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Supplemental Material

Long-Term Particulate Matter Exposure and Onset of Depression in Middle-Aged Men and Women

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Table S1. Baseline characteristics of Kangbuk Samsung Health Study (KSHS) cohort participants.

Characteristic	Participant with CES-D	Participant without CES-D	P value
N	123,045	10,295	
Age (year)	39.4 (6.8)	46.7 (12.8)	0.001
Male sex	73,930 (60.1)	4,587 (44.6)	0.001
12-month PM _{2.5} average (µg/m ³)	24.3 (1.3)	24.2 (1.3)	0.001
12-month PM ₁₀ average (µg/m ³)	50.6 (4.5)	51.7 (4.5)	0.001
60-month PM ₁₀ average (µg/m ³)	55.2 (4.0)	55.4 (4.8)	0.001
BMI			0.73
<18.5	6,203 (5.0)	506 (4.9)	
18.5 ≤ BMI <23	53,368 (43.4)	4,460 (43.3)	
23 ≤ BMI <25	28,317 (23.0)	2,377 (23.1)	
≥25	34,870 (28.3)	2,922 (28.4)	
Unknown	287 (0.2)	30 (0.3)	
Smoking status			0.001
Never smoker	54,723 (44.5)	4,862 (47.2)	
Former smoker	27,151 (22.1)	1,305 (12.7)	
Current smoker	27,095 (22.0)	1,730 (16.8)	
Unknown	14,076 (11.4)	2,398 (23.3)	
Education			0.001
No education	28 (0.0)	45 (0.4)	
Elementary school	216 (0.2)	385 (3.7)	
Middle school	527 (0.4)	364 (3.5)	
High school	14,972 (12.2)	1,361 (13.2)	
Technical college	14,609 (11.9)	534 (5.2)	
University	88,181 (71.7)	2,057 (20.0)	
Unknown	4,512 (3.7)	5,549 (53.9)	
Alcohol intake			0.001
None	16,552 (13.5)	1,489 (14.5)	
Moderate	81,672 (66.4)	5,090 (49.4)	
High	17,159 (13.9)	1,284 (12.5)	
Unknown	7,662 (6.2)	2,432 (23.6)	
Daily physical activity			0.001
None	72,092 (58.6)	5,778 (56.1)	
Less than 3 times	40,048 (32.5)	2,535 (24.6)	
3 times or more	7,554 (6.1)	751 (7.3)	
Unknown	3,351 (2.7)	1,231 (12.0)	

Numbers in the Table are mean (SD) or count (%). ^a P value for differences of means of proportions comparing CES-D score ≥16 and CES-D score <16 group, calculated using one-way ANOVA for continuous variable and chi-square test for categorical variable. The data were complete for continuous variables. Alcohol intake was categorized as none, moderate drinking, excessive drinking, and unknown (>30 grams of alcohol for men and >20 grams of alcohol for women)

Table S2. Hazard ratios (95% confidence intervals) for the developing depression (CESD ≥ 16) for a 10 $\mu\text{g}/\text{m}^3$ increase in PM_{10} air pollution in the Kangbuk Samsung Health Study (KSHS).

Adjustment	Cases/ Person years	12-month		60-month		
		Per 10 $\mu\text{g}/\text{m}^3$ increase		Per 10 $\mu\text{g}/\text{m}^3$ increase		
		HR	95%CI	HR	95%CI	
Follow-up since 2011 ^a	Model 1	5,807/	1.13	1.07, 1.21	1.09	1.02, 1.18
	Model 2	158,778	1.12	1.05, 1.19	1.08	1.00, 1.16
Follow-up since 2015	Model 1	2,795/	1.02	0.94, 1.12	1.01	0.91, 1.11
	Model 2	58,371	1.02	0.93, 1.12	1.00	0.91, 1.11

Model 1. Adjusted for age, sex, study center, and year of visit. Model 2. Additionally, adjusted for educational level, smoking status, body-mass index, alcohol consumption, physical activity, and presence of diabetes, hypertension, and heart disease. Estimates represent HRs (95%CI) for CES-D ≥ 16 as a dichotomous outcome. ^a Use same group of participants to primary $\text{PM}_{2.5}$ analyses.

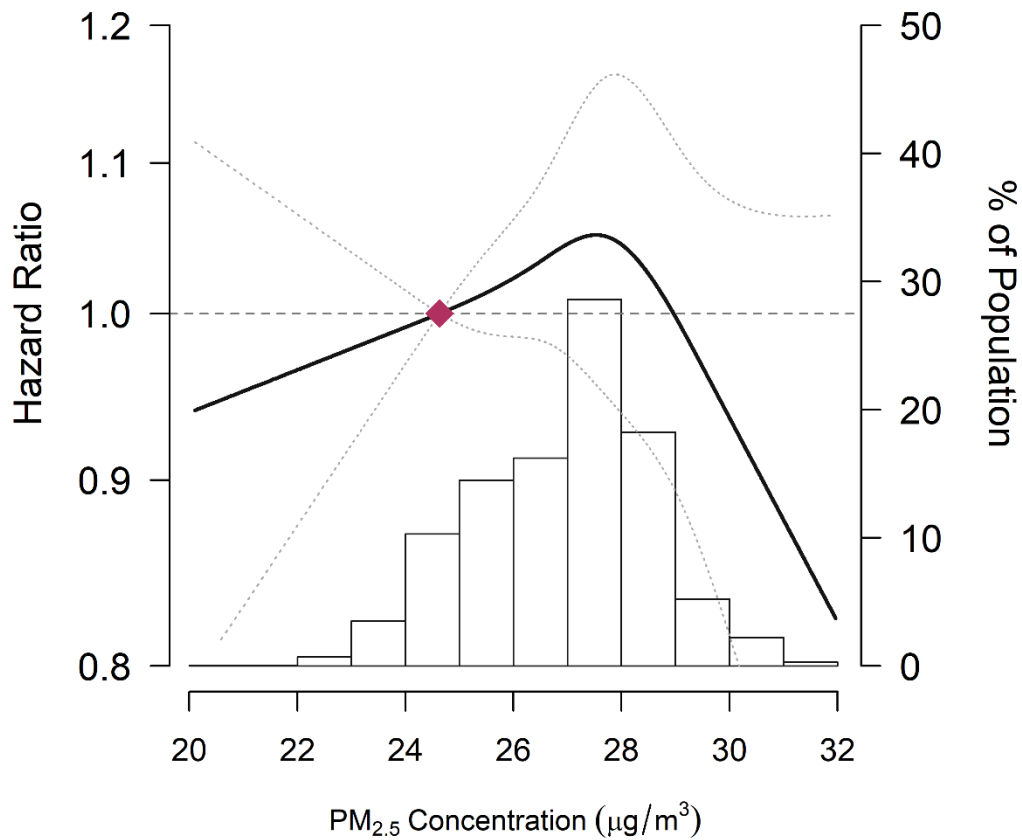


Figure S1. Hazard ratio (95% confidence interval) for incident depression by level of exposure to 60-month PM_{10} concentrations.

Incident depression was defined as the development of a CES-D score ≥ 16 over follow-up. The dose-response curve was calculated using restricted cubic splines with knots at the 5th, 35th, 65th, and 95th percentiles of the distribution of 12-month $PM_{2.5}$ concentrations. The reference exposure level was set at the 10th percentile of the distribution of 12-month $PM_{2.5}$ concentrations ($24.63 \mu\text{g}/\text{m}^3$). Hazard ratios were adjusted for age, sex, study center, year of visit, educational level, smoking status, body-mass index, alcohol consumption, and physical activity. The histogram illustrates the distribution of 12-month $PM_{2.5}$ concentrations.