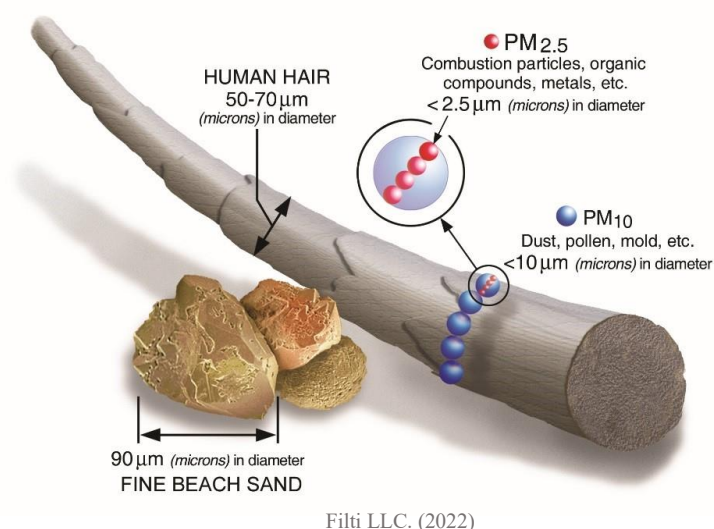


Human Health & Air Quality

Air Pollution & Particulate Matter

Particle pollution (particulate matter (PM) or particles) is a general term for a mixture of solid and liquid droplets suspended in the air. Air pollution is not just one substance, but a combination of substances depending on the location and the season. It is because of the variety that particles can also vary in their size. Some particles are so small they require an electron microscope. It is because of their small size that particulate matter can penetrate indoor spaces. Therefore, the air we breathe, both indoors and outdoors always contains particulate matter (2022).

Outdoor air pollution can vary greatly from exhaust from cars, trucks and vehicle traffic to factories and coal-fired electrical generation. In more rural areas dust blown up from farms can be a major source. Combustion-related events such as wildfires, heavily add to pollution level, even far away from the fires themselves. Wildfires release large quantities of carbon dioxide, carbon monoxide, and fine particulate matter into the atmosphere. It is the gases and particulate matter that contribute to poor air quality. According to the World Health Organization (2023), wildfires also release a significant amount of mercury into the air, which can lead to impairment of vision, speech, hearing, motor control and walking. These combustion-events can substantially increase the particulate matter concentration in the air, to the point that the particulate matter is visible to the naked eye.



Individuals at a greater risk of health effects from wildfire smoke include those with cardiovascular disease, respiratory diseases & illnesses, children under 18 years of age, older adults (>65 years), pregnant women, outdoor workers or those who are frequently exposed to poor air quality, and those of lower socioeconomic status (2022). At risk populations should be concerned with particles that are < 10 μm in diameter because these are the particles that generally pass through the nose and throat passageways to enter the lungs (2022). Particles < 2.5 μm are even able to be absorbed into the circulation from the lungs (2022). Particles that are > 10 μm typically are not able to pass into the lungs, but they can still irritate the eyes, ears, nasal sinuses, and throat.

The Air Quality Health Index (AQHI)

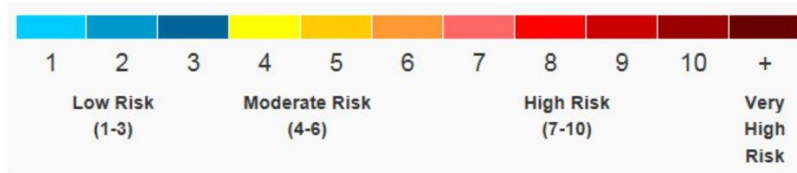
AQHI is calculated based on the relative risks of a combination of common air pollutants known to be harmful to health. These pollutants are: 1) Ozone (O₃) at ground level, 2) Particulate Matter (PM_{2.5}/PM₁₀) and 3) Nitrogen Dioxide (NO₂).

Canada uses an AQHI to establish air quality and risk to health and makes recommendations based on what they find. Exercise should be avoided or limited both outdoors and even indoors on days with high-risk air quality.

AQHI is measured on a scale ranging from 1-10+. The AQHI values are grouped into health risk categories, that allow individuals to identify their level of risk easily and quickly.

To find out your risk, please visit the following link:

<https://www.canada.ca/en/environment-climate-change/services/air-quality-health-index/about.html>



- 1-3 Low health risk
- 4-6 Moderate health risk
- 7-10 High health risk
- 10 + Very high health risk

Due to climate change and the resulting increased frequency of poor air quality, companies have developed applications, such as the IQAir AirVisual App, that you can access on your cellular devices. The IQAir AirVisual App can help you determine the air quality in your region. Think of these applications as a weather forecast, but for air quality!



IQAir AirVisual | Air Quality (4+)

Global air pollution AQI PM2.5

[IQAir AG](#)

#2 in Weather

★★★★★ 4.8 • 33.3K Ratings

Free

HEPA Filters

What is a HEPA filter?

High Efficiency Particulate Air (HEPA) Filters are air purifiers that removes particulates from the air. More specifically, these particulates can include atmospheric and household dust, coal dust, insecticide dust, mites, pollen, mold spores, fungi, bacteria, viruses, pet dander, cooking smoke and grease, tobacco smoke and odours. (2020).

What are the benefits?

This can provide relief from allergies, asthma, and other respiratory illnesses by providing a healthier and more comfortable air quality environment, year-round.

How do HEPA Filters work?

Millions of airborne pollutants are carried to the Air Cleaner by a motor, where the particles then pass through the 3-stage air filtration system. The first filter is an Activated Carbon Pre-Filter, which removes lint and odors before they enter the HEPA system. The second step in the filtration system involves a long-life True HEPA Filter. This filter is 99.97% effective at removing particles that are 0.3microns (μm) in size. Lastly, a Carbon VOC After Filter further removes odours, (2020).

How often should I change the HEPA Filters?

The Activated Carbon Pre-Filter should be replaced every 3-6months. The True HEPA Filter should be replaced every 2-4 years. The Carbon VOC After Filter should be replaced every 6-12 months. (2020).

Exercising in the Heat & Air Quality

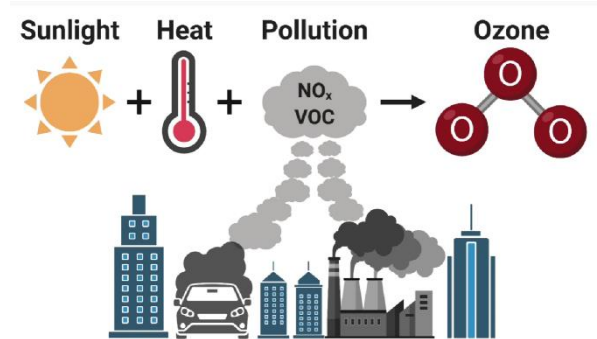
During exercise we breathe more deeply, exposing us to a greater amount of overall pollution than a non-exercising individual because deep breathing causes the pollutants to travel deeper down into the airways.

This high pollutant load can cause short-term irritation of the airways, such as coughing and making it difficult to breathe, which can be even more detrimental to those who have health conditions such as emphysema, COPD, and cardiovascular disease.

One pollutant that is directly related to summer weather is **Ozone**, which is a molecule of three oxygen atoms rather than the normal two Oxygen atoms which are found up high in the atmosphere. Ozone is important in protecting us from the sun's radiation. However, at ground level, ozone is a respiratory irritant causing chest tightness and difficulty breathing.

How does hot weather affect the Ozone?

Ground level Ozone is created when pollutants from burning fossil fuels, such as Nitrogen Oxides and volatile organic compounds chemically interact with heat and sunlight. The warmer and sunnier days of summer is a perfect condition to create more ground Ozone, even more than during sunny days in winter.



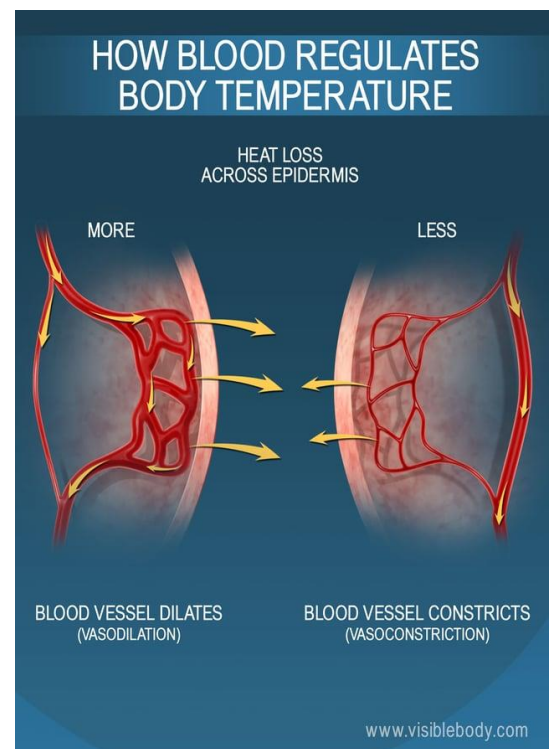
Cheung, S. (2021) Environmental Ergonomics Lab, Brock University.

Hot & Humid Weather

When the weather is hot and humid, the body attempts to regulate its internal temperature. It vasodilates blood vessels (increases the diameter of the blood vessels) to redirect blood to the skin to assist with dissipating heat. However, this systemic vasodilation can impact blood pressure. In order to maintain blood pressure during large-scale vasodilation, the body must \uparrow cardiac output, \uparrow HR & \uparrow contractility.

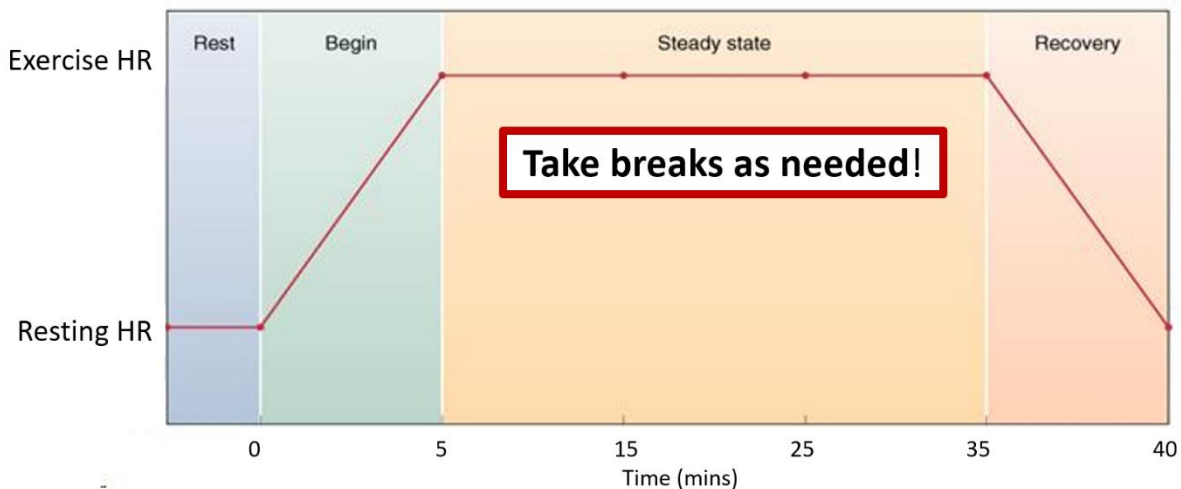
However, in the elderly & those with **pre-existing cardiovascular conditions**, the heart is less able to meet these \uparrow demands (\uparrow cardiac output, \uparrow HR & \uparrow contractility). This causes a mis-match of supply (increased vasodilation for regulating temperature) & demand (ability of the heart to accommodate and regulate blood pressure).

Hot and humid weather places stress on the heart. During the summer months, there are \uparrow admissions to the emergency room for heart-related problems, an \uparrow risk of a cardiac event, an \uparrow in angina symptoms, and a \downarrow in exercise tolerance.



Safe Exercise Recommendations for Hot Weather & Poor Air Quality

1. Avoid exercising in “peak” hours (mid-day sun)
 - If you need to, exercise inside with air conditioning or a well-ventilated area
 - Use indoor electric fans to help keep you cool
 - Stay hydrated throughout the day
2. Staying hydrated during exercise
 - Moderate temperatures: ~6oz of water for every 10mins of exercise
 - Hot temperatures: ~10oz for every 6mins of exercise
3. Continue to take your medications, & continue to take them at the prescribed intervals
4. Recommendations for exercise timing
 - Wait 30 minutes after waking up before exercising
 - Wait 30 minutes after eating a heavy meal before exercising
 - Wait ~60mins after drinking coffee, alcohol or smoking before exercising
5. Dress for the weather
 - Wear lightweight, light-colored clothing in breathable fabrics (ex. cotton) or a technical fabric that wicks away moisture
 - Proper footwear (well-ventilated)
 - Sun protection (SPF, hat, sunglasses, etc.)
6. Recommendations during exercise:
 - Warm up first for ~3-5mins
 - Adjust your efforts accordingly so that you stay within your prescribed HR range **or** within an RPE of 11-14 (conversation pace)
 - Cool down for 3-5 minutes afterward exercise



Borg's Rating of Perceived Exertion (RPE) Scale	
Perceived Exertion Rating	Description of Exertion
6	No exertion; sitting and resting
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

7. Strategies to limit exposure to poor air quality

- Exercising indoors where there is a quality air filtration system (Ex. HEPA Filter)
- Exercise early in the morning
- Avoid major roadways and high traffic areas
- Wear a mask
 - Masks can reduce inhalation of particulate matter
 - It is important to read the label/packaging for the mask to know what diameter of particulate matter it can filter
 - N-95 masks are 95% efficient at filtering out particle sizes that are $>0.3\mu\text{m}$
 - Most surgical masks are only able to achieve a rating of PM2.5 (filters particle sizes that are $>2.5\mu\text{m}$)

Reminders: Signs & Symptoms of Medical Emergencies

1. Warning Signs of Heat Exhaustion

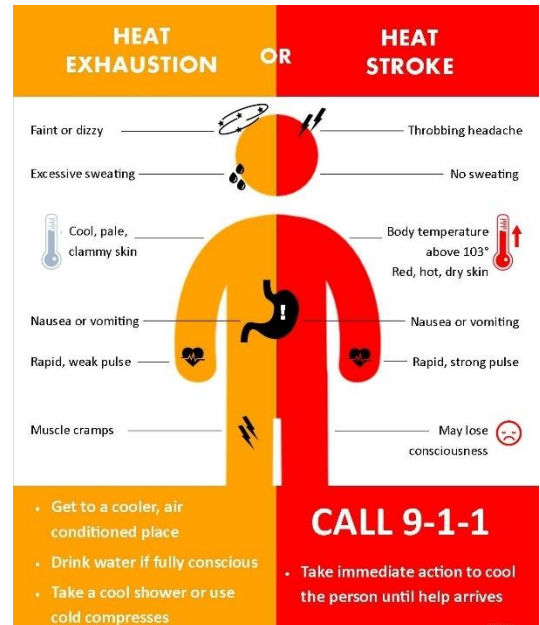
If you experience any of the following symptoms, move to a cooler place, stop exercising and cool down immediately by using cool wet cloths, compresses, and fanning. You may need to seek medical attention.

1. Headaches
2. Cool, moist skin
3. Dizziness and light-headedness
4. Weakness
5. Nausea and vomiting
6. Dark urine

2. Warning Signs of Heat Stroke

If you or someone you know is showing the following signs or symptoms, seek medical attention right away (call 9-1-1)

1. Fever
2. Irrational behavior
3. Extreme confusion
4. Dry skin (person has stopped sweating)
5. Flushed and warm skin
6. Rapid, shallow breathing
7. Rapid, weak pulse
8. Seizures
9. Unconsciousness



3. Warning Signs of a Heart Attack

If you or someone you know is showing the following signs or symptoms, seek medical attention right away (call 9-1-1).

1. Pain or discomfort in the chest
2. Lightheadedness/nausea/vomiting
3. Pain in the jaw, neck, back
4. Pain in the shoulder or arm
5. Shortness of breath



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