Soluble Ions with ICP-MS are Superior to Total Elements with XRF in Assessing Component-specific Cardiovascular Effects of Fine Particulate Matter (PM_{2.5})

<u>Neas LM</u>¹, Schneider A², Kovalcik KD³, Herbst MC⁴, Hinderliter A⁴, Case M¹, Williams RW³, Cascio WE¹, Peters A², Devlin RB¹

¹Environmental Public Health Division, EPA, RTP, NC

²Helmholtz Zentrum München, Institute of Epidemiology II, Neuherberg, Germany

³Human Exposure and Atmospheric Sciences Division, EPA, RTP, NC

⁴University of North Carolina, School of Medicine, Chapel Hill, NC

Background: We previously reported that total fine particulate matter ($PM_{2.5}$) was associated with flow-mediated dilation (FMD), interleukin-6 (IL-6) and tumor-necrosis-factor-alpha ($TNF\alpha$) in 22 individuals with type 2 diabetes.

Objectives: We now compare two laboratory methods of assessing $PM_{2.5}$ constituents.

Methods: We conducted a prospective panel study with four repeated measurements. Total elemental composition was analyzed by x-ray florescence (XRF). Water-soluble extractions were analyzed using inductively coupled plasma mass spectrometry (ICP-MS). Results from models with random patient effects are presented as %-changes [95%confidence intervals] for a method-specific interquartile change.

Results: Moderate Pearson correlations between ICP-MS and XRF measurements were seen for copper (0.55), zinc (0.67), iron (0.61), and selenium (0.70). The association of copper and FMD (lag0) was much stronger with ICP-MS (-16.2% [-26.9 to -5.6] per 16.4 μ g/L) than with XRF (-12.7% [-27.6 to +2.2] per 1.9ng/m³). The association of selenium and FMD (lag0) was identical, but more precise, with ICP-MS (-11.9% [-22.3 to -1.6] per 19.7 μ g/L) than with XRF (-12.0% [-26.7 to +2.7] per 1.4ng/m³). The association of zinc and IL-6 (lag2) was stronger with ICP-MS (+21.3% [8.6 to 34.0] per 146.9 μ g/L) than with XRF (+10.9% [-3.7 to +25.6] per 6.6ng/m³). The association of iron and TNF α (lag2) was stronger with ICP-MS (+12.2% [6.1 to 18.2] per 275.8 μ g/L) than with XRF (+8.2% [3.3 to 13.2] per 44.1ng/m³).

Conclusions: Water-soluble components measured with ICP-MS are superior to total elements measured with XRF in assessing component-specific cardiovascular effects.

This abstract of a proposed presentation does not necessarily represent EPA policy.

Keywords: air pollution, diabetes, ICP-MS, XRF, sources, components

249 words