Environmental exposures in obstructive lung disease: Mechanism linking prevalence and exacerbation

강원대학교병원 호흡기내과
홍윤기

Smoking +

Occupational exposure
Air pollution
 - indoor
 - outdoor

Environmental exposures
in obstructive lung disease

Infection
 - Tb
Socioeconomic status
Education
Nutrition

Asthma, COPD

대기 오염 (outdoor air pollution)
-> 천식, COPD

주민 건강 해친 시멘트 공장 6억2천300만원 배상하라" | 단양소식-®

淸岩 張基萬 2013.05.08 09:38 http://blog.daum.net/cjddka49/15710146 복사

환경부 중앙환경분쟁조정위원회가 7일 시멘트공장 인근 지역주민들이 시멘트 분진으로 인한 건강피해 배상을 요구한 사건에 대해 그 피해를 인정했다.

위원회는 이날 A시멘트(주) 등 4개 사에 총 6억 2천300만원을 배상하도록 결정했다.

이에 앞서 충북 단양과 제천 및 강원도 영월과 삼척 지역에 소재한 A시멘트 등 4개사의 5개 시멘트공장 인근에 거주하는 지역주민 99명은 시멘트공장에서 발생하는 분진으로 인해 진폐증과 만성폐쇄성 폐질환(COPD)에 걸리는 건강상 피해와 함께 정신적 피해를 받았다며 시멘트공장을 상대로 15억5천800만원의 배상을 요구했다.

강원대병원 환경보건센터

– 강원대학교병원 호흡기계질환 환경보건센터 지정 및 개소식 개최 –

강원대학교병원은 2012년 4월 6일 환경부로부터 호흡기계질환 분야 환경보건센터로 지정받았습니다. 강원대학교병원의 경우 시멘트 공장 및 석회석 광산 인근지역 주민에 대한 건강조사 결과 만성폐쇄성폐질환, 진폐증 등이 확인되면서 이번에 새롭게 지정되었습니다. 우리 센터는 앞으로 미세먼지 등 환경요인으로 인한 호흡기질환에 대한 기초 조사 · 연구 및 질환자 모니터링 등을 실시할 계획입니다. 2012년 5월 15일 강원대학교병원 암노인센터 대강당에서 '강원대학교병원 호흡기계질환 환경보건센터'개소식을 개최하였습니다. 이날 개소식에는 환경부, 강원도, 강원대학교, 영월의료원, 제천시, 강원도보건환경연구원, 전국 12개 환경보건센터, 강원도에 위치한 시멘트 공장의 환경안전담당자 등 약 150여명이 참석해 주셨습니다.

1부 개소식은 김중곤 강원대학교병원장의 기념사를 시작으로 정회석 환경부 환경보건정책관, 문남수 강원도 환경정책과장, 권영중 강원대학교총장, 손병관 환경보건센터 협의회장의 축사가 이어졌습니다. 이후 환경보건센터 현판식을 기념하는 행사가 있었습니다.

2부 심포지엄에서는 김우진 강원대학교병원 환경보건센터장이 '호흡기계질환 환경보건센터의 배경', 권재우 강원대학교병원 연구팀장은'환경과 호흡기계질환'을 주제로 향후 호흡기계질환 환경보건센터로서의 사업에 대한 발표를 하였습니다. 이어서 이근화 제주의대 환경보건센터 사무국장이'제주의대 센터 교육홍보사업 사례발표', 오인보 울산대병원 환경보건센터 사무국장이 '울산대병원 환경보건센터 교육, 홍보사업'에 대한 발표를 통해 기존 센터의 교육 · 홍보사업 수행의 노하우를 공유할 수 있었습니다. 이후 토의를 통해 전국의 환경보건센터 관계자께서 주신 조언은 강원대학교병원 환경보건센터에서 사업을 추진하는데 있어 많은 도움이 될 것입니다.

이외에도 전국 13개 센터에 대한 소개와 사업내용을 홍보하는 포스터를 전시하였으며, 2007년부터 개발된 각 센터의 교육 및 홍보자료를 전시하였습니다. 또한 협의회 소개 동영상을 상영하여 개소식 참석자를 대상으로 환경보건센터의 역할과 협의회의 활동사항을 소개하였습니다. 강원대학교병원 환경보건센터는 개소식을 통하여 호흡기계질환 환경보건센터로서 수행할 사업에 대한 열의와 다짐을 보여 주었습니다.

센터소개

강원대학교병원은 호흡기계질환 환경보건센터입니다. 강원, 충북, 전남 등지에 위치한 시멘트공장과 석회석광산 인근지역의 분진 관련 호흡기계질환자의 사후관리, 환경요인과 질환의 상관관계 연구, 질환의 예방관리 교육 및 홍보 사업을 수행하고자 합니다.

설립목적

- 분진관련 호흡기계질환자의 사후관리와 모니터링
- DB 구축을 통한 기초자료의 수집
- 환경적 요인과 호흡기계질환의 상관관계 연구
- 호흡기계질환 예방관리 교육 및 홍보

사업내용

- 호흡기계질환의 DB구축 및 모니터링
  - 호흡기계질환자 DB구축 및 모니터링
  - 대기오염 측정망 자료 및 기상자료 DB 구축
- 환경요인과 질환간의 상호작용 연구
  - 대기오염과 호흡기질환 악화의 후향적 연구 및 기전 연구
  - 호흡기계질환의 환경요인 연구
- 환경보건 교육 · 홍보
  - 교육: 유소견자, 지역주민, 전문인력 대상 교육
  - 홍보: 지역사회, 관련기관 네트워크를 활용한 홍보, 홈페이지 구축

향후계획

- 시멘트공장, 석회석광산 지역 호흡기계질환 유소견자 관리와

목차

- 대기오염의 종류
- 대기오염에 의한 건강영향 연구
- 호흡기계에 대한 급성 영향
  - 천식
  - COPD
- 호흡기 질환에 대한 만성 영향
- 춘천에서의 연구

In 1952, London smog
-> 5일간 약 4000명 사망

Volume 329

Number 24

AN ASSOCI **S. CITIES**

Doug D.,

Jo

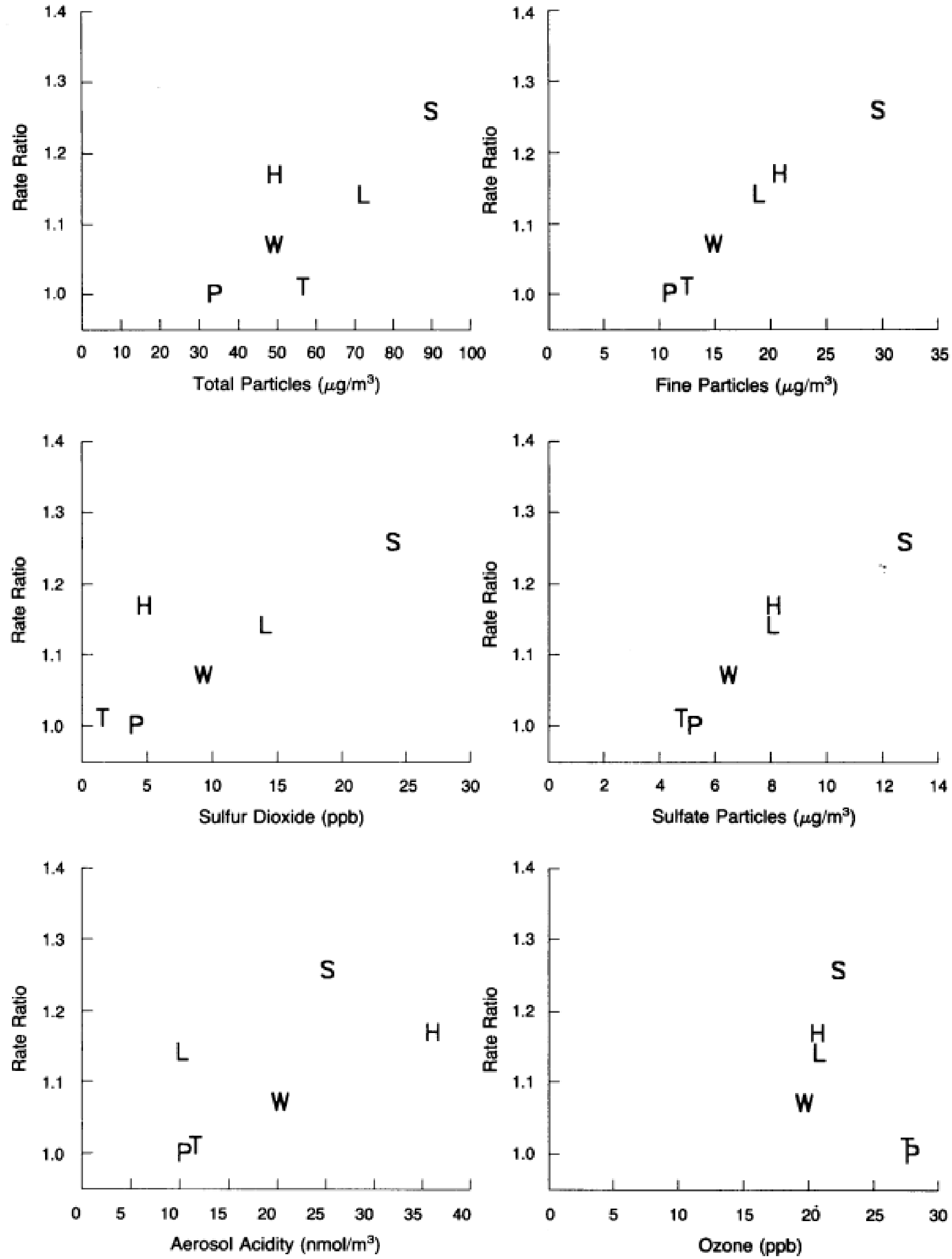


Figure 3. Estimated Adjusted Mortality-Rate Ratios and Pollution Levels in the Six Cities.
Mean values are shown for the measures of air pollution. P denotes Portage, Wisconsin; T Topeka, Kansas; W Watertown, Massachusetts; L St. Louis; H Harriman, Tennessee; and S Steubenville, Ohio.

대기오염에 따른 건강 영향

- **7 million premature deaths annually liked to air pollution in 2012**

 # Outdoor air pollution-caused deaths

- Ischaemic heart disease (40%)
- Stroke (40%)
- **COPD (11%)**
- Lung cancer (6%)
- Acute lower respiratory infections in children (3%)

World Health Organization

대기 오염 물질

- 가스상 물질

 - SO2, CO, NO2, O3 …

- 입자상 물질

 - Dust: Particulate matter (PM_{10} or $PM_{2.5}$)

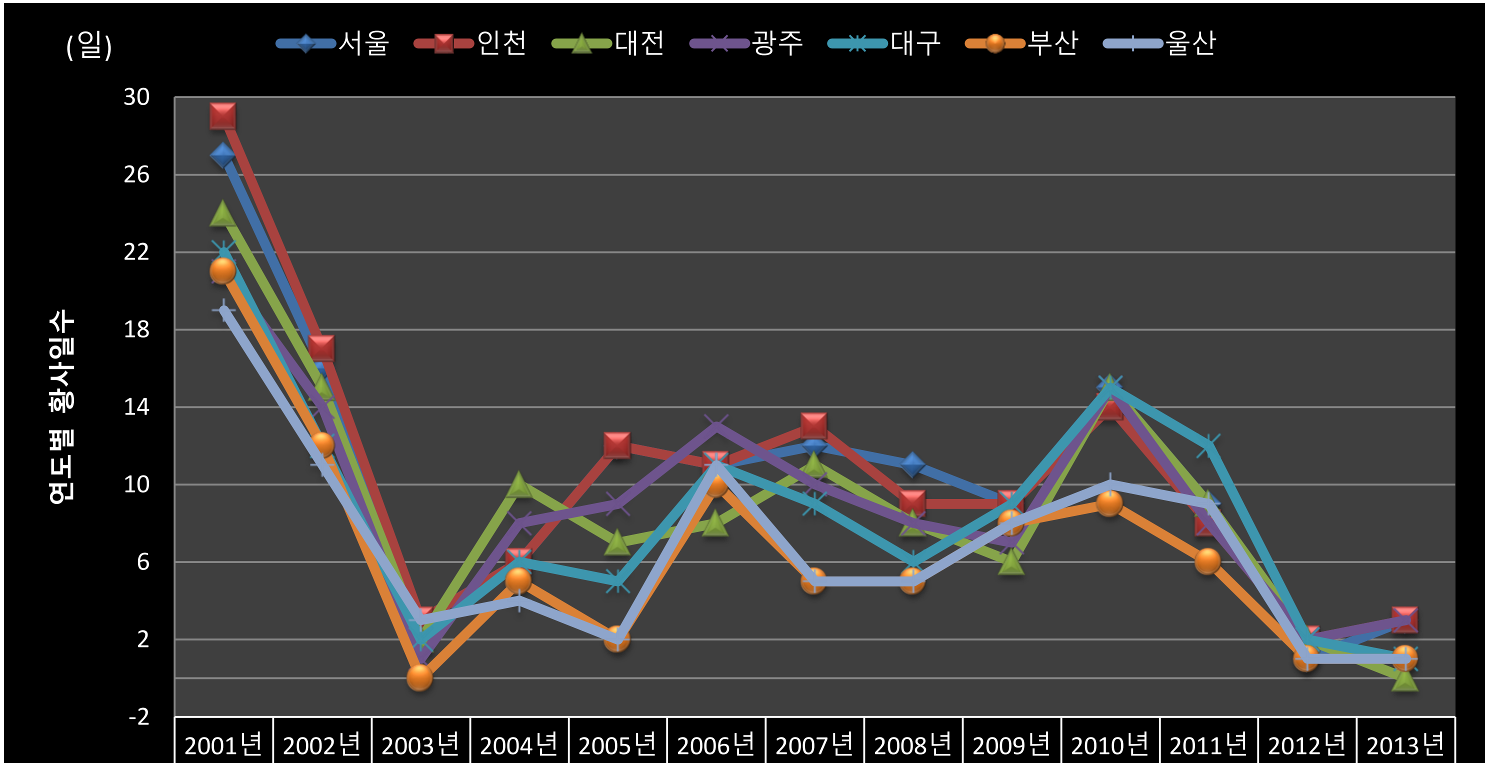
대기 오염 현상

(1) Haze, Mist, Fog

	Fog (안개)	**Mist (박무)**	**Haze (연무)**
Visibility	Less than 1 km	1 km and more	1 km and more
Relative Humidity		70% or greater	Below 70%

(2) Asian dust

The dust originates in the deserts of Mongolia, northern China and Kazakhstan where high-speed surface winds and intense dust storms kick up dense clouds of fine, dry soil particles.



	2001년	2002년	2003년	2004년	2005년	2006년	2007년	2008년	2009년	2010년	2011년	2012년	2013년
서울	27	16	3	6	12	11	12	11	9	15	9	1	3
인천	29	17	3	6	12	11	13	9	9	14	8	2	3
대전	24	15	2	10	7	8	11	8	6	15	9	2	0
광주	21	14	1	8	9	13	10	8	7	15	8	2	3
대구	22	12	2	6	5	11	9	6	9	15	12	2	1
부산	21	12	0	5	2	10	5	5	8	9	6	1	1
울산	19	11	3	4	2	11	5	5	8	10	9	1	1

한국 광역시 황사발생 현황(2001-2013)

우리나라 황사의 특성

- 황사 -> 미세먼지의 농도 증가
- 황사 - 자연발생 물질
  : 입자가 크고, 초미세먼지는 적음
    -> 건강영향이 크지 않음.
- 우리나라로 유입되는 황사입자
  : 중국의 동부 공업지대를 통과
    -> 대기오염 물질을 많이 포함
       초미세먼지도 증가
    -> 건강 피해 증가

대기오염원별 국외 규제 및 기준치

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 μg/m^3 [(1)]	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb [(2)]	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm [(3)]	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution Dec 14, 2012	$PM_{2.5}$	primary	Annual	12 μg/m^3	annual mean, averaged over 3 years
		secondary	Annual	15 μg/m^3	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb [(4)]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

as of October 2011

National Ambient Air Quality Standards
by U.S. Environmental Protection Agency

대기오염원별 국내 기준치

CO

NO_2

O_3

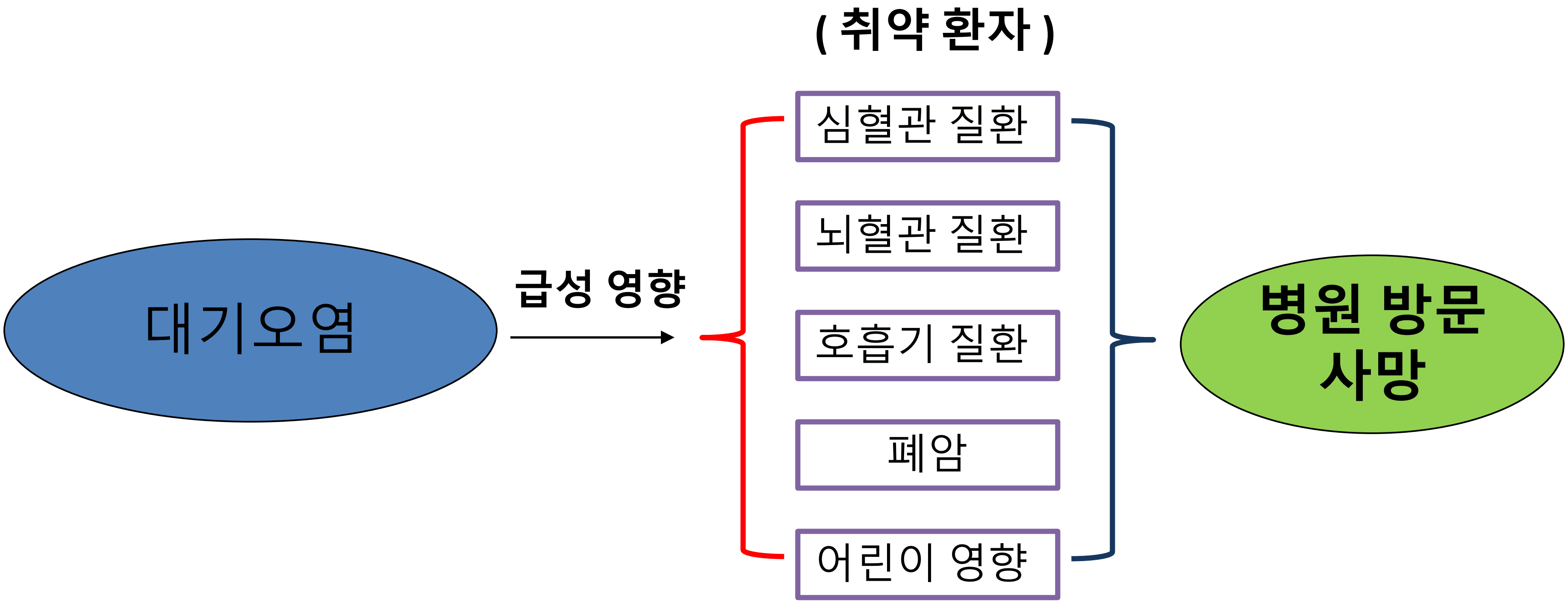
SO_2

PM_{10} or $PM_{2.5}$

항목	기준	측정 방법
아황산가스 (SO2)	[illegible]	자외선형광법 U.V. Fluorescence Method)
일산화탄소 (CO)	[illegible]	비분산적외선분석법 ispersive Infrared Method)
이산화질소 (NO2)	[illegible]	화학발광법 emiluminescent Method)
미세먼지 (PM-10)	[illegible]	베타선흡수법 Ray Absorption Method)
미세먼지 (PM-2.5)	[illegible]	는 이에 준하는 자동측정법
오존 (O3)	1시간 평균치 0.1ppm 이하	자외선광도법 .V Photometric Method)
납 (Pb)	연간 평균치 0.5㎍/㎥ 이하	원자흡광광도법 (Atomic Absorption Spectrophotometry)
벤젠 (C6H6)	연간 평균치 5㎍/㎥ 이하	가스크로마토그래프법 (Gas Chromatography)

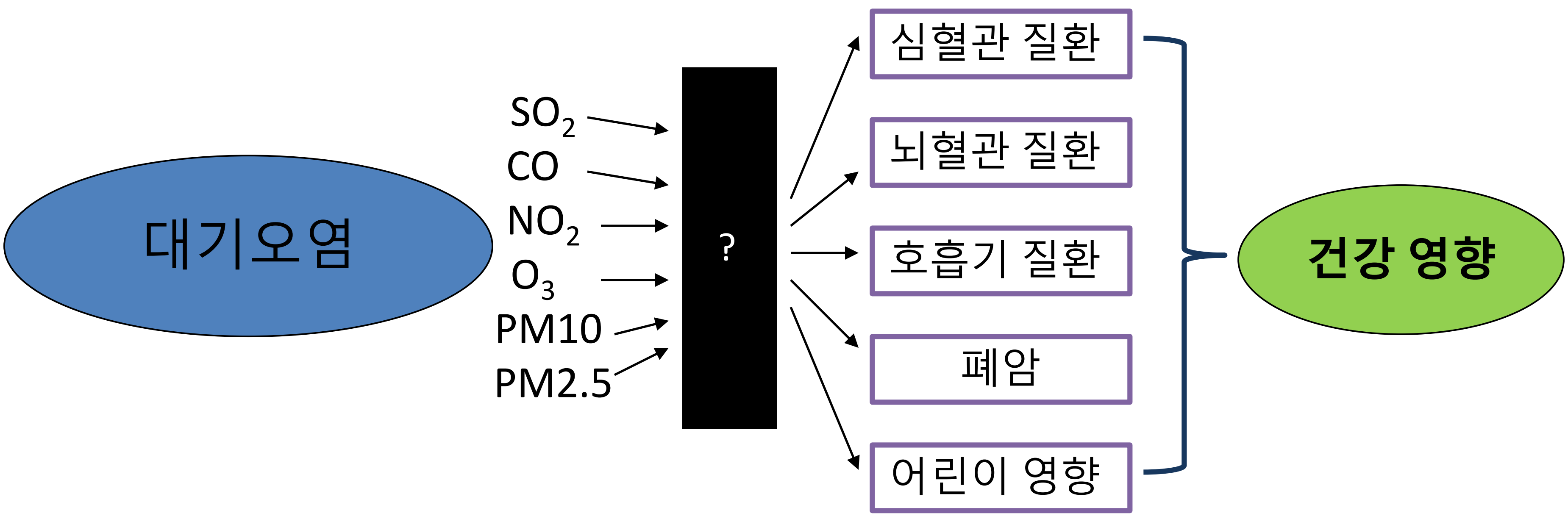
환경정책기본법 제12조 제1항 및
환경정책기본법 시행령 제2조 및 별표 제 1호

대기오염에 의한 건강영향 연구



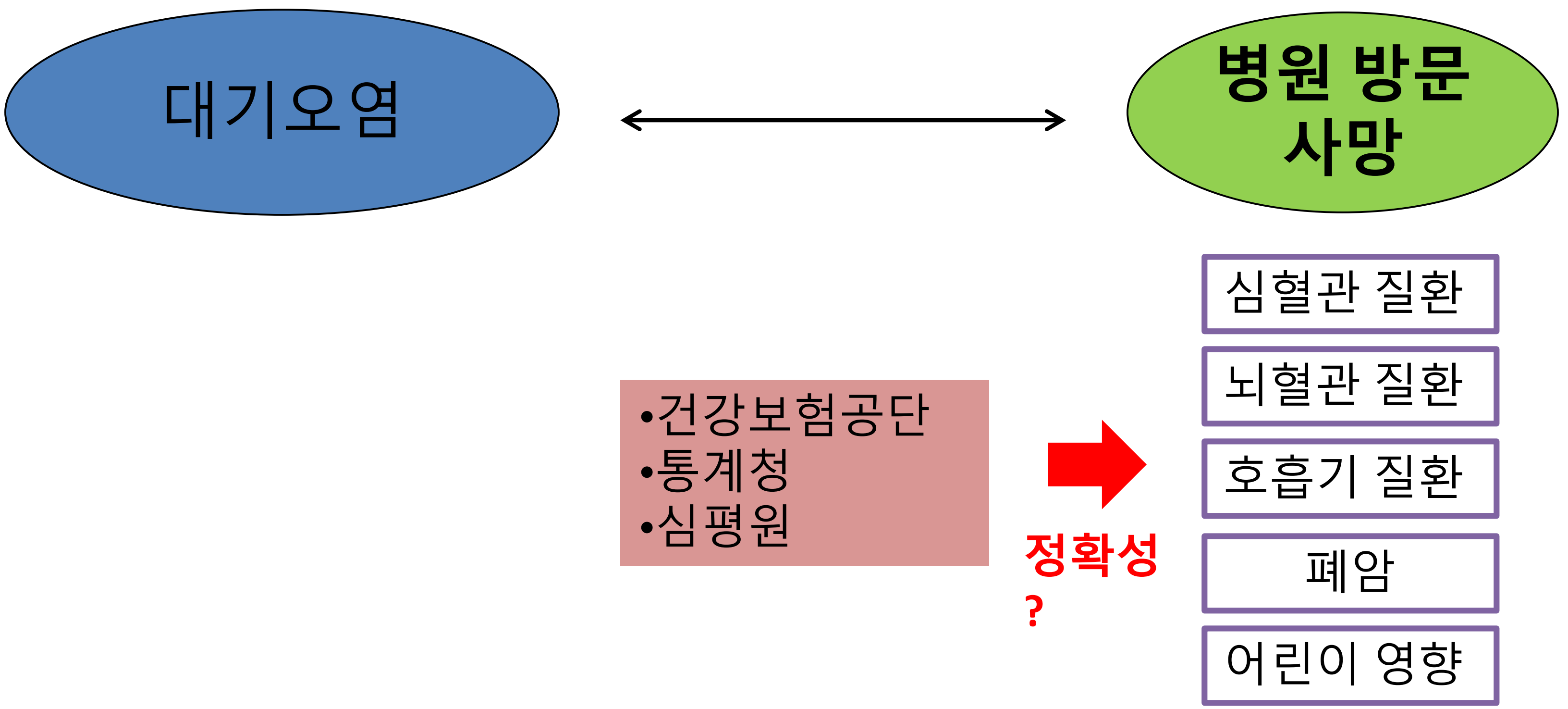
대기오염 연구의 제한점

- **대기오염 종류별 – 질환별 인과관계 ?**

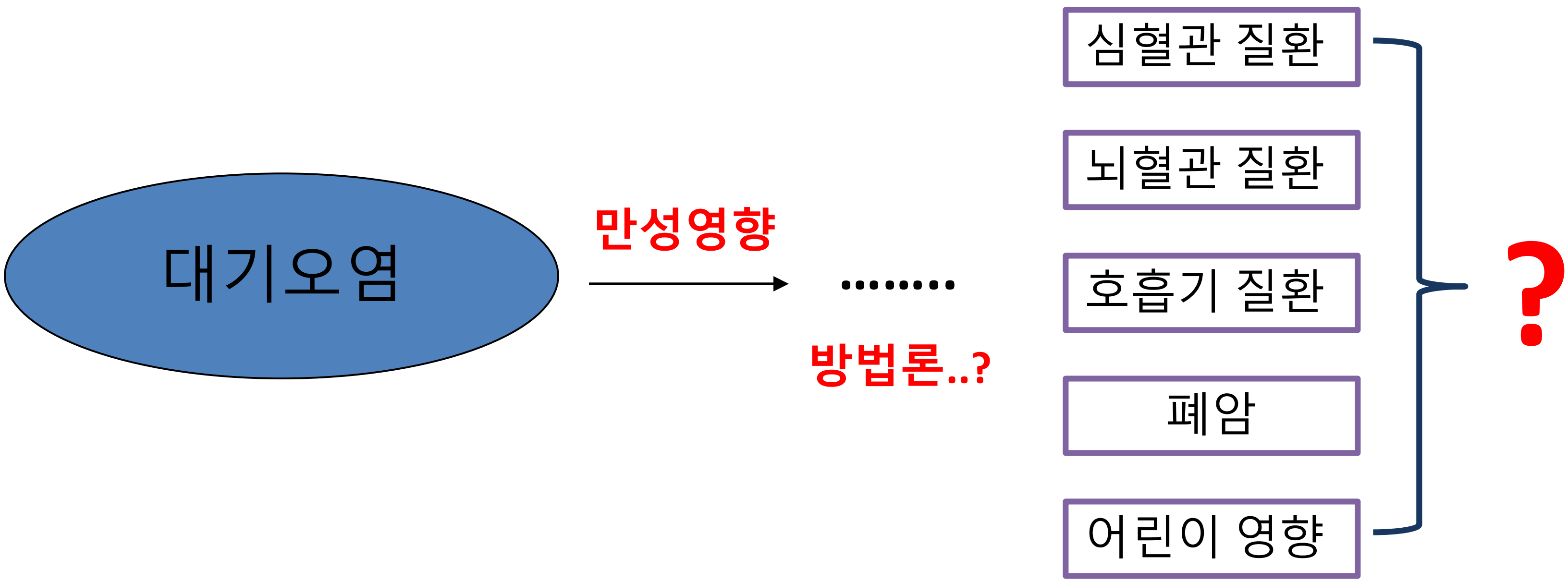


대기오염 연구의 제한점

- **진단명의 정확성**

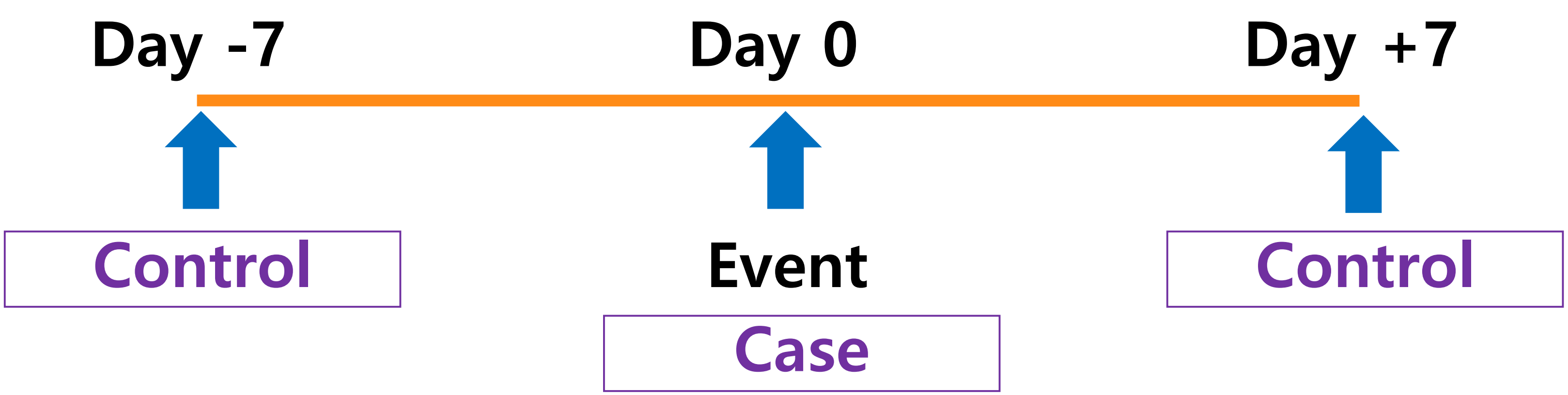


대기오염 연구의 제한점

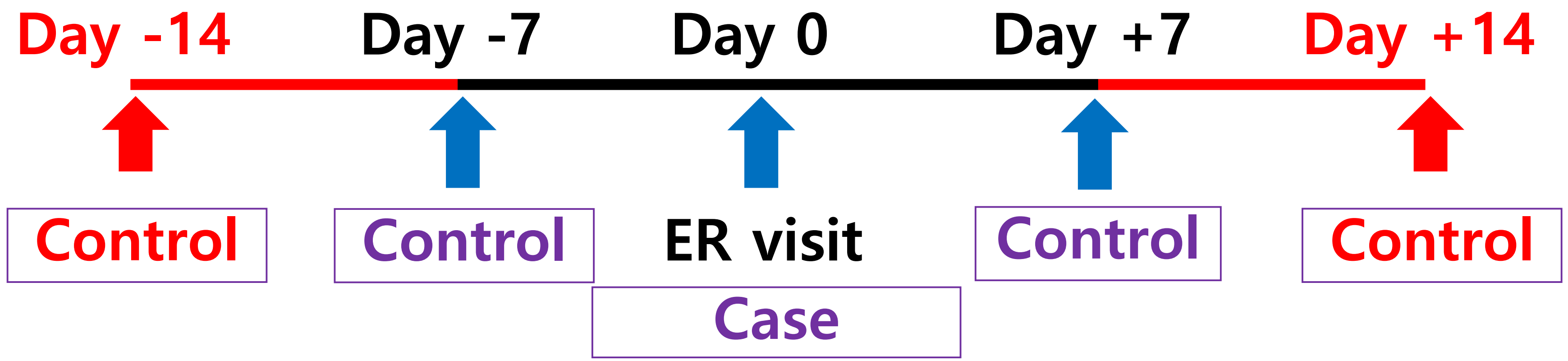


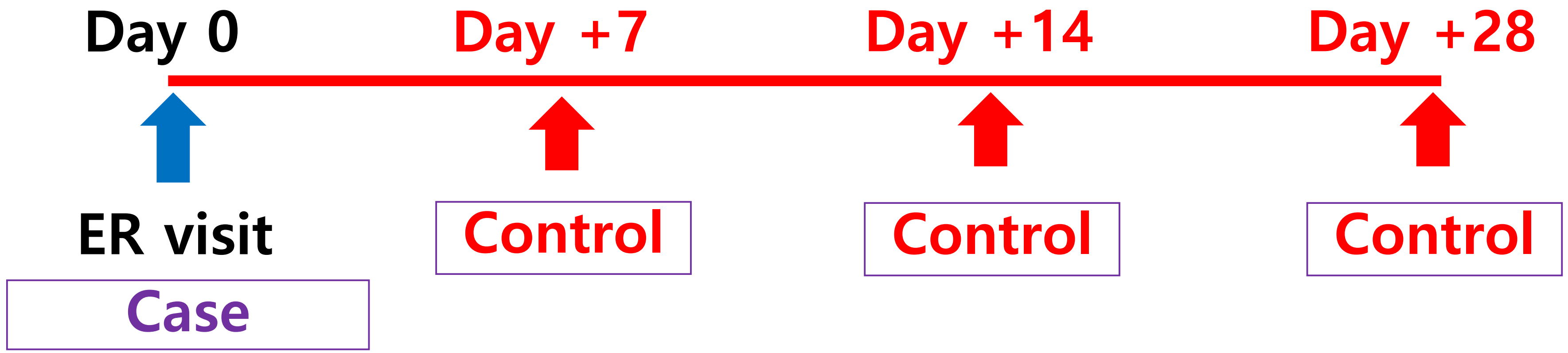
Case-crossover analysis

- Exposure
  - LAG 0 ~ LAG 3
    - lag 0 (same day) / lag 1 (one day after)
- Case-crossover analysis
  - Controls : 1 week before and after ER visits
  - Conditional logistic regression



Time stratified sampling method





공동연구 수행

강원대학교병원 호흡기질환
환경보건센터

- 자료 수집, DB 구축
- 호흡기 영향

(1차년도) 대기오염과 관련된 질병에 관한 자료 축적

↓

(2차년도) 대기오염 건강피해 추정모델 개발

↓

(3차년도) 건강에 악영향을 미치는 대기오염 통제지침 개발

세브란스병원
SEVERANCE HOSPITAL

- 질환의 조작적 정의
- 심혈관 영향

서울대학교 보건대학원
GRADUATE SCHOOL OF PUBLIC HEALTH
SEOUL NATIONAL UNIVERSITY

- 자료연계
- 통계분석

대기오염의 급성 영향, 호흡기 영향

PM_{10}

The New England
Journal of Medicine

VOLUME 343 DECEMBER 14, 2000 NUMBER 24

TABLE 4. SUMMARY PM_{10} ESTIMATES FROM TWO-POLLUTANT MODELS*

Outcome	PM_{10} Only	+ NO_2	+ O_3	PM_{10} Only[‡]	+ SO_2	PM_{10} Only[§]	+ CO
Asthma, 0–14 yr	1.2 (0.2, 2.3)	0.1 (−0.8, 1.0)	1.3 (0.1, 2.5)[†]	1.3 (0.2, 2.5)	0.8 (−3.7, 5.6)[†]	1.5 (0.2, 2.7)	0.7 (−0.3, 1.7)[†]
Asthma, 15–64 yr	1.1 (0.3, 1.8)	0.4 (−0.5, 1.3)	1.1 (0.1, 2.1)[†]	1.1 (0.3, 1.9)	1.6 (0.6, 2.6)	1.0 (0.2, 1.9)	0.8 (0.2, 1.4)[†]
COPD + asthma, 65+ yr	1.0 (0.4, 1.5)	0.8 (−0.6, 2.1)[†]	0.4 (−1.5, 2.2)[†]	0.9 (0.5, 1.3)	1.3 (0.7, 1.8)	1.1 (0.7, 1.5)	1.0 (0.4, 1.5)[†]
All respiratory, 65+ yr	0.9 (0.6, 1.3)	0.7 (−0.3, 1.7)[†]	0.8 (0.2, 1.4)[†]	0.9 (0.6, 1.2)	1.1 (0.7, 1.4)	1.1 (0.8, 1.4)	1.0 (0.7, 1.3)

Summary estimates for PM10 were typically increases of 1% in mean daily admissions for 10 ug/m3 increases in PM10

Department of Public Health Sciences, St. George's Hospital Medical School, London, United Kingdom; Unitat de Recerca Respiratoria i Ambiental, Institut Municipal Investigació Médica (IMIM), Barcelona, Spain; Birmingham Heartlands Hospital, Bordesley Green East, Birmingham, United Kingdom; Department of Statistics, University of Florence, Florence, Italy; Faculty of Medical Sciences, Department of Epidemiology and Statistics, University of Groningen, Groningen, The Netherlands; Health Regional Observatory, Paris, France; Agency for Public Health, Lazio, Italy; Department of Public Health and Clinical Medicine, Umea University, Umea, Sweden; Department of Hygiene-Epidemiolgy, Athens, Greece; and Environmental Epidemiology Program, Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts

$PM_{2.5}$

ORIGINAL CONTRIBUTION

Fine Particulate Air Pollution and Hospital Admission for Cardiovascular and Respiratory Diseases

Table 2. Annual Reduction in Admissions Attributable to a 10-µg/m³ Reduction in the Daily $PM_{2.5}$ Level for the 204 Counties in 2002

Cause-Specific Hospital Admissions	Annual No. of Admissions	Annual Reduction in Admissions (95% PI)*
Cerebrovascular disease	226 641	1836 (680 to 2992)
Peripheral vascular disease	70 061	602 (−42 to 1254)
Ischemic heart disease	346 082	1523 (69 to 2976)
Heart rhythm	169 627	967 (−17 to 1951)
Heart failure	246 598	3156 (1923 to 4389)
COPD	108 812	990 (196 to 1785)
Respiratory tract infection	226 620	2085 (929 to 3241)

Abbreviations: COPD, chronic obstructive pulmonary disease; PI, posterior interval; $PM_{2.5}$, particulate matter of less than or equal to 2.5 µm in aerodynamic diameter.
*Per 10-µg/m³ reduction in $PM_{2.5}$.

Ozone

ORIGINAL CONTRIBUTION

Ozone and Short-term Mortality in 95 US Urban Communities, 1987-2000

Figure 1. Percentage Change in Daily Mortality for a 10-ppb Increase in Ozone for Total and Cardiovascular Mortality, for Single-Lag and Distributed-Lag Models

A 10-ppb increase in the previous week's ozone was associated with a 0.52% increase in daily mortality
(95% posterior interval [PI], 0.27%-0.77%) and
a 0.64% increase in cardiovascular and respiratory mortality
(95% PI, 0.31%-0.98%).

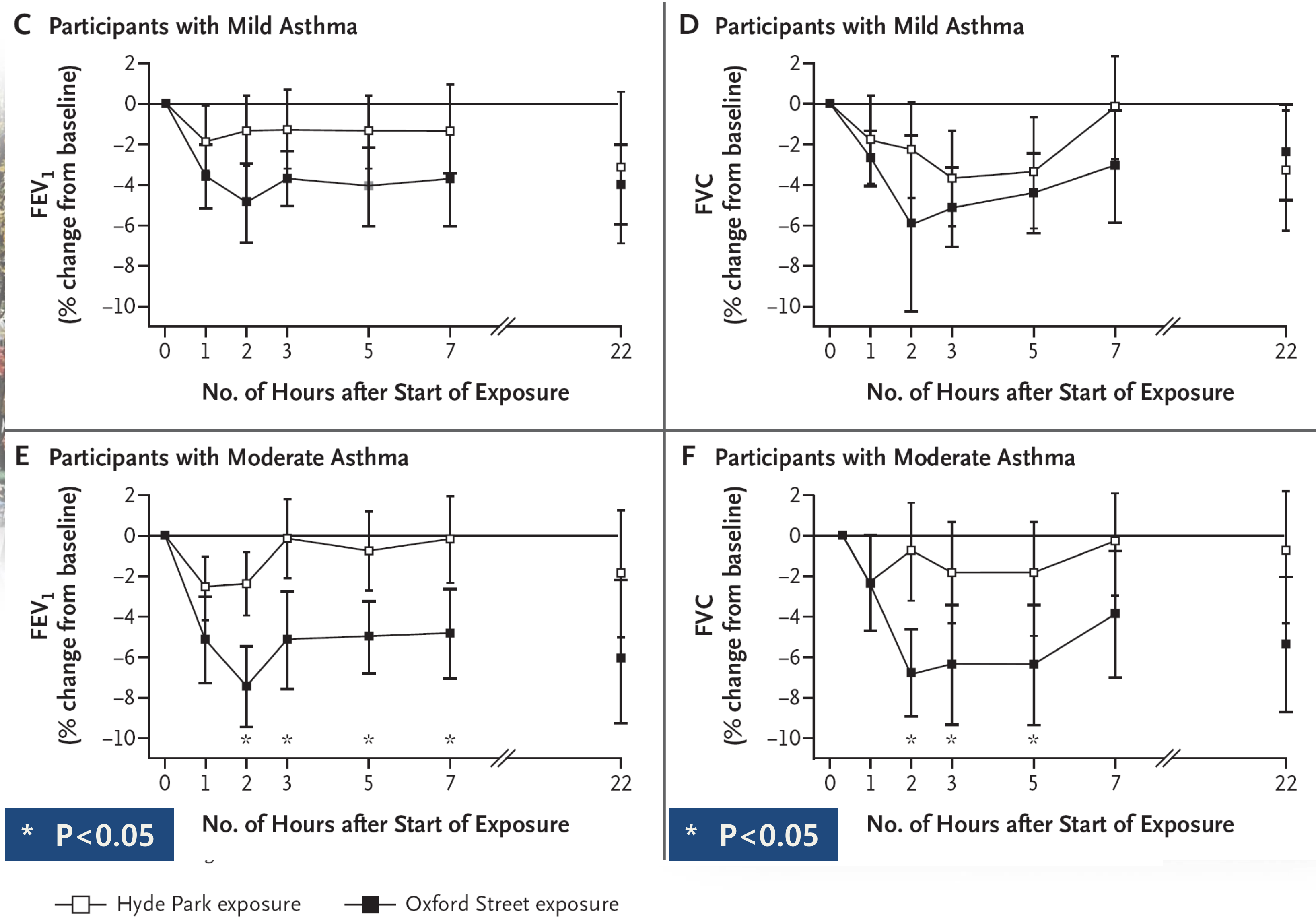
The single-lag model reflects the percentage increase in mortality for a 10-ppb increase in ozone on a single day. The distributed-lag model reflects the percentage change in mortality for a 10-ppb increase in ozone during the previous week. Error bars indicate 95% posterior intervals.

- NO_2
- SO_2
- CO

대기오염의 급성 영향, 천식

(consulted by prof. JW Kwon, department of allergy, KNUH)

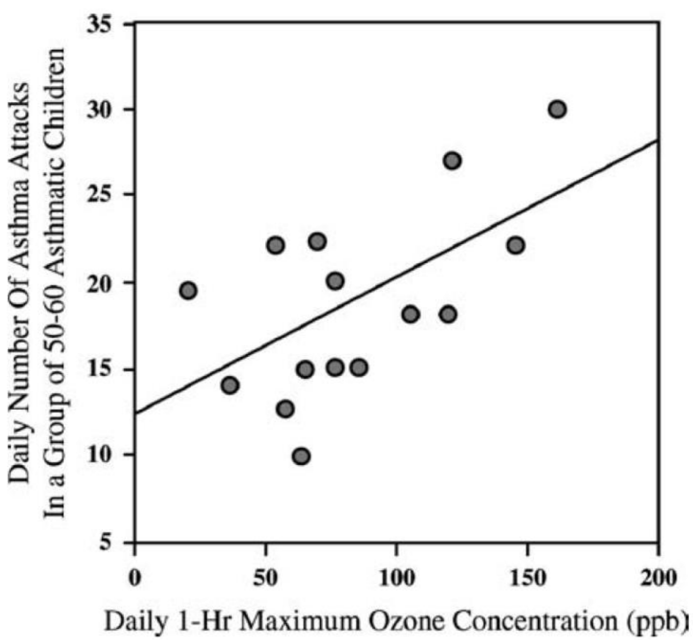
Oxford Street and Hyde Park



McCreanor J, et al. J N Engl J Med. 2007

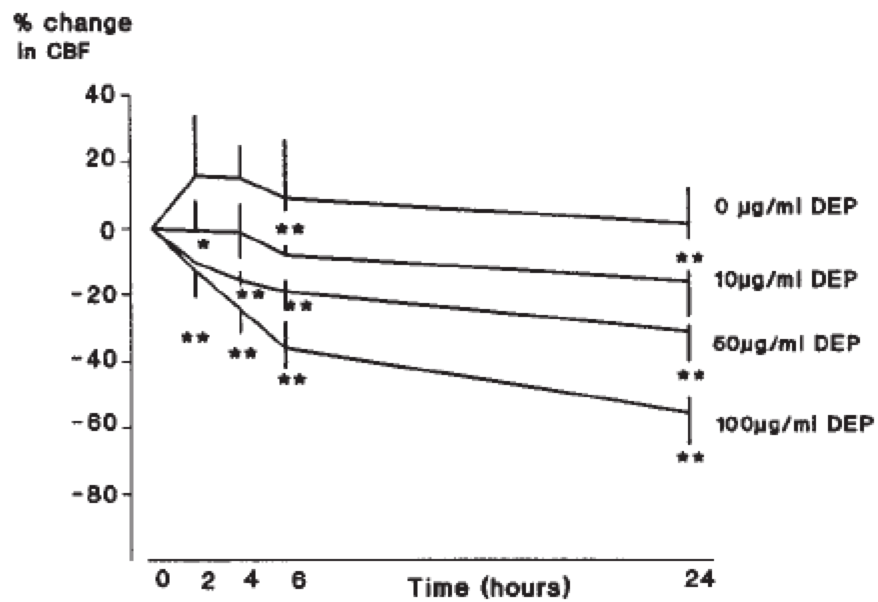
대기오염의 급성 영향, 천식

- 오존 (O_3) 노출에 따른 천식 악화의 증가



Trasande L, et al. *J Allergy Clin Immunol* 2005

- DEP 노출에 따른 점액배출능력 감소



Hasan Bayram, et al. *J Allergy Clin Immunol* 1998

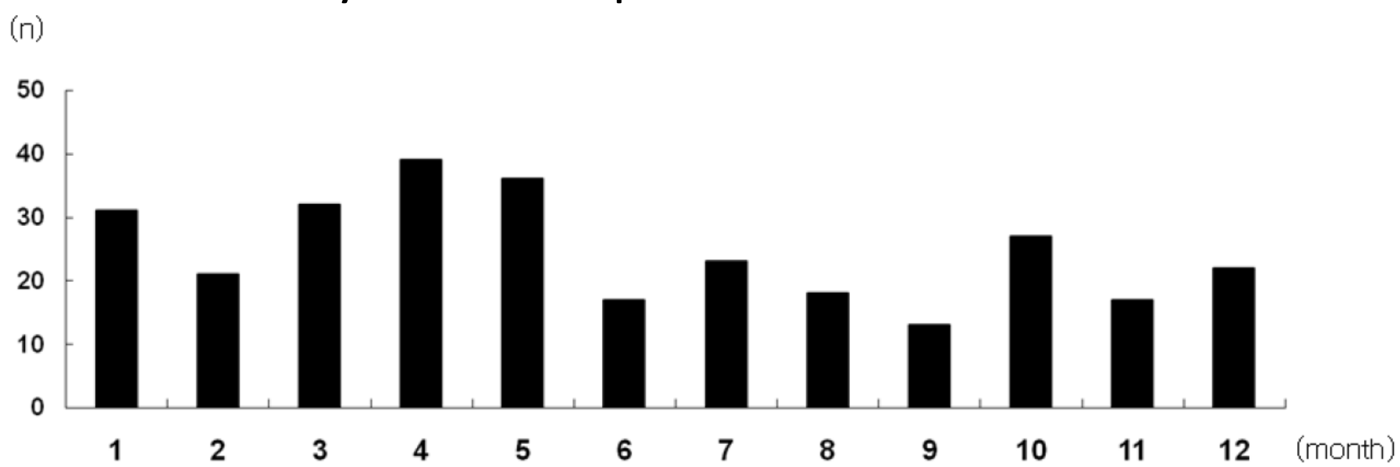
대기오염의 급성 영향, 천식, 계절 영향

연구자	지역	대상	내용
Ehara A, et al. (2000)	Hakodate , Tokyo	소아 (< 17세) single-center	천식증상으로 인한 입원↑ : 기압(D0, D-1) ↑, **상대습도**(D0, D-1)↓ 일교차 (D-1) ↑
Kashiwabara K (2002)	District in Island, Kyushu	소아 single-center	ER visits of asthmatic children ↑ on misty or foggy nights
Mireku N et al. (2009)	Detroit, Michigan	소아 single-center	소아천식 ER 내원 ↑ : Intraday humidity ↑ (D-2~D-1) Intraday temperature ↑ (D-1~D-0) 기압 무관
Santić Z, et al. (2002)	Bosnia and Herzegovina	129 patients 5-67 years	35세 이상 성인 천식증상 In 11-1월 (**highest humidity**, lowest temperature)
Marks G, et al. (2001)	Australia		asthma ER visits: ↑ thunderstorm in spring and summer (pollen conc. ↑)

서울지역 대기오염이 성인 천식 급성 악화에 미치는 영향: 환자교차연구

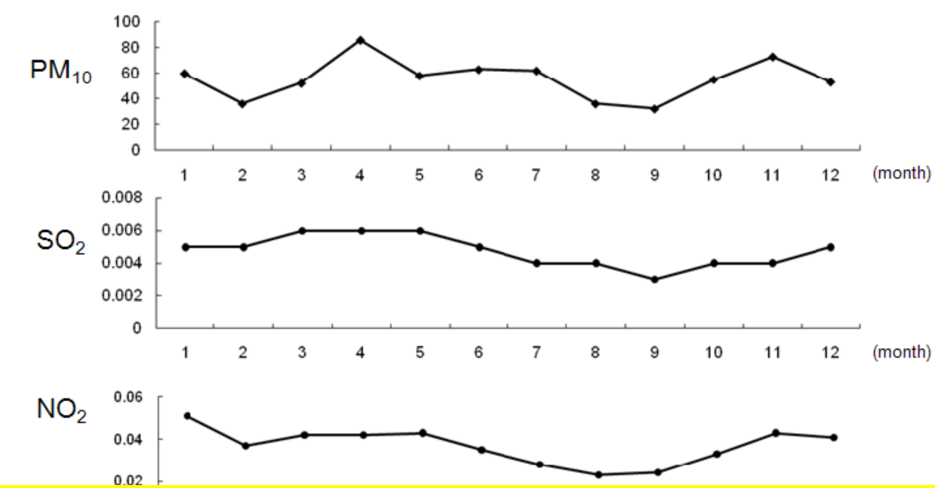
- Relative risk of acute exacerbation of asthma due to an increase in air pollutant levels
  - ER visits of 3 University Hospitals in Seoul
  - Over 12 months (from January 2005 to December 2005)

  => 297 ED visits by 237 adult patients with asthma

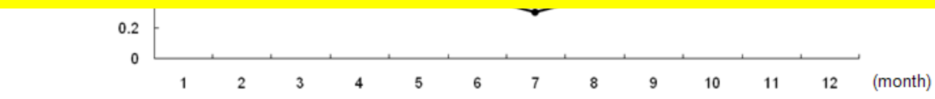


Numbers of ER visits of three hospitals

김상헌, 윤호주 외 대한내과학회지 2010



- **No significant impact of air pollution on ED visits for acute exacerbation of asthma in adult patients living in Seoul**



Pollutants	Lag 0	Lag 1	Lag 2
PM_{10}	0.996 (0.990~1.001)	0.997 (0.992~1.002)	0.996 (0.992~1.001)
SO_2	0.975 (0.904~1.051)	0.944 (0.879~1.013)	0.976 (0.904~1.055)
NO_2	1.004 (0.991~1.018)	0.995 (0.983~1.007)	0.994 (0.982~1.006)
O_3	0.988 (0.975~1.001)	0.993 (0.983~1.003)	0.999 (0.989~1.009)
CO	0.975 (0.902~1.052)	0.924 (0.852~1.002)	0.941 (0.873~1.015)

대기오염의 급성 영향, COPD

International Journal of COPD
Dovepress
open access to scientific and medical research
Open Access Full Text Article
REVIEW

Particulate matter air pollution exposure: role in the development and exacerbation of chronic

Acute exacerbations of COPD, chronic bronchitis (CB), or emphysema have been associated with short-term exposure to air pollution.

It is interesting to note that in COPD, the PM, as opposed to gases such as nitrogen dioxide and ozone, are the strongest associated with increased mortality

penetrating deep into the alveolar spaces. Ineffective clearance of this PM from the airways could cause particle retention in lung tissues, resulting in a chronic, low-grade inflammatory response that may be pathogenetically important in both the exacerbation, as well as, the progression of lung disease. This review focuses on the adverse effects of exposure to ambient PM air pollution on the exacerbation, progression, and development of COPD.

Keywords: chronic obstructive pulmonary disease, particulate matter, air pollution, alveolar macrophage

대기오염의 만성 영향, COPD

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 1, 2007 VOL. 356 NO. 5

Long-Term Exposure to Air Pollution and Incidence of Cardiovascular Events in Women

Kristin A. Miller, M.S., David S. Siscovick, M.D., M.P.H., Lianne Sheppard, Ph.D., Kristen Shepherd, M.S., Jeffrey H. Sullivan, M.D., M.H.S., Garnet L. Anderson, Ph.D., and Joel D. Kaufman, M.D., M.P.H.

- time-to-event 자료의 구축
- generalized Cox model

Chronic Obstructive Pulmonary Disease and Long-Term Exposure to Traffic-related Air Pollution

A Cohort Study

Zorana J. Andersen[1], Martin Hvidberg[2], Steen S. Jensen[2], Matthias Ketzel[2], Steffen Loft[3], Mette Sørensen[1], Anne Tjønneland[1], Kim Overvad[4,5], and Ole Raaschou-Nielsen[1]

[1]Institute of Cancer Epidemiology, Danish Cancer Society, Copenhagen, Denmark; [2]National Environmental Research Institute, Aarhus University, Roskilde, Denmark; [3]Department of Environmental Health, University of Copenhagen, Copenhagen, Denmark; [4]School of Public Health, Aarhus University, Aarhus, Denmark; [5]Centre for Cardiovascular Research, Aalborg Hospital, Aarhus University Hospital, Aalborg, Denmark

1971 ~ 2006, annual mean levels of (NO2) and (NOx)

at the residential addresses

1993 ~ 2006, first hospital admission for COPD

-> a Cox proportional hazards model

TABLE 3. ASSOCIATION BETWEEN TRAFFIC-RELATED AIR POLLUTION AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE INCIDENCE (N = 1,797) AMONG 52,799 DIET, CANCER, AND HEALTH COHORT PARTICIPANTS

	Adjusted for Age	Adjusted for Age, Smoking Status, Duration, Intensity, and Environmental Tobacco Smoke	Fully Adjusted*
35-yr mean (1971 to event, censoring, or 27 June 2006)			
NO_2,† μg/m^3	1.22 (1.15–1.29)	1.08 (1.02–1.14)	1.08 (1.02–1.14)
NO_x,† μg/m^3	1.16 (1.11–1.22)	1.05 (1.01–1.10)	1.05 (1.01–1.10)
25-yr mean (1981 to event, censoring, or 27 June 2006)			
NO_2,† μg/m^3	1.20 (1.13–1.27)	1.06 (1.01–1.13)	1.07 (1.01–1.13)
NO_x,† μg/m^3	1.14 (1.09–1.19)	1.04 (0.99–1.09)	1.04 (0.99–1.09)
15-yr mean (1991 to event, censoring, or 27 June 2006)			
NO_2,† μg/m^3	1.18 (1.11–1.24)	1.05 (0.99–1.11)	1.05 (1.00–1.11)
NO_x,† μg/m^3	1.12 (1.07–1.17)	1.03 (0.99–1.08)	1.03 (0.97–1.09)
1-yr mean at cohort baseline (1993–1997)			
Major road‡ within 50 m	1.25 (1.07–1.45)	1.05 (0.90–1.22)	1.04 (0.89–1.21)
Traffic load§ within 200 m	1.10 (1.06–1.14)	1.01 (0.98–1.05)	1.01 (0.97–1.05)

Associations of Ambient Air Pollution with Chronic Obstructive Pulmonary Disease Hospitalization and Mortality

Wen Qi Gan[1,2], J. Mark FitzGerald[3,4], Chris Carlsten[3,4,5], Mohsen Sadatsafavi[3,4], and Michael Brauer[3,4,5]

[1]Department of Population Health, Hofstra North Shore-LIJ School of Medicine, Great Neck, New York; [2]Feinstein Institute for Medical Research, North Shore-Long Island Jewish Health System, Great Neck, New York; [3]Respiratory Division, Department of Medicine, Vancouver Hospital and Health Science Centre, Vancouver, British Columbia, Canada; and [4]Institute for Heart and Lung Health and [5]School of Population and Public Health, University of British Columbia, Vancouver, British Columbia, Canada

Am J Respir Crit Care Med, 2013

METHODS

Population and Study Design

the provincial health insurance program

-> link various administrative databases

-> a population-based cohort

a 5-year exposure period (1, 1994 to 12, 1998)

a 4-year follow-up period (1, 1999 to 12, 2002)

Inclusion, at baseline (January 1999)

(1) registered with the provincial health insurance plan

(2) <u>resided in the study region during the 5-year exposure period</u>

(3) aged 45–85 years

(4) had no previous physician diagnosis of COPD

- **high spatial resolution land use regression models**

  black carbon, NO_2, NO, and $PM_{2.5}$

- **we calculated 5-year average concentrations of each pollutant for each study subject.**

- **COPD hospitalization cases and death cases**

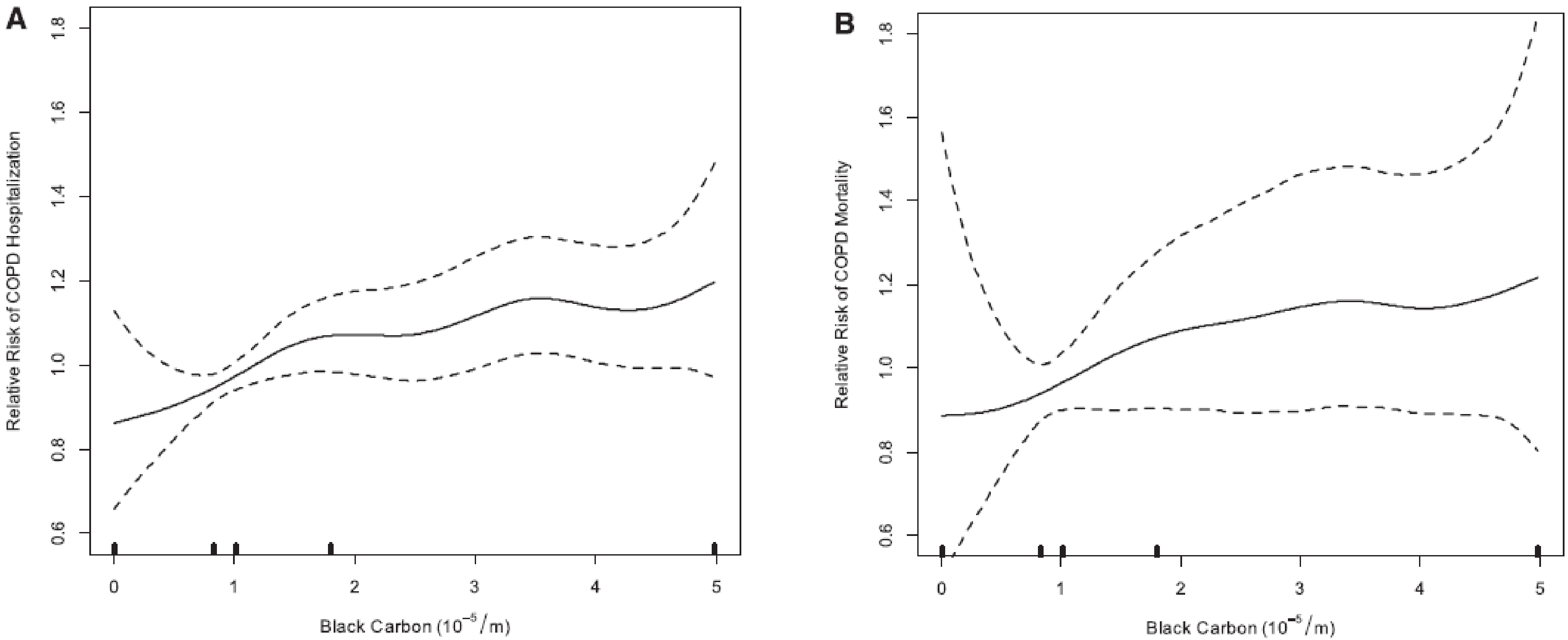
- **Cox proportional hazards regression model**

During the follow-up period,

2,299 subjects were hospitalized for COPD

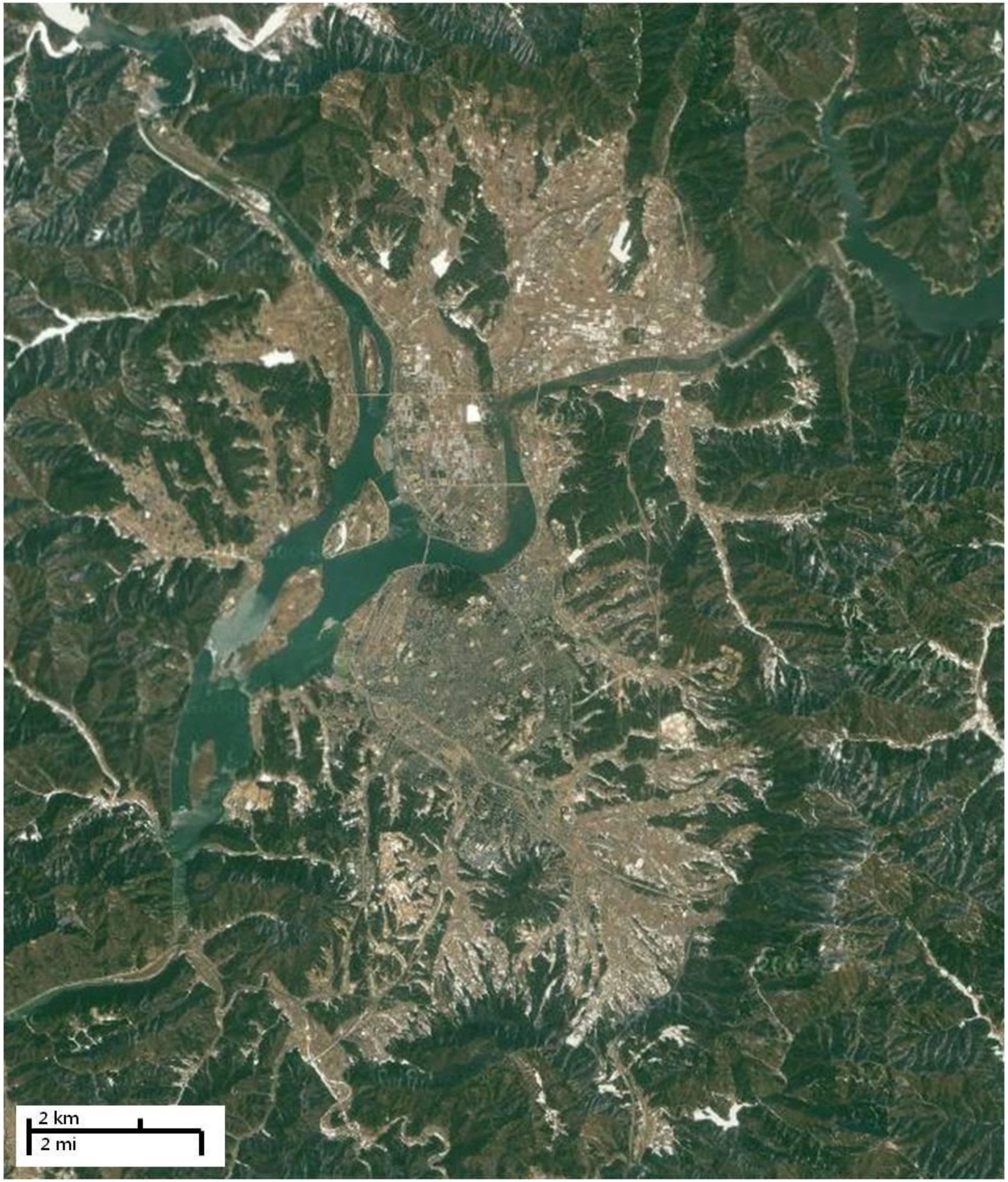
541 subjects died from COPD

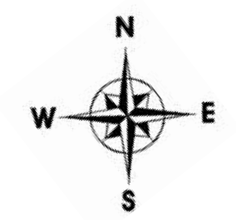
-> Exposure to black carbon was strongly associated with the risk of COPD hospitalization and mortality


A
Relative Risk of COPD Hospitalization
Black Carbon (10⁻⁵/m)
B
Relative Risk of COPD Mortality
Black Carbon (10⁻⁵/m)
0.6
0.8
1.0
1.2
1.4
1.6
1.8
0
1
2
3
4
5

춘천에서의 연구

춘 천





From google map

1. 춘천 안개

by JW Kwon, Allergy & Clinical Immunology , KNUH

Methods

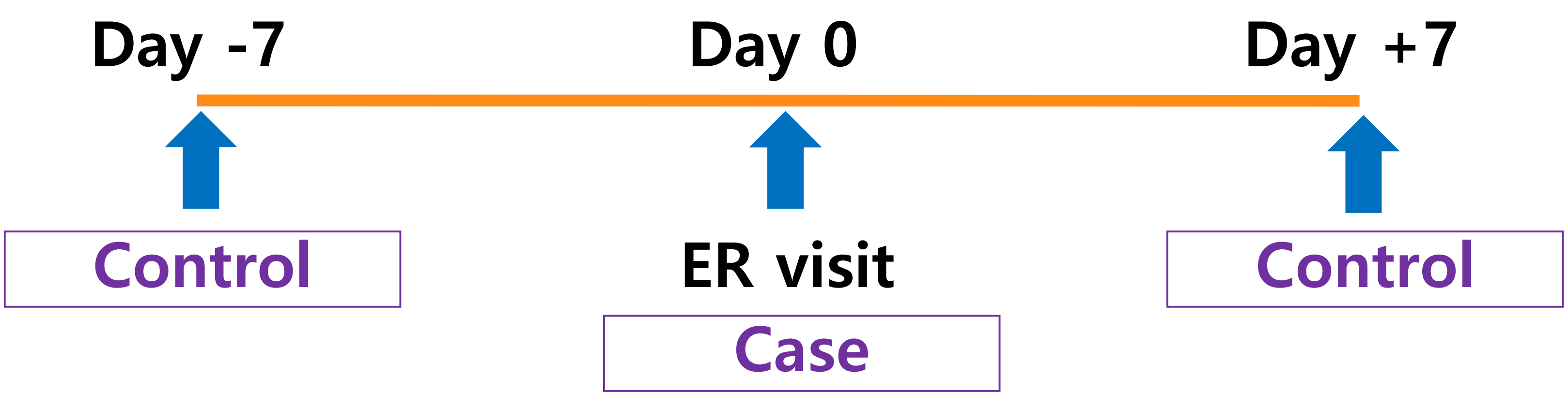
- Subjects
  - 2006. 1. 1 ~ 2011. 12. 31
  - 2 university hospitals
    - Kangwon National University Hospital (KNUH)
    - Hallym University Hospital (HUH)
  - **ER visits with asthma exacerbations**
    - Diagnosis of asthma by doctor at ER
    - Use of salbutamol nebulizer at ER

Methods

- Meteorological data *(daily climate factors)*
  - Maximum ,Mean, Minimum temperature
  - Daily temperature range (DTR) : max. temp. – min. temp.
  - Mean dew point temperature
  - Mean, Minimum Relative humidity
  - Maximum, Mean wind
  - Maximum wind direction
  - Mean pressure / mean cloud / rain
  - Solar irradiation, day light hour
  - **Fog (0/1 coding)**
- Air pollution data
  - PM_{10}, CO, SO2, NO_2, O_3

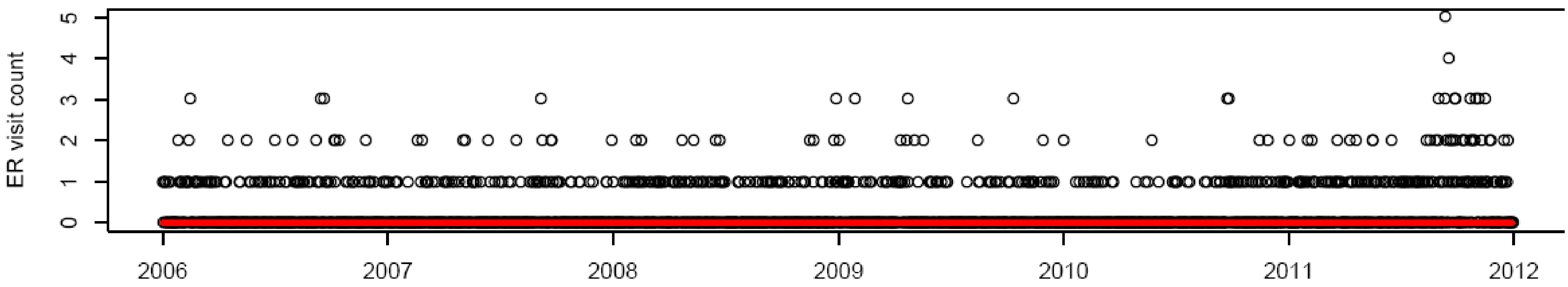
Case-crossover analysis

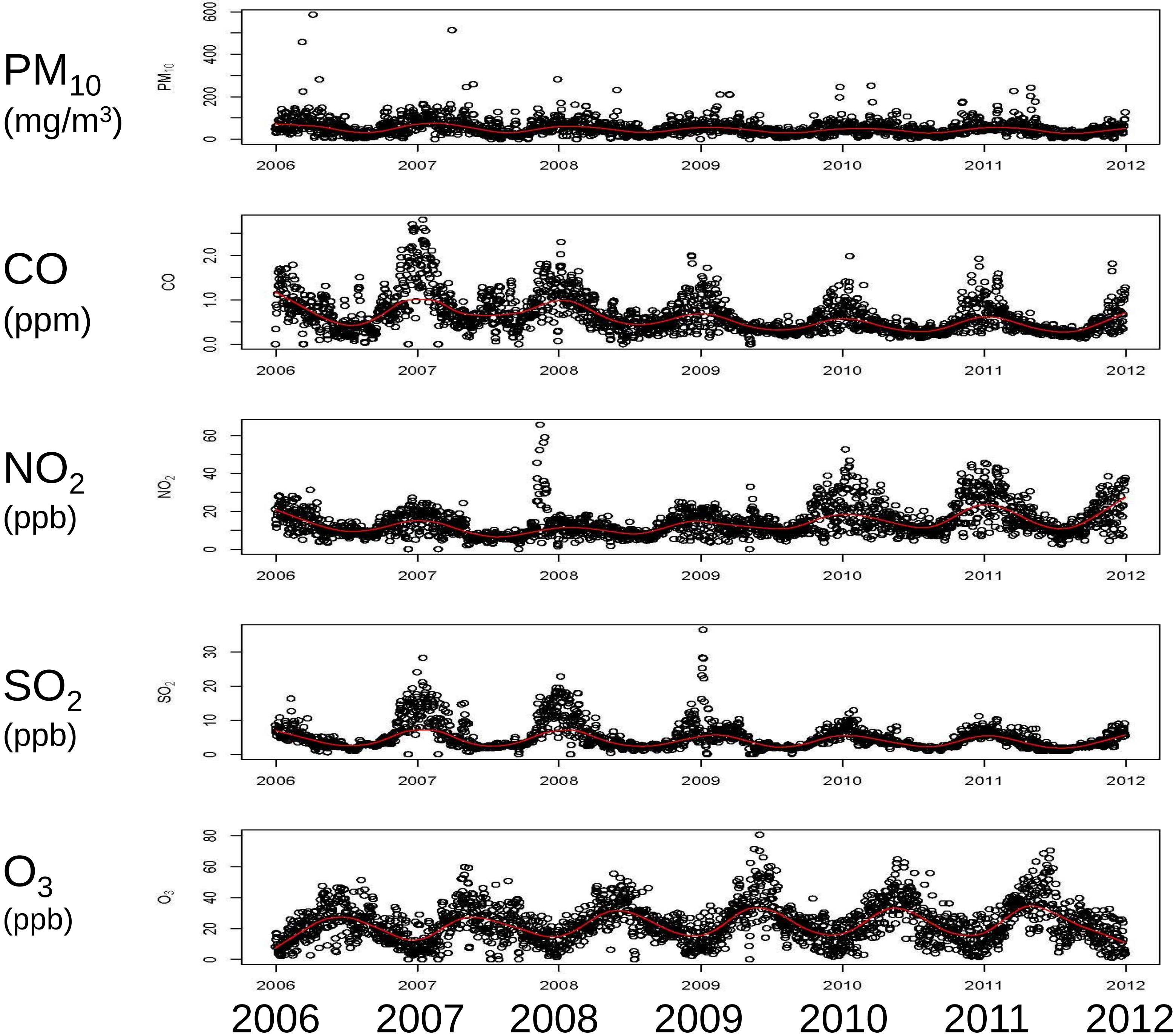
- Exposure
  - LAG 0 ~ LAG 3
    - lag 0 (same day) / lag 1 (one day before)
- Case-crossover analysis
  - Controls : 1 week before and after ER visits
  - Conditional logistic regression



Results

- Baseline characteristics
  - 583 patients (660 ER visits) (2006. 1. 1 ~ 2011. 12. 31)
  - In 546 days: median number of visits 1(1-5)





PM_{10}
(mg/m^3)
CO
(ppm)
NO_2
(ppb)
SO_2
(ppb)
O_3
(ppb)
2006
2007
2008
2009
2010
2011
2012

	No fog			Fog			
	No. of days	Mean	SD	No. of days	Mean	SD	p^*
PM_{10} (mg/m^3)	2013	48.73	37.04	329	**69.49**	35.35	<0.0001
CO (ppm)	2014	0.59	0.38	329	**0.88**	0.48	<0.0001
NO_2 (ppb)	2014	13.48	7.3	329	**18.88**	9.68	<0.0001
O_3 (ppb)	2014	**24.77**	12.77	329	16.75	11.17	<0.0001
SO_2 (ppb)	2014	4.66	3.7	329	5.46	3.76	0.0003
Mean temperature (˚C)	1983	11.06	10.88	329	9.4	9.72	0.005
Max temperature (˚C)	1983	16.76	10.66	329	15.34	10.12	0.0193
Dew point temperature (˚C)	1983	4.48	12.21	329	5.31	9.53	0.161
Mean humidity (%)	1983	67.9	13.78	329	**78.97**	9.49	<0.0001
Average wind speed (m/s)	1983	**1.15**	0.61	329	0.75	0.44	<0.0001
Max wind speed (m/s)	1983	2.88	1.2	329	2.3	1.11	<0.0001
Mean cloud cover (tenth)[†]	1983	5.18	3.26	329	6.23	2.69	<0.0001
Evaporation amount (mm)	440	2.74	1.9	46	2.14	1.77	0.0411
Rainfall (mm)	1710	5.14	18	300	2.94	15.98	0.0317
Maximum depth of snow cover (cm)	60	3.44	2.5	8	5.71	3.26	0.0226
Diurnal temperature range (˚C)	1983	10.74	4.2	329	10.29	3.66	0.0427

Univariate analysis

Variable	Lag 1				Lag 2				Lag 3			
	% change	95% CI		*p*	% change	95% CI		*p*	% change	95% CI		*p*
Air press (hPa = mb)	0.94	-15.36	20.39	0.917	-2.02	-17.62	16.54	0.818	2.46	-14.51	22.80	0.793
Mean temperature (˚C)	1.74	-17.14	24.91	0.870	-0.41	-18.38	21.51	0.968	-1.86	-19.79	20.07	0.855
Max temperature (˚C)	0.00	-16.60	19.90	1.000	-0.66	-17.29	19.33	0.944	-6.03	-21.75	12.85	0.505
Minimum temperature (˚C)	-2.88	-19.58	17.30	0.762	-3.76	-19.70	15.35	0.679	-2.80	-19.27	17.02	0.764
Dew point temperature (˚C)	-9.45	-23.41	7.05	0.245	-8.51	-22.15	7.53	0.281	-8.87	-22.61	7.31	0.266
Mean humidity (%)*	**-9.55**	-16.37	-2.18	**0.012†**	**-8.57**	-15.53	-1.04	**0.027**	-7.45	-14.58	0.28	0.058
Minimum humidity (%)	-0.46	-6.01	5.43	0.876	-2.51	-7.86	3.15	0.377	-0.76	-6.21	5.00	0.790
Mean wind speed(m/s)	**18.50**	0.07	40.32	**0.049**	**20.58**	2.22	42.25	**0.026**	**24.00**	4.84	46.67	**0.012**
Maximum wind speed (m/s)	-0.33	-8.56	8.65	0.940	8.62	-0.42	-4.17	0.062	8.85	-0.09	18.59	0.053
Mean cloud cover (tenth)	-23.13	-43.39	4.38	0.092	-10.06	-33.70	22.02	0.496	-8.90	-33.00	23.88	0.552
Rainfall (mm)	-3.16	-10.67	4.99	0.436	0.76	-5.20	7.09	0.808	**8.05**	0.51	16.15	**0.036**
Fog	-20.74	-39.89	4.50	0.099	**-29.41**	-46.32	-7.17	**0.013**	-10.96	-31.27	15.33	0.379
Duration of sunshine	18.53	-7.99	52.69	0.188	10.39	-15.00	43.34	0.459	2.79	-20.77	33.35	0.836
Quantity of solar radiation	-1.09	-15.60	15.90	0.892	1.42	-13.62	19.08	0.863	-6.17	-19.99	10.04	0.433
Diurnal temperature range (˚C)	4.77	-17.51	33.07	0.703	6.10	-17.14	35.85	0.638	-5.97	-26.34	20.05	0.621
PM_{10} (mg/m^3)*	-0.70	-3.64	2.32	0.644	-2.24	-5.20	0.82	0.149	0.84	-2.00	3.77	0.567
CO (ppm)	**-29.08**	-48.89	-1.59	**0.040**	**-46.87**	-62.42	-24.89	**0.000**	**-37.51**	-55.76	-11.72	**0.008**
SO_2 (ppb)*	-5.33	-32.97	33.69	0.756	-13.52	-38.70	22.02	0.409	-7.94	-35.58	31.58	0.650
O_3 (ppb)*	9.25	-1.12	20.72	0.082	10.34	-0.55	22.42	0.063	6.16	-4.44	17.95	0.265
NO_2 (ppb)*	-13.16	-25.89	1.76	0.081	**-21.19**	-33.40	-6.74	**0.006**	**-16.69**	-29.94	-0.93	**0.039**

* per 10 units change of exposure

Multivariate analysis

	Lag 0				Lag 1				Lag 2				Lag 3			
	RC*	95% CI		*p*	RC*	95% CI		*p*	RC*	95% CI		*p*	RC*	95% CI		*p*
Mean wind speed (m/s)	-14.24	-31.34	7.11	0.176	4.47	-17.14	31.71	0.712	2.17	-18.17	27.57	0.850	14.79	-8.03	43.27	0.223
Relative humidity (%)	-9.13	-16.99	-0.51	**0.038**[†]	-7.69	-15.65	1.02	0.082	-5.39	-13.55	3.54	0.229	-3.69	-11.91	5.29	0.409
NO_2	-5.85	-24.04	16.69	0.582	-5.98	-22.97	14.76	0.545	-16.98	-32.65	2.33	0.081	-6.94	-24.94	15.39	0.512
Mean wind speed (m/s)	-12.46	-27.92	6.32	0.18	4.73	-14.83	28.78	0.662	10.79	-7.99	33.39	0.280	19.83	0.98	42.21	**0.038**
Relative humidity (%)	-9.00	-16.98	-0.26	**0.044**	-7.04	-15.17	1.87	0.118	-6.66	-14.40	1.79	0.119	-7.36	-14.84	0.79	0.076
CO	-8.13	-36.69	33.30	0.655	-17.84	-43.28	19.03	0.299	-15.21	-41.19	22.25	0.377	-15.87	-41.20	20.38	0.345
Mean wind speed (m/s)	-10.54	-26.35	8.67	0.262	7.32	-12.94	32.31	0.508	11.59	-9.08	36.97	0.294	21.33	-0.71	48.25	0.059
Relative humidity (%)	-9.69	-17.91	-0.64	**0.036**	-7.41	-15.77	1.78	0.111	-5.34	-13.84	4.00	0.252	-4.56	-13.10	4.81	0.329
O_3	-1.30	-12.41	11.21	0.83	1.92	-9.87	15.25	0.762	2.76	-9.66	16.88	0.679	-2.72	-14.38	10.52	0.671

* RC, Risk change (%)

Conclusion

- High wind speed and low humidity were associated with an increased risk of asthma ED visits.

- Fog was associated with a decreased risk of asthma ED visits after controlling for seasonal variations in weather and air pollution.

2. 춘천 대기오염

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TRD
Tuberculosis and Respiratory Diseases

The Influence of Asian Dust, Haze, Mist, and Fog on Hospital Visits for Airway Diseases

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Methodes

(1) Region : Chuncheon, Kangwondo, Korea

(2) Period : 2006.01.01 ~ 2012.04.30

(3) Hospital visit and admissions data

- Data were obtained from the National Health Insurance Service(NHIS).
- The daily number of hospital visit and admissions for asthma (ICD-9: J45.0, J45.9, J46.0, J46.1, J46.9) and COPD(ICD-9: J448, J449).

(4) Meteorological data

(5) Case-crossover analysis

Case-crossover analysis

- Exposure
  - LAG 0 ~ LAG 3
    - lag 0 (same day) / lag 1 (one day after)
- Case-crossover analysis
  - Controls : 1 week before and after ER visits
  - Conditional logistic regression

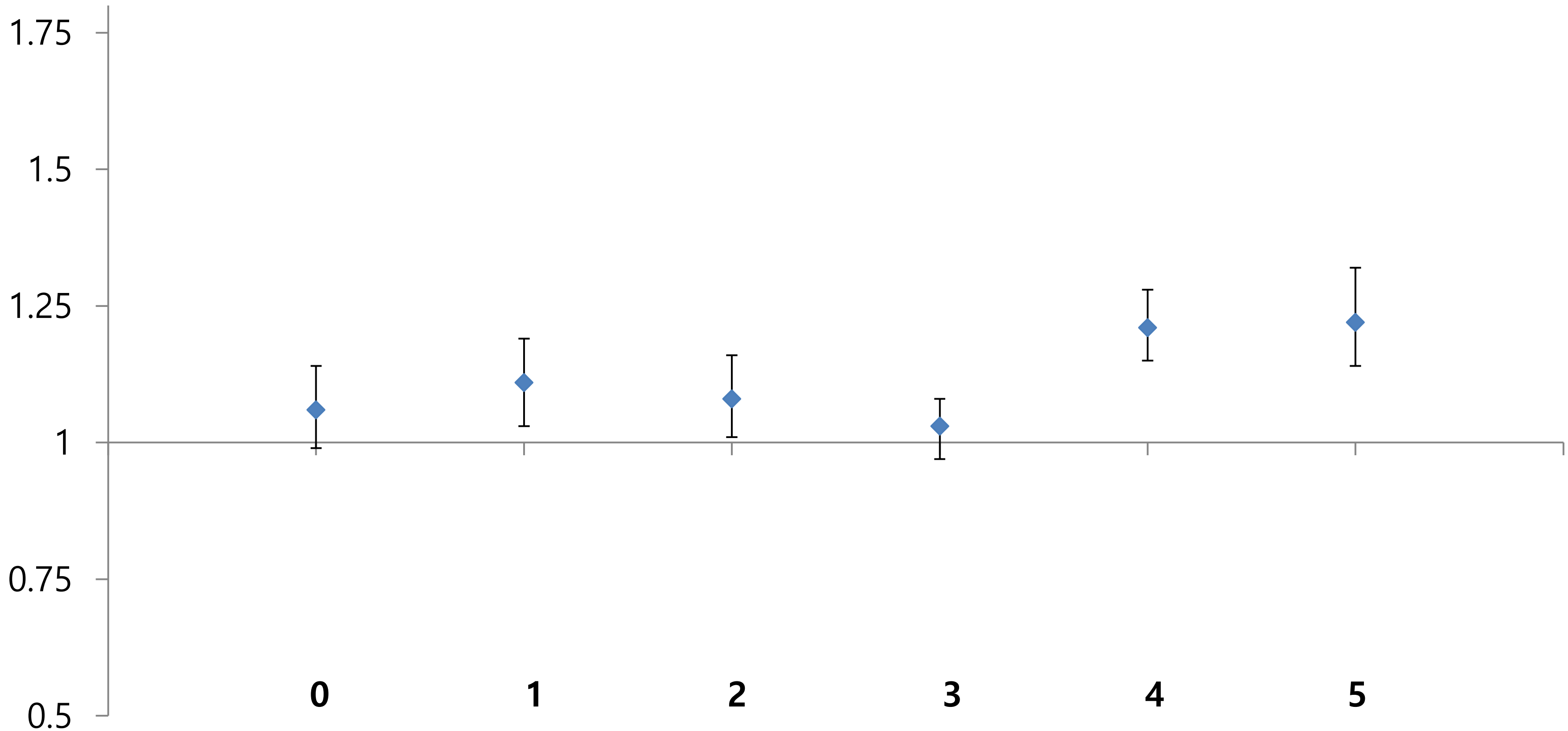
Results

	Asian Dust		Haze	
	Control(n=104)	Event(n=52)	Control(n=334)	Event(n=167)
PM_{10}	63.7(2.7)	**162.5(12.6)***	47.5(1.84)	**82.3(2.69)***
CO	0.70(0.04)	0.61(0.04)	0.53(0.02)	0.78(0.03)*
O_3	0.02(0.001)	0.03(0.002)	0.03(0.001)	0.03(0.001)
NO_2	0.016(0.001)	0.013(0.001)*	0.015(0.001)	0.021(0.001)*
SO_2	0.006(0.0004)	0.005(0.0004)	0.005(0.0002)	0.006(0.0004)*
Temperature	7.38(0.76)	8.18(1.07)	7.83(0.61)	9.38(0.79)
Dew point	0.62(0.84)	-0.66(1.22)	0.60(0.97)	3.81(0.79)*
Humidity	66.9(1.50)	58.2(2.16)*	65.2(0.79)	72.5(0.88)*
daily mean wind speed	1.08(0.06)	1.75(0.10)*	1.09(0.03)	0.85(0.04)*
maximum wind speed	2.88(0.11)	4.00(0.19)*	2.92(0.07)	2.48(0.10)*
daily mean cloud amount	5.08(0.32)	4.50(0.42)	4.58(0.17)	5.30(0.22)*
Duration of sunshine	5.42(0.39)	5.77(0.55)	5.85(0.20)	5.05(0.27)

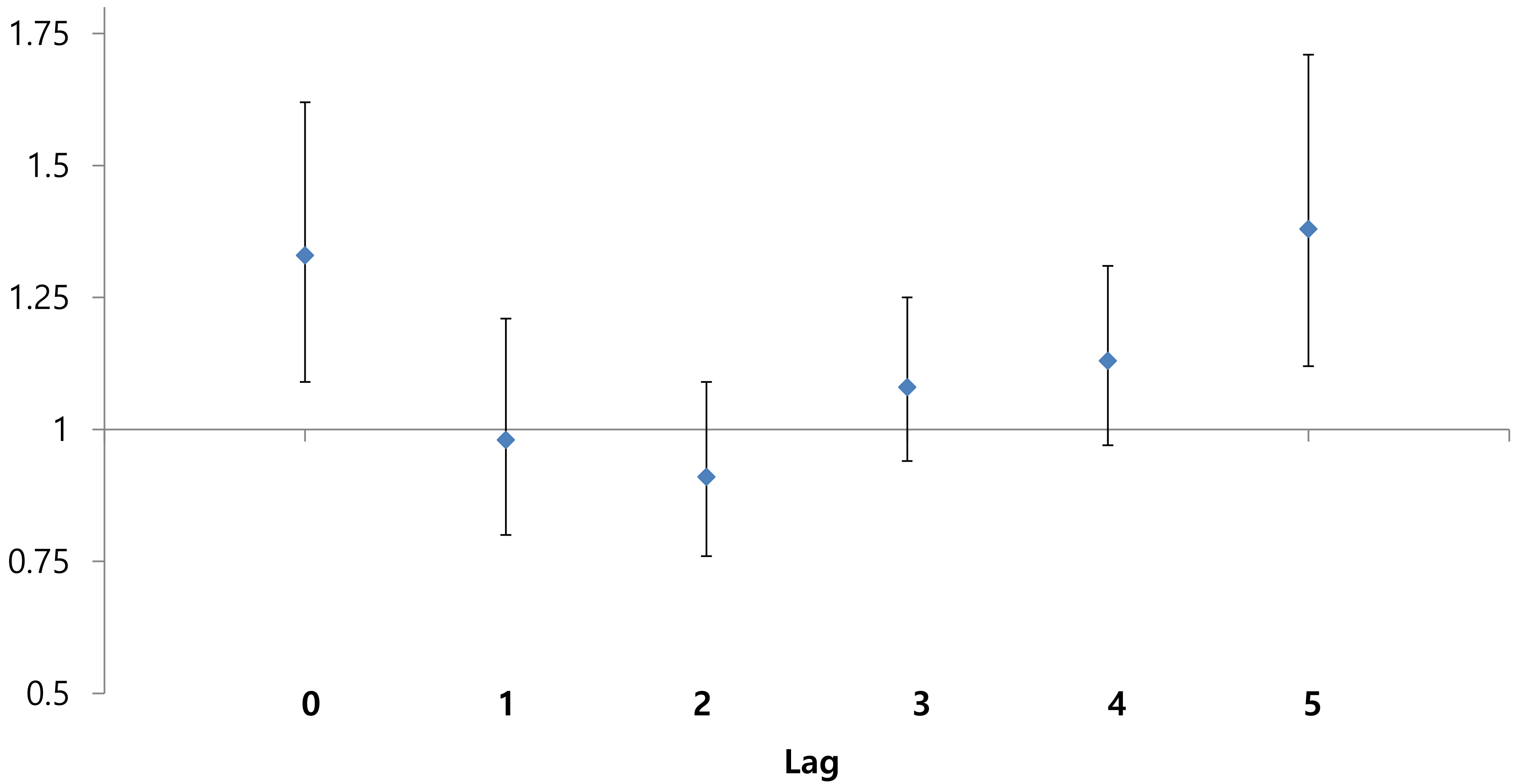
Results

	Mist		Fog	
	Control(n=352)	Event(n=176)	Control(n=102)	Event(n=51)
PM_{10}	48.5(1.84)	**91.1(4.42)***	68.5(3.59)	**87.7(5.74)***
CO	0.54(0.02)	0.77(0.03)*	0.78(0.04)	0.87(0.05)
O_3	0.03(0.001)	0.025(0.001)	0.02(0.001)	0.020(0.002)
NO_2	0.015(0.0004)	0.020(0.0008)*	0.021(0.001)	0.022(0.001)
SO_2	0.005(0.0002)	0.006(0.0003)*	0.006(0.0004)	0.006(0.0005)
Temperature	7.46(0.57)	9.32(0.74)	10.78(1.08)	10.88(1.54)
Dew point	0.20(0.63)	3.76(0.75)*	4.11(1.25)	4.10(1.73)
Humidity	64.9(0.75)	72.4(0.88)*	66.8(1.5)	66.8(2.1)
daily mean wind speed	1.13(0.03)	0.93(0.04)*	1.31(0.07)	1.24(0.08)
maximum wind speed	2.99(0.07)	2.61(0.10)*	3.19(0.13)	3.15(0.16)
daily mean cloud amount	4.49(0.17)	5.44(0.21)*	5.19(0.33)	5.56(0.52)
Duration of sunshine	6.04(0.20)	4.81(0.26)*	5.72(0.38)	5.46(0.56)

Relative Risk of hospital visit and admission for asthma on Asian dust days



Relative Risk of hospital visit and admission for COPD on Asian dust days



Conclusion

- The average PM_{10} level and a humidity for the event days were higher than the average for the control days.

- **Asian dust events are associated with an increased risk of hospital visit and admission for asthma and COPD.**

- The strongest estimated effect of Asian dust was increased risk for asthma and COPD **five days after** an events.

The Effect of $PM_{2.5}$ on Hospital visits for COPD in Chuncheon

The Effect of $PM_{2.5}$ on Hospital visits for COPD in Korea or Seoul


Air korea
에어코리아란
실시간 자료조회
대기질 예·경보
통계정보
배움터
고객의 소리
NEWS
기상정보
날씨
기온
강수
풍향
풍속
2016년 02월 19일 10시 현재
아이콘설명
대기질 예·경보
MORE
예보
경보
현재 경보발령내용이 없습니다.
시도별 대기정보
미세먼지 정보
우리동네 대기정보
실시간 대기정보
시도별 대기정보
대기질 예 · 경보
PM10
PM2.5
오존
이산화질소
일산화탄소
아황산가스
통합대기지수
2016년 02월 19일 10시 현재
울릉도/독도
백령도
제주도
본 자료는 통합대기환경지수 산정을 위한 24시간예측이동평균 자료임.
측정망 구분
농도범위 (㎍/㎥)
좋음 (0~15)
보통 (16~50)
나쁨 (51~100)
매우나쁨 (101~)
데이터없음
우리동네 대기질
중구
측정소 검색
미세먼지(PM10)
2016년 02월 19일 10시
83 ㎍/㎥
(1시간 농도:122㎍/㎥)
나쁨
항목 | 범례 | 측정값
미세먼지 PM10 | 83 ㎍/㎥(24H) | 122 ㎍/㎥(1H)
미세먼지 PM2.5 | 36 ㎍/㎥(24H) | 48 ㎍/㎥(1H)
오존 | 0.004 ppm(1H)
이산화질소 | 0.052 ppm(1H)
일산화탄소 | 1.2 ppm(1H)
아황산가스 | 0.013 ppm(1H)
CAI | 105
인근 측정소
측정소명 | 측정망 | 거리
[서울] 중구 | 도시대기 | 0.0km
[서울] 한강대로 | 도로변대기 | 1.7km
[서울] 종로 | 도로변대기 | 2.0km
행복한 대한민국을 여는 정부 3.0
[개 방 · 공 유 · 소 통 · 협 력]

- COPD cohort
  - KOLD
  - KOCOSS
  - CODA
- 개별 노출 정도 측정
  - exposure matrix