The Health Effects of Asian Dust in Korea

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- Korean's perception about the Asian dust?
- Characteristics of the Asian dust
- Epidemiologic studies on the Asian dust
  - Asian dust and admission
  - Asian dust and daily mortality

What's The Asian Dust?

- Dust clouds or storm blown by winds from the arid deserts of Mongolia and China in springtime; *Whangsa* , which means "yellow sand" in Korean.
- Sometimes transported across the Pacific and detected on the western coast of North America (Husar *et al.*, 2001)

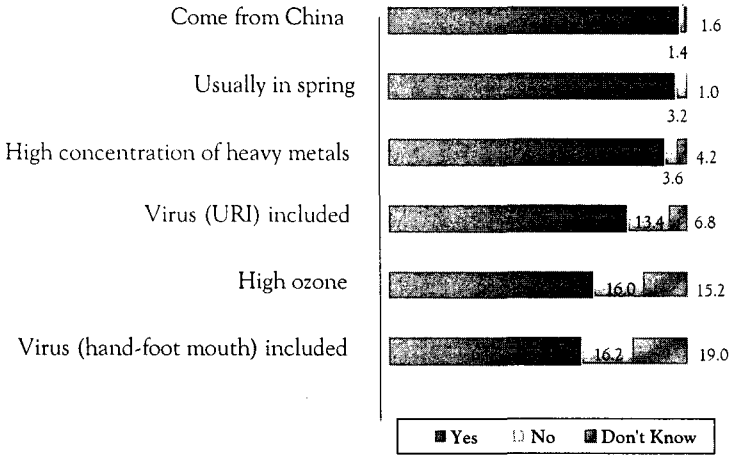
Survey Design

Population	Residents of Seoul Metropolitan area, aged 20 or more
Sample Size	500
Survey Method	Telephone Interview with Structured Questionnaire
Sampling Method	Random sampling using telephone books
Standard Error	±4.38 (95% CI)
Study Period	2003/5/12~ 2002/5/13

1. 황사에 대한 인지내용

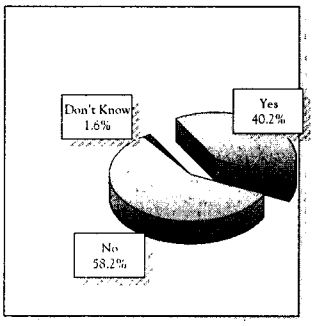
Perception on the Asian dust events

(Unit : %)



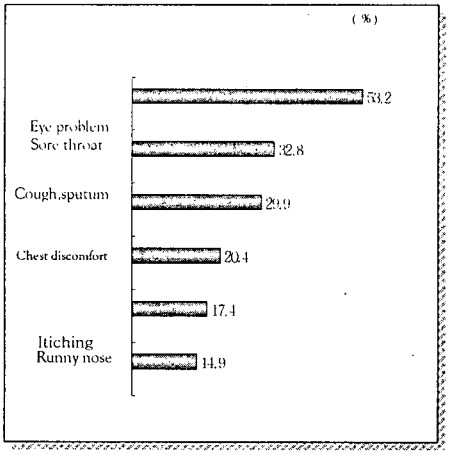
Prevalence of dust event related symptoms

Have you experienced any discomfort related to dust event ?



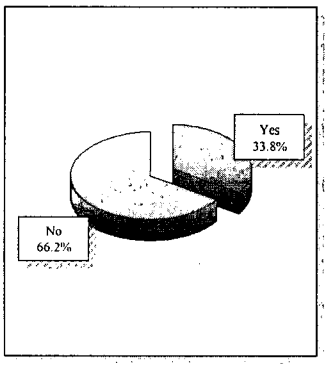
		No	Sx. Prevalence
Gender	Male	(237)	32.5
	Female	(263)	47.1
Age	< 30	(121)	40.5
	< 40	(128)	39.1
	< 50	(115)	44.3
	< 60	(71)	42.3
	60 >=	(65)	32.3
Education	Middle school	(74)	31.1
	High school	(209)	44.0
	College	(206)	39.8
	Graduate	(9)	33.3
Address	Seoul	(344)	40.1
	Kyungki	(76)	50.0
	Incheon	(80)	31.3

Asian dust related symptoms



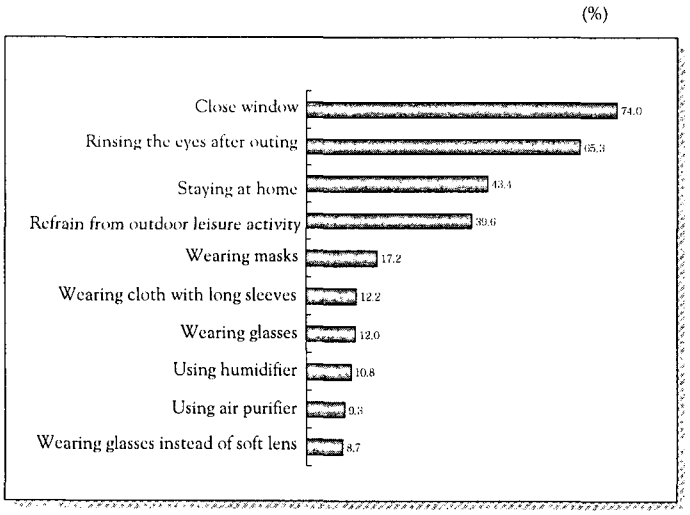
	Gender		Age				
	Male	Female	20	30	40	50	60 +
No	(77)	(124)	(49)	(50)	(51)	(30)	(21)
Eye problem	46.8	57.3	38.8	51.0	61.7	60.0	47.6
Skin	3.9	25.8	20.4	14.0	19.6	16.7	14.3
Runny nose	10.4	17.7	20.4	14.0	17.6	10.0	4.8
Cough, sputum	28.6	30.6	30.6	28.0	35.3	13.3	12.9
Chest discomfort	21.7	17.7	22.4	20.0	21.6	20.0	14.3
Sore throat	29.9	34.7	34.7	30.0	33.3	26.7	33.0

Have you ever visited hospitals due to Asian dust?



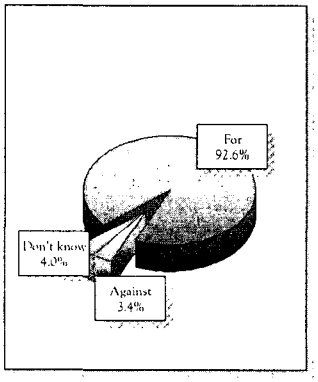
	사례수	호흡증상이 있다 (%)
Gender		
Male	(77)	24.7
Female	(124)	39.5
Age		
20	(49)	30.6
30	(50)	34.0
40	(51)	35.3
50	(30)	36.7
60+	(21)	33.3
Area		
Seoul	(138)	34.8
Kyunggi	(38)	26.3
Inchon	(25)	40.0

How to cope with the Asian Dust?



Public opinion on school shutdown during severe dust event

What's your opinion on school shutdown during sever dust event?

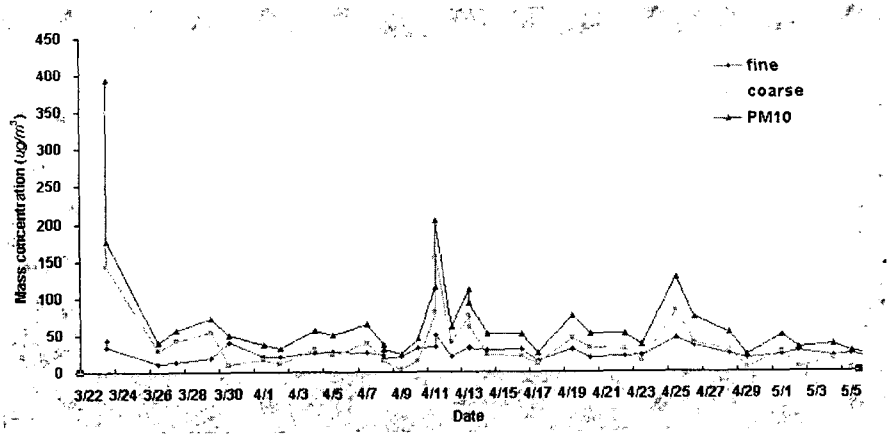


		No	For (%)
Gender	Male	(237)	90.3
	Female	(263)	94.7
Age	20	(121)	95.9
	30	(128)	93.8
	40	(115)	90.4
	50	(71)	94.4
	60+	(65)	86.2
Education	Middle school	(74)	85.1
	High school	(209)	92.3
	College	(206)	95.1
	Graduate schoo	(9)	100.0
Area	Seoul	(344)	93.3
	Kyunggi	(76)	92.1
	Inchon	(80)	90.0

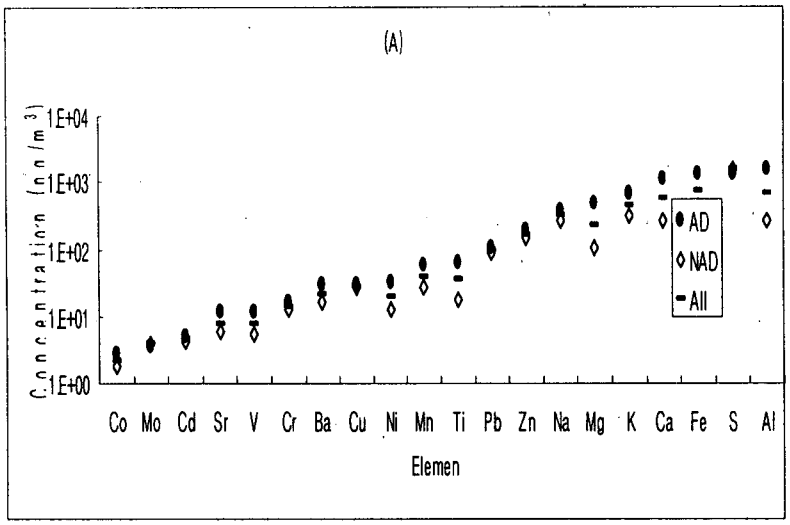
How do we know the health effects of the Asian dust event?

- Analogical inference
  - from physio-chemico-biologicial property of dust
- Toxicological studies
- Epidemiological approach
  - Respiratory symptoms
  - Physiological index
  - Utilization
  - Mortality

$PM_{2.5}$ & PM_{10} at Kwangju during the Asian dust event



Source: Kyung W. Kim and Young J. Kim



Source: Kim et al., *Atmospheric environment,* in press

Isolated bacteria from soil in china and dust of Yellow sand-Rural development administration

Bacteria	Area	
	China	Suwon, Korea
Arthrobactor sp	+	-
Bacillus sp	+	-
Brevibacterium sp	+	-
Cellulomonas sp	+	-
Curtobacterium sp	-	+
Deinococcus sp.	+	-
Kocuria sp.	+	-
Micrococcus sp.	+	-
Pseudomonas sp.	-	+
Rhodococcus sp.	-	+
Streptoverticillium sp.	+	-
Tsukamurella sp.	-	+

Fungus and Virus

Fungus

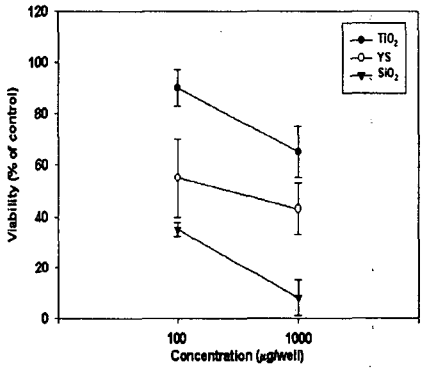
- Five molds were identified from the soil in china and 8 were identified from the dust of yellow sand, 5 were found in both samples
- All the genera found are nontoxic and common

• Virus

- Not detected in both samples

Cytotoxicity of yellow sand in lung epithelial cells

- Rat alveolar type II cell line was treated with 3 particles (silica, titanium dioxide, yellow sand)
- Silica showed the strongest toxic effect while TiO_2 had the least toxic effect.



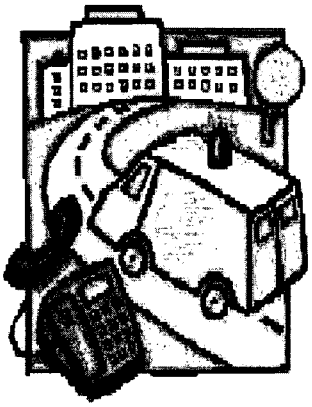
Source: Kim et al., *J of Bioscience*, in press

Asian dust and respiratory symptoms and pulmonary function

- Twenty one patients with bronchial asthma in Seoul, spring of 2000
- Asthma and rhinoconjuctivitis symptoms were recorded by self-administered standardized questionnaire and by monitoring PEF
- No statistically significant relationship between the increment of yellow sand particles and respiratory symptoms or PEF variability

Source: J Asthma Allergy Clin Immunol 21(6):1179-1186,2001)

Is daily mortality and morbidity associated with the Asian dust events?



Daily Averages of Environmental Levels and Pollutants on Asian dust days and Control days in Seoul, Korea, 2000-2002 Spring

	Asian dust days (N=46)		Control days (N=230)	
	Mean	(S.D.)	Mean	(S.D.)
Temperature †	10.1	(5.4)	12.9	(5.9)
Relative humidity (%)	53.1	(15.2)	56.9	(13.4)
Daily temperature range*	8.7	(3.0)	9.9	(2.9)
PM_{10} ($\mu g/m^3$) †	204.5	(160.3)	80.8	(31.4)
CO (100ppb)	8.6	(3.3)	8.3	(2.7)
NO_2 (ppb)*	36.3	(13.2)	40.6	(10.8)
O_3 (ppb)	19.1	(6.1)	19.4	(6.9)
SO_2 (ppb)	5.8	(2.2)	6.0	(2.0)

*p<0.05, †p<0.01

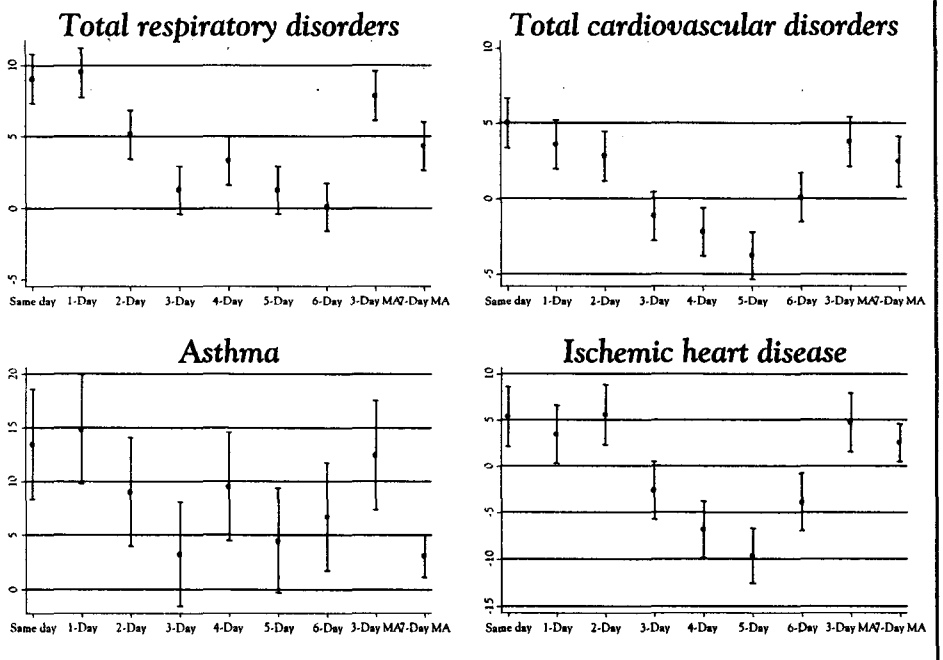
Daily Averages of Hospital Admissions on Asian dust days and Control days in Seoul, Korea, 2000-2002 Spring

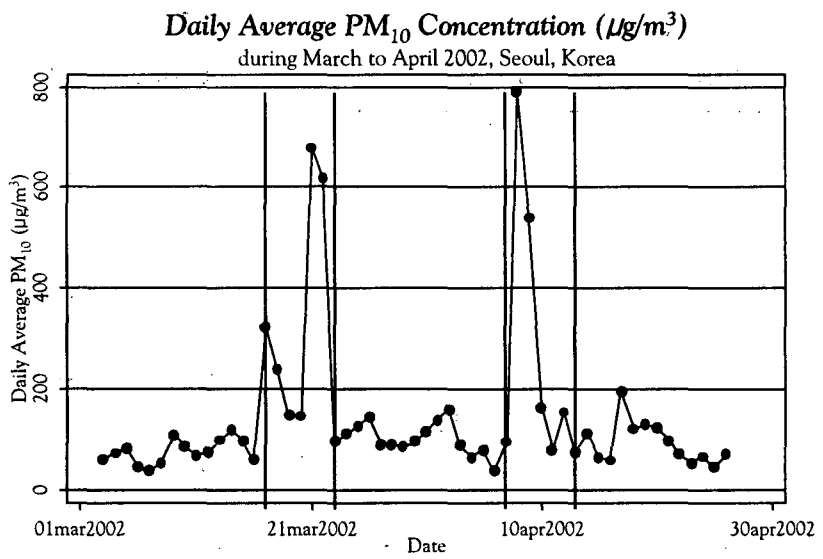
	Asian dust days (N=46)		Control days (N=230)	
	Mean	(S.D.)	Mean	(S.D.)
Daily admissions from respiratory disorders*	442.6	(106.9)	390.0	(113.2)
Daily admissions from cardiovascular disorders	450.8	(106.7)	412.4	(117.3)
Daily admissions from asthma*	55.8	(16.3)	47.3	(16.8)
Daily admissions from ischemic heart disease	119.1	(38.6)	108.6	(40.0)

*p<0.05

Estimated Percentage Increases in the Risk of Hospital Admissions and 95% Confidence Intervals Associated with Asian Dust Events across the Various Lags

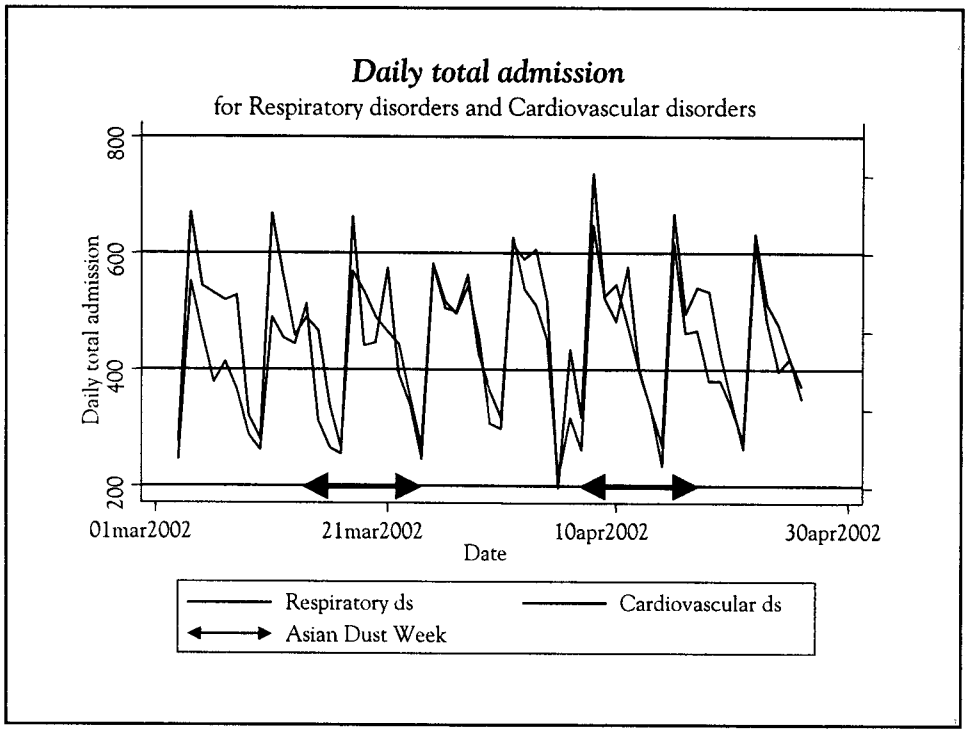
	Same day	3-Day Moving average	7-Day Moving average
Total respiratory disorders	9.0 (7.3, 10.8)	7.8 (6.1, 9.6)	4.3 (2.6, 6.0)
Total cardiovascular disorders	5.0 (3.3, 6.6)	3.7 (2.1, 5.4)	2.4 (0.8, 4.1)
Asthma	13.4 (8.4, 18.6)	12.3 (7.4, 17.5)	3.1 (1.2, 5.0)
Ischemic heart disease	5.3 (2.1, 8.6)	4.7 (1.5, 7.9)	2.5 (0.5, 4.6)

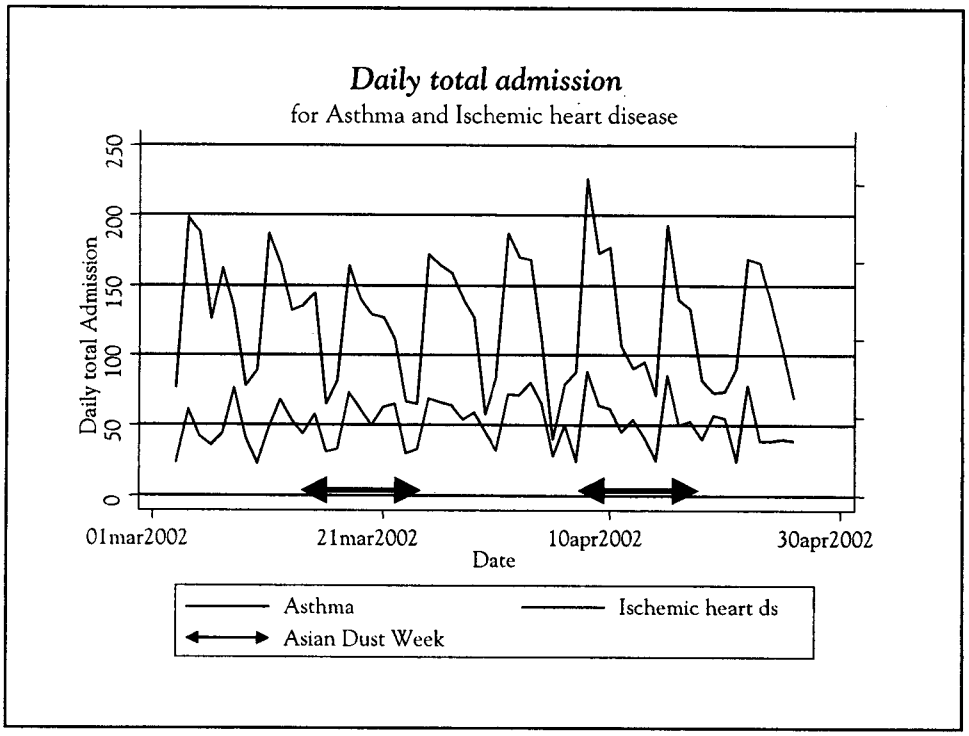


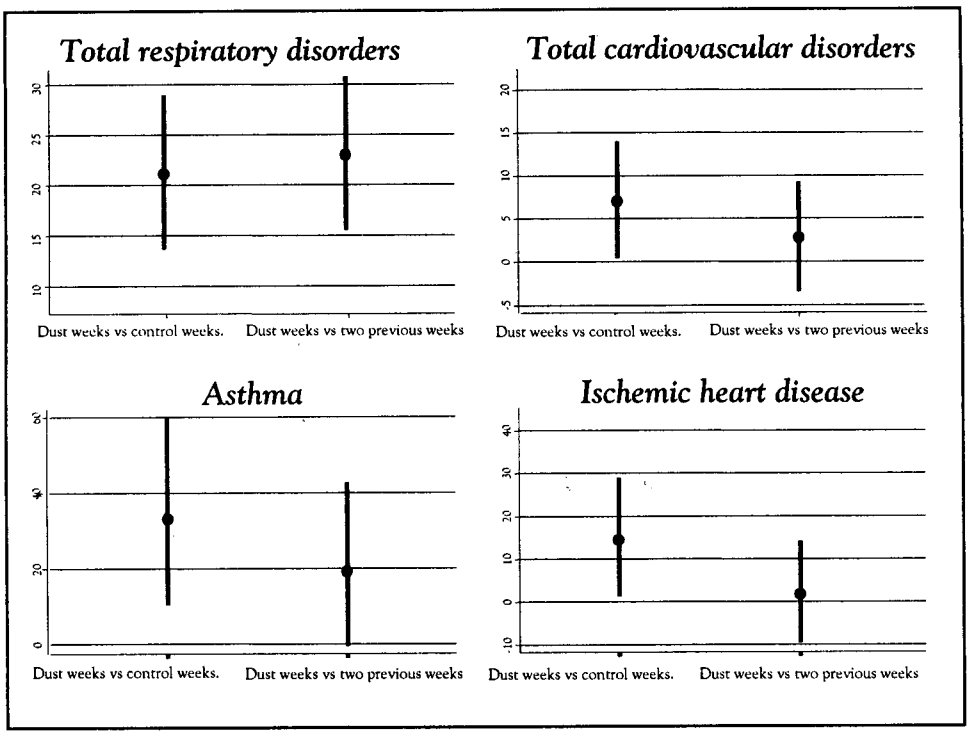


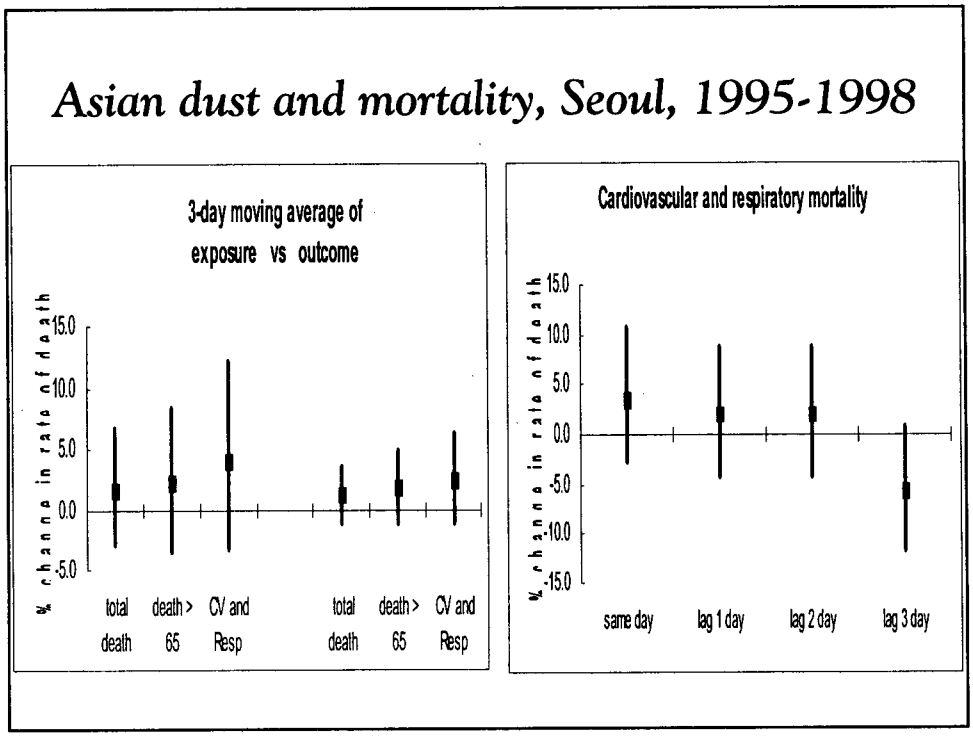
Daily Averages of Hospital Admissions on Asian dust weeks and Control weeks in Seoul, Korea, 2002 spring

	Asian dust weeks (N=2)		Control weeks (N=6)	
	Mean	(S.D.)	Mean	(S.D.)
Daily admissions from respiratory disorders	462.4	(25.8)	431.3	(37.1)
Daily admissions from cardiovascular disorders	450.2	(6.4)	447.0	(27.4)
Daily admissions from asthma	53.9	(0.2)	50.1	(5.6)
Daily admissions from ischemic heart disease	126.8	(13.6)	124.4	(9.6)


Daily total admission
for Respiratory disorders and Cardiovascular disorders
Daily total admission
800
600
400
200
01mar2002
21mar2002
10apr2002
30apr2002
Date
Respiratory ds
Cardiovascular ds
Asian Dust Week


Daily total admission
for Asthma and Ischemic heart disease
Daily total Admission
250
200
150
100
50
0
01mar2002
21mar2002
10apr2002
30apr2002
Date
Asthma
Ischemic heart ds
Asian Dust Week

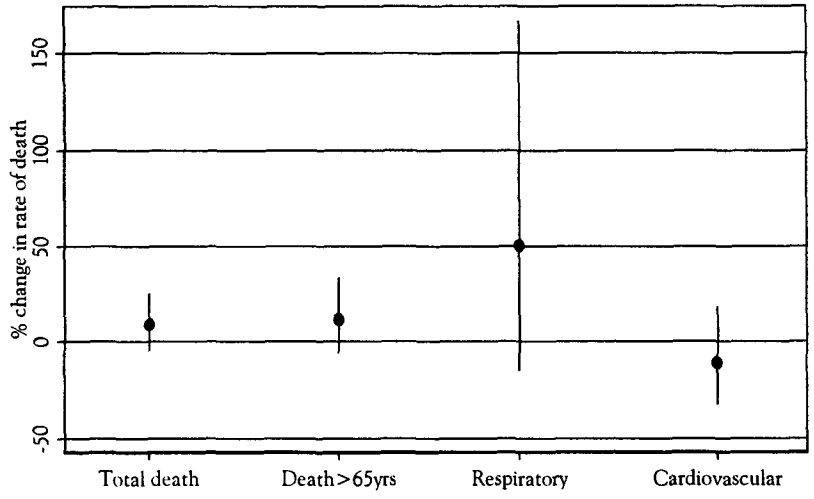

Total respiratory disorders
Dust weeks vs control weeks.
Dust weeks vs two previous weeks
Total cardiovascular disorders
Dust weeks vs control weeks.
Dust weeks vs two previous weeks
Asthma
Dust weeks vs control weeks.
Dust weeks vs two previous weeks
Ischemic heart disease
Dust weeks vs control weeks.
Dust weeks vs two previous weeks


Asian dust and mortality, Seoul, 1995-1998
3-day moving average of
exposure vs outcome
% change in rate of death
total death
death > 65
CV and Resp
Cardiovascular and respiratory mortality
% change in rate of death
same day
lag 1 day
lag 2 day
lag 3 day

Daily Averages of Deaths on Asian dust weeks and Control weeks in the spring of 2002, Seoul, Korea

	Asian dust weeks (N=2)		Control weeks (N=6)	
	Mean	(S.D.)	Mean	(S.D.)
Daily deaths for all causes	109.9	(9.2)	108.1	(9.1)
Daily deaths for aged 65 yrs and older	65.6	(6.8)	63.6	(7.2)
Daily deaths for respiratory disease	6.7	(3.2)	5.7	(2.2)
Daily deaths for cardiovascular disease	25.6	(4.3)	26.7	(4.8)

Estimated percentage increase in the rate of deaths during the spring of 2002



Summary

- The risk of being admitted with respiratory disease is increased by 9% on the Asian dust day
- The risk of cardiovascular admission is increased by 5%
- During the great dust event in 2002, the counts of respiratory admission seems to be increased, but we couldn't observed the epidemic of respiratory disease
- The Asian dust events are weakly associated with daily mortality