



Personal-level actions to reduce air pollution exposure

Practical advice



**World Health
Organization**

European Region

Background

Air pollution remains the largest environmental health risk in the WHO European Region, and contributes to numerous adverse health outcomes, including cardiovascular and respiratory diseases.

While the main focus to reduce air pollution exposure should be on reducing emissions at public policy level, in the recent report, *Personal-level actions to reduce air pollution exposure in the WHO European Region*,¹ the WHO Regional Office for Europe provides a detailed examination of various strategies to minimize personal exposure to air pollution, supported by a literature review and expert consultation.

Practical, actionable advice

Based on the full report, this collection of briefs distils complex considerations into practical, actionable advice on:

- reducing time spent in air-polluted outdoor environments
- physical activity and air pollution
- portable air cleaners and air pollution
- central air cleaners and air pollution
- respirators and air pollution
- face masks and air pollution
- active transportation, routes and air pollution
- driving styles, vehicle settings and air pollution.



The main aims are to empower individuals to make informed decisions to protect their health and provide a foundation for understanding the suggested actions. National public health authorities or specialists can also use the briefs as the basis for locally relevant communication materials.

¹ Personal-level actions to reduce air pollution exposure in the WHO European Region. Copenhagen: WHO Regional Office for Europe; 2024 (<https://iris.who.int/handle/10665/375889>, accessed 7 June 2024).

Brief on reducing time spent in air-polluted outdoor environments

At a glance

Avoiding outdoor environments is an appropriate response to public health advice on staying indoors during episodes of high air pollution. The impact of this action depends on the amount of time spent indoors, outdoor air pollution levels, the amount of air pollution infiltrating the building and indoor pollution sources. High air pollution episodes are defined based on local or national air quality standards and policies.

This brief offers practical advice for both members of the public and public health practitioners on minimizing time spent in polluted outdoor environments.

Practical advice



- **Limit outdoor activities:** reduce time spent outdoors, particularly when air pollution levels are high.
- **Enhance indoor air quality:**
 - close windows to limit the entry of outdoor air pollutants;
 - use air ventilation systems with high-efficiency particulate air filters;
 - reduce indoor emission-generating activities; and
 - ensure buildings minimize air penetration and leakage.
- **Stay informed:** check local air quality information to guide decisions on outdoor activities.

This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. staying indoors when outdoor air pollution levels are high);
- risks to health and environment (e.g. increased energy consumption or activities that inadvertently raise indoor air pollutant levels); and
- additional considerations (e.g. accessibility and equity).

Reduced exposure and associated health benefits

Avoiding high outdoor pollution by staying indoors, combined with efforts to reduce outdoor-indoor air penetration, can reduce exposure to air pollutants (e.g. particulate matter and ozone). Such actions have the potential to avert acute health issues affecting the cardiovascular or respiratory system.

Risks to health and environment

Indoor air quality can be compromised by indoor emission sources such as cooking, heating and tobacco smoking, requiring careful ventilation and air pollution management.

While staying indoors, increased use of household appliances and of heating and ventilation systems can have a negative impact on the environment, especially if they are powered by fossil fuels.

Additional considerations

- **Air pollution variability:** air pollution exposure and indoor air quality vary depending on the location, climate and individual circumstances.
- **Accessibility and equity:** not everyone has access to quality indoor spaces, the autonomy to decide when to stay indoors or adequate literacy to understand advice.
- **Personal costs:** ensuring a clean indoor environment may require expenditure on proper ventilation and air cleaning systems, building maintenance and/or clean fuels.



Brief on physical activity and air pollution

At a glance

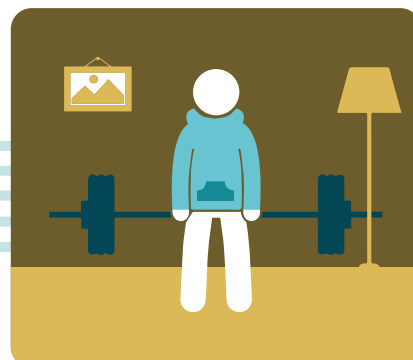
Physical activity includes all forms of bodily movement, including for exercise (e.g. running), leisure (e.g. swimming) and everyday activities (e.g. walking to work or activity as part of work). Choosing to undertake physical activity in cleaner environments and at times of day when air pollution is lower can reduce the inhalation of harmful air pollutants. However, the impact of avoiding outdoor air pollutants must be weighed against the benefits of regular physical activity.

This brief offers practical advice for both members of the public and public health practitioners on avoiding polluted environments while undertaking physical activity.

Practical advice



- **Stay active:** regular physical activity is generally beneficial, except when air pollution is extreme or for individuals with underlying conditions that increase the risks of air pollution exposure.
- **Choose cleaner spaces:** if possible, perform physical activity in green spaces away from motorized traffic or in indoor environments with air filtration systems.
- **Find the optimal timing:** check local air quality information to avoid outdoor physical activity when pollution levels are high.
- **Take care:** reduce the intensity or stop exercising if you experience symptoms such as coughing, a tight chest or wheezing. If needed, consult your health-care provider.



This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. exercising in quality indoor or green spaces or when outdoor air pollution is lower);
- risks to health and environment (e.g. weighing up the benefits of physical activity against the risks of outdoor air pollutants); and
- additional considerations (e.g. having the flexibility to choose the time and place for exercising).

Reduced exposure and associated health benefits

Physical activity increases the breathing rate and the inhalation of harmful air pollutants, so choosing a cleaner environment and times when air pollution is lower for physical activity can significantly reduce exposure. Vigorous exercise can temporarily impair the body's natural defences against air pollutants. However, the health benefits of regular exercise provide a counterbalance to the adverse health effects of air pollution.

Risks to health and environment

Although care should be taken to choose cleaner environments and times of low pollution for physical activity, it is also important not to avoid physical activity altogether because of air pollution concerns and not to contribute to pollution while exercising. Reduced physical activity may be detrimental to overall health.

Additional considerations

- **Individual variability:** personal circumstances, underlying health conditions and other factors all impact the risks and benefits of outdoor physical activity.
- **Flexibility:** some people have less flexibility to choose the time and place for physical activity (e.g. their work may involve outdoor physical activity, or the demands of work and personal life may limit the ability to choose when and where to exercise).
- **Accessibility:** not everyone has access to clean indoor spaces or green space for physical activity, depending on where they live and work and their personal circumstances. The personal costs of accessing some spaces may be a barrier.



Brief on portable air cleaners and air pollution

At a glance

Portable air cleaners are small electric cleaning units used in living spaces to reduce indoor air pollution levels resulting from actions such as cooking, cigarette smoking and cleaning. Their effectiveness depends on the type of filtration used, regular maintenance and where they are positioned, among other factors. When combined with other actions, the use of portable air cleaners can be an effective part of a holistic strategy to reduce air pollution exposure.

This brief offers practical advice for both members of the public and public health practitioners on reducing air pollution exposure through the use of portable air cleaners.

Practical advice

- **Pollution levels:** consider using indoor PACs in heavily polluted areas, especially for people with underlying health conditions.
- **Filtration:** choose PACs equipped with a HEPA filter and replace filters regularly.
- **Room size:** make sure PACs deliver the correct amount of clean air for the room size. Prioritize the bedroom and living room.
- **Placement:** place the PAC as close to the room's occupants as possible, at the highest operating speed. Make sure there are no objects blocking airflow.
- **Ozone levels:** avoid electrostatic and ionizing air cleaners, which can produce ozone.



- **Other actions:** combine PACs with closing windows, reducing indoor emissions, and maintaining building structures.

This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. potential cardiorespiratory health improvements);
- risks to health and environment (e.g. raised ozone levels, increased energy consumption); and
- additional considerations (e.g. personal costs, operating noise).

Reduced exposure and associated health benefits

Using PACs can lower air pollution (particles and, in some cases, gases) from indoor sources, outdoor air pollutants leaking into buildings, household chemicals, and pollen. PACs with HEPA filters are most effective, as long as the filters are replaced at least every 6 months. Consistent and correct use of PACs may improve respiratory and cardiovascular health outcomes, especially when used alongside other efforts to reduce air pollution exposure.

Risks to health and environment

PACs that work through ionization of particles can generate ozone, which can be dangerous to health. Some PACs generate noise, which can have an adverse effect on health and may discourage use. However, this should be weighed against the health benefits of cleaner indoor air.

PACs have some negative environmental impacts like electricity consumption and waste generation.

Additional considerations

- **Cost and equity:** PACs can be expensive. The costs of initial purchase, filter replacements, and electricity to run them may be prohibitive.
- **Correct use:** the effectiveness of PACs can be lowered if they are too small for the space, if they are placed incorrectly, and if filters are not regularly changed.
- **Acceptability:** PACs need to be used continuously and at their highest settings for full benefit, but this can generate noise which may discourage use especially in bedrooms.

Brief on central air cleaners and air pollution

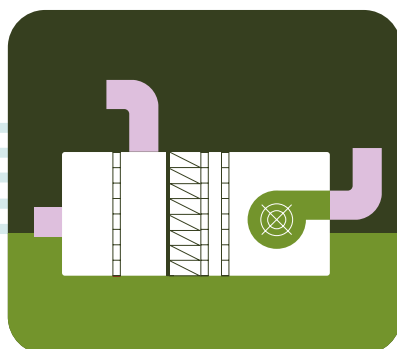
At a glance

Central air cleaners are duct-mounted air cleaners installed in a home or building, including filters installed in heating, ventilation and air-conditioning systems. High-efficiency central air filters can substantially reduce indoor pollution from actions such as cooking, cigarette smoking and cleaning. The effectiveness of air cleaners depends on the rating of the filters used and on proper maintenance. They can be effective as part of a holistic strategy to reduce air pollution exposure

This brief offers practical advice for both members of the public and public health practitioners on reducing indoor air pollution through air cleaners, in particular heating, ventilation and air-conditioning systems.

Practical advice

- **Pollution levels:** consider using an indoor heating, ventilation and air-conditioning system in heavily polluted areas, especially for people with underlying conditions.
- **Filtration:** choose a system with filters rated M6 or higher. Replace filters and maintain the system regularly.
- **Other actions:** combine using a heating, ventilation and air-conditioning system with other actions, e.g. closing windows, reducing indoor emissions and maintaining building structures.
- **Effectiveness:** heating, ventilation and air-conditioning systems may be less effective for reducing indoor air pollution than other options such as portable air cleaners.



This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. but the health benefits may be lower than those linked to portable air cleaner use);
- risks to health and environment (e.g. noise exposure, increased energy consumption); and
- additional considerations (e.g. installation and maintenance costs).

Reduced exposure and associated health benefits

Heating, ventilation and air-conditioning systems equipped with high-efficiency filters rated M6 or higher can substantially reduce the levels of indoor air pollutants, including particles and, in some cases, gases. This has the potential to reduce personal exposure to air pollutants, especially when combined with other actions. However, there is some evidence that heating, ventilation and air-conditioning air cleaning systems are less effective than alternatives such as portable air cleaners.

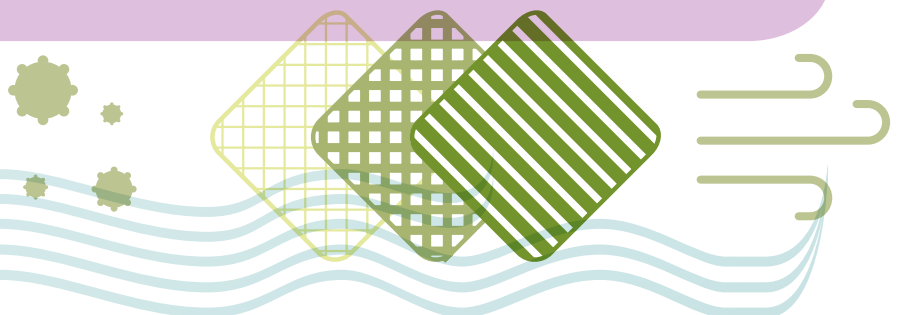
Risks to health and environment

Some central air cleaners can produce high noise levels, which can have health impacts on some people. These risks need to be weighed against the benefits of cleaner indoor air.

Heating, ventilation and air-conditioning systems also have high levels of energy consumption, which is an environmental concern. Their production and maintenance also create waste.

Additional considerations

- **Personal costs and equity:** purchasing, professional installation and maintenance of an heating, ventilation and air-conditioning system can be expensive. The more effective the central air cleaner is, the more expensive it is likely to be. The high cost can make them inaccessible to many people.
- **Ease of use:** once installed, heating, ventilation and air-conditioning systems are easy to use and more likely to be in regular use than, for example, portable air cleaners. However, they may not be a feasible option for people who do not already have them installed in their home or workplace.



Brief on respirators and air pollution

At a glance

Respirators are personal protective devices that cover the nose and mouth. The difference from face masks is that a respirator creates a facial seal, meaning that they filter air both entering and exiting the lungs. When worn correctly, respirators can reduce exposure to air pollution. Their effectiveness depends on the rating and how well they fit the face.

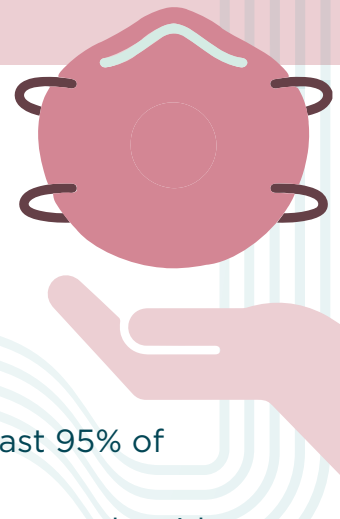
This brief offers practical advice on respirator use for both members of the public and public health practitioners.

Practical advice

- **Unavoidable exposure:** use a respirator only if air pollution exposure cannot be avoided (e.g. from wildfires or disaster clean-ups).
- **When choosing a respirator:**
 - choose respirators over face masks; and
 - choose close-fitting respirators approved to remove at least 95% of particles (e.g. FFP2, N95, KN95).
- **Individual variation:** respirators are less effective for children, people with facial hair, and people whose face shape or size prevents a tight facial seal.
- **Safety:** never use respirators on babies or toddlers.
- **Health concerns:** check with your health-care provider before using a respirator if you have health conditions that make breathing difficult.
- **Follow instructions:** use and change the respirator according to manufacturer's recommendations.

This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. improvements in some cardiorespiratory health outcomes);
- risks to health and environment (e.g. rashes or overheating); and
- additional considerations (e.g. ease of access and use).



Reduced exposure and associated health benefits

Respirators can reduce exposure to air pollution, particularly airborne particles. Some designs include adsorbent material that may offer some protection from gaseous air pollutants. Limited evidence suggests that respirators may improve some cardiorespiratory health outcomes in air-polluted environments. They are generally more effective than face masks.

Risks to health and environment

Prolonged respirator use can cause rashes, overheating and skin inflammation. They can increase resistance to breathing, which could have adverse health outcomes in people with respiratory and cardiovascular diseases. Poorly fitting respirators can create a false sense of security, which can lead the wearer to unknowingly placing themselves at risk. They have the potential to cause choking and suffocation in babies and toddlers.

Single-use respirators can cause high levels of waste and litter, with negative environmental impacts. Their production also causes carbon emissions.

Additional considerations

- **Personal costs:** individual respirators are relatively affordable but as most are disposable (single use), regular use can increase costs.
- **Acceptability:** respirator use has become more widely accepted worldwide, but wearers may still face stigma and discrimination in some contexts.
- **Correct use:** the effectiveness of respirator use depends on the following six factors:
 - wearing it correctly;
 - ensuring a correct fit;
 - using continuously during exposure;
 - replacing the respirator or filter when saturated;
 - choosing a respirator that is correctly rated to remove over 95% of particles; and
 - choosing a respirator that is certified by a relevant national or international agency.



Brief on face masks and air pollution

At a glance

Face masks are cloth or synthetic face coverings. They do not protect the wearer from inhaling air pollutants or other substances, but instead reduce the amount of exhaled droplets or pathogens entering the environment. Thus, face masks are not considered personal protective equipment and are not a recommended method to reduce air pollution exposure.

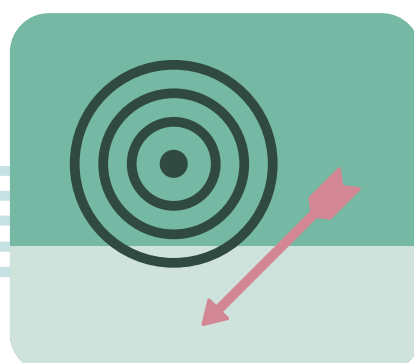
This brief offers practical advice for both members of the public and public health practitioners on using face masks.

Practical advice

- **Evidence:** there is insufficient evidence that face masks significantly reduce air pollution exposure.
- **Alternatives:** instead of face masks, consider using a respirator (for certain situations) or other method to reduce air pollution exposure.

This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. very limited effectiveness);
- risks to health and environment (e.g. skin irritation); and
- additional considerations (e.g. knowledge about face mask effectiveness).



Reduced exposure and associated health benefits

The effectiveness of face masks for reducing air pollution exposure and improving health outcomes is very limited and depends on several factors, including the material and fit. Synthetic and surgical masks are slightly more effective than cloth masks. However, even the best face masks only filter a small percentage of airborne particles. They are much less effective for reducing air pollution exposure than, for example, respirators.

Risks to health and environment

Face masks can cause skin irritation and rashes if worn for long periods. They can also create a false sense of security, leading to higher air pollution exposure.

Mask production creates carbon emissions that can harm the environment. They are single-use items that create waste and litter if not disposed of properly.

Additional considerations

- **Personal costs:** individual face masks are relatively affordable, but because they are single-use items maintaining protection over time can be costly.
- **Acceptability:** face mask use has become more widely accepted worldwide, but wearers may still face stigma and discrimination in some contexts.
- **False sense of security:** lack of knowledge about face mask types and their effectiveness and use can create a false sense of safety. This can lead to higher air pollution exposure for wearers.



Brief on active transportation, routes and air pollution

At a glance

Active transportation is transport powered by human energy, such as walking and cycling. Transport routes are the paths that people or vehicles follow to their destinations. Decisions about active transportation and route choice can impact the level of personal exposure to air pollution, especially during high air pollution episodes. High air pollution episodes are defined based on local or national air quality standards and policies.

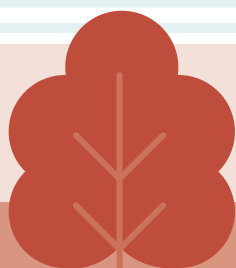
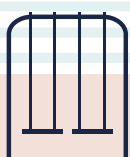
This brief offers practical advice for both members of the public and public health practitioners on making decisions about active transportation and routes.

Practical advice

- **Get moving:** choose active transportation such as walking or cycling whenever possible.
- **Avoid traffic:** avoid areas with heavy traffic as far as possible.
- **Green routes:** choose routes with green space and off-road options.
- **Stay informed:** check local air quality information to guide decisions on the route and timing of active transportation, and consult your health-care provider if you have a pre-existing health condition.

This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. distance from traffic)
- risks to health and environment (e.g. pre-existing health conditions)
- additional considerations (e.g. availability of suitable, safe routes).



Reduced exposure and associated health benefits

Active transportation can expose individuals to traffic-related air pollution. Exposure levels are lower if the chosen walking or cycling routes are further from traffic. This can be achieved by simple acts such as crossing to the less-busy side of a road or choosing an off-road cycle path.

However, for most people the health benefits of physical activity usually outweigh the risks of air pollution exposure even when pollution levels are high.

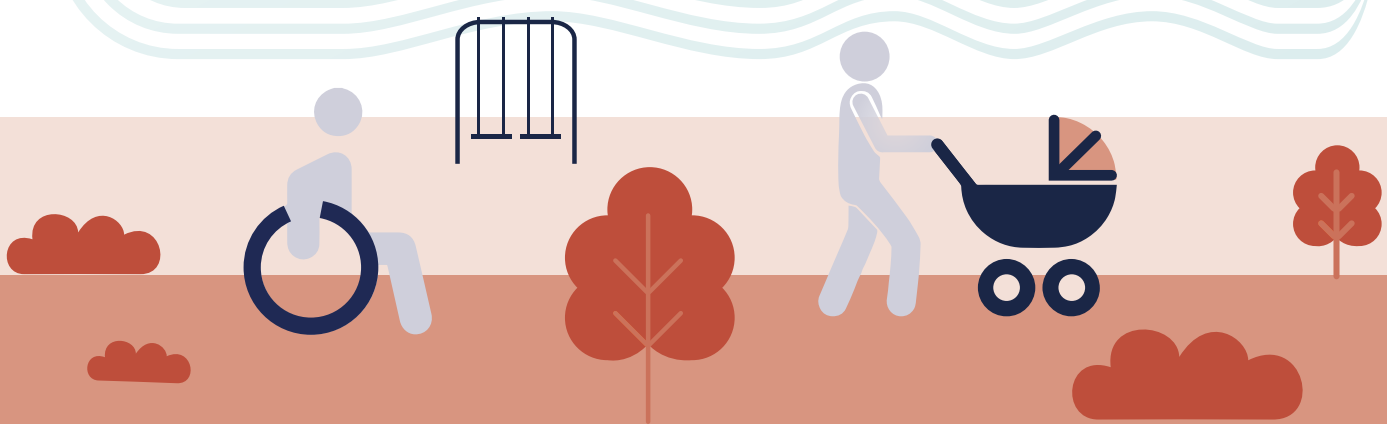
Risks to health and environment

Children, older people and those with pre-existing health conditions may be at greater risk from air pollution exposure from active transportation. Routes in heavily trafficked areas also carry the risk of traffic-related accidents.

Active transportation also reduces the overall levels of emissions compared with, for example, motorized transport.

Additional considerations

- **Suitable routes:** people are more likely to choose active transportation if safe, pleasant, and low-traffic routes and infrastructure are available for walking or cycling.
- **Accessibility:** active transportation may not be accessible to people with disabilities or to those living in areas lacking the relevant infrastructure such as pavements or bicycle lanes.
- **Climate and environment:** climate, weather conditions and the terrain can impact people's choices about active transportation.
- **Safety:** safety fears, both personal and related to motorized traffic, may prevent people from choosing active transportation.



Brief on driving styles, vehicle settings and air pollution

At a glance

Driving styles relate to driving patterns, including the frequency of acceleration or engine idling. Vehicles settings that are relevant to air pollutant exposure include those controlling air filtration and ventilation. Choices about driving styles and vehicle settings can impact the level of air pollution exposure inside a vehicle.

This brief offers practical advice for both members of the public and public health practitioners on reducing air pollution exposure linked to driving styles and vehicle settings.



Practical advice

- **Cabin isolation:** when the external air pollution is high, drive with the windows closed and recirculate air through the air-conditioning system. Optimize and maintain vehicle filtration/ventilation systems.
- **Lower emissions:** avoid fast acceleration and deceleration, minimize engine idling and maintain the vehicle correctly.
- **Active mobility:** whenever possible, choose active transportation such as walking or cycling over motorized transport.

This advice takes the following considerations into account, among others:

- reduced exposure and associated health benefits (e.g. benefits of closing windows and using air-conditioning);
- risks to health and environment (e.g. of generating more pollution); and
- additional considerations (e.g. personal costs and accessibility).

Reduced exposure and associated health benefits

When travelling in a motorized vehicle, closing the windows and using air-conditioning can reduce air pollution exposure and may improve some health outcomes. Setting the air-conditioning to recirculate air significantly lowers in-vehicle air pollutant levels compared with driving with windows open.

Driving styles that include frequent acceleration and engine idling increase air pollutant emissions and exposure inside the vehicle, especially on busy routes, as well as creating external emissions. In general, older vehicles produce more emissions than newer vehicles. Adjusting the driving style can lower pollutant exposure for vehicle occupants.

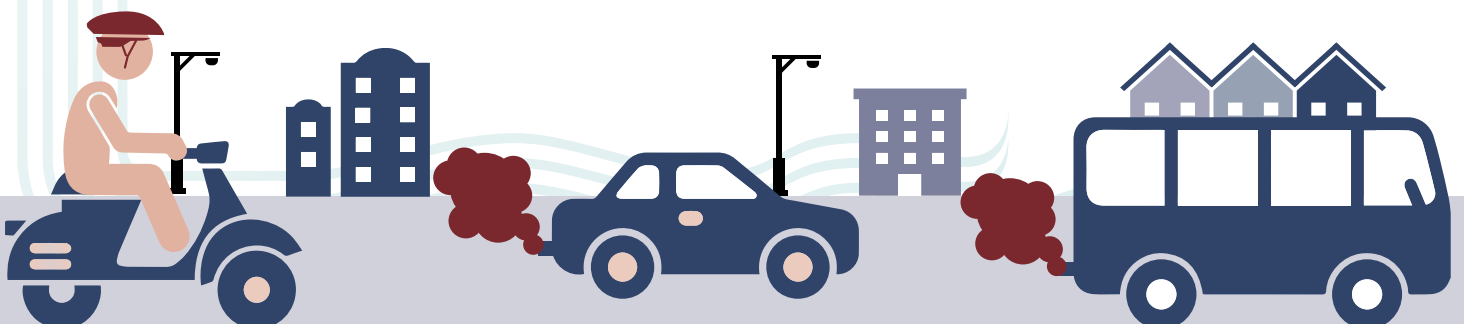
Risks to health and environment

Closing windows and recirculating air can increase carbon dioxide levels inside the vehicle, which can cause drowsiness and reduce cognitive function.

Motorized vehicles generally have direct negative impacts on the environment by producing air and noise pollution. They also require infrastructure that impacts biodiversity, soil and water quality. Most vehicles run on fossil fuels and electric vehicles create other kinds of emission. Use of the vehicle's air-conditioning system can increase fuel consumption.

Additional considerations

- **Personal costs and equity:** people with a lower income may not have access to motorized vehicles with features that reduce air pollution exposure or be able to afford regular maintenance. In general, the purchase and maintenance of motorized vehicles are expensive, especially for lower-emission electric vehicles.
- **Feasibility:** some vehicles have poor cabin isolation, which can lead to the penetration of outdoor air pollution even when windows are closed.



Acknowledgements

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The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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