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**Exposure of PM<sub>2.5</sub> and its constituents are associated with chronic kidney disease**

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**Objectives :** The connection between exposure to fine particulate matter (PM<sub>2.5</sub>) and chronic kidney disease (CKD) has been observed, but remains a topic of debate. The impact of PM<sub>2.5</sub>'s individual and combined components on CKD has been underexplored. Our study aims to examine the relationship between long-term exposure to 15 key PM<sub>2.5</sub> components and CKD.

**Methods :** We included 23,820 participants from seven regions in Taiwan in our study. The Taiwan Environmental Protection Administration provided hourly PM<sub>2.5</sub> concentration readings from January 2006 to December 2008. We employed a refined kriging model to estimate each participant's long-term exposure to PM<sub>2.5</sub> at their residence. We also utilized spherical spatial models to calculate residential PM<sub>2.5</sub> levels. The 15 analyzed PM<sub>2.5</sub> constituents were elemental carbon, organic carbon, sulfate, ammonium, nitrate, barium, iron, copper, manganese, zinc, antimony, molybdenum, cadmium, lead, and nickel. CKD was identified using the estimated glomerular filtration rate (eGFR), with an eGFR below 60 ml/min/1.73 m<sup>2</sup> indicating CKD.

**Results :** After removing participants with incomplete renal data, those in CKD stage 5, deceased before 2008, or residing outside Taiwan's main island, 12,250 participants were included in the analysis. Adjusting for factors such as age, sex, body mass index, smoking habits, diabetes, heart disease, and serum uric acid levels, we found a significant negative correlation between PM<sub>2.5</sub> levels and eGFR (beta±SE: -0.16±0.019, P < 0.0001) in Table 1. Almost all PM<sub>2.5</sub> components showed a strong link with eGFR, except for ammonium and copper. When evaluating the impact of all PM<sub>2.5</sub> components together, elemental carbon, organic carbon, and antimony were identified as having the most significant effect on eGFR levels (Table 2).

**Conclusions :** Our findings confirm a significant association between PM<sub>2.5</sub> exposure and CKD, highlighting elemental carbon, organic carbon, and antimony as key contributors to this relationship.

Table 1.jpg

	Univariate			Multivariate		
	beta	se	P-value	beta	se	P-value
PM <sub>2.5</sub> exposure	-0.30119	0.02092	<.0001	-0.15793	0.01858	<.0001
Age	-0.70727	0.01418	<.0001	-0.65587	0.01389	<.0001
Male sex	-2.71673	0.2517	<.0001	1.6215	0.34849	<.0001
BMI	-0.10398	0.02453	<.0001	0.04972	0.02157	0.0212
Ever smoker	-2.41003	0.28382	<.0001	-0.60337	0.36903	0.1021
Diabetes	-4.1113	1.27175	0.0012	0.88864	1.118	0.4267
Hypertension	-7.28987	0.73072	<.0001	-0.76673	0.6548	0.2416
Heart disease	-3.73795	1.24349	0.0027	-0.71226	1.08962	0.5133
Uric acid	-2.79402	0.08173	<.0001	-2.63321	0.08159	<.0001

Table 1.jpg

	LASSO Regression Model			Beta
	Lower CL	Upper CL	P-value	
EC	20.848	39.482	<.0001	0.136
OC	-4.917	-2.881	<.0001	-0.161
NH <sub>4</sub>				
Cu	-0.048	0.068	0.735	0.004
Mn	-0.252	0.044	0.169	-0.016
Zn	-0.007	0.017	0.396	0.010
Sb	-11.827	-4.532	<.0001	-0.052
Mo				
Cd	0.000	0.002	0.079	0.018
Pb	0.001	0.029	0.031	0.024