

Case crossover study of infant bronchiolitis and fine particulate air pollution

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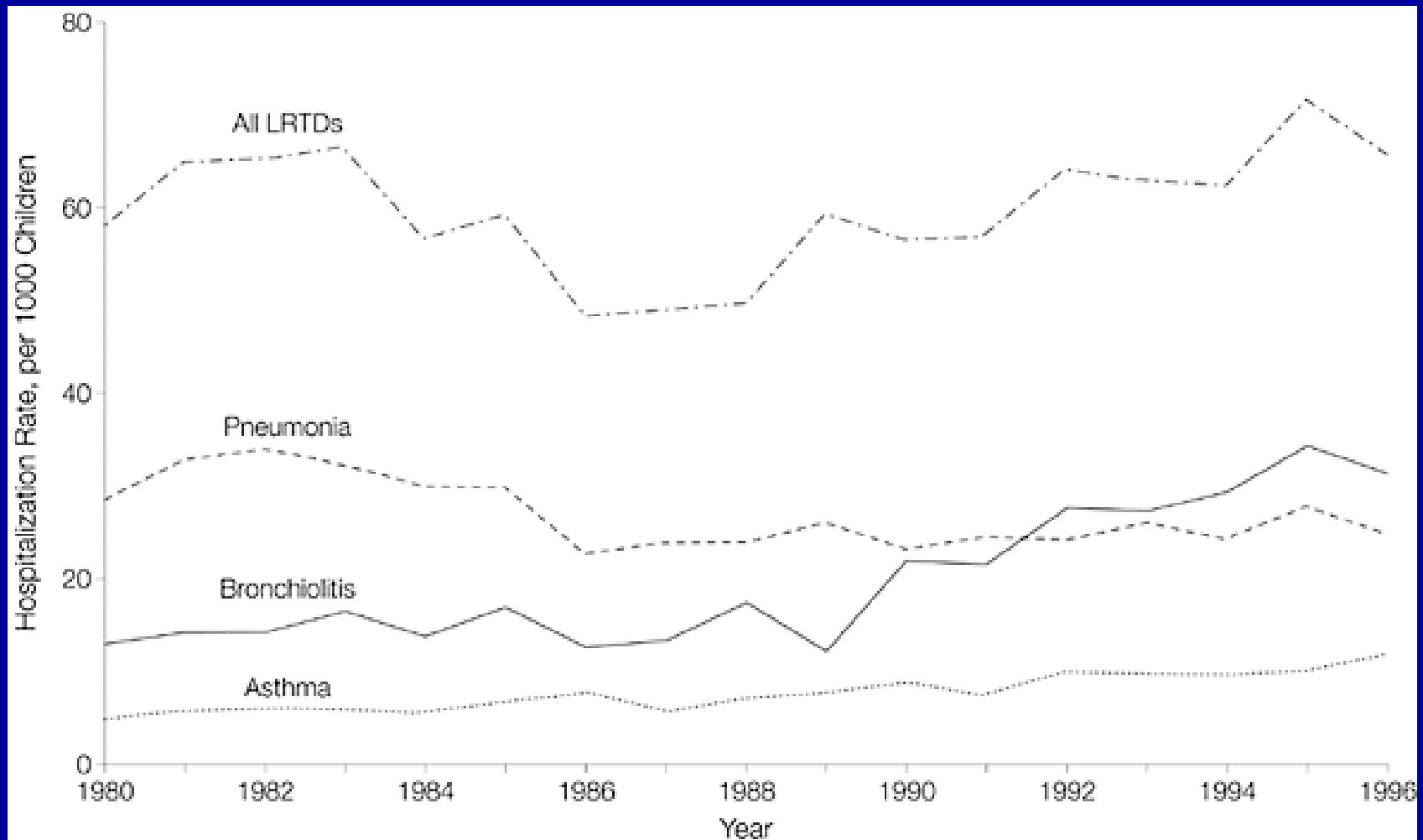
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Background

- A growing literature links pediatric respiratory health problems with ambient air pollution
- Few data on bronchiolitis
- Fine particulate air pollution of increasing focus

Immense Public Health Burden: RSV bronchiolitis rates



Shay DK. JAMA 1999. 282:1440-1446.

Study Questions

Do short term (acute) increases in fine particulate air pollution ($PM_{2.5}$) impact risk of hospitalization for bronchiolitis?

Consider potentially vulnerable subgroups of infants (prematurity, underlying cardiopulmonary disease, etc)

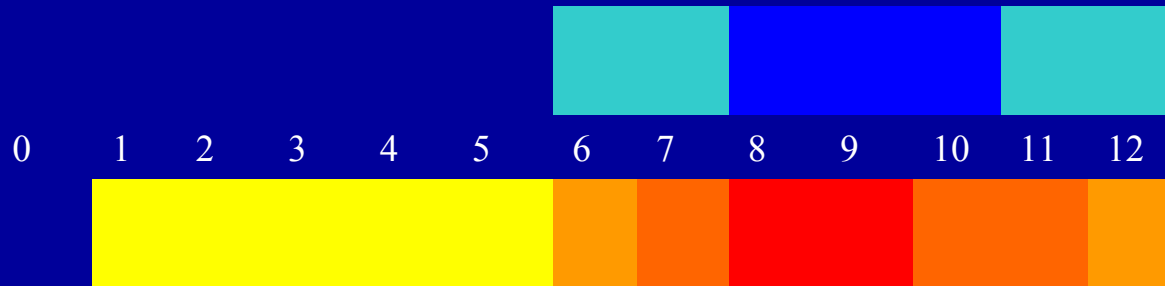
What is the relevant window of exposure?

Acute Exposure Windows

↓lag 6,7,8

↓lag 3-5 ↓lag 1-2

sx start peak (admit) decline



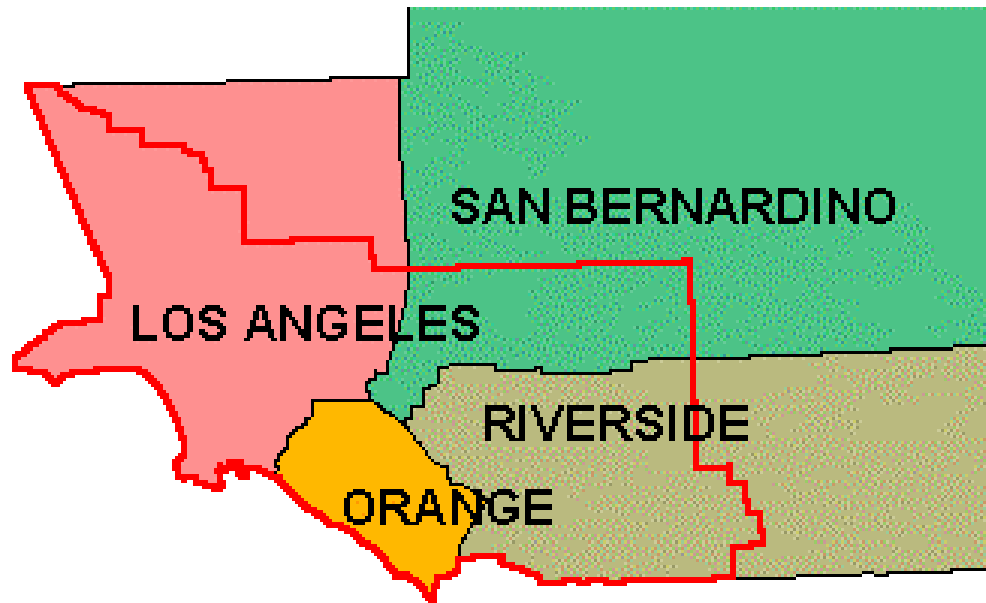
rsv

infxn incubation

log phase replication, peak, decline

Study Setting

South Coast Air Basin



Methods: Study subjects

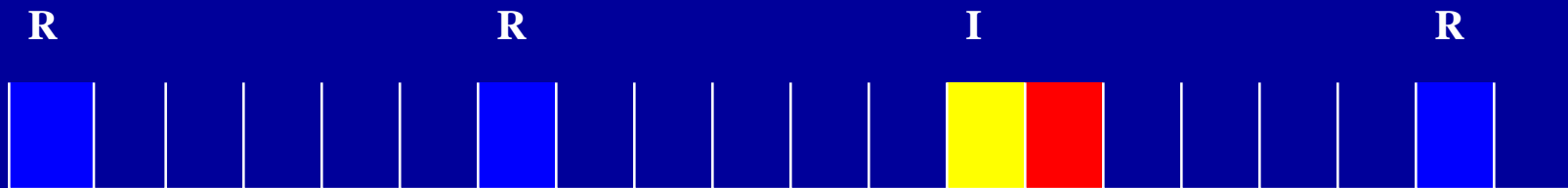
- Infants who were born in the South Coast Air Basin 1999-2000
- Identified via birth records linked to first year of life hospital discharge records
- Discharge diagnosis of acute bronchiolitis (ICD9 CM 466.1) from November to May

Methods: Exposure assessment

- California Environmental Protection Agency Air Resources Board – electronic database of monitor data
- Each case linked to a representative monitor based on their zip code (distance, topography, wind conditions)

Methods: Study design

Time stratified case-crossover
index and referent sampling



Exposure Distribution (24 hr avg PM_{2.5})

	N	Min	25%	50%	75%	90%	Max	Mean
Lag 1-2 days	21,384	1.5	12.9	20.2	30.5	42.1	121.4	23.6
Lag 3-5 days	26,684	1.5	13.2	20.5	31.7	44.1	121.4	24.1
Lag 6-8 days	26,137	1.5	12.9	20.3	31.7	44.1	121.4	24.0

EPA 24 hour standard = 65 mcg/m³

Results: case-crossover

Distribution of monitor to residential zipcode centroid (miles)

	Min	25%	50%	75%	90%	Max	Mean
PM_{2.5}	0.4	3.0	4.7	6.5	11.0	25.3	5.4
Temp/ Humid	0.4	2.6	4.2	5.8	7.4	19.1	4.6

Bronchiolitis risk per 10 mcg/m³ increase in PM_{2.5} (24 hr avg)

		All Infants
	N	OR (95% C. I.)
Lag 1-2 days	4,353	0.96 (0.94-0.99)
Lag 3-5 days	5,444	0.98 (0.96-1.00)
Lag 6-8 days	5,319	0.96 (0.93-0.98)

Effect of gestational age

Lag 1-2 days

Gestational Age (weeks)	N	OR (95% C.I.)
25-29	46	0.98 (0.75-1.29)
29 1/7 -34	176	0.96 (0.83-1.11)
34 1/7- 37	449	0.97 (0.89-1.06)
37 1/7-44	4,794	0.96 (0.94-0.99)

Effect of gestational age

Lag 3-5 days

Gestational Age (weeks)	N	OR (95% C.I.)
25-29	61	1.26 (1.01-1.57)
29 1/7 -34	223	0.95 (0.85-1.08)
34 1/7- 37	567	0.95 (0.88-1.02)
37 1/7-44	4,593	0.98 (0.96-1.01)

Effect of gestational age

Lag 6-8 days

Gestational Age (weeks)	N	OR (95% C.I.)
25-29	67	1.41 (1.11-1.79)
29 1/7 -34	218	0.99 (0.88-1.11)
34 1/7- 37	549	0.96(0.89-1.03)
37 1/7-44	4,485	0.95 (0.93-0.98)

Effect of underlying cardiopulmonary disease

No effect modification observed for:

Respiratory distress syndrome

Bronchopulmonary dysplasia

Pulmonary anomalies

Any pulmonary disease

Cardiac anomalies

Summary

- No clear association between fine particulate matter air pollution and bronchiolitis for term and near term infants
- Evidence of increased risk for significantly premature infants (≤ 29 weeks gestation)

Summary

- No suggestion of increased risk for infants with underlying cardiopulmonary disease
- Acute windows of exposure most consistently associated with effects were lagged 3-8 days

Limitations

- **Exposure assessment**
 - Monitors as proxies for personal exposure
 - Exposure windows
- **Outcome assessment**
 - Case definition
 - Sparse subgroup data
- **Unaddressed Confounding**
 - Weather (temperature, humidity)
- **Bias?**

acknowledgements

Dissertation Committee

- Joel Kaufman (chair)
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- Jane Koenig (UW Particulate Center)
- Fred Rivara

Time-stratified case-crossover: sampling index and referent periods

1	2	3	4 ref	5 ref	6 ref	7*
8	9	10 ref	11 ref	12 ref	13*	14
15	16 ref	17 ref	18 ref	19 *	20	21
22 index	23 index	24 index	25* admit	26	27	28 ref
29 ref	30 ref	31*				