International travel and health

Module 2: Environmental health risks

World Health Organization

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Cover photo: Credit: WHO/Petra Hongell
Boy jumping off a pontoon into the sea.

Contents

Foreword

Depending on the health profile of the traveller, the type of travel to be undertaken, and the place of transit and destination, travellers may face various health risks during travel. The *International travel and health* is an update of International travel and health (2012) and serves as an entry point for other World Health Organization (WHO) publications that provide further information. Its primary target audience is travel health practitioners and travel health professionals who provide health advice to travellers on appropriate precautions to be taken to minimize any travel-related health risks in unfamiliar environments, before, during and after travel. The guidance may also be useful to health authorities who intend to support travel health professionals in their jurisdiction or develop health advice for their population. It may also be of interest to travellers who wish to obtain such information for themselves as well as those working in the travel industry, such as agents and organizers, airlines and shipping companies.

Module 2: Travellers often experience abrupt and dramatic changes in environmental conditions, which may have detrimental effects on their health and well-being. Travel may involve major changes in altitude, temperature and humidity, and exposure to microbes, animals and insects. The negative impact of sudden changes in the environment can be minimized by taking simple precautions.

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Contributors

This module was updated by the following contributors:

WHO headquarters staff

Dr Bernadette Abela, Neglected Tropical Diseases/Public Health, Vector Control and Environment

Dr Stéphane De La Rocque, Human Animal Interface for IHR, Health Security Preparedness

Dr Pierre Formenty, Health Emergency Interventions/High Impact Epidemics

Dr Qudsia Huda, Disaster Risk Management and Resilience, Health Security Preparedness

Dr Anais Legand, Health Emergency Interventions/High Impact Epidemics

Dr David Meddings, Social Determinants of Health/Healthier Populations

Dr Kate Medlicott, Water, Sanitation, Hygiene and Health Environment, Climate Change and Health

Dr Simone Moraes Raszl, Multisectoral Action in Food Systems, Nutrition and Food Safety

Dr Peter Olumese, Diagnostics, Medicine and Resistance, Global Malaria Programme

Dr Samantha Pegoraro, Environment, Climate Change and Health

Dr Ingrid Rabe, Emerging Diseases and Zoonoses, Epidemic and Pandemic Preparedness and Prevention

Dr Ankur Rakesh, Disaster Risk Management and Resilience, Health Security and Preparedness

Dr Diana Rojas Alvarez, Emerging diseases and Zoonoses/Epidemic and Pandemic Preparedness and Prevention

Dr Raman Velayudhan, Neglected Tropical Diseases/Public Health, Vector Control and Environment

Dr Emilie Van Deventer, Environment, Climate Change and Health

Dr David Williams, Access to Medicines and Health Products, Vaccines and Immunization Devices Assessment

WHO Regional Office for Europe

Dr Pierpaolo Mudu, Environment, Climate Change and Health/Air Quality and Health/Living and Working Environments

External contributors

Contributing members of the International Travel and Health (ITH) Editorial Peer Review Group (EPRG)

Dr Bhawana Amatya
Consultant General Practitioner
Travel Medicine Specialist
Site Director, Kathmandu GeoSentinel Site
CIWEC Hospital and Travel Medicine Centre
Kathmandu
Nepal

Dr Andrea Boggild
Medical Director
Division of Infectious Diseases
Department of Medicine
Toronto General Hospital and University of Toronto
Canada

Dr Sarah Borwein
General Practitioner, Travel Medicine Practitioner
Former GeoSentinel Site Director Hong Kong
Beacon Medical Centre
China, Hong Kong SAR

Ms Lindsay Lee
Wheelchair-using frequent traveller, Data Analyst
United States of America

Dr Kokou Nouwame Alinon
Principal Technical Officer
Division of Surveillance and Disease Intelligence
Africa Centres for Disease Control and Prevention
Addis Ababa
Ethiopia

Dr Dipti Patel
Director
National Travel Health Network and Centre
United Kingdom of Great Britain and Northern Ireland

Professor Patricia Schlagenhauf
Epidemiology, Biostatistics and Prevention Institute
Department of Public and Global Health
WHO Collaborating Centre for Travellers' Health
University of Zurich
Switzerland

Declaration of interest

All external contributors of the International Travel and Health Editorial Peer Review Group (EPRG) completed a WHO declaration of interests form in accordance with WHO policy for experts. The declarations of interest and the results of a web-based search for each member were reviewed by the WHO staff. No conflict of interest was declared by any of the EPRG members.

Credit: WHO/Ala Kheir
A child washes their hands during a cholera awareness raising activity for internally displaced people (IDPs) at Barakat School in Wad Madani on 22 October 2023. The school is now a host centre for 85 internally displaced families from Khartoum.

Module 2: Environmental health risks

Travellers often experience abrupt and dramatic changes in environmental conditions, which may have detrimental effects on their health and well-being. Travel may involve major changes in altitude, temperature and humidity, and exposure to microbes, animals and insects. The negative impact of sudden changes in the environment can be minimized by taking simple precautions.

1. Heat

1.1 Overview

A heatwave is a marked unusual period of hot weather over a region persisting for at least two consecutive days during the hot period of the year based on local climatological conditions, with thermal conditions recorded above given thresholds (World Meteorological Office, 2020). As a consequence of climate change, the frequency and intensity of heatwaves is expected to continue rising in almost all regions of the world. Therefore, travellers should consider that dangerous high temperatures can be experienced in almost all regions of the world during the summer months.

The health impact of a heatwave depends on the intensity and duration of the high temperatures, the acclimatization and adaptation of the population, and their preparedness to face it. However, various measures could help people and communities to better prepare to face high-temperature events and ameliorate negative effects on health and well-being.

1.2 Health effects

1.2.1 Direct effects of heatwave exposure

Exposure to heat can cause severe symptoms, such as heat exhaustion, heat stress and heat stroke. These can present as faintness, dry and warm skin due to the inability of the body to adapt to high temperatures, swelling in the lower limbs, heat rash on the neck, cramps, headache, irritability, lethargy and weakness. In extreme cases, heat can also cause severe dehydration, acute cerebrovascular accidents and contributes to thrombogenesis (blood clots). Ultimately, extreme high temperatures can lead to death.

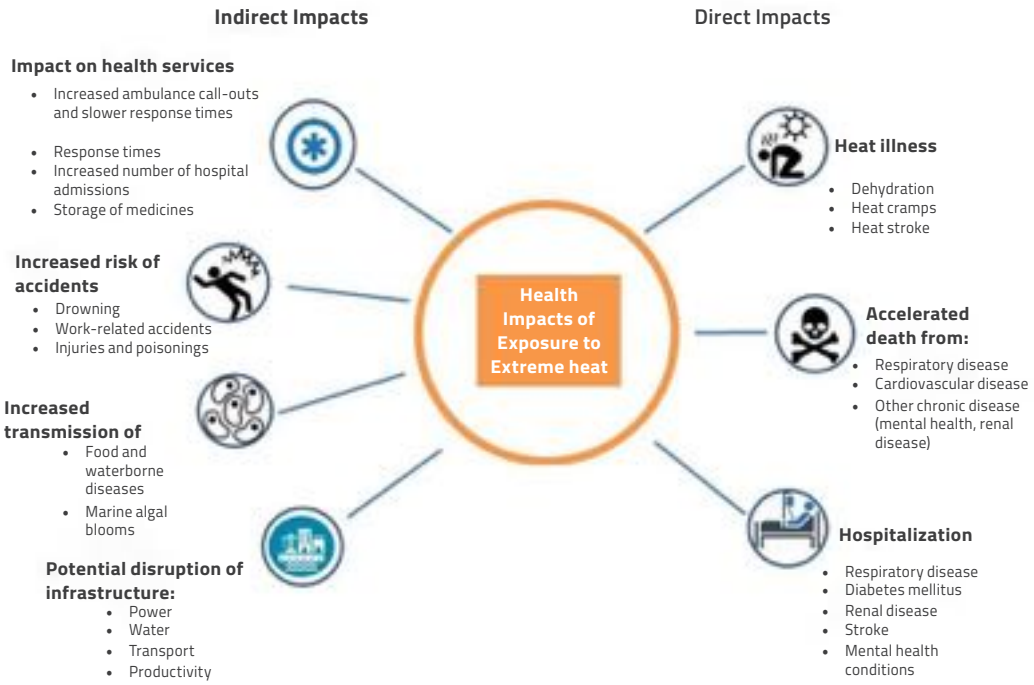
1.2.2 Exacerbation of pre-existing health conditions due to heatwaves

People with chronic conditions who take daily medications are at a greater risk of complications and death during a heatwave, especially older people and children. Prolonged exposure to periods of high temperature exacerbates other comorbidities like respiratory, cardiovascular, metabolic and renal diseases (Cheng et al, 2019; Moon, 2021; Lee et al, 2019). Furthermore, short periods of exposure to heatwaves can lead to public health emergencies and can impact on the lives, livelihoods and health of populations especially the most vulnerable (Boyle et al. 2010; Margolis , 2021).

Source: Heat and health [key facts]. Geneva: World Health Organization; 2018 (https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health).

1.2.3 Indirect effects of heatwaves

Heatwaves exacerbate and magnify the effects, intensity and severity of various other hazards such as wildfires, droughts, cyclones, urban heat islands and poor air quality. People travelling to places with a high risk of heatwaves should be aware of the related climate events that can take place during or after the high-heat days or season.



Source: Heat and health [key facts]. Geneva: World Health Organization; 2018 (https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health).

1.3 Protective measures

Reactions to heat depend on each person's ability to adapt, and serious effects can appear suddenly. Therefore, it is important to pay attention to the alerts and recommendations of local authorities. In addition, it is crucial to be aware of the local conditions through liaising with the local community and knowing about the heat-resilient infrastructure for seeking shelter.

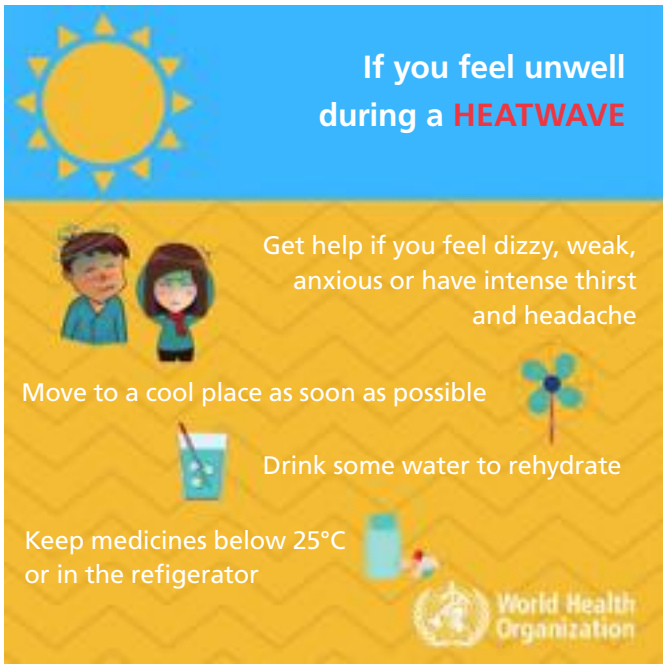
Travel health facilities should keep records of countries and regions with a high risk for seasonal heatwave events to enable them to advise travellers accordingly. Although avoiding these areas is not always possible, it is important to reduce exposure to heat at the hottest

time of the day and during the days on which extreme temperatures have been predicted. Other basic recommendations for travellers are to map out in advance possible climate shelters they can seek, to stay hydrated, to wear sunscreen with a high SPF and to wear climate-appropriate garments, including hats and sunglasses.

As mentioned above, it is also important for travel health practitioners and travellers to acknowledge the probability of related climate events, such as cyclones, droughts and wildfires and to prepare for them.

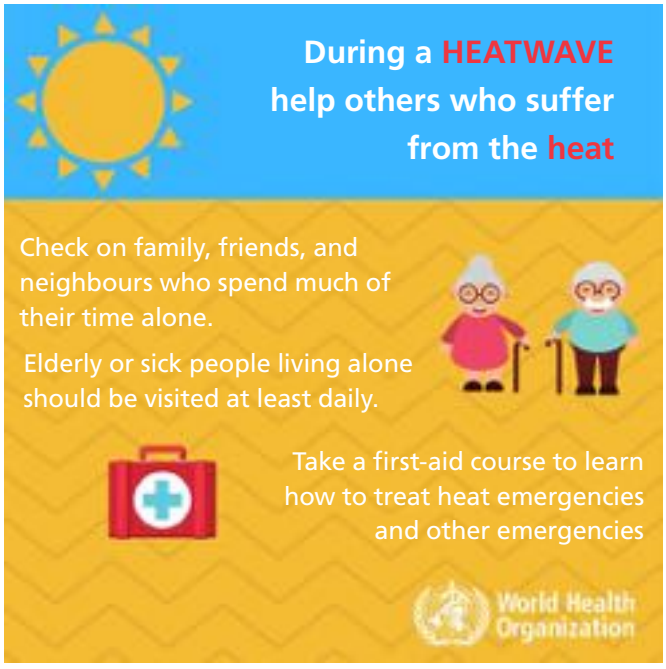
Simple actions that the public could take to minimize the adverse health impacts of heatwaves are depicted in the infographics.

Infographic: Throughout a heatwave, keep yourself cool and hydrated



Infographic: If you feel unwell during a heatwave

Infographic: Throughout a heatwave, try to keep out of heat



Infographic: During a heatwave, help others who suffer from the heat

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Credit: WHO/Adele Sarkozi
Heatwaves across Europe are affecting the health and livelihoods of millions of people. In 2022 in the WHO European Region, extreme heat claimed more than 60 000 lives, and by 2050 this could rise to 120 000 heat-related deaths every year. Climate change is increasing the risk of heatwaves, and extreme heat in the summer months is becoming the norm, not the exception.

2. Ultraviolet radiation

2.1 Overview

Ultraviolet (UV) radiation covers the wavelength range of 100–400 nm, which is a higher frequency and lower wavelength than visible light. UV radiation comes naturally from the sun, but it can also be created by artificial sources used in industry, commerce and recreation.

The UV wavelengths are divided into three bands:

- UVA (315–400 nm)
- UVB (280–315 nm)
- UVC (100–280 nm)

As sunlight passes through the atmosphere, all UVC and approximately 90% of UVB radiation is absorbed by ozone, water vapour, oxygen and carbon dioxide. UVA radiation is less affected by the atmosphere. Therefore, the UV radiation reaching the Earth's surface is largely composed of UVA with a small UVB component.

The amount of UV radiation from the sun that hits the Earth's surface depends on several factors, including:

- Sun elevation: the higher the sun is in the sky, the higher the UVR level; UVR levels vary with time of day and time of year.
- Latitude: the closer to the equator, the higher the UVR levels.
- Altitude: UVR levels increase with altitude as the air is thinner at high altitudes and less UVR is absorbed.
- Cloud cover: UVR levels are highest under cloudless skies but can be high even with cloud cover.
- Ozone: ozone absorbs part of the UVR from the sun. Less ozone means more UVR reaches the Earth's surface.
- Reflection: reflective surfaces, such as water, sand and fresh snow, increase the UVR level.
- Climate change, including through variations in ozone and cloud cover, is expected to impact UVR levels at the Earth's surface.

Reductions in the ozone layer due to human-created pollution increase the amount of UVA and UVB that reaches the Earth's surface. This can impact human health, animals, marine organisms and plant life. In humans, increased UV exposure can cause skin cancers, cataracts and immune system damage.

2.2 Health effects

Small amounts of UVR are beneficial to health and play an essential role in the production of vitamin D. However, excessive exposure to UVR is associated with negative health consequences as UVR is carcinogenic to humans.

2.2.1 Effects on the skin

Acute effects of UVR include DNA damage, sunburn, phototoxic and photoallergic reactions, and suppression of the immune system. Immunosuppression can be considered as a risk factor for cancer and can cause reactivation of viruses (e.g. cold sores on the lip).

Chronic effects on skin and lips from UVR exposure include:

- cutaneous melanoma: a life-threatening malignant skin cancer;
- squamous cell carcinoma (SCC): a malignant cancer, which generally spreads less than melanoma and is less likely to cause death;
- basal cell carcinoma (BCC): a slow-growing skin cancer appearing predominantly in older people; and
- premature skin ageing: a loss of skin elasticity at a young age with decreased wound healing.

Excessive exposure to UVR caused around 1.2 million new cases of non-melanoma skin cancers (SCC and BCC) and 325 000 melanomas of the skin, and 64 000 premature deaths from non-melanoma and 57 000 melanomas of the skin in 2020.

2.2.2 Effects on the eyes

Acute effects of UVR include photokeratitis and photoconjunctivitis (inflammation of the cornea and conjunctiva, respectively). These effects are reversible, easily prevented by protective eyewear and are not usually associated with any long-term damage but are painful and might require therapeutic intervention.

Chronic effects of UVR include:

- cataract (an eye disease where the lens becomes increasingly opaque, resulting in impaired vision and eventual blindness);
- pterygium (growth of fleshy tissue which can cover part of the cornea); and
- cancer in and around the eye (BCC, SCC and melanoma).

UV exposure may also be involved in the development of age-related macular degeneration.

Worldwide, it is estimated that 15 million people are blind due to cataracts; of these, some 10% may be due to exposure to UVR.

2.2.3 Vitamin D production

UVR in small amounts is essential to good health as it leads to the production of vitamin D in the body. Vitamin D strengthens the bone and musculoskeletal system. People who have very low sun exposure – such as those in institutional care or who are housebound, people with deeply pigmented skin living in high latitudes or those who, for religious or cultural reasons cover their entire body surface when they are outdoors – should consider oral vitamin D supplementation.

2.3 Protective measures

Skin cancer is highly preventable. WHO recommends the following measures to protect against excessive exposure to UVR.

- Limit time in the midday sun.
- Seek shade.

- Wear protective clothing.
- Wear a broad-brimmed hat to protect the eyes, face, ears and neck.
- Wear wraparound-style sunglasses that provide 99 to 100% protection against UVA and UVB.
- Use broad-spectrum sunscreen, which protects against both UVA and UVB radiation, on areas of skin that cannot be covered by clothes. Sun protection is best achieved by seeking shade and wearing clothes rather than applying sunscreens. Sunscreens should not be used as a way of extending the time spent in the sun.
- Avoid use of artificial tanning devices. Sunbed use increases the risk of developing skin cancers. Artificial tanning should never be considered as an option to achieve sufficient vitamin D status. Several countries have implemented legislation to ban or restrict the use of sunbeds.

Encouraging children to take the simple precautions above will prevent both short-term and long-term damage while still allowing them to enjoy the time they spend outdoors.

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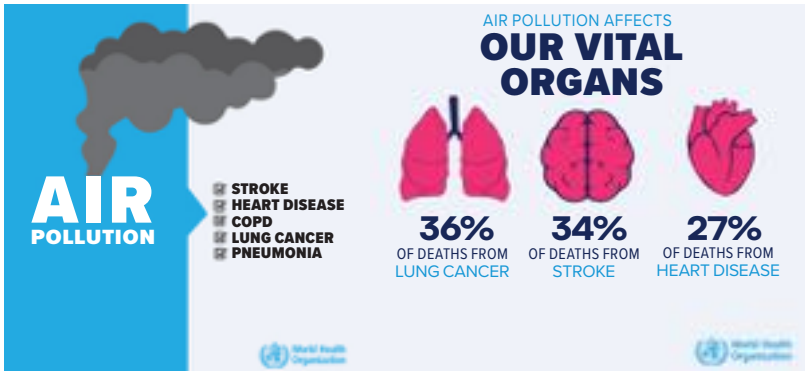
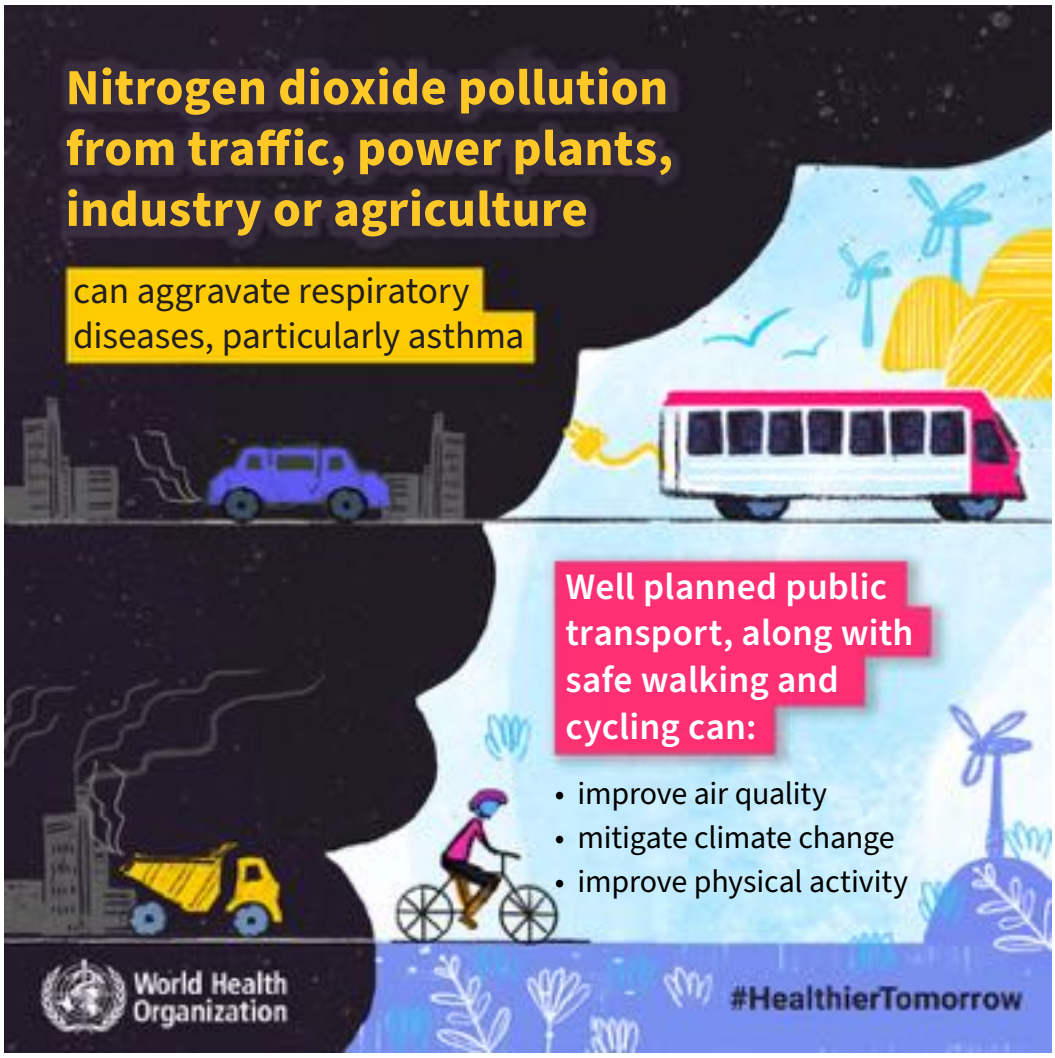
3. Air pollution

The vast majority of the population of the planet is exposed to unsafe levels of polluted air, which represents a significant global threat to human and public health. Each year, the combined effects of ambient air pollution and household air pollution are responsible for approximately 7 million premature deaths, mostly in low- and middle-income countries, where hardly any of the cities meet WHO air quality guidelines (World Health Organization, 2021).



Air pollution is associated with increased mortality and morbidity, mostly from noncommunicable diseases such as ischaemic heart disease, stroke, chronic obstructive pulmonary disease and lung cancer, but also from acute lower respiratory tract infections such as pneumonia, which mainly affects children living in disadvantaged settings. Furthermore, a growing and consistent body of evidence shows that additional effects of air pollution on health include preterm and low-birthweight, exacerbation and onset of asthma, as well as cognitive and neurological impairment. The impact of air pollution is higher on vulnerable individuals with a low socioeconomic status who are subjected to greater exposure levels and on susceptible individuals with pre-existing health conditions or in specific life stages, for example, older people, newborns, children and pregnant women. Additionally, people who are active or work outdoors or who live near busy roads or industrial areas are at risk of high levels of exposure. Poor air quality affects us all and long-term consequences are the main effects to be considered. However short-term acute effects are more evident as they are responsible for the increase in hospital emergency admissions in a short span of time (for example, during days of unbearable levels of air pollution in cities). This often represents a source of public alarm.

Air pollution is a mixture of solid and liquid substances commonly referred to as “particulate matter” (PM) as well as gas. Fine particulate matter ($PM_{2.5}$) is the most widely used indicator for estimating the health impacts of air pollution. Common sources of air pollution include anthropogenic sources such as heat and power generation, traffic, industry, agriculture, building sector, waste burning as well as non-anthropogenic sources such as desert dust. Another important source is wildfires. These different sources are associated with specific air pollutants. For example, heat and power generation relying on fossil fuels emit sulfur dioxide, nitrogen dioxides and PM. Motor vehicles and traffic-related sources release significant amounts of nitrogen oxides and carbon monoxide. Waste burning emits PM and carcinogens such as dioxins, furans and black carbon. Building sector activities can contribute to increases

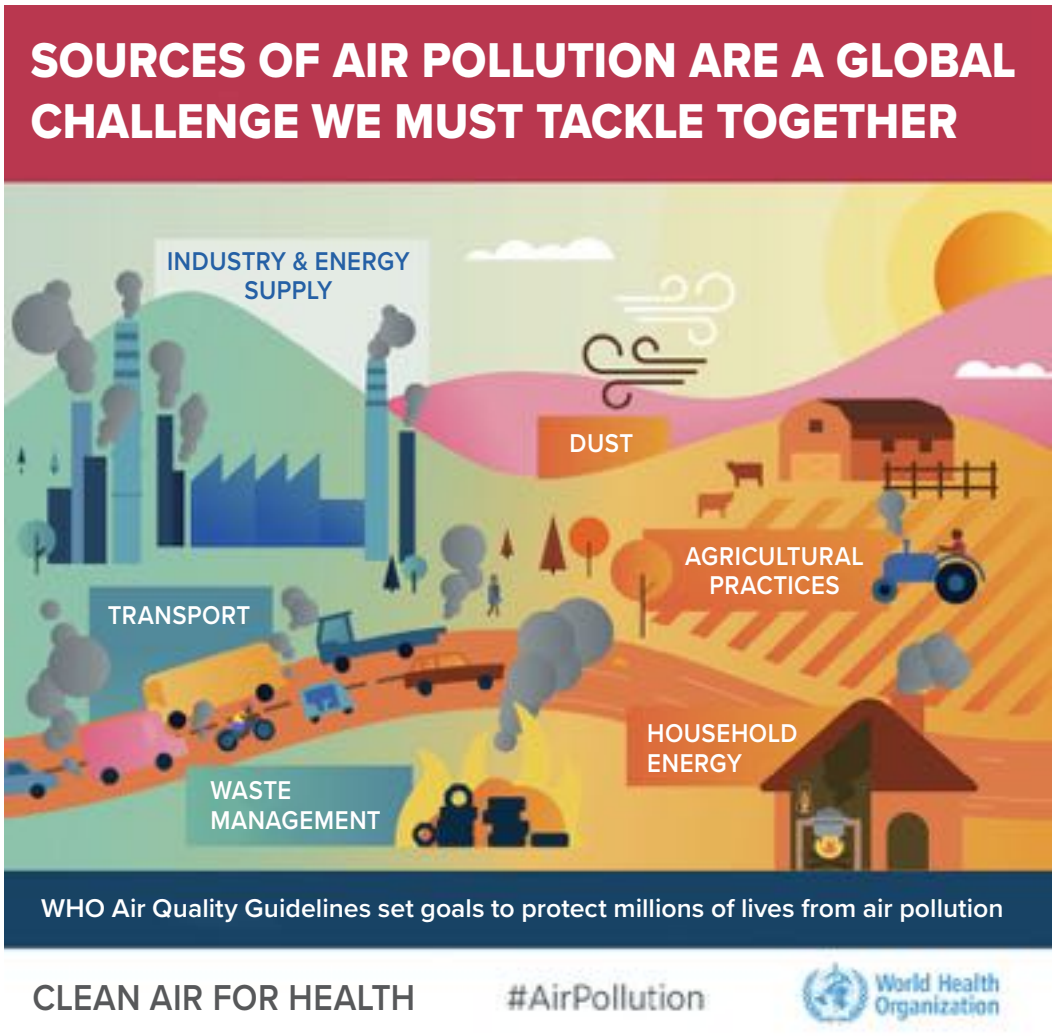


in the levels of PM. Sources emitting nitrogen dioxide are also responsible for the generation of substances that can potentiate global warming substances (for example, ozone and black carbon, which is a component of PM). The tourism industry has a significant impact on both global warming and air pollution emissions, often putting pressure on local environments and communities.

WHO recommends specific air quality levels to be respected so as to protect the health of populations. The most recent recommendations were formulated for the following pollutants: $PM_{2.5}$, PM_{10}, ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide (World Health Organization, 2021).

3.1 Exposure to high levels of air pollution

Although long-term effects of air pollution generate the bulk of the burden of disease for public health, it is important for travellers to consider exposure that may occur over a short period in places with high levels of air pollution. The scientific literature suggests that short-term daily exposure to $PM_{2.5}$, ozone, nitrogen dioxide and sulfur dioxide is associated with several adverse health outcomes and increased emergency hospital admissions due to cardiovascular and respiratory events. For example, ozone, even at low levels, causes inflammation, lung function decline and respiratory symptoms leading to increased medication use by patients with chronic illness. It also leads to hospital admissions and emergency department visits related to exacerbations of asthma and/or chronic obstructive



pulmonary disease. Beyond its acute toxicity at high concentrations, short-term exposure to carbon monoxide is associated with ischaemic heart disease and other cardiovascular events. Increased mortality from respiratory diseases and asthma attacks requiring emergency care have been related to short-term exposure to nitrogen dioxide and sulfur dioxide. It is also important to be aware that air pollution potentiates the allergenicity of pollen, potentially leading to more severe respiratory symptoms. Acute and chronic diseases exacerbated by air pollution exposure are the same as those known to be responsible for more severe cases of COVID-19.

3.2 Precautions for travellers in highly polluted areas

Travellers should acquire information on air quality to be better prepared for their destination, particularly if they have respiratory, cardiovascular or metabolic conditions, and especially when visiting cities with consistently poor air quality. In particular, data on current levels (or on annual mean concentrations, key sources and seasonal variations) of $PM_{2.5}$ and other pollutants such as nitrogen dioxide, carbon monoxide, ozone and sulfur dioxide should be consulted. Air quality indexes are produced by the governmental authorities in many countries to report daily air quality and alert the public when air pollution is high (World Health Organization, 2020; Cromar & Lazrak, 2023). Individuals with heart and lung conditions are at increased risk of becoming ill and needing treatment. However, only a minority of those who suffer from these conditions are likely to be affected and it is not possible to predict in advance who will be affected.

The health effects of air pollution on travellers is an important matter that needs to be addressed. Although a limited number of studies have been published so far, the results already give cause for concern (Vilcassim, 2019; Vilcassim, Callahan & Zierold, 2021). International travellers should be aware that air pollution affects their health, particularly the most vulnerable groups such as older people, children, pregnant women and people living with chronic conditions.

Before travelling

Travellers should gather information on the levels of air pollution in the places they plan to visit. They should also be aware that there may be seasonal variations due to human activities (for example, burning of crop residues or increased use of biomass for heating) or related to natural sources (dust storms or wildfires).

Travellers with a chronic health condition or older travellers should visit their health practitioner before starting their trip. Adults and children with asthma may notice that they need to increase their use of inhaled reliever medication on days when levels of air pollution are higher than average (Met Office). Travellers with asthma or chronic obstructive pulmonary disease should consult their doctor about travelling with an inhaler, antibiotics or oral steroids. Pregnant women and travellers with newborns or young children should avoid destinations with high levels of air pollution as far as possible (IAMAT, 2020). It is important to keep in mind that there are significant deficits in the coverage of travel health topics online, although COPD websites have the best quality (Rofaiel, Hession & Flaherty, 2021). Authorities responsible for providing travel advice should be encouraged to include information on air quality and its potential health implications as part of their guidelines for users.

At the destination

- Reduce your exposure: in all cases, common-sense precautions should be adopted for avoiding high levels of exposure to air pollution.
- Check the availability of an air quality index and related health recommendations. Be aware that some countries have early warning systems for informing the public about how they can reduce sources of outdoor and indoor air pollution.
- For some individuals, the following are important:
    - » Patients who take medication should follow their physician's recommendations.
    - » Individuals with asthma or other respiratory conditions should be advised not to undertake strenuous exercise when ambient air pollution levels are high (WHO, 2020). "The limited evidence on the impact of air pollution on the short-term beneficial effects of physical activity indicate that these effects may be diminished, although not completely eliminated, in populations with diseases such as cardiovascular and respiratory conditions and also in healthy populations. At similar levels of air pollution, people with pre-existing conditions benefit less from physical activity than healthy individuals. The evidence also suggests that, in the presence of air pollution, patients on medication benefit more from physical activity than people without medication" (WHO, 2020).
    - » Due to a lack of evidence, no definitive recommendations for children, pregnant women, people with illnesses and populations from low- and middle-income countries can be made on physical exertion in destinations where air pollution is above the levels stipulated in the WHO air quality guidelines (WHO, 2020).

    - » Evidence from healthy adult populations in high-income countries supports continued promotion of regular physical activity, even if the air quality does not reach the levels recommended by WHO, as the health benefits of physical activity are maintained.
- Although staying indoors and/or reducing physical activity are classic public health precautions for reducing exposure when air pollution is elevated, these may not be possible or even advisable, for everyone. Changing the location, timing and type of outdoor activity can, however, modify and therefore reduce exposure to pollution, as the levels of air pollutants vary both spatially and temporally. The recommendation should include consideration of ozone levels and temperature, especially in warmer climates.
- In countries exposed to sand and desert dust storms, which produce high levels of PM, it is important to check short-term air pollution action plans alerting the population to stay indoors and heed advice on taking personal measures to minimize exposure and prevent subsequent short-term health effects.
- Wearing a face mask is advisable during acute episodes of air pollution such as during a wildfire, but masks do not fully filter out all pollutants, and in most cases can only reduce exposure to large pollution particles. Face masks need to be worn correctly if they are to reduce exposure. Most face masks do not fit children's faces.
- Behavioural changes made to avoid exposure to air pollution should be properly thought through as they might have unintended consequences such as reducing the benefits of outdoor physical activity and social interaction.
- Travellers should be aware of the need reduce their impact on local air pollution, reduce their environmental footprint and support local and sustainable practices (United Nations World Tourism Organization (UNWTO), 2022).

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Credit: WHO/Kiana Hayeri
On 25 November 2022, a boy plays with a kite on a hillside in Kabul. Air pollution in the city below is clearly visible.

4. Safe food, safe water and diarrhoeal diseases

4.1 Water and health

Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, salmonellosis and other diseases that cause diarrhoea and dysentery, hepatitis A, typhoid and polio. Absent, inadequate or inappropriately managed water and sanitation services expose individuals to preventable health risks (WHO, 2023).

4.2 Foodborne illness

Unsafe food containing harmful bacteria, viruses, parasites or chemical substances causes more than 200 diseases, with consequences ranging from diarrhoea to cancers. It also creates a vicious cycle of disease and malnutrition, particularly affecting infants, young children, older people and the sick.

Foodborne diseases are usually infectious or toxic in nature and caused by bacteria, viruses, parasites or chemical substances entering the body through contaminated food.

Some examples of the organisms and the affected foods are listed below.

Bacteria:

- *Salmonella*, eggs, poultry and other products of animal origin
- *Campylobacter*: raw milk, raw or undercooked poultry and drinking-water
- Enterohaemorrhagic *Escherichia coli*: unpasteurized milk, undercooked meat and contaminated fresh fruits and vegetables
- *Listeria*: unpasteurized dairy products and various ready-to-eat foods – can grow at refrigeration temperatures
- *Vibrio cholerae*: raw vegetables, and raw or undercooked seafood.

Viruses:

- *Hepatitis A:* raw or undercooked seafood or contaminated raw produce.

4.3 Diarrhoeal diseases

Diarrhoea is defined as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual). Frequent passing of formed stools is not diarrhoea, nor is the passing of loose, “pasty” stools by breastfed babies. When diarrhoea contains blood or mucus, it is called dysentery.

Diarrhoea or dysentery are usually a symptom of an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms. Infection is spread through contaminated food or drinking-water, or from person to person as a result of poor hygiene.

Key measures to prevent diarrhoea and dysentery include:

- access to safe drinking-water;
- use of improved sanitation;
- hand washing with soap;
- exclusive breastfeeding for the first six months of life;
- good personal and food hygiene during food-handling and preparation;
- health education about how infections spread; and
- being up to date with necessary vaccinations.

A WHO guide on safe food for travellers

What to do if you get diarrhoea?

Most diarrhoeal attacks are self-limited and clear up in a few days. Diarrhoea may be accompanied by nausea, vomiting and/or fever. **The important thing is to avoid becoming dehydrated. Ensure that you always drink sufficient amounts of fluids,** particularly when travelling in a hot climate. This is extremely important for children. If the child is restless or irritable, or shows signs of strong thirst, or has sunken eyes, or dry skin with reduced elasticity, dehydration is already progressing and immediate medical attention should be sought.

Should bowel movements be very frequent, very watery or contain blood, or last beyond 3 days you should seek medical help. Where there is no medical help available a complete 3-day course of ciprofloxacin* (500 mg twice a day for adults, 15mg/kg twice a day for children) can be taken.

As soon as diarrhoea starts, drink more fluids, such as oral rehydration formula, boiled, treated or bottled water, weak tea, soups or other safe fluids. **Avoid any drinks that tend to remove more water from the body, including coffee, overly sweetened drinks, some medicinal teas and alcohol.**

Age group	Amount of fluids or ORS** to drink
Children less than 2 years	Up to ½ cup after each loose stool
Children 2-10 years	Up to 1 cup after each loose stool
Older children and adults	Unlimited amount

Contrary to common belief, **medicines which reduce bowel movements are not recommended.** In children, these preparations should never be used as they may cause intestinal obstruction.

** generic name - can be sold under other names*

***** If ORS are not available, mix 6 teaspoons of sugar plus one level teaspoon of salt in one litre of safe water ("taste of tears") and drink as indicated in the table.***

Each day millions of people become ill and thousands die from a preventable foodborne disease

The advice given in this leaflet is important for every traveller, and of particular importance for high-risk groups i.e. infants and young children, pregnant women, elderly and immunocompromised individuals, including those with HIV/AIDS; persons in these groups are particularly susceptible to foodborne diseases.

Remember: Prevention is better than cure

The WHO Five Keys to Safer Food global message is adapted in this guide to specifically address the health concerns associated with travel.

The Five Keys to Safer Food global message is available at: www.who.int/foodsafety/consumer/5keys/en

World Health Organization

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A GUIDE ON
SAFE FOOD
FOR TRAVELLERS

How to avoid illnesses caused by unsafe food and drink and what to do if you get diarrhoea

World Health Organization

Five keys to safer food

This poster has been translated into nearly 90 languages and copies are available at: https://www.who.int/teams/nutrition-and-food-safety/multisectoral-actions-in-food-systems/five-keys-to-safer-food-poster

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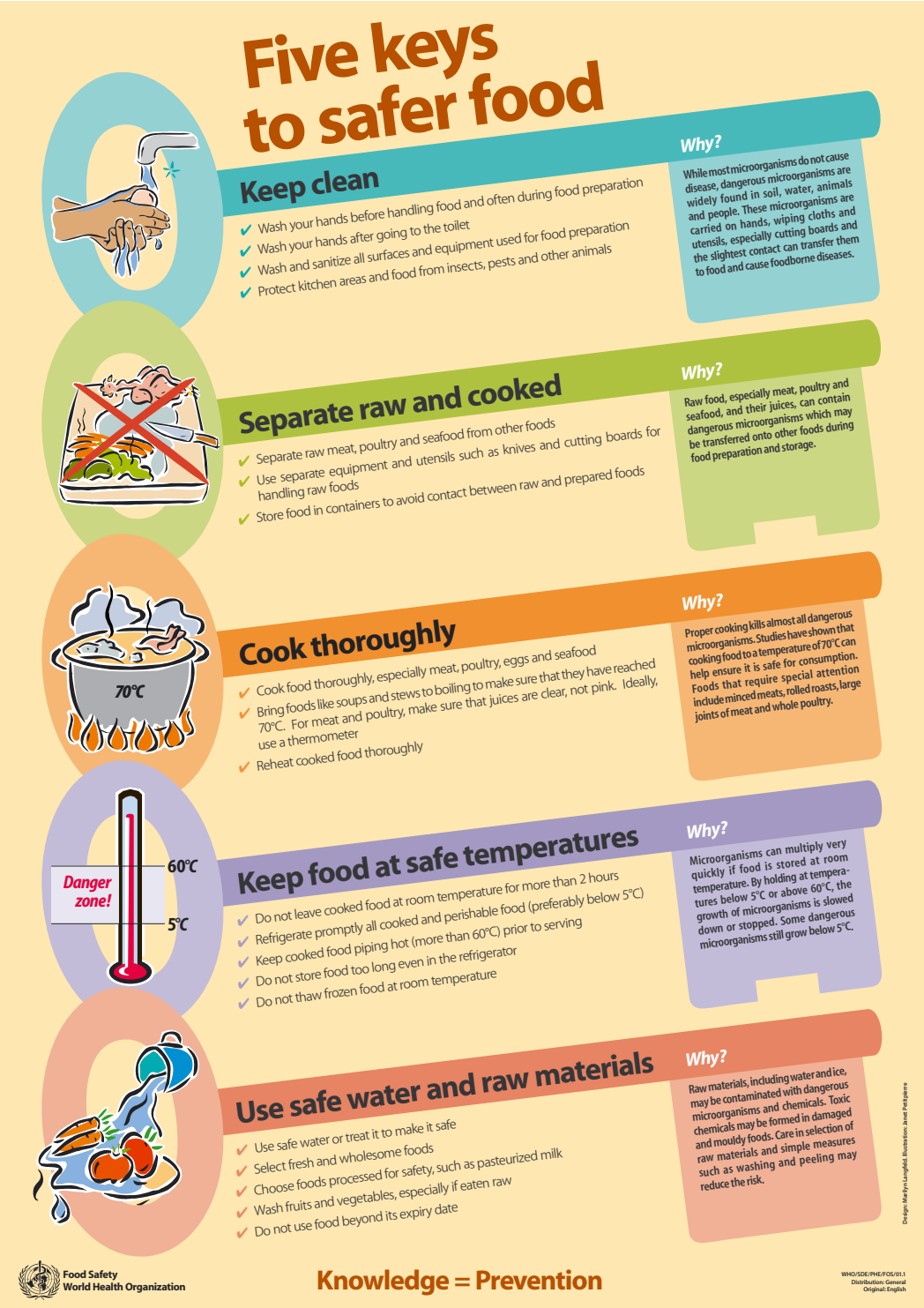

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Credit: WHO/Sue Price
Curry cooking at Ga Me Ga Hotel in Phuentsholing, Bhutan, on 13 August 2023.

5. Recreational waters

Use of coastal, estuarine and freshwater recreational environments has significant benefits for health and well-being, including rest, relaxation, exercise, cultural and religious practices and aesthetic pleasure, while also providing substantial local, regional and national economic benefits. Yet, human activity and climate change are impacting the quality and safety of our waters. Popular swimming locations may become contaminated by overflows of untreated sewage, runoff of animal excreta from nearby farms, or algal blooms triggered by high nutrient loads. Stagnant waters can be contaminated by bacteria such as Leptospira, by viruses (for example, hepatitis A and E) or by parasites such as schistosomes, which are the agent of schistosomiasis (bilharzia). Travellers become infected by ingesting water or when larvae penetrate the skin. Some sites may also be affected by chemical pollution from industrial activities or become polluted by beach users themselves through poor sanitation and littering. This contamination erodes the benefits to well-being and the economic potential of the site, as well as potentially causing illness for water users (WHO, 2021 Volume 1).

Other potential health risks include drowning, in addition to exposure to sun, heat and cold. Risk factors that are associated with an increased risk of drowning include alcohol use, unfamiliarity with local water risks and features, and leaving infants unsupervised or alone with another child around water (WHO fact sheet: Drowning).

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Credit: WHO / Sören Talu
Outdoor activities in beautiful Estonia.

6. Zoonoses

Zoonoses are diseases that are naturally transmitted from vertebrate animals to humans and vice versa. Zoonotic pathogens may be bacteria, viruses, parasites, fungi or even unconventional agents such as prions, and can be transmitted from animals to humans through direct contact, vectors, food, water or the environment. They represent a major public health problem around the world due to our close relationship with livestock, companion animals and wildlife. Zoonoses can also cause disruptions in the production and trade of animal products for food and other uses.

More than six out of every 10 known infectious diseases in people can be spread from animals, and three out of every four new or emerging infectious diseases in people come from animals. Recent examples include severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), coronavirus disease (COVID-19), avian flu, Ebola virus diseases, monkeypox (Mpox), Crimean-Congo haemorrhagic fever and salmonellosis, to name but a few. Endemic zoonoses such as rabies, taeniasis and echinococcosis are also threats to travellers in many parts of the world.

6.1 Prevention

To prevent infection with zoonoses travellers should ensure that they know about:

- access to safe food (such as meat, eggs, dairy products and even some vegetables);
- access to safe drinking-water;
- access to safe waste removal;
- protections relating to surface water in the natural environment;
- hand washing after contact with animals, and other behavioural adjustments;
- the need to be careful in markets selling the meat or by-products of wild animals, which are particularly high risk due to the large number of new or undocumented pathogens known to exist in some wild animal populations; and
- being up to date with necessary vaccinations.

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Credit: WHO/Quinn Mattingly
Vegetables are washed and prepared lunch at a rural home in northern Viet Nam.

7. Vector-borne diseases

7.1 Vectors

Vectors are living organisms that can transmit infectious pathogens between humans, or from animals to humans. Many of these vectors are bloodsucking arthropods (insects and ticks), which ingest disease-producing microorganisms during a blood meal from an infected host (human or animal) and later transmit it to a new host, after the pathogen has replicated. Often, once a vector becomes infectious, it is able to transmit the pathogen for the rest of its life during each subsequent bite/blood meal.

7.2 Vector-borne diseases

Vector-borne diseases are human illnesses caused by parasites, viruses and bacteria that are transmitted by vectors. Every year there are more than 700 000 deaths from diseases such as malaria, dengue, schistosomiasis, human African trypanosomiasis, leishmaniasis, Chagas disease, yellow fever, Japanese encephalitis and onchocerciasis.

The burden of these diseases is highest in tropical and subtropical areas, and they disproportionately affect the poorest populations. Major outbreaks of dengue, malaria, chikungunya, yellow fever and Zika have afflicted populations, claimed lives and overwhelmed health systems in many countries. Diseases such as chikungunya, leishmaniasis and lymphatic filariasis cause chronic suffering, lifelong morbidity, disability and occasional stigmatization.

Distribution of vector-borne diseases is determined by a complex set of demographic, environmental and social factors. Global travel and trade, unplanned urbanization and climate change have introduced vector-borne diseases to new countries.

7.3 Vector-borne diseases, according to their vector

The table contains a non-exhaustive list of vector-borne diseases, ordered according to the vector by which they are transmitted. The list also includes the type of pathogen that causes the disease in humans.

Water plays a key role in the lifecycle of most vectors. Thus, the transmission of many vector-borne diseases is seasonal as there is a relationship between rainfall and the existence of breeding sites. Temperature and relative humidity are also critical factors, limiting the distribution of vectors by altitude and latitude.

Travellers are at lower risk of exposure to some vector-borne diseases in urban centres, especially if they sleep in air-conditioned rooms. They may, however, be exposed to the *Aedes* mosquito vectors of dengue, chikungunya, and Zika viruses which are frequent in urban centres in tropical countries and which bite mostly during the day. Travellers to rural areas

or to areas with poor hygiene and sanitation are usually at higher risk of exposure to disease vectors, and personal protection is therefore essential. Evening and night-time activities outdoors may increase exposure to malaria vectors.

Vector		Disease caused	Type of pathogen
Mosquito	*Aedes*	Chikungunya	Virus
		Dengue	Virus
		Lymphatic filariasis	Parasite
		Rift Valley fever	Virus
		Yellow fever	Virus
		Zika	Virus
	Anopheles	Lymphatic filariasis	Parasite
		Malaria	Parasite
	Culex	Japanese encephalitis	Virus
		Lymphatic filariasis	Parasite
		West Nile fever	Virus
Aquatic snails		Schistosomiasis (bilharziasis)	Parasite
Blackflies		Onchocerciasis (river blindness)	Parasite
Fleas		Plague (transmitted from rats to humans)	Bacteria
		Tungiasis	Ectoparasite
Lice		Typhus	Bacteria
		Louse-borne relapsing fever	Bacteria
Sandflies		Leishmaniasis	Parasite
		Sandfly fever (phlebotomus fever)	Virus
Ticks		Crimean-Congo haemorrhagic fever	Virus
		Lyme disease	Bacteria
		Relapsing fever (borreliosis)	Bacteria
		Rickettsial diseases (eg: spotted fever and Q fever)	Bacteria
		Tick-borne encephalitis	Virus
		Tularaemia	Bacteria
Triatome bugs		Chagas disease (American trypanosomiasis)	Parasite
Tsetse flies		Sleeping sickness (African trypanosomiasis)	Parasite

7.4 Protection against vectors

Travellers may protect themselves from mosquitoes and other vectors by the means outlined below.

Insect repellents are substances applied to exposed skin or to clothing to prevent human/vector contact. Repellents should be used in strict accordance with the manufacturers' instructions and the dosage must not be exceeded, especially for young children and pregnant women. The active ingredient in a repellent repels insects but does not kill them. Travellers should choose a repellent containing DEET (N,N-diethyl-3-methylbenzamide), IR3535 (3-[N-acetyl-N-butyl]-aminopropionic acid ethyl ester) or icaridin (1-piperidinecarboxylic acid, 2-(2-hydroxyethyl)-1-methylpropylester). Insect repellents should be applied to provide protection at times when insects are biting. Care must be taken to avoid the repellent coming into contact with mucous membranes; insect repellents should not be sprayed on the face, applied to the eyelids or lips, or applied to sensitive, sunburned or damaged skin or deep skin folds. Always wash the hands after applying the repellent. Repeated applications may be required every 3–4 hours, especially in hot and humid climates when sweating may be profuse.

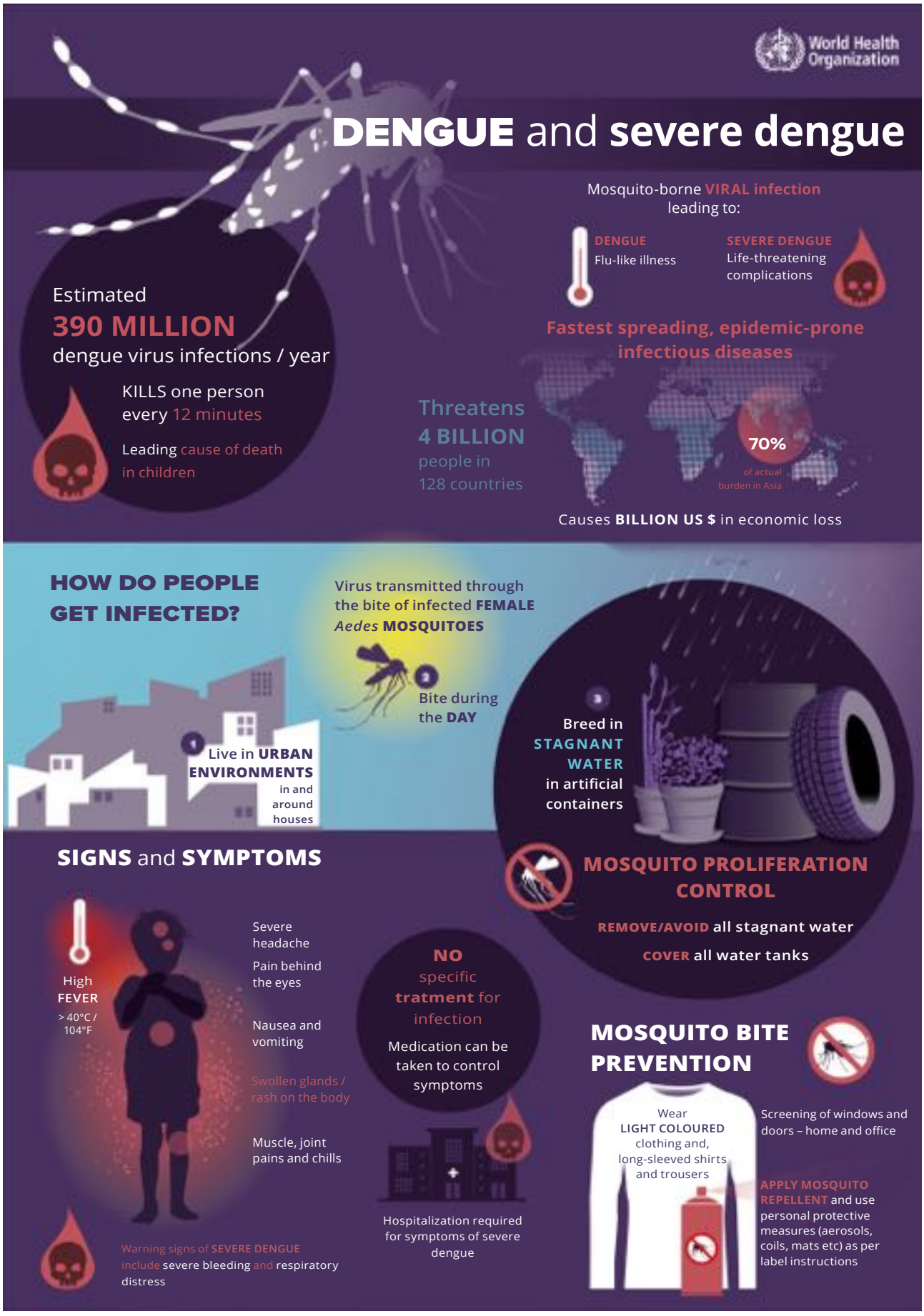
Mosquito nets are excellent means of personal protection while sleeping. Nets can be used either with or without insecticide treatment. However, treated nets are much more effective. Pretreated nets may be commercially available. Nets should be strong and have a mesh size no larger than 1.5 mm. The net should be tucked in under the mattress, after ensuring that it is not torn and that there are no mosquitoes inside. Nets for hammocks are available, as are nets for cots and small beds.

Mosquito coils are the best-known example of insecticide vaporizer, usually with a synthetic pyrethroid as the active ingredient. A more sophisticated product, which requires electricity, is an insecticide mat that is placed on an electrically heated grid, causing the insecticide to vaporize. Battery-operated vaporizers are also available. Such devices can also be used during the daytime if necessary.

Aerosol sprays intended to kill flying insects are effective for quick knockdown and killing. Indoor sleeping areas should be sprayed before bedtime. Treating a room with an insecticide spray will help to free it from insects, but the effect may be short-lived. Spraying before bedtime, combined with the use of a vaporizer or a mosquito net is recommended. Aerosol sprays intended for crawling insects (e.g. cockroaches and ants) should be sprayed on surfaces where these insects walk.

Protective clothing can help at times of the day when vectors are active. The thickness of the material is critical. Insect repellent applied to clothing is effective for longer than it may be on the skin. Extra protection is provided by treating clothing with permethrin or etofenprox to prevent mosquitoes from biting through clothing. In tick- and flea-infested areas, the feet should be protected by appropriate footwear and by tucking long trousers into the socks. Such measures are further enhanced by application of repellents to the clothing.

- Travellers camping in tents should use a combination of mosquito repellents and screens. The mesh size of tent screens often exceeds 1.5 mm, meaning that special mosquito screens are necessary.
- Screening of windows, doors and eaves reduces exposure to flying insects. Accommodation with these features should be sought where available.
- Air-conditioning is a highly effective means of keeping mosquitoes and other insects out of a room as long as the room has no gaps around windows or doors. In air-conditioned hotels, other precautions are not necessary indoors.


World Health Organization
DENGUE and severe dengue
Mosquito-borne VIRAL infection leading to:
DENGUE
Flu-like illness
SEVERE DENGUE
Life-threatening complications
Estimated
390 MILLION
dengue virus infections / year
KILLS one person every 12 minutes
Leading cause of death in children
Threatens
4 BILLION
people in
128 countries
Fastest spreading, epidemic-prone infectious diseases
70%
of actual burden in Asia
Causes BILLION US $ in economic loss
HOW DO PEOPLE GET INFECTED?
Virus transmitted through the bite of infected FEMALE Aedes MOSQUITOES
Bite during the DAY
Live in URBAN ENVIRONMENTS in and around houses
Breed in STAGNANT WATER in artificial containers
MOSQUITO PROLIFERATION CONTROL
REMOVE/AVOID all stagnant water
COVER all water tanks
SIGNS and SYMPTOMS
High FEVER
> 40°C / 104°F
Severe headache
Pain behind the eyes
Nausea and vomiting
Swollen glands / rash on the body
Muscle, joint pains and chills
Warning signs of SEVERE DENGUE include severe bleeding and respiratory distress
NO specific tratment for infection
Medication can be taken to control symptoms
Hospitalization required for symptoms of severe dengue
MOSQUITO BITE PREVENTION
Wear LIGHT COLOURED clothing and, long-sleeved shirts and trousers
Screening of windows and doors – home and office
APPLY MOSQUITO REPELLENT and use personal protective measures (aerosols, coils, mats etc) as per label instructions

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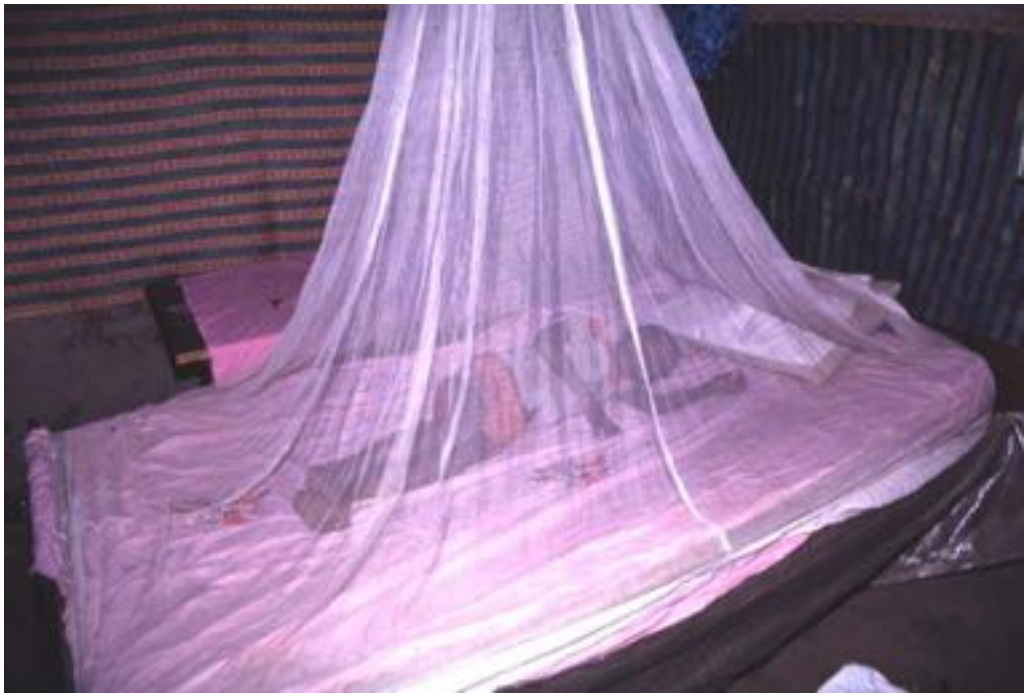

Malaria in United Republic of Tanzania – 1993
A young boy lies under a mosquito net in Namwa Wala village. Bednets impregnated with insecticide have been shown to reduce malaria deaths. Villagers here also impregnate reed mats and hang them on the walls to help kill mosquitos.
Country: United Republic of Tanzania
Date created: 1993
Credit: WHO / TDR / Andy Crump
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Reference: HQ78349


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