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Supplementary appendix

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Supplemental Materials

Ambient air pollution (including PM_1) in relation to diabetes mellitus and glucose-homeostasis markers in China: a cross-sectional study with findings from the 33 Communities Chinese Health Study

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Supplementary methods: Explanation of the air pollution data (PM_{10}, SO_2, NO_2 and O_3)

The operation of the monitoring stations has strictly followed the quality assurance/quality control (QA/QC) procedure set by the State Environmental Protection Administration of China (SEPAC, 1992). The environmental monitoring centers in each of the three cities conducted regularly performance audits and precision checks on the air-monitoring equipment. Quarterly performance audits are conducted to assess data accuracy on PM_{10}, SO_2, NO_2, and O_3 monitoring systems.

1) The calculation method

   The calculation method is performed according to Chinese National standards (GB8170-87). The unit of monitored pollutants is mg/m^3 accurate to the third decimal (0·000). The units can also be expressed as $\mu g/m^3$, depending on the pollutant's concentration. For concentrations that were too low to be measured, half of the lowest checking limit of the equipment will be used as the measured value.

2) Outliers

   When the measured concentration is too low (e.g. background value), a negative value can be obtained because of the zero drift of the monitor. There is no physical meaning to this value. This negative value can be regarded as a value of "unable to measure."

   For the monitoring station with an automatic calibration system, if equipment zero drift/span drift exceeds the control range during the period of zero/span calibration, the data from the time it becomes out of control until the equipment is recovered should be regarded as invalid data. The data cannot be used statistically.

   The data during the period of zero calibration/span calibration should be regarded as invalid data. It cannot be used statistically, but a flag should be made on these data and the records stored as evidence.

   When values are missing because of a loss of power, any data received by the central control station during the period of the loss of power should be regarded as invalid data. The period of loss of power should be counted at the start of power outage until complete warm-up of equipment. The data cannot be used statistically.

   Because pollutant concentrations change over time and change slowly, there should be no swift change in pollutant concentration in the results of normal monitoring. Either a swift change or no change indicates that there is an equipment problem. The problem should be identified, and the data between the start of problem to recovery should be regarded as outliers. These data cannot be used statistically.

3) Statistics of monitoring data

   One time value

   The central control station uses an average of 15 minutes of pollutant concentrations measured at the branch station as a one-time value. The central control modifies this value and judge whether this value is an outlier using the report software.

   One hour mean value

   At least 75% of the one-time values should be used to calculate the one-hour average mean value. One-hour average mean value is calculated by averaging all the valid one-time values within one hour.

   Daily average mean

   For PM_{10} at least 12 valid hourly mean values are needed to calculate the daily mean value (using the calendar as the valid time frame), using all available valid hourly mean values. For SO_2 and NO_2 at least 18 hourly mean values everyday are needed to calculate valid daily mean value (using the calendar as the valid time frame). For O_3, at least six hourly concentrations of O_3 per day are needed for calculating the 8-hour average concentration of O_3. All of the valid hourly mean values are used to calculate the daily mean. (National Environmental Air Quality Standard GB3095-2012)

Monthly mean values are the arithmetic means of all valid daily mean values within the month. Seasonal mean values are the arithmetic means of all valid daily mean values within the season. Yearly mean values are the arithmetic means of all valid daily mean values within the year. District daily mean values are calculated using the monthly mean value, the seasonal mean value, and the yearly mean value from the available stations in the district.

Supplemental methods: Explanation of ground-monitored air pollution data (PM_1 and $PM_{2.5}$)

Ground-monitored PM_1 and $PM_{2.5}$ were obtained from the China Atmosphere Watch Network (CAWNET) of the China Meteorological Administration (CMA). The network consisted of 96 stations across mainland China. Concentrations of PM_1 and $PM_{2.5}$ at all stations were measured with GRIMM Aerosol Spectrometer (Model 1.108, Grimm Aerosol Technik GmbH, Ainring, Germany). Two quality-control procedures have been applied to all PM measurements: a "limit check" and "climatological check". For the limit check, we checked each valid PM measurement to determine whether it falls within its possible limits, otherwise, they will be removed. In the climatological check, the median and standard deviation (SD) of hourly PM measurements were calculated at each PM observational site. Any PM values lying outside of more than three SDs from the median PM have been removed.

Supplemental methods: Detailed information on two-level binary logistic regression model

At the participant level, we predicted the logit of the prevalence rate of diabetes as a function of k covariates (X_1 ….X_k) as follows:

$$\text{logit}\,[\text{Probability}\,(Y_{ij})] = \alpha j + \beta_1 X_{1ij} + \ldots. + \beta_k X_{1ij} + e_{ij} \qquad (1)$$

The variable (Y) in equation 1 is diabetes, the subscript j is for districts (j=1,…, 11) or communities (j=1…33), the subscript i is for adults (i=1,..n_j), αj are the intercepts at the district or community level, β_1 …β_k are the regression coefficients of covariates, and e_{ij} are the random errors, assumed to have means of zero and constant variance. The αj are random coefficients because they are assumed to vary across districts or communities.

At the district level, we regressed the district (or community)-specific intercepts α_j on the district (or community)-specific pollutant level (Z_j) to explain the variations of α_j, as follows:

$$\alpha j = \alpha + \gamma_1 Z_j + u_j \qquad (2)$$

Equation 2 predicts the prevalence rates in a district or community by Z_j. If γ_1 is positive then the districts (or communities) with higher pollutant levels have a higher prevalence rate of diabetes (adjusting for covariates). Conversely, if $\gamma 1$ is negative, then the prevalence rates are lower in districts (or communities) with a higher pollutant level (adjusting for covariates). The u-terms u_j are random errors at the district (or community) level, assumed to be independent and have mean of zero and constant variance. These random errors characterize the variation between districts and are assumed to be independent from e_{ij} at the participant level. Note that α, β_1,…, β_k, and γ_1 are not assumed to vary across districts or communities. Therefore, they have no subscript j to indicate to which district (or community) they belong; they are referred to as fixed effects given that they apply to all districts (or communities).

Substituting the equation 2 into equation 1 yields a single regression equation:

$$\text{logit}\,[P\,(Y_{ij})] = (\alpha + \gamma_1 Z_j + \beta_1 X_{1ij} + \ldots + \beta_k X_{kij}) + (u_j + e_{ij}) \qquad (3)$$

The terms in the first and second parentheses in equation 3 are often respectively called the fixed (or deterministic) and random (or stochastic) parts of the model.

***Table S1*: Annual average concentrations and pair wise correlations of air pollutants**

	Spearman correlation coefficients (p value)					
Exposure	**$PM_{1.0}$**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
$PM_{1.0}$ ($\mu g/m^3$)	1.00	0.99 (<0.0001)	0.73 (0.0104)	0.52 (0.1042)	0.67 (0.0235)	0.47(0.1433)
$PM_{2.5}$ ($\mu g/m^3$)		1.00	0.72 (0.0133)	0.51 (0.1050)	0.63 (0.0378)	0.45 (0.1654)
PM_{10} ($\mu g/m^3$)			1.00	0.81 (0.0025)	0.65 (0.0299)	0.81 (0.0021)
SO_2 ($\mu g/m^3$)				1.00	0.25 (0.4563)	0.84 (0.0011)
NO_2 ($\mu g/m^3$)					1.00	0.45 (0.1638)
O_3 ($\mu g/m^3$)						1.00

Abbreviations: NO_2, nitrogen dioxides; O_3, ozone; $PM_{1.0}$, particle with aerodynamic diameter ≤1.0 μm; $PM_{2.5}$, particle with aerodynamic diameter ≤2.5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

***Table S2*: Characteristics of the study participants and non-participants (without blood sampling)**

Characteristics	Participants (n = 15 477)	Non-participants (n = 9368)	Total (n = 24 845)
Age (years, mean ± SD)	45·0 ± 13·5	45·7 ± 13·0	45·6 ± 13·5
Sex			
Men	8156 (52·7%)	4505 (48·1%)	12 661 (51·0%)
Women	7321 (47·3%)	4863 (51·9%)	12 184 (49·0%)
Nationality			
Han	14 554 (94·0%)	8916 (95·2%)	23 470 (94·5%)
Others	923 (6·0%)	452 (4·8%)	1375 (5·5%)
Education			
Junior college or higher (≥16 years old)	3579 (23·1%)	1896 (20·2%)	5475 (22·0%)
Middle school (13-15 years old)	9554 (61·7%)	5379 (57·4%)	14 933 (60·1%)
Primary school (7-12 years old)	1863 (12·0%)	1583 (16·90%)	3446 (13·8%)
No school	481 (3·1%)	510 (5·4%)	991 (4·0%)
Career			
Organization cadres	2900 (18·7%)	1543 (16·5%)	4443 (17·9%)
Blue-collar workers	4996 (32·3%)	2231 (23·8%)	7227 (29·1%)
Farmers	2210 (14·3%)	2670 (28·5%)	4880 (19·6%)
Others	5371 (34·7%)	2924 (31·2%)	8295 (33·4%)
Family income per year			
≤5000 Yuan	1167 (7·5%)	1057 (11·3%)	2224 (9·0%)
5001-10000 Yuan	1977 (12·8%)	1560 (16·7%)	3537 (14·2%)
10001-30000 Yuan	7869 (50·8%)	4479 (47·8%)	12 348 (49·7%)
≥30000 Yuan	4464 (28·8%)	2272 (24·3%)	6736 (27·1%)
Smoking status			
Nonsmoker	10 837 (70·0%)	6706 (71·6%)	17 543 (70·6%)
Smoker	4640 (30·0%)	2662 (28·4%)	7302 (29·4%)
Alcohol consumption			
Nondrinker	11 668 (75·4%)	7414 (79·1%)	19 082 (76·8%)
Drinking	3809 (24·6%)	1954 (20·9%)	5763 (23·2%)
Exercise (more than 180 mins per week)			
No	10 545 (68·1%)	6653 (71·0%)	17 198 (69·2%)
Yes	4932 (31·9%)	2715 (29·0%)	7647 (30·8%)
Control diet with low calories and low fat			
No	11 616 (75·1%)	7041 (75·2%)	18 657 (75·1%)
Yes	3861 (24·9%)	2327 (14·8%)	6188 (24·9%)
Sugar-sweetened soft drink			
≤1 day per week	13 621 (88·0%)	8318 (88·8)	21 939 (88·3)
2-4 days per week	1286 (8·3%)	688 (7·3)	1974 (8·0)
≥5 days per week	570 (3·7%)	362 (3·9)	932 (3·8)
Body mass index			
≤25 kg/m^2	9220 (59·6%)	5426 (57·9%)	14 646 (59·0%)
25-30 kg/m^2	5418 (35·0%)	3346 (35·7%)	8764 (35·3%)
≥30 kg/m^2	839 (5·4%)	596 (6·4%)	1435 (5·8%)
Family history of diabetes mellitus			
No	13 156 (85·0%)	7857 (83·9%)	21 013 (84·6%)
Yes	2321 (15·0%)	1511 (16·1%)	3832 (15·4%)

SD indicates standard deviation.

***Table S3*: Associations of ambient air pollutants with diabetes mellitus before and after excluding people with pre-diabetes and taking anti-diabetic medication simultaneously**

Pollutant	OR (95% CI) [*†] (after excluding)	OR (95% CI) [*†] (before excluding)
PM_1	1.14 (1.05, 1.24)	1.13 (1.04, 1.22)
$PM_{2·5}$	1.15 (1.04, 1.27)	1.14 (1.03, 1.25)
PM_{10}	1.19 (1.10, 1.28)	1.20 (1.12, 1.28)
SO_2	1.12 (1.04, 1.22)	1.12 (1.04, 1.21)
NO_2	1.20 (1.09, 1.32)	1.22 (1.12, 1.33)
O_3	1.13 (1.03, 1.24)	1.14 (1.05, 1.25)

CI indicates confidence interval; NO_2, nitrogen dioxide; O_3, ozone; OR, odds ratio; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]OR was scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S4*: Associations of air pollution with diabetes mellitus stratified by education, smoking, and BMI**

	OR (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	1.15 (1.06-1.24)	1.16 (1.05-1.28)	1.20 (1.12-1.29)	1.14 (1.06-1.24)	1.24 (1.13-1.35)	1.17 (1.07-1.27)
>9 years	1.07 (0.98-1.17)	1.06 (0.95-1.18)	1.15 (1.06-1.24)	1.06 (0.96-1.17)	1.15 (1.04-1.27)	1.05 (0.94-1.18)
Smoking						
Nonsmoker	1.11 (1.01-1.23)	1.13 (1.00-1.27)	1.19 (1.09-1.29)	1.08 (0.99-1.19)	1.20 (1.07-1.33)	1.12 (1.01-1.25)
Smoker	1.16 (1.02-1.32)	1.16 (0.98-1.37)	1.21 (1.07-1.37)	1.23 (1.08-1.40)	1.27 (1.09-1.49)	1.22 (1.05-1.42)
BMI						
Normal weight	1.06 (0.98-1.15)	1.05 (0.94-1.16)	1.14 (1.05-1.23)	1.03 (0.94-1.13)	1.13 (1.03-1.25)	1.04 (0.94-1.15)
Overweight/obesity	1.18 (1.09-1.28)	1.20 (1.09-1.33)	1.23 (1.15-1.33)	1.21 (1.11-1.32)	1.29 (1.17-1.41)	1.25 (1.14-1.37)

BMI indicates body mass index; CI, confidence interval; NO_2, nitrogen dioxide; O_3, ozone; OR, odds ratio; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]OR was scaled to the interquartile range (IQR) for each pollutant (15 $\mu g/m^3$ for PM_1; 26 $\mu g/m^3$ for $PM_{2·5}$; 19 $\mu g/m^3$ for PM_{10}, 20 $\mu g/m^3$ for SO_2, 9 $\mu g/m^3$ for NO_2, and 22 $\mu g/m^3$ for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S5*: Adjusted estimates for fasting glucose, 2h glucose, fasting insulin, 2h insulin, HOMA-IR, and HOMA-B per interquartile range increase of ambient air pollutants after excluding people with pre-diabetes**

	β (95% CI)[*†]					
	Fasting glucose	**2h-glucose**	**Fasting insulin**	**2h-insulin**	**HOMA-IR**	**HOMA-B**
PM_1	0.08 (0.04, 0.12)	0.16 (0.06, 0.25)	0.28 (-0.22, 0.79)	0.38 (-0.91, 1.68)	0.12 (-0.10, 0.35)	-5.08 (-17.28, 7.12)
$PM_{2.5}$	0.10 (0.05, 0.15)	0.18 (0.06, 0.30)	0.30 (-0.33, 0.92)	0.20 (-1.40, 1.80)	0.14 (-0.14, 0.42)	-6.01 (-21.10, 9.09)
PM_{10}	0.08 (0.04, 0.12)	0.23 (0.14, 0.32)	0.18 (-0.27, 0.63)	0.98 (-0.17, 2.14)	0.12 (-0.09, 0.32)	-9.45 (-20.36, 1.47)
SO_2	0.04 (-0.01, 0.08)	0.15 (0.06, 0.25)	0.03 (-0.47, 0.53)	0.96 (-0.32, 2.24)	0.01 (-0.22, 0.23)	-4.57 (-16.69, 7.55)
NO_2	0.09 (0.05, 0.14)	0.21 (0.10, 0.32)	0.48 (-0.09, 1.06)	1.83 (0.36, 3.31)	0.24 (-0.02, 0.50)	-7.12 (-21.03, 6.79)
O_3	0.04 (-0.01, 0.08)	0.16 (0.05, 0.26)	0.13 (-0.43, 0.69)	0.81 (-0.61, 2.23)	0.06 (-0.19, 0.31)	-7.96 (-21.39, 5.48)

β indicates regression coefficient; CI, confidence interval; HOMA-B, homeostasis model assessment of beta-cell function; HOMA-IR, homeostasis model assessment of insulin resistance index, NO_2, nitrogen dioxide; O_3, ozone; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S6*: Adjusted estimates for fasting glucose per interquartile range increase of ambient air pollutants by education, smoking, and BMI**

	β (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	0.07 (0.03, 0.11)	0.08 (0.03, 0.14)	0.08 (0.04, 0.11)	0.02 (-0.02, 0.06)	0.08 (0.03, 0.13)	0.02 (-0.02, 0.07)
>9 years	0.07 (0.04, 0.11)	0.09 (0.04, 0.13)	0.10 (0.06, 0.13)	0.10 (0.07, 0.14)	0.12 (0.08, 0.16)	0.10 (0.06, 0.14)
Smoking						
Nonsmoker	0.06 (0.02, 0.10)	0.07 (0.03, 0.12)	0.06 (0.03, 0.09)	-0.01 (-0.04, 0.03)	0.07 (0.02, 0.11)	0.01 (-0.03, 0.05)
Smoker	0.07 (0.01, 0.13)	0.08 (0.00, 0.16)	0.09 (0.04, 0.15)	0.13 (0.07, 0.19)	0.12 (0.05, 0.20)	0.10 (0.02, 0.17)
BMI						
Normal weight	0.05 (0.01, 0.09)	0.06 (0.01, 0.11)	0.06 (0.03, 0.10)	0.03 (-0.01, 0.07)	0.08 (0.03, 0.12)	0.03 (-0.02, 0.07)
Overweight/obesity	0.08 (0.03, 0.14)	0.10 (0.04, 0.17)	0.09 (0.04, 0.14)	0.05 (-0.00, 0.11)	0.09 (0.03, 0.16)	0.04 (-0.02, 0.10)

β indicates partial regression coefficient; BMI, body mass index; CI, confidence interval; NO_2, nitrogen dioxide; O_3, ozone; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S7*: Adjusted estimates for 2h-glucose per interquartile range increase of ambient air pollutants by education, smoking, and BMI**

	β (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	0.09 (0.00, 0.19)	0.09 (-0.02, 0.21)	0.18 (0.09, 0.26)	0.11 (0.02, 0.20)	0.15 (0.04, 0.25)	0.12 (0.02, 0.22)
>9 years	0.13 (0.02, 0.24)	0.16 (0.03, 0.30)	0.21 (0.11, 0.32)	0.23 (0.12, 0.34)	0.23 (0.10, 0.36)	0.20 (0.07, 0.33)
Smoking						
Nonsmoker	0.12 (0.03, 0.21)	0.13 (0.03, 0.24)	0.20 (0.12, 0.28)	0.10 (0.01, 0.18)	0.19 (0.09, 0.29)	0.12 (0.03, 0.22)
Smoker	-0.01(-0.15, 0.14)	-0.02 (-0.20, 0.16)	0.08 (-0.05, 0.21)	0.19 (0.04, 0.33)	0.03 (-0.14, 0.20)	0.11 (-0.05, 0.27)
BMI						
Normal weight	0.07 (-0.02, 0.16)	0.08 (-0.03, 0.19)	0.14 (0.06, 0.22)	0.12 (0.03, 0.20)	0.15 (0.05, 0.25)	0.10 (0.00, 0.20)
Overweight/obesity	0.11 (-0.02, 0.24)	0.12 (-0.04, 0.29)	0.21 (0.09, 0.33)	0.14 (0.01, 0.27)	0.14 (-0.01, 0.20)	0.16 (0.01, 0.30)

β indicates partial regression coefficient; BMI, body mass index; CI, confidence interval; NO_2, nitrogen dioxide; O_3, ozone; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S8*: Adjusted estimates for fasting insulin per interquartile range increase of ambient air pollutants by education, smoking, and BMI**

	β (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	0.18 (-0.32, 0.69)	0.16 (-0.46, 0.78)	0.16 (-0.25, 0.60)	0.02 (-0.48, 0.52)	0.37 (-0.20, 0.94)	0.11 (-0.43, 0.66)
>9 years	0.73 (0.39, 1.06)	0.88 (0.46, 1.30)	0.67 (0.35, 0.98)	0.43 (0.10, 0.77)	1.09 (0.70, 1.48)	0.52 (0.13, 0.91)
Smoking						
Nonsmoker	0.08 (-0.47, 0.63)	0.07 (-0.61, 0.75)	-0.04 (-0.53, 0.45)	-0.06 (-0.60, 0.49)	0.19 (-0.43, 0.82)	-0.02 (-0.62, 0.58)
Smoker	0.72 (0.45, 1.00)	0.80 (0.45, 0.94)	0.86 (0.60, 0.99)	0.45 (0.17, 0.72)	1.29 (0.97, 1.61)	0.66 (0.35, 0.97)
BMI						
Normal weight	0.13 (-0.49, 0.76)	0.14 (-0.63, 0.92)	-0.01 (-0.56, 0.55)	-0.12 (-0.73, 0.50)	0.23 (-0.47, 0.94)	-0.04 (-0.73, 0.64)
Overweight or obesity	0.48 (0.17, 0.79)	0.49 (0.11, 0.87)	0.60 (0.33, 0.89)	0.43 (0.12, 0.74)	0.91 (0.55, 1.27)	0.52 (0.18, 0.87)

β indicates partial regression coefficient; BMI, body mass index; CI, confidence interval; NO_2, nitrogen dioxide; O_3, ozone; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S9*: Adjusted estimates for 2h-insulin per interquartile range increase of ambient air pollutants by education, smoking, and BMI**

	β (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	0.55 (-0.66, 1.77)	0.35 (-1.16, 1.86)	1.41 (0.34, 2.48)	1.11 (-0.09, 2.32)	2.48 (1.11, 3.86)	1.03 (-0.29, 2.34)
>9 years	1.72 (-1.25, 4.69)	2.24 (-1.46, 5.95)	2.21 (-0.61, 5.05)	3.41 (0.44, 6.38)	3.33 (-0.16, 6.83)	1.97 (-1.50, 5.43)
Smoking						
Nonsmoker	0.12 (-1.35, 1.60)	0.08 (-1.74, 1.89)	0.53 (-0.77, 1.84)	1.14 (-0.32, 2.59)	1.25 (-0.41, 2.91)	0.56 (-1.04, 2.16)
Smoker	2.43 (0.56, 4.31)	2.50 (0.16, 4.85)	4.11 (2.40, 5.82)	3.05 (1.17, 4.93)	6.11 (3.92, 8.31)	3.01 (0.88, 5.13)
BMI						
Normal weight	-0.38 (-1.84, 1.09)	-0.50 (-2.31, 1.31)	0.17 (-1.12, 1.45)	0.16 (-1.28, 1.60)	0.41 (-1.23, 2.05)	-0.12 (-1.71, 1.47)
Overweight or obesity	2.50 (0.58, 4.42)	2.62 (0.24, 5.01)	3.70 (1.94, 5.46)	3.96 (2.02, 5.90)	5.96 (3.71, 8.20)	3.31 (1.14, 5.48)

β indicates partial regression coefficient; BMI, body mass index; CI, confidence interval; NO_2, nitrogen dioxide; O_3, ozone; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S10*: Adjusted estimates for HOMA-IR per interquartile range increase of ambient air pollutants by education, smoking, and BMI**

	β (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	0.08 (-0.15, 0.30)	0.08 (-0.20, 0.36)	0.10 (-0.10, 0.30)	-0.00 (-0.22, 0.22)	0.20 (-0.06, 0.45)	0.06 (-0.19, 0.30)
>9 years	0.23 (0.14, 0.32)	0.28 (0.17, 0.39)	0.23 (0.15, 0.32)	0.18 (0.09, 0.27)	0.35 (0.25, 0.46)	0.20 (0.09, 0.30)
Smoking						
Nonsmoker	0.05 (-0.20, 0.30)	0.06 (-0.25, 0.36)	0.03 (-0.19, 0.25)	-0.08 (-0.32, 0.17)	0.13 (-0.15, 0.41)	-0.01 (-0.28, 0.26)
Smoker	0.25 (0.15, 0.34)	0.27 (0.15, 0.39)	0.32 (0.23, 0.41)	0.25 (0.15, 0.34)	0.46 (0.35, 0.58)	0.27 (0.16, 0.38)
BMI						
Normal weight	0.07 (-0.22, 0.35)	0.08 (-0.27, 0.43)	0.06 (-0.19, 0.31)	-0.07 (-0.35, 0.21)	0.17 (-0.15, 0.49)	0.01 (-0.31, 0.31)
Overweight or obesity	0.19 (0.09, 0.28)	0.20 (0.08, 0.32)	0.23 (0.15, 0.32)	0.18 (0.08, 0.28)	0.32 (0.21, 0.43)	0.19 (0.08, 0.30)

β indicates partial regression coefficient; BMI, body mass index; CI, confidence interval; HOMA-IR, homeostasis model assessment of insulin resistance index, NO_2, nitrogen dioxide; O_3, ozone; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S11*: Adjusted estimates for HOMA-B per interquartile range increase of ambient air pollutants by education, smoking, and BMI**

	β (95% CI) [*†]					
	PM_1	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_2**	**O_3**
Education level						
≤9 years	-5.72 (-17.99, 6.54)	-6.58 (-21.72, 8.56)	-10.13 (-20.89, 0.62)	-3.44 (-15.56, 8.68)	-7.88 (-21.74, 5.97)	-8.01 (-21.29, 5.26)
>9 years	-0.30 (-7.25, 6.64)	-0.41 (-9.07, 8.25)	-2.05 (-8.65, 4.54)	-5.00 (-11.93, 1.95)	1.26 (-6.89, 9.42)	-2.99 (-11.08, 5.09)
Smoking						
Nonsmoker	-4.46 (-13.60, 4.69)	-5.11 (-16.37, 6.15)	-9.42 (-17.52, -1.32)	-5.81 (-14.83, 3.21)	-8.35 (-18.64, 1.94)	-6.51 (-16.46, 3.44)
Smoker	-4.98 (-27.71, 17.76)	-5.73 (-34.15, 22.69)	-5.38 (-26.15, 15.39)	0.42 (-22.35, 23.19)	-1.20 (-27.91, 25.51)	-8.61 (-34.38, 17.16)
BMI						
Normal weight	-6.90 (-22.07, 8.26)	-7.76 (-26.51, 10.99)	-11.81 (-25.13, 1.52)	-4.23 (-19.12, 10.67)	-10.52 (-27.53, 6.49)	-10.38 (-26.83, 6.06)
Overweight/obesity	-0.36 (-7.76, 7.04)	-0.55 (-9.72, 8.62)	-2.78 (-9.56, 3.99)	-3.21 (-10.66, 4.23)	0.34 (-8.31, 8.99)	-2.35 (-10.70, 6.00)

β indicates partial regression coefficient; BMI, body mass index; CI, confidence interval; HOMA-B, homeostasis model assessment of beta-cell function; NO_2, nitrogen dioxide; O_3, ozone; OR, odds ratio; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 $\mu g/m^3$ for PM_1; 26 $\mu g/m^3$ for $PM_{2·5}$; 19 $\mu g/m^3$ for PM_{10}, 20 $\mu g/m^3$ for SO_2, 9 $\mu g/m^3$ for NO_2, and 22 $\mu g/m^3$ for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, smoking, alcohol consumption, exercise, control diet with low calorie and low fat, sugar-sweetened soft drink, family history of diabetes mellitus, and district.

***Table S12*:** Associations of ambient air pollutants with diabetes mellitus after moving variables smoking, drinking, exercise, controlled diet with low calorie and low fat, and sugar-sweetened soft drink consumption out of the model

Pollutant	**OR (95% CI) [*†] (after excluding)**	**OR (95% CI) [*†] (before excluding)**
PM_1	1.14 (1.06, 1.23)	1.13 (1.04, 1.22)
$PM_{2·5}$	1.15 (1.05, 1.27)	1.14 (1.03, 1.25)
PM_{10}	1.19 (1.11, 1.28)	1.20 (1.12, 1.28)
SO_2	1.12 (1.03, 1.20)	1.12 (1.04, 1.21)
NO_2	1.22 (1.12, 1.34)	1.22 (1.12, 1.33)
O_3	1.14 (1.05, 1.24)	1.14 (1.05, 1.25)

CI indicates confidence interval; NO_2, nitrogen dioxide; O_3, ozone; OR, odds ratio; PM_1, particle with aerodynamic diameter ≤1 μm; $PM_{2·5}$, particle with aerodynamic diameter ≤2·5 μm; PM_{10}, particle with aerodynamic diameter ≤10 μm; and SO_2, sulfur dioxide.

[*]Estimates were scaled to the interquartile range (IQR) for each pollutant (15 μg/m^3 for PM_1; 26 μg/m^3 for $PM_{2·5}$; 19 μg/m^3 for PM_{10}, 20 μg/m^3 for SO_2, 9 μg/m^3 for NO_2, and 22 μg/m^3 for O_3).

[†]Adjusted for age, sex, body mass index, education, family income, family history of diabetes mellitus, and district.