Air Quality & Respiratory Problems

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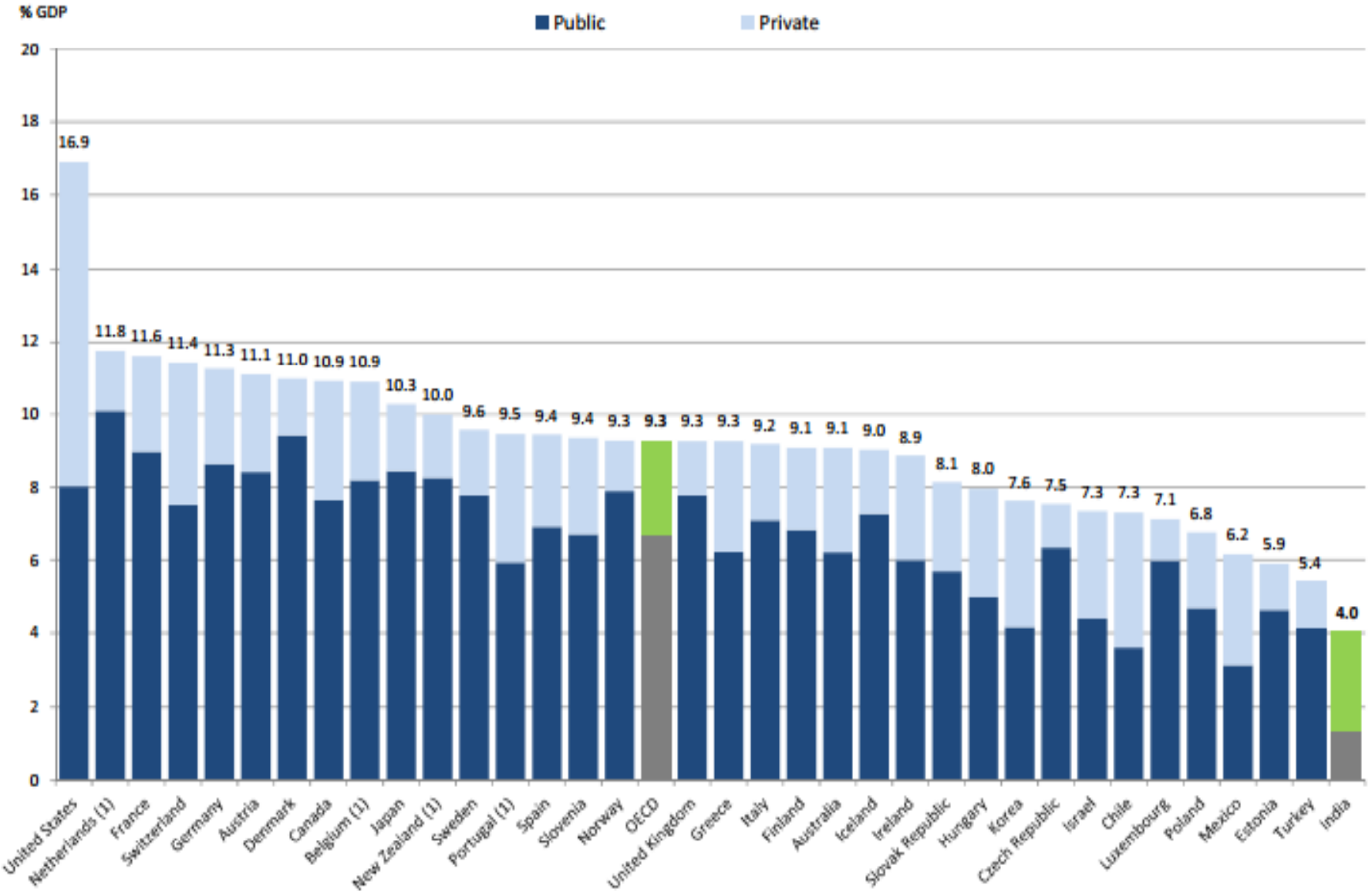
Our Focus

- Large no. of patients presenting with chronic cough
- Smoking belt, stubble burning of crops
- Younger patients who have recently moved to Gurgaon
- Exponential rise in prevalence of Asthma in kids

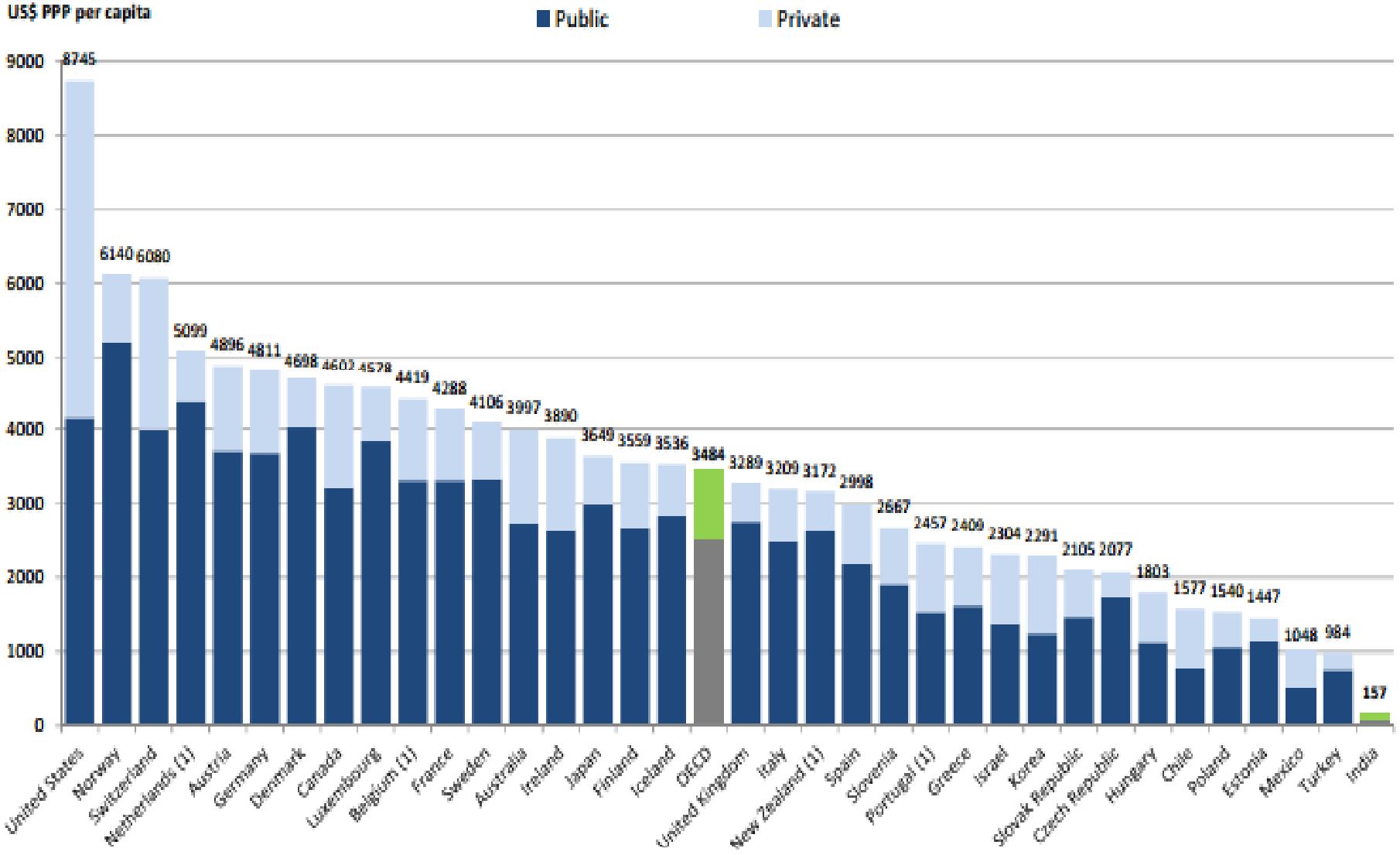
Health expenditure as a share of GDP, India and OECD countries, 2012 or latest year



1. Total expenditure excluding capital expenditure.

Source: *OECD Health Statistics 2014; WHO Global Health Expenditure Database*

Health expenditure per capita, India and OECD countries, 2012 or latest year



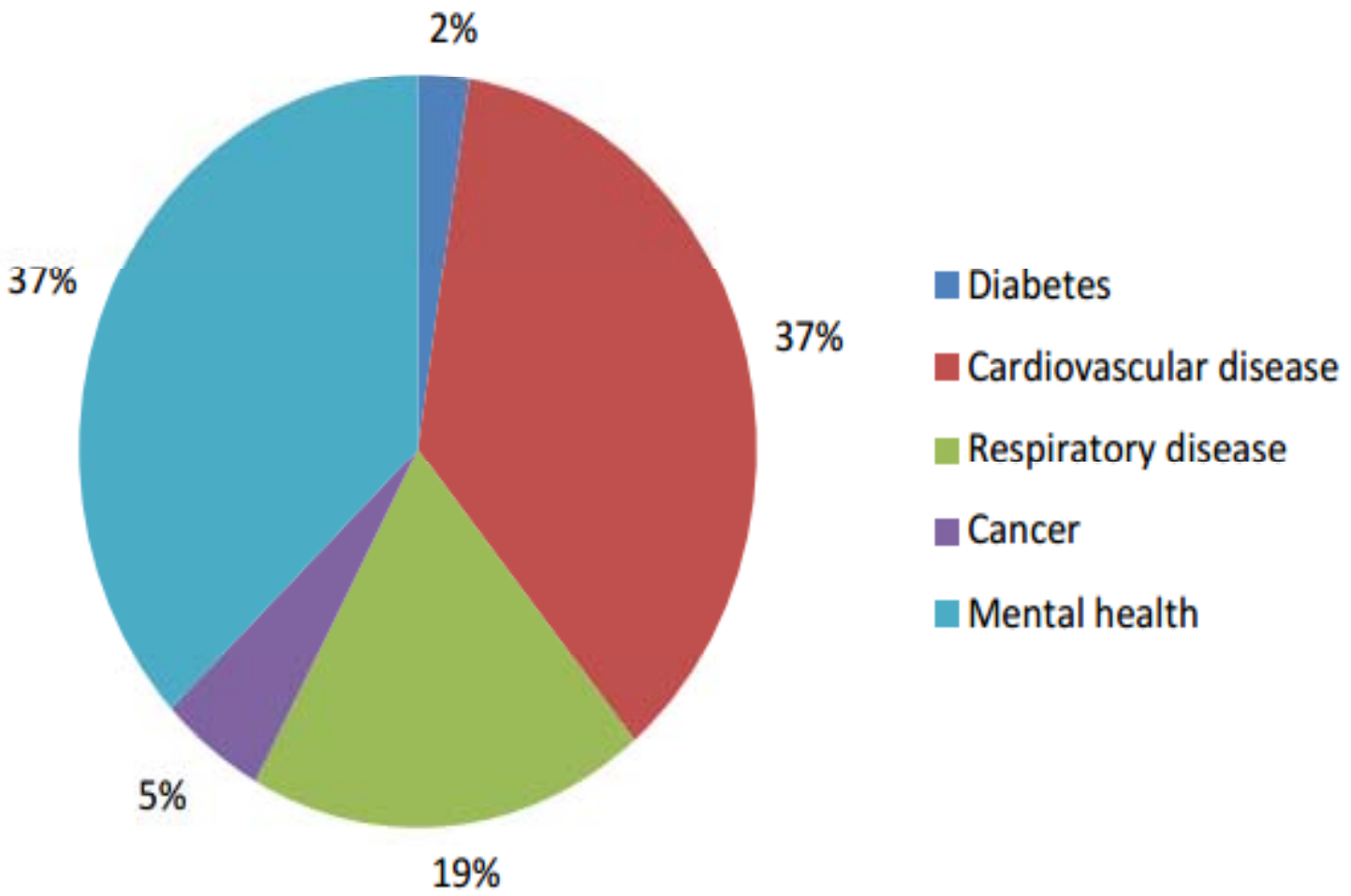
1. Total expenditure excluding capital expenditure.

Source: *OECD Health Statistics 2014; WHO Global Health Expenditure Database*

Table 5.Output losses, 2012-2030, model raw output for India

Disease	Loss, 2010 USD (trillions)
Diabetes	0.15
Ischemic heart disease	1.21
Cerebrovascular disease	0.49
COPD	0.71
Breast cancer	0.02
TOTAL	**2.58**

Figure 7. Contribution of each disease to overall lost output for India



The Respiratory Epidemic

- Out of focus epidemic
- Amenable to prevention
- Multiple contributing factors
  - Tobacco
  - Air Quality & Pollution
- Greater challenges in the developing world

Table 1. WHO default values of relative risk (per 10 µg/m³ increase of daily averages for SO_2, TSP and NO_2) corresponding to mortality

Pollutant	Mortality/Morbidity	Relative Risk (RR)	Baseline Incidence Per 100 000 (I) [b]
SO_2	Total Mortality	1.004 (1.003–1.0048) [c]	1 013
	Cardiovascular Mortality	1.008 (1.002–1.012)	497
	Respiratory Mortality	1.010 (1.006–1.014)	66
	Hospital Admission COPD [a]	1.0044 (1–1.011)	1 014
TSP	Total Mortality	1.003 (1.002–1.007)	1 013
	Cardiovascular Mortality	1.002 (1–1.006)	497
	Respiratory Mortality	1.008 (1.004–1.018)	66
	Hospital Admissions COPD [a]	1.0044 (1–1.0094)	1 014
NO_2	Total Mortality		
	Cardiovascular Mortality	1.002 (1–1.004)	497
	Respiratory Mortality		

Note: The total, cardiovascular and respiratory mortality is the annual number of deaths in a given age group per the population in that age group (usually expressed per 100 000) due to exposer of air pollution. However Hospital Admission COPD is the annual number of morbidity in a given age group per the population in that age group (usually expressed per 100 000) due to exposer of air pollution.

[a] *COPD: Chronic Obstructive Pulmonary Disease*

[b] *Baseline Incidence per 100 000 is based on threshold limit given in WHO guideline*

[c] *Lower and upper limits (range) of the 95% confidence interval of RR values*

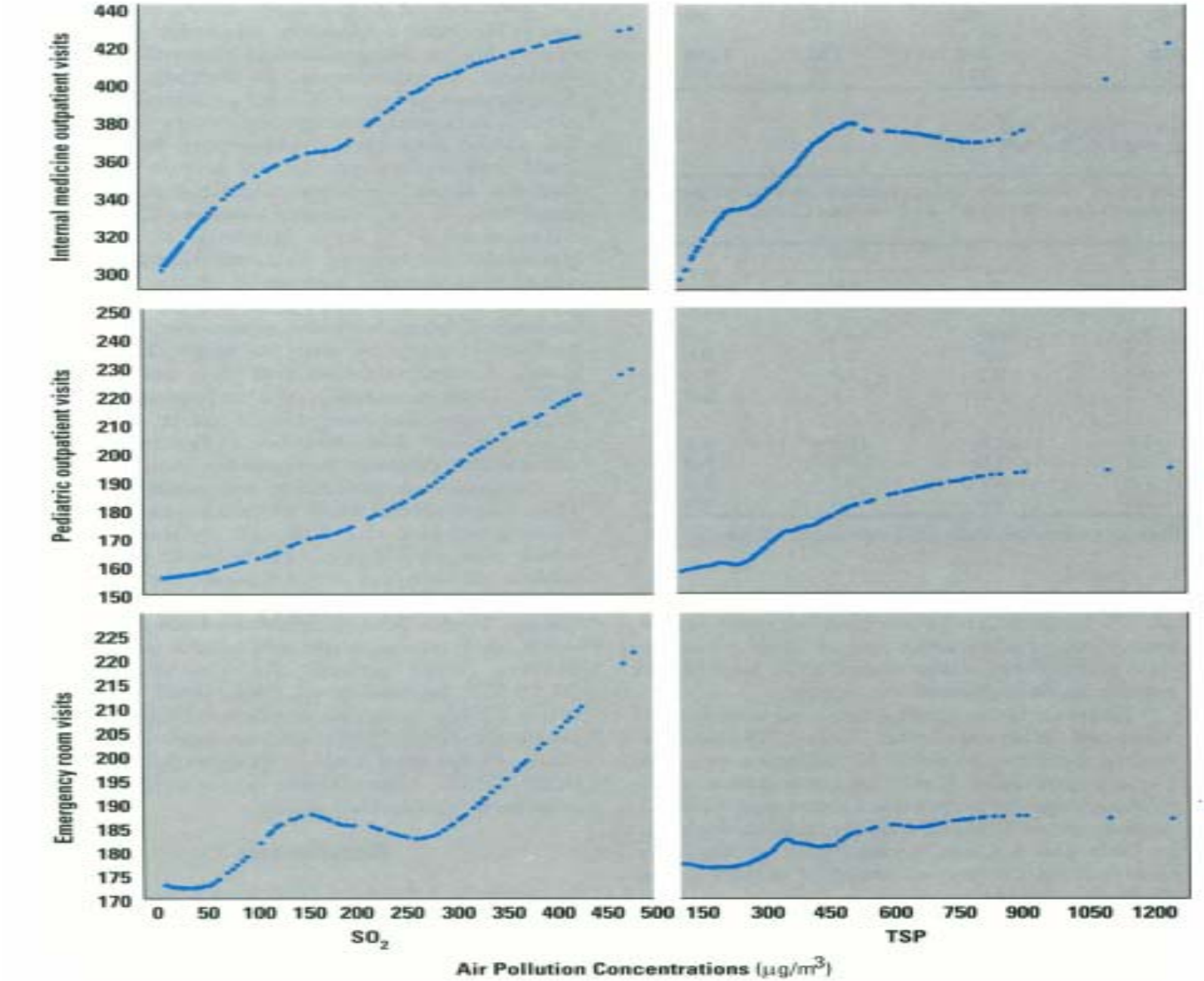

Internal medicine outpatient visits
440
420
400
380
360
340
320
300
Pediatric outpatient visits
250
240
230
220
210
200
190
180
170
160
150
Emergency room visits
225
220
215
210
205
200
195
190
185
180
175
170
0 50 100 150 200 250 300 350 400 450 500
SO2
150 300 450 600 750 900 1050 1200
TSP
Air Pollution Concentrations (μg/m3)

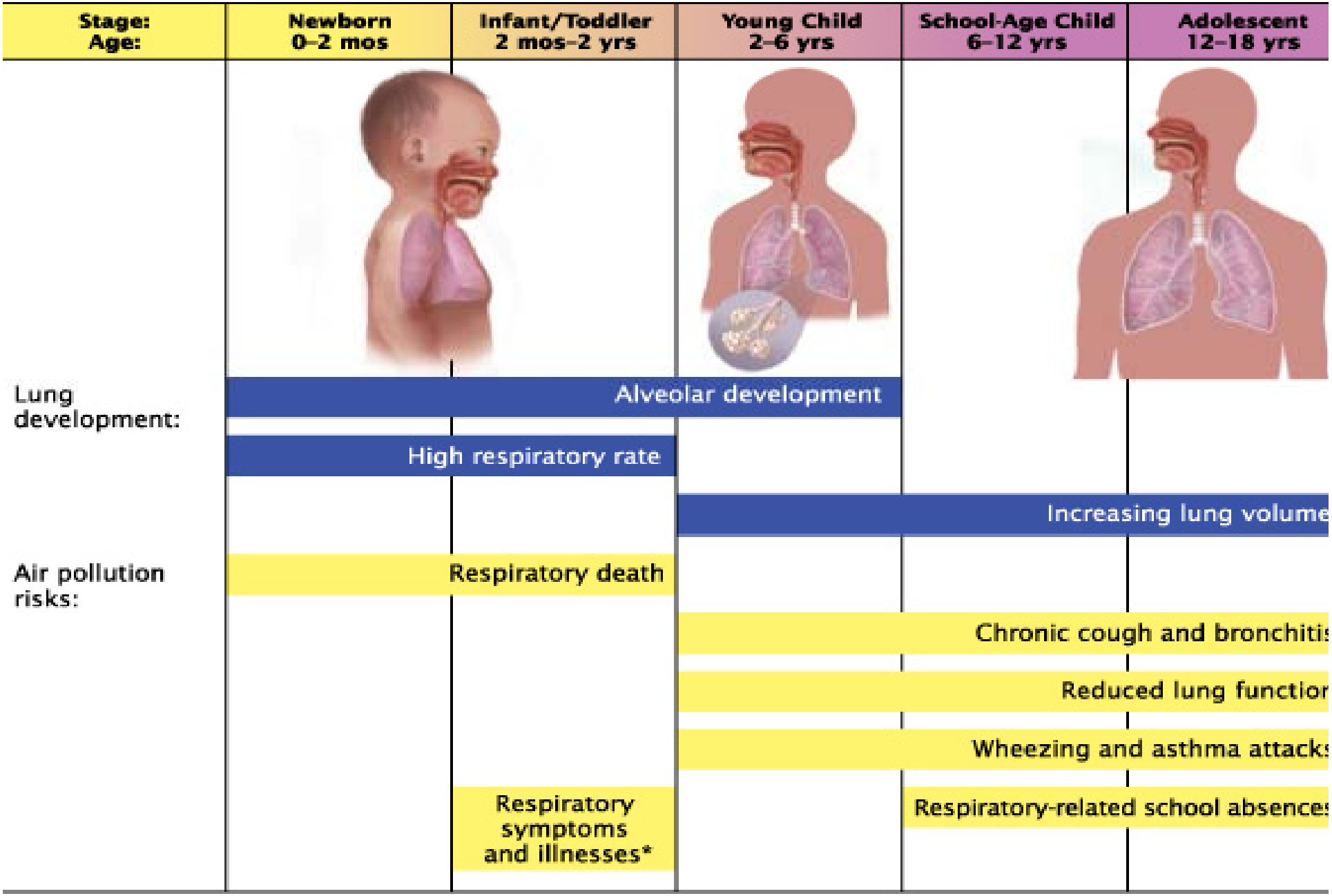
Table 1. A comparison of the prevalence of lung function deficits, chronic obstructive pulmonary disease (COPD) and hypertension between urban and rural subjects

	Reduced lung function (%)	COPD (%)	Hypertension (%)
Urban subjects			
Traffic police (n = 56)	51.8	5.3	42.8
Street hawkers (n= 188)	40.9	3.7	35.1
Auto rickshaw drivers (n= 82)	48.8	3.6	36.6
Bus drivers (n=78)	56.4	5.1	37.1
Motor mechanics (n= 56)	50.0	7.1	33.9
With office jobs (n=470)	35.3	2.6	21.9
Urban, total (n=932)	41.2*	3.4*	29.1*
Rural control (n= 812)	18.0	0.7	10.6

, $p<0.001$ comapred with rural control in Chi-square test

Susceptibility to Air Pollution

- Individuals with heart disease – such as coronary artery disease or congestive heart failure
- Individuals with lung disease – such as asthma, emphysema or chronic obstructive pulmonary disease (COPD)
- Pregnant women
- Outdoor workers
- Children under age 14, whose lungs are still developing
- Athletes who exercise vigorously outdoors



*Air pollution exposure has also been more recently linked to respiratory symptoms and illnesses in early life including cough, bronchitis, wheeze and ear infections

Air Quality – Immediate issues

- Aggravated cardiovascular and respiratory illness
- Added stress to heart and lungs, which must work harder to supply the body with oxygen
- Damaged cells in the respiratory system

Air Quality- Long term effects

- Accelerated aging of the lungs
- Loss of lung capacity
- Decreased lung function
- Development of diseases such as asthma, bronchitis, emphysema, and cancer
- Shortened life span

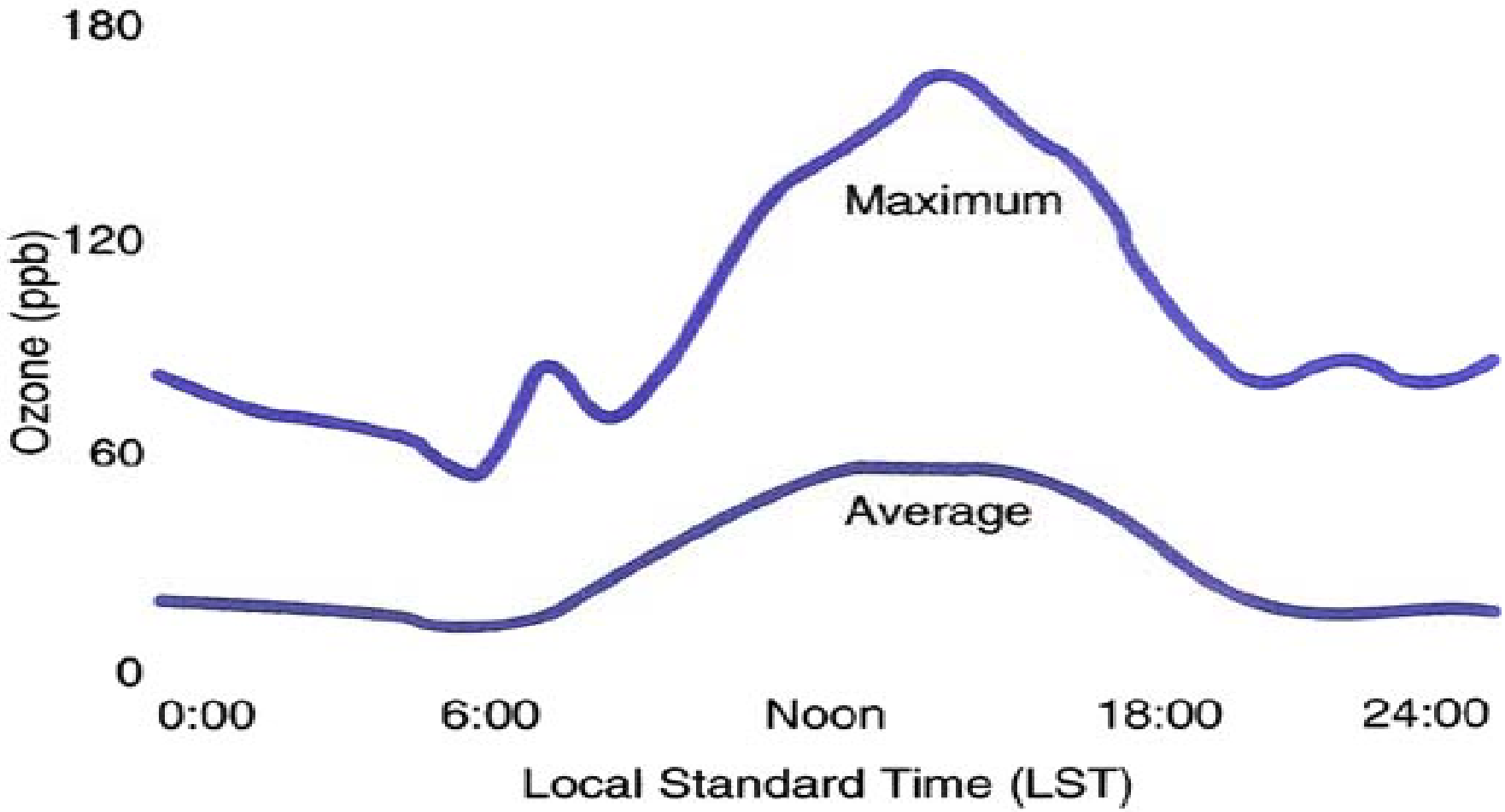
Air Pollution

- Ground level Ozone
- Particulates, especially PM 2.5
- Air-borne toxics
- Tobbaco

Air Pollutants:
Ground Level Ozone

- Produced from VOCs & oxides of Nitrogen react with uv light
- Source include cars, trucks, buses, construction equipment and agricultural equipment
- Strong irritant that can cause constriction of the airways, forcing the respiratory system to work harder

Figure 12.10. Typical Ozone Concentrations by Time of Day



Source: U.S. Environmental Protection Agency. Data reflect all observations recorded at the Plaza Rd. site in Charlotte. 1981-89.

Ozone- Health Impacts

- Aggravated respiratory disease such as emphysema, bronchitis and asthma
- Coughing, soar throat, wheezing, chest pain, dry throat, headache or nausea
- Reduced resistance to infection
- Increased fatigue
- Weakened athletic performance

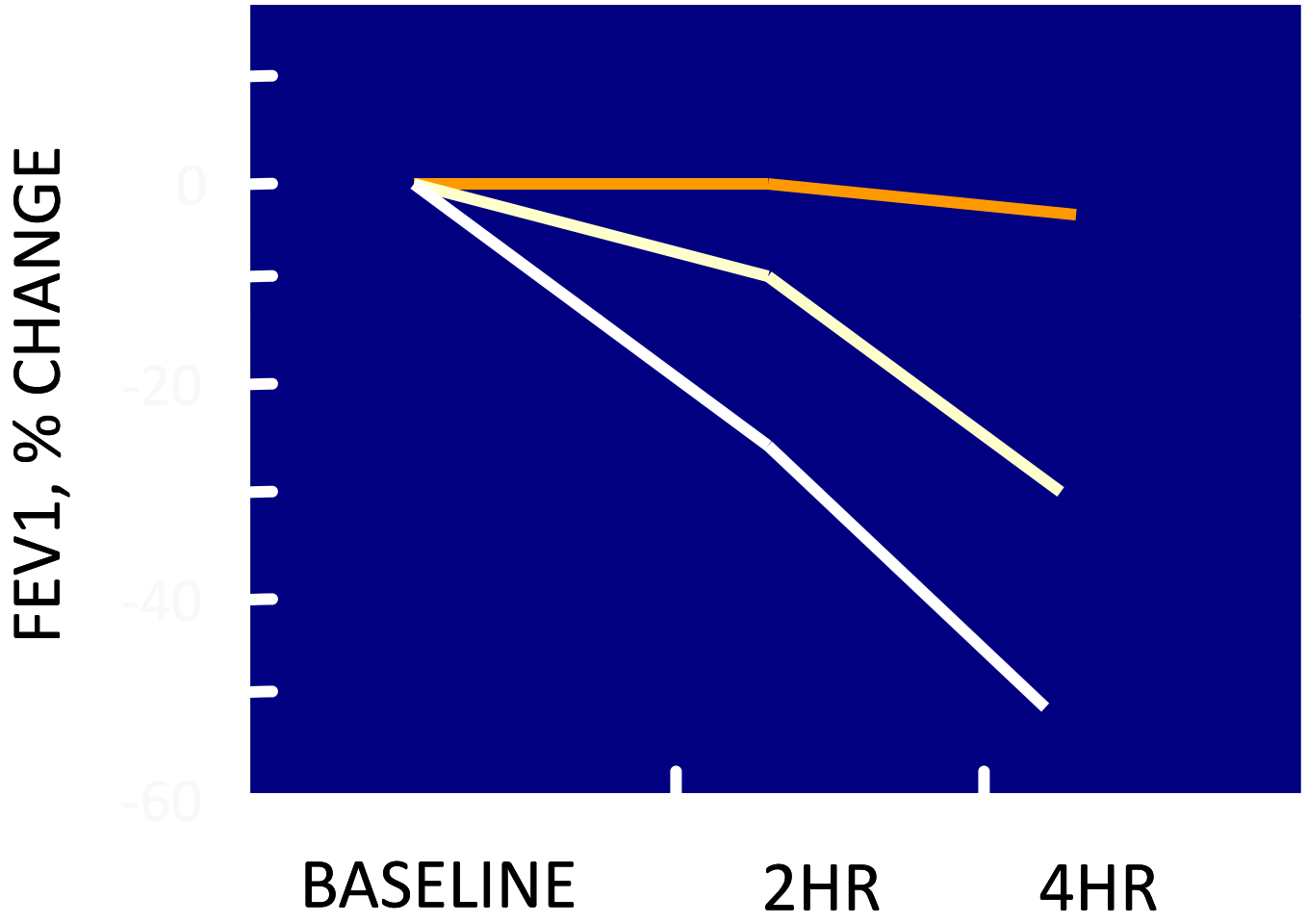
Asthma Epidemic

- ↑ 50 % in Children
- ↑ 100% in Adults

Ozone and Asthma Attacks

- Multiple studies from around the world all show the same results
- More ozone pollution exposure leads to more asthma attacks
- Dose = Response relationship

Ozone Reduces Lung Function



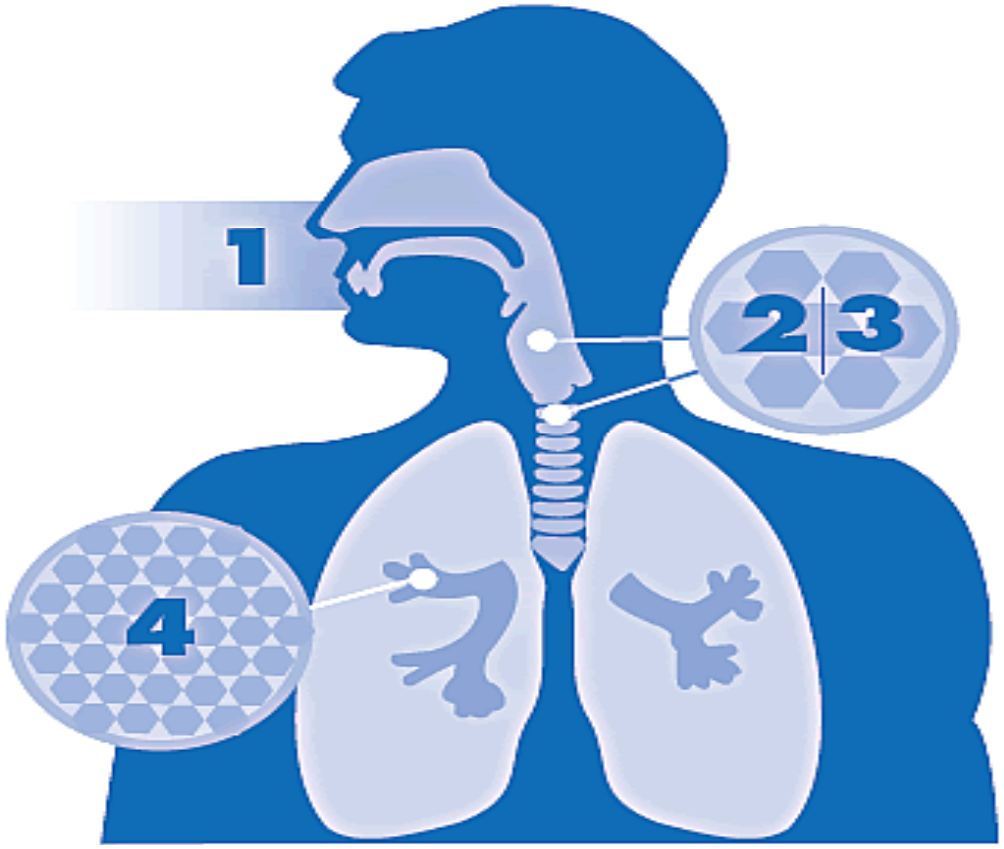
Air Pollutants: Particulates

- Sulfates, nitrates,
- Polycyclic Aromatic Hydrocarbons (PAH),
- Soot / Carbon
- Dust

PM Physiology

- The size of particles is directly linked to their potential for causing health problems.
- Small particles (known as PM2.5 or fine particulate matter) pose the greatest problems.
- They penetrate deep into lungs and reach alveoli setting up a inflammatory cascade

How Particulate Matter Enters Our Body



1 Particulate matter enters our respiratory (lung) system through the nose and throat.

2 | 3 The larger particulate matter (PM10) is eliminated through coughing, sneezing and swallowing.

4 PM2.5 can penetrate deep into the lungs. It can travel all the way to the alveoli, causing lung and heart problems, and delivering harmful chemicals to the blood system.

Air Pollutants: Particulates

Year round exposures

Penetrate buildings

PM – Health Impacts

- Increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing
- Decreased lung function
- Development of chronic respiratory disease in children
- Development of chronic bronchitis or chronic obstructive lung disease
- Irregular heartbeat
- Nonfatal heart attacks
- Premature death in people with heart or lung disease, including death from lung cancer

Particulates and Asthma

- **Multiple studies show direct correlation between exposure to particulates and increases in asthma attacks and hospitalization rates**

- **Effects seen in adults and especially pronounced in children**

Two Different Immune System Responses

- **Th1 = Normal infection fighting response**

- **Th2 = Allergic/Asthmatic response**

Diesel Exhaust Permanently Changes Immune Response

- **More Asthmatic and Allergic responses**
- **Increases Th2 & Decreases Th1**
- **Polycyclic aromatic hydrocarbons (PAH) are the culprits**
- **Diesel and vehicle exhaust and coal smoke**

Nel, A.E., et al., J of Allergy and Clinical Immunology, 2001

Air Quality – Impact on Healthy People

- ↑ Asthma rates in adults
- ↑ Pneumonia and respiratory infections
- ↑ Lung cancer rates similar to living with a smoker
- ↑ Overall death rates

Faster decline in lung function with age

Why should “We Care”

Gurgaon- Our City

- Economic Hub of state/region
- Home to most of the fortune 500 companies
- Major medical hub treating patients from >30 countries
- “ New City” likely to experience major immigration
- Younger demographics
- Surrounded by industrial belts

Forging Meaningful Collabrations

How Can We help ?

- Helping create awareness
- Measuring health impacts- lung function testing
- Measuring outcomes
- Participating in research protocols
- Camps across the city throughout January & February

Lets Take Care of Our Future!