Short-term Exposure of $PM_{2.5}$ and Epigenetic Aging: A Quasi-Experimental Study

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Blue line plots indicate 24-h average outdoor $PM_{2.5}$ concentrations based on data obtained from nearby environmental fixed-site monitoring stations. Green line plots indicate 24-h average indoor $PM_{2.5}$ concentrations. Red diamonds indicate $PM_{2.5}$ concentrations at the dates of blood draws.

Table S1 Correlation matrix of the seven epigenetic ages and corresponding accelerations with chronological age (Spearman's coefficients) [a]

Spearman coefficients	Age	DNA methylation age (Horvath)	Age acceleration (Horvarth)	DNA methylation age (Hannum)	Age acceleration (Hannum)	PhenoAge	Age acceleration (PhenoAge)	GrimAge	Age acceleration (GrimAge)	DunedinPoAm	Mortality risk score	epiTOC
Age	1											
DNA methylation age (Horvath)	**0.357**	1										
Age acceleration (Horvarth)	**0.359**	**0.999**	1									
DNA methylation age (Hannum)	**0.389**	**0.689**	**0.688**	1								
Age acceleration (Hannum)	**0.386**	**0.687**	**0.685**	**0.999**	1							
PhenoAge	**0.401**	**0.722**	**0.720**	**0.840**	**0.839**	1						
Age acceleration (PhenoAge)	**0.409**	**0.728**	**0.726**	**0.844**	**0.844**	**0.999**	1					
GrimAge	**0.272**	**0.361**	**0.359**	**0.632**	**0.632**	**0.608**	**0.609**	1				
Age acceleration (GrimAge)	-0.046	0.175	0.169	**0.407**	**0.409**	**0.494**	**0.488**	**0.857**	1			
DunedinPoAm	-0.207	**0.399**	**0.400**	**0.348**	**0.349**	**0.379**	**0.374**	**0.433**	**0.425**	1		
Mortality risk score	0.156	**0.564**	**0.560**	**0.831**	**0.832**	**0.815**	**0.813**	**0.629**	**0.536**	**0.364**	1	
epiTOC	-0.016	**0.465**	**0.464**	**0.653**	**0.655**	**0.623**	**0.623**	**0.684**	**0.650**	**0.517**	**0.663**	1

a: Bolded correlation coefficients were with a *p*-value <0.05.

Table S2 Associations between $PM_{2.5}$ pollution waves (PPWs) and epigenetic ages (z-scored) [a]

Epigenetic ages	Pre-PPWs	During-PPWs		Post-PPWs		*p*-trend
		Coefficients (SE)	*p*-value	Coefficients (SE)	*p*-value	
Age acceleration (Horvarth)	Ref	0.165 (0.274)	0.55	0.019 (0.273)	0.95	0.81
Age acceleration (Hannum)		0.195 (0.258)	0.45	0.119 (0.258)	0.65	0.75
Age acceleration (PhenoAge)		0.012 (0.247)	0.96	-0.037 (0.247)	0.88	0.97
Age acceleration (GrimAge)		0.170 (0.268)	0.53	0.027 (0.268)	0.92	0.79
DunedinPoAm		0.181 (0.262)	0.49	-0.071 (0.262)	0.79	0.61
DNA methylation mortality risk score		0.264 (0.268)	0.33	0.029 (0.268)	0.91	0.56
epigenetic timer of cancer (epiTOC)		0.184 (0.283)	0.52	0.079 (0.283)	0.78	0.81

a: Model adjusted for age (years), sex (male/female), body mass index (BMI), indoor temperature, and relative humidity; the ID of each participant was controlled for as a random effect.

Table S3 Sensitivity analyses for the associations between time-weighted personal $PM_{2.5}$ exposure concentrations during the 0–24h and 24–48h prior to the health examinations and the changes of DNA methylation aging biomarkers (z-scored) during and post PPWs [a]

Epigenetic ages	0-24h		24-48h	
	Coefficients (SE)	*p*-value	Coefficients (SE)	*p*-value
Age acceleration (Horvarth)	**0.027 (0.014)**	**0.0465**	0.008 (0.013)	0.5769
Age acceleration (Hannum)	**0.029 (0.011)**	**0.0368**	0.011 (0.012)	0.3679
Age acceleration (PhenoAge)	0.020 (0.014)	0.1727	0.012 (0.014)	0.4219
Age acceleration (GrimAge)	**0.031 (0.014)**	**0.0304**	0.022 (0.014)	0.1287
DunedinPoAm	**0.040 (0.019)**	**0.0340**	**0.040 (0.018)**	**0.0327**
DNA methylation mortality risk score	**0.031 (0.013)**	**0.0199**	0.015 (0.013)	0.2486
epigenetic timer of cancer (epiTOC)	**0.020 (0.010)**	**0.0442**	0.012 (0.010)	0.2232

a: Model adjusted for age (years), sex (male/female), body mass index (BMI), indoor temperature, relative humidity, and the average 48h average outdoor $PM_{2.5}$ levels at the baseline; the ID of each participant was controlled for as a random effect. Coefficients are corresponding to an increase of 10μg/m^3 in personal $PM_{2.5}$ concentrations. The ΔEAs were estimated separately for during and post PPWs and were then analyzed in one model for each EA.