Supplementary Online Content

Kim SY, Kong IG, Min C, Choi HG. Association of air pollution with increased risk of peritonsillar abscess formation [published online April 25, 2019]. *JAMA Otolaryngol Head Neck Surg*. doi:10.1001/jamaoto.2019.0742

This supplementary material has been provided by the authors to give readers additional information about their work.

Air pollution increases the risk of peritonsillar abscess formation: A nested case-control study using meteorological data and national sample cohort data

eMethods: Study Population and Data Collection

This national cohort study used data from the Korean Health Insurance Review and Assessment Service - National Sample Cohort (HIRA-NSC). The Korean National Health Insurance Service (NHIS) selects samples directly from the entire population database to prevent nonsampling errors. Approximately 2% of the samples (one million) were selected from the entire Korean population (50 million). The selected data were classified at 1,476 levels (age [18 categories], sex [2 categories], and income [41 categories]) using randomized stratified systematic sampling methods with proportional allocation to represent the entire population. After data selection, the appropriateness of the sample was verified by a statistician who compared the data from the entire Korean population to the sample data. The details of the methods used to perform these procedures are provided by the National Health Insurance Sharing Service (http://nhiss.nhis.or.kr/). The database included (i) personal information, (ii) health insurance claim codes (procedures and prescriptions), (iii) diagnostic codes using the International Classification of Disease-10 (ICD-10), (iv) death records from the Korean National Statistical Office (using the Korean Standard Classification of disease), (v) socioeconomic data (residence and income), and (vi) medical examination data for each participant over a period ranging from 2002 to 2013.

Because all Korean citizens are recognized by a 13-digit resident registration number from birth to death, exact population statistics can be determined using this database. It is mandatory for all Koreans to enroll in the NHIS. All Korean hospitals and clinics use the 13-digit resident registration number to register individual patients in the medical insurance system. Therefore, the risk of overlapping medical records is minimal, even if a patient moves from one place to another. Moreover, all medical treatments in Korea are tracked using the HIRA system. In Korea, a notice of death to an administrative entity is legally required before a funeral can be held. Causes and dates of death are recorded by medical doctors on death certificates.

Meteorological Data

Temperature (˚C), relative humidity (%), and spot atmospheric pressure (hPa) data were obtained from the meteorological administration using an automated synoptic observing system (ASOS) that manually recorded measurements in 94 places each hour. Quality was controlled using a quality inspection manual (https://data.kma.go.kr/cmmn/main.do).

SO_2 (ppm), NO_2 (ppm), O_3 (ppm), CO (ppm), and PM_{10} (µg/m3) data were obtained by the ministry of the environment. Measurements were obtained by ASOS in 273 places across the country each hour. Quality was controlled using an air pollution quality control manual (http://www.me.go.kr/home/web/index.do?menuId=10259). Daily mean values were assessed.

eTable 1 Crude odd ratios (95% confidence intervals) of the meteorological and pollution matter for peritonsillar abscess formation

Characteristics	Peritonsillar abscess	
	Crude OR (95% CI)	P-value
Mean daily temperature for 14 days (˚C)	1.00 (0.99-1.00)	0.289
Mean daily temperature for 10 days (˚C)	1.00 (0.99-1.00)	0.312
Mean daily temperature for 7 days (˚C)	1.00 (0.99-1.00)	0.296
Mean daily temperature for 5 days (˚C)	1.00 (0.99-1.00)	0.284
Mean daily temperature for 3 days (˚C)	1.00 (0.99-1.00)	0.289
Highest daily temperature for 14 days (˚C)	1.00 (0.99-1.00)	0.293
Highest daily temperature for 10 days (˚C)	1.00 (0.99-1.00)	0.323
Highest daily temperature for 7 days (˚C)	1.00 (0.99-1.00)	0.305
Highest daily temperature for 5 days (˚C)	1.00 (0.99-1.00)	0.303
Highest daily temperature for 3 days (˚C)	1.00 (0.99-1.00)	0.315
Lowest daily temperature for 14 days (˚C)	1.00 (1.00-1.00)	0.316
Lowest daily temperature for 10 days (˚C)	1.00 (1.00-1.00)	0.340
Lowest daily temperature for 7 days (˚C)	1.00 (1.00-1.00)	0.330
Lowest daily temperature for 5 days (˚C)	1.00 (1.00-1.00)	0.308
Lowest daily temperature for 3 days (˚C)	1.00 (1.00-1.00)	0.301
Daily temperature difference for 14 days (˚C)	1.00 (0.99-1.02)	0.918
Daily temperature difference for 10 days (˚C)	1.00 (0.99-1.02)	0.895
Daily temperature difference for 7 days (˚C)	1.00 (0.99-1.01)	0.958

Daily temperature difference for 5 days (˚C)	1.00 (0.99-1.02)	0.839
Daily temperature difference for 3 days (˚C)	1.00 (0.99-1.01)	0.758
Relative humidity for 14 days (%)	1.00 (1.00-1.00)	0.943
Relative humidity for 10 days (%)	1.00 (1.00-1.00)	0.861
Relative humidity for 7 days (%)	1.00 (1.00-1.00)	0.845
Relative humidity for 5 days (%)	1.00 (1.00-1.00)	0.747
Relative humidity for 3 days (%)	1.00 (1.00-1.00)	0.755
Spot atmospheric pressure for 14 days (hPa)	1.00 (1.00-1.01)	0.261
Spot atmospheric pressure for 10 days (hPa)	1.00 (1.00-1.01)	0.279
Spot atmospheric pressure for 7 days (hPa)	1.00 (1.00-1.01)	0.257
Spot atmospheric pressure for 5 days (hPa)	1.00 (1.00-1.01)	0.261
Spot atmospheric pressure for 3 days (hPa)	1.00 (1.00-1.01)	0.265
SO_2 for 14 days (0.1 ppm)	0.97 (0.17-5.64)	0.972
SO_2 for 10 days (0.1 ppm)	1.35 (0.24-7.54)	0.736
SO_2 for 7 days (0.1 ppm)	1.21 (0.23-6.40)	0.823
SO_2 for 5 days (0.1 ppm)	1.48 (0.30-7.36)	0.636
SO_2 for 3 days (0.1 ppm)	1.69 (0.37-7.71)	0.496
NO_2 for 14 days (0.1 ppm)	9.92 (6.65-14.80)	<0.001*
NO_2 for 10 days (0.1 ppm)	9.65 (6.51-14.30)	<0.001*
NO_2 for 7 days (0.1 ppm)	7.91 (5.41-11.56)	<0.001*
NO_2 for 5 days (0.1 ppm)	6.57 (4.57-9.44)	<0.001*
NO_2 for 3 days (0.1 ppm)	5.38 (3.84-7.54)	<0.001*
O_3 for 14 days (0.1 ppm)	0.34 (0.23-0.52)	<0.001*
O_3 for 10 days (0.1 ppm)	0.35 (0.24-0.54)	<0.001*

O_3 for 7 days (0.1 ppm)	0.35 (0.24-0.53)	<0.001*
O_3 for 5 days (0.1 ppm)	0.38 (0.26-0.56)	<0.001*
O_3 for 3 days (0.1 ppm)	0.40 (0.28-0.58)	<0.001*
CO for 14 days (1 ppm)	1.01 (0.85-1.21)	0.893
CO for 10 days (1 ppm)	1.03 (0.86-1.23)	0.759
CO for 7 days (1 ppm)	1.01 (0.85-1.19)	0.954
CO for 5 days (1 ppm)	1.00 (0.85-1.18)	1.000
CO for 3 days (1 ppm)	1.03 (0.88-1.20)	0.733
PM_{10} for 14 days (10 $\mu g/m^3$)	1.04 (1.02-1.06)	<0.001*
PM_{10} for 10 days (10 $\mu g/m^3$)	1.03 (1.02-1.05)	<0.001*
PM_{10} for 7 days (10 $\mu g/m^3$)	1.03 (1.01-1.04)	<0.001*
PM_{10} for 5 days (10 $\mu g/m^3$)	1.02 (1.01-1.04)	0.002
PM_{10} for 3 days (10 $\mu g/m^3$)	1.02 (1.01-1.03)	0.005

* Logistic regression model, significance at $P < 0.05$

We analyzed the odd ratios of meteorological data for peritonsillar abscess formation using a simple logistic regression analysis. In these results, only NO_2, O_3, and PM_{10} showed statistical significance ($P < 0.05$). Therefore, we chose these factors, namely, NO_2, O_3, and PM_{10}, as independent variables.

eTable 2 Akaike Information Criterion and Bayesian Information Criterion of the pollution matter in crude logistic regression analysis for peritonsillar abscess formation

Pollution matter	AIC	BIC
NO_2 for 14 days (0.1 ppm)	18989.101	19004.815
NO_2 for 10 days (0.1 ppm)	18987.856	19003.571
NO_2 for 7 days (0.1 ppm)	19001.714	19017.428
NO_2 for 5 days (0.1 ppm)	19012.742	19028.456
NO_2 for 3 days (0.1 ppm)	19020.570	19036.284
O_3 for 14 days (0.1 ppm)	19089.118	19104.832
O_3 for 10 days (0.1 ppm)	19089.750	19105.465
O_3 for 7 days (0.1 ppm)	19088.582	19104.296
O_3 for 5 days (0.1 ppm)	19090.305	19106.019
O_3 for 3 days (0.1 ppm)	19091.047	19106.761
PM_{10} for 14 days (μg/m^3)	19098.964	19114.678
PM_{10} for 10 days (μg/m^3)	19100.021	19115.736
PM_{10} for 7 days (μg/m^3)	19103.580	19119.295
PM_{10} for 5 days (μg/m^3)	19104.918	19120.633
PM_{10} for 3 days (μg/m^3)	19106.786	19122.501

AIC: Akaike Information Criterion

BIC: Bayesian Information Criterion

NO_2, O_3, and PM_{10} (for 14 days, 10 days, 7 days, 5 days, and 3 days prior to the matched index date) all showed statistical significance (S2 table); thus, we chose only one of these factors.

For NO_2, the AIC and BIC showed the smallest value at 14 days prior to the matched index date. We chose the mean NO_2 at 14 days before the index date.

For PM_{10} at 14 days prior to the matched index date, the smallest AIC and BIC were observed. We chose the mean PM_{10} at 14 days before the index date.

For O_3 at 7 days prior to the matched index date, the smallest AIC and BIC were observed. However, we chose the value at 14 days before the index date because we selected that date for NO_2 and PM_{10}.

eTable 3 Correlation analysis of pollution matter

	NO_2 for 14 days	O_3 for 14 days	PM_{10} for 14 days
NO_2 for 14 days	1	-0.434*	0.520*
O_3 for 14 days	-0.434*	1	0.005
PM_{10} for 14 days	0.520*	0.005	1

* Significance at $P < 0.01$

In this analysis, the NO_2 showed the correlation of moderate intensity ($0.3 < | r | < 0.7$) with O_3 and PM_{10}

eTable 4 Adjusted odd ratios (95% confidence interval) of PM_{10} for 14 days (10 μg/m^3) for peritonsillar abscess in subgroup analysis according to age and sex

Subgroup	N (participants)	Peritonsillar abscess	
		AOR of NO_2	P-value
Total	19,210	1.04 (1.02-1.06)	<0.001*
Age (<30 years old), men	4,235	1.04 (1.00-1.09)	0.052
Age (<30 years old), women	3,175	1.02 (0.98-1.07)	0.389
Age (30-59 years old), men	6,380	1.05 (1.02-1.08)	0.004*I
Age (30-59 years old), women	3,955	1.04 (1.00-1.08)	0.053
Age (≥ 60 years old), men	645	1.04 (0.912-1.18)	0.575
Age (≥ 60 years old), women	705	1.02 (0.91-1.14)	0.756

*Logistic regression model adjusted model for age, sex, income, region of residence, hypertension, diabetes, and dyslipidemia, Significance at $P < 0.05$