

Respirator mask reduces effects of pollution on the heart

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The use of a respiratory filter mask, a common practice in China and Japan, among other countries, helps minimize the impact of pollution on people with heart failure during rush-hour traffic in cities such as São Paulo, Brazil.

For healthy people, wearing this type of anti-pollution mask can also reduce the risk of developing [cardiovascular disease](#).

These are the main findings of a study performed by researchers at the Heart Failure Center of the University of São Paulo's Heart Institute (INCOR-USP), part of the general and teaching hospital run by the university's [medical school](#) (HC-FMUSP).

"The study shows for the first time that it's possible to intervene simply, cheaply and effectively in a situation of risk for patients with heart failure due to exposure to [air](#) pollution from [motor vehicle traffic](#) in cities. Intervention of this kind can have beneficial public health effects and can reduce mortality from cardiovascular diseases", said principal investigator Edimar Alcides Bocchi, who heads the Heart Failure Center and is also a professor at the Medical School's Department of Cardiopulmonary Sciences.

The air pollution caused by city traffic has recently begun to be considered a risk factor for coronary heart disease and adverse cardiovascular events such as stroke and [acute myocardial infarction](#), according to Bocchi. The toxic particles expelled by motor vehicles easily penetrate the airways.

In the past, however, most studies of the subject focused on the effects of air pollution on patients already suffering from the aftermath of a heart attack or with diabetes and metabolic syndrome.

Hitherto, no studies had investigated patients with cardiovascular conditions such as heart failure, which is when the heart cannot pump enough blood to supply oxygen and nutrients to other

organs. Heart failure causes 10.8% of deaths in Brazil and is the leading cause of hospitalization for the treatment of cardiorespiratory diseases via the Brazilian national health system (SUS).

To assess the effects of pollution on patients with heart failure, the researchers exposed 41 people to controlled pollution: 26 patients undergoing treatment at INCOR and 15 control volunteers with healthy hearts.

The study was performed in collaboration with the Pollution Experiment Laboratory at USP's Medical School. The participants were exposed to three different levels of air quality, at rest for 15 minutes and while walking on a treadmill for six minutes at an easy but moderately tiring pace.

In the first session, they received clean air, which they breathed in through a mouthpiece from compressed air cylinders.

In the second session, they were exposed to unfiltered [polluted air](#) consisting of a mixture of clean air and exhaust gases from a diesel engine with 300 micrograms of particulate matter per cubic meter, equivalent to half the particulate matter in the air of São Paulo City during most of the year according to measurements by CETESB, the São Paulo State environmental agency.

In the third session, the participants breathed polluted air but were protected by a particulate respirator mask with a filter, such as the masks that are worn by health workers and sold in pharmacies.

The participants' endothelial function and heart rate variability were measured for each session, as well as serum biomarkers such as B-type natriuretic peptide (BNP).

BNP is a hormone secreted by the ventricles and atria of the heart in response to excessive stretching or stressing of heart muscle cells, usually

a sign of heart failure. The endothelium is a thin membrane that lines the inside of the heart and blood vessels. Endothelial cells release substances that control vascular relaxation and contraction as well as blood clotting.

The results of the experiment showed that exposure to polluted air caused an increase in BNP and deterioration in endothelial function, whereas use of the respirator mask caused a reduction in BNP and an improvement in endothelial function.

BNP rose significantly during the 21 minutes of exposure to polluted air, and when the patients wore the mask it fell back to the base rate measured while they breathed clean air.

According to the researchers, the results of the study suggest that wearing a respirator mask is especially beneficial for people with heart failure and who are repeatedly exposed to [air pollution](#) from motor vehicles, such as bus, truck and taxi drivers, traffic wardens, police, and filing station attendants.

In addition to these groups, however, wearing a mask can also benefit people without [heart failure](#) by protecting them against endothelial dysfunction, considered a risk factor for [coronary heart disease](#).

More information: Jefferson L. Vieira et al. Respiratory Filter Reduces the Cardiovascular Effects Associated With Diesel Exhaust Exposure, *JACC: Heart Failure* (2016). [DOI: 10.1016/j.jchf.2015.07.018](#)

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