. Due to salty sea air and limited knowledge about maintenance, air-conditioning units corrode quickly, which can contribute to mould growth and poorer indoor air quality in homes (experts).

4.2.2 Infectious disease risks

Mosquitoes capable of transmitting dengue, Zika and chikungunya are established in the Caribbean Netherlands.[49,135] Climate change is making conditions more favourable for these vectors.[136,137] This also increases the likelihood of a second infection. Several studies show that a second dengue infection and dengue after Zika may be more severe, although this does not apply to all dengue types.[138] Higher temperatures also increase the likelihood of new vector-borne infectious diseases, such as malaria,[131,132] tick-borne encephalitis,[133] new variants of diseases such as dengue,[122] and, as one expert notes, infectious diseases found in the Latin American region such as Chagas disease (transmitted by triatominea conenose bugs) or leishmaniasis (transmitted by sandflies).

Climate change is also increasing waterborne infectious diseases, for example because Vibrio bacteria survive longer in warmer and less saline seawater.[124,133] Increasingly heavy rainfall and flooding can contaminate drinking water with bacteria and cause conditions such as diarrhoea, gastroenteritis, leptospirosis and cryptosporidiosis.[124,131-133] Drought affects the quality of surface water used for hygiene and water recreation.[128]

As pathogens become more prevalent, so too does the likelihood of an infectious disease outbreak. The consequences can be significant, partly because of the limited ability of healthcare centres, especially on Saba and Sint Eustatius,[14] the high level of often daily mobility between Bonaire, Aruba and Curaçao and between Saba, Sint Eustatius and Sint Maarten, and the temporary increase in the number of people due to tourism. A relatively large share of the population is also difficult to reach, such as migrants and people with low literacy or other literacy needs (experts).

4.2.3 Extreme weather and disasters

Due to climate change hurricanes of the most severe category occur more often near Saba and Sint Eustatius. In 2017, Hurricane Irma, a hurricane of the most severe category, passed close to these islands and caused major damage to buildings, the airport and the port on Sint Maarten, resulting in four deaths.[4] Hurricanes have major consequences for safety, food security, pressure on and access to the health-care system, drinking water supplies, infectious diseases and mental health.[128,130,131] Connections with other islands for medical assistance and food may also be cut off,

and buildings and infrastructure may be damaged.[122] This can have direct and indirect consequences for the population's health.

Flooding caused by hurricanes, storms (potentially in combination with high water levels) and heavy rainfall can degrade surface water quality, increasing the risk of infectious diseases. It can also damage homes and lead to mould growth, posing a risk of respiratory diseases.[131,136,139]

4.2.4 Mental health impacts

Sea-level rise on Bonaire and changes in the living environment, such as the die-off of mangrove forests and coral reefs, lead not only to acute health risks but also to mental health problems. This is due to concern or anxiety about the living environment, for example among young people and children.[140] Concerns about reduced tourism income can also affect mental health.[7] Furthermore, extreme weather poses risks to mental health. For example, it can lead to stress, trauma or PTSD, particularly in children. Mental health problems may also increase due to the loss of a home or job.[124] In addition, flooding caused by sea-level rise may in the future lead to the migration of part of the population, with associated mental health effects.[131]

4.3 Healthcare system

The health effects of climate change increase pressure on the sometimes already overburdened healthcare system, including emergency care, particularly during heatwaves, the tourist season and infectious disease outbreaks.[128,130] Healthcare centres may become inaccessible or lose access to power during extreme weather such as heavy rainfall or a hurricane. Saba and Sint Eustatius each have a small healthcare centre. Extreme weather can make flights to hospitals and the import of medicines impossible (experts).

4.4 Societal and economic impacts

Climate change also has major societal consequences that can indirectly affect health. For example, climate change affects drinking-water supply[124] and food security, particularly for fresh produce, which is already expensive.[122,131,133] Imported food and food from local agriculture become more expensive and less available, for example, because of failed harvests and reductions in livestock and fisheries, or because logistics and supply chains are disrupted by extreme weather.[7,122]

Infrastructure, such as electricity supply and roads, is also damaged by heat, excess water and storms.[122] Tourism is expected to decline due to heat and coral degradation.[141] After extreme weather such as hurricanes, storms or floods, the economic damage can be enormous.[124] For reconstruction after Hurricane Irma, the Netherlands, in cooperation with the World Bank, allocated €550 million for Sint Maarten and €67 million for Saba and Sint Eustatius, in addition to direct emergency aid.[142] During an extreme weather event, social and political stability may also come under pressure.[143]

The economic burden of the health effects of climate change may also be high, for example, due to reduced labour productivity as temperatures rise.[124]

4.5 High-risk groups

In the Caribbean Netherlands, some groups face greater risks of harm to health due to higher susceptibility, greater exposure, and/or limited capacity to adapt, avoid exposure or recover from harm to health. The examples below are additional to, or differ from, those in the European Netherlands.

4.5.1 High susceptibility

In the Caribbean Netherlands, a larger proportion of people are highly susceptible to health risks. A relatively large share of the population has a chronic condition,[131] and the proportion of people who are overweight exceeds 70% on all three islands (compared with 44.8% in the European Netherlands).[144] Climate change also creates barriers to healthy living: high temperatures limit physical activity,[124] healthy food becomes more expensive due to extreme weather or failed harvests[131] and mental stress increases.[122,140] As a result, children and young people are also at higher risk of developing chronic conditions, which will make them more susceptible in the future to the health effects of climate change.

Population growth and ageing on the islands mean an increasing number of older people, who are more susceptible to health risks.[145] People with existing mental health problems are also more susceptible, including those who have previously experienced disasters or extreme weather. Several experts indicate that past experiences with heavy rainfall and flooding lead to severe stress responses among some residents whenever rain is forecast and perceived risks are high.[128]

Patients requiring specialist care cannot access it on Saba and Sint Eustatius and must travel to another island. This applies, for example, to pregnant women and to dialysis patients on Saba and Sint Eustatius, who travel to another island three times a week for treatment (experts). Travel is sometimes not possible due to extreme weather.

4.5.2 High exposure

In the Caribbean Netherlands, various groups are more highly exposed to climate-related factors. These include people living in homes that are difficult to cool, not resistant to strong winds or heavy rainfall, or with poor and/or unhygienic sewerage and sanitation systems, which increase the risk of infectious diseases.[122] Groups living in low-lying coastal areas with a higher risk of flooding are also vulnerable. Women, on average, spend more time indoors doing paid or unpaid work.[146] In neighbourhoods with poor sewerage, this increases the risk of infectious diseases, and in hot neighbourhoods, it increases the risk of heat stress.[122] Children and young people are exposed to heat in school environments, and often at home,

leading to concentration problems. Play and sports areas are also often too hot, without sufficient cooling options (experts).

As in the European Netherlands, some occupational groups face higher health risks due to climate change, such as outdoor workers. On Bonaire, physically demanding outdoor work with high heat exposure is often carried out by migrant workers.[147] Healthcare workers are more exposed to infectious diseases and/or extreme weather when providing care. Pressure on their mental health is also increasing, which further strains the healthcare system.[122,131] People whose work depends on the ocean face greater risks of Vibrio infections and storm-related hazards.[124]

4.5.3 Limited capacity to adapt, avoid exposure or recover from harm to health

In the Caribbean Netherlands, many people live in poverty.[148] They have limited ability to protect themselves against the health effects of climate change because of already high and rising costs for electricity (needed for ventilation or air conditioning), drinking water and healthy food (experts). They are also often unable to choose climate-resilient housing.[122] For people whose livelihoods depend on tourism, climate change may threaten income security, with both physical and mental health consequences.[122,133]

There is a high proportion of people with low literacy or other literacy needs on the islands (17% on Bonaire in 2015), which limits their access to information needed to protect themselves against health risks.[149]

During extreme weather or disasters, such as hurricanes or heavy rainfall with landslides, some people are less able than others to adapt to or avoid risks, or to recover from them. These include people with disabilities, people on low incomes or in ocean-dependent work, people with low literacy or other literacy needs, people without insurance or residence permits, and other marginalised groups.[122] Women and adolescent girls are also more likely worldwide to experience sexual violence after disasters, for example in shelters.[150]

People with limited capacity to adapt, avoid exposure or recover from harm to health are more often exposed to the health risks of climate change. In the Caribbean Netherlands, exposures are more severe, and a relatively larger share of the population cannot avoid them. As a result, a relatively large proportion of the population in the Caribbean part of the Netherlands experiences unjust health inequalities. This is rooted in factors in the social, economic and physical living environment, such as the quality of existing infrastructure and housing, and the level of the social minimum.

05 Policy recommendations

In brief

Under current policy, the Dutch population is insufficiently protected against the increasing health risks of climate change. Central government must take the lead in reducing these risks, and allocate responsibilities and funding for the longer term. By addressing the negative health effects of climate change alongside other issues, the government can pursue several policy goals simultaneously. The committee recommends, when developing policy, to prioritise groups of people who find it difficult to adapt to or avoid health risks, as well as the Caribbean Netherlands.

5.1 Current policy

5.1.1 The European Netherlands

In the European Netherlands, policy aimed at reducing the health risks of climate change is limited; see box. Current policy focuses mainly on knowledge development, knowledge transfer and information provision.[15,17,151,152] With the exception of the National Heatwave Plan, current policy to reduce the health risks of climate change is generally not structurally embedded and few concrete goals have been set. Structural funding for measures therefore also lags behind. Preparedness for new health risks is limited. For example, there is still little attention to the early detection of new pathogens or to monitoring pathogens in vectors and surface water.

Moreover, current climate adaptation policy is still insufficiently focused on strengthening social infrastructure, which partly determines people's capacity to adapt to, avoid or recover from climate change risks, particularly in the case of weather extremes and disasters.[103,152] The home and work environment are places where people spend long periods and where a large share of environmental exposure occurs. However, current national housing and employment policy pays limited attention to the health risks posed by climate change. Quality standards for heat and health have been developed – in the form of a standard – for new-build homes, but not for existing buildings; see box.[153] The policy vision document on working conditions issued by the Ministry of Social Affairs and Employment (SZW) does not mention climate change risks.[154] The Social and Economic Council of the Netherlands (SER) has advised that this policy should better anticipate the new and changing climate-related risks at work.[155]

Box: Current policy

Climate adaptation policy

Dutch climate adaptation policy has traditionally focused strongly on measures relating to water safety, including flood prevention.[75,156] As the effects of climate change become increasingly apparent, broader societal risks are receiving more attention. In the National Climate Adaptation Implementation Programme (NUP KA, 2023), the recalibration of the Delta Programme (2026) and the National Climate Adaptation Strategy (NAS) (publication in 2026), climate adaptation is being approached more broadly and now focuses more than before on health risks resulting from temperature increases, heat and other extreme weather events.[151,157,158]

For policy aimed at limiting the risks of vector-borne diseases and zoonoses – infections that can be transmitted from animals to humans – the NUP KA refers to the National Action Plan for Strengthening Zoonoses Policy.[159,160] This action plan was developed in part to address climate change and focuses strongly on preventing zoonotic infections from livestock farming. Climate change has led to greater attention to monitoring and research into vector-borne infections, but monitoring is conducted only in humans and animals, not in vectors or the environment, such as water, where pathogens may originate. To limit the health risks of infectious diseases, pathogens need to be monitored in humans, animals and the environment. Scientists therefore advocate a One Health approach, based on the interconnectedness of human, animal, and environmental health.[161]

In the Hitte aanpak 2025, the Ministries of Health, Welfare and Sport (VWS), Housing and Spatial Planning (VRO), and Infrastructure and Water Management (IenW) set out the ambition to keep the living environment in cities, towns and villages healthy and liveable during periods of heat, and to halve the number of people dying prematurely from heat by 2050.[162] The ministries support integrated action on heat through the Samen Klimaatbestendig Platform, a network of local authorities that share knowledge on reducing heat in buildings and neighbourhoods.[163]

Housing policy

Current housing policy focuses on creating more homes, including through new construction and better use of existing buildings. As part of building regulations, the TOjuli-requirement (temperature exceedance in July) has been in place since 2020 and aims to limit the risk of overheating in new-build homes. There is no comparable standard for existing homes. Policy also focuses on improving the sustainability and quality of existing homes, for example through the National Insulation Programme. The Housing Summit agreements state that new-build homes must meet quality standards for, among other things, climate adaptation and health.[153] In housing policy, there is still little attention to the health effects of climate change in existing homes. Policy for other climate risks to homes, including foundation damage due to drought, flooding and land subsidence, is fragmented and mainly focused on technical measures, such as repairing damage or regulating groundwater levels.[152,164]

Health policy

New principles for future health policy were recently formulated in the *Landelijke nota gezondheidsbeleid*. These include a shift from care to prevention, the Health in all policies agenda, greater attention to the role of the living environment and efforts to find ways of structurally embedding health policy.[165,166] Reducing health inequalities has been a policy objective for many years, with various ambitions formulated to that end.[167-169]

Health policy does refer to the risks of climate change, mainly in relation to heat and UV protection. Little concrete policy has yet been formulated.[15,165,167] Since 2007, the

National Heatwave Plan has been in place to address the health effects of heat. This is a system for warning organisations, healthcare professionals, other professionals and informal carers about expected heat. They can then take this into account when supporting and caring for high-risk groups during hot periods. Since 2010, mortality from high temperatures in the Netherlands has decreased, likely partly due to the National Heatwave Plan. The reduction in mortality occurred mainly among older people, women and residents of neighbourhoods with low socioeconomic status.[62,63] However, due to rising temperatures and population ageing, the number of heat-related deaths is expected to increase (Chapter 2). To prevent excessive exposure to UV radiation, the Dutch Skin Fund, commissioned by the Ministry of Health, Welfare and Sport, runs a prevention campaign aimed at behavioural change.[170] Health policy on infectious diseases is mainly focused on controlling outbreaks of known infectious diseases.[15] The National Institute for Public Health and the Environment (RIVM) coordinates surveillance and signalling to detect and prevent infectious disease risks at an early stage.

5.1.2 The Caribbean Netherlands

The islands have the status of public entities, each with its own administration that serves as both a province and a municipality.[171,172] Under the coordination of the Ministry of the Interior and Kingdom Relations (BZK), each ministry, as in the European Netherlands, is responsible for implementing its national policy on Bonaire, Saba and Sint Eustatius, according to the comply-or-explain principle: all policy intensifications for the European Netherlands apply in the Caribbean Netherlands, unless there are good reasons to implement them in adapted form or not at all.[173,174]

In the Caribbean Netherlands, too, policy on health and climate adaptation is still under development. This includes the Health Deal at the Ministry of Health, Welfare and Sport (VWS) and the climate adaptation plans being prepared on each island, with support from the Ministry of Infrastructure and Water Management (IenW). A separate chapter of the NAS 2026 will also be devoted to the Caribbean Netherlands.[175] Relevant policy intensifications are also under development in areas including housing construction and spatial planning.[176,177] The impact of climate change on health is not taken into account in all policy intensifications.

Current policy to reduce the health risks of climate change is therefore still limited. A recent court ruling states that, under its current policy, the Dutch State does not provide sufficient protection against climate change for the residents of Bonaire.[178] In other areas relevant to protection against the health risks of climate change, striking differences have also been identified in central government policy efforts in the Caribbean Netherlands compared with the European Netherlands. These include the physical domain, public health and the safeguarding of human rights.[14,148,172,179-184]

5.1.3 Conclusion on current policy

The committee notes that there is still little concrete policy to protect the population in the European Netherlands and the Caribbean Netherlands against the health risks of climate change. Recent policy plans do, however, contain starting points for

limiting climate-related risks, such as the attention given to prevention and the living environment in the National Health Policy Memorandum, and to health risks in the forthcoming National Climate Adaptation Strategy (NAS) 2026. However, these plans still need to be elaborated further and translated into concrete measures to address health risks caused by climate change. In other policy areas, there is little attention to reducing the health risks of climate change. In the following sections, the committee outlines the steps needed to protect the population from the health risks of climate change and makes several recommendations to that end.

5.2 General recommendations

Climate change is creating a new reality with adverse consequences for health. This includes increased exposure to known environmental factors, more frequent weather extremes and disasters, and new health risks. The committee finds that current policy is inadequate and that the population in both the European Netherlands and the Caribbean Netherlands is currently insufficiently protected. Current and planned global and national policies to reduce greenhouse gas emissions (climate mitigation) remain important for limiting climate change and the associated health risks, but so far they are insufficient to stop further climate change.[3,12] Without appropriate adaptation measures, health risks from climate change will therefore continue to increase in the future.

Limiting and preventing health risks from climate change is a responsibility of government and, like other forms of preventive public health policy, a constitutional duty (duty of care). Preventing chronic conditions and promoting healthy behaviour are important for reducing the health risks associated with climate-related exposures. People with unhealthy lifestyles or chronic conditions face higher risks when exposed to, for example, heat.[12] However, preventive health policy in the context of climate change goes beyond this. It also involves limiting exposure as much as possible to climate-related environmental factors such as heat, UV radiation, summer smog and pollen, preventing the spread of and exposure to new and existing pathogens, and ensuring adequate preparedness for extreme weather conditions and disasters.

5.2.1 Structural and coherent policy

Recommendation 1

Implement structural and coherent policy to protect people from the health risks of climate change, now and in the future.

Structural policy entails long-term allocation of responsibilities and funding. To achieve this, central government must take the lead and support local authorities, civil society organisations and businesses. Coherent policy integrates multiple policy objectives and is developed jointly across policy areas and levels of government. In developing coherent policy, existing interdepart-

mental structures and other forms of cooperation should be used as much as possible.

Structural policy is long-term policy in which both funding and organisation are secured. It clearly defines which ministry has overall responsibility, and allocates roles and responsibilities transparently between ministries and across levels of government.

Coherent policy connects multiple policy objectives and is developed or aligned across different policy domains and levels of government. It enables multiple societal challenges to be addressed simultaneously. In the context of climate adaptation, there are clear opportunities for measures that generate co-benefits – that is, multiple positive effects. Examples include increasing 'green and blue' infrastructure in cities, which helps reduce heat, enhance biodiversity, improve water retention and prevent surface water flooding.[17]

Preventing health problems resulting from climate change often requires action in policy domains beyond public health.[185,186] For example, reducing exposure to heat and UV radiation requires heat-resilient housing, green spaces and shaded areas in the living environment. Coherent policy therefore at least includes health policy that incorporates climate change risks, as well as climate adaptation policy that addresses health risks (health in all policies). In developing such policy, existing interdepartmental structures and collaborative frameworks should be used wherever possible.[162,186] For certain challenges, cooperation is both logical and efficient, such as in housing development and the creation of heat- and climate-resilient neighbourhoods. Coherent policy is also necessary to prevent unintended side effects, such as infection risks associated with water retention facilities or increased pollen exposure resulting from greening choices.

5.2.2 Reducing unjust health inequalities

Recommendation 2

Prioritise policy development for groups that find it difficult to adapt to or avoid health risks, or to recover from harm to their health.

The aim of this policy is to make it possible and easy for people to adapt to increasing risks, avoid them, or recover from harm to their health; for example, by improving the physical living environment and social conditions. As a tool, the committee has developed a step-by-step plan for policy development relating to climate-related health risks, aimed at reducing unjust health inequalities.

Climate change particularly affects people who find it difficult to adapt to health risks, avoid them or recover from them. Without targeted policy for these groups, climate change will lead to an undesirable increase in health inequalities. As these risks are also avoidable, this is unjust. This means that more needs to be done for

certain groups, or that a different approach is needed for them. Despite policy efforts, existing health inequalities have not decreased in recent years.[16] This may be because policy in recent years has mainly focused on encouraging behavioural change, with an emphasis on people's own responsibility.[187] However, people with less capacity to adapt to, avoid or recover from health risks benefit less from this policy than others.[187-189] Policy that fails to take sufficient account of these groups will therefore unintentionally widen health inequalities.[190] The committee has developed a step-by-step plan that can be used to identify unequal opportunities in relation to health risks caused by climate change and policy options for addressing them; see 3.4. The committee has used this plan in the present advisory report. Table 3 provides an example of a completed step-by-step plan for heat exposure.

To increase equity in opportunities for health, policy aimed at improving the conditions needed for healthy living has the potential to deliver the greatest health gains.[98,191] These conditions include where people live, work and grow up. Reducing health inequalities, therefore, requires policy efforts across multiple areas. Adaptations to the physical living environment and improvements in social conditions can reduce exposure to climate risks and strengthen people's capacity to adapt, avoid exposure or recover.[192]

Table 3 Completed step-by-step plan for identifying unjust health inequalities due to climate change and assessing policy advice: heat in the European Netherlands

Identifying unjust health inequalities due to climate change **Heat in the European Netherlands**	
1	*What is the risk for the population as a whole, now and in the future?* • 250 additional deaths per year due to increased exposure to heat. Decrease in cold-related mortality. • The likelihood of heatwaves has increased from once every 5 years (second half of the previous century) to once every 1-2 years (since 2000). • Heat stress, effects on sleep disturbance, mental health effects – both positive and negative – and effects on preterm births and birth weight. • Low perception of the risks of average temperature rise; higher risk perception of heatwaves.
2	*Are there groups that may face higher risks, now and in the future? Due to:* • *High susceptibility* Older people (75+), babies/children, pregnant women, chronically ill people (physical/mental), people who are overweight, and users of medicines, alcohol and drugs • *High exposure* Residents of highly built-up neighbourhoods with little green space, residents in the south and south-east of the country, outdoor workers, and people in workplaces that are difficult to cool, residents of poor-quality homes, people staying in poor-quality buildings, outdoor athletes and recreational users. • *Limited capacity to adapt, avoid exposure or recover from harm to health* People in a disadvantaged socioeconomic position are more likely to face unhealthy conditions in daily life. This includes, for example, people with income insecurity and/or limited resources and opportunities to adapt their home; workers in a dependent relationship with their employer; children and older people who depend on others; people experiencing loneliness and people with a small social network; and people with less access to care.
3	*Are there high-risk groups with both avoidably high exposure and limited capacity to adapt, avoid exposure or recover from harm to health? Within these groups, are there also groups that are more susceptible to the risk?* • Tenants and residents of low-cost owner-occupied homes who have fewer resources to improve their homes themselves, living in highly built-up neighbourhoods with little green space and in poor-quality homes. This applies particularly to dependent young and older residents, and lonely and/or marginalised people. • People without work and/or housing. • Children and older people in poor-quality homes and buildings, such as schools, childcare centres, nursing homes and residential care homes

- Workers in outdoor occupations and in workplaces that are difficult to cool.
- Chronically ill people in poor-quality homes and buildings, including healthcare institutions.
- Children who live, attend school and play outdoors in hot neighbourhoods.

4 *What policy options are available to reduce unjust health inequalities for this health risk? Select a policy option for Part 2 of the step-by-step plan.*

- Address heat in poor-quality homes
- Address heat in poor-quality healthcare institutions, schools and childcare centres
- Protect workers from heat in the workplace
- Address heat in neighbourhoods

Assessing policy advice

Addressing heat in poor-quality homes

5 *What policies are already in place to reduce risks for the population as a whole and/or specifically to reduce unjust health inequalities?*

- Since 2020, a standard (the TOjuli-requirement) has been in place to limit the risk of overheating in new-build homes.
- No such standards exist for existing buildings. People living in poor-quality rented homes are at greater risk of living in homes that become too hot. As mitigation measures must be taken by landlords, these residents have limited ability to avoid heat in their homes.

6 *What is known about the effectiveness of these policies in reducing health risks? What additional policy is needed for the population as a whole and/or specifically to reduce unjust health inequalities?*

- Solar shading, safe ventilation and active cooling are effective measures.
- A standard comparable to that for new-build homes is needed for existing homes.
- Priority in housing improvements should be given to poor-quality homes that residents cannot improve themselves.

7 *Are there any potential side effects of this policy that go beyond reducing health risks, and how can they be strengthened?*

- Well-insulated and ventilated homes protect not only against heat, but also against mould and damp, and provide greater comfort.
- Insulation and solar shading also make homes more energy-efficient. This supports climate mitigation and helps address energy poverty.

8 *Are there unintended negative side effects of this policy, and how can they be avoided?*
If action is needed but adjustment is not possible, consider returning to step 6.

- Housing improvements could lead to higher housing costs. As these often affect groups in a disadvantaged socioeconomic position, this should be avoided as far as possible.
- Making homes more sustainable may create new risks, such as Legionella in tap water due to insufficient heating by heat pumps. This should be taken into account during implementation.

9 *To what extent is the recommended policy the least intrusive[a] means of achieving the objective, and is it proportionate?[b]*
If necessary, return to step 6.

- Making existing poor-quality homes more sustainable involves high financial costs.
- The benefits include health gains through prevention.
- The benefits also include reducing unjust health inequalities.
- This is a political consideration.

10 *What policy is recommended?*

- Make homes resilient to heat, starting with rented homes.

[a] Least intrusive: Is this the least intrusive policy needed to achieve the objective?
[b] Proportionate: Is the policy objective reasonably proportionate to the expected health gains and other positive effects? Are there opportunities to align with other policies?

5.2.3 Policy in the Caribbean Netherlands

Recommendation 3

Prioritise policy development for residents of the Caribbean Netherlands.

All policy recommendations apply with greater urgency to the Caribbean Netherlands. Each relevant and responsible ministry is involved in national policy. It is essential that the ministries concerned enter into dialogue with the public entities and local parties to develop and implement policy that fits the local context.

The committee finds that the health effects of climate change in the Caribbean Netherlands are more severe and more diverse than in the European Netherlands. In addition, shortcomings in basic services mean that residents of the Caribbean Netherlands face greater health risks as a result of climate change. Protecting the

population of the Caribbean Netherlands against the health effects of climate change should therefore be a priority within climate adaptation policy. This priority for the Caribbean Netherlands also applies to all the recommendations set out in this advisory report. This is in line with a court ruling that the Dutch State must do more to protect residents of Bonaire against climate change and is required to develop and implement a comprehensive and effective climate adaptation plan by 2030.[178]

To protect residents of the Caribbean Netherlands against climate risks, central government must provide structural funding and capacity for the development and implementation of policy in the Caribbean Netherlands, both within the public entities and at the ministerial level.[179,180] Ministries must work with the public entities to tailor policy to the local context. This requires incorporating local and regional expertise[122,193] and involving local communities, organisations and businesses.[172,179,181]

5.3 Recommendations for policy domains

Public health policy in a changing climate requires measures across different policy domains. The committee makes seven more specific recommendations for different policy domains, following from general recommendations 1, 2 and 3, on which work can begin now. By applying the step-by-step plan, the committee has identified topics and prioritised high-risk groups for policy development. This includes both physical and social measures, and concerns the built environment – homes, buildings and neighbourhoods – working conditions, and a resilient society and healthcare sector prepared for known and new risks.

5.3.1 Housing and neighbourhoods

Recommendation 4

Make homes resilient to heat and other climate risks, starting with rental properties.

Develop additional regulations for existing homes, make binding agreements with landlords, such as housing associations, for both existing and new homes, and support this with subsidies if appropriate.

The committee recommends focusing on improving the resilience of homes to heat, flooding and storms, starting with the homes of people who cannot adapt to or avoid exposure. Improving rented homes is therefore a priority. In the European Netherlands, a large share of heat exposure occurs in homes. Because guidelines exist to limit heat in new-build homes but not in existing homes, the committee recommends developing additional regulations or making binding agreements with social and private landlords for the existing housing stock. Standards for new homes should take further climate change into account (Box text Recommendation #4).

In the Caribbean Netherlands, it is important to make both existing and new homes more resilient to heat, storms and flooding. Here too, priority should be given to residents who cannot adapt to or avoid exposure. A reliable electricity infrastructure is needed for ventilation and air conditioning, especially during hot and windless periods. To reduce infectious disease risks, homes need good and hygienic sanitation facilities.

There is sufficient knowledge of effective measures to counter heat in homes (Box text Recommendation #4). The energy transition challenge – climate mitigation – can be combined with the challenge of making homes heat-resilient – climate adaptation.[194,195] Unintended adverse effects must be taken into account. For example, making homes heat-resilient should not lead to higher housing costs.[196,197] National direction is important for the housing challenge: the Ministry of the Interior and Kingdom Relations (BZK) is responsible for realising climate-resilient and climate-neutral homes, in an integrated approach with the Ministries of Economic Affairs and Climate Policy (EZK) and Infrastructure and Water Management (IenW), for both the European Netherlands and the Caribbean Netherlands.

Recommendation #4

Climate-resilient homes: What this could look like

Ways to make rented homes heat-resilient include establishing a standard, making binding agreements between relevant parties or introducing a climate label.
For existing homes, there is no standard aimed at limiting the risk of overheating. Such a standard exists for new-build homes: the Temperature Exceedance in July (TOjuli) requirement. Existing standards should also take into account the climate scenarios for 2050 and 2100. Binding agreements, such as the agreements on making homes more sustainable in the Nationale prestatieafspraken, could also be made for heat. As making homes heat-resilient involves substantial costs, central government will need to provide landlords with financial support. Central government can better enable homeowners with limited financial resources to improve their homes. Existing schemes aimed at improving the sustainability of homes could be used, such as the Renewable Energy Investment Subsidy Scheme (ISDE). Sufficient knowledge is available on cooling buildings through external solar shading, ventilation and, where necessary, active cooling.[198,199] In the Caribbean Netherlands, local knowledge on climate-resilient construction could also be used as a supplement.

Recommendation 5

Make buildings used for education and long-term care resilient to heat and other climate risks.

To this end, encourage owners of these buildings to make them more climate-resilient by setting standards or advisory values, providing subsidies, introducing a climate label, or providing information.

The committee considers that buildings and outdoor spaces used for education and long-term care should be climate-resilient and healthy places, because children, older people and chronically ill people, among others, find it difficult to avoid heat and other climate risks in these locations. This concerns resilience to heat and flooding, as well as protection against infectious diseases. In the Caribbean Netherlands, a reliable electricity supply for ventilation and air conditioning in these buildings, and outdoor play areas with sufficient shade and opportunities for cooling for children and young people, require particular attention.

As with homes, effective measures against overheating are available (Box text Recommendation #4). Knowledge is also available on controlling infectious disease risks in outdoor spaces (Box text Recommendation #5). Central government can encourage the owners of buildings used for education and long-term care to make these buildings climate-resilient (Box text Recommendation #5). This can be addressed together with other challenges, such as making buildings more sustainable and creating healthy and safe childcare, school and care buildings; for example, in agreements following the Outline Agreement on Elderly Care (HLO). Responsibility for this lies with the Ministry of the Interior and Kingdom Relations (BZK), for both the European Netherlands and the Caribbean Netherlands. Other parties involved include the Ministries of Education, Culture and Science (OCW) and Health, Welfare and Sport (VWS), municipalities, public entities and municipal public health services (GGDs).

Recommendation #5

Climate-resilient education and care locations: What this could look like

Central government can, together with municipalities, encourage owners to make their buildings heat- and climate-resilient by setting standards or advisory values, providing subsidies, introducing a climate label or providing information.
These buildings are owned by various parties, including municipalities, healthcare institutions, real estate investors, housing associations, school boards and educational institutions. Different routes are therefore needed to reach them.
Owners can use existing information to make their buildings and outdoor spaces heat- and climate-resilient. Knowledge of effective measures to limit infection risks in outdoor spaces is also available, such as avoiding stagnant water that can serve as breeding sites for mosquitoes.[115]

Recommendation 6

Make neighbourhoods resilient to heat and other climate risks, starting with neighbourhoods where people face the highest health risks.

This can be done by establishing urban greening standards, providing municipalities with funding for greening and water retention, removing regulations that hinder climate adaptation measures, or providing information to prevent potential health risks arising from these measures.

The committee recommends developing national policy on the climate resilience of residential neighbourhoods in relation to health, both through targeted health policy and by incorporating health into climate adaptation policy. In highly built-up neighbourhoods with little green space, temperatures can rise sharply during hot periods.[11] This contributes to heat in homes. Measures are needed particularly for residents with limited ability to keep their homes cool; for example, because they rent their home or have limited financial resources. This applies to both the European Netherlands and the Caribbean Netherlands.

For measures against flooding, such as sewerage adaptations or water retention, it is important to counter potential negative health risks, for example from infectious diseases. In addition, when designing and building neighbourhoods, it is important to take flood risks and rising sea levels into account. This is already a more pressing issue in the Caribbean Netherlands, particularly on Bonaire. Publicly accessible cooling locations, such as a library or community centre, are also essential in a climate-resilient neighbourhood.

There is sufficient evidence for the cooling effect of greening in neighbourhoods (Box text Recommendation #6). Greening neighbourhoods for health involves addressing several challenges, including creating liveable and safe neighbourhoods, restoring biodiversity, ensuring water safety, managing flood risks, and spatial planning. Addressing these challenges in an integrated way can deliver significant benefits. In such an approach, the Ministry of Infrastructure and Water Management (IenW) has overall responsibility, in cooperation with the Ministries of the Interior and Kingdom Relations (BZK), Agriculture, Fisheries, Food Security and Nature (LVVN), and Health, Welfare and Sport (VWS), for both the European Netherlands and the Caribbean Netherlands, and together with local authorities.

Recommendation #6

Climate-resilient neighbourhoods: What this could look like

More and better greenery in neighbourhoods helps combat heat and surface water flooding and benefits the health of the entire population, especially residents of hot neighbourhoods who have limited ability to keep their homes cool.[200] Greening public space falls under municipal policy and forms part of environmental visions and plans. Municipal public health services (GGDs) can provide information on the health benefits of greening and on preventing health risks, such as infectious diseases, in green spatial design.[115] Central government has a role in supporting municipalities. This can

include defining urban greening standards, providing financial resources for neighbourhoods with many residents from high-risk groups, and removing rules that hinder greening, such as parking standards.

From a climate adaptation perspective, a climate-resilient neighbourhood must be resilient not only to heat but also to flood risks and sea-level rise.[201] By applying a climate adaptation assessment for housing development, decisions can be made on which locations are or are not suitable for construction in the longer term.[201]
For the Caribbean Netherlands, the Climate Impact Atlas can be consulted for this purpose.[202] In addition, large-scale measures are recommended for water safety in specific neighbourhoods, such as sewerage adaptations, water retention areas and watercourses.[64]

5.3.2 Working conditions

Recommendation 7

Ensure that climate risks are better embedded in occupational health and safety policy.

Do this through regulation, binding agreements with employers' and employees' organisations, or by encouraging employers to better identify climate-related risks and take action.

The committee recommends better embedding protection against climate risks in existing occupational health and safety policy. This is important for all employees, but particularly for workers who are highly exposed and find it difficult to avoid that exposure. Due to climate change, workers will be exposed more often and to a greater extent to heat, UV radiation and infection risks, among other things. This applies mainly to people in physically demanding occupations and outdoor workers. Sufficient practical knowledge is available to enable measures to be taken (Box text Recommendation #7).

In the Caribbean Netherlands, many workers are highly exposed to heat, UV radiation and infection risks. Protecting workers' health in the Caribbean Netherlands also means ensuring that people in occupations threatened by climate change have an adequate social safety net to safeguard their livelihood.

The Ministry of Social Affairs and Employment (SZW), in cooperation with employers' and employees' organisations, is responsible for better embedding climate risks in occupational health and safety policy.

Recommendation #7

Occupational health and safety policy: What this could look like

Under the Working Conditions Act (Arbowet), employers are required to ensure safe and healthy working conditions. This also includes protection against high temperatures, UV radiation and infection risks. The Act does not set limit values for exposure to heat or UV radiation. However, scientifically substantiated reference values do exist for exposure to heat.[203] To limit climate-related exposures in the workplace, the

government should impose more binding measures on employers. This could be done by including a standard for heat stress in the workplace or by introducing more detailed requirements for the risk inventory and evaluation that employers are required to prepare under the Working Conditions Act. Employers need information on effective measures; the government can facilitate this.[102] Business associations also indicate that subsidies and schemes are needed to make commercial premises more sustainable, including through insulation.[204] Employers can also pay more attention to climate-related risks themselves by identifying them more effectively and taking measures.[102,205]

To protect workers against climate-related infection risks, it is important that occupational physicians report occupational infectious diseases.[206] In addition, vaccines are available for some infectious diseases. For example, the Health Council of the Netherlands has advised offering vaccination against the tick-borne encephalitis virus to workers who work in green spaces.[207]

5.3.3 Resilience

Recommendation 8

Strengthen the knowledge base and monitoring to limit future health risks.

To this end, fund and facilitate the monitoring of climate-related exposures and impacts, the detection of new and existing infectious diseases, research into the health effects of climate change and research into the effectiveness of measures.

The committee recommends expanding the monitoring of the various climate-related exposures and their effects on physical and mental health in both the European Netherlands and the Caribbean Netherlands. This also includes expanding the monitoring and surveillance of infectious disease risks (Box text Recommendation #8).

The committee emphasises that there is sufficient knowledge for policy development in both the European Netherlands and the Caribbean Netherlands. At the same time, new knowledge can help set future policy priorities and improve policy effectiveness. The committee therefore recommends that the effects of policy implementation should be studied as standard practice. To prevent unjust health inequalities, the effects on different groups in society need to be better evaluated. Monitoring and research into the health effects of climate change fall under the responsibility of the Ministries of Health, Welfare and Sport (VWS) and Agriculture, Fisheries, Food Security and Nature (LVVN).

Recommendation #8

Knowledge base and monitoring: What this could look like

Better pooling of knowledge on climate-related factors and health for both the European Netherlands and the Caribbean Netherlands would improve insight into the climate-related disease burden and provide a clearer picture of accumulating risks. This could be done, for example, by combining knowledge from the RIVM Public Health Foresight Study, the Living Environment Atlas and the Climate Impact Atlas.

The WKR has previously advised developing a periodically published national adaptation monitor.[201]

Detection of new climate-related infectious disease risks can be improved by broadening it to include pathogens in the environment, for example in water, and in vectors (One Health).[161] At present, infectious disease surveillance is limited to signals from animal and human healthcare.

Research on climate adaptation and health is developing rapidly, and a great deal of knowledge is already being shared.[115] The connection between climate change and many other challenges requires policy development and knowledge development to proceed together. Steps are being taken in this direction, for example through programmes run by ZonMw and the Dutch Climate Research Initiative (KIN), which can serve as good examples.

The Climate Impact Atlas for the Caribbean Netherlands could be combined with, or expanded to include, information on health effects.[202] Cooperation with local and regional research institutes, such as PAHO and CARPHA, is important for building and sharing knowledge. To prevent new infectious diseases, it is important to monitor vectors and pathogens that occur in the region. Sufficient implementation capacity for vector control and communication on both existing and new infection risks on the islands is also essential.

Recommendation 9

Increase people's resilience to the health risks of climate change and support people who are less self-reliant.

To this end, facilitate and encourage initiatives by local authorities and civil society organisations that help improve social structures and reach specific groups of people. This will strengthen both collective and individual resilience.

The committee recommends strengthening society's resilience to the health risks of climate change by creating a physical and social environment that makes it possible and easy for people to avoid or adapt to climate-related risks. This concerns both the resilience of society as a whole (social resilience) and the resilience of individuals (self-reliance). This requires policy that is effective for people with more limited capacity to adapt, avoid exposure or recover. They in particular benefit from a resilient society with strong social networks and support in high-risk situations.
This applies to both the European Netherlands and the Caribbean Netherlands.
It is also important to improve the self-reliance of all people in the Netherlands.

The Ministries of Infrastructure and Water Management (IenW) and Health, Welfare and Sport (VWS) are responsible for shaping climate adaptation and health policy. In doing so, they can encourage initiatives by local authorities and civil society organisations. It can also be made even easier for people to be self-reliant. (Box text Recommendation #9)

Recommendation #9

People's resilience: What this could look like

Central government can provide greater support to initiatives by local authorities and civil society organisations in the European Netherlands and the Caribbean Netherlands by providing resources, knowledge and practical skills to increase resilience to the health effects of climate change. These organisations (such as NGOs, religious institutions and community initiatives) reach different groups and can also provide support in relation to the health risks of climate change; for example, in preparing for and during a heatwave. Organisations specialising in education and public information can be involved; for example, by organising a network of climate change and health ambassadors.

A recent advisory report by the Netherlands Scientific Council for Government Policy (WRR) identifies strengthening social infrastructure as part of strengthening social networks. This includes the physical spaces and conditions that enable people to meet, such as local community meeting places.[103]

Combinations of measures, including a strong social network, a living environment with cool places and shaded areas, and financial measures – such as a free emergency kit or discounts on sun protection products – make it easier for people to avoid or adapt to periods of heat. Because awareness of the health risks of climate change is relatively low in both the European Netherlands and the Caribbean Netherlands, it is important to provide people with appropriate information about different risks, such as heat, UV radiation, flooding and infectious diseases, and about what they can do to reduce those risks. This can be done through a combination of national or local public campaigns, professional training, educational programmes for schools, or specific information about the living environment or the home.

Recommendation 10

Increase society's resilience by preparing emergency services and the healthcare sector for extreme weather events, disasters and new infectious diseases.

To this end, support emergency services and the healthcare sector in their preparedness; for example, by establishing joint standards for climate adaptation, stress testing, protocols, capacity and funding.

The committee advises central government to ensure that emergency services (ambulance service, police and fire service) and the healthcare sector (such as hospitals, GPs, municipal public health services (GGDs) and mental healthcare services (GGZ)) can prepare for weather extremes and new climate-related health risks. Risk management through adaptation measures and effective monitoring is the basis for preparedness for known and new risks. Emergency services and healthcare must also be prepared for situations such as extreme weather, outbreaks of new and existing infectious diseases, floods and wildfires, and unpredictable combinations of these. The healthcare sector is currently insufficiently prepared for this and needs government support. Knowledge of climate risks, in the form of stress tests and scenarios, is also needed, and healthcare professionals will need to be trained in this (Box text Recommendation #10).

The urgency of better equipping the healthcare sector for the adverse health effects of climate change is particularly high in the Caribbean Netherlands. Access to healthcare centres during extreme weather is essential, as are sufficient stocks of equipment and supplies at different locations. The shortage of healthcare staff remains an ongoing concern.

The government must provide emergency services and the healthcare sector with clarity on a joint standard for climate adaptation, and on responsibilities and funding for preparedness for known and new climate risks. Other parties, such as the safety regions (including GHOR, which organises and connects emergency services and healthcare during disasters) also play an important role.

Recommendation #10

Emergency services and the healthcare sector: What this could look like

From 2026, under the Critical Entities Resilience Act (Wet weerbaarheid kritieke entiteiten), healthcare providers will be responsible for preparing for risks, regardless of their cause. The government provides support in this. This support appears to remain insufficient: healthcare institutions need knowledge about climate risks, a joint standards framework setting out the rules they must comply with, and clarity on the funding of climate adaptation measures.[91] The outcomes of stress tests can be used to develop training and protocols for healthcare professionals and healthcare institutions. Stress tests are intended to identify risks from extreme rainfall, heat, drought and flooding.[208] Knowledge institutions and advisory bodies are also reporting more often using scenarios involving extreme weather, disasters or infectious disease outbreaks.[4,209,210] To prevent unsafe situations for healthcare institutions and emergency services caused by extreme rainfall, the Dutch Safety Board (OVV) recommends expanding stress tests, improving the sharing of stress test results, and conducting risk inventories for extreme rainfall through the National Network for Acute Care.[64] The Dutch Institute for Public Safety (NIPV) has produced the Guide to Safe Climate Adaptation for the safety regions.[211] Preparedness in both the European Netherlands and the Caribbean Netherlands also requires capacity and resources to scale up during peak demand, such as municipal public health service capacity for infectious disease control, training for healthcare professionals and aftercare following disasters.

The Health Council of the Netherlands has previously advised on aftercare following disasters, focusing on psychosocial support, information provision, and health research and monitoring.[61]

5.4 In conclusion

This advisory report outlines the climate adaptation measures needed to prevent a further increase in adverse health effects. Climate change will continue, even if greenhouse gas emissions remain limited in the future. However, measures to counter warming remain just as important for limiting climate change and its consequences. Several key measures to reduce greenhouse gas emissions are also directly beneficial to health. Examples include generating renewable energy instead of burning fossil fuels, eating more plant-based foods and fewer animal-based foods, and active travel, such as walking and cycling.[212] Climate change and public

health are inextricably linked. The committee advocates developing public health policy and climate policy in an integrated way.

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The Health Council of the Netherlands is an independent scientific advisory body to the government and parliament on the broad field of public health and healthcare.

For more information, see healthcouncil.nl

The Scientific Climate Council (WKR) advises the government and parliament on the development of a climate-neutral and climate-resilient society, based on broad scientific insights and with an eye to other societal challenges.

For more information, see english.wkr.nl

You can download this document, the summary and the visual summary at gezondheidsraad.nl and wkr.nl. The advice has been translated into English and Papiamentu.

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WKR.