# Transports et allergies

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# Polluants impliqués

| Polluants | Essence sans catalyseur | Essence avec catalyseur | Diesel sans catalyseur | Diesel avec catalyseur |
|---|---|---|---|---|
| NOx | **** | * | ** | ** |
| VOC | **** | ** | *** | * |
| CO | *** | *** | ** | * |
| PM | ** | * | **** | *** |
| SO2 | * | * | **** | **** |
| CO2 | *** | *** | * | ** |
| PAH | *** | * | **** | ** |

Quality of Urban Review Air Group, 1993, Dpt of Environment, Birmingham, UK

# Polluants impliqués

- CO
- CO2
- SO2
- PM
- (NOx)

# Polluant indirect: ozone

1. **Hiver**

   $NO + O_3 = NO_2 + O_2$

   $NO + NO + O_2 = \mathbf{NO_2 + NO_2}$

2. **Été**
   - Formation photochimique:

     $NO_2 + \text{radiation} = NO + O$

     $O + O_2 + M = \mathbf{O_3} + M$

   - Oxydation des hydrocarbures

     $CH_4 + O_2 + NO + OH +$

     $\text{radiation} = H_2O + CH_3O + NO + \mathbf{O_3}$

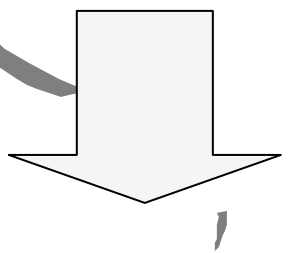
# Modèles animaux

| | |
|---|---|
| • **Asthme/allergie** (ovalbumine) | **O3, NO2, SO2, PM** |
| • **Bronchite** (SO2, polymyxine) | **PM** |
| • **Emphysème** (elastase) | **O3, NO2, SO2, PM, fumées** |
| • **Fibrose pulmonaire** (bléomycine) | **PM** |
| • **Infections pulmonaires** (RSV, influenza, strepto, pyo) | **O3, PM, NO2, SO2** |
| • **Vasculites/HT pulmonaires** (monocrotaline) | **PM** |

UP Kodavanti, Air pollution and health, 1999

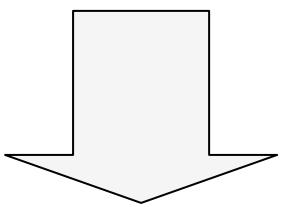
# Mécanismes

- Afférence immune
  - Th1/Th2
  - IgE
  - IgG
  - Immunité innée



**Nouveaux cas**

- Efférence immune
  - Éosino, macrophages, CD4, PMN, cell épith
  - Nerfs
  - f.m.l.
  - Perméabilité



**Exacerbations**

# Pollution de l’air ($SO_2$, $NO_2$)

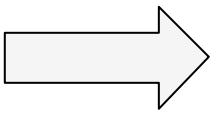
| | Pollution | Prévalence des allergies |
|---|---|---|
| Allemagne Ouest | + | +++ |
| Allemagne Est | +++ | + |
| Suède Ouest | + | ++ |
| Suède Baltique | ++ | + |

# Trafic

- Diesel = 90% de la masse des PM
- DAM Particule Diesel = 0,2 µM (90% < 1,0 µM)
- Particule Diesel absorbe allergènes

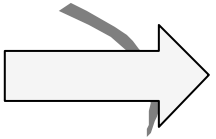
# Diesel et sensibilisation allergénique

- Allergènes IN



IL4, IL5, IL10, IL13 **= +**

- Allergènes IN + Diesel IN



IL4, IL5, IL10, IL13 **= ++++**

***Diaz-Sanchez et al J Immunol 1997; 158:2406***

# Diesel et inflammation allergénique

- Diesel
  - Adhésion des éosinophiles à la muqueuse nasale
  - Induit la production d'IgE intranasal

***(Diaz-Sanchez et al JCI 1994; 94: 1417)***

# Trafic (camions)

- Épidémiologie
  - Relation faible entre trafic de camions et risque d'atopie/asthme

Wjst et al BMJ 1993;307:596
Nitta et al Arch Environ Health 1993;48:53
Oosterlee et al OEM 1996;53:241

# Trafic (urbain)

- 7509 enfants (ISAAC II)
- SPT, RAS, EFR
- Trafic évalué par comptage (tenant compte de la distance de l'habitat)
- Mesures des concentrations en suies, benzène et NO2

*T Nicolai, D Carr, S.K. Weiland, H Duhme, O von Ehrenstein, C Wagner, E von Mutius. Urban traffic and pollutant exposure related to repiratory outcomes and atopy in a large sample of children. Eur Respir J 2003; 21: 956-63*

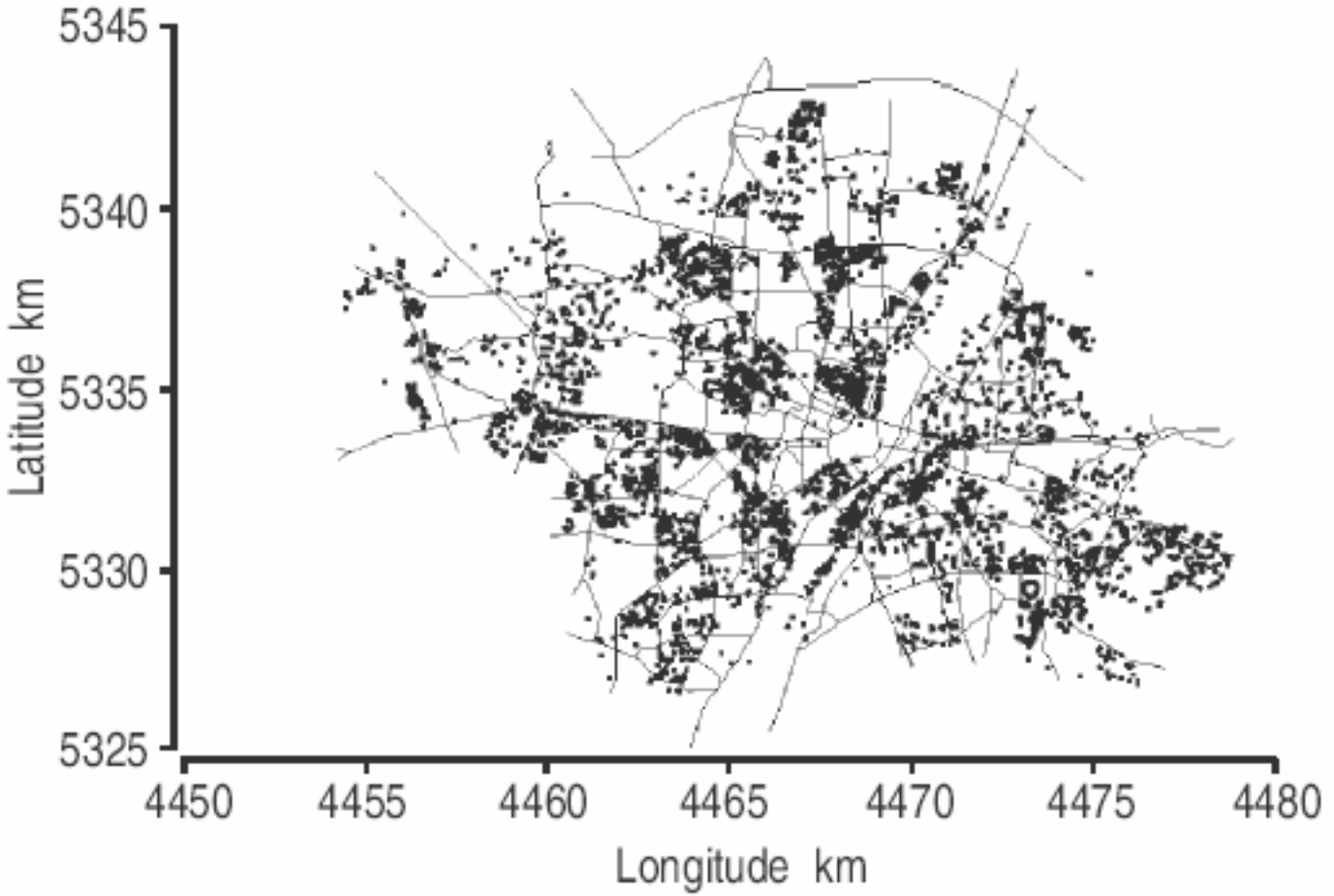



Fig. 1.–Places of residence of children and street segments in Munich.

Table 4. – Respiratory and atopic outcomes in relation to traffic counts in the area of residence

| Outcome | Crude reference prevalence % (raw numbers) | Exposure tertile | Crude prevalence % (raw numbers) | Adjusted OR (95% CI) |
|---|---|---|---|---|
| Asthma | 10.4 (318/3071) | Low | 9.4 (18/192) | 0.902 (0.545–1.493) |
| | | Medium | 9.6 (20/208) | 0.931 (0.576–1.506) |
| | | High | 12.2 (24/197) | 1.194 (0.762–1.871) |
| Current asthma[#] | 5.0 (157/3124) | Low | 3.1 (6/196) | 0.607 (0.264–1.396) |
| | | Medium | 5.7 (12/211) | 1.177 (0.639–2.171) |
| | | High | 8.6 (17/197) | → 1.790 (1.051–3.048)[§] |
| Current wheeze[#] | 8.6 (266/3085) | Low | 7.3 (14/192) | 0.848 (0.483–1.488) |
| | | Medium | 8.5 (18/211) | 1.008 (0.609–1.669) |
| | | High | 13.5 (26/193) | → 1.663 (1.073–2.578)[§] |
| Cough[¶] | 18.0 (559/3097) | Low | 18.7 (36/193) | 1.049 (0.720–1.528) |
| | | Medium | 22.3 (47/211) | 1.323 (0.942–1.858) |
| | | High | 26.8 (52/194) | → 1.622 (1.162–2.266)[f] |
| Hay fever | 11.7 (360/3082) | Low | 10.9 (21/192) | 0.940 (0.585–1.510) |
| | | Medium | 12.4 (26/209) | 1.061 (0.688–1.638) |
| | | High | 13.3 (26/196) | 1.171 (0.756–1.814) |
| Skin-prick test $\geqslant$3 mm | 19.4 (341/1762) | Low | 17.9 (20/112) | 0.846 (0.509–1.405) |
| | | Medium | 18.2 (22/121) | 0.971 (0.595–1.584) |
| | | High | 23.4 (26/111) | 1.373 (0.857–2.200) |
| Pollen | 13.9 (243/1754) | Low | 14.2 (16/113) | 0.961 (0.551–1.677) |
| | | Medium | 14.2 (17/120) | 1.067 (0.619–1.840) |
| | | High | 18.9 (21/111) | 1.567 (0.940–2.613)[+] |
| Specific IgE aeroallergens $\geqslant$0.7 kU·mL$^{-1}$ | 36.3 (476/1311) | Low | 28.8 (23/80) | 0.682 (0.411–1.130) |
| | | Medium | 34.7 (34/98) | 0.933 (0.600–1.453) |
| | | High | 39.5 (32/81) | 1.213 (0.755–1.947) |

*T Nicolai, et al Eur Respir J 2003; 21: 956-63*

Table 5. – Respiratory and atopic outcomes in relation to traffic counts in the area of residence for children additionally expos to environmental tobacco smoke

| Outcome | Crude reference prevalence % (raw numbers) | Exposure tertile | Crude prevalence % (raw numbers) | Adjusted OR (95% CI) |
|---|---|---|---|---|
| Asthma | 10.8 (126/1169) | Low | 4.8 (4/83) | 0.438 (0.157–1.22 |
| | | Medium | 11.0 (11/100) | 1.009 (0.521–1.95 |
| | | High | 13.6 (14/103) | 1.343 (0.736–2.45 |
| Current asthma[#] | 5.2 (62/1193) | Low | 1.2 (1/83) | 0.232 (0.032–1.70 |
| | | Medium | 5.9 (6/101) | 1.130 (0.472–2.70 |
| | | High | 9.7 (10/103) | 2.047 (1.005–4.17 |
| Current wheeze[#] | 9.1 (107/1178) | Low | 4.8 (4/83) | 0.523 (0.187–1.46 |
| | | Medium | 9.9 (10/101) | 1.095 (0.550–2.17 |
| | | High | 14.0 (14/100) | 1.697 (0.927–3.10 |
| Cough[¶] | 19.1 (226/1186) | Low | 20.7 (17/82) | 1.177 (0.674–2.05 |
| | | Medium | 25.7 (26/101) | 1.487 (0.927–2.38 |
| | | High | 26.7 (27/101) | 1.543 (0.967–2.46 |
| Hay fever | 10.4 (123/1179) | Low | 6.1 (5/82) | 0.578 (0.227–1.47 |
| | | Medium | 16.8 (17/101) | 1.678 (0.944–2.98 |
| | | High | 15.7 (16/102) | 1.739 (0.967–3.12 |
| Skin-prick test $\geqslant$3 mm | 15.8 (110/695) | Low | 13.7 (7/51) | 0.785 (0.339–1.81 |
| | | Medium | 23.8 (15/63) | 1.539 (0.812–2.91 |
| | | High | 28.8 (15/52) | 2.670 (1.353–5.26 |
| Pollen | 11.8 (82/694) | Low | 11.5 (6/52) | 0.915 (0.372–2.24 |
| | | Medium | 19.4 (12/62) | 1.662 (0.829–3.33 |
| | | High | 25.0 (13/52) | 3.255 (1.581–6.69 |
| Specific IgE aeroallergens $\geqslant 0.7\ kU \cdot mL^{-1}$ | 33.1 (164/496) | Low | 25.7 (9/35) | 0.655 (0.296–1.45 |
| | | Medium | 33.3 (16/48) | 1.003 (0.524–1.92 |
| | | High | 45.0 (18/40) | 1.761 (0.897–3.45 |

# Trafic (urbain)

- EFR et BHR
  - Non associés aux paramètres d'exposition

*T Nicolai, D Carr, S.K. Weiland, H Duhme, O von Ehrenstein, C Wagner, E von Mutius. Urban traffic and pollutant exposure related to repiratory outcomes and atopy in a large sample of children. Eur Respir J 2003; 21: 956-63*

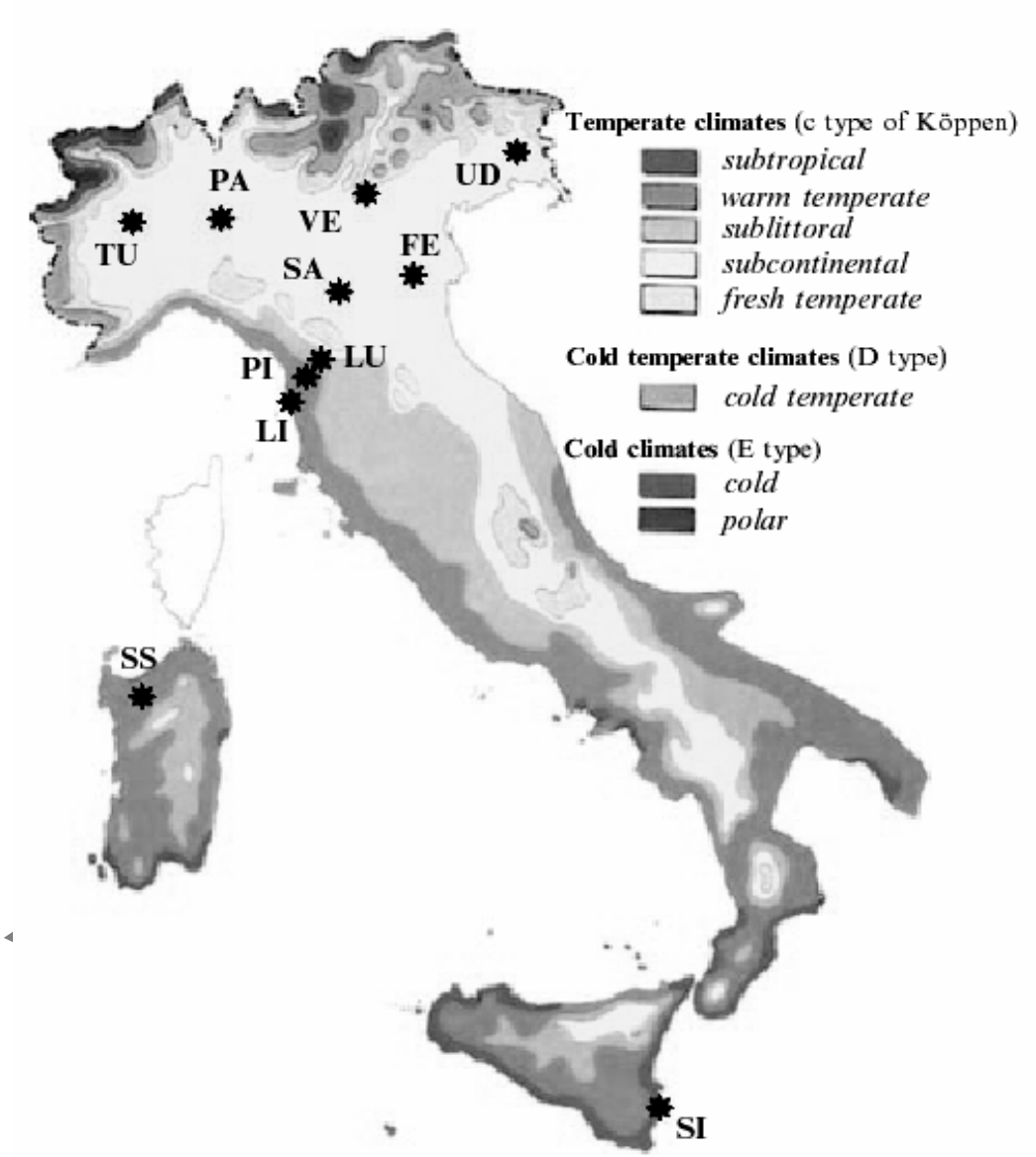
# Trafic (urbain)

- Conclusions
  - 1/ l'exposition au trafic intense est un facteur de risque d'asthme, toux, wheezing chez l'enfant
  - 2/ associé au tabagisme passif, l'exposition au trafic intense est un facteur de risque de sensibilisation allergique
  - 3/ un effet confondant lié au statut socio-économique ne peut être exclu

*T Nicolai, D Carr, S.K. Weiland, H Duhme, O von Ehrenstein, C Wagner, E von Mutius. Urban traffic and pollutant exposure related to repiratory outcomes and atopy in a large sample of children. Eur Respir J 2003; 21: 956-63*

# Trafic (urbain)

- **Rôle de la proximité de l'habitat:**
  - Pas d'effet significatif du trafic:
    - Venn A et al. Located road traffic activity and the prevalence , severity, and persistence of wheeze in school children: combined cross sectional and longitudinal study. OEM 2000; 57: 152-8.
  - Effet significatif du trafic
    - Venn A et al. Living near a main road and the risk of wheezing illness in children. AJRCCM 2001; 164: 2177-80



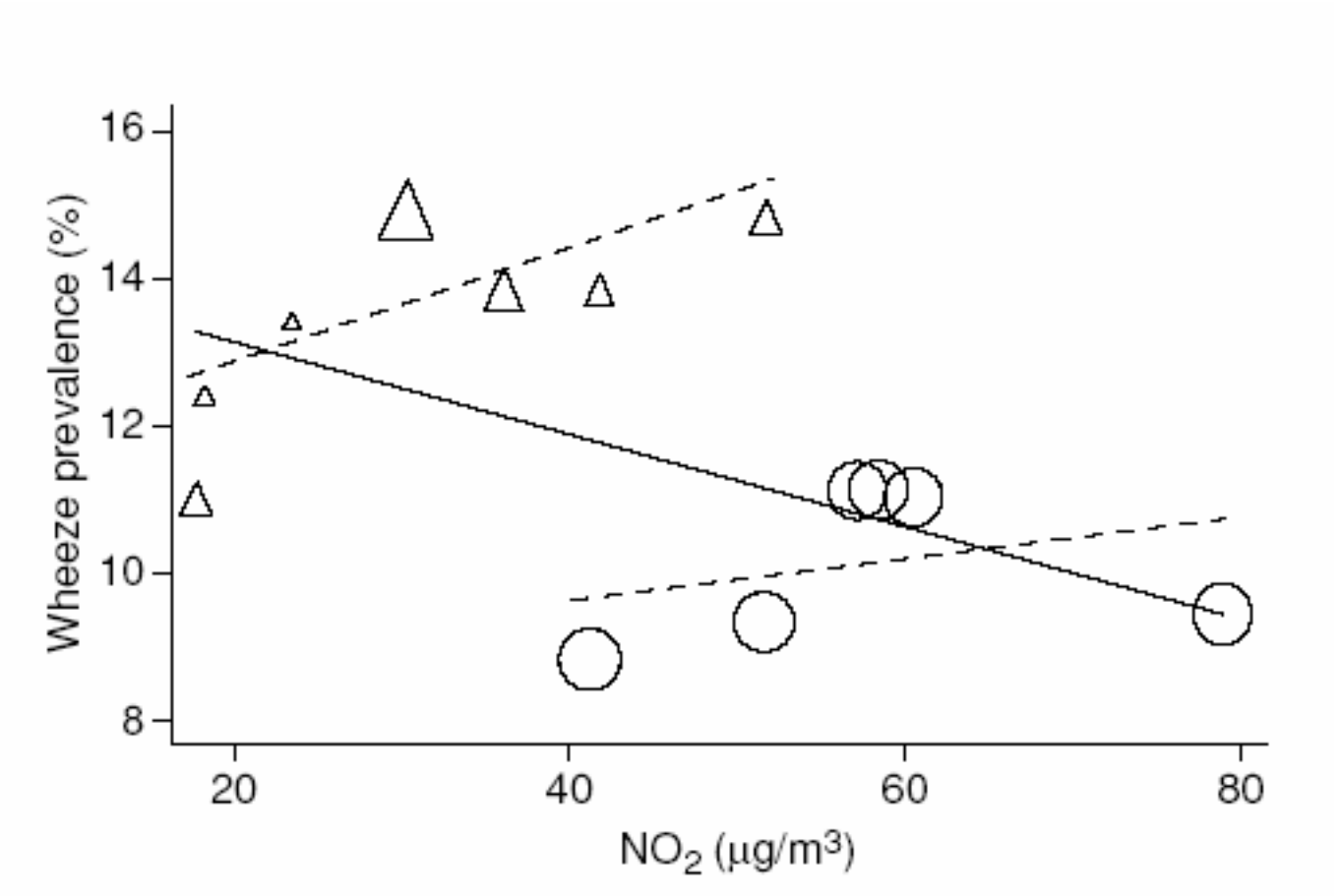

*R de Marco et al Clin Exp Allergy 2002; 32; 1405*

# Variations de NO2 associées au climat

| | Méditérranée | Continental | p |
|---|---|---|---|
| | | | |
| Temperature (°C) | 16,2 | 12,9 | |
| NO2 (µg/m3) | 31,5 | 58,0 | |
| Wheezing | OD = 1,23 | | <0,001 |
| dyspnée | OD = 1,21 | | <0,001 |
| asthme | OD = 1,19 | | <0,001 |
| | | | |

*R de Marco et al Clin Exp Allergy 2002; 32; 1405*

# Relation wheezing, climat et NO2

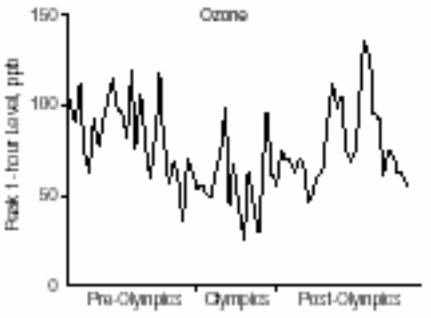



(○, subcontinental areas; △, Mediterranean areas).

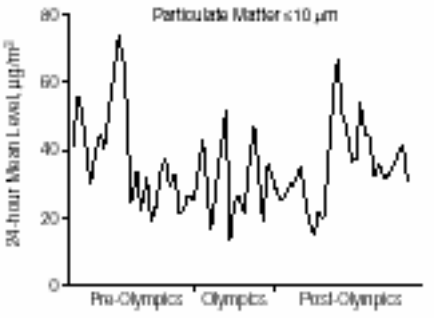
*R de Marco et al Clin Exp Allergy 2002; 32; 1405*

# Impact du changement de mode de transport pendant les JO d'Atlanta

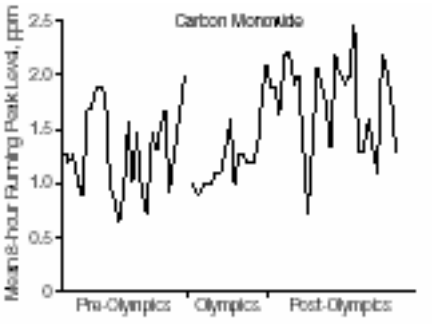
O3



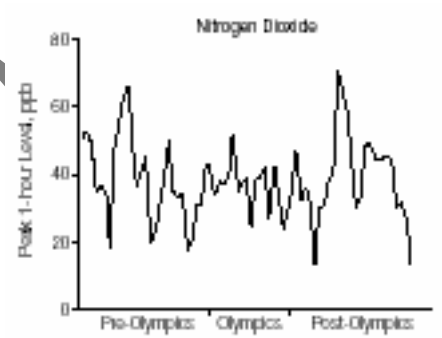

PM



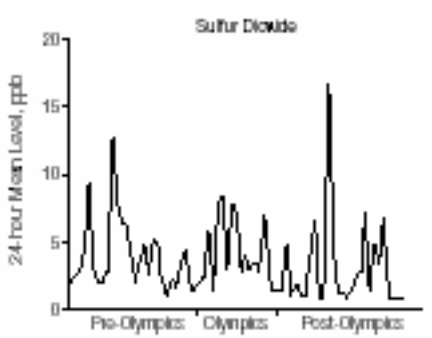

CO



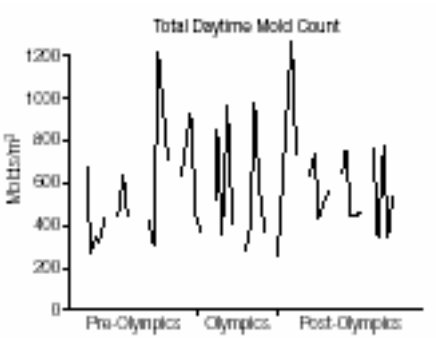

NO2




S02

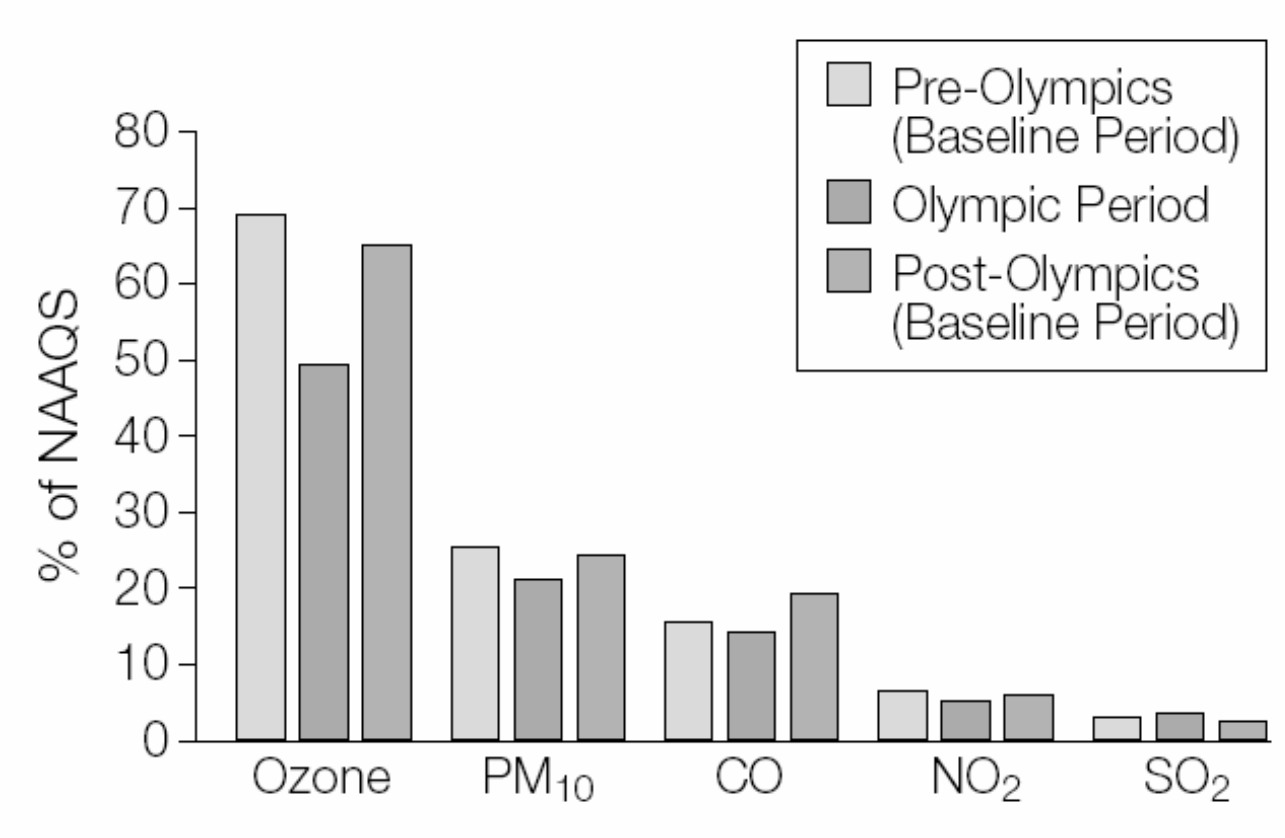



traffic count




*MS Friedman et al. JAMA 2001; 285: 897-905*

# Impact du changement de mode de transport pendant les JO d'Atlanta




*MS Friedman et al. JAMA 2001; 285: 897-905*

# Impact du changement de mode de transport pendant les JO d'Atlanta

**Table 1.** Acute Asthma Events and Acute Nonasthma Events Among Children and Youth During the 1996 Summer Olympic Games Compared With the 1996 Summertime Baseline Period

| | | Acute Asthma Events | | | Acute Nonasthma Events | | |
|---|---|---|---|---|---|---|---|
| | | Mean (SD) No. of Events Per Day | | | Mean (SD) No. of Events Per Day | | |
| Data Source | Type of Asthma Event | Baseline Period* | Olympic Period† | % Change | Baseline Period* | Olympic Period† | % Change |
| Georgia Medicaid claims file | Emergency care and hospitalizations | 4.23 (2.81) | 2.47 (1.46) | −41.6 | 100.5 (18.6) | 97.4 (16.4) | −3.1 |
| Health maintenance organization | Emergency care, urgent care, and hospitalizations | 1.36 (1.63) | 0.76 (0.83) | −44.1 | 37.6 (19.6) | 38.1 (18.4) | +1.3 |
| Pediatric emergency departments | Emergency care and hospitalizations | 4.77 (2.52) | 4.24 (2.49) | −11.1 | 118.4 (20.5) | 115.9 (15.9) | −2.1 |
| Georgia Hospital Discharge Database | Hospitalizations | 2.04 (1.53) | 1.65 (1.50) | −19.1 | 19.7 (5.1) | 19.9 (3.5) | +1.0 |

*Defined as June 21–July 18 and August 5–September 1, 1996.
†Defined as July 19–August 4, 1996.

*MS Friedman et al. JAMA 2001; 285: 897-905*

# Impact du changement de mode de transport pendant les JO d'Atlanta

- Conclusion:
  - La réduction de la pollution par l'ozone diminue la fréquence des exacerbations asthmatiques chez l'enfant

*MS Friedman et al. JAMA 2001; 285: 897-905*

# Trafic et allergies

- Conclusions générales

| | allergies | asthme |
|---|---|---|
| **Trafic** | **-** | **+** |
| **Diesel** | **+** | **-** |
| **NO2** | **-** | **+/-** |
| **O3** | **-** | **++** |