

EDITORIAL

Environmental Pollution and Cardiovascular Diseases: Identify and Prevent!

Claudio Tinoco Mesquita

Universidade Federal Fluminense, Niterói, RJ - Brazil

"Education is the most powerful weapon which you can use to change the world."

Nelson Mandela

Exposure to environmental pollution is a key factor in the development and worsening of cardiovascular diseases. This alert was issued in a 2004 statement from the American Heart Association (AHA).¹ A large body of new scientific evidence has been accumulated since then, allowing for a better understanding of the aspects related to this modifiable risk factor for cardiovascular diseases.

Cardiovascular diseases (CVD) are the major cause of death worldwide, accounting for more than 17 million premature deaths in 2016. Out of these deaths, 3.3 million are attributable to air pollution, 2.1 million of which are due to ischemic heart disease (IHD) and 1.1 million due to stroke.² Air pollution accounts for 19% of all cardiovascular deaths, and those 3.3 million deaths linked to air pollution exceed the deaths caused by smoking (2.48 million), obesity (2.85 million) and elevated blood glucose levels (2.84 million). Hypertension is the only risk factor that compared to pollution contributes to a greater burden of cardiovascular mortality.³

Exposure to chronic pollution causes an increase in oxidative stress and a consequent inflammatory state, which accelerates atherosclerosis through vasoconstriction, increased heart rate, increased blood pressure, endothelial dysfunction, increased platelet aggregation, dyslipidemia and insulin resistance.³ Figure 1 illustrates some of the mechanisms proposed for the pathophysiology of the effects of pollution on the

cardiovascular system. However, it is not only chronic exposure to air pollutants that is dangerous, since short-term exposure to polluted air can be extremely harmful for cardiovascular health, with an increased risk of myocardial infarction and stroke.⁴ One of the major studies was carried out in China and showed that a 10 $\mu\text{g}/\text{m}^3$ increase within a 2-day period in concentration of inhalable particles with aerodynamic diameters less than 10 microm (PM10) is associated with a 0.35% and 0.44% increase in total mortality and cardiovascular mortality, respectively.⁵ Among the populations particularly susceptible to the effects of pollution are women, the elderly and lower-income individuals, obese individuals, diabetic individuals and those with traditional cardiovascular risk factors, such as hypertensive and dyslipidemic individuals.⁶

International cardiology societies have published reports recommending that cardiologists assume an active position in raising awareness of the risks for heart disease posed by pollution.^{6,7} The active involvement of the cardiology community in public policy formulations aiming at the control of air pollution levels is essential. Individuals with heart disease who practice physical exercise for the sake of improving their cardiovascular health may not see its full benefit when exposed to traffic pollution, since it can prevent the beneficial cardiopulmonary effects of walking in people with ischaemic heart disease, and those free from chronic cardiopulmonary diseases.⁸ Thus, it is essential that cardiologists begin to focus their attention on environmental pollution, identifying the more susceptible individuals and proposing changes in their lifestyle, which may mitigate the deleterious effects of this new risk factor. Hadley et al.,³ proposed a series of actions with the purpose of developing a clinical approach to mitigate the effects of pollution on the cardiovascular system (Table 1).

Keywords

Cardiovascular Diseases/mortality; Cardiovascular Diseases/prevention & control; Environmental Pollution; Air Pollution; Risk Factors; Oxidative Stress.

Mailing Address: Claudio Tinoco Mesquita

Pós-Graduação em Ciências Cardiovasculares, Avenida Marques do Paraná, 303. Postal Code: 24033-900, Centro, Niterói, Rio de Janeiro, RJ - Brazil.
E-mail: claudiotinocomesquita@id.uff.br

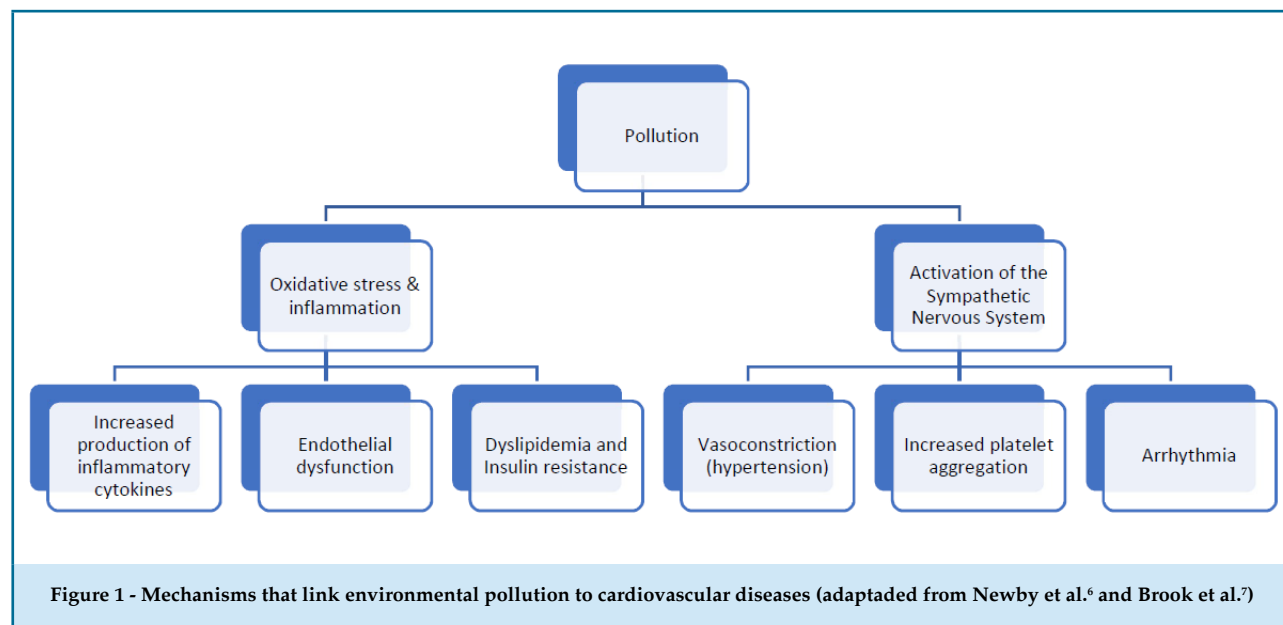


Table 1 - Strategies for the assessment of individuals at risk of the effects of environmental pollution and ways to enhance their protection (adapted from Hadley et al.³)

Identification of individuals more susceptible to the cardiovascular effects of pollution

Burning of solid fuels at home for heating or cooking

Live in residences with poor ventilation and with pollution sources, such as stoves or fireplaces

Live or work in urban industrial environment with intense pollution

Time spent routinely in heavy traffic areas

Outdoor physical activity in polluted environments or near highways or on busy urban roads

The obese, the elderly and individuals with traditional risk factors for cardiovascular disease

Interventions & Recommendations to reduce the risk of environmental pollution

Educate individuals at risk about the risk of pollution

Prioritize treatment of cardiovascular risk factors in individuals exposed to pollution

Collaborate with government efforts to reduce pollution emissions

Propose the use of more efficient heating, cooking and ventilation methods in patients' household

Educate patients to avoid exposure to environmental pollution: keeping the car's windows closed when in traffic or avoiding the practice of physical activity in high-exposure locations and times

Encourage the use of filters to reduce exposures, such as N95 respirator masks or central air conditioners with high efficiency filters

In 2016, 95% of the world's population lived in areas where ambient PM_{2.5} levels exceeded 10 $\mu\text{g}/\text{m}^3$ (annual average), which is the maximum tolerated limit established by the World Health Organization. Global population-weighted PM_{2.5} concentrations are 18% higher compared to the 2010 levels, which means that

the world's population is progressively more exposed to pollution.⁹ This trend must be reverted so that we can have a healthier planet and healthier hearts. It is the responsibility of health-care professionals to disseminate ways to achieve the sustainable development goals of the United Nations Organization.¹⁰ With regard to

environmental pollution, educating society, health-care professionals and patients is essential to mitigate

the harmful effect of this new prevalent cardiovascular risk factor.

References

1. Brook RD, Franklin B, Cascio W, Hong Y, Howard G, Lipsett M, et al. Air pollution and cardiovascular disease: A statement for healthcare professionals from the expert panel on population and prevention science of the American Heart Association. *Circulation* 2004;109(21):2655–71.
2. GBD 2016 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 84 behavioral, environmental and occupational, and metabolic risks or clusters of risks, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017;390(10100):1345–422.
3. Hadley MB, Baumgartner J, Vedanthan R. Developing a clinical approach to air pollution and cardiovascular health. *Circulation*. 2018;137(7):725–42.
4. Wellenius GA. Ambient air pollution and the risk of acute ischemic stroke. *Arch Intern Med*. 12;172(3):229.
5. Chen R, Kan H, Chen B, Huang W, Bai Z, Song G, et al. Association of particulate air pollution with daily mortality: The China air pollution and health effects study. *Am J Epidemiol*. 2012;175(11):1173–81.
6. Newby DE, Mannucci PM, Tell GS, et al. Expert position paper on air pollution and cardiovascular disease. *Eur Heart J* 2015;36(2):83–93.
7. Brook RD, Rajagopalan S, Pope CA, Baccarelli AA, Brook RD, Donaldson K, et al. Particulate matter air pollution and cardiovascular disease: An update to the scientific statement from the American Heart Association. *Circulation*. 2010;121(21):2331–78.
8. Sinharay R, Gong J, Barratt B, Ohman-Strickland P, Ernst S, Kelly FJ, et al. Respiratory and cardiovascular responses to walking down a traffic-polluted road compared with walking in a traffic-free area in participants aged 60 years and older with chronic lung or heart disease and age-matched healthy controls: a randomised, crossover. *Lancet*. 2017;391(10118):339–49.
9. Shaddick G, Thomas M, Amini H, Broday D, Cohen A, Frostad J, et al. Data integration for the assessment of population exposure to ambient air pollution for global burden of disease assessment. *Environ Sci Technol*. Jul 30 2018 [Epub ahead print]
10. Mesquita CT, Leão M, Mesquita CT, Leão M. Cardiology and sustainable development. *Int J Cardiovasc Sci*. 2017;31(1):1–3.

