Supplementary Materials

Excess mortality associated with high ozone exposure: A national cohort study in China

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Table S1. Estimates of HRs using converted metrics of O_3 concentrations

O_3 metrics	HR (95% CI)
6mDMA8	**1.179 (1.132–1.229)**
ADA24	1.090 (1.067–1.113)
ADMA8	1.153 (1.113–1.195)
ADMA1	1.189 (1.139–1.241)
6mDA24	1.104 (1.078–1.132)
6mDMA1	1.219 (1.161–1.281)

Notes: We used 6-month warm-season mean of daily maximum 8-h average (6mDMA8) as the ozone metric in our analyses and considered five metrics for conversion as (1) 6-month warm-season mean of 24-h daily average (6mDA24), (2) annual mean of daily maximum 8-h average (ADMA8), (3) annual mean of 24-h daily average (ADA24), (4) annual mean of daily maximum 1-h average (ADMA1), and (5) 6-month warm-season mean of daily maximum 1-h average (6mDMA1).

Table S2. Descriptive characteristics of air pollutants at participants' residential cities during 2011–2018 and spearman's rank correlation coefficients among the air pollutants.

Pollutants	Mean (SD)	Min.	Quartile			Max.	Correlation coefficients		
			P_{25}	P_{50}	P_{75}		O_3	$PM_{2.5}$	NO_2
O_3, μg/m^3	100.7 (14.8)	60.7	89.7	100.5	110.5	142.4	1		
$PM_{2.5}$, μg/m^3	52.0 (18.1)	16.1	38.1	49.7	64.1	102.4	0.57	1	
NO_2, μg/m^3	25.3 (11.3)	11.3	16.4	22.4	31.9	72.9	0.62	0.8	1

Abbreviation: SD, standard deviation; NO_2, nitrogen dioxide; $PM_{2.5}$, fine particulate matter; O_3, ozone.

Table S3. Sensitivity analysis for the association between long-term ozone exposure and all-cause mortality.

	Per 10 ug/m^3 Increase		***P*-value**
	HR	**95% CI**	
Single-pollutant			
Main analysis	1.179	1.132–1.229	<0.001
Excluding individuals with survive time <1 year	1.182	1.132–1.234	<0.001
Considering the clustering effect of cities	1.247	1.196–1.300	<0.001
Adjusting for province-level GDP	1.217	1.165–1.270	<0.001
Adjusting for variables based on DAG	1.181	1.134–1.230	<0.001
Using 1-year lag O_3 exposure	1.088	1.065–1.111	<0.001
Using 2-year lag O_3 exposure	1.025	1.003–1.048	<0.001
Co-pollutant			
Main analysis adjusting for $PM_{2.5}$	1.250	1.191–1.312	<0.001
Adjusting for NO_2	1.286	1.222–1.352	<0.001
Adjusting for $PM_{2.5}$ and NO_2	1.259	1.200–1.320	<0.001

Notes: Main analysis was stratified by gender and age, adjusted for demographic characteristics: educational level, married status, residence and region; behavioral factors: alcohol consumption, smoking status and social activity; health status: BMI, hypertension, diabetes, disability; and annual average temperature. Abbreviation: GDP, Gross Domestic Product; DAG, directed acyclic graph.

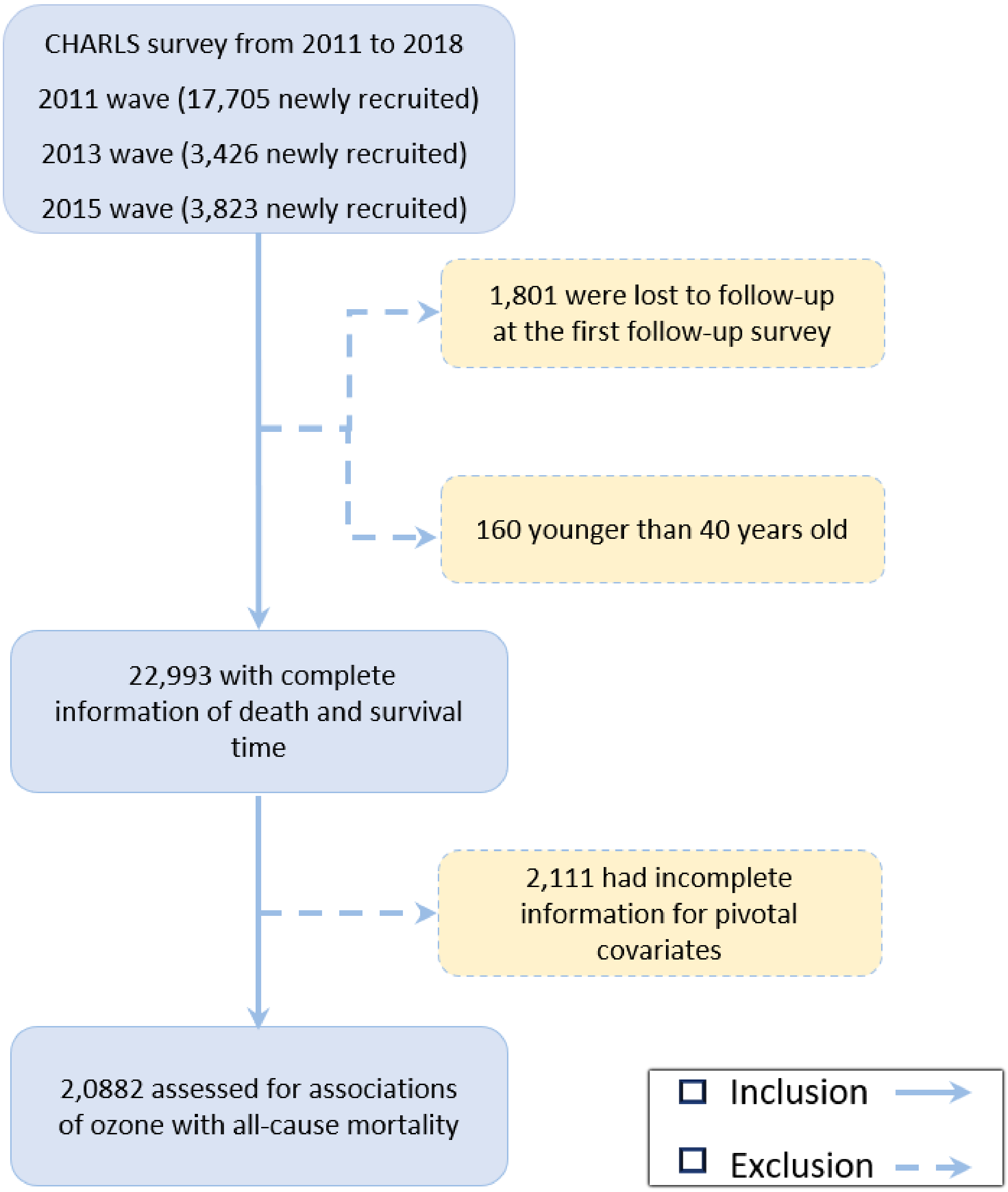

Figure S1. Flowchart of participant inclusion and exclusion.

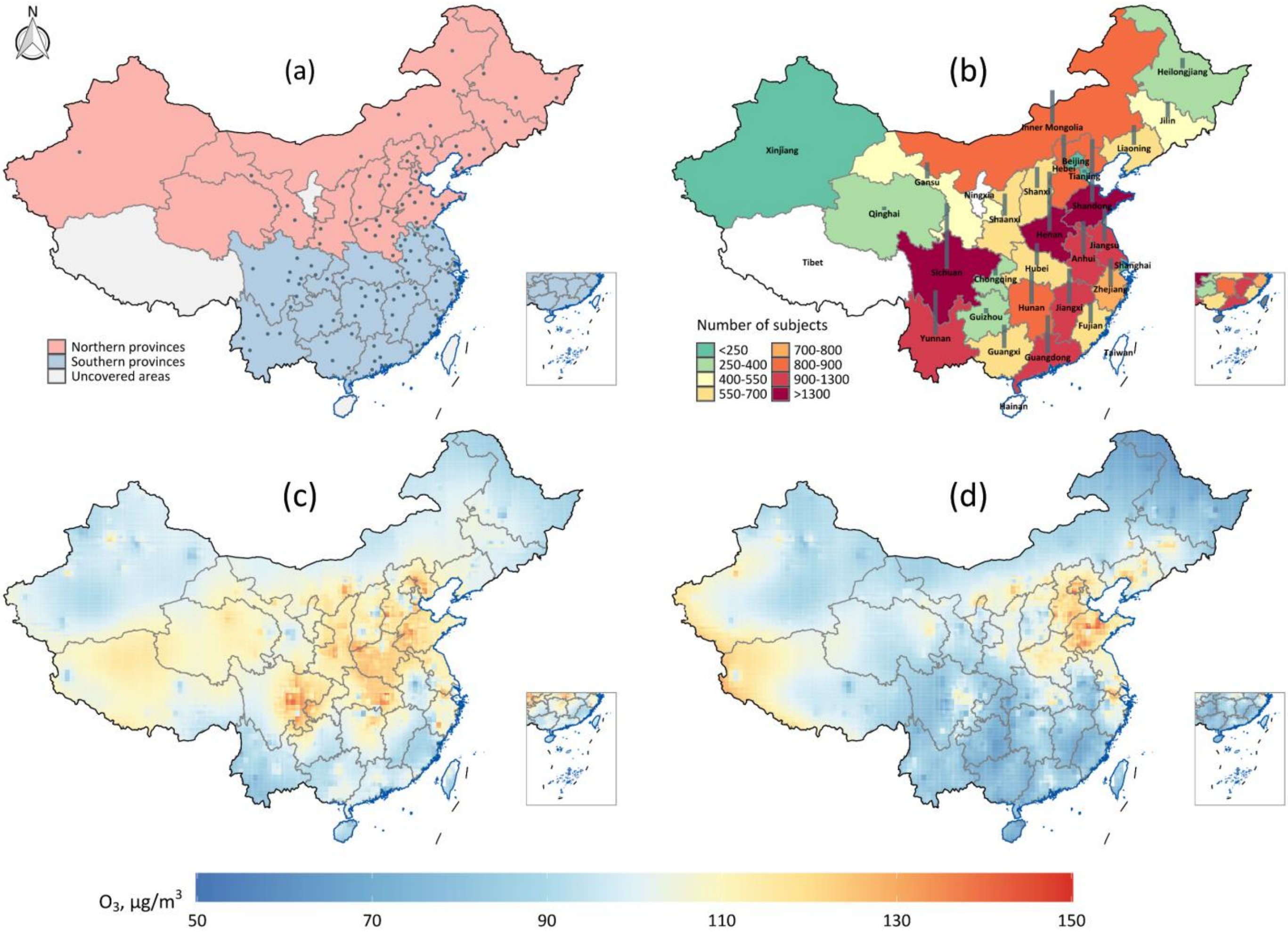

Figure S2. Distributions of survey cities and O_3 concentrations across China. (a) Geographical locations of 125 survey cities; (b) the number of participants by province; (c) annual warm-season O_3 concentration in 2011; (d) annual warm-season O_3 concentration in 2018.

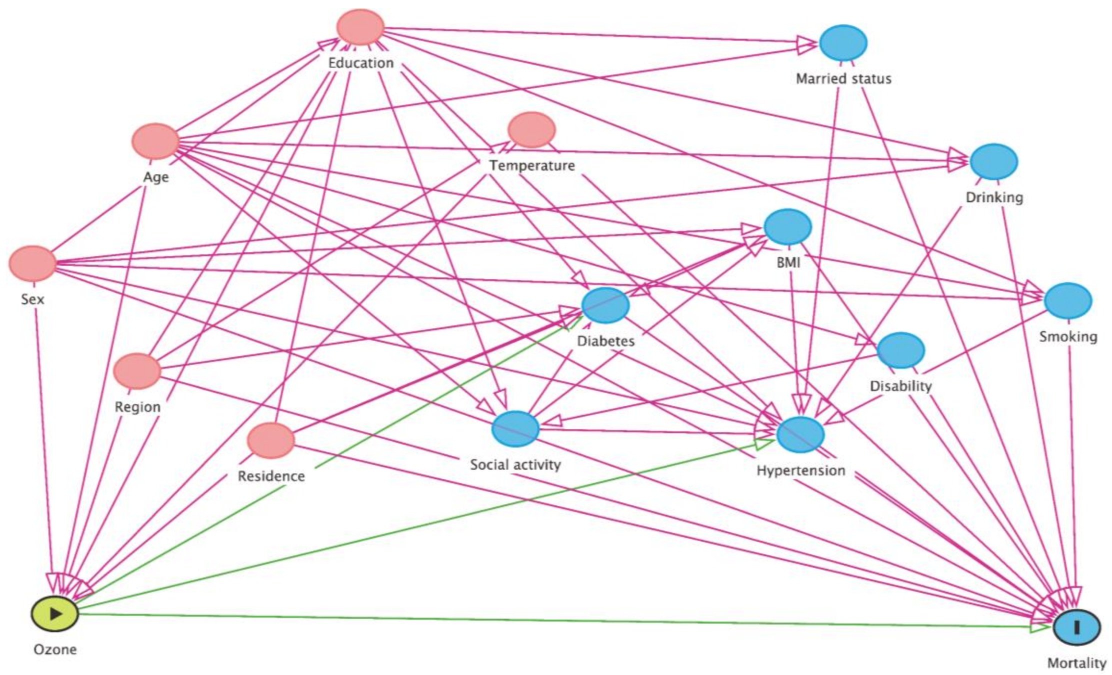

Figure S3. The directed acyclic graph for the association between long-term O_3 exposure and mortality. DAG was created by using the online DAGitty tool (http://www.dagitty.net/, accessed on October 21th, 2022), and used to identify a minimal adjustment set of variables. In this study, the minimal set included sex, age, education, temperature, residence and region.

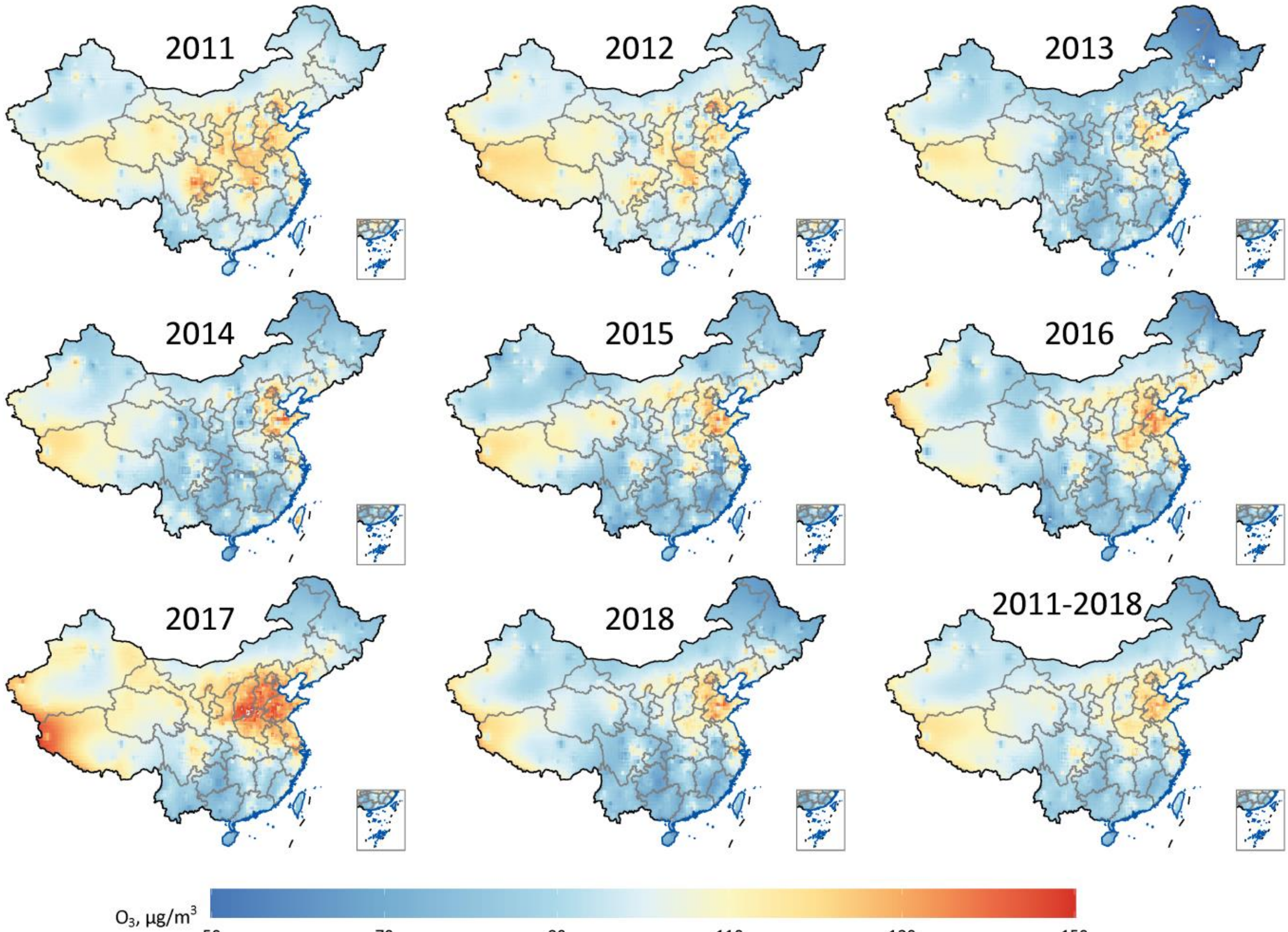

Figure S4. Annual average warm-season O_3 concentrations in China from 2011 to 2018.