

**eTable 1.** Descriptive data on the study period, total non-accidental death, and environmental factors for 100 Japanese cities

Prefecture	City	Region	2015 Population Census		Study period	Total non-accidental death (ICD-10 A00-R99)	Days	Frequency of days with daily mean $\geq 25 \mu\text{g}/\text{m}^3$	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )					Coarse PM ( $\mu\text{g}/\text{m}^3$ )		O <sub>3</sub> (ppb)		NO <sub>2</sub> (ppb)		SO <sub>2</sub> (ppb)		Ambient temperature (°C)		Relative humidity (%)		
			Population	Area (km <sup>2</sup> )					Mean	SD	25 <sup>th</sup> percentile	Median	75 <sup>th</sup> percentile	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean
1	Hokkaido	Sapporo	East	1952356	1121.3	4/12-3/15	39380	1091	2.2	8.0	6.1	4.2	6.8	10.2	4.0	2.6	41.5	11.4	10.1	7.6	0.8	1.0	9.6	9.8	70	11
2		Asahikawa	East	339605	747.7	4/12-3/15	10612	1088	7.2	13.3	8.6	8.1	11.3	15.6			11.7	10.4	0.8	0.8	7.6	11.0	7.6	9	76	9
3		Hakodate	East	265979	677.9	4/12-3/15	9406	1083	4.6	12.6	6.7	8.1	11.5	15.3			11.6	6.2	1.4	0.9	9.8	9.4	7.5	9	76	9
4	Aomori	Aomori	East	287648	824.6	4/13-3/15	6131	724	5.5	11.9	7.1	7.5	10.3	14.4	4.2	4.8			7.8	5.2			10.9	9.4	7.6	10
5		Hachinohe	East	231257	305.5	4/12-3/15	6823	1087	5.9	12.3	7.4	7.0	10.7	15.6			8.5	4.2	2.8	1.9	10.6	9.0	7.6	12	10	11
6	Iwate	Morioka	East	297631	459.2	4/12-3/15	7424	1089	5.4	12.3	8.4	7.2	10.2	15.7			37.1	11.3			11.0	9.4	11.0	9.7	75	11
7		Sendai	East	1082159	786.3	4/12-3/15	21332	1081	5.6	11.7	7.6	6.3	10.3	15.7			38.3	11.5	10.7	5.4	0.5	0.5	13.0	8.6	71	13
8	Akita	Akita	East	315814	906.1	4/12-3/15	9295	1081	8.1	13.6	8.1	8.0	11.5	16.9	6.7	6.2	43.9	10.2	4.7	2.7	1.1	0.7	12.3	9.4	73	10
9	Yamagata	Yamagata	East	253832	381.3	4/12-3/15	7202	1088	6.7	12.5	8.0	6.8	10.8	16.6	2.5	3.6	41.1	12.5	10.3	6.6	1.2	0.8	12.1	9.7	74	11
10	Fukushima	Fukushima	East	294247	767.7	4/14-3/15	2801	363	5.8	11.3	6.9	6.0	10.4	14.9	7.9	2.5	38.9	12.2	9.6	5.8	0.7	0.5	13.5	8.1	69	12
11		Koriyama	East	335444	757.2	4/13-3/15	5551	726	6.3	12.0	7.4	6.7	10.5	15.1	3.7	2.5	41.8	12.6	9.6	4.9	1.3	0.5	12.0	8.9	73	13
12		Iwaki	East	350237	722.2	4/13-3/15	7385	722	8.2	12.3	8.1	6.5	10.3	15.5	8.8	4.4	40.0	12.2	8.8	4.9	2.7	2.5	13.8	7.6	72	15
13	Ibaraki	Mito	East	270783	217.3	4/12-3/15	6624	1084	5.1	12.2	7.0	7.1	10.6	15.5	4.2	4.7	43.2	13.6	7.6	3.2	0.6	0.4	14.3	8.3	73	14
14		Tsukuba-Tsuchiura	East	367767	406.6	4/12-3/15	7804	1038	12.9	15.9	9.0	9.8	14.2	19.8	8.6	4.4	41.0	15.0	11.0	6.2	0.6	0.5	14.5	8.6	72	14
15	Tochigi	Utsunomiya	East	518594	416.9	4/13-3/15	7985	729	8.0	13.5	7.5	8.0	12.4	17.3	3.9	3.9	46.0	17.1	10.3	5.3			14.4	8.8	67	14
16	Gunma	Maebashi	East	336154	311.6	4/12-3/15	9343	1065	14.0	15.3	9.1	8.3	14.4	20.8			49.1	16.8	8.0	4.0	1.5	0.7	15.2	8.8	60	14
17		Takasaki	East	370894	459.2	4/14-3/15	3360	360	14.4	15.7	9.8	8.8	13.5	20.4	6.1	6.0					1.1	0.4	15.2	8.8	60	14
18		Ota	East	219807	175.5	4/13-3/15	3453	701	11.1	15.0	8.4	8.7	13.6	19.7			47.2	18.4	12.4	6.6	1.9	0.7	15.2	8.8	60	14
19	Saitama	Saitama	East	1263979	217.4	4/13-3/15	16858	726	9.9	14.4	8.3	8.4	12.9	18.6	7.1	7.0	42.9	17.1	15.7	7.4	0.9	0.6	15.6	8.7	63	16
20		Tokorozawa	East	340386	72.1	4/12-3/15	6873	1084	7.2	14.1	7.4	8.8	13.2	17.8			44.9	17.4	13.6	6.0	0.6	0.5	15.6	8.7	63	16
21		Kawaguchi	East	578112	62.0	4/13-3/15	8140	722	13.3	14.9	9.6	8.1	12.4	19.3	4.6	6.4	41.2	16.8	20.7	9.1	2.0	1.2	15.6	8.7	63	16
22		Kawago	East	350745	109.1	4/14-3/15	2672	361	10.2	14.8	8.1	8.4	13.6	19.9			44.2	17.5	14.6	6.5	1.2	0.7	15.6	8.7	63	16
23		Koshigaya	East	337498	60.2	4/13-3/15	7210	1089	7.0	15.0	8.4	7.2	10.2	15.4	4.1	4.9	43.4	15.2	9.7	4.3	1.5	0.8	15.6	8.7	63	16
24	Chiba	Chiba	East	971882	271.8	4/12-3/15	20053	1089	14.0	15.2	10.5	7.8	12.6	20.0	10.2	5.9	40.5	15.2	11.9	6.4	1.8	1.1	16.4	7.9	65	16
25		Ichikawa	East	481732	57.5	4/12-3/15	8722	1028	14.0	15.2	9.9	8.5	13.4	19.5	5.7	5.5	41.3	16.7	16.6	8.9	1.2	1.0	16.4	7.9	65	16
26		Funabashi	East	622890	85.6	4/12-3/15	11970	1081	8.1	13.0	8.3	7.0	11.2	17.1			40.0	15.3	13.5	7.6	1.6	1.1	16.4	7.9	65	16
27		Matsudo	East	483480	61.4	4/12-3/15	10127	1084	9.4	13.7	8.8	7.5	11.8	17.8			37.1	15.0	17.9	8.3	1.1	0.9	16.4	7.9	65	16
28		Kashiwa	East	413954	114.7	4/12-3/15	7722	1060	8.4	13.5	8.2	7.7	12.0	17.7	4.3	5.2	44.1	16.6	14.2	7.8	3.5	1.2	16.4	7.9	65	16
29		Ichihara	East	274656	368.2	4/13-3/15	6364	722	15.2	14.5	9.2	8.2	12.0	19.0			40.0	15.3	13.2	7.2	1.9	1.5	16.7	7.9	65	16
30	Tokyo	Tokyo's 23 wards	East	9272740	626.7	4/12-3/15	199866	1073	15.9	17.0	9.0	10.5	15.4	21.2	3.8	3.7	35.4	14.6	22.9	9.3	2.0	1.1	16.8	8.2	62	16
31		Hachioji	East	577513	186.4	4/12-3/15	12788	1093	5.7	12.8	6.7	8.0	11.5	15.9			41.6	17.9	16.3	6.3	1.4	0.4	16.8	8.2	62	16
32		Machida	East	432348	71.8	4/12-3/15	8924	1073	9.6	14.7	7.8	9.2	13.3	18.5	5.2	4.3	45.4	18.9	14.1	6.5	1.7	0.6	16.8	8.2	62	16
33		Fuchu	East	260274	29.4	4/13-3/15	3318	710	11.0	15.0	8.1	9.0	13.7	18.8	5.4	4.2	44.3	19.1	17.3	7.5			16.8	8.2	62	16
34		Chofu	East	223061	21.6	4/13-3/15	2647	663	6.9	12.9	7.0	7.8	11.8	16.2	6.8	4.7	42.0	18.2	15.3	7.1			16.8	8.2	62	16
35		Nishitokyo	East	320012	15.8	4/13-3/15	3125	663	15.8	20.0	12.2	11.5	14.5	25.6	4.7	4.6	47.5	19.1	14.5	8.1	1.1	0.7	16.8	8.2	62	16
36	Kanagawa	Yokohama	East	3724844	437.5	4/12-3/15	78088	1083	11.3	14.7	8.9	8.4	12.8	18.5	10.7	6.3	38.2	15.7	18.2	8.4	4.0	3.1	16.4	7.8	66	16
37		Kawasaki	East	1475213	143.0	4/12-3/15	25624	1081	7.7	13.6	7.7	7.9	12.1	17.4	5.1	5.0	41.6	17.4	18.6	8.9	1.4	1.1	16.4	7.8	66	16
38		Yokosuka	East	406586	100.8	4/13-3/15	7990	708	9.2	14.7	8.4	8.8	12.8	18.3	6.5	6.1	43.6	16.3	14.8	8.2	2.6	1.4	16.4	7.8	66	16
39		Sagamihara	East	173612	253.7	4/12-3/15	14523	1083	9.4	13.8	8.9	7.5	12.0	18.1	7.1	4.1	42.3	17.2	16.0	6.7	2.9	1.1	16.4	7.8	66	16
40		Hiratsuka	East	173612	253.7	4/13-3/15	3942	703	8.5	14.7	7.6	9.8	13.3	18.0	6.9	4.6	41.4	17.2	14.2	7.2	0.9	0.7	16.4	7.8	66	16
41		Fujisawa	East	423804	69.6	4/12-3/15	6966	722	11.1	14.5	8.4	8.4	11.4	16.2	4.4	4.8	44.4	17.1	14.5	8.1	1.1	0.7	16.4	7.8	66	16
42		Yamato	East	232922	27.1	4/12-3/15	4612	1059	8.4	14.3	7.6	8.8	12.8	18.3	7.1	3.3	36.1	15.4	19.4	7.3	2.4	0.9	16.4	7.8	66	16
43		Atsugi	East	225714	93.8	4/14-3/15	1434	362	4.4	11.6	6.9	6.9	10.4	14.9	13.7	6.5	40.6	17.6	16.1	7.4	1.3	0.6	16.4	7.8	66	16
44	Niigata	Niigata	East	810157	726.5	4/12-3/15	21735	1074	7.7	12.7	8.0	7.3	11.1	16.0	8.3	3.8	44.8	11.3	8.6	4.2	1.5	0.9	14.0	9.0	72	10
45		Toyama	Central	418686	1241.8	4/12-3/15	11842	1095	5.9	10.7	7.7	5.6	9.2	14.3	3.1	3.8	44.2	12.2	8.3	6.1	0.9	0.5	14.5	9.2	74	12
46		Ishikawa	Central	465699	468.6	4/13-3/15	7601	719	7.9	12.7	7.8	7.5	10.9	15.7	4.7	4.4	44.5	13.4	9.7	4.3	1.4	1.6	15.1	9.0	70	11
47		Fukui	Central	265904	536.4	4/12-3/15	7199	1048	12.0	14.2	8.9	9.5	14.2	19.6	4.6	3.3	43.3	15.1	8.2	4.0	1.2	0.8	14.9	9.2	74	11
48		Nagano	Central	377598	834.8	4/12-3/15	10529	1063	4.8	11.7	7.1	6.5	10.6	15.7	3.6	3.7	44.9	14.4	5.8	4.6	3.5	1.6	12.3	9.8	72	11
49		Matsumoto	East	243293	978.5	4/12-3/15	6348	1071	3.1	11.0	6.5	6.0	9.9	15.0	4.9	4.8	40.3	12.8	9.4	6.2	3.4	0.9	12.3	9.6	66	12
50	Gifu	Gifu	Central	406735	203.6	4/12-3/15	11140	1052	7.3	13.1	8.1	7.3	11.9	17.1			45.3	15.3	9.3	3.9	0.7	0.7	16.2	8.9	65	13
51	Shizuoka	Shizuoka	East	704989	1411.9	4/13-3/15	8871	724	7.0	12.9	8.0	7.4	10.8	16.2	8.2	7.1	43.5	14.7	10.1	4.0	1.6	0.7	16.9	7.6	66	14
52		Hamanatsu	East	737980	1558.1	4/12-3/15	23486	1081	8.7	13.3	8.3	7.6														

**eTable 2.** Pearson's correlation coefficients among daily mean pollutant concentrations

	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	Coarse PM (µg/m <sup>3</sup> ) <sup>a</sup>	Ox (ppb) <sup>b</sup>	NO <sub>2</sub> (ppb)	SO <sub>2</sub> (ppb)
PM <sub>2.5</sub> , µg/m <sup>3</sup>	1				
Coarse PM, µg/m <sup>3a</sup>	0.33	1			
Ox, ppb <sup>b</sup>	0.37	0.09	1		
NO <sub>2</sub> , ppb	0.47	0.05	-0.20	1	
SO <sub>2</sub> , ppb	0.42	0.24	0.26	0.35	1

NO<sub>2</sub>, nitrogen dioxide; Ox, photochemical oxidants; PM, particulate matter; SO<sub>2</sub>, sulphur dioxide.

<sup>a</sup>Concentrations of coarse PM were calculated by subtracting PM<sub>2.5</sub> concentrations from those of suspended particulate matter.

<sup>b</sup>Daily maximum 8-h mean concentrations.

**eTable 3.** Pooled estimates for the association between coarse PM exposure and mortality in 77 Japanese cities, April 2012 to March 2015

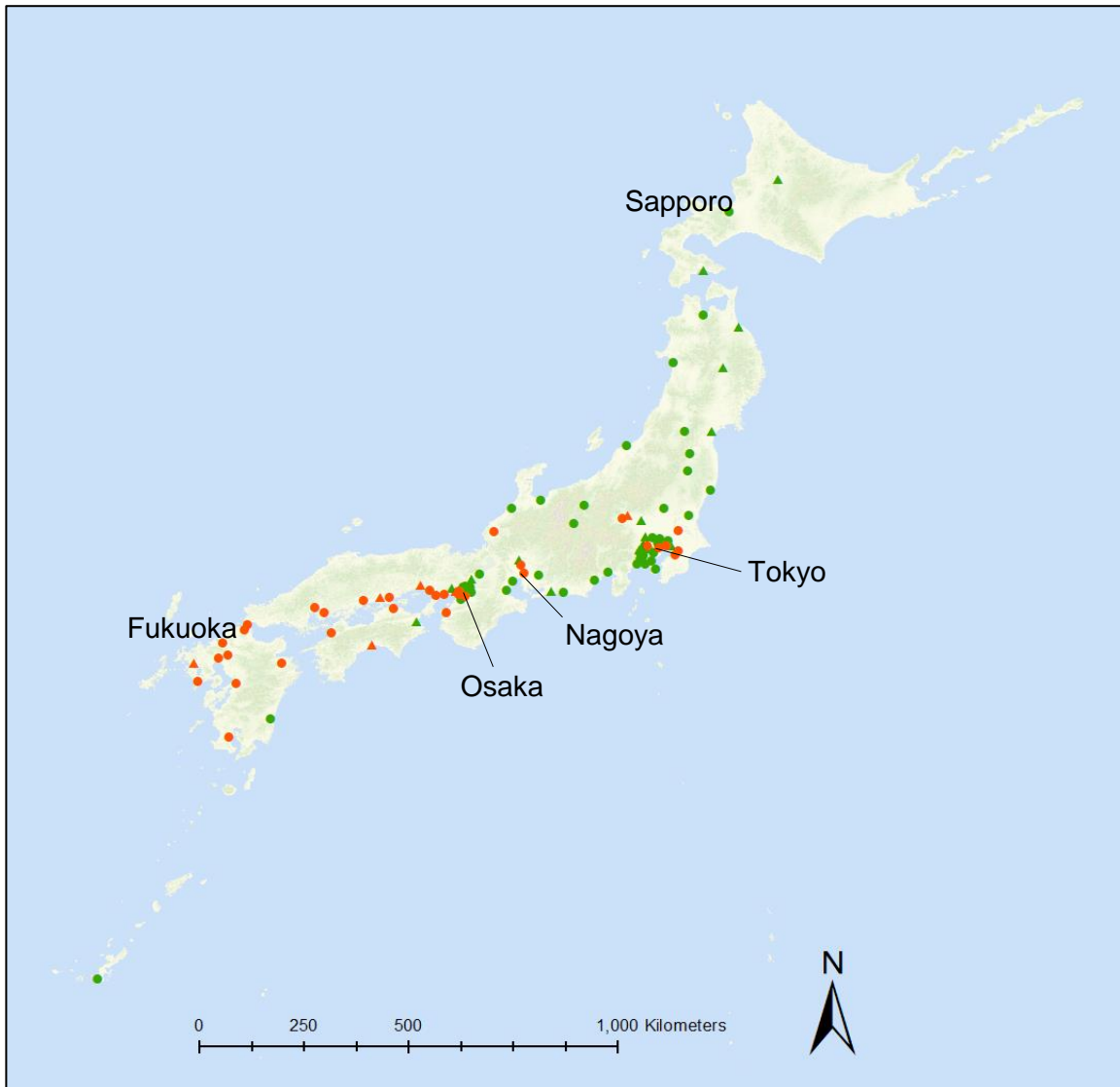
	Lag0-1		Lag2		Lag3	
	Percentage increase for 10 $\mu$ g/m <sup>3</sup> increase in coarse PM <sup>a,b</sup>	(95% CI)	Percentage increase for 10 $\mu$ g/m <sup>3</sup> increase in coarse PM <sup>a,b</sup>	(95% CI)	Percentage increase for 10 $\mu$ g/m <sup>3</sup> increase in coarse PM <sup>a,b</sup>	(95% CI)
Total non-accidental (ICD-10: A00-R99)	2.3	(1.4 to 3.3)	-1.4	(-2.2 to -0.7)	-0.9	(-1.6 to -0.2)
Cardiovascular disease (ICD-10: I00-99)	2.6	(0.7 to 4.4)	-0.9	(-2.4 to 0.5)	-0.5	(-1.8 to 0.8)
Coronary heart disease (ICD-10: I20-25)	3.8	(0 to 7.7)	0.2	(-3.7 to 4.2)	1.2	(-2.2 to 4.6)
Stroke (ICD-10: I60-69)	2.7	(-0.9 to 6.4)	-2.2	(-5.2 to 0.8)	-1.2	(-3.9 to 1.5)
Respiratory disease (ICD-10: J00-99)	1.4	(-0.8 to 3.7)	-2.3	(-4.5 to 0)	-0.8	(-2.7 to 1.1)

CI, confidence interval; ICD, international classification of diseases; PM, particulate matter.

<sup>a</sup>Concentrations of coarse PM were calculated by subtracting PM<sub>2.5</sub> concentrations from those of suspended particulate matter.

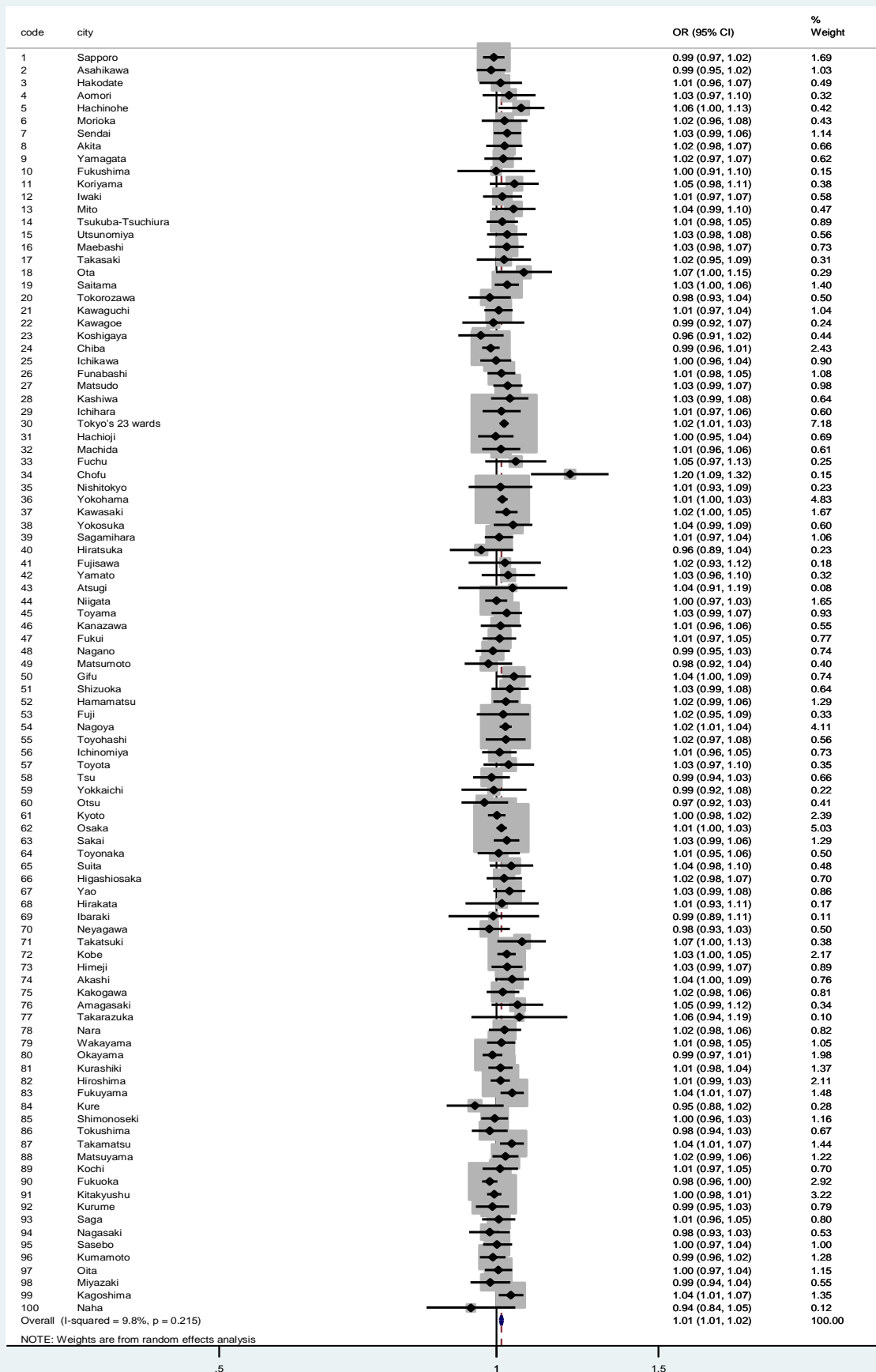
<sup>b</sup>Adjusted for coarse PM at lag0-1, lag2, and lag3 simultaneously, ambient temperature at lag0-1, relative humidity at lag0-1, and influenza epidemics.

**eFigure 1.** Location of monitoring stations in 100 Japanese cities

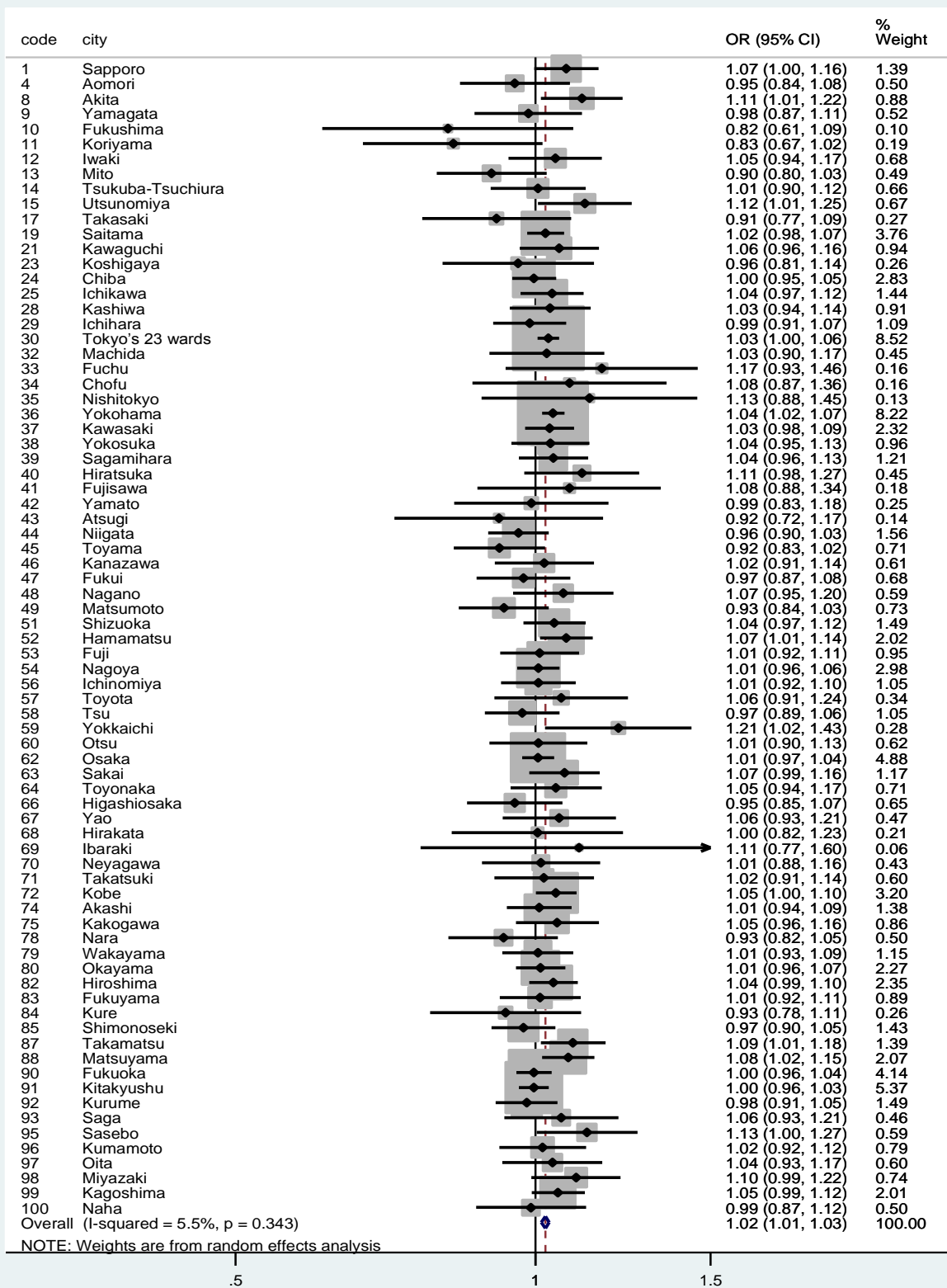


There are 77 cities included in the analysis of the coarse PM-mortality association (circle), and 23 cities not included (triangle). Green color means the average daily mean PM<sub>2.5</sub> concentration was  $\leq 15 \mu\text{g}/\text{m}^3$ , and orange color means that was  $> 15 \mu\text{g}/\text{m}^3$ .

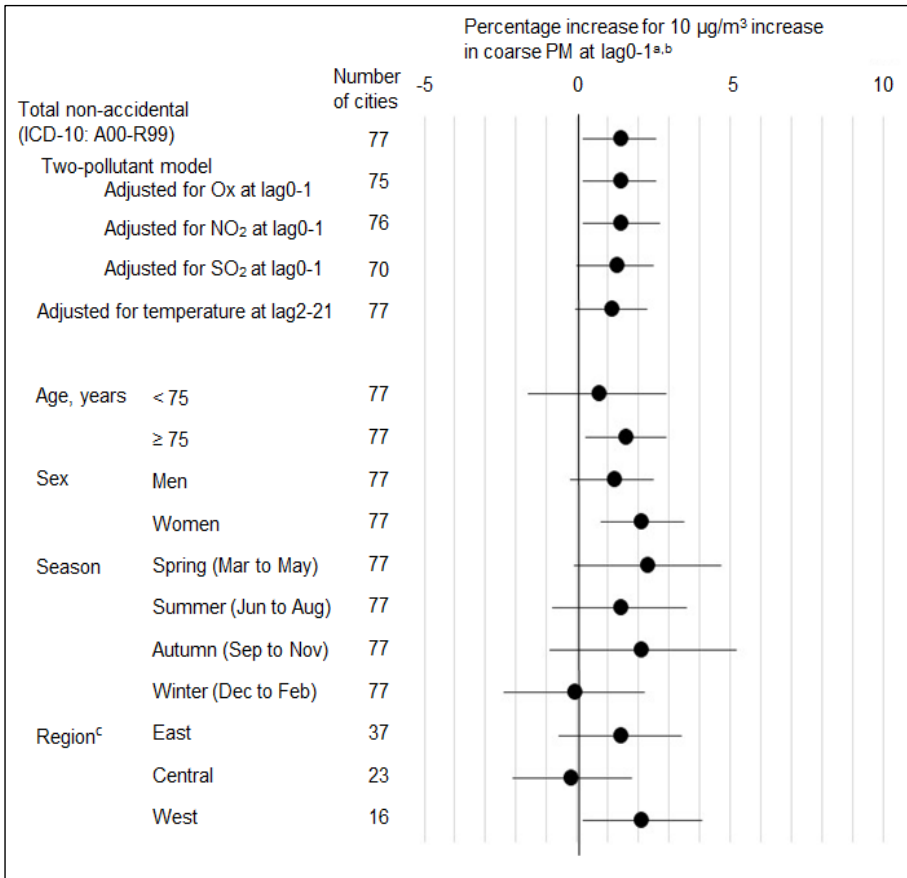
**eFigure 2.** City-specific odds ratios (ORs) of total non-accidental death with a 10  $\mu\text{g}/\text{m}^3$  increase in  $\text{PM}_{2.5}$  concentrations at lag0-1



**eFigure 3.** City-specific odds ratios (ORs) of total non-accidental death with a 10  $\mu\text{g}/\text{m}^3$  increase in coarse particulate matter concentrations at lag0-1



**eFigure 4.** Sensitivity and stratified analyses of the association between coarse PM exposure and total non-accidental mortality



CI, confidence interval; ICD, international classification of diseases; NO<sub>2</sub>, nitrogen dioxide; Ox, photochemical oxidants; PM, particulate matter; SO<sub>2</sub>, sulphur dioxide.

<sup>a</sup>Concentrations of coarse PM were calculated by subtracting PM<sub>2.5</sub> concentrations from those of suspended particulate matter.

<sup>b</sup>Adjusted for PM<sub>2.5</sub> at lag0-1, coarse PM at lag2, and lag3, ambient temperature at lag0-1, relative humidity at lag0-1, and influenza epidemics.

<sup>c</sup>See eTable 1.