

Air Pollution

Traveler Summary

Key Points

- Air pollution (both indoor and outdoor) has immediate and long-term effects on health.
- Cities in Asia are the most polluted, but health effects can occur almost anywhere.
- Risk is highest for travelers with underlying respiratory or cardiac disease, for children, and for older adults; however, in the most polluted areas, all travelers are likely to experience health effects.
- Health effects include increased respiratory symptoms, aggravated asthma, risk of lung or heart disease, and cancer.
- Prevention includes monitoring air quality using publicly and privately available resources, limiting outdoor exposure, limiting activities, and wearing a face mask during peak periods of low air quality.

Introduction

Air pollution (both indoor and outdoor) is an often neglected health concern for travelers and expatriates. Risk is highest for travelers with underlying respiratory or cardiac disease, for children, and for older adults; however, in the most polluted areas, all travelers are likely to experience health effects.

Seven million premature deaths (or 1 of 8 deaths worldwide) are attributed to heart disease, stroke, respiratory disease, and cancer, all due to air pollution. Levels of air pollution have been increasing significantly in low- and middle-income countries.

Causes of Air Pollution

Outdoor air pollution in urban areas is caused mainly by motor vehicle emissions (carbon monoxide, carbon dioxide, nitric acid, benzene, and particulate matter) and power and heat generation (soot/particulate matter and sulfur dioxide from soft coal combustion and industrial power generation). In some areas, wind-blown dust also contributes to pollution.

Indoor air pollution is caused by cooking and heating with biomass (organic) fuel or coal (which produces indoor smoke) and indoor cooking or heating with gas (which produces nitrogen dioxide).

Health Effects of Air Pollution

Air pollution (both indoor and outdoor) is a particular health concern for travelers and expatriates, especially those with underlying diseases (asthma, chronic obstructive pulmonary disease, or heart disease), for children, and for older adults. The US Environmental Protection Agency Air Quality Index (AQI), which many countries use to quantify risk, describes health effects at different air quality levels.

Table: Air Quality Index (AQI) Guidelines	
Guideline Values	Health Effects
0-50 (Good)	Air quality is considered satisfactory, and air pollution poses little or no risk.
51-100 (Moderate)	Air quality is acceptable; however, for some pollutants, a moderate health concern may exist for a very small number of people who are unusually sensitive to air pollution.
101-150 (Unhealthy for sensitive groups)	Air quality is frequently unhealthy for members of sensitive groups (people with lung or heart disease, adults aged 70 years and older, teenagers, or children). Members of sensitive groups may experience health effects. The general public is not likely to be affected. Members of sensitive groups should reduce prolonged or heavy outdoor exertion.
151-200 (Unhealthy)	Air quality is frequently unhealthy. All travelers may begin to experience health effects. Members of sensitive groups (people with lung or heart disease, adults aged 70 years and older, teenagers, or children) may be more seriously affected. Members of sensitive groups should avoid prolonged or heavy outdoor exertion. Others should reduce prolonged or heavy outdoor exertion.

Guideline Values	Health Effects
201-300 (Very unhealthy)	Air quality is frequently very unhealthy. All travelers are likely to experience health effects. Members of sensitive groups (people with lung or heart disease, adults aged 70 years and older, teenagers, or children) should avoid all outdoor physical activity except at times when air quality is better. Others should avoid prolonged or heavy outdoor exertion and consider postponing such activities until air quality is better.
301-500 (Hazardous)	Air quality is frequently hazardous. All travelers are likely to experience serious health effects. Members of sensitive groups (people with lung or heart disease, adults aged 70 years and older, teenagers, or children) should remain indoors and keep activity levels low. Others should avoid all outdoor physical activity and postpone such activity until air quality is better.

Risk Areas

The major cities of Asia (particularly South Asia) have poor air quality. Cities in India and Pakistan have the world's highest annual mean particulate matter concentrations, with Chinese cities not far behind. In China (except for some cities where natural or liquid petroleum gas is available), brown coal is the major source of energy, resulting in high levels of sulfur dioxide and particulate matter indoors. In Beijing, the existing particulate pollution is dramatically increased by loess (fine particulate matter blown in by wind from the Gobi Desert). In some areas of Asia, particulate problems are exacerbated by other phenomena, such as forest/field clearing by burning.

In Europe, indoor ventilation levels may not reach US standards; central and eastern Europe and Russia have significant levels of all primary pollutants, and particulates and other toxic pollutants are of concern due to limited emission controls. Mediterranean countries lag behind northern Europe in pollution reduction (e.g., Athens, Greece has a significant nitrogen dioxide problem). Northern Europe can experience high particulate levels during the summer months.

In the Middle East, sandstorms are common and often necessitate respiratory protection. The combination of dust and extreme heat (up to 40-55°C [120-130°F]) can lead to significant health risks. Several cities in the Middle East (including Abu Dhabi, United Arab Emirates; Doha, Qatar; and Amman, Jordan) also have highly hazardous particulate concentrations.

Pollution related to regular thermal inversions plagues the entire Pacific coast of the Americas from Los Angeles, California to Santiago, Chile.

Data are unavailable for many countries of Africa, but major cities such as Accra, Ghana; Dakar, Senegal; and Johannesburg, South Africa have particulate concentrations rivaling some Asian counterparts. In sub-Saharan Africa, the harmattan winds blow desert sands over many major cities and frequently combine with air pollution from other sources.

Risk Factors

Risk depends on the extent of air pollution (both indoor and outdoor) at the planned destination, the duration and timing of the trip, underlying health conditions of the traveler (underlying respiratory or cardiac disease). Children and older adults are at increased risk.

Recommendations for Travelers

Prevention measures integrate the likelihood and duration of exposure during the trip, possible methods to reduce the level of exposure, underlying risk of or exacerbation of disease, and medical resources available.

Employers should be encouraged to provide additional tools that assist in determination or forecasting of air quality including:

- City-wide networks that provide detailed site-specific data
- Internet-enabled sensors placed inside and outside employee homes
- Forecasting services that can alert to short-term issues

Discuss the following issues with a travel medicine provider prior to travel:

- The level of outdoor air pollution at the destination
- Possible exposure to indoor air pollution from cooking or heating with biomass fuels, kerosene, or coal in a poorly ventilated environment
- The need to stabilize underlying health conditions before travel
- Early signs of respiratory infections and plans for medical evaluation at destination

- Medications to carry (such as inhalers for asthma) and any necessary documentation for those medications (e.g., a medication letter to be used in customs)
- The need for health and/or evacuation insurance for trip
- The need to consider postponing discretionary travel for truly hazardous air quality or choosing a different travel destination

All travelers should:

- Monitor local AQI, weather-oriented websites, or local media to determine the need to restrict/curtail activities, exercise indoors, or choose mode of transportation.
- Exercise (if outdoors) in the early morning to potentially lower exposure to outdoor pollution.
- Use mass transit (but not buses) and ride in enclosed automobiles in polluted areas.
- Travel at times of the year when outdoor air quality is least affected by pollution, if local variability occurs.
- Consider wearing a properly fitting face mask (such as an N95 respirator, which filters most small particulates) because they are accepted and popular among the local population in affected areas.
 - When worn properly, breathing effort is increased, so this may be a problem for persons with underlying respiratory disease.
 - Masks do not filter gases such as ozone, nitrogen dioxide, or sulfur dioxide.
- Travelers who usually wear contact lenses should bring eye glasses if they will be in an area of heavy dust and ozone.

Expatriates should:

- Monitor employer provided sensors, networks, or forecasting services for real-time information on pollution levels in the home, workplace, and community.
- Stay/work in buildings using clean-air filtration systems with indoor measurement devices that ensure adequate function.
- Consider home leave for the worst pollution times during the year.

AQI Resources

- International air quality website: <http://airnow.gov/index.cfm?action=airnow.international>
- Air quality index visual map: <http://aqicn.org/map/world>

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