

Interactions and imbalances between gasotransmitters can be easily understood using the fact that nitric oxide is a vasodilator and hydrogen sulfide is a vasoconstrictor.

The following is provided for discussion purposes.

<http://www.mcfip.net/upload/Warburg%20Effect%20Variations.pdf>

Bioinformatic search can identify studies that verify the fact that carbon monoxide can displace/release nitric oxide.

## Summary

The air pollution in households that can cause cardiovascular disease can be established as carbon monoxide driven through a DIY exercise.

<https://medicalxpress.com/news/2018-04-household-air-pollution-linked-cardiovascular.html>

# Household air pollution linked to cardiovascular disease risk

April 5, 2018, University of Oxford

Exposure to household air pollution from using wood or coal for cooking and heating is associated with higher risk of death from heart attack and stroke, according to new research published in the *Journal of the American Medical Association (JAMA)*.

Around three billion people worldwide use solid fuels (e.g. coal, wood, charcoal and crop wastes) to cook and to heat their homes. When burnt, these fuels produce smoke that contains a very high concentration of fine particles (known as PM2.5) and other harmful substances, especially in houses without adequate ventilation.

It is estimated that worldwide about 2.5 million deaths in 2016 were related to the resulting household air pollution. In China, despite rapid urbanisation in recent decades, about one in three people still rely heavily on solid fuels, mostly coal and wood, for domestic purposes. The health impact of household air pollution on the Chinese population is therefore believed to be substantial, but previous research has not provided concrete evidence.

Researchers from the University of Oxford, Huazhong University of Science and Technology, the Chinese Academy of Medical Sciences, and Peking University in China have studied the association of the long-term use of solid fuels for cooking and heating

with the risk of death from cardiovascular disease in a large study of 271,000 residents in five rural areas in China.

This study is based on the China Kadoorie Biobank prospective study of 0.5 million adults from five urban and five rural areas, which was established jointly by the University of Oxford and Chinese Academy of Medical Sciences during 2004-08. The present report only included participants from 5 rural areas, where use of solid fuels for domestic purposes is still common. The health status of study participants was monitored through linkages to death registries for an average of seven years. During this time over 5,500 participants died of cardiovascular disease (e.g. stroke, heart attack) among those who had no history of cardiovascular disease at the initial recruitment.

The researchers found that, compared with people who mainly used gas or electricity ('clean fuels'), those who regularly cooked using coal or wood ('solid fuels') had a 20% higher mortality risk from cardiovascular disease, and people who heated their homes using solid fuels had a 29% increase in risk, after taking account of the effects of age, sex, socio-economic status, smoking, alcohol drinking, diet, physical activity, and adiposity. The study also showed clearly that the longer people used solid fuels, the higher the risk of death. Moreover, there were synergistic effects of household air pollution and tobacco smoking, with the risk of death from cardiovascular disease being 76% higher among smokers who used solid fuel than non-smokers who used clean fuels.

Study author, Professor Zhengming Chen, from the University of Oxford, UK, the co-lead Principal Investigator of the China Kadoorie Biobank, said: "Air pollution has caused a lot of concern in China, but people have been focusing mainly on the outdoor air quality and overlooking the health consequences of pollution arising from domestic burning of coal and wood for cooking and heating, which may have a more profound impact on health."

While it is known that burning solid fuels gives rise to harmful PM2.5, the direct evidence linking household air pollution to long-term risk of death, especially from cardiovascular causes, has been very limited. The analysis of data in this very large study provides new evidence of the hazards of long-term exposure and ways to mitigate excess risk of death. The study showed that switching from solid to clean fuels for cooking reduced the risk of cardiovascular death by 17% and switching from solid to clean fuels for heating reduced the risk by 43%. An equally important finding was that individuals who cooked on stoves using solid fuels but had proper ventilation had an 11% lower risk, compared with those whose cookstoves were not properly ventilated. Study author, Professor Tangchun Wu, from Huazhong University of Science and Technology, China, said: "These findings are important because even though people might have been using solid fuels for a long time, there are still clear health benefits in switching to cleaner fuels. Installing ventilation facilities will be a cheaper and effective alternative for those who cannot switch to clean fuels."

In recent decades, Chinese government has launched a massive campaign to replace traditional cooking stoves and to encourage more widespread use of clean fuels. Findings from this study confirm the health benefits of switching to clean fuels and having proper ventilation. Despite this, use of solid fuel to cook and heat and poor ventilation are still prevalent in many rural areas of China, which will continue to cause many premature deaths from vascular (and many other) diseases.

Study author, Professor Liming Li, Peking University, China, the co-lead Principal Investigator of the China Kadoorie Biobank, said: "We can't conclude from these observational findings that burning coal and wood on its own is causing death, but, irrespective of this, China and other low and middle-income countries should encourage their people to change to cleaner domestic fuels, and to prioritise policies and practices to allow a swift, widespread and sustainable switch."

**Explore further: Household air pollution linked to higher risk of heart attacks, death**

**More information:** Kuai Yu et al. Association of Solid Fuel Use With Risk of Cardiovascular and All-Cause Mortality in Rural China, *JAMA* (2018). **DOI:** [10.1001/jama.2018.2151](https://doi.org/10.1001/jama.2018.2151)

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