Supplementary Material

The rationale of using $PM_{2.5}$, O_3, NO_2, and SO_2 to construct the air quality health index (AQHI):

Similar to previous studies in Guangzhou Province (*1*) and New York City (*2*), the air pollutants in the AQHI included $PM_{2.5}$, O_3, NO_2, and SO_2. In Hong Kong, China, the developed AQHI were based on the health effects of PM_{10}, O_3, SO_2 (*3*), and NO_2. While in Canada, the established AQHI were based on the health effects of $PM_{2.5}$, O_3, and NO_2 (*4*). The inclusion of O_3 and NO_2 is not controversial. Considering the collinearity of $PM_{2.5}$ and PM_{10}, and the health hazard differences between them, $PM_{2.5}$ was chosen in our calculations. SO_2 was included by considering the pollution types in different regions of China. Several studies revealed that SO_2 was strongly associated with total mortality risk (*5–6*). SO_2 pollution mainly comes from the combustion of sulfur-containing fossil fuels (*7*). Notably, China is a country with massive coal production and consumption (*8*). According to the Bulletin of China's Ecological Environment 2018, the yearly average concentration of SO_2 in the Fen-Wei Plains was 24 μg/m^3 in 2018 (*9*). According to our data in 2013–2018 (Supplementary Table S1), more than 25% of daily average concentration of county was higher than 26 μg/m^3. Therefore, the health risk of SO_2 pollution in China still needs to be considered.

SUPPLEMENTARY TABLE S1. Frequency distribution of air quality health index (AQHI) in 36 cities[*] of China, 2013–2018.

City	Level	Frequency	Distribution
Xiamen	[1,3]	1,381	68.64%
	(3,6]	609	30.27%
	(6,10]	22	1.09%
	(10,10+]	0	0%
Shenzhen	(1,3]	1,345	66.68%
	(3,6]	657	32.57%
	(6,10]	15	0.74%
	(10,10+]	0	0%
Dalian	(1,3]	959	47.62%
	(3,6]	968	48.06%
	(6,10]	84	4.17%
	(10,10+]	3	0.15%
Qingdao	(1,3]	705	34.88%
	(3,6]	1,183	58.54%
	(6,10]	121	5.59%
	(10,10+]	12	0.59%
Ningbo	(1,3]	748	37.12%
	(3,6]	1,172	58.16%
	(6,10]	92	4.57%
	(10,10+]	3	0.15%
Beijing	(1,3]	628	31.99%
	(3,6]	1,076	54.81%
	(6,10]	227	11.56%
	(10,10+]	32	1.63%
Shanghai	(1,3]	539	26.74%
	(3,6]	1,321	65.53%
	(6,10]	148	7.34%
	(10,10+]	8	0.40%

Continued

City	Level	Frequency	Distribution
Tianjin	(1,3]	398	19.77%
	(3,6]	1,234	61.30%
	(6,10]	317	15.75%
	(10,10+]	64	3.18%
Chongqing	(1,3]	704	34.90%
	(3,6]	1,273	63.11%
	(6,10]	40	1.98%
	(10,10+]	0	0%
Hefei	(1,3]	720	35.80%
	(3,6]	1,206	59.97%
	(6,10]	85	4.23%
	(10,10+]	0	0%
Fuzhou	(1,3]	1,502	74.58%
	(3,6]	508	25.22%
	(6,10]	4	0.20%
	(10,10+]	0	0%
Lanzhou	(1,3]	484	24.02%
	(3,6]	1,377	68.34%
	(6,10]	153	7.59%
	(10,10+]	1	0.05%
Guangzhou	(1,3]	798	39.62%
	(3,6]	1,086	53.92%
	(6,10]	125	6.21%
	(10,10+]	5	0.25%
Guilin	(1,3]	1,121	66.33%
	(3,6]	542	32.07%
	(6,10]	25	1.48%
	(10,10+]	2	0.12%
Guiyang	(1,3]	1375	68.24%
	(3,6]	603	29.93%
	(6,10]	37	1.84%
	(10,10+]	0	0%
Haikou	(1,3]	1,948	96.72%
	(3,6]	66	3.28%
	(6,10]	0	0%
	(10,10+]	0	0%
Shijiazhuang	(1,3]	250	12.39%
	(3,6]	1,113	55.18%
	(6,10]	463	22.95%
	(10,10+]	191	9.47%
Zhengzhou	(1,3]	1,345	66.68%
	(3,6]	657	32.57%
	(6,10]	15	0.74%
	(10,10+]	0	0%

Continued

City	Level	Frequency	Distribution
Harbin	(1,3]	789	39.12%
	(3,6]	882	43.73%
	(6,10]	264	13.09%
	(10,10+]	82	4.07%
Wuhan	(1,3]	493	24.52%
	(3,6]	1,198	59.57%
	(6,10]	293	14.57%
	(10,10+]	27	1.34%
Changsha	(1,3]	818	40.62%
	(3,6]	1,050	52.14%
	(6,10]	146	7.25%
	(10,10+]	0	0%
Changchun	(1,3]	660	32.77%
	(3,6]	1,126	55.91%
	(6,10]	212	10.53%
	(10,10+]	16	0.79%
Nanjing	(1,3]	438	21.73%
	(3,6]	1,339	66.42%
	(6,10]	228	11.31%
	(10,10+]	11	0.55%
Nanchang	(1,3]	973	48.31%
	(3,6]	963	47.82%
	(6,10]	75	3.72%
	(10,10+]	3	0.15%
Shenyang	(1,3]	402	20.00%
	(3,6]	1,181	58.76%
	(6,10]	324	16.12%
	(10,10+]	103	5.12%
Hohhot	(1,3]	538	26.74%
	(3,6]	1,229	61.08%
	(6,10]	237	11.78%
	(10,10+]	8	0.40%
Yinchuan	(1,3]	530	26.38%
	(3,6]	1,108	55.15%
	(6,10]	315	15.68%
	(10,10+]	56	2.79%
Xining	(1,3]	553	27.43%
	(3,6]	1,404	69.64%
	(6,10]	59	2.93%
	(10,10+]	0	0%
Jinan	(1,3]	133	6.58%
	(3,6]	1,385	68.50%
	(6,10]	421	20.82%
	(10,10+]	83	4.10%

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City	Level	Frequency	Distribution
Taiyuan	(1,3]	320	15.90%
	(3,6]	1,198	59.54%
	(6,10]	399	19.83%
	(10,10+]	95	4.72%
Xi'an	(1,3]	365	18.13%
	(3,6]	1,344	66.77%
	(6,10]	264	13.11%
	(10,10+]	40	1.99%
Chengdu	(1,3]	387	19.22%
	(3,6]	1,422	70.61%
	(6,10]	198	9.83%
	(10,10+]	7	0.35%
Lhasa	(1,3]	1,792	88.98%
	(3,6]	222	11.02%
	(6,10]	0	0%
	(10,10+]	0	0%
Urumchi	(1,3]	530	26.36%
	(3,6]	1,161	57.73%
	(6,10]	292	14.52%
	(10,10+]	28	1.39%
Kunming	(1,3]	1,255	62.31%
	(3,6]	755	37.49%
	(6,10]	4	0.20%
	(10,10+]	0	0%
Hangzhou	(1,3]	709	35.19%
	(3,6]	1,228	60.94%
	(6,10]	76	3.77%
	(10,10+]	2	0.10%

Note: 36 cities reffer to all municipalities directly under the central government, cities specifically designated in the state plan, and provincial-level capitals.

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