Supplement Materials

Table S1. Urban population baseline mortality (y0, $\times 10^5$) for chronic obstructive pulmonary disease (COPD), lung cancer (LC), ischemic heart disease (IHD) and cerebrovascular disease (CEVD) for different age groups in 2015.

Urban	COPD		LC		IHD		CEVD	
Age	Male	Female	Male	Female	Male	Female	Male	Female
25-29	0.26	0.31	0.68	0.37	3.09	0.84	2.83	1.12
30-34	0.7	0.51	1.54	1.13	6.45	1.92	6.45	1.63
35-39	0.63	0.55	3.67	2.46	9.86	2.4	11.51	2.75
40-44	2.32	0.97	10.38	5.22	22.02	5.88	24.7	9.24
45-49	4.1	2.04	18.54	9.69	30.64	8.93	36.63	12.95
50-54	12.19	5.38	61.6	23.68	81.45	23.29	96.66	37.03
55-59	22.98	7.42	89.5	29.25	85.65	28.83	113.81	43.12
60-64	62.94	25.81	193.75	63.34	174.26	77.3	223.63	111.98
65-69	145.98	62.81	304.67	103.97	287.73	165.03	422.41	237
70-74	307.15	154.49	398.22	146.14	464.56	330.84	701.41	439.11
75-79	587.8	317.19	497.12	234.06	850.52	697.68	1213.84	853.12
80-84	1269.95	765.45	726.66	335.47	1843.33	1681.13	2267.13	1820.92
85+	2984.57	1898.16	909.96	409.87	4825.13	4837.97	4428.88	3907.41

Table S2. Urban population baseline mortality (y0, $\times 10^5$) for chronic obstructive pulmonary disease (COPD), lung cancer (LC), ischemic heart disease (IHD) and cerebrovascular disease (CEVD) for different age groups in 2016.

Urban	COPD		LC		IHD		CEVD	
Age	Male	Female	Male	Female	Male	Female	Male	Female
25-29	0.18	0.17	0.56	0.43	3.03	0.66	2.83	1
30-34	0.65	0.38	1.89	1.06	7.3	1.43	6.1	1.91
35-39	0.73	0.47	3.18	1.95	9.59	2.37	10.24	2.84
40-44	2.25	1.47	7.99	5.09	20.64	4.74	22.09	6.89
45-49	3.73	1.83	16.6	8.48	32.77	8.91	35.25	13.56
50-54	14.66	5.84	63	24.46	86.87	25.4	99.73	36.41
55-59	19.02	6.32	85.06	25.05	85.87	26.24	103.8	38.59
60-64	62.18	27.31	207.46	69.16	189.17	83.61	236.41	112.5
65-69	126.73	57.36	289.3	98.56	291.33	168.57	410.96	219.36
70-74	258.45	122.73	354.93	126.47	444.17	300.39	634.07	379.64
75-79	485.72	253.83	434.26	194.64	751.99	631.84	1038.71	721.68
80-84	1078.78	662.35	650.82	316.1	1753.91	1644.13	2122.02	1716.53
85+	2707.67	1795.82	880.44	421.59	4911.68	4963.56	4502.7	3990.78

Table S3. Urban population baseline mortality (y0, $\times 10^5$) for chronic obstructive pulmonary disease (COPD), lung cancer (LC), ischemic heart disease (IHD) and cerebrovascular disease (CEVD) for different age groups in 2017.

Urban	COPD		LC		IHD		CEVD	
age	Male	Female	Male	Female	Male	Female	Male	Female
25-29	0.14	0.39	1.04	0.34	3.2	0.96	2.74	1.06
30-34	0.47	0.46	1.79	0.92	6.33	2.19	6.42	2.23
35-39	0.94	0.45	2.92	1.87	10.37	2.78	11.36	2.89
40-44	1.6	0.81	7.97	5.06	19.6	5.54	20.8	5.82
45-49	3.35	1.88	15.57	8.63	33.91	9.59	34.85	12.03
50-54	12.75	5.94	63.7	25.06	90.31	24.77	99.67	40.38
55-59	16.28	5.4	76.96	23.37	83.23	26.95	95.77	34.14
60-64	62.15	21.67	208.75	66.89	188.63	82.5	244.33	110.58
65-69	125.92	51.4	307.8	106.73	299.74	171.64	417.85	223.1
70-74	248.64	103.98	357.02	128.39	424.53	299.31	626.91	377.52
75-79	446.63	224.39	445.1	182.68	733.66	599.93	1024.63	703.8
80-84	1020.86	595.66	641.55	315.38	1736.21	1639.08	2026.27	1712.45
85+	2717.04	1714.34	885.37	445.66	5062.6	5130.75	4479.7	4006.03

Table S4. Population age distribution data for China in three years.

Age	2015 (%)			2016 (%)			2017 (%)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
25-29	9.35	4.73	4.62	9.21	4.68	4.53	8.79	4.49	4.3
30-34	7.38	3.73	3.65	7.56	3.81	3.76	7.77	3.9	3.86
35-39	7.07	3.61	3.47	6.95	3.54	3.41	7.21	3.66	3.55
40-44	8.56	4.37	4.19	8.18	4.17	4.01	7.66	3.91	3.75
45-49	9.01	4.58	4.43	9.03	4.59	4.44	9.21	4.69	4.52
50-54	7.58	3.84	3.74	8.43	4.27	4.16	8.45	4.28	4.17
55-59	5.6	2.85	2.75	5.15	2.61	2.54	5.22	2.64	2.58
60-64	5.68	2.84	2.85	5.85	2.92	2.93	5.94	2.97	2.97
65-69	3.99	1.99	2	4.18	2.06	2.12	4.5	2.21	2.29
70-74	2.64	1.3	1.35	2.74	1.34	1.39	2.85	1.38	1.47
75-79	1.93	0.92	1.01	1.94	0.93	1.01	1.97	0.94	1.03
80-84	1.19	0.52	0.66	1.24	0.56	0.68	1.28	0.58	0.7
85-89	0.52	0.21	0.31	0.55	0.23	0.33	0.58	0.24	0.34
90-94	0.16	0.06	0.1	0.16	0.05	0.11	0.17	0.06	0.11
95+	0.03	0.01	0.02	0.04	0.01	0.02	0.04	0.01	0.03

Table S5. Annual and seasonal average fine particulate matter ($PM_{2.5}$) concentrations during the study period ($\mu g/m^3$, mean ± SD, calculated from daily values).

	Annual Mean	Spring	Summer	Fall	Winter
2015	87±64	77±41	65±27	68±65	117±92
2016	95±89	65±40	46±29	116±74	191±125
2017	82±63	66±38	53±18	74±35	97±64
Average	87±73	69±40	55±26	85±64	136±105

Table S6. The relative risk and 95% CI from chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD), lung cancer (LC) and cerebrovascular disease (CEVD) due to exposure of ambient $PM_{2.5}$ in 2015-2017 and under target scenarios.

	$PM_{2.5}$	RR			
	($\mu g/m^3$)	COPD	IHD	LC	CEVD
2015	86.53	1.33(1.16,1.53)	1.46(1.28,1.98)	1.47(1.13,1.73)	1.90(1.21,2.34)
2016	94.51	1.36(1.17,1.56)	1.47(1.29,2.01)	1.50(1.15,1.78)	1.92(1.22,2.35)
2017	81.82	1.32(1.15,1.51)	1.45(1.28,1.96)	1.45(1.13,1.71)	1.89(1.21,2.34)
IT-1	35.00	1.17(1.06,1.28)	1.30(1.19,1.52)	1.22(1.05,1.37)	1.51(1.13,1.86)
IT-2	25.00	1.12(1.04,1.22)	1.25(1.16,1.38)	1.16(1.03,1.28)	1.33(1.10,1.68)
IT-3	15.00	1.07(1.02,1.14)	1.17(1.11,1.25)	1.09(1.01,1.16)	1.12(1.06,1.20)
US AAQS	12.00	1.05(1.01,1.10)	1.14(1.07,1.21)	1.06(1.01,1.12)	1.07(1.02,1.14)
AQG	10.00	1.03(1.01,1.08)	1.11(1.04,1.19)	1.04(1.00,1.09)	1.04(1.00,1.11)

Table S7. The attributable fractions and 95% CI from chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD), lung cancer (LC) and cerebrovascular disease (CEVD) due to $PM_{2.5}$ exposure in 2015-2017 and under target scenarios.

	$PM_{2.5}$($\mu g/m^3$)	Attributable fractions (AF_S) (%)			
		COPD	IHD	LC	CEVD
2015year	86.53	25(13,35)	31(22,49)	32(12,42)	47(18,57)
2016year	94.51	26(14,36)	32(23,50)	33(13,44)	48(18,58)
2017year	81.82	24(13,34)	31(22,49)	31(11,41)	47(17,57)
IT-1	35.00	14(6,22)	23(16,34)	18(4,27)	34(11,46)
IT-2	25.00	11(4,18)	20(14,27)	14(3,22)	25(9,40)
IT-3	15.00	7(2,12)	15(10,20)	8(1,14)	11(5,16)
US AAQS	12.00	5(1,9)	12(7,18)	6(1,11)	6(2,12)
AQG	10.00	3(1,7)	10(4,16)	4(0,8)	4(0,10)

Table S8. Compared different methods of years of life lost (YLL)(years) and Disability-adjusted life-years (DALYs) (years) from this study and other studies. (Shijiazhuang: SJZ).

	DALYs/ 100000	YLL per person	YLL_{Toatl}	YLL_T/1000	Population (million)	[$PM_{2.5}$] ($\mu g/m^{-3}$)
Guo et al. (2018) [1]		2			8.10(Delhi)	120
Nie et al. (2018)[2]			98802(2014)	12.02	8.22(Nanjing)	71
			87647(2015)	10.65	8.27(Nanjing)	55
Ghude et al. (2016)[3]		3.4±1.1			1.2×10^3(India)	~60
		6.3±2.0			-(Delhi)	-
Cohen et al. (2017)[4]	1478.6				1.371×10^3(China)	58.4
	2922.1				1.31×10^3(India)	74.3
	1081.1				0.258×10^3(Indonesia)	15.4
	337.1				0.321×10^3(USA)	8.4
	573.7				0.2041×10^3(Brazil)	11.4
This study[1]		5.1 (2015)	25666(2015)		4.70×10^{-3}(SJZ)	86
		5.3 (2016)	26918(2016)		4.79×10^{-3}(SJZ)	94
		5.3 (2017)	27049(2017)		4.74×10^{-3}(SJZ)	82
This study[2]			47001(2015)	16.20	2.90(SJZ)	86
			47880(2016)	16.20	2.96(SJZ)	94
			47381(2017)	15.86	2.98(SJZ)	82
This study[3]		5.2±1.7(2015)			-	86
		5.7±1.9(2016)			-	94
		5.0±1.6(2017)			-	82

[1] YLL is usually calculated as a summation of the number of deaths at each age group multiplied by the number of years remaining; YLL per person is calculated by dividing the total YLL by the premature mortality.

[2] The YLL can be calculated by The DALY calculation template provided by the WHO, the YLL per 1000 people can be calculated by dividing the total YLL by the total population, then multiplying by 1000.

[3]YLL was calculated based on the linear relationship assumption that an increase of 1 $\mu g/m^3$ in $PM_{2.5}$ exposure decreases mean life expectancy by about 0.061±0.02 years. The linearity assumption between YLL and $PM_{2.5}$ concentration may introduce additional uncertainties to their result.

[4]Disability-adjusted life-years (DALYs) is calculated by summing years of life lost (YLLs) and years of life lived with disability (YLDs).

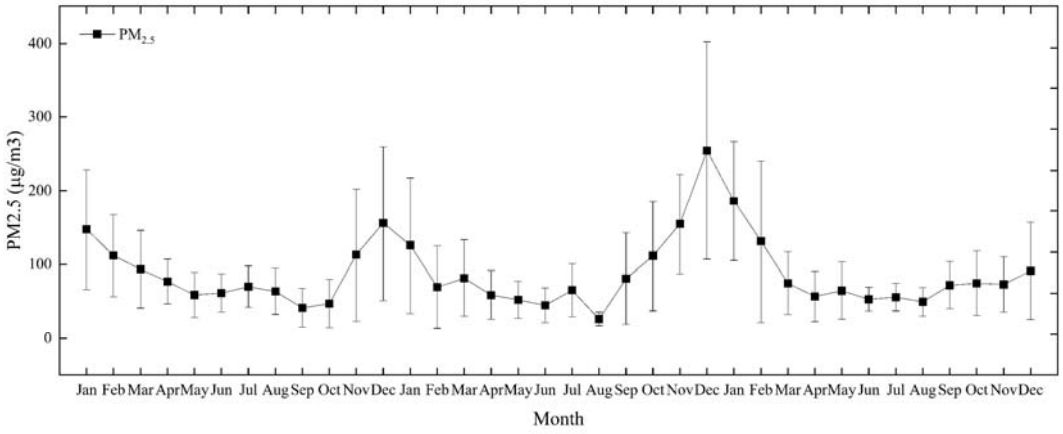

Fig. S1 Monthly variation of $PM_{2.5}$ concentrations in 2015-2017.

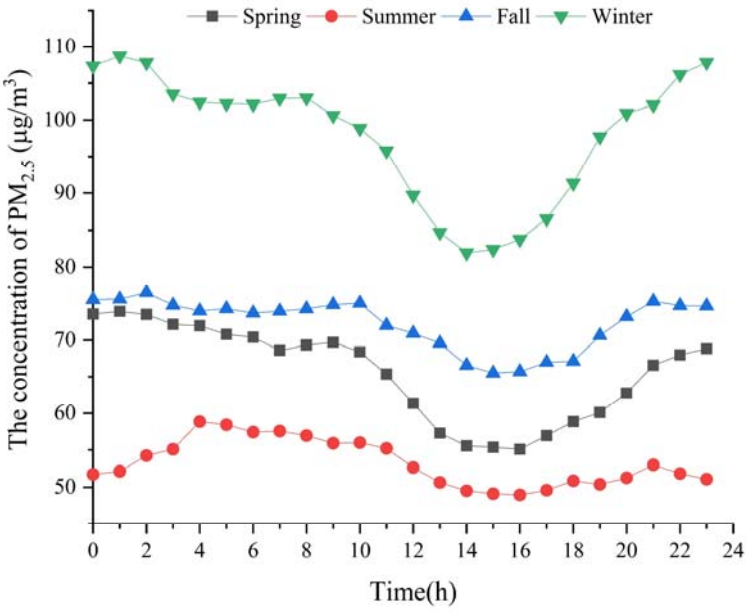

Fig. S2 Diurnal variation of hourly $PM_{2.5}$ concentrations in 2017.

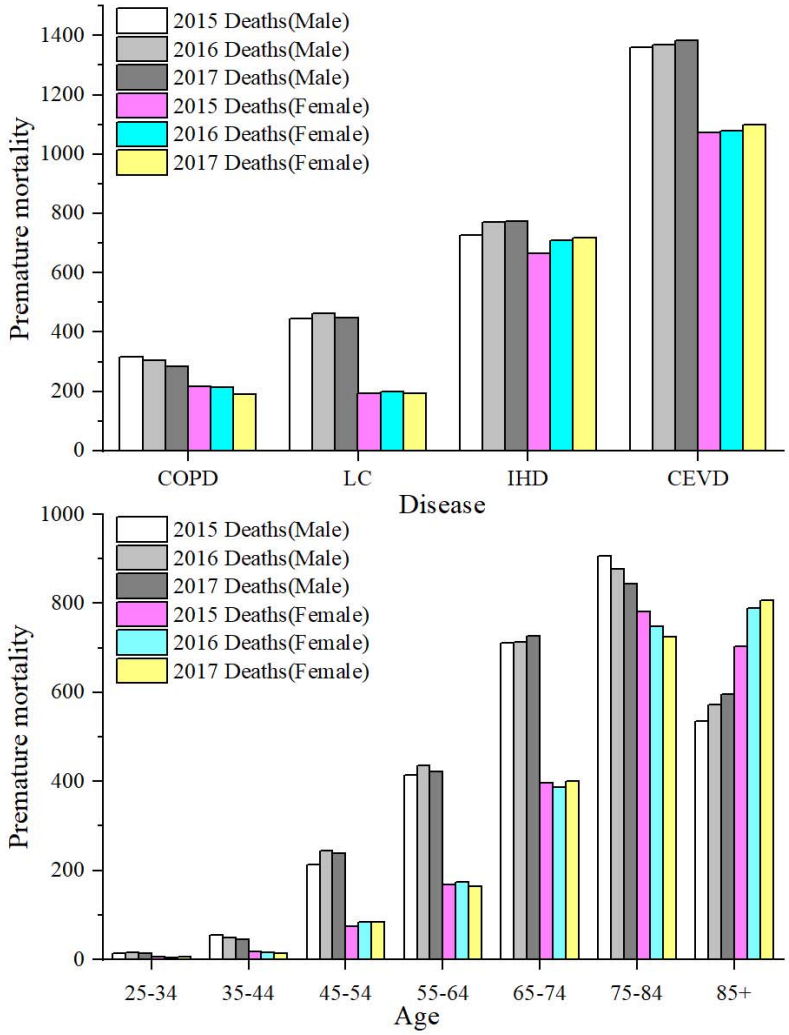

Fig. S3 Premature mortality attributable to $PM_{2.5}$ in Shijiazhuang among 2015-2017.

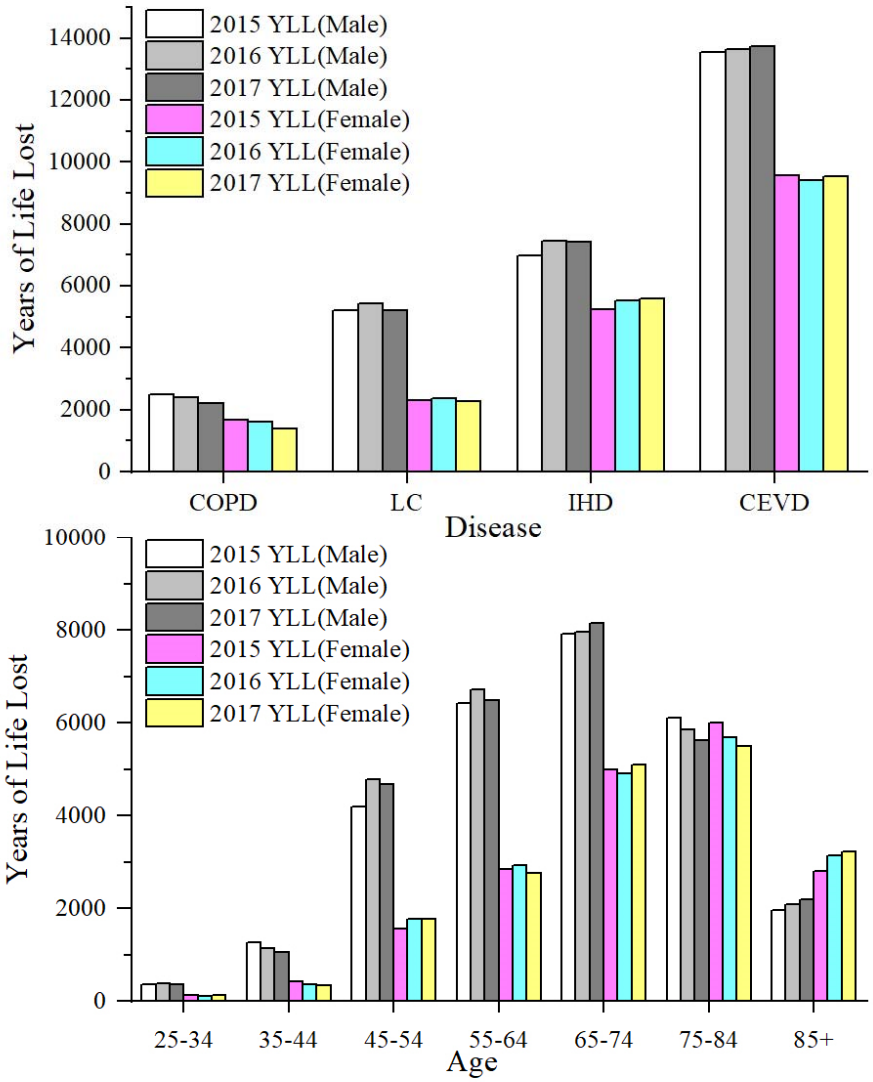

Fig. S4 Years of life lost attributable to $PM_{2.5}$ in Shijiazhuang in 2015-2017.

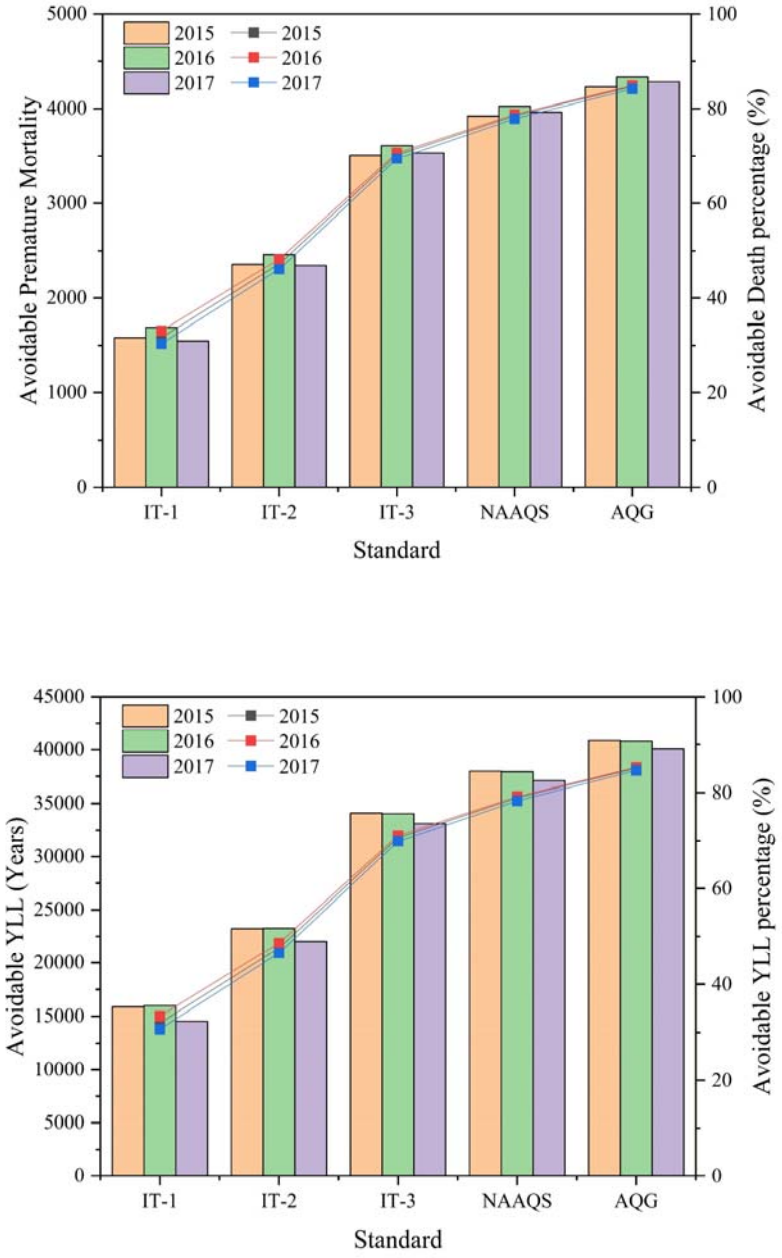

Fig. S5 Potentially avoidable premature mortalities (and YLL) and the relative percentage from reducing $PM_{2.5}$ concentration to five reduction scenarios, that is the WHO three interim targets (ITs), US NAAQS and Air Quality Guidelines (AQG).