

Effects of CO Exposure on Heart Attacks

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In 2021, the World Health Organization (WHO) published revised recommendations for ambient air quality (WHO 2021). To support this update WHO published a review paper in 2021 evaluating the best available evidence on the effects of short-term exposure to carbon monoxide (CO) and myocardial infarction (Lee *et al.* 2021).

Specifically, the research published updated quantified risk ratios for exposure to CO on hospitalisation for myocardial infarction (heart attacks).

Highlights

- Myocardial infarction was associated with exposure to ambient carbon monoxide.
- The overall evidence was assessed to be of moderate certainty.
- Further research in low- and middle-income countries is needed.

(Lee *et al.* 2021)

Research Findings

Following screening and selection, Lee and fellow researchers systematically reviewed 26 air pollution epidemiology studies of short-term exposure to CO. Mean daily concentrations of CO reported in 21 studies ranged from 0.3 – 4.6 milligrams per cubic metre (mg/m³).

The studies were mainly conducted in the 1980s and 1990s, with a mean duration of 6.4 years (standard deviation 4.0, range 2-15). The studies originated from 14 countries, however, the majority of these were high-income countries.

Lee and fellow researcher's meta-analysis of epidemiological studies developed a new risk ratio, which follows, to represent the quantitative risks posed by short-term exposure to carbon monoxide and myocardial infarction:

Daily CO risk ratio 1.052 (95% Confidence Interval: 1.017, 1.089, n = 26)¹

This means for every 1 mg/m³ increase in daily concentration of CO, hospitalisations due to heart attacks increased by 5.2%, with 95% of the data being between 1.7 – 8.9% across 26 epidemiological studies.

The certainty of evidence was judged to be moderate.

¹ For more information on the study methods and interpreting risk ratios please see the separate fact sheet titled "Health Effects of Air Pollutant Factsheets: Supporting Information". (Wickham *et al.* 2022)

Discussion

The researchers noted the following important observations:

- 24-hour exposure to **carbon monoxide correlates with increased risk of hospitalisation for myocardial infarction** (heart attack).
- The review identified 10 additional studies evaluating the short-term effects of carbon monoxide on admission to hospital for myocardial infarction or mortality from myocardial infarction. The magnitude of the association was **very similar to a previous meta-analysis** of 20 studies (Mustafić *et al.* 2012).
- There was insufficient stratification to permit subgroup analyses by sex, age, multipollutant studies or conflict of interest.

Conclusions

Lee and fellow researchers concluded that 24-hour exposure to carbon monoxide correlates with increased risk of hospitalisation for myocardial infarction (heart attack).

Overall, the evidence was assessed to be of moderate quality.

WHO Short-Term CO Guidelines

The WHO 2000 air quality guidelines (AQG) for CO were set to "protect non-smoking, middle-aged and elderly population groups with documented or latent coronary artery disease from acute ischaemic heart attacks, and to protect the foetuses of non-smoking pregnant women from untoward hypoxic effects" (WHO 2000). Specifically, a range of time averaged AQG were provided to ensure a maximum carboxyhaemoglobin concentration of 2.5% was not exceeded.

In 2010, WHO updated the AQG for CO to address 15-minute, 1-hour and 24-hour exposures (WHO 2010). The 24-hour average AQG was further updated in 2021 based on a new evaluation of the effects of short-term exposure to CO on hospital admissions for myocardial infarction (Lee *et al.* 2021). Existing guidelines remain valid (WHO 2021).

Time Average	CO Guideline (mg/m ³)	No. Permitted Exceedances
24-hour	4	3-4/year
8-hour	10	-
1-hour	35	1/day
30-minutes	60	-
15-minutes	100	1/day

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