HEPA filters reduce cardiovascular health risks associated with air pollution

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Using inexpensive air filters may help reduce cardiovascular disease risk that results from exposure to air pollution, according to researchers from Canada, who studied healthy adultsliving in a small community in British Columbia where wood burning stoves are the main sources of pollution. The researchers found that high efficiency particle air (HEPA)filters reduced the amount of airborne particulate matter, resulting in improved blood vessel health and reductions in blood markers that are associated with an increased risk of cardiovascular disease.

The findings were published online ahead of the print edition of the American Thoracic Society's American Journal of Respiratory and Critical Care Medicine.

"Our main objectives were to evaluate the potential for a simple intervention to improve indoor air quality and reduce pollution-related cardiovascular health risks and to better understand the mechanisms that contribute to air pollution-related cardiovascular health problems" said Ryan Allen, PhD, assistant professor, Simon Fraser University, Burnaby, British Columbia. "Specifically, we were interested in learning more about the effects of residential wood smoke on the endothelium, the cells that line the inside of blood vessels, and on systemic inflammation, which is related to cardiovascular disease risk."

Previous studies on the effects of air pollution on cardiovascular disease have been conducted primarily in urban areas and have focused largely on vehicle emissions,Dr. Allen noted. The results of those studies have

indicatedpollution causes inflammation in the lungs and vessels and may also cause endothelial cells to function poorly, ultimately contributing to cardiovascular disease; however, few studies have been conducted in smaller communities or communities where woodsmoke is a main source of pollution, he added.

The researchers recruited 45 adults from 25 homes. Individuals from self-reported tobacco-smoking households were excluded from participating. Each participant's home was monitored for two consecutive seven-day periods, during which time a HEPA filter (Honeywell model 50300) was operated in the main activity room and a quieter HEPA filter (Honeywell 18150) was operated in the participant's bedroom. HEPA filters were operated normally during one seven-day period and without the internal filters in place during the other period. The order of filtration or non-filtration was random and participants did not know during which period the air was being filtered. Indoor pollution sampling equipment was placed in each home's main activity room.Participants were asked to record their activities, locations and proximity to pollution sources every 60 minutes.Of the 25 homes enrolled in the study, 13 had woodstoves in use during the study period.

At the end of each 7-day period blood and urine samples were collected from each participant and markers of cellular injury, as well as the body's response to that injury, were measured. Endothelial function also was evaluated using a fingertip device to evaluate blood volume in small blood vessels, and air samples were collected and analyzed.

Specifically, the researchers measured reactive hyperemia, a transient increase in blood flow which follows a period of ischemia, or blood flow shortage.A reduced reactive hyperemia index indicates blood vessels have an impaired response to changes in blood flow, and is an indicator of the earliest stages of atherosclerosis. Levels of a blood protein called C-reactive protein, which increase during inflammation, were also

measured.

After analyzing their data, the researchers found portable HEPA filters reduced the average concentrations of fine particulates inside homes by 60% and woodsmoke by 75%, and their use was associated with improved endothelial function (a 9.4% increase in reactive hyperemia index) and decreased inflammation (a 32.6% decrease in C-reactive protein).

"Our results support the hypothesis that systemic inflammation and impaired endothelial function, both predictors of cardiovascular morbidity, can be favorably influenced by a reduction of particle concentration and add to a growing body of evidence linking short-term exposure to particulate matter with a systemic inflammatory response," Dr. Allen said."Reducing air pollution appears to provide health benefits even if the pollution levels are already relatively low."

HEPA filters offer an accessible option to help reduce the risks of cardiovascular disease that may be associated with inhaling wood smoke, especially as consumers turn more frequently to woodstoves as a source of heat, he added.

"HEPA filters are a potentially useful intervention since they are relatively inexpensive to purchase and operate and can effectively remove tiny particles that can be inhaled, to improve air quality inside homes where the majority of time is spent," Dr. Allen noted. "The importance of residential wood smoke as a source of air pollution is likely to increase due to the rising costs of other fuels."

Dr. Allen said future studies may help determine the health benefits of programs that promote the replacement of older, highly-polluting woodstoves with cleaner-burning alternatives.

"Ultimately, the best safeguard against these health risks is to minimize the amount of air pollution that is created," he said.

Provided by American Thoracic Society

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