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Global association of air pollution and heart failure: a systematic review and meta-analysis

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Summary

Background

Acute exposure to air pollution has been linked to myocardial infarction, but its effect on heart failure is uncertain. We did a systematic review and meta-analysis to assess the association between air pollution and acute decompensated heart failure including hospitalisation and heart failure mortality.

Methods

Five databases were searched for studies investigating the association between daily increases in gaseous (carbon monoxide, sulphur dioxide, nitrogen dioxide, ozone) and particulate (diameter <2.5 µm [PM_{2.5}] or <10 µm [PM₁₀]) air pollutants, and heart failure hospitalisations or heart failure mortality. We used a random-effects model to derive overall risk estimates per pollutant.

Findings

Of 1146 identified articles, 195 were reviewed in-depth with 35 satisfying inclusion criteria. Heart failure hospitalisation or death was associated with increases in carbon monoxide (3.52% per 1 part per million; 95% CI 2.52–4.54), sulphur dioxide (2.36% per 10 parts per billion; 1.35–3.38), and nitrogen dioxide (1.70% per 10 parts per billion; 1.25–2.16), but not ozone (0.46% per 10 parts per

billion; -0.10 to 1.02) concentrations. Increases in particulate matter concentration were associated with heart failure hospitalisation or death ($PM_{2.5}$ 2.12% per $10 \mu\text{g}/\text{m}^3$, 95% CI 1.42 – 2.82 ; PM_{10} 1.63% per $10 \mu\text{g}/\text{m}^3$, 95% CI 1.20 – 2.07). Strongest associations were seen on the day of exposure, with more persistent effects for $PM_{2.5}$. In the USA, we estimate that a mean reduction in $PM_{2.5}$ of $3.9 \mu\text{g}/\text{m}^3$ would prevent 7978 heart failure hospitalisations and save a third of a billion US dollars a year.

Interpretation

Air pollution has a close temporal association with heart failure hospitalisation and heart failure mortality. Although more studies from developing nations are required, air pollution is a pervasive public health issue with major cardiovascular and health economic consequences, and it should remain a key target for global health policy.

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