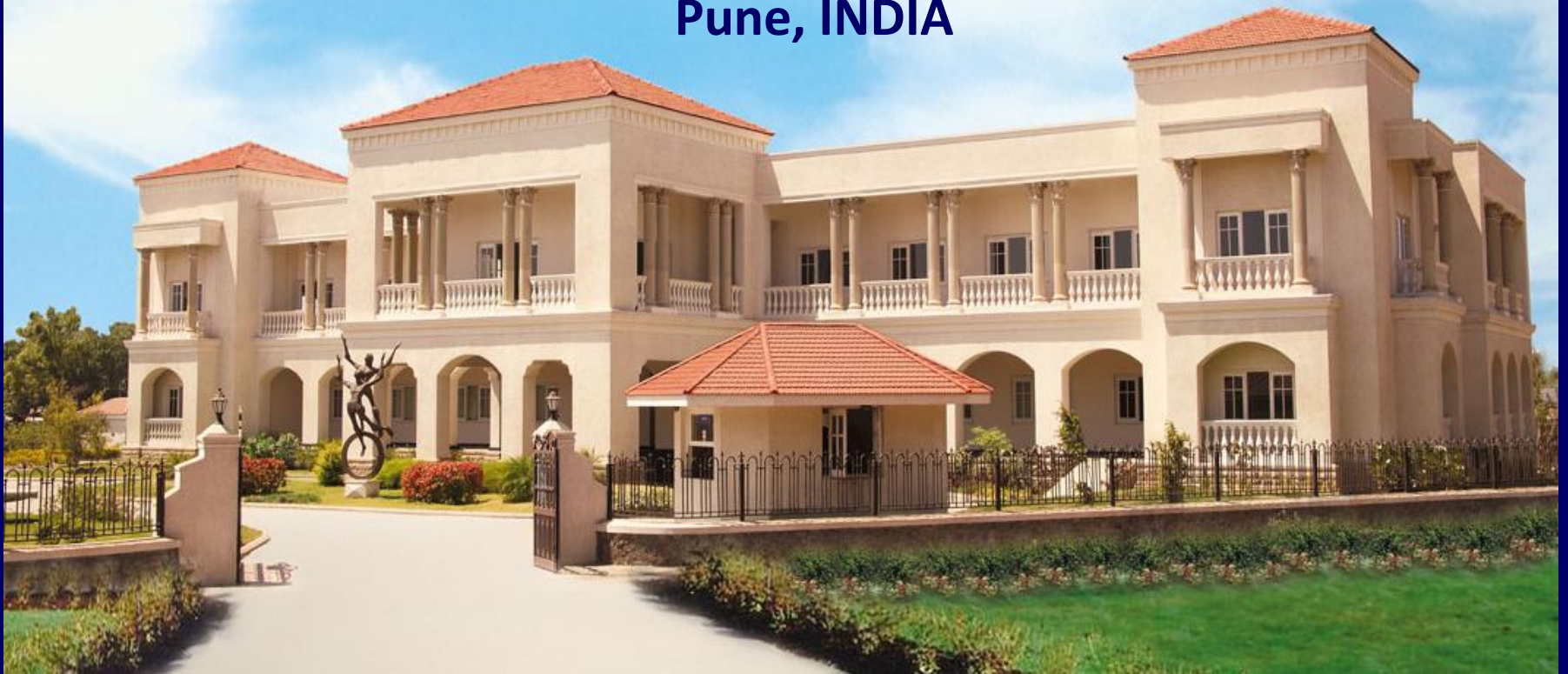


# AIR POLLUTION AND HEALTH

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**Dr SUNDEEP SALVI** MD, DNB, PhD, FCCP  
**Chest Research Foundation**  
**Pune, INDIA**



[ssalvi@crfindia.com](mailto:ssalvi@crfindia.com)

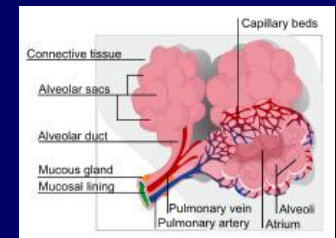
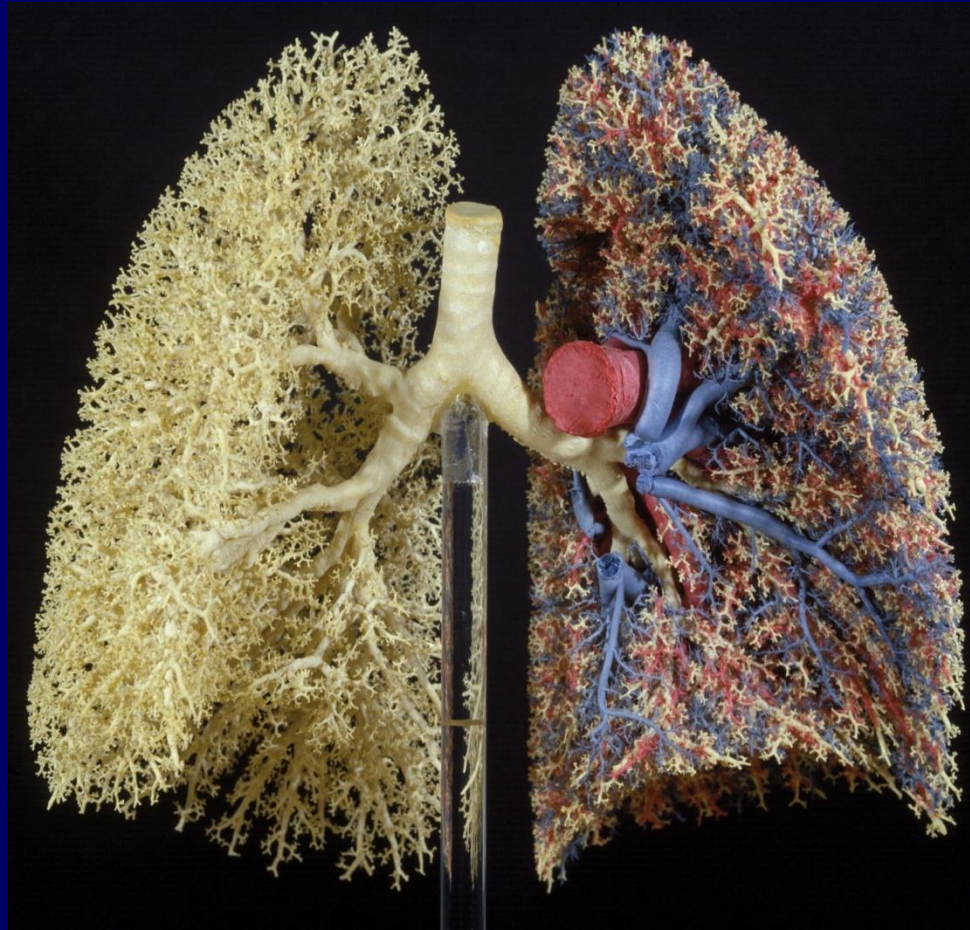
<http://www.crfindia.com>

# LUNGS: THE AMAZING ORGAN

100-200 million  
branching tubes

Need to remain patent  
all the time

10,000 liters air  
every day



600 million air sacs

Very thin membrane  
(0.3 micron)

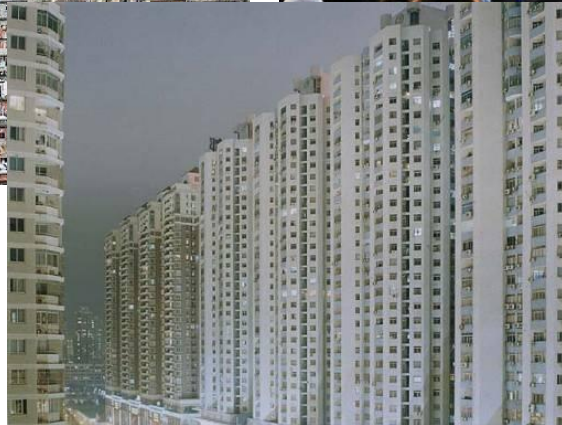
10,000 liters blood  
every day

Oxygen – 420 Lts  
Carbon Dioxide – 350 Lts

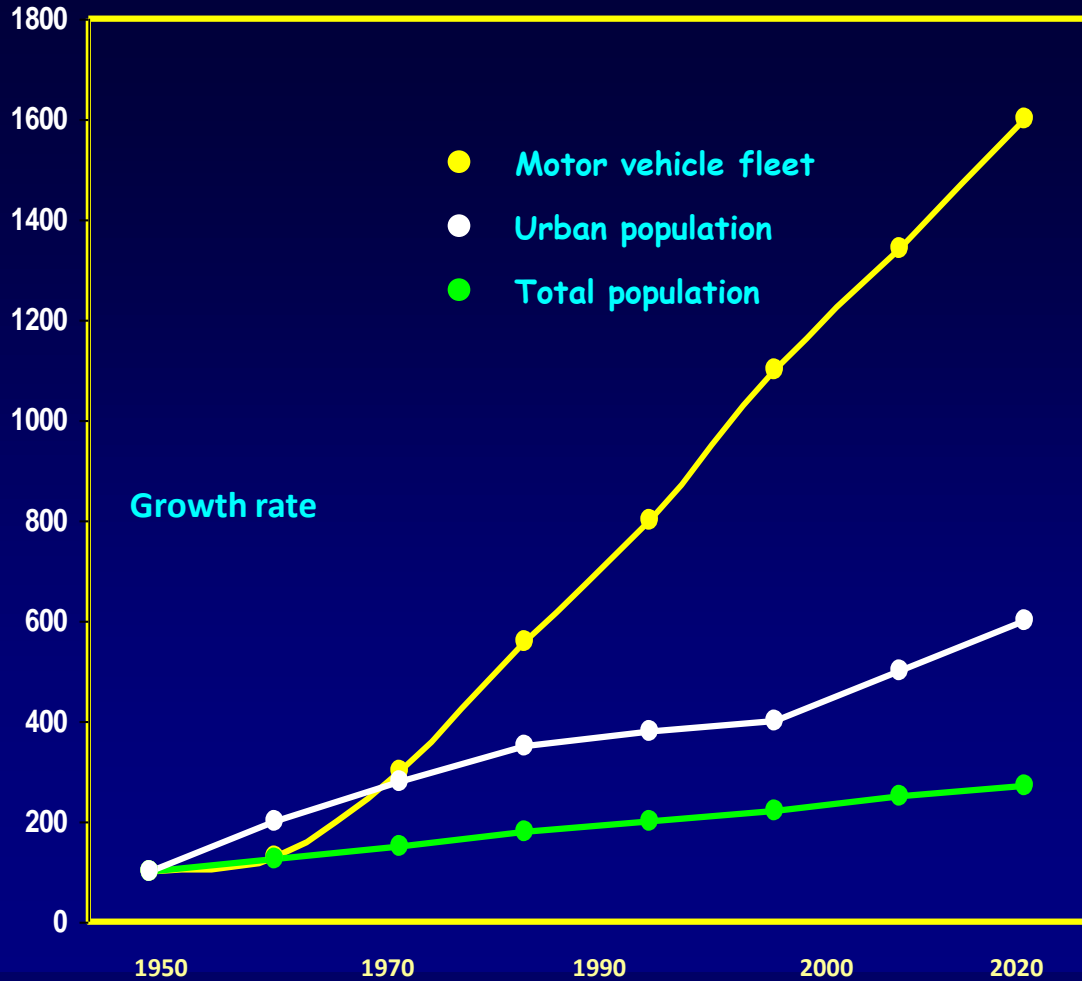




**The world is becoming more urbanized..  
And the Air is becoming more foul....**



# WORLD GROWTH



(World Bank, 1990)

# INDIAN SCENARIO

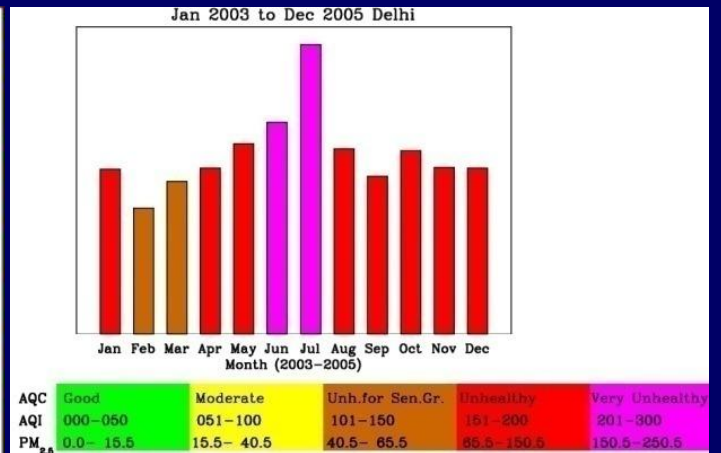
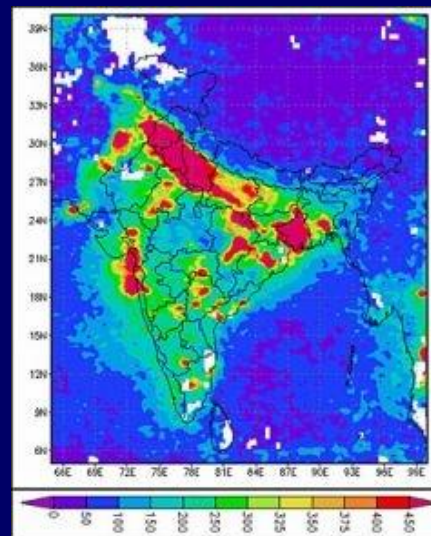
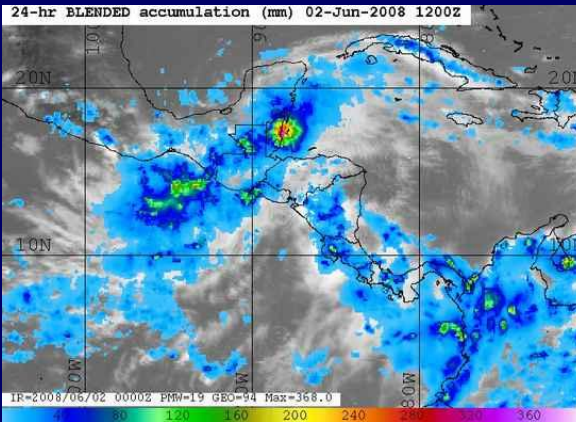
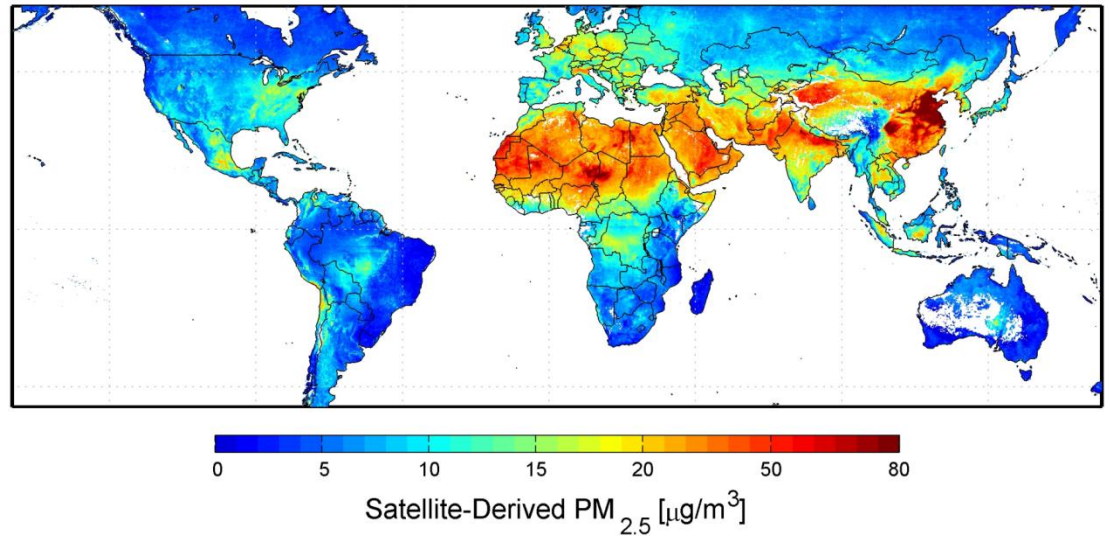
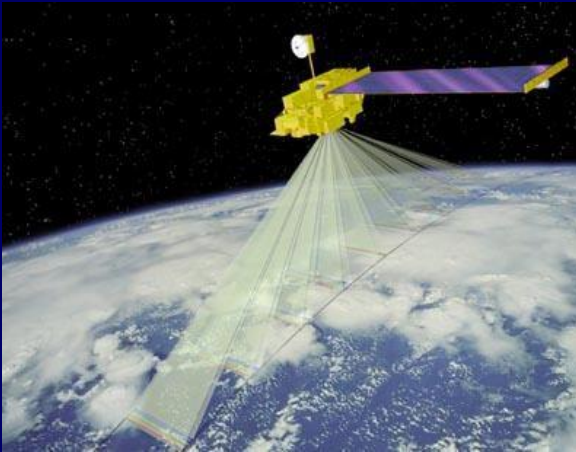
## No. of Motor vehicles in India

1951	0.3 million
1997	37.2 million
2012	100 million





# Remote sensing of air pollution from space



(Indian Inst. of Tropical Meterology)

(Van Donkelaar et al. Environ Health Perspect 2010; 118(6): 847 DOI: 10.1289/ehp.0901623)

# DO POLLUTANTS INHALED BY THE MOTHER ENTER INTO THE GROWING FETUS?



10 newborn babies randomly selected  
by Red Cross from USA  
Cord blood collected and sent for  
analysis for different pollutants

## **BodyBurden** The Pollution in Newborns

A benchmark investigation of industrial  
chemicals, pollutants, and pesticides in  
human umbilical cord blood

**287 pollutants, chemicals, pesticides identified in  
the umbilical cord blood**

(<http://www.ewg.org/reports/bodyburden2/execsumm.php>)

## RUDOLF DIESEL

(1858-1913)

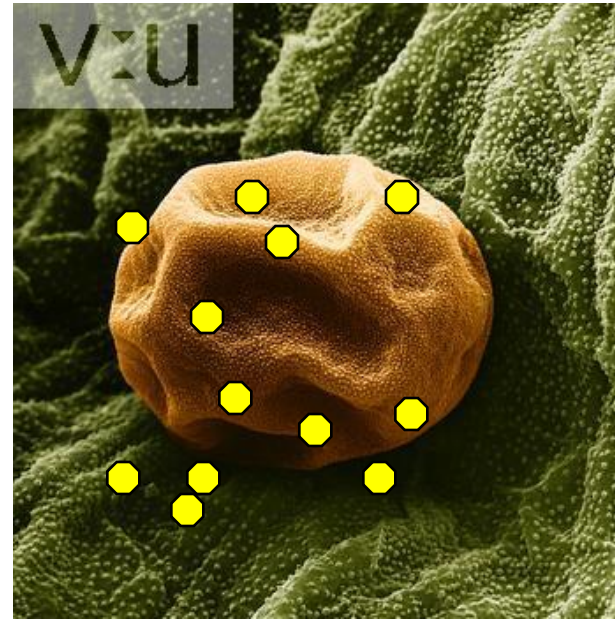


<u>Pollutant</u>	<u>Petrol</u>	<u>Diesel</u>
Carbon dioxide	++++	+
Carbon monoxide	+++	++
Benzene	+++	++
Nitrogen oxides	+	++
Hydrocarbons	++	+++
Aldehydes	++	+++
Sulphur dioxide	+	++++
PAHs	+	++++
Particulate matter*	+	++++



Diesel vehicles produce 1500-times more particles than Petrol vehicles





**Diesel exhaust particles increase allergenicity by up to 50-fold**

**Pollen become more allergenic when these trees grow in an urban environment**

(Knox et al, Clin Exp Allergy 1997)

Takenaka et al, J Allergy Clin Immunol 1995; 95: 103-115)

(Bryce M et al., Int Arch Alergy Immunol 2010; 151: 45-65)



# Residential Proximity to main roads during Pregnancy and Risk of Asthma

Japanese Birth Cohort Study, 756 pregnant mothers,  
Babies followed for 2 yrs after birth



<50 mts versus >200 mts

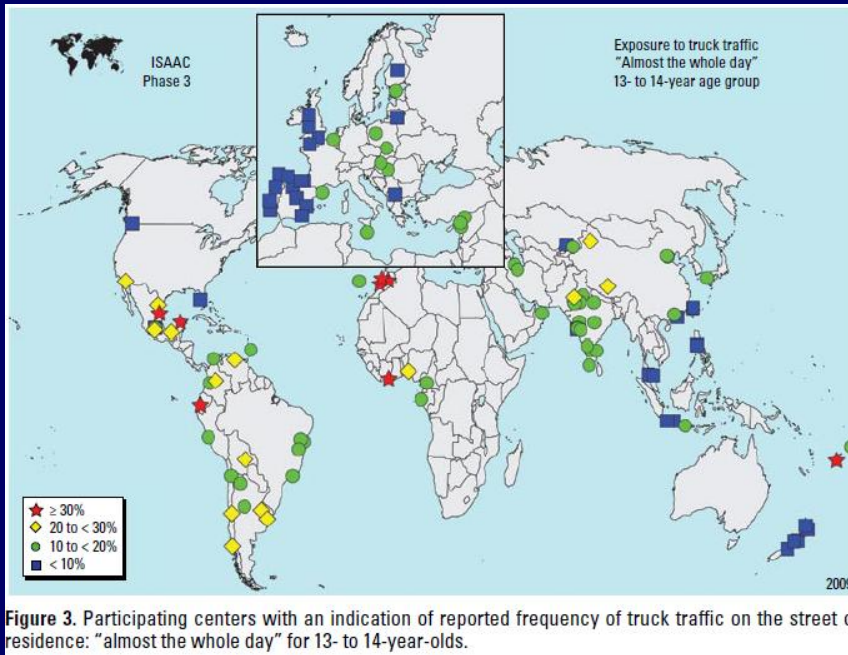
Doctor diagnosed asthma: **4.0** (1.4-11.2)

Doctor diagnosed eczema: **2.3** (1.1-4.6)

Maternal exposure to vehicular pollutants during pregnancy is strongly associated with early childhood asthma

(Miyake Y et al, *Pediatr Allergy Immunol* 2010; 21: 22-28)

# IS THERE ANY ASSOCIATION BETWEEN TRUCK TRAFFIC DENSITY AND CHILDHOOD ASTHMA?



Current wheeze vs Truck traffic on street of residence  
(n = 513,087; 98 countries, 238 centers)

Pune and Nagpur  
(16,000 school children)

Figure 3. Participating centers with an indication of reported frequency of truck traffic on the street of residence: "almost the whole day" for 13- to 14-year-olds.

**Table 6.** Adjusted<sup>a</sup> association between self-reported truck traffic on the street of residence and current wheeze in 6- to 7-year-old children participating in the ISAAC phase 3 study in different parts of the world.

Region	No.		Total	OR (95% confidence interval) <sup>b</sup>		
	Country	Center		High vs. never	Medium vs. never	Low vs. never
Africa	1	1	833	1.41 (0.24–8.43)	0.32 (0.03–3.32)	0.32 (0.04–2.71)
Asia-Pacific	3	5	13,064	1.27 (0.95–1.69)	1.25 (0.98–1.61)	0.93 (0.75–1.15)
Eastern Mediterranean	2	4	7,882	1.20 (0.83–1.73)	1.12 (0.79–1.59)	0.93 (0.67–1.28)
Indian subcontinent	1	7	16,972	2.43 (1.66–3.56)	1.41 (0.97–2.04)	1.48 (1.06–2.07)
Latin America	5	7	15,841	1.51 (1.22–1.88)	1.33 (1.09–1.61)	1.08 (0.91–1.30)
North America	2	2	3,076	1.60 (1.12–2.29)	1.88 (1.37–2.59)	1.13 (0.87–1.48)
Northern and Eastern Europe	3	3	6,592	1.12 (0.76–1.66)	1.23 (0.87–1.74)	0.98 (0.71–1.36)
Oceania	1	4	9,541	1.08 (0.83–1.41)	1.16 (0.96–1.39)	1.02 (0.87–1.21)
Western Europe	3	12	26,953	1.23 (1.00–1.52)	1.22 (1.06–1.41)	1.07 (0.93–1.22)

<sup>a</sup>Adjusted for sex, language, GNI, maternal education, maternal and paternal smoking, exercise, television watching, fast food consumption, current paracetamol use, siblings, and cooking fuel. <sup>b</sup>High, almost the whole day; medium, frequently during the day; low, seldom.

Truck traffic density



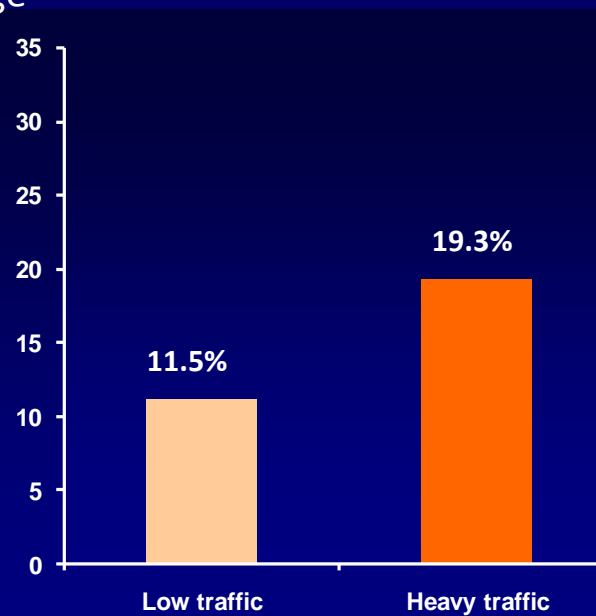
- \*Wheeze
- \*Rhinoconjunctivitis
- \*Eczema

# Traffic density around school and prevalence of Asthma amongst school children

(n = 6550; Bangalore, India)



%age



**2-fold  
increase in  
prevalence**

(Paramesh H. Indian J Paed 2002; 69(4): 309-312)



# WHICH MODE OF TRANSPORT EXPOSES YOU TO MORE AIR POLLUTANTS?

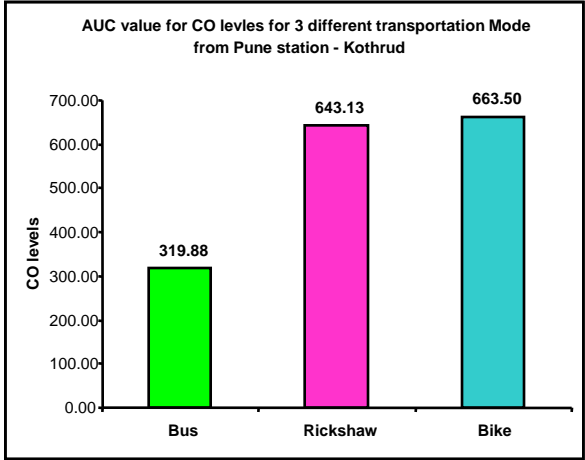
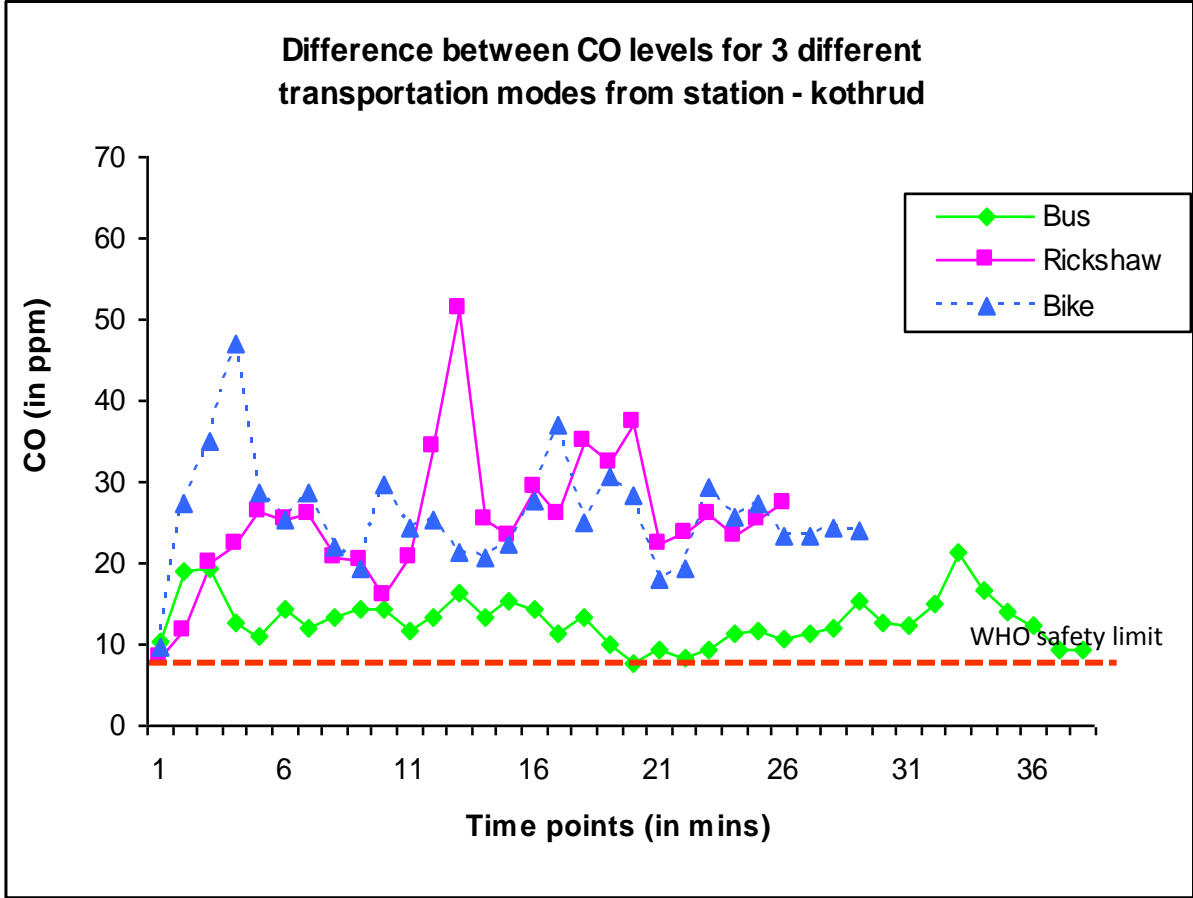


Pune Station to Kothrud  
Deccan to Hadapsar



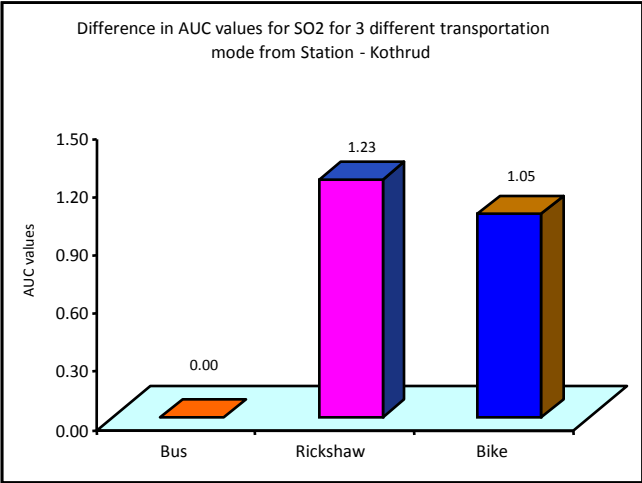
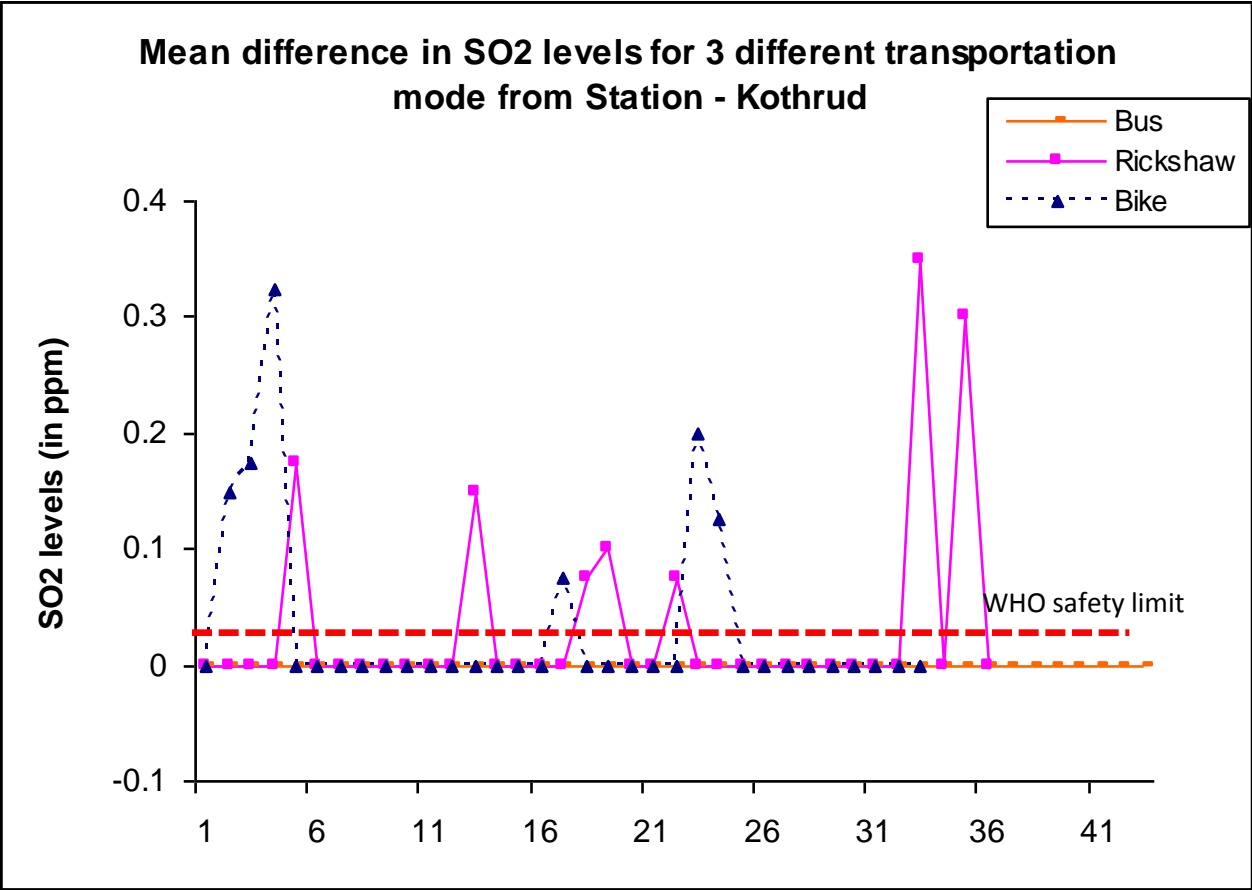
(Chest Research Foundation, 2007)

# CARBON MONOXIDE



(Chest Research Foundation, 2007)

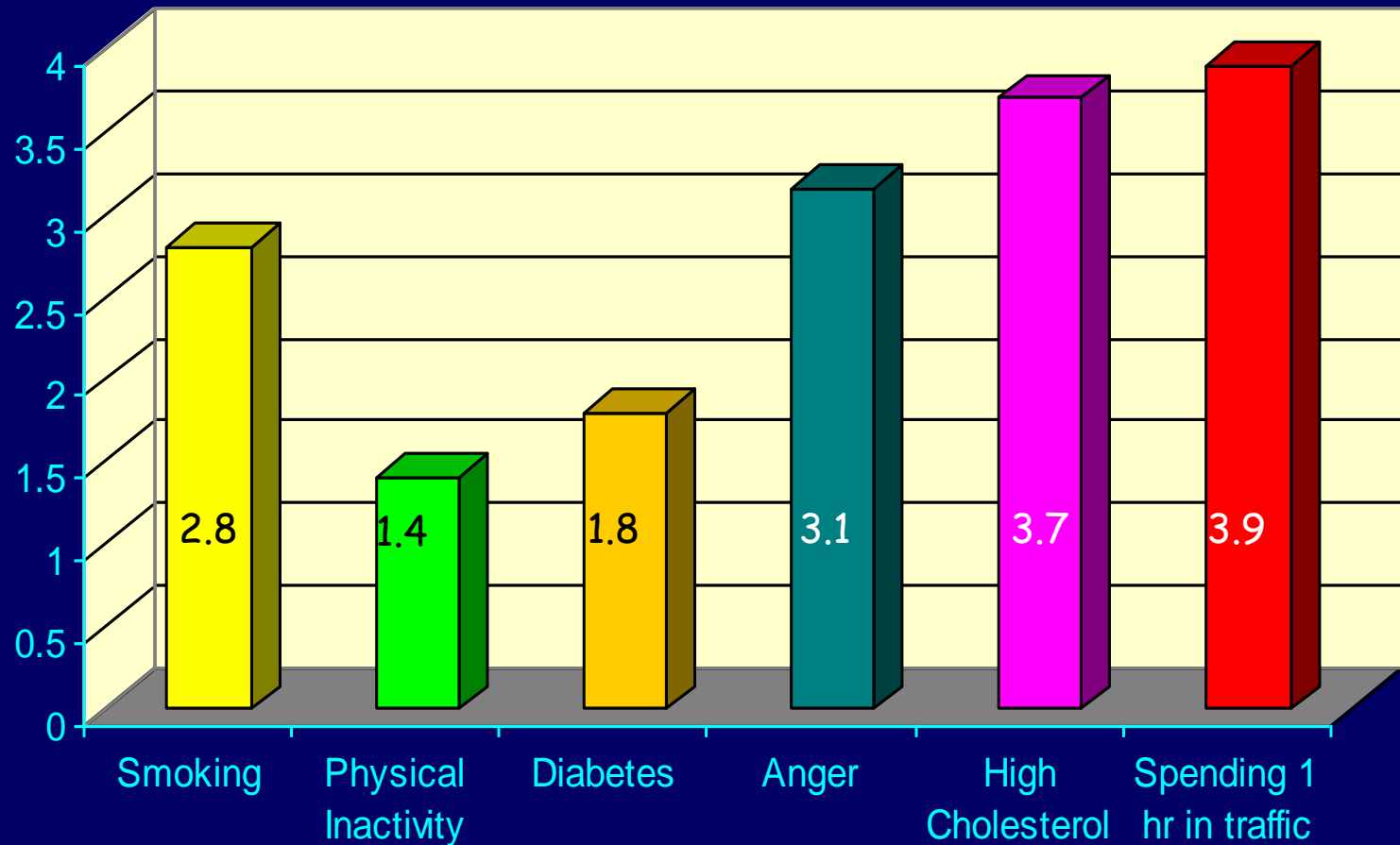
# SULPHUR DIOXIDE



(Chest Research Foundation, 2007)



# RELATIVE RISK OF SUDDEN HEART ATTACK



(Peters, New Engl J Med Oct 2004)

# IMPACT OF AIR POLLUTION IN DIABETIC PATIENTS FROM PUNE CITY

Is there any association between ambient air pollution and serum inflammatory mediators in Type II diabetic patients from Pune city?

Blood C-Reactive Proteins

Vs

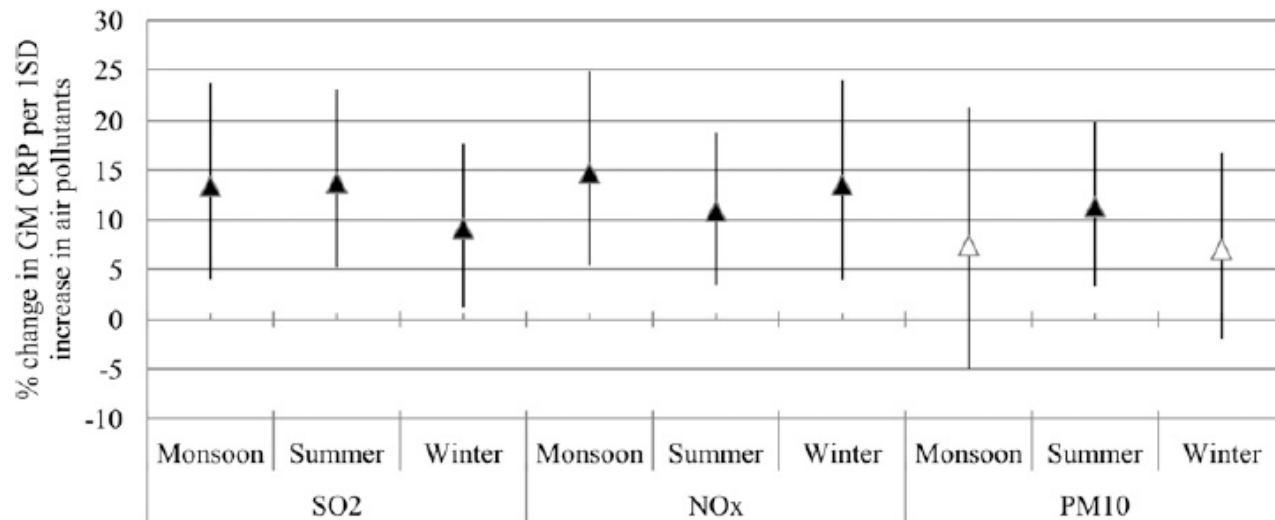
Ambient Air Pollution Levels

MPCB data

1392 Type II Diabetic patients

GPS Mapping of residence

Correlations with SOX, NOX, PM10 studied

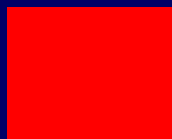


(Khafaie M et al, Diabetes Care 2013; 36: 625-630)





# CHEMISTRY OF FIREWORKS COLORS



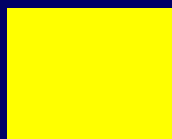
Lithium and Strontium salts



Calcium salts



Incandescence of iron (with carbon), charcoal, or lampblack



Sodium compounds



Barium compounds



Copper compounds

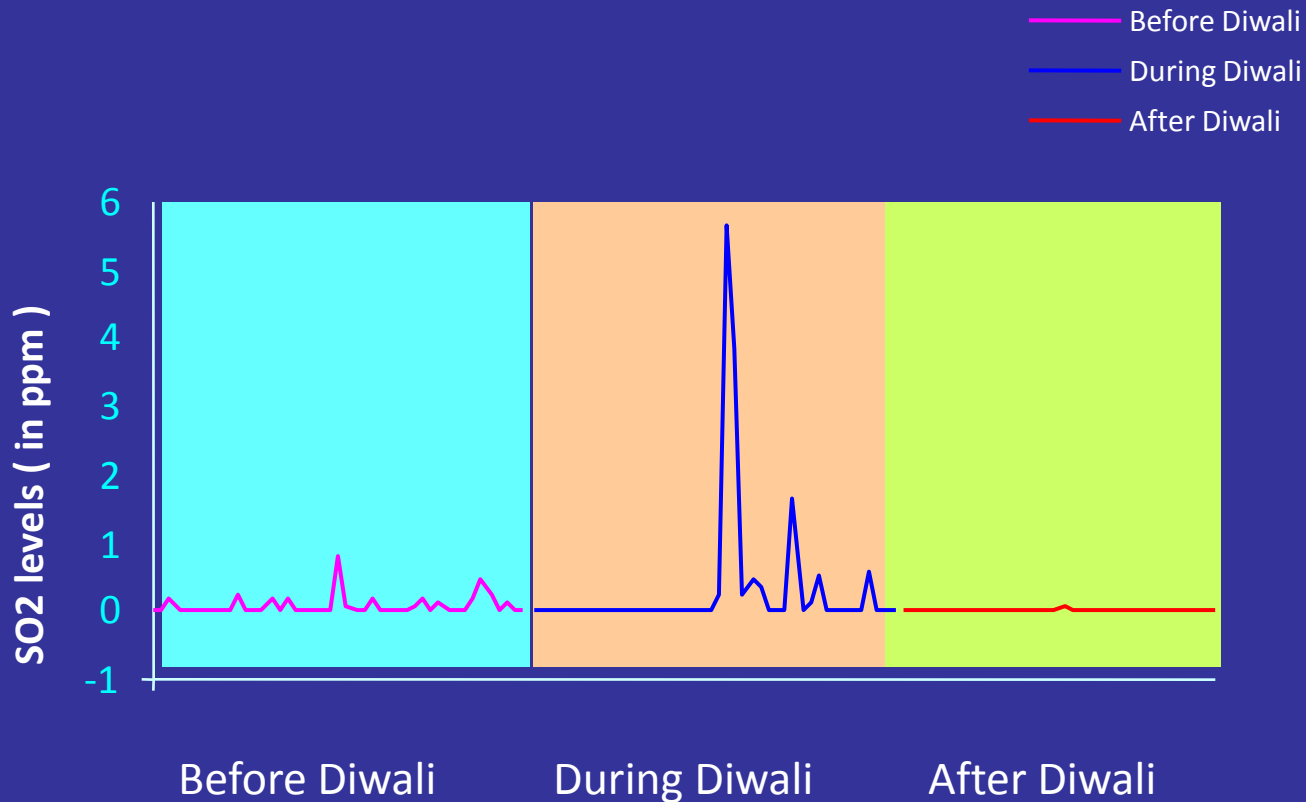


Burning aluminum, titanium, or magnesium powder or flakes

**FIREWORK  
FUEL**

**Charcoal  
Sulphur**

# MEAN CHANGES IN SO<sub>2</sub> LEVELS (ppm)



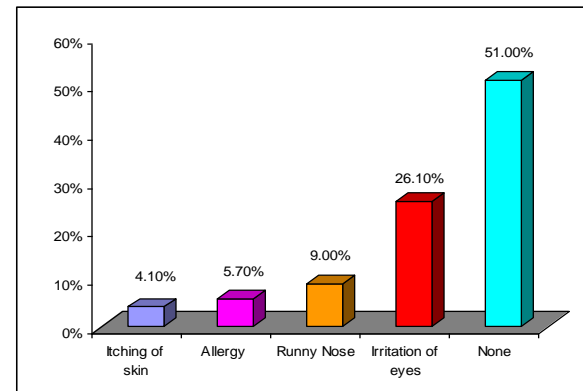
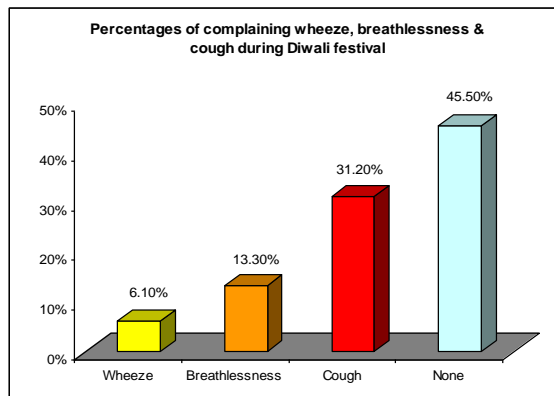
Ambient SO<sub>2</sub> levels reached values 200 times above the safety limits recommended by WHO

# PREVALENCE OF RESPIRATORY SYMPTOMS DURING THE DIWALI FESTIVAL

Symptom	Pre-existing Prevalence (%)	New symptoms Prevalence (%)	Total Prevalence (%)
<b>Cough</b>	4.2 ↑	26.3	31.2
<b>Breathlessness</b>	2.5 ↑	10.8	13.3
<b>Wheeze</b>	1.8 ↑	4.3	6.1

Irritation in Eyes	Runny Nose	Allergic Symptoms	Itchy Skin
26.1%	9%	5.7%	4.1%

n = 510





# INDOOR AIR POLLUTION AND RESPIRATORY IMPACT



**1 Mosquito coil = 100 cigarettes**

(Liu W, EHP 2003; 111: 1454-1460)



**Acute Laryngo-tracheo-bronchitis**

(Dr Sahasrabudhe T, ERS 2010)

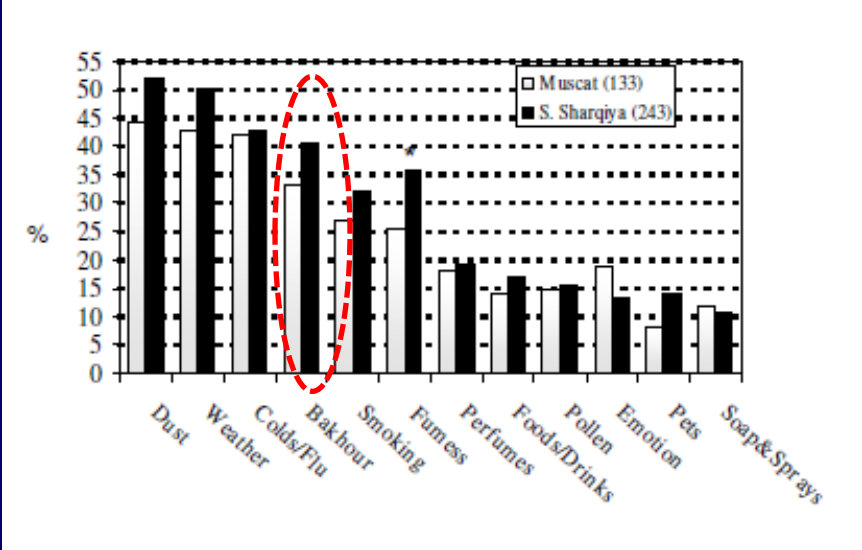
# MOSQUITO NETS



# INCENSE BURNING AND ASTHMA



Aromatic woods, herbs, flowers,  
essential oils, perfumes  
PAH, Benzene, CO, Isoprene



Oman, Muscat  
2441 children 10 yrs

40% of asthmatic children reported worsening of symptoms due to incense burning



(Al-Rawas et al, BMC Pulm Med 2009; 9: 23)  
(Wang JJ et al, Eur Respir J 2011; 37(6): 1371-1377)



# OBSTRUCTIVE AIRWAYS DISEASE IN PUJARIS



50 Pujaris in Pune

**Spirometry:**

25% showed presence of  
Obstructive Airways Disease

# The Telegraph

**MESSI MATCH**



**BIG DAY TODAY**  
BHAICHUNG BHUTIA WRITES PLUS SPECIAL PACKAGE  
IN SPORTS

IN PRICE CALCUTTA FROM 2 SEPTEMBER 2011 INR 120 2011 www.telegraphindia.com

The Telegraph  
2nd Sept. 2011

**IN BRIEF**



**From 110 to 120**  
The price of the newspaper has increased from 110 to 120 rupees per copy from September 2nd onwards.

**Food inflation in double digits**  
The inflation rate for food has crossed the 10% mark for the first time in over a year.

**Manila legend dies**  
A prominent figure in the Philippines has passed away at the age of 85.

**Protest at Sets**  
A group of people has gathered to protest against a new policy.

**Tobacco tax offers smuggler incentive**  
The government's new tax on tobacco is seen as a reward for smugglers.

**Sen quits before LS trial**  
A senior official has resigned before facing a trial in the lower house.

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## Cross-continental survey raises deeper air pollution fears than suspected World's worst lungs are in India

**INDIA**

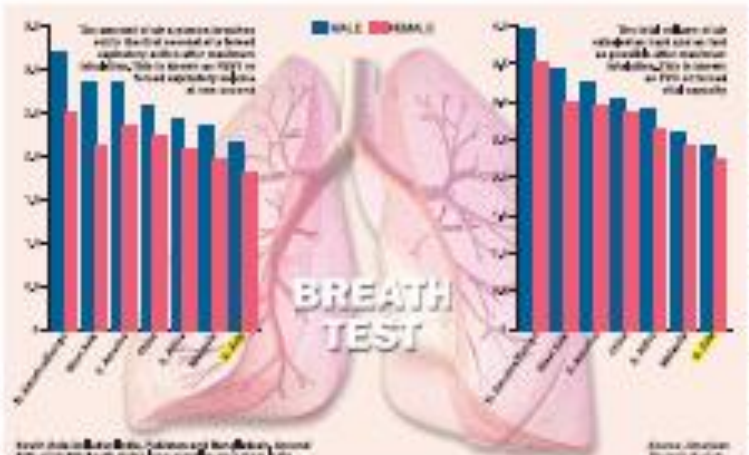
New Delhi, Sept 2 (Reuters) — A cross-continental survey of lung capacity among 11 populations around the world has revealed that the lungs of people in India are 30% weaker than those in Europe and America.

An international study that measured the lung capacity of people from 11 countries has found that the average lung capacity of people in India is 30% lower than that of people in Europe and America.

This evidence is long known to mean that people in India have a higher risk of respiratory disease, and it is now being confirmed by a study of lung capacity in 11 countries.

The study, led by Dr. Anoop Singh, a professor at the All India Institute of Medical Sciences, New Delhi, and a member of the study team.

The study found that the average lung capacity of people in India is 30% lower than that of people in Europe and America.



Men in India have the lowest lung capacity in the world, 30% lower than those in Europe and America.

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**Indian Lungs are 30% weaker than European/American Lungs**

**Tobacco tax offers smuggler incentive**  
The government's new tax on tobacco is seen as a reward for smugglers.

**THE GOLDEN CHANCE**

Advertisement for a financial product or service, featuring a large number '1' and various promotional text.

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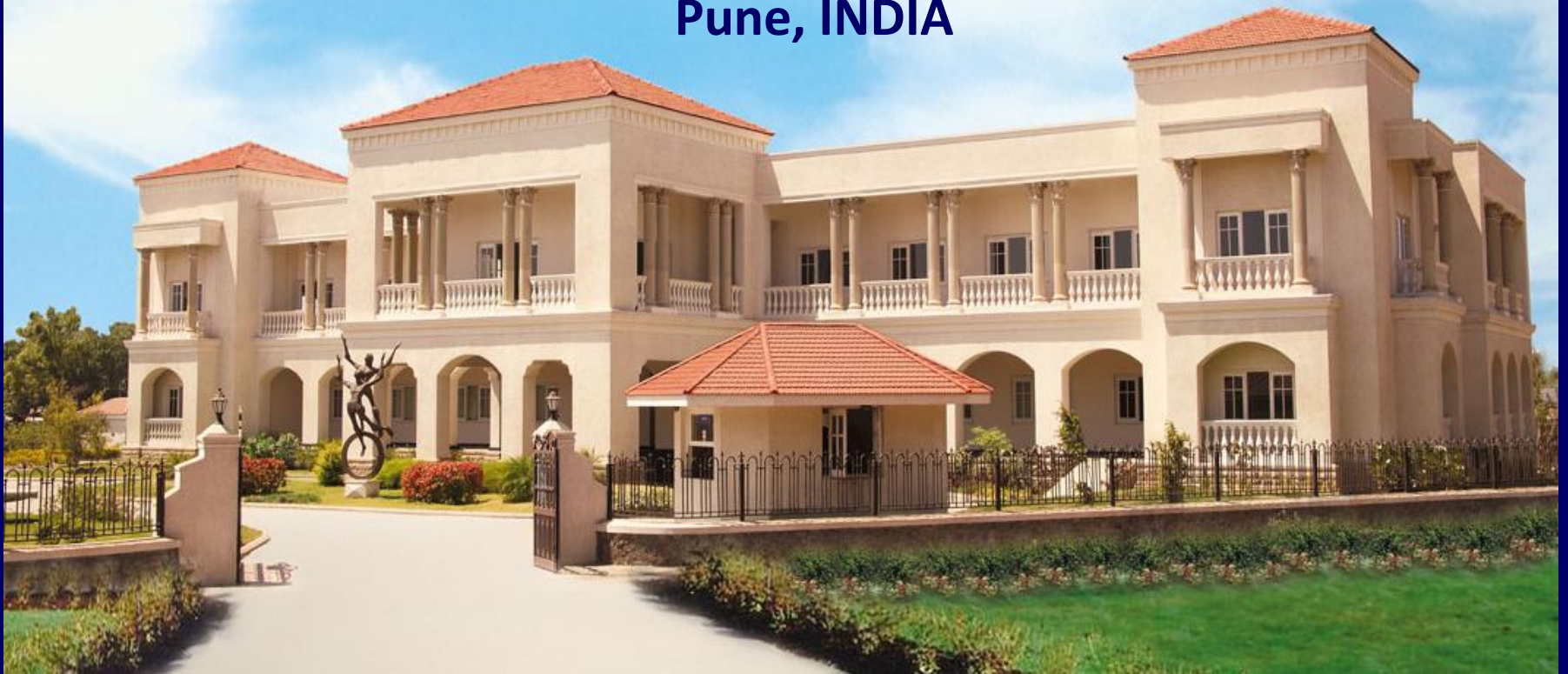
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