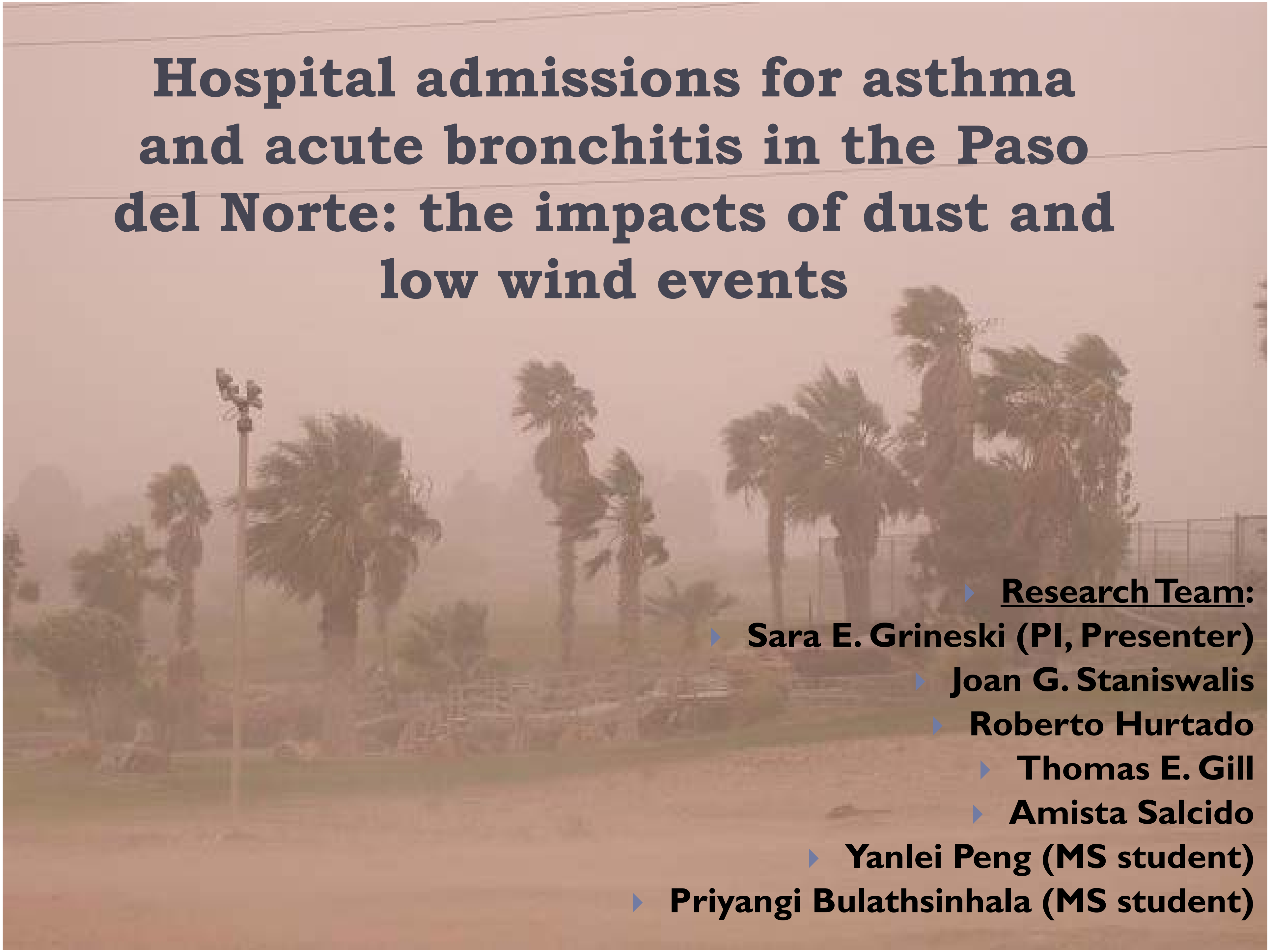

Hospital admissions for asthma and acute bronchitis in the Paso del Norte: the impacts of dust and low wind events

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Proposed Project (EH-08-04)

- What are the respiratory health effects of dust storms in El Paso and Ciudad Juárez?
- Health Data Needs:
  - El Paso:
    - Daily hospitalization data
  - Juárez
    - Daily hospitalization data
    - Weekly hospitalization data

Juárez Weekly Results

Finding for Juárez

- Limitations
  - Weekly data
- Weeks with at least one dust storm had 1.08 times more hospital admissions for asthma, respiratory infections, and pneumonia (combined) than weeks without a dust storm (95% CI= .99-1.16) adjusting for month.
- When adjusting for dew point, PM2.5, ozone, temperature, and NO_2, the dust effect abated to 1.04 times (CI = 96-1.13).

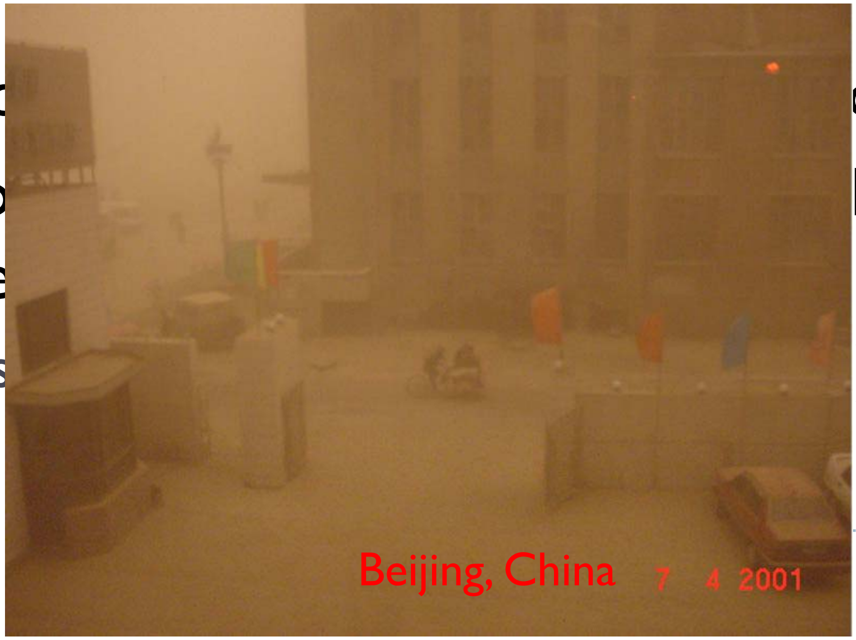
Hospital admissions for asthma and acute bronchitis in El Paso, Texas: Do age, sex, and insurance status modify the effects of dust and low wind events?

Low wind event:

Dust event:

Literature

- Dust and low wind: less studied than air pollution (e.g., NO_2, ozone, etc)
- Majority of studies focus on Asian Dust Events
  - Find effects using case cross over design
    - 8% increase in asthma admissions in Taiwan (Yang et al,. 2005)
    - 80% increase in children's asthma admissions in Japan (Kanatani et al., 2010)
- Low wind over design
- Effect mo he dust literature (compare
  - By age, s)



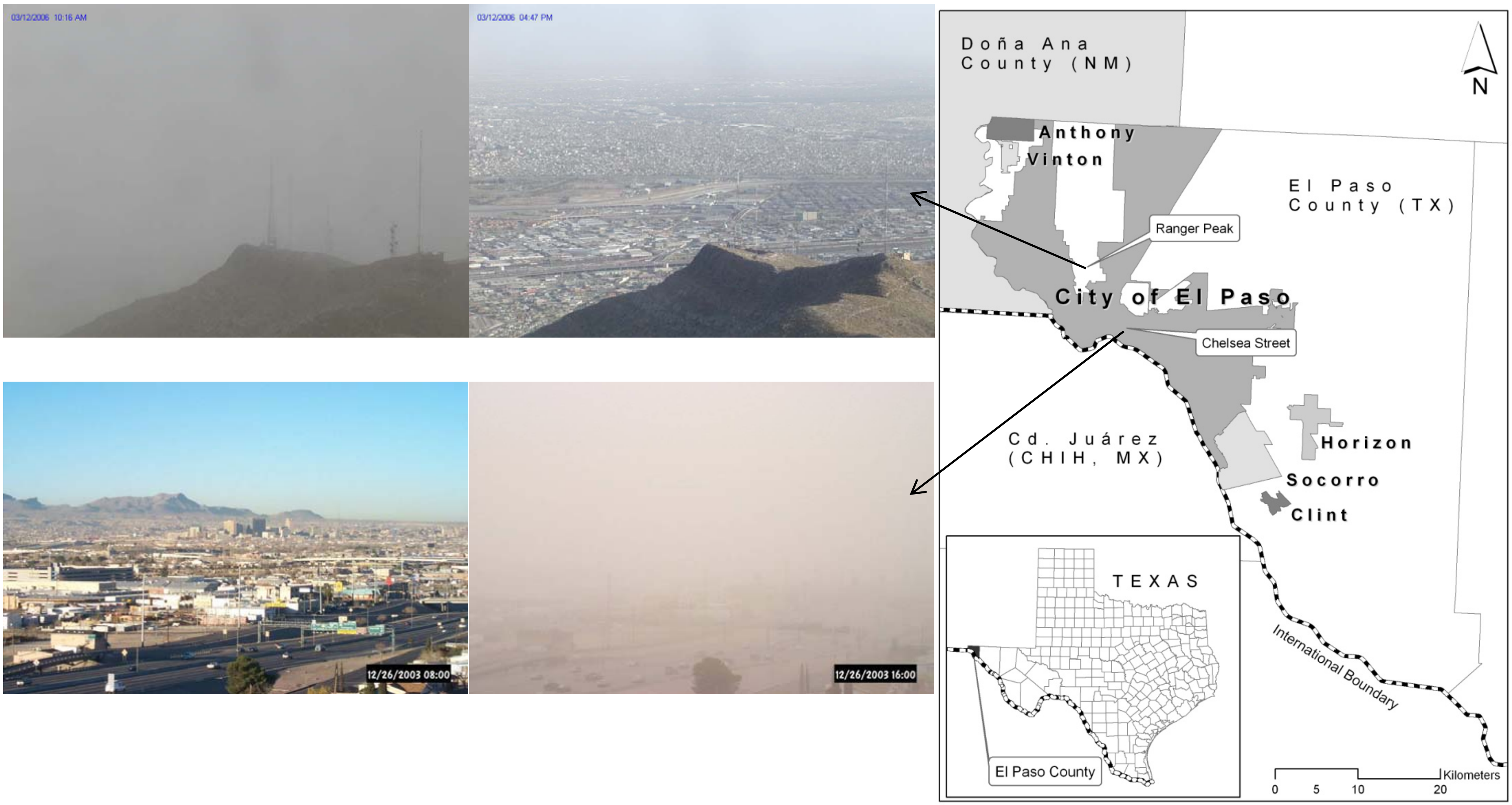
Study Area: El Paso, TX

- Dustiest city in the United States (Rivera Rivera et al., 2009)
- Air stagnation is common (Lauer et al., 2009)
- Both high wind and low wind conditions raise levels of pollutants in the air (Hosiokangas et al. 2004).

- Risk of PM-induced mortality was higher during still-air inversions than it was during high wind events (Staniswalis et al. 2005).

- Population: 742,000 (2008); 82% Latino

Dust Storms: Before and After



Research Questions

- 1) Are airborne dust and low wind events associated with an increase in asthma and acute bronchitis hospitalizations in El Paso after adjustments for the effects of weather and other air pollutants for all ages, ages 1-17 years, 18-64 years, and over 65 years of age?
- 2) Are the effects of airborne dust and low wind events on asthma and acute bronchitis hospitalizations in El Paso modified by insurance status and sex in each age group, adjusting for the effects of weather and air pollution?

Data (2000-2003)

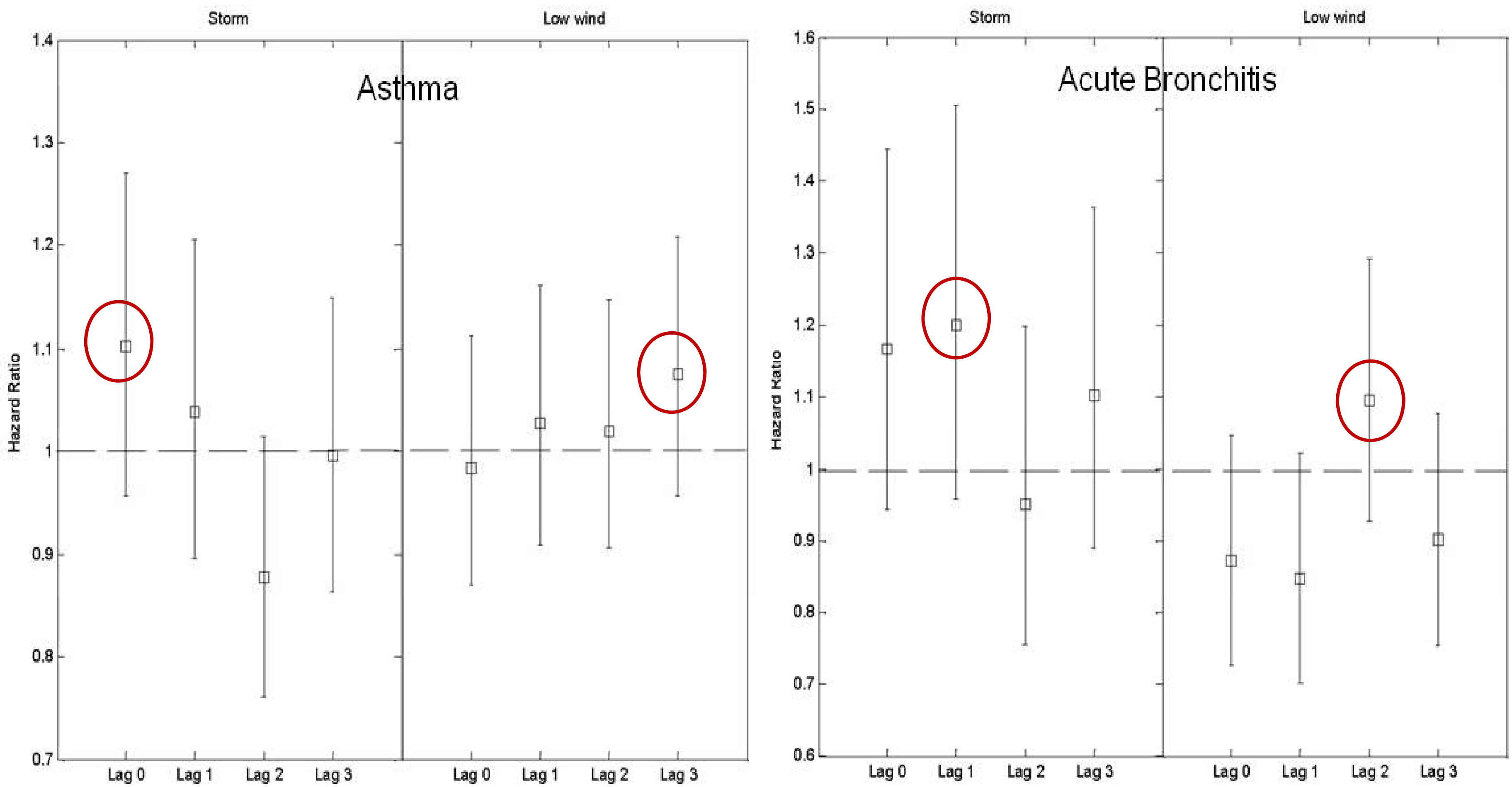
- Dust: observational data from National Weather Service
  - Presence/Absence of dust storm
- Low Wind: National Weather Service
  - Daily average wind speed < 2 m/s (Li et al., 2005) = Low wind event
- Health: State of Texas
  - Dates of all hospital admissions for asthma and acute bronchitis (including age, sex, and insurance status of patient)
- Pollution: TCEQ monitors
  - NO_2 and PM2.5
- Weather: National Weather Service
  - Apparent Temperature

Methods

- Case-cross over design (conditional logistic regression)
- Exposures on the index date (i.e., date of hospitalization) are compared with exposures on referent date, which occurred on same day-of-week, month and year as the index date (Perez et al., 2008; Belleudi et al., 2010).
- Compute odds ratios (OR)

- Lags: selected dust and wind lag w/largest OR (Perez et al., 2008; Yi et al., 2010).
  - Asthma: lag 0 for dust; lag 3 for low wind.
  - Bronchitis, lag1 for dust; lag 2 for low wind

Odds Ratio with 95% Confidence Interval for the associations between dust storm and low wind with asthma and acute bronchitis



Asthma Results

Main Effects and Interaction (*) Effects	Odds Ratio (95% Confidence Interval) for Dust Storm (Lag0)
All ages	1.11 (.96, 1.28)
Children*Dust/Wind	0.96 (.71, 1.31)
Elderly*Dust/Wind	0.81 (.57, 1.17)
Medicare*Dust/Wind	0.89 (0.63, 1.27)
Medicaid*Dust/Wind	0.95 (.69, 1.32)
Other Public*Dust/Wind	0.48 (.15, 1.59)
None*Dust/Wind	1.34 (.68, 2.66)
Female*Dust/Wind	0.92 (.70, 1.21)
Subgroup Analysis	
Children (age 0-17)	1.16 (.94, 1.43)
Medicaid*Dust/Wind	0.87 (.58, 1.32)
Other Public*Dust/Wind	0.76 (.20, 2.80)
None*Dust/Wind	1.02 (.33, 3.22)
Female*Dust/Wind	1.00 (.66, 1.52)
Adults (age 18-64)	1.16 (.91, 1.50)
Medicare*Dust/Wind	1.16 (.59, 2.23)
Medicaid*Dust/Wind	1.09 (.61, 1.95)
None*Dust/Wind	1.56 (.66, 3.69)
Female*Dust/Wind	0.76 (.43, 1.32)
Elderly (age≥65)	0.96 (.71, 1.30)
Medicare*Dust/Wind	1.28 (.24, 6.99)
Female*Dust/Wind	0.93 (.50, 1.73)

Bronchitis Results

Main Effects and Interaction (*) Effects	Odds Ratio (95% Confidence Interval) for Dust Storm (Lag1)
All ages	1.23 (.99, 1.55)
Children*Dust/Wind	1.05 (.57, 1.91)
Elderly*Dust/Wind	0.83 (.40, 1.74)
Medicare*Dust/Wind	0.69 (.37, 1.32)
Medicaid*Dust/Wind	1.01 (.61, 1.68)
None*Dust/Wind	0.44 (.11, 1.74)
Female*Dust/Wind	1.45 (.95, 2.21)
Subgroup Analysis	
Children (age 0-17)	1.33 (1.01, 1.75)
Medicaid*Dust/Wind	0.92 (.52, 1.63)
None*Dust/Wind	0.34 (.04, 3.31)
Female*Dust/Wind	1.83 (1.09, 3.08)
Adults (age 18-64)	1.20 (.66, 2.16)
Medicare*Dust/Wind	0.71 (.16, 3.17)
Medicaid*Dust/Wind	1.63 (.41, 6.42)
None*Dust/Wind	0.69 (.10, 4.93)
Female*Dust/Wind	1.41 (.41, 4.80)
Elderly (age≥65)	0.97 (.57, 1.66)
Female*Dust/Wind	0.65 (.22, 1.93)

4 Discussion Points

- Dust and low wind were related to asthma and bronchitis
- Children were generally the most sensitive age group
  - Largest OR: Children's bronchitis admissions & dust events
- Girls were more likely to be hospitalized after dust events, but boys were more likely to be hospitalized after low wind events
  - Pollution Lit: Girls/females are more sensitive to pollution (Chang et al, 2009)
  - Dust studies: Boys/males were more sensitive (Kanatani et al., 2010; Meng and Bin, 2007)
- Medicaid coverage (all ages, children) = more sensitivity to bronchitis after low wind events

Conclusion

- Academic:
  - Must consider acute bronchitis (in addition to asthma), especially on the US-MX border
  - Should extend effect modification approach into dust & low wind studies
- Practical:
  - Dust and low wind events are health concerns for children and they impact boys and girls differently
  - Similar impacts in Juárez are likely
  - School policies (keep kids inside)

Thank-you!

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Summary Statistics: Hospitalizations in El Paso, TX, 2000-2003

Asthma Admissions	Patient Sex			Patient Insurance Status					
	Female	Male	Total	Private	Medi-care	Medi-caid	None	Other public	Total
Age (1-17)	698	1189	1887	626	1	1165	58	37	1887
Age (18-64)	917	247	1164	585	167	289	104	18	1163
Age (≥65)	503	182	685	31	637	13	1	3	685
Total	2118	1618	3736	1242	805	1467	163	58	3735

Bronchitis Admissions	Patient Sex			Patient Insurance Status					
	Female	Male	Total	Private	Medi-care	Medi-caid	None	Other public	Total
Age (1-17)	1530	2145	3675	763	0	2816	63	33	3675
Age (18-64)	131	75	206	95	50	36	21	4	206
Age (≥65)	186	81	267	13	247	6	1	0	267
Total	1847	2301	4148	871	297	2858	85	37	4148

Summary statistics for temperature, dew point, NO_2, and PM2.5, El Paso, TX, 2000–2003

Variables (unit)[a]	**N**	**Min**	**5th %**	**25th %**	**Median**	**Mean**	**75th %**	**95th %**	**Max**	**St.Dev**
Temperature (°C)	1461	-1.1	4.4	11.1	20	18.8	26.7	30.6	33.3	9.1
Dew Point (°C)	1461	-21.1	-9.4	-3.9	1.7	2.4	9.4	58	14.4	9.7
Apparent Temperature (°C)	1461	-3.1	2.9	8.8	17.7	17.1	25.9	29.5	32.6	9.1
Nitrogen Dioxide (ppb)	1461	7	16	27	35	35.0	43	54	99	12.0
Nitrogen Dioxide L01[a] (ppb)	1460	10.0	20.0	28.0	34.5	35.0	41.0	52.0	76.0	10.1
Nitrogen Dioxide L03[b] (ppb)	1458	13.3	22.8	29.3	34.5	35.0	40.0	49.8	65.8	8.2
PM2.5[c] (µg per meter^3)	1461	1.3	4.3	7.4	10.7	12.8	15.6	26.6	119.1	9.0
PM2.5 L01 (µg per meter^3)	1460	1.8	4.9	8.2	11.3	12.8	15.4	26.0	68.2	7.4
PM2.5 L03 (µg per meter^3)	1458	2.5	5.6	8.8	11.6	12.8	15.3	23.9	55.2	6.1