IMPACT OF AIR POLLUTION ON LUNG DISEASE IN THE SOUTH ASIAN SUBCONTINENT

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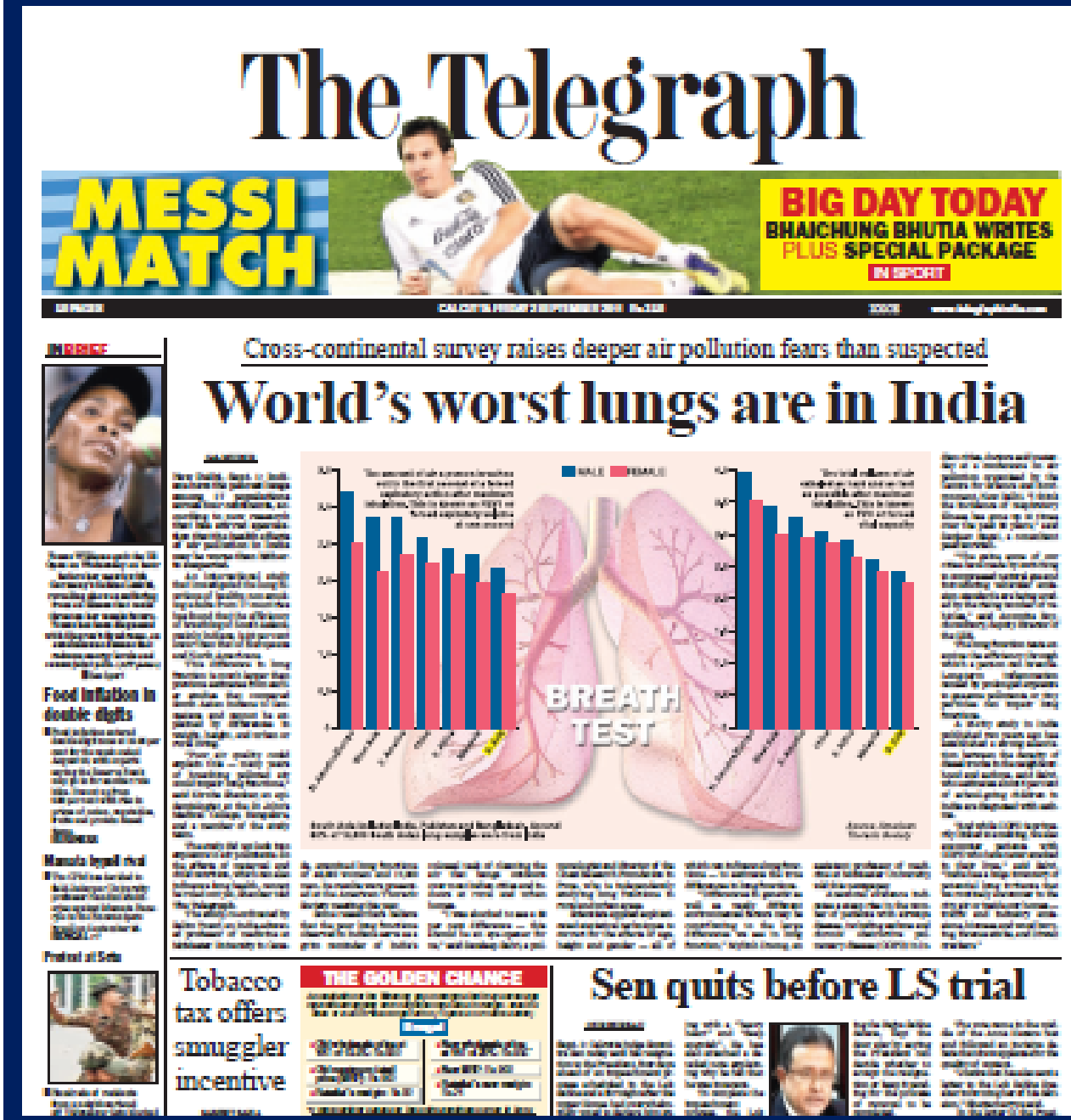


The Telegraph

MESSI MATCH

BIG DAY TODAY
BHAICHUNG BHUTIA WRITES
PLUS SPECIAL PACKAGE
IN SPORT

Cross-continental survey raises deeper air pollution fears than suspected

World's worst lungs are in India

BREATH TEST

Food inflation in double digits

Tobacco tax offers smuggler incentive

THE GOLDEN CHANCE

Sen quits before LS trial

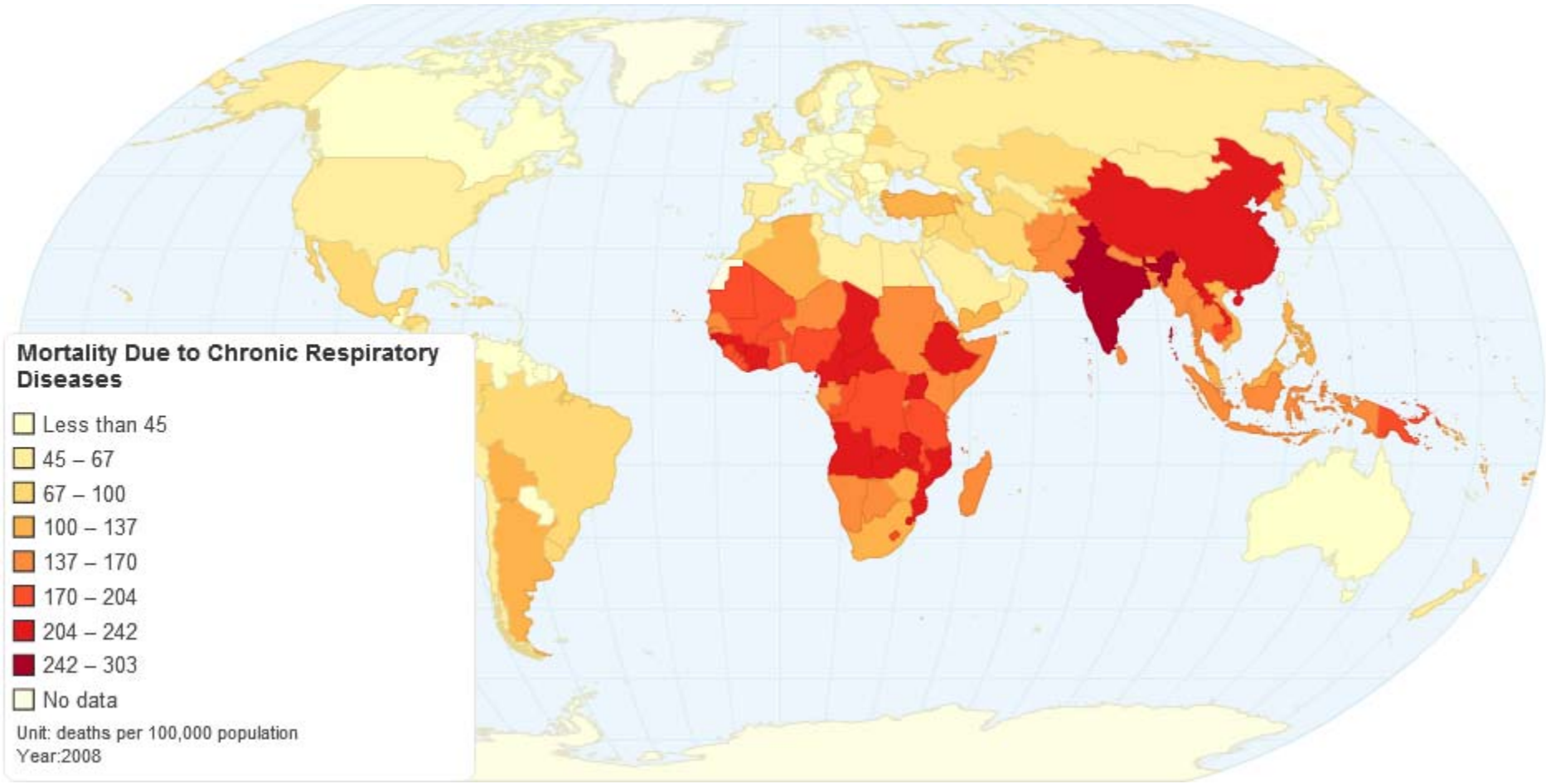
The Telegraph
2nd Sept. 2011

FVC and FEV1 values are 30% lower than the Europeans/North Americans

- **Ethnic factors**
- **Nutritional factors**
- **Quality of air we breathe**

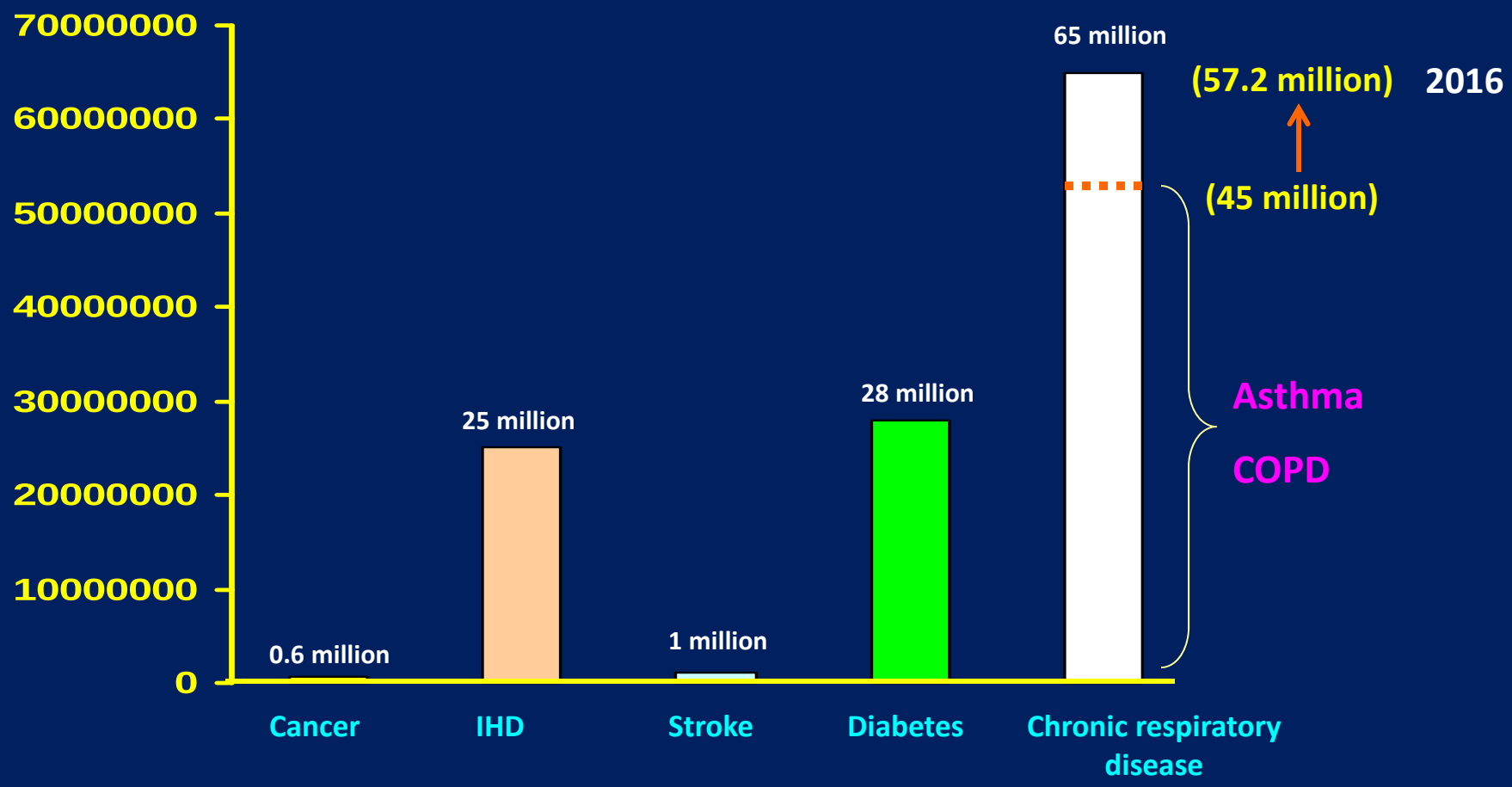
(ATS Abstract, May 2011)

GLOBAL MORTALITY DUE TO CHRONIC RESPIRATORY DISEASES



Mortality due to Chronic respiratory diseases, Global Health Observatory Data Repository, World Heath Organisation (WHO), viewed 4th November, 2011

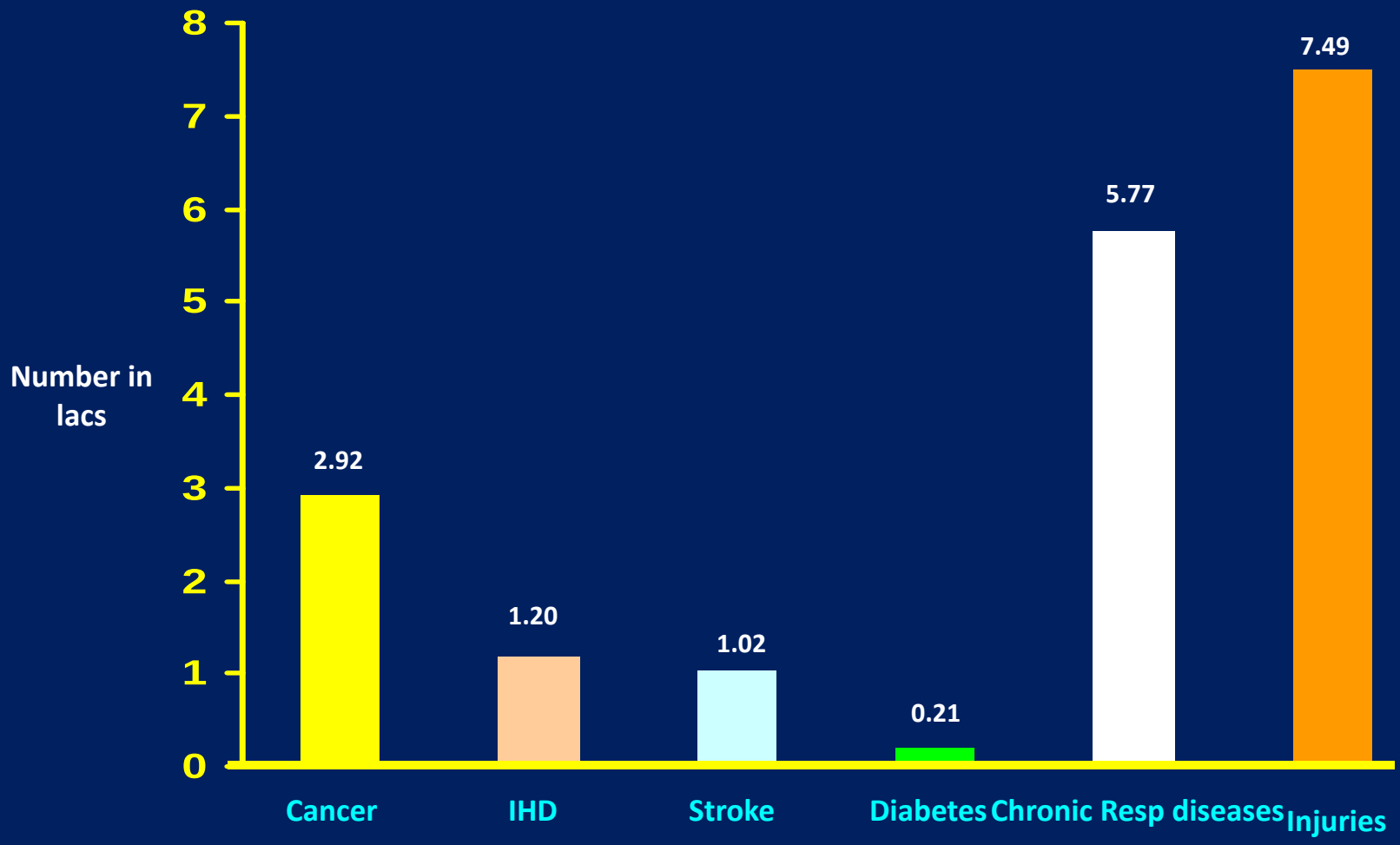
ESTIMATED MORBIDITY FOR NON COMMUNICABLE DISEASES IN INDIA



(Nongkynrih B et al, JAPI 2004 Feb; 52: 118-123

Murthy, NCMH Background Papers, GOI, 2005)

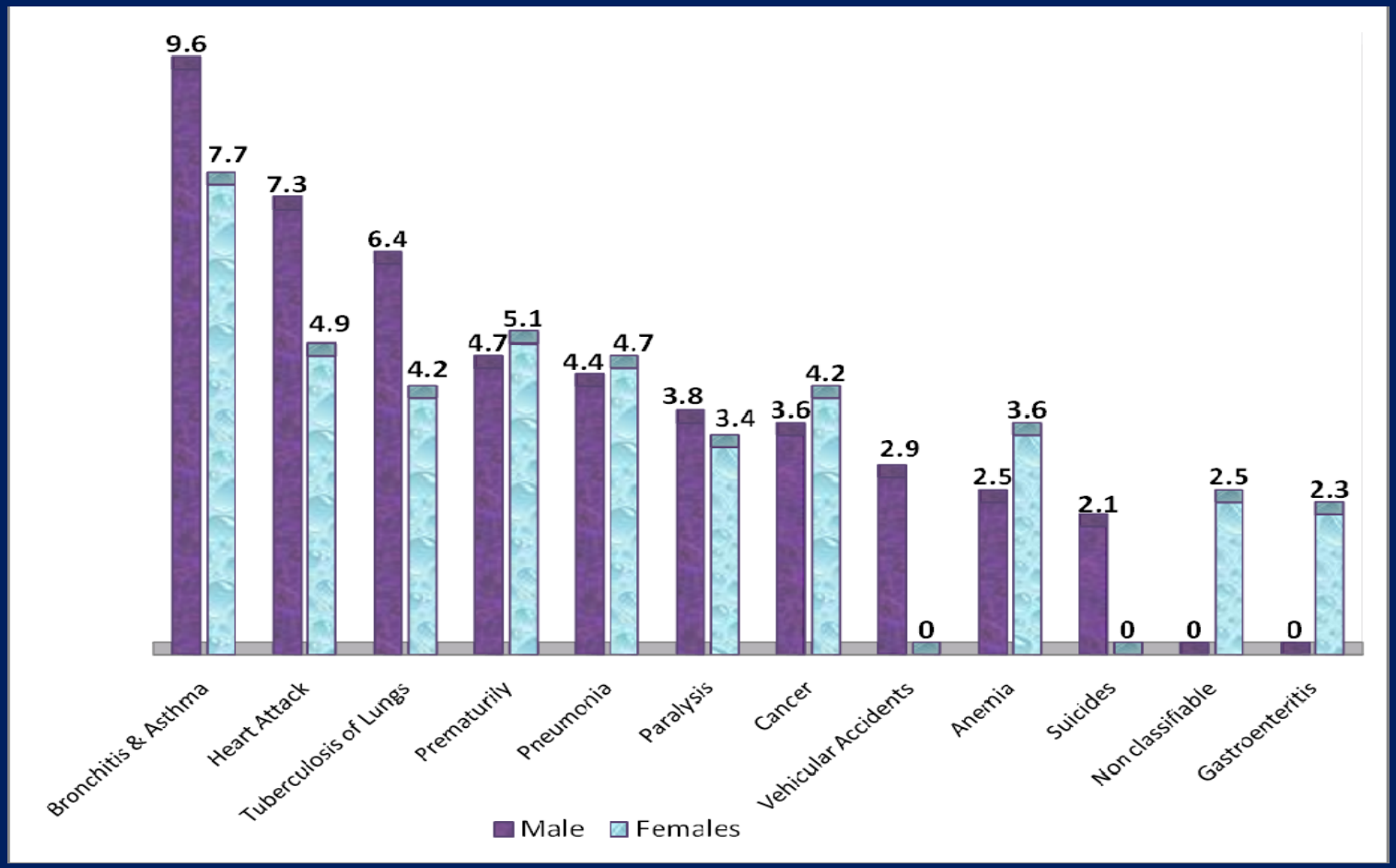
ESTIMATED MORTALITY FOR NON COMMUNICABLE DISEASES IN INDIA



(Nongkynrih B et al, JAPI 2004 Feb; 52: 118-123)

WHO, 2002 data

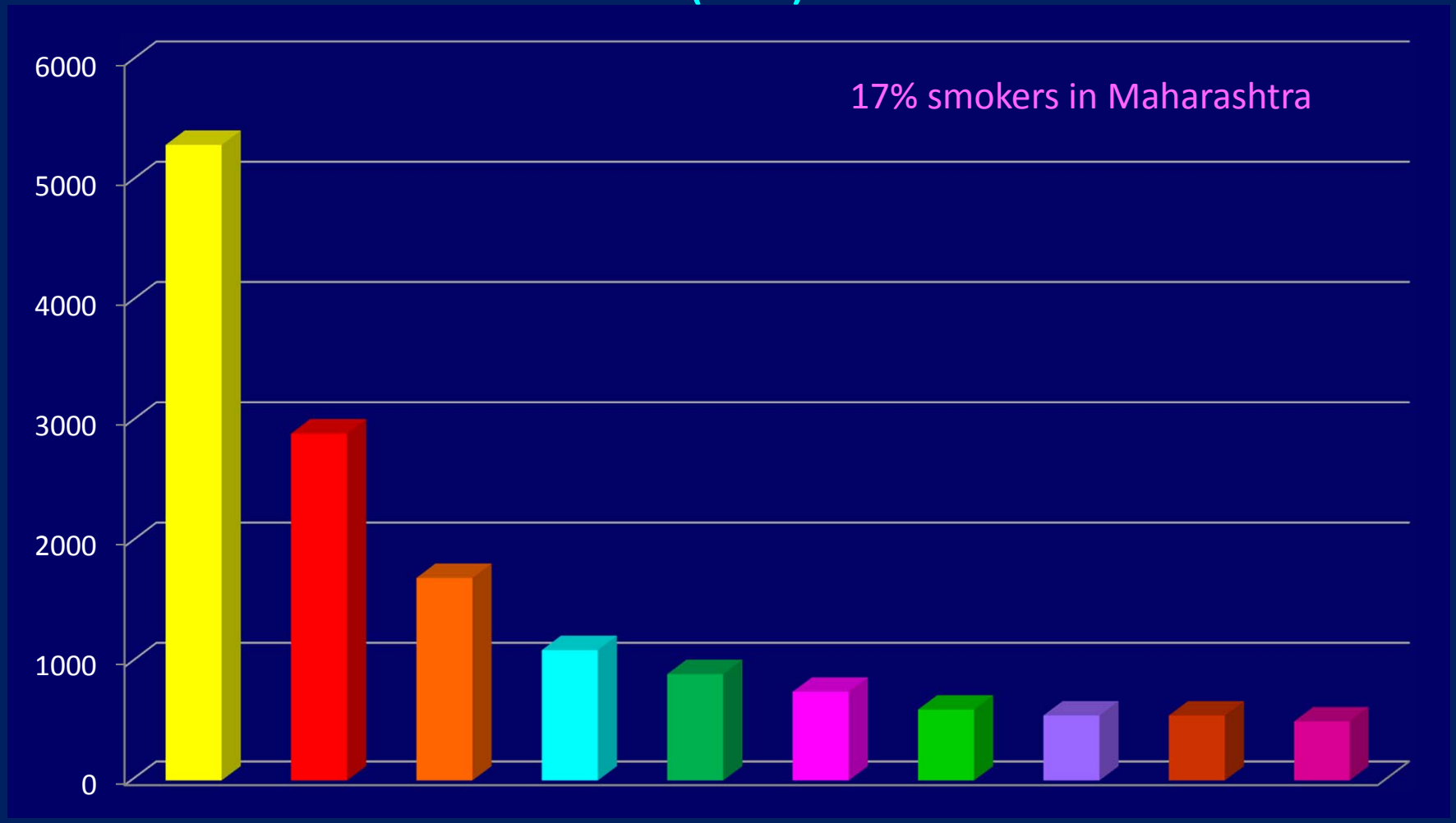
LEADING CAUSES OF MORTALITY IN RURAL INDIA - 1994



(Ramanakumar et al, The Internet J Epidemiol 2005: 2(2): DOI: 10.5580/3ed

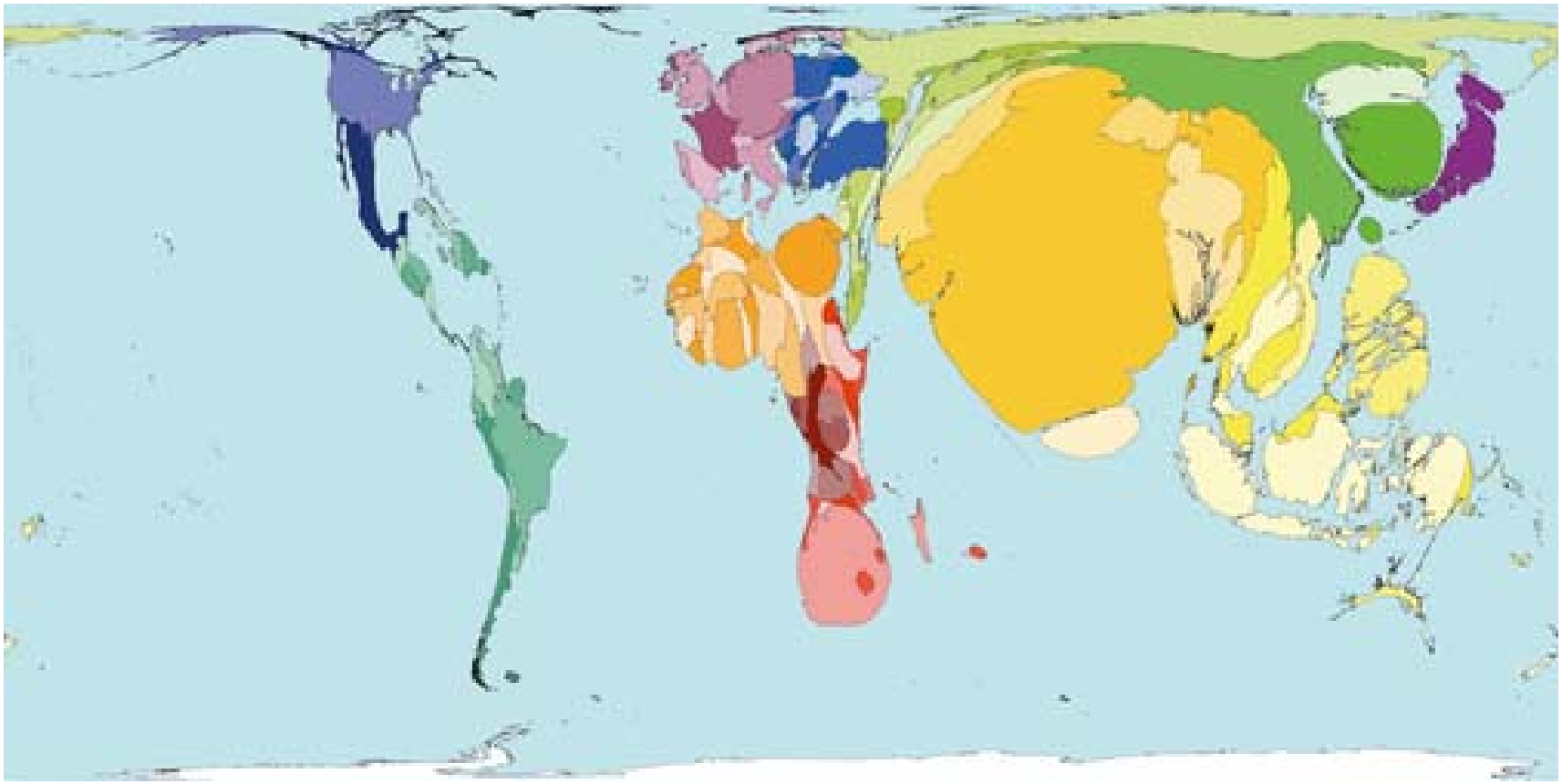
TOP 10 CAUSES OF DEATH IN MAHARASHTRA, INDIA

(2008)



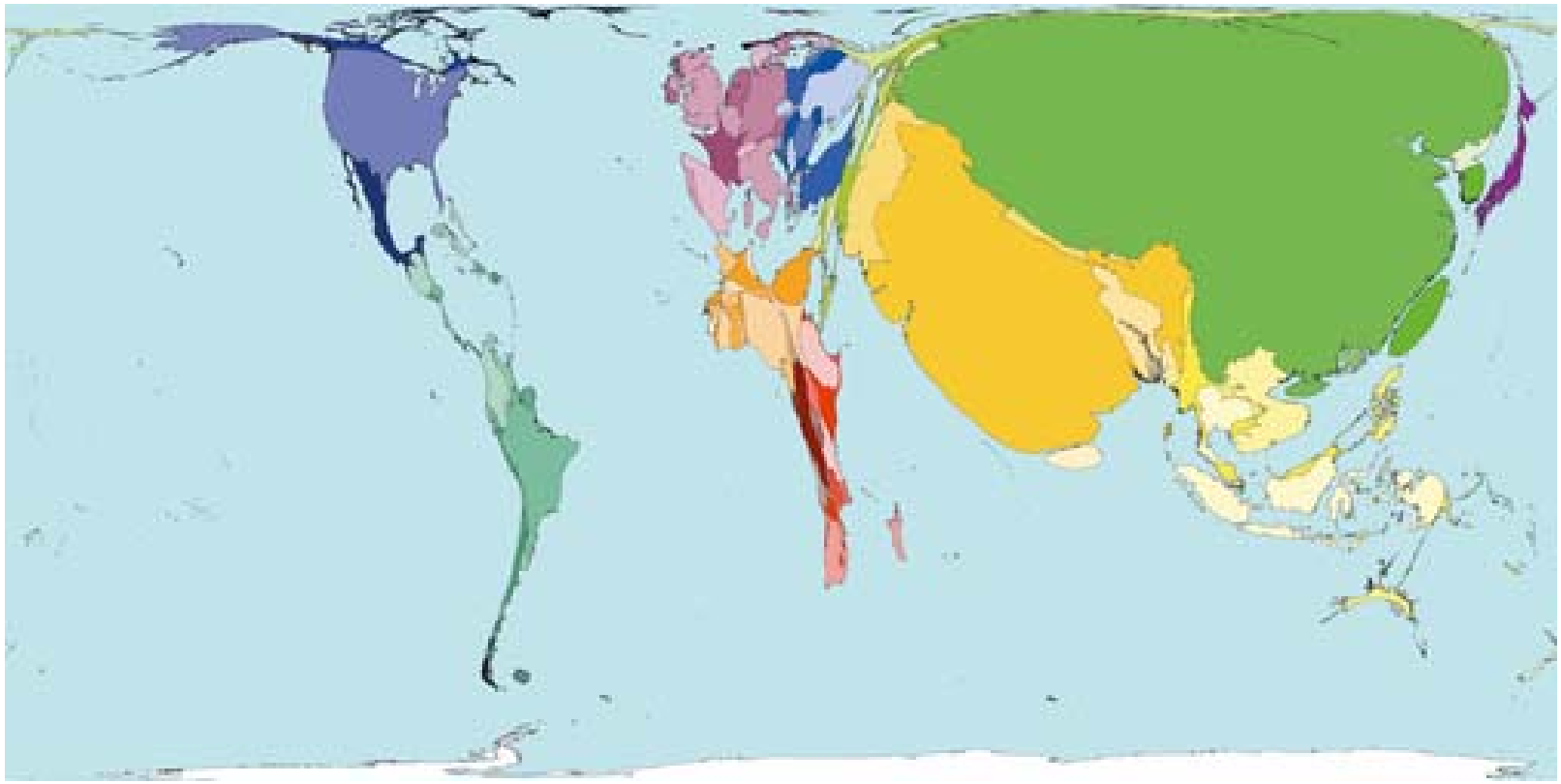
(Health Status Maharashtra 2009: State Health Systems Resource Centre; 2010, Pg 20-21.)

GLOBAL ASTHMA MORTALITY



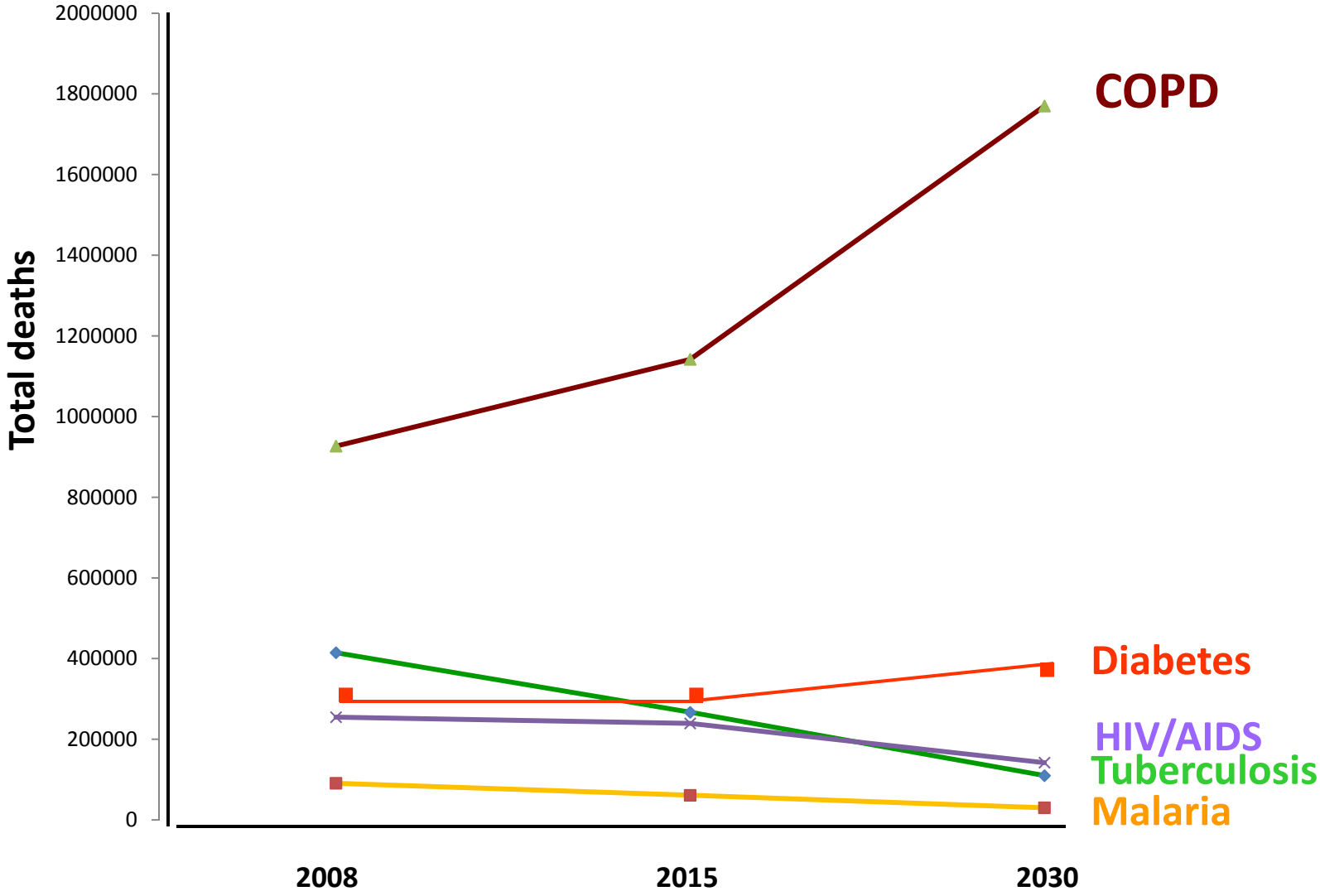
(http://www.worldmapper.org/display_extra.php?selected=459)

GLOBAL COPD MORTALITY



(http://www.worldmapper.org/display_extra.php?selected=458)

CAUSES OF DEATHS IN SOUTH-EAST ASIAN REGION



From: The Global Burden of Disease, WHO 2008

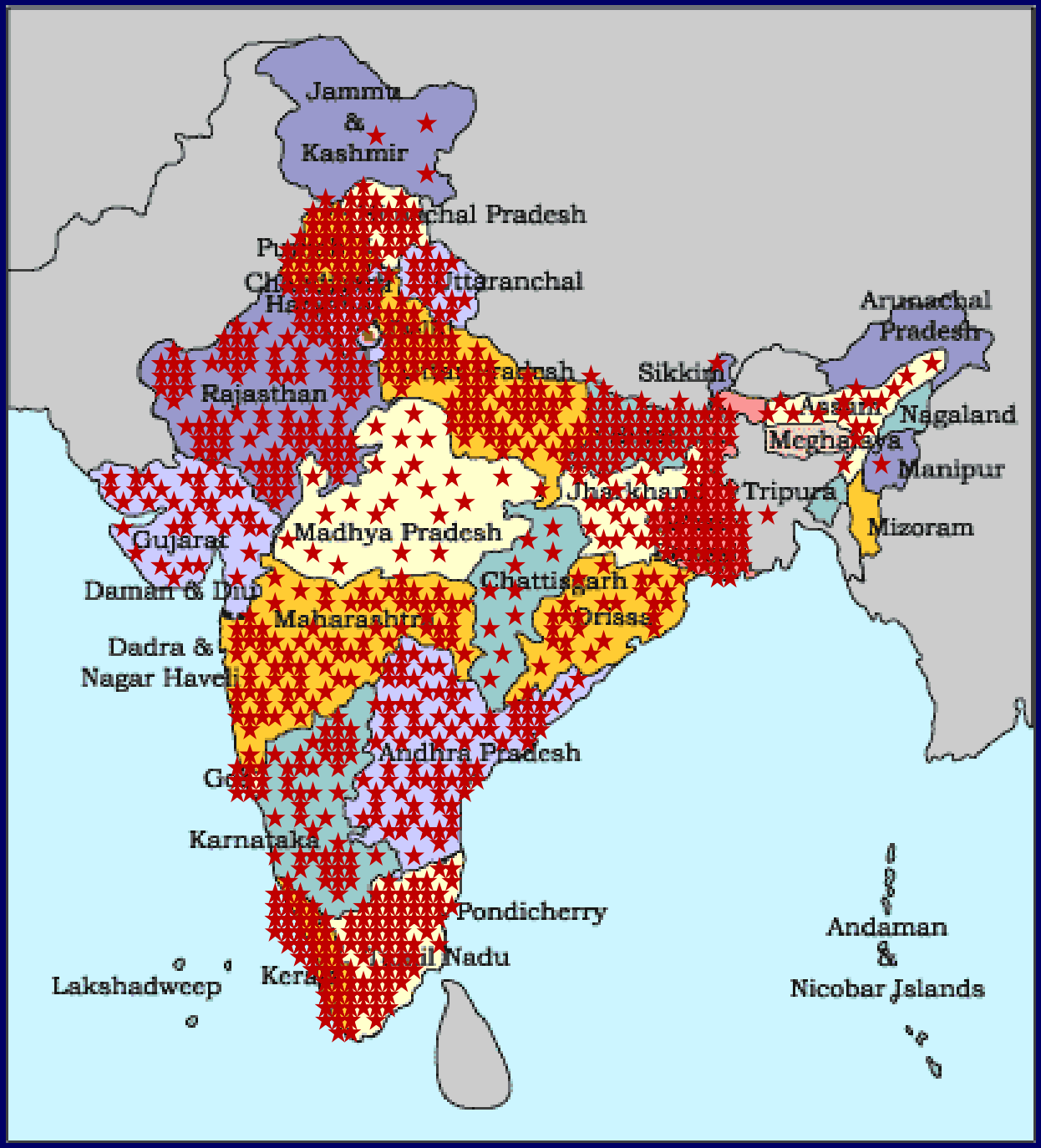
WHAT AILS INDIA?

13,225 doctors across India
- General Physicians
- General Practitioners
- Pediatricians

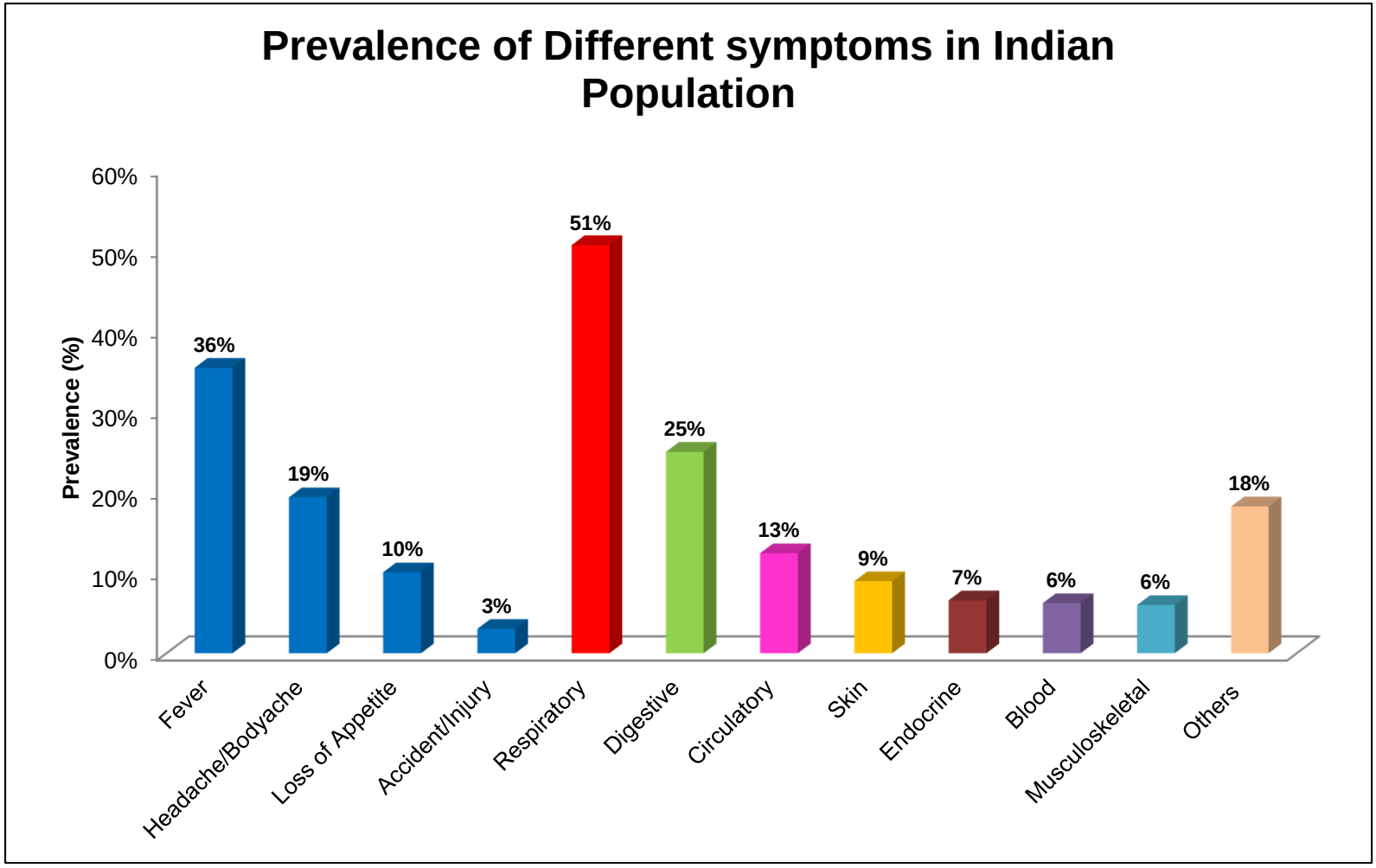
888 cities and towns across India

1st February 2011

2,04, 912 patients



MOST COMMON SYMPTOMS FOR WHICH A PATIENT VISITS A DOCTOR (NON-SPECIALIST) IN INDIA



Pune city

>20,000 children

2003 – 2.9%

2008 – 5.4%

THE TIMES OF INDIA

INCLUSIVE OF PUNE TIMES

'Child asthma cases have doubled in 5 yrs'

TIMES NEWS NETWORK

Pune: The number of children suffering from asthma in the city has almost doubled in the last five years, a study carried out by the Chest Research Foundation (CRF) here has revealed.

The study, revealed on the eve of World Asthma Day, was conducted in 17 randomly selected schools across the city on 3,909 children. Interestingly, asthma was found to be more prevalent amongst students in private schools (5.9 per cent) compared to their counterparts in municipal schools (4.7 per cent).

"The first study, completed in 2003, had shown that asthma prevailed amongst 2.9 per cent of schoolchildren in Pune. The study was repeated in 2008-2009 using the same tools and methods on the same population. We have found that childhood asthma is now prevalent amongst 5.4 per cent, a jump of over 80 per cent," said chest physician Sundeep Salvi, who is the director of CRF.

► Continued on Page 4

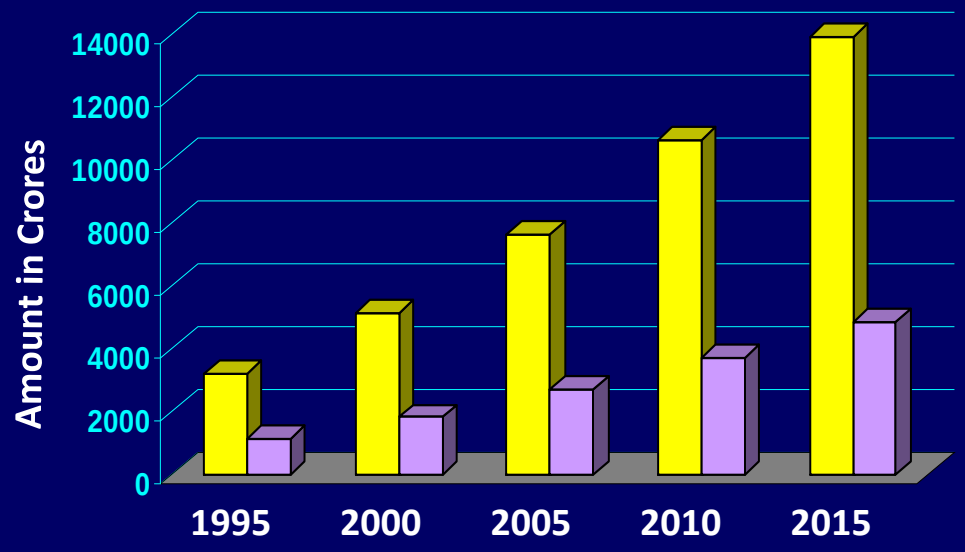
Risk factors

- Children born through Caesarean section
- Those born in homes that use biomass fuel for cooking
- Motor vehicle pollution
- Children who receive mixed feeds during the first six months
- Children with family history of asthma

(Times of India, 5th May 2009)

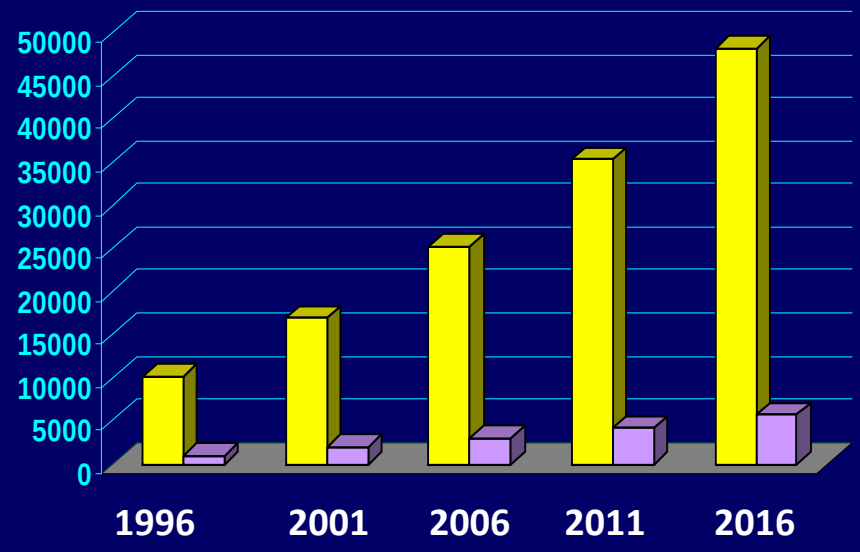
ECONOMIC BURDEN OF ASTHMA AND COPD IN INDIA (Estimated figures for 2010)

US $ 2.5 billion



ASTHMA

US $ 7.5 billion



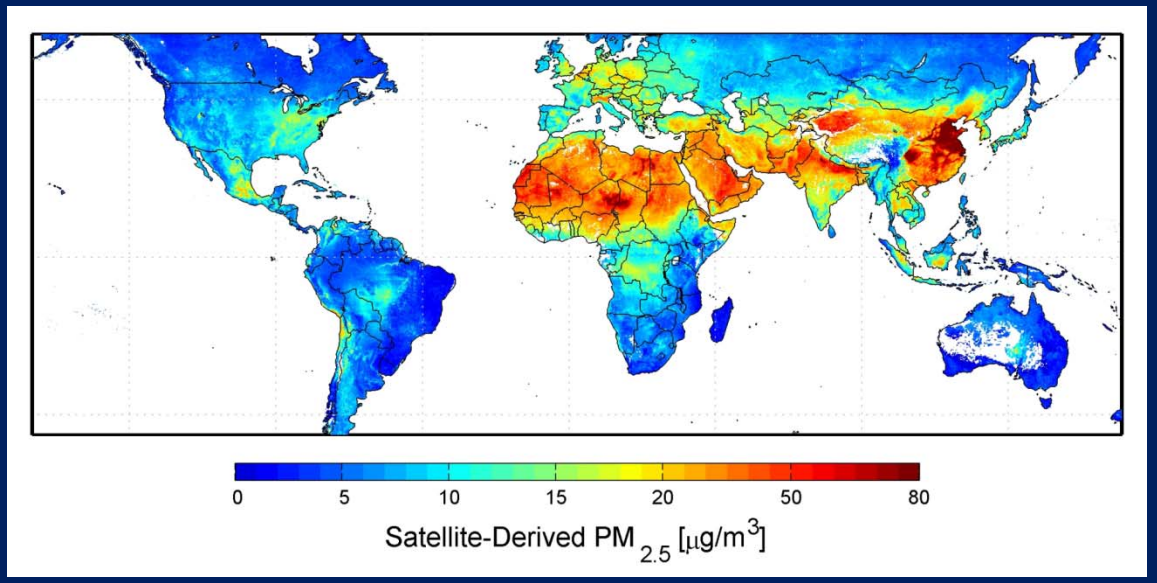
COPD

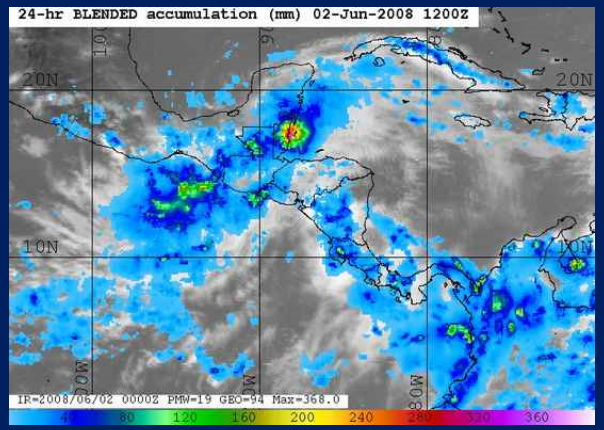
Current

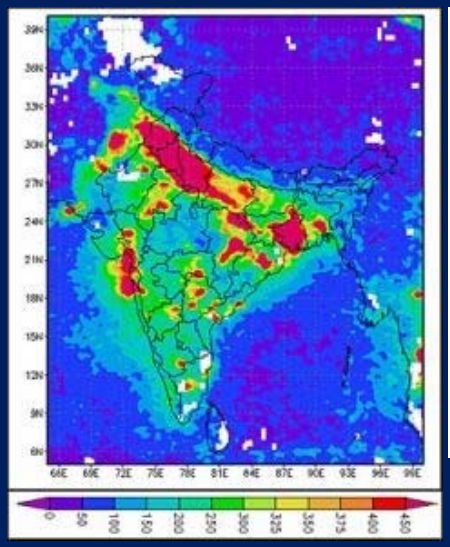
If we follow guidelines

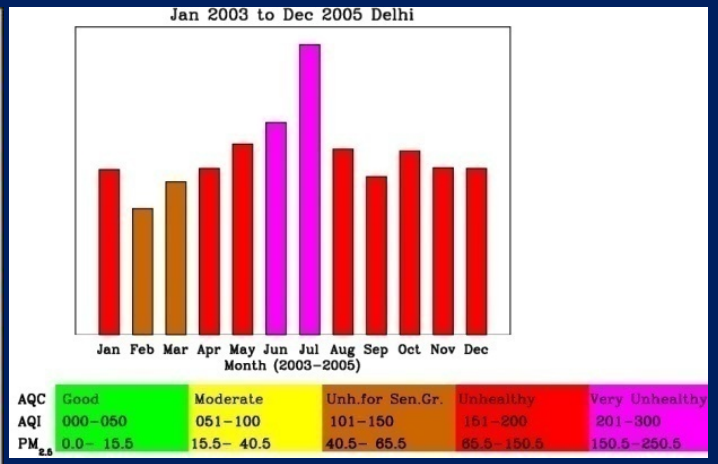
(Murthy KJR et al, NCMH Background Papers, 2005)

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?

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

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

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)

TRUCK TRAFFIC DENSITY AND CHILDHOOD ASTHMA

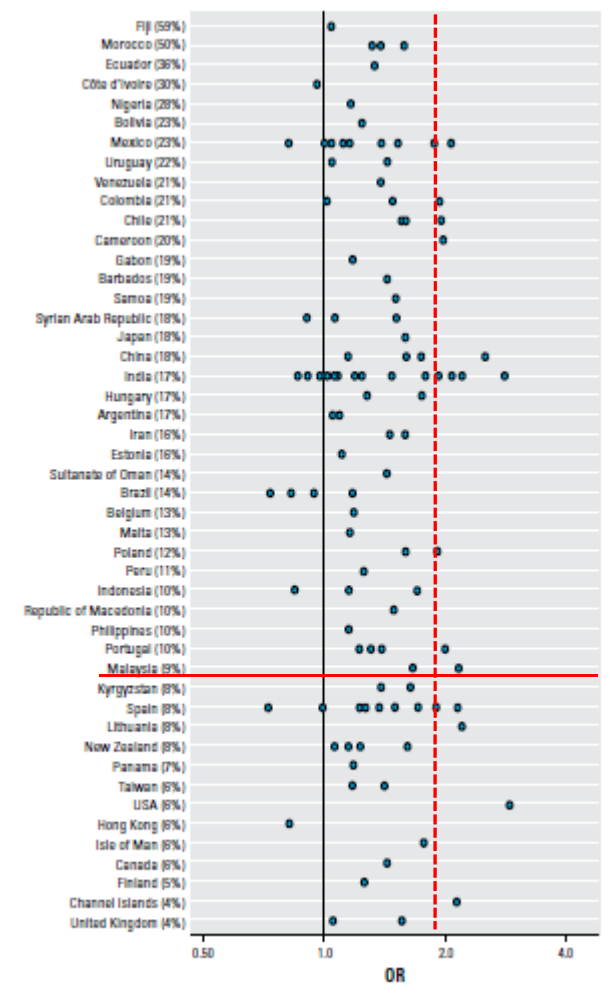


Figure 4. ORs of wheeze in 13- to 14-year-olds for "almost the whole day" truck traffic versus "never," by center and country. Percentages shown are for "almost the whole day."

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

Table 6. Adjusted[a] 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.

	No.			OR (95% confidence interval)[b]		
Region	Country	Center	Total	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	15,641	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)

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

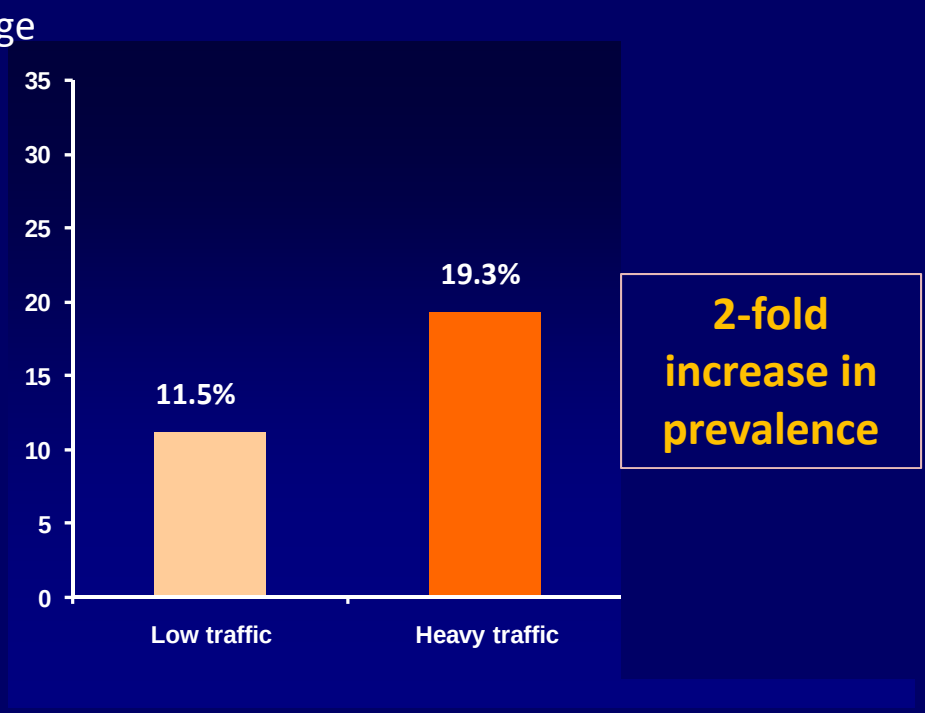
Truck traffic density $\propto$ ***Wheeze**
***Rhinoconjunctivitis**
***Eczema**

Living in homes close to busy roads (<50m) is significantly associated with increased asthma risk in children

(Brunekreef B et al, Environ Health Perspect 2009; 117: 1791-1798)

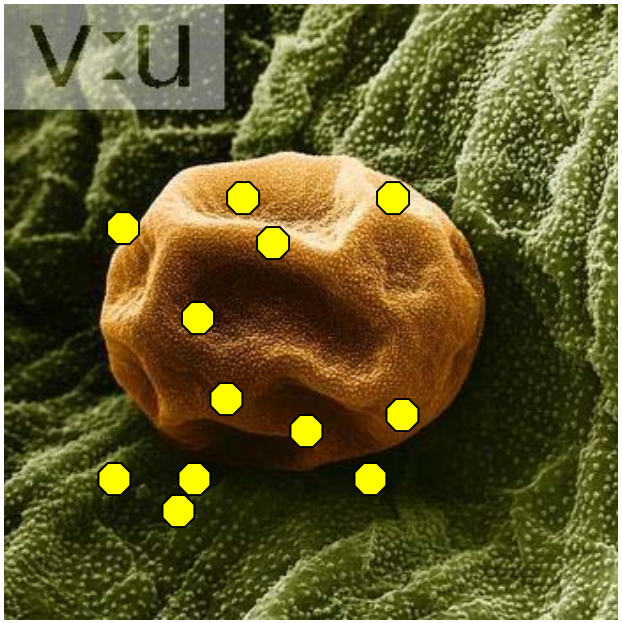
Traffic density around school and prevalence of Asthma amongst school children

(n = 6550; Bangalore, India)



2-fold increase in prevalence

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



Diesel exhaust particles increase allergenicity by up to 50-fold

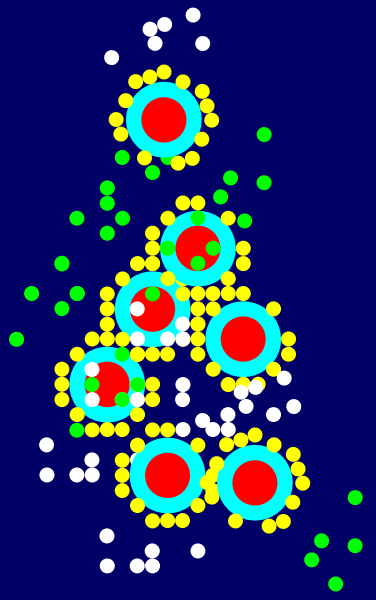
Pollen become more allergenic when these trees grow in an urban environment

(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)

Diesel exhaust particles



Carbon core
Adsorbed hydrocarbons
Soluble organic fraction
Sulphates
Vapour phase hydrocarbons

Cadmium
Arsenic

→ DNA methylation

↓

? Increase in allergic diseases that may last for several generations

EPIGENETICS

(Baccarelli A et al., Am J Respir Crit Care Med 2009; 179: 572-578)

WHICH MODE OF TRANSPORT EXPOSES YOU TO MORE AIR POLLUTANTS?

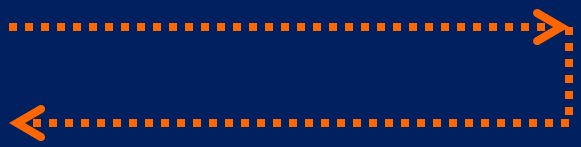
Autorickshaw

Bus

Motor cycle

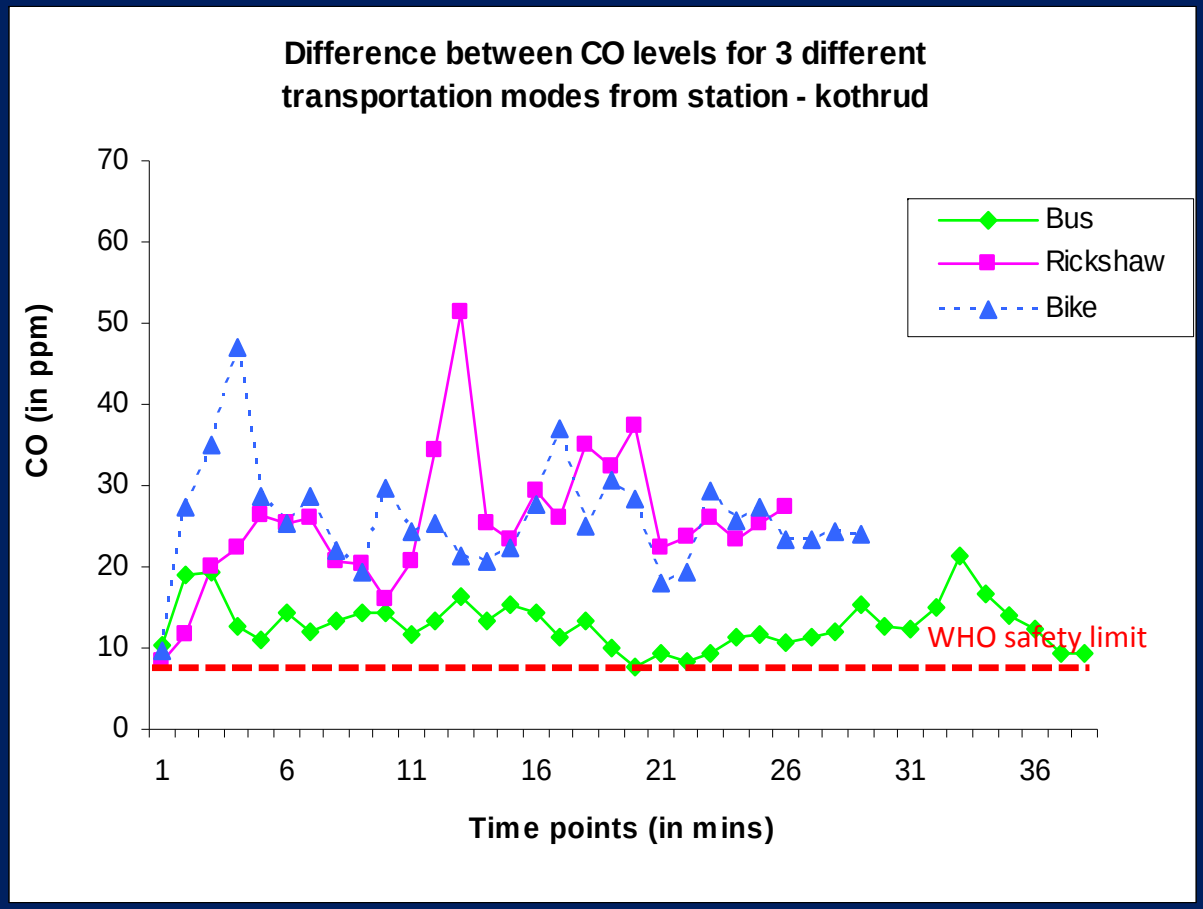
Station to Kothrud

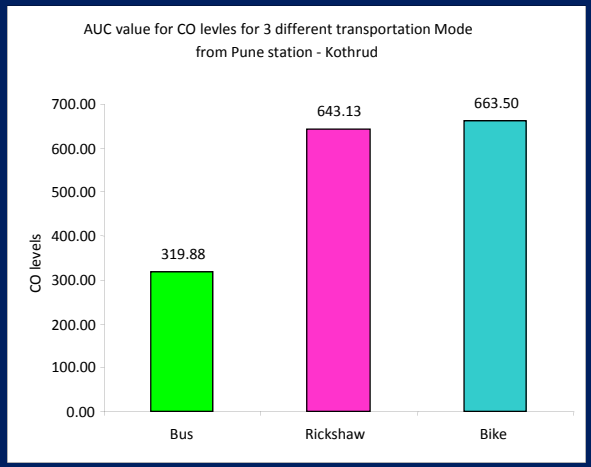
Deccan to Hadapsar



(Chest Research Foundation, 2007)

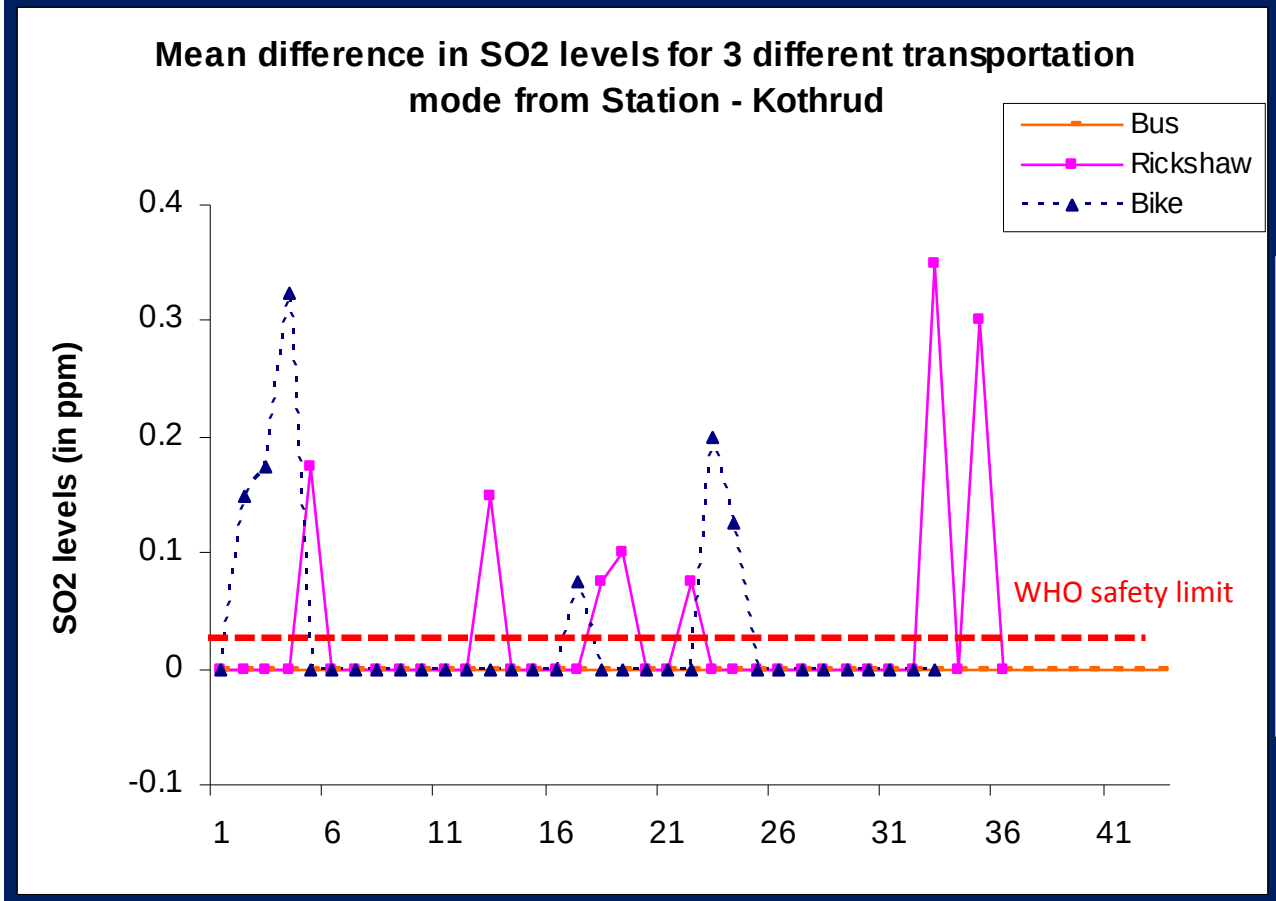
CARBON MONOXIDE

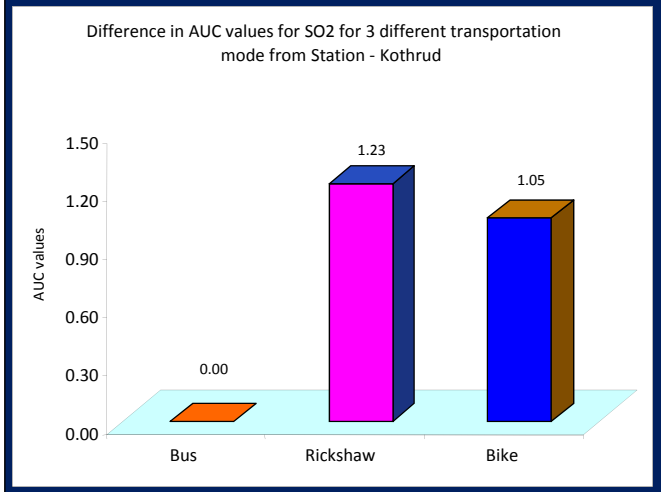




(Chest Research Foundation, 2007)

SULPHUR DIOXIDE

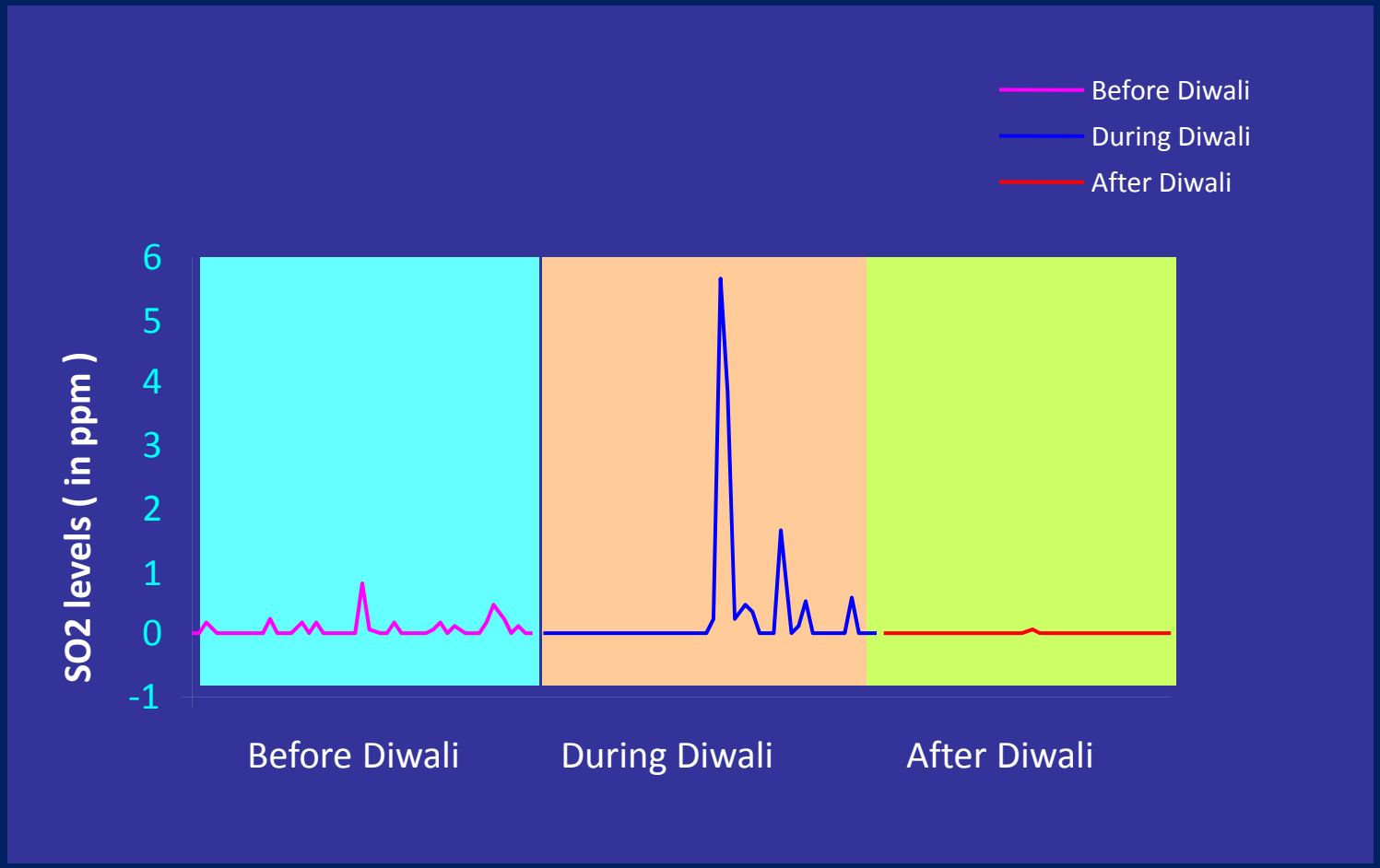




(Chest Research Foundation, 2007)


Indicom

MEAN CHANGES IN SO2 LEVELS (ppm)



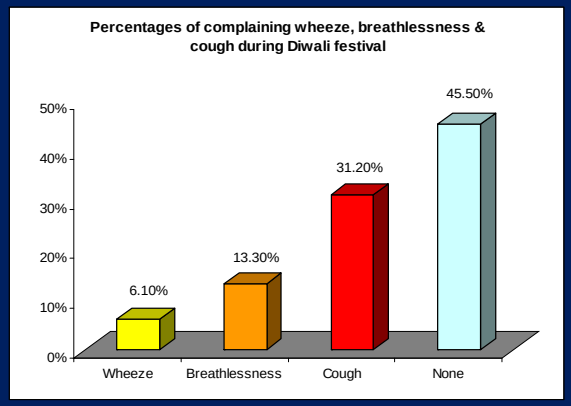
Ambient SO2 levels reached values **200 times** above the safety limits recommended by WHO

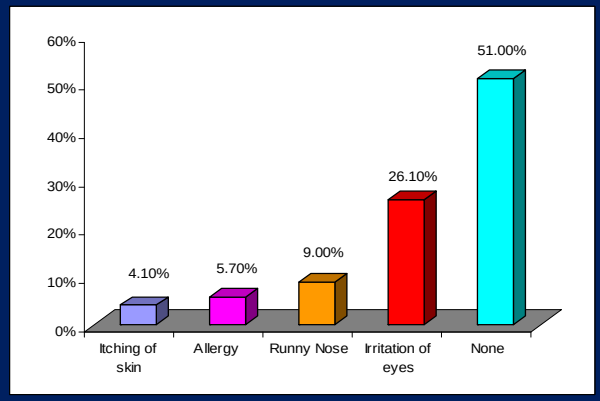
PREVALENCE OF RESPIRATORY SYMPTOMS DURING THE DIWALI FESTIVAL

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

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

n = 510





(Chest Research Foundation, India, 2008)

PREVALENCE OF COPD AMONGST URBAN SLUM DWELLERS OF PUNE CITY, INDIA

(n = 12,050; Questionnaire)

Prevalence of COPD: 7.2%

56% of COPDs were never smokers

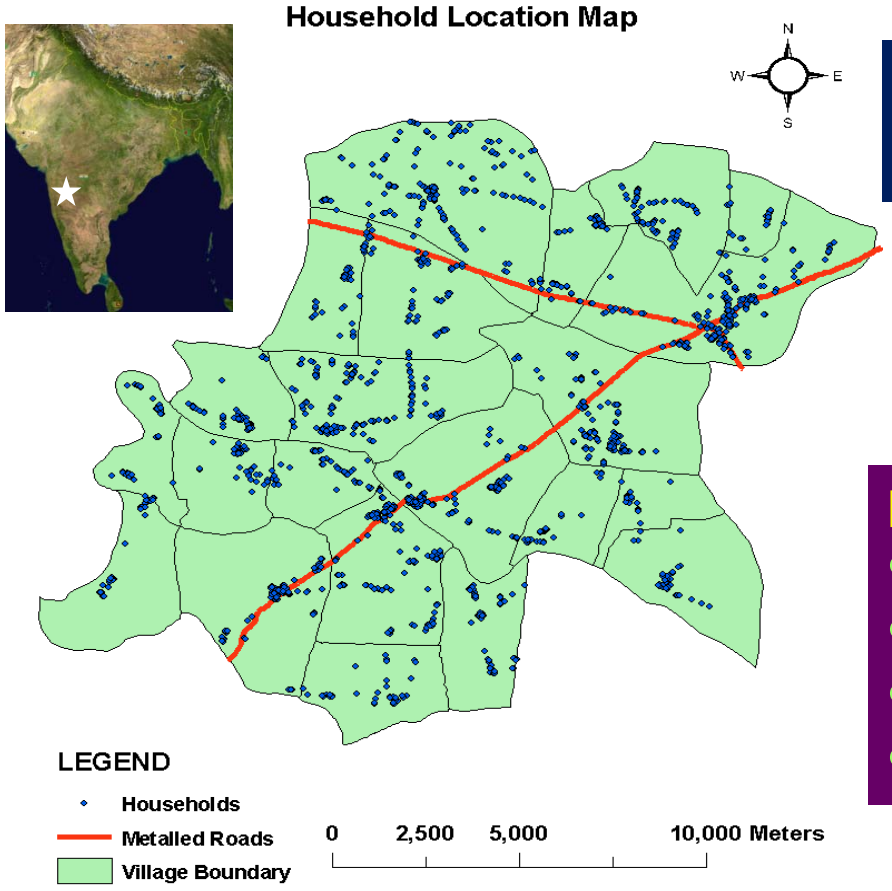
COPD in
Kerosene users vs LPG users
OR: 2.51 (CI; 1.1 - 5.7)

(Chest Research Foundation, Pune, India, 2007)

PREVALENCE OF COPD IN PUNE

Joint Collaborative Study between Chest Research Foundation, Pune and Imperial College, London, UK

(22 villages; n = 3,500; Age: >25 yrs; BOLD Protocol – Questionnaire, Spirometry)



Prevalence of COPD: 5.1%
(M:6.5%, F:3.4%)

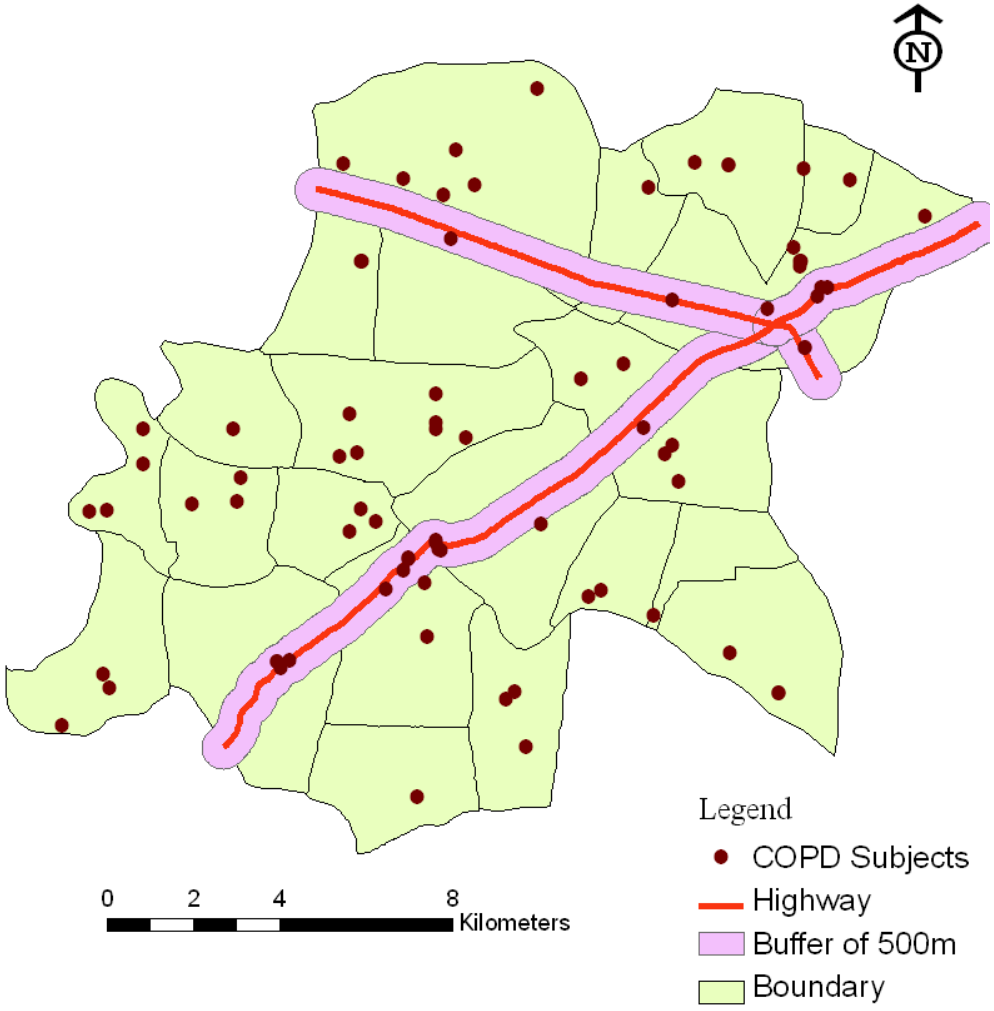
85% of COPD patients were never smokers

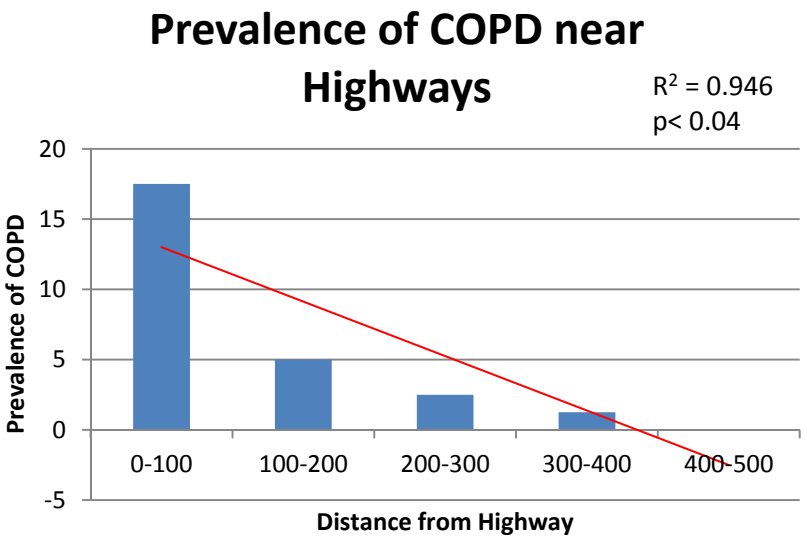
Risk Factors associated with COPD:

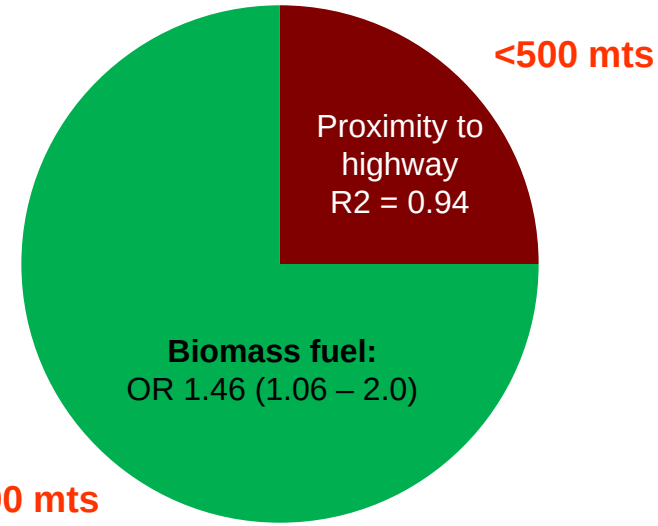
- Tobacco smoking
- Increasing age
- Male gender
- Use of biomass fuel for cooking

(Salvi S et al, Manuscript in preparation)

Spatial Distribution of COPD in Rural Population using GIS





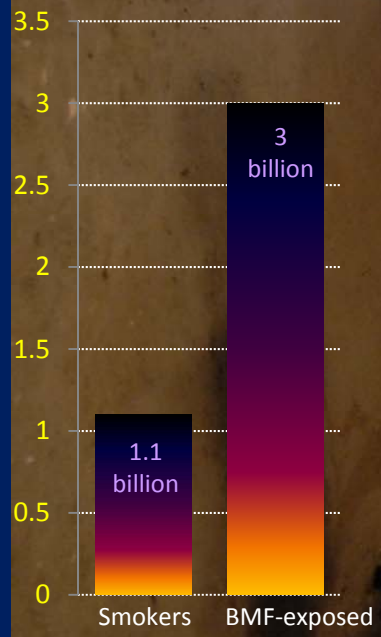


(Muralidharan V et al, Manuscript in preparation)

COPD RISK FACTORS

Odds Ratio:

Smoker developing COPD	2.5
Biomass smoke exposure and COPD	2.5



Review

Salvi SS, Barnes PJ.

Lancet 2009: 374: 733-743

Chronic obstructive pulmonary disease in non-smokers

Sundeep S Salvi, Peter J Barnes

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality worldwide. Tobacco smoking is established as a major risk factor, but emerging evidence suggests that other risk factors are important, especially in developing countries. An estimated 25–45% of patients with COPD have never smoked; the burden of non-smoking COPD is therefore much higher than previously believed. About 3 billion people, half the worldwide population, are exposed to smoke from biomass fuel compared with 1·01 billion people who smoke tobacco, which suggests that exposure to biomass smoke might be the biggest risk factor for COPD globally. We review the evidence for the association of COPD with biomass fuel, occupational exposure to dusts and gases, history of pulmonary tuberculosis, chronic asthma, respiratory-tract infections during childhood, outdoor air pollution, and poor socioeconomic status.

Lancet 2009; 374: 733–43

See Editorial page 663

Chest Research Foundation, Pune, India (S S Salvi MD); and National Heart and Lung Institute, Imperial College, London, UK (Prof P J Barnes FRS)

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Introduction

Chronic obstructive pulmonary disease (COPD) is

reported physician diagnosis, which was similar to the prevalence of chronic cough, phlegm, or wheezing

CHEST

Editorial

CHEST | Volume 137 | Number ■ | ■■■ 2010

Salvi SS, Barnes PJ.

Chest 2010: 138(1): 3-6

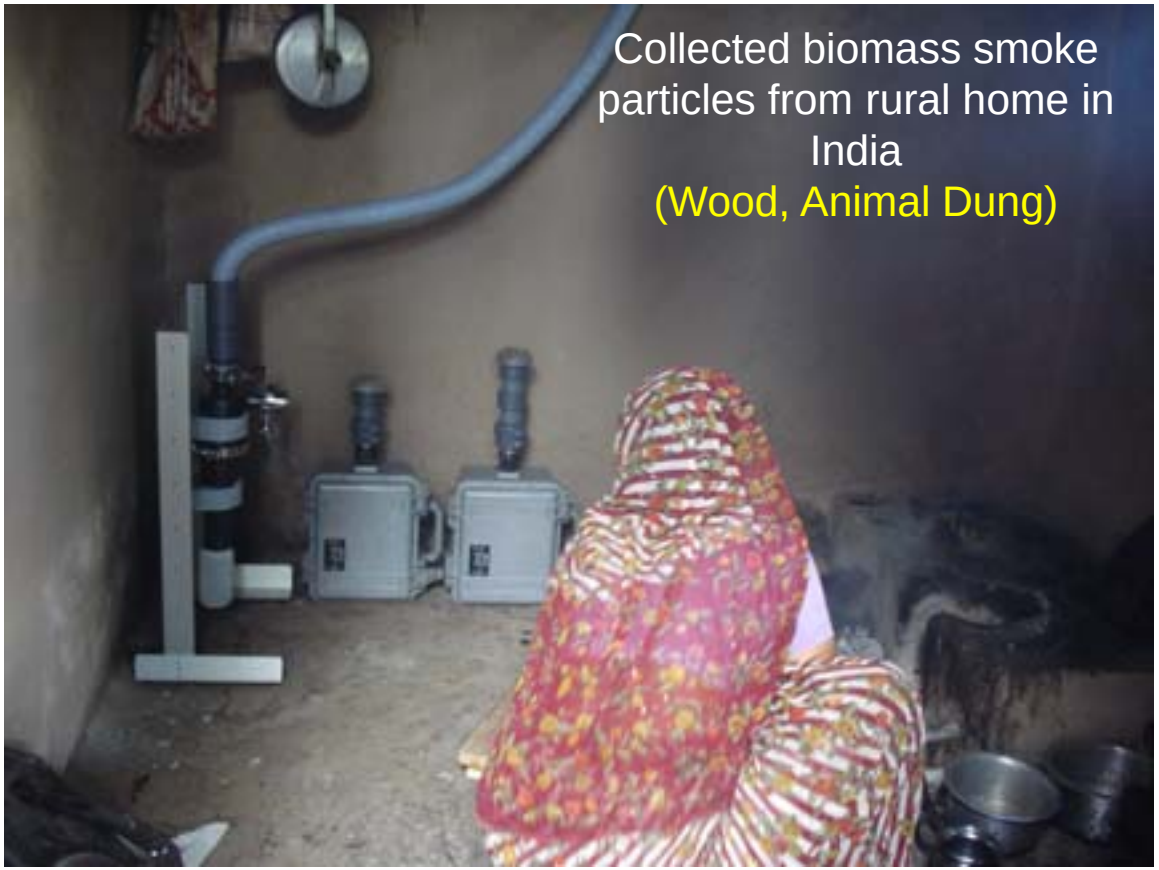
Is Exposure to Biomass Smoke the Biggest Risk Factor for COPD Globally?

About 1.5 million years ago, our ancestors *Homo erectus* learned to light fire from wood to keep wild animals away. Over the years, the human race has used several biologic sources of fuel to produce fire, not only for getting rid of enemies but also for cooking and heating. These sources have included wood, charcoal, dried twigs and grass, crop residues, and animal dung cakes, which collectively are

inhalable size range.[6,7] A significant number of these biomass smoke constituents are known to be toxic or have irritant effects on the respiratory tract and include particulate matter that are < 10 microns in aerodynamic diameter (PM_{10}), carbon monoxide (CO), nitrogen dioxide, sulfur dioxide, aldehydes (eg, formaldehyde), polycyclic aromatic hydrocarbons (eg, benzopyrene), volatile organic compounds, chlorinated dioxins, and free radicals. Among these, PM_{10} has the most significant adverse health impacts. In homes that use biomass fuels, the mean 24-h PM_{10} levels have been shown to reach 300 to 3,000 $\mu g/m^3$ and sometimes can be as high as 30,000 $\mu g/m^3$.[1]

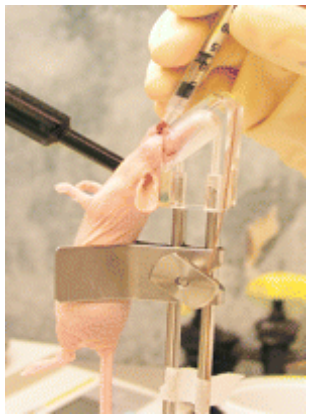
TOXICOLOGY OF BIOMASS SMOKE PARTICLES

(Animal Exposure Studies)



(Chest Research Foundation, India and Johns Hopkins University, USA)

Cyclone Particle collector



Intra-tracheal instillation in mice

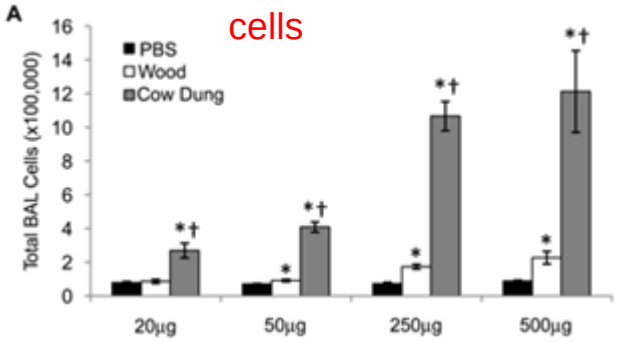
(0, 20, 50, 250, 500 mcg)

CELLULAR AND MEDIATOR INFLAMMATORY RESPONSES

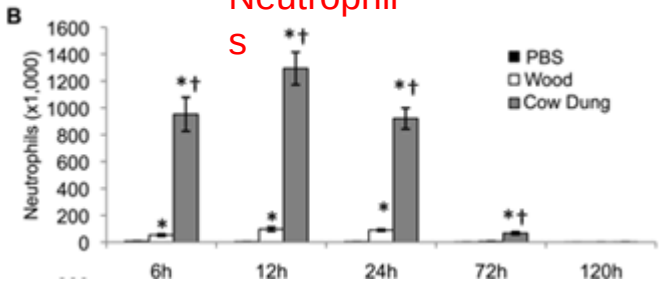
(Wood Smoke versus Animal Dung Smoke)

BAL

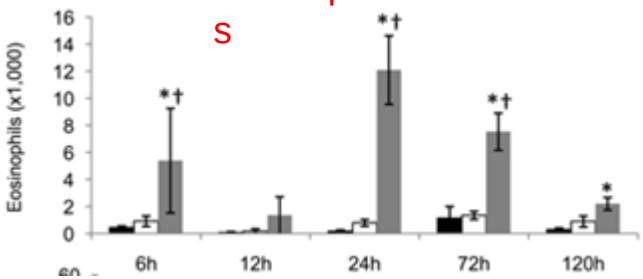
Total cells



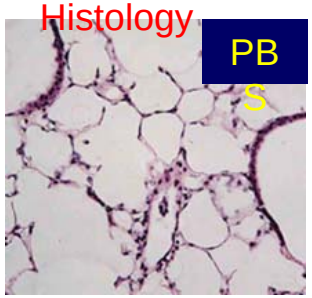
Neutrophils

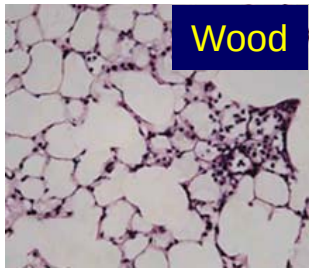


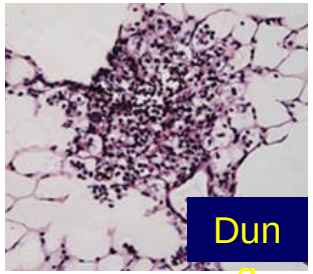
Eosinophils



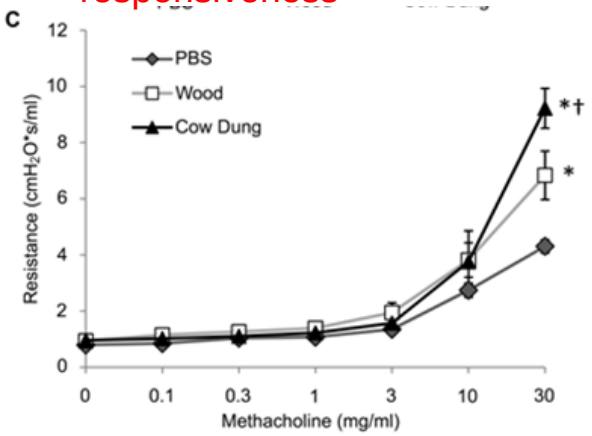
Lung Histology







Bronchial Hyper-responsiveness



(Sussan T et al, Manuscript submitted, 2013)

MOSQUITO COIL

Mosquito Coil

0.3 – 0.4% Pyrethrin (insecticide)

99.6% - Binders, Fillers

Burning one mosquito coil releases the same amount of $PM_{2.5}$ mass as that of burning 75-137 cigarettes.

The emission of formaldehyde can be as high as that released from burning 51 cigarettes

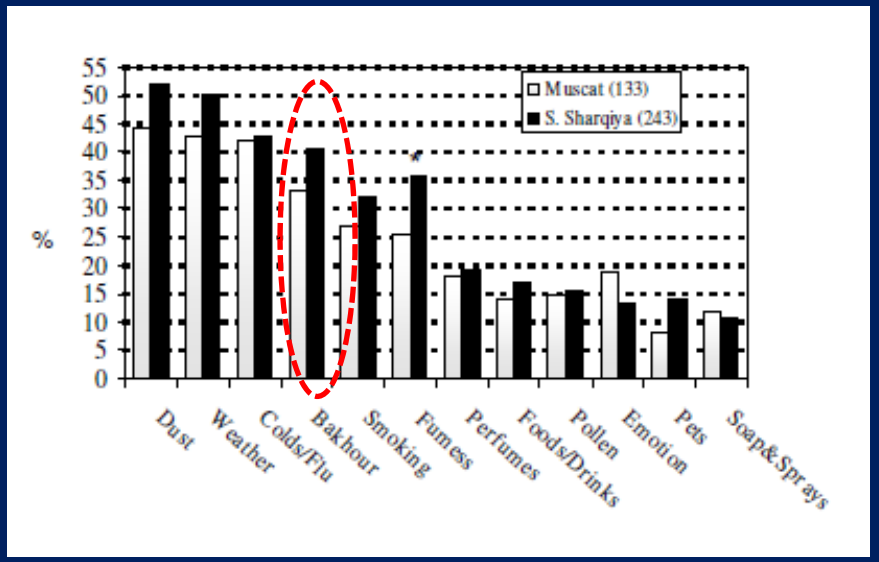
(Liu W et al, Environ Health Perspect 2003; 111: 1454-1460)

PAHs in Cigarettes vs Mosquito coil smoke

Polyaromatic hydrocarbons	Cigarette ($\times 10^{-6}$)	Mosquito Coil (10^{-6})
Benzo[a]pyrene	170	16
Benzo[b]fluoranthene	2.0	1.2
Benzo[k]fluoranthene	110	50
Pyrene	21	60
Dibenz[a,h]anthracene	3	110
Chrysene	0.5	ND

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

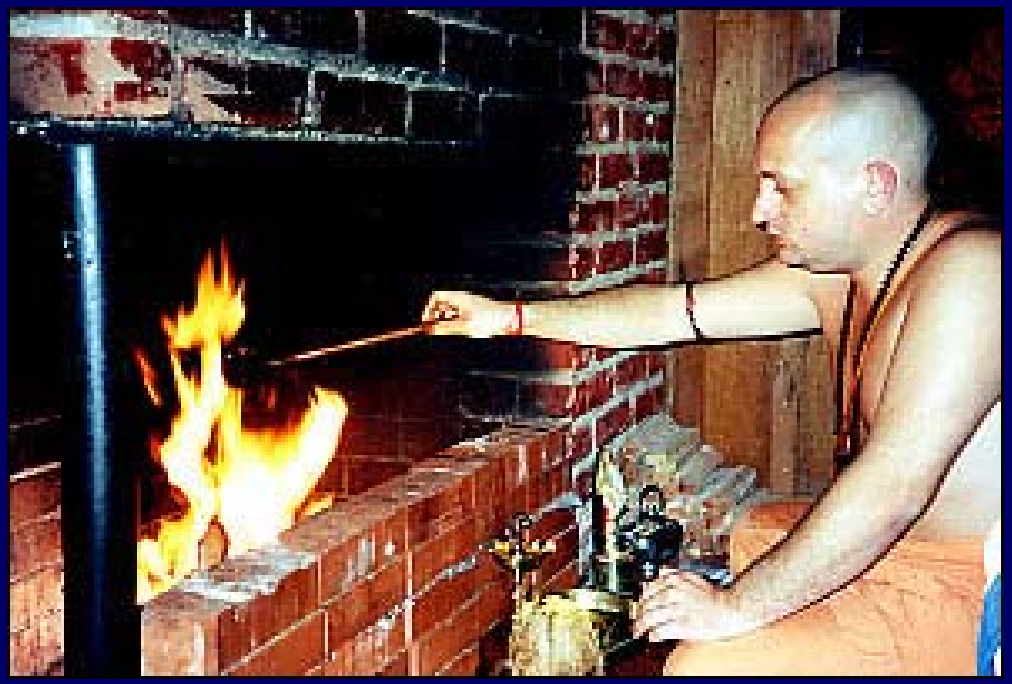
Taipei, Taiwan
3764 children, 10 yrs

Incense burning at home was associated with a significantly increased risk of asthma
Association was strongest in those who had a GSTT1 null genotype

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

SMOKE PARTICLES FROM DHOOP AGARBATTIS

OBSTRUCTIVE AIRWAYS DISEASE IN PUJARIS

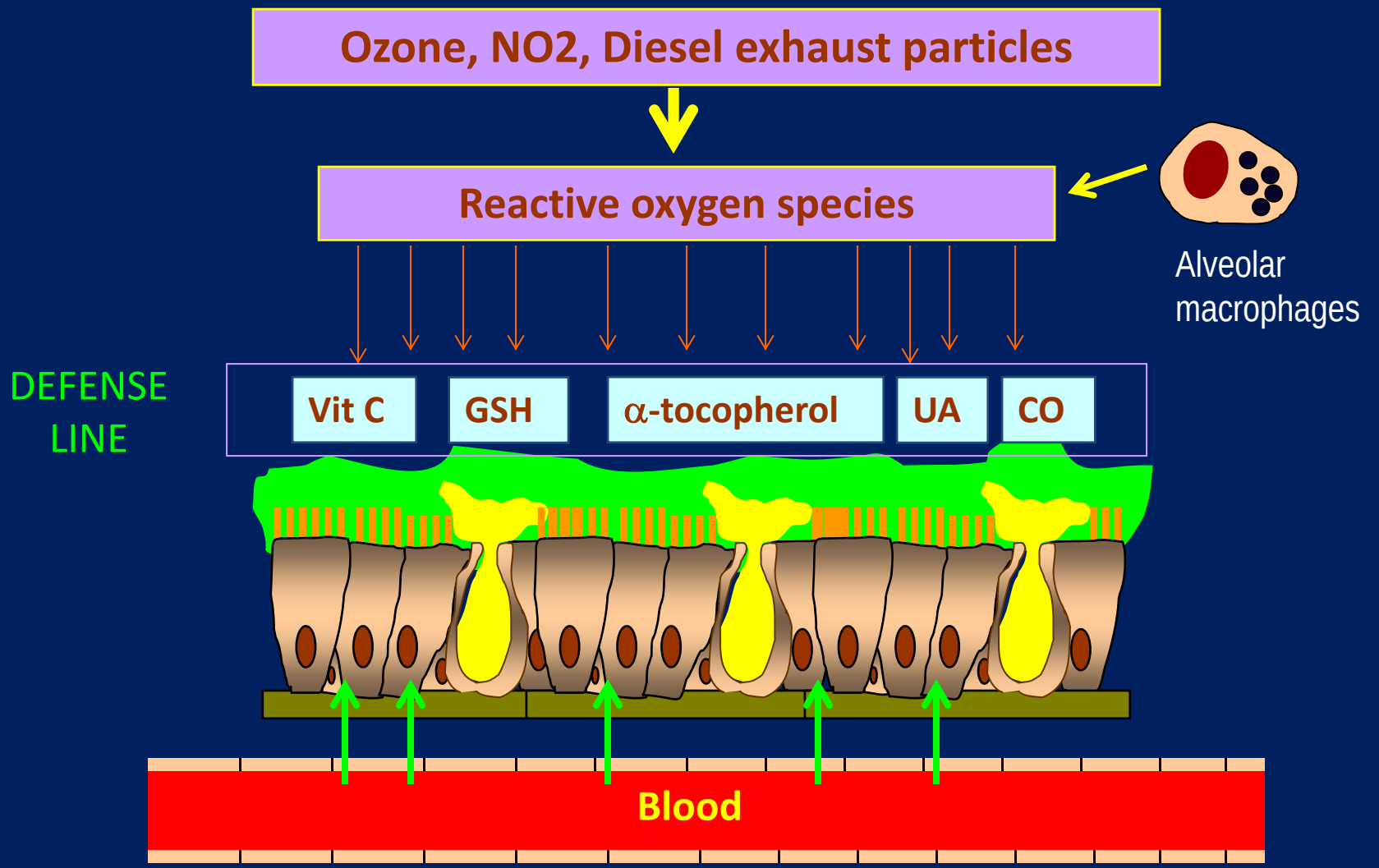


50 Pujaris from 35 temples in Pune city

Spirometry:

25% showed presence of Obstructive Airways Disease

ANTIOXIDANT PROPERTIES OF THE EPITHELIAL LINNG FLUID



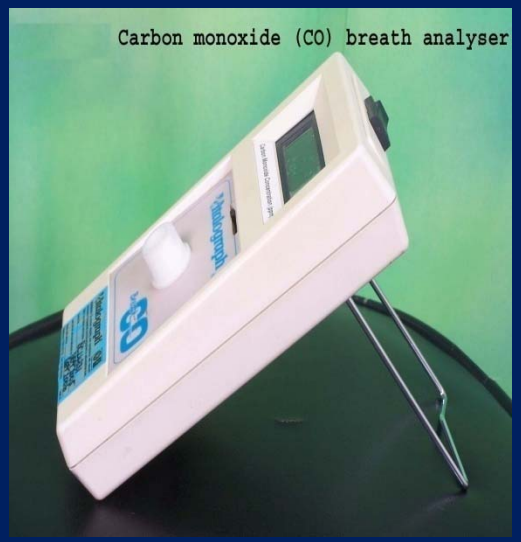
DOES N-ACETYL CYSTEINE AS AN ANTIOXIDANT REDUCE LUNG OXIDATIVE STRESS AND IMPROVE LUNG FUNCTION IN PMT BUS DRIVERS?

PMT Bus Drivers

(n = 72)

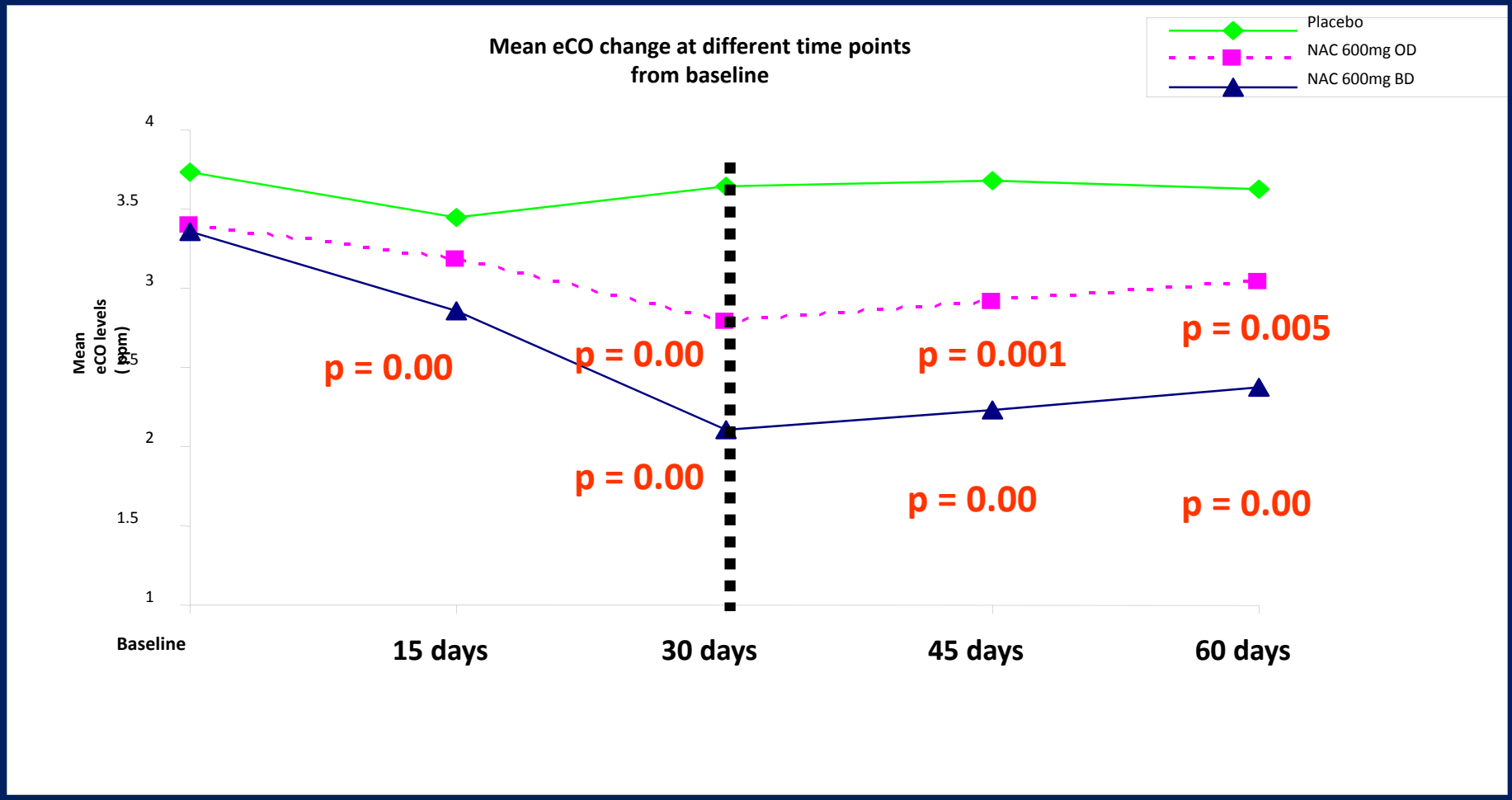
- Placebo
- NAC 600mg/day
- NAC 1200mg/day

X 4 weeks



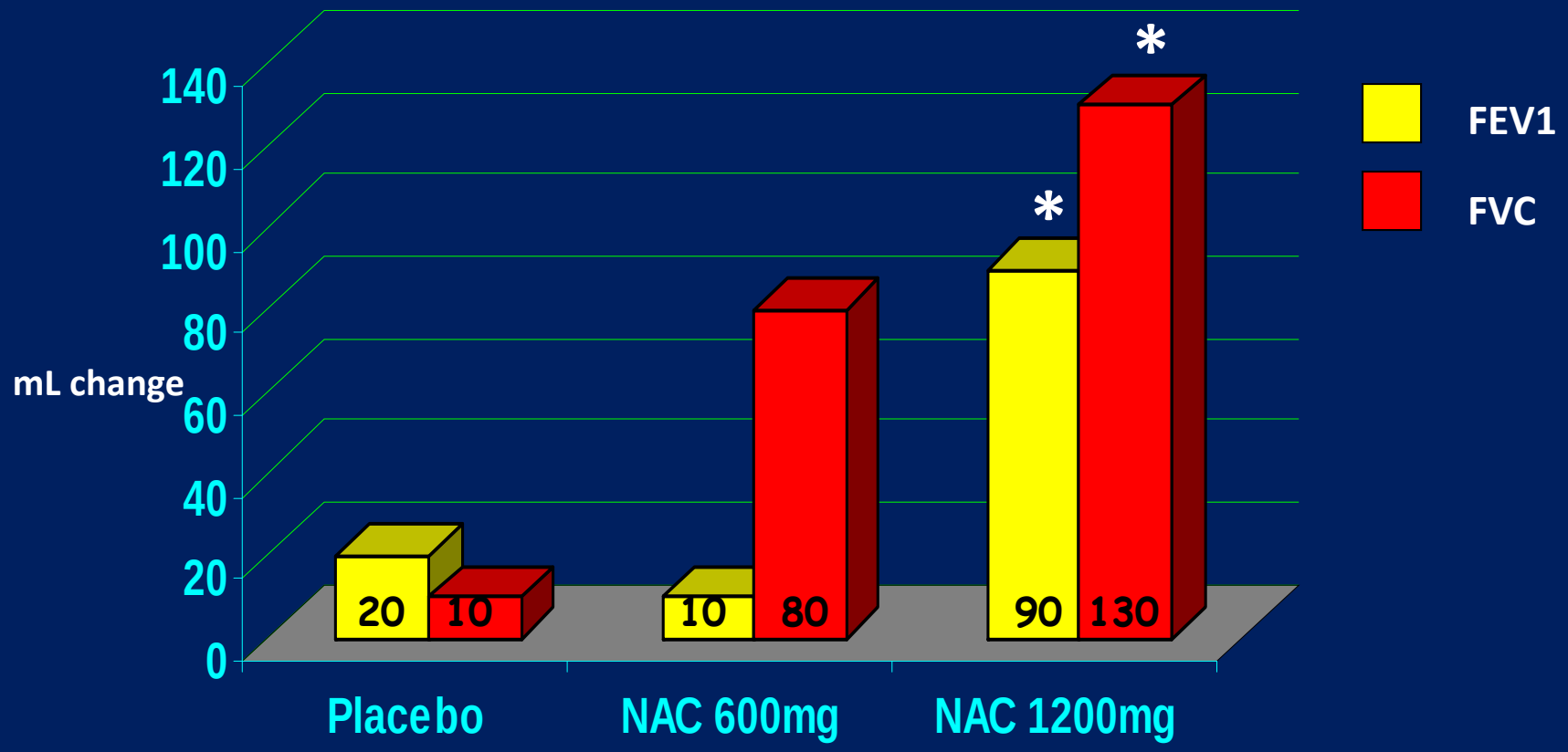
(Chest Research Foundation, B.J. Medical College)

4 week treatment of NAC/Placebo on lung oxidative stress in PMT bus drivers



(Chest Research Foundation, B.J. Medical College)

4 week treatment of NAC/Placebo on lung function changes in PMT bus drivers



(Chest Research Foundation, B.J. Medical College)

THE NEED

RESPIRATORY REVOLUTION

- Improve Quality of Research in Respiratory Medicine
- Improve Quality of Care to patients with Respiratory Diseases
- Improve Quality of Undergraduate and Postgraduate Medical Education in Respiratory Medicine

Good quality doctors | Good quality researchers | Good quality educators

Introducing India's First Respiratory Research Network

RESPIRATORY RESEARCH NETWORK OF INDIA

Unfortunately, the contribution made by India to new knowledge generation for world medical literature is meagrely 0.5%. Despite the enormous burden of both communicable as to form a steering committee and start this initiative, in the presence of Dr. Shyam Biswal, Director, Biswal lab, Johns Hopkins School of Public Health, USA. Dr. Sneha Limaye, Head of Clinical Trials Division at CRF led of diseases and demographics. Collectively it has extensive knowledge and experience in respiratory research and close links with centres of excellence and key opinion leaders in India and other countries. RRNI adds value

SPIROMETRY SIMPLIFIED

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Complete training module

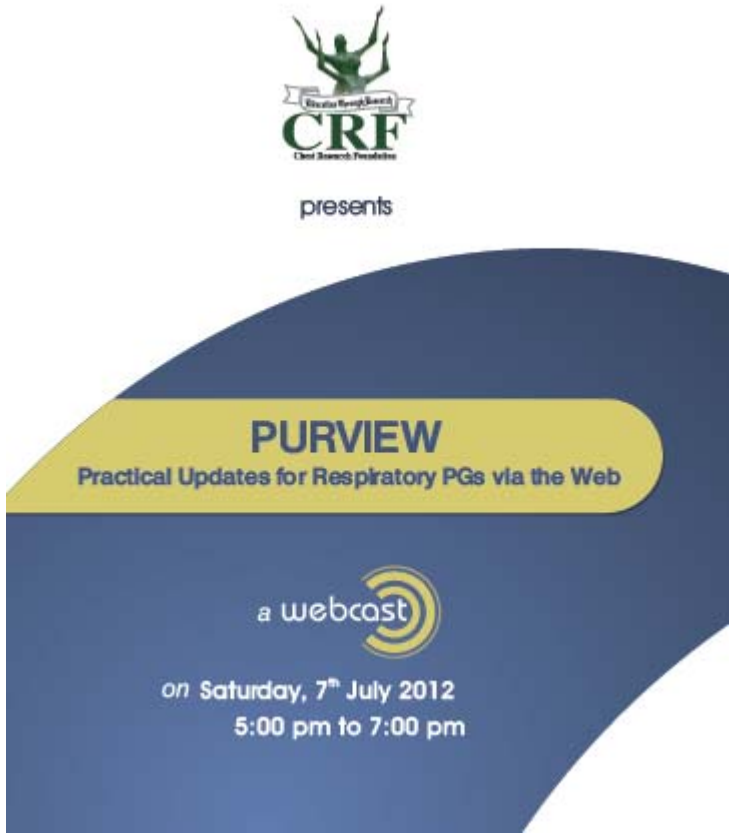
http://www.crflearning.org

PURVIEW

Practical Updates for Respiratory PGs via the Web

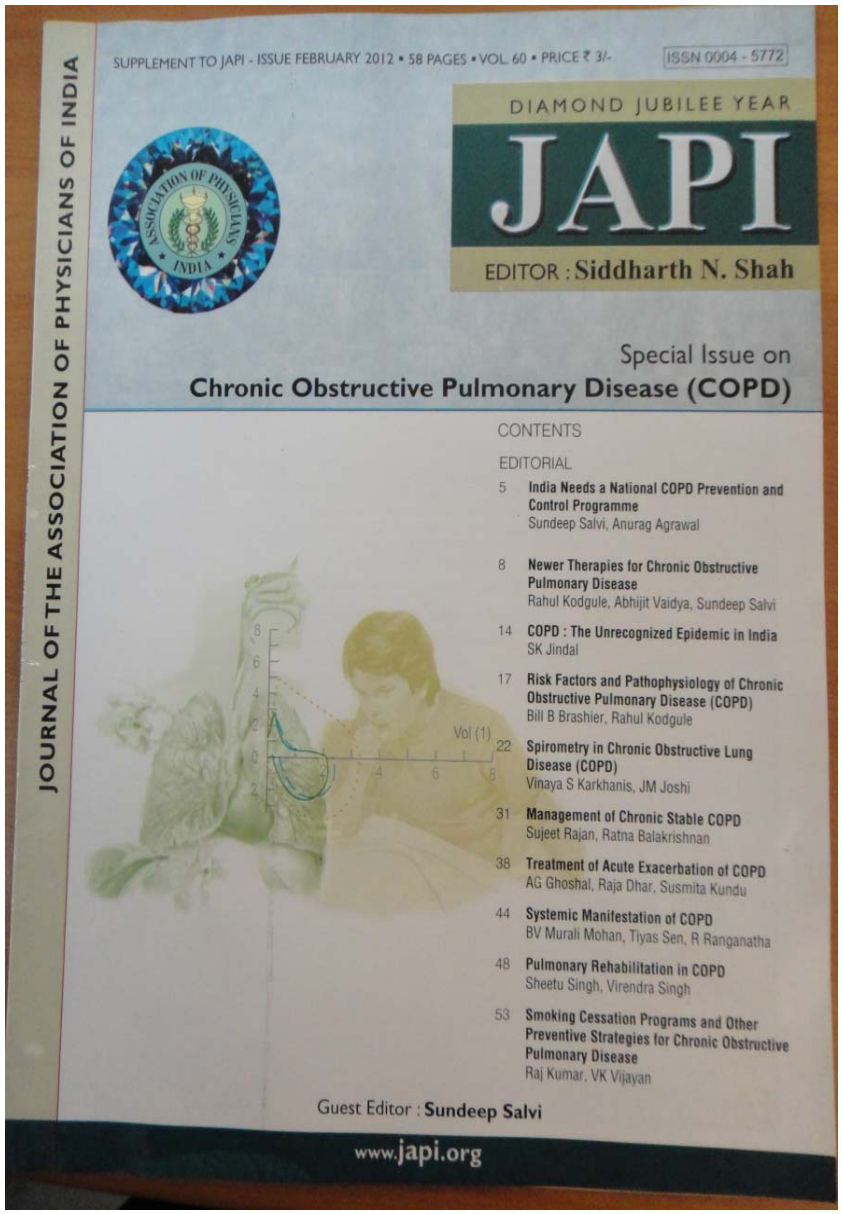
1. Basics of Lung Physiology and How to Select a Dissertation Topic
2. COPD – I
3. Tuberculosis Update 2012
4. COPD – II
5. Radiology in Chest Medicine
6. Asthma – Beyond Prescription
7. Understanding Spirometry
8. Diffuse Parenchymal Lung Disease
9. ILD in Systemic Vasculitis and Autoimmune Vasculitis
10. Hospital Acquired Pneumonias

11. Pleural Diseases



June 2013

(http://www.crfindia.com)



Editorial

India Needs a National COPD Prevention and Control Programme

Sundeep Salvi*, Anurag Agrawal+

Chronic Obstructive Pulmonary Disease (COPD) kills more than 3 million people every year, making it the 4th largest cause of death in the world.[1] It has been estimated that by the year 2030, COPD will become the third biggest cause of death. According to the World Health Organisation, COPD kills more people than HIV-AIDS, Malaria and Tuberculosis all put together in the South East Asian region. What is more worrying is the fact that mortality rates due to COPD are anticipated to increase by over 160% over the next 2 decades (Figure 1).[2] Half a million

prevalence of COPD in India and most of these have used a respiratory health questionnaire and presence of symptoms to define the presence of COPD. Dr Jindal SK from the Postgraduate Institute of Medical Education and Research in Chandigarh has given an overview of the burden of COPD in India in Chapter 2, and has highlighted the growing prevalence and epidemic proportion of COPD in India. There seems to be a wide discrepancy in the prevalence of COPD across different studies, ranging from 2%-22% in men and 1.2%-19% in women.[3]

(Salvi S, Agrawal A, JAPI 2012 Feb; 60: 5-7)

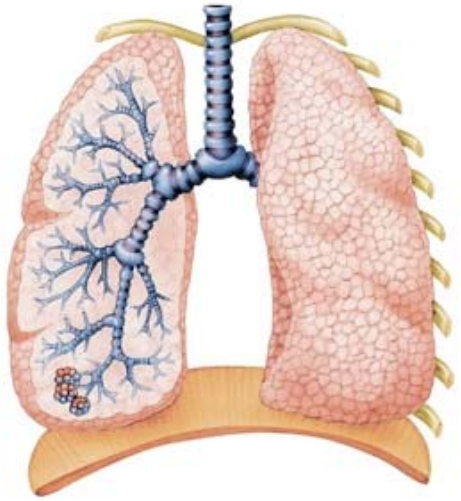
1st COPD CONFERENCE OF INDIA
January 2014, Pune, India

2-day Conference

10-12 overseas speakers
10-12 Indian speakers

- Develop ideas that will guide future research and funding support in the area of interventional and preventive strategies for COPD
- Bring together clinicians, researchers and stakeholders from all parts of the world at a common platform in India
- Giving an identity to COPD in India
- Phenotyping and management of COPD
- Translation of basic research to develop novel therapies

Nationwide competition to give an Indian identity to COPD – PG students



CRF Chest Research Foundation

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

IUSSTF Indo-US Science and Technology Forum

IGIB Institute of Genomics & Integrative Biology

COPD FOUNDATION 1-866-316-COPD (2673)

THANK YOU

ssalvi@crfindia.com

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