"COPD in Non smoker - Evolving NCD"

Attributable to Indoor airpollution – A research Perspective

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Contents of this Presentation

- COPD Defnition
- Risk factors for COPD
- Statistics
  - Burden of Disease estimates
  - Prevalence
- Risk factors for COPD
- Attributable Risk factor -Indoor airpollution (household biomass use)
- Research projects conducted at SRIHER in the field of IAP and Respiratory health (COPD)

COPD - Chronic Obstructive Pulmonary Disease

- COPD is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases

Figure 2.1. Pathways to the diagnosis of COPD

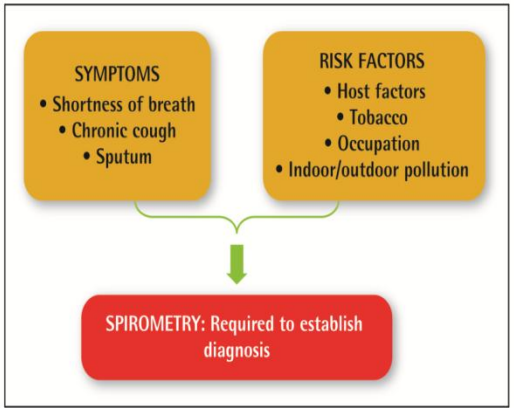


Table 2.4. Classification of airflow limitation severity in COPD (Based on post-bronchodilator FEV_1)		
In patients with $FEV_1/FVC < 0.70$:		
GOLD 1:	Mild	$FEV_1 \geq 80\%$ predicted
GOLD 2:	Moderate	$50\% \leq FEV_1 < 80\%$ predicted
GOLD 3:	Severe	$30\% \leq FEV_1 < 50\%$ predicted
GOLD 4:	Very Severe	$FEV_1 < 30\%$ predicted

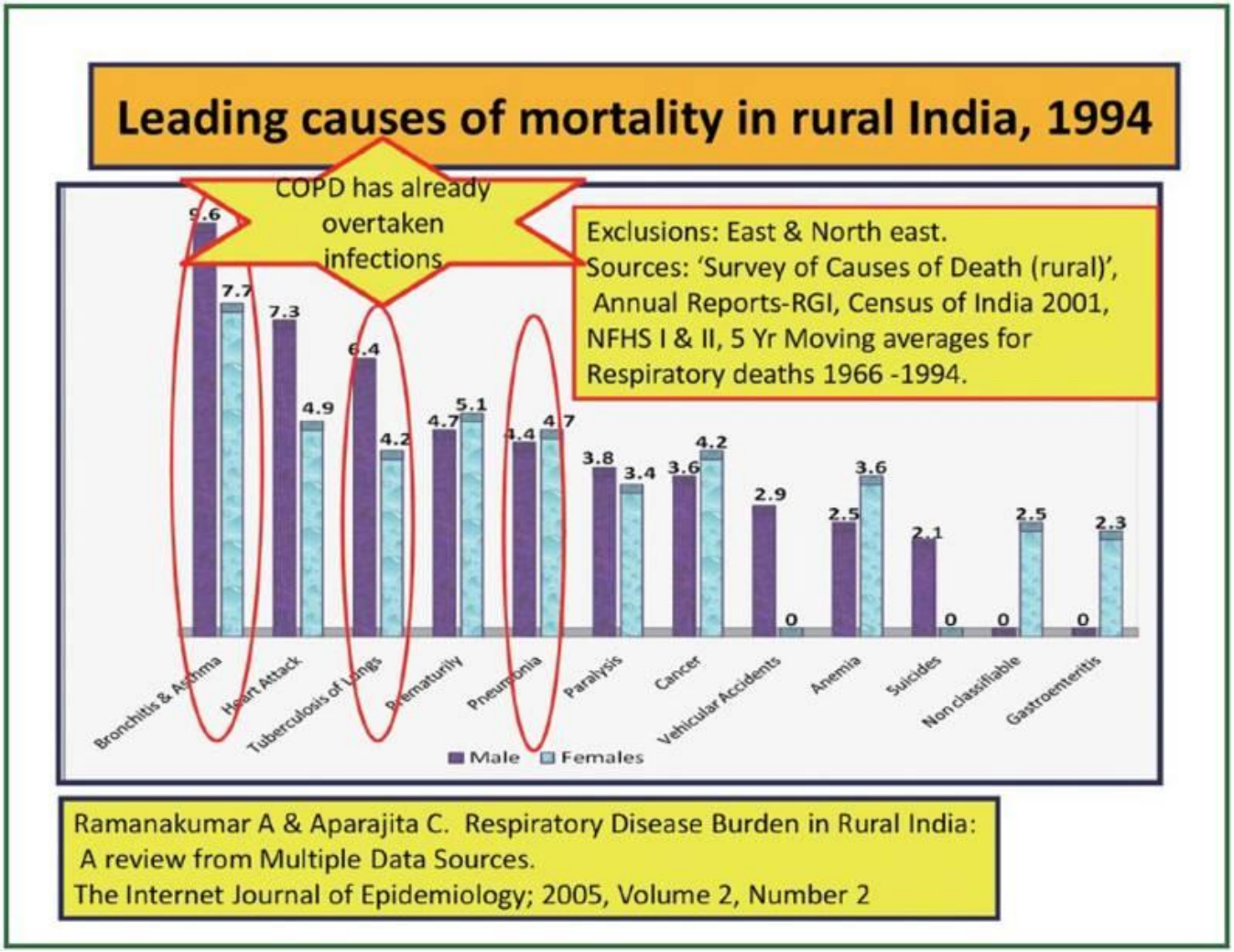
	FEV_1 (% predicted)
GOLD 1	≥ 80
GOLD 2	50-79
GOLD 3	30-49
GOLD 4	< 30

BURDEN OF ILLNESS

Cause	Deaths
CHD	724,269
Cancer	534,947
CVA	158,060
COPD	114,318
Accidents	94,828
Diabetes	64,574

- COPD is the 4th leading cause of death (next to IHD, Cancer, CVA).
- In 2000, the WHO estimated 2.74 million COPD deaths worldwide.
- In 1990, COPD was ranked 12th among the burden of diseases
- By 2020 it is projected to rank 3rd.
- Often, COPD is covert

Situation in Rural India



COPD PREVALENCE 2000

Cause	% Change
CHD	- 59%
Cancer	- 64%
CVA	- 39%
COPD	+ 163%
Accident	+ 32%
All other	- 7%

- Established Market Economies 6.98
- Formerly Socialist Economies 7.35
- India 4.38
- China 26.20
- Other Asia and Islands 2.89
- Sub-Saharan Africa 4.41
- Latin America and Caribbean 3.36
- Middle Eastern Crescent 2.69
- World 9.34

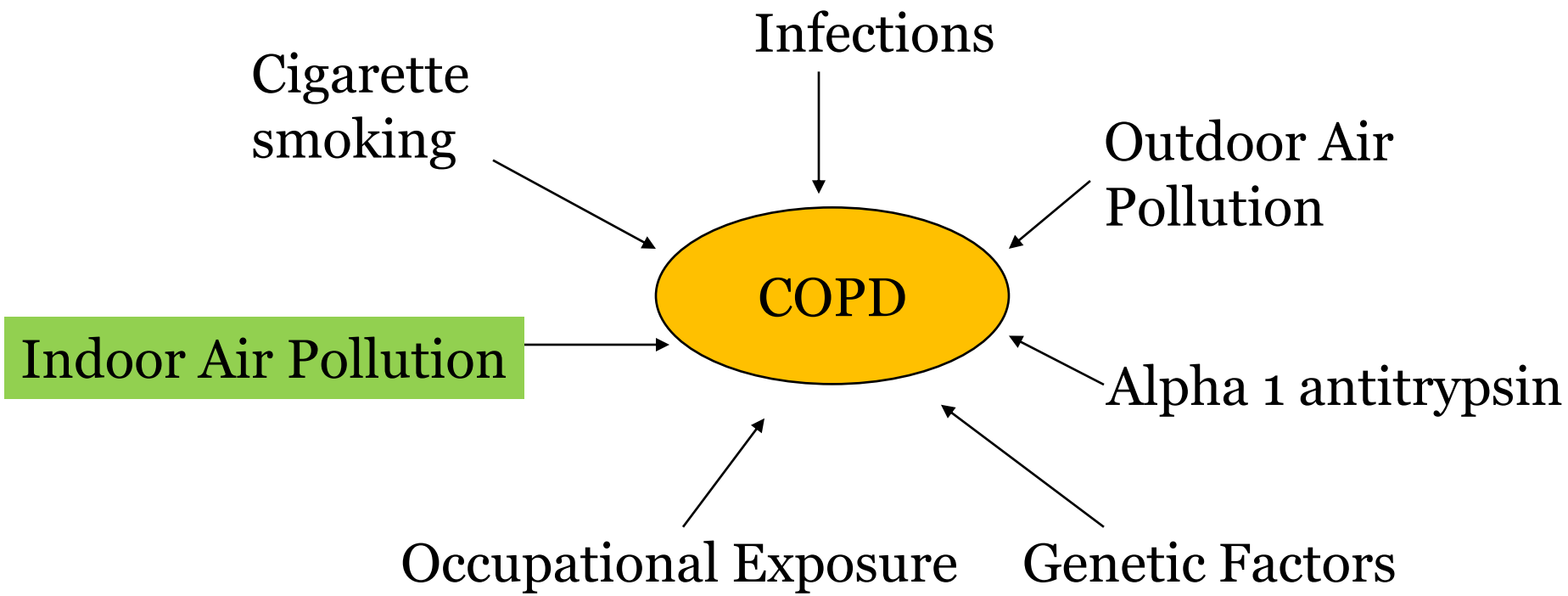
*From Murray & Lopez, 2001

COPD Prevalence in India – INSEARCH study (16 centers)

- Prevalence of COPD from India (from different population-based studies): highly variable
- Male subjects: 2.12% to 9.4% (North India), 1.4% to 4.08% (South India)
- Female subjects: 1.33% to 4.9% (North India), 2.55% to 2.7% (South India)
- Median prevalence rates (>30 years): Male – 5%, Female – 2.7%
- More common in males

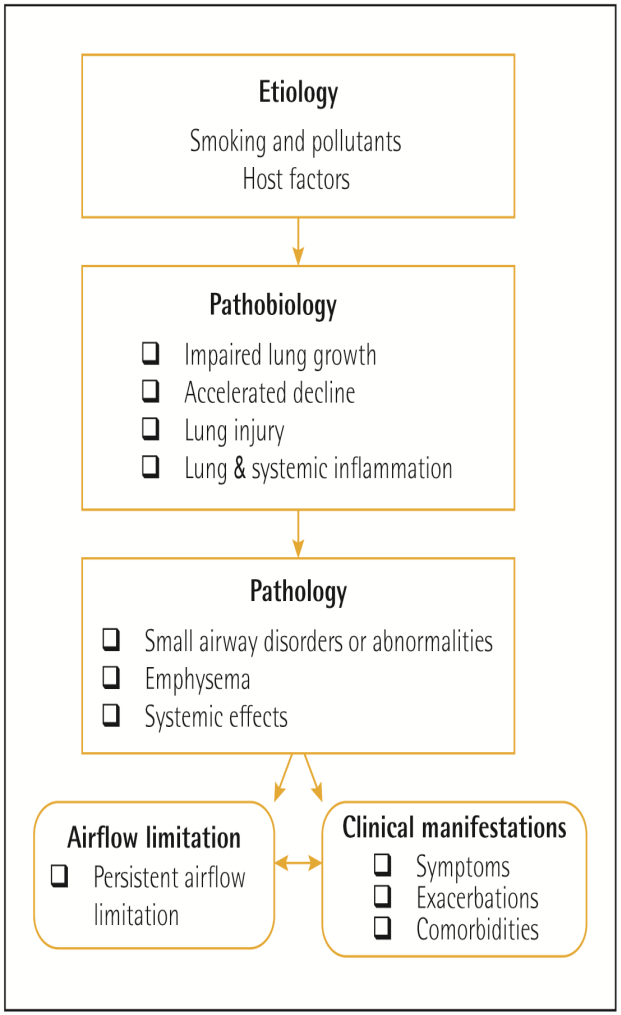
Jindal et al. 2004

Risk factors for COPD



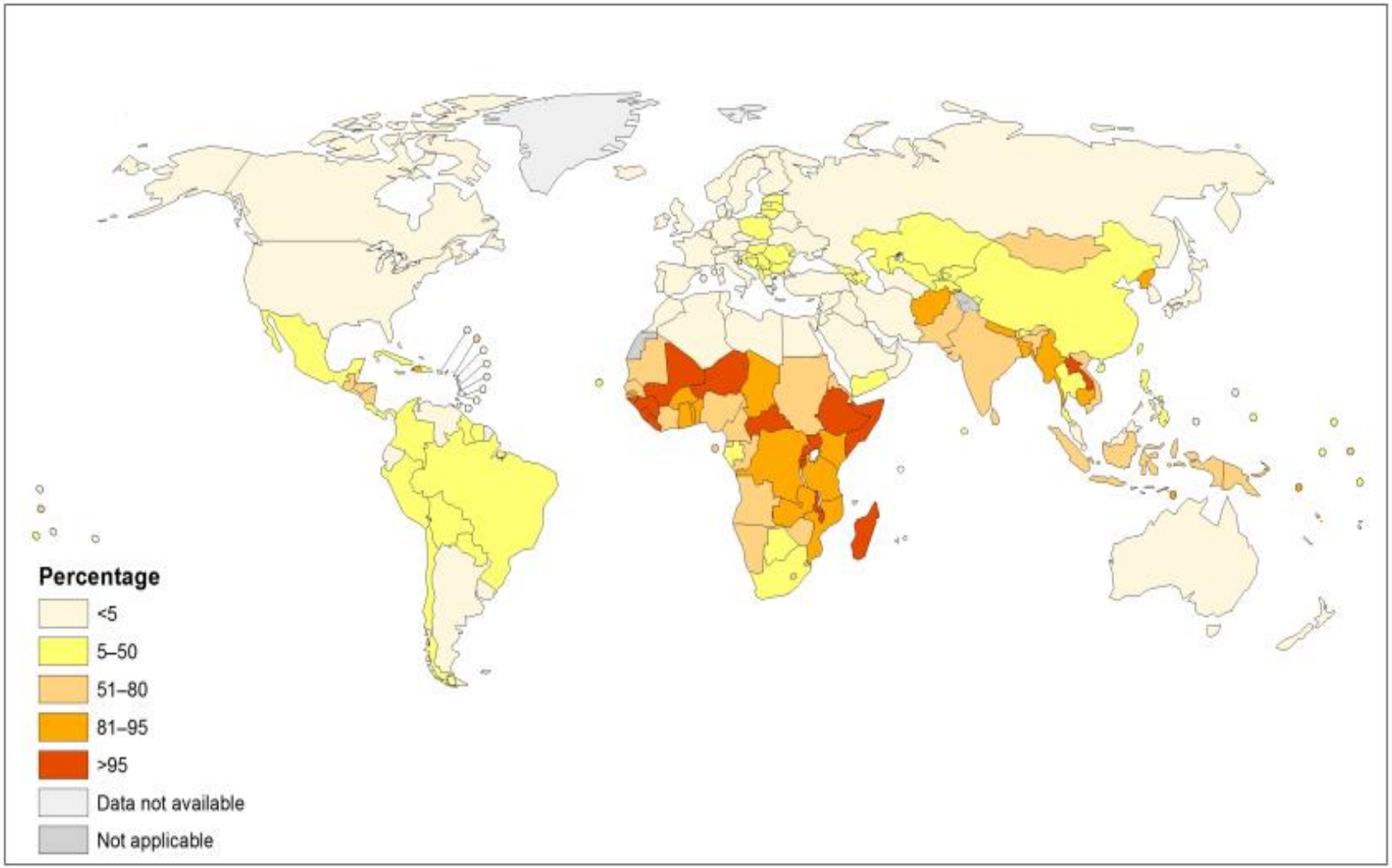
COPD Etiology, Pathobiology & Pathology

Figure 1.1. Etiology, pathobiology and pathology of COPD leading to airflow limitation and clinical manifestations



- Pathology
  - Chronic inflammation
  - Structural changes
- Pathogenesis
  - Oxidative stress
  - Protease-antiprotease imbalance
  - Inflammatory cells
  - Inflammatory mediators
  - Peribronchiolar and interstitial fibrosis
- Pathophysiology
  - Airflow limitation and gas trapping
  - Gas exchange abnormalities
  - Mucus hypersecretion
  - Pulmonary hypertension

Population using solid fuels (%), 2010
Total



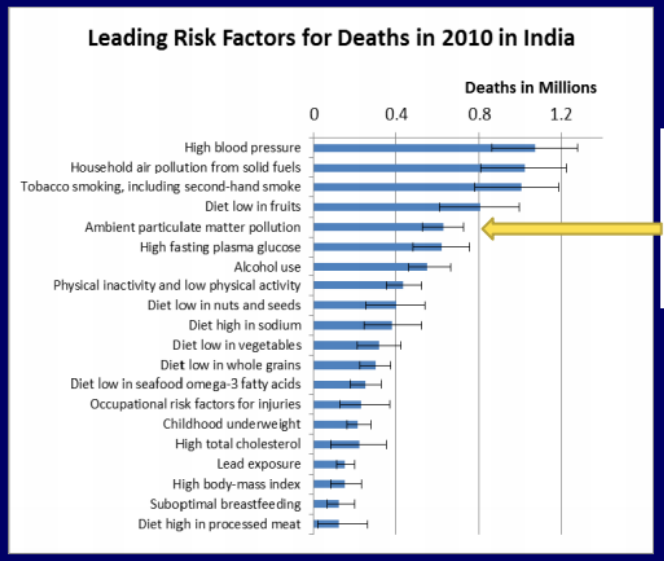
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

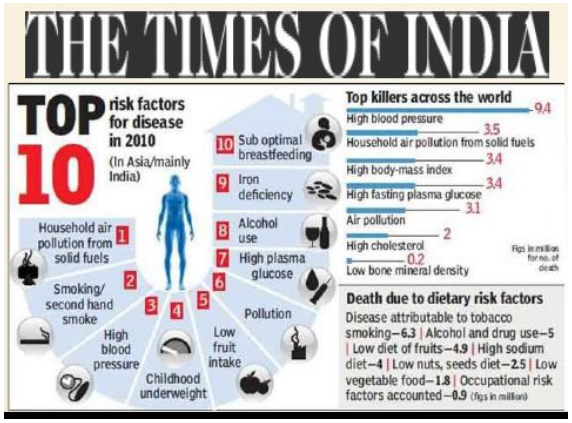
World Health Organization

Global Burden of disease attributable to 20 leading risk factors in 2010

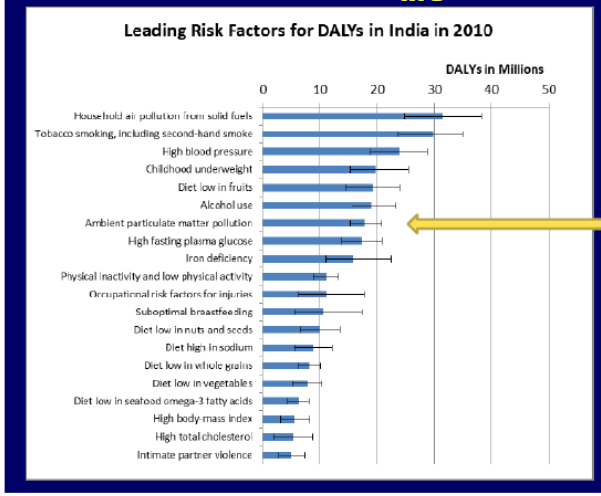
Top 20 Mortality Risk Factors in India for 2010
Ambient $PM_{2.5}$ is 5th leading mortality risk factor



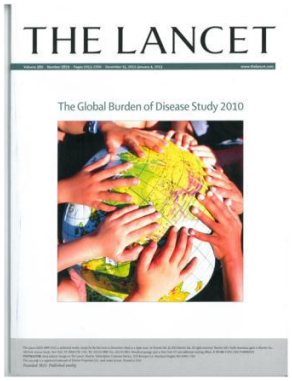
Ambient $PM_{2.5}$ caused an estimated 627,000 deaths ~6% of all deaths in 2010



Top 20 Health Burden Risk Factors in India for 2010 (DALYs)
Ambient $PM_{2.5}$ is 7th leading risk for lost-years-of-healthy-life



Ambient $PM_{2.5}$ caused an estimated 17.7 million DALYs ~3% of all DALYs in 2010



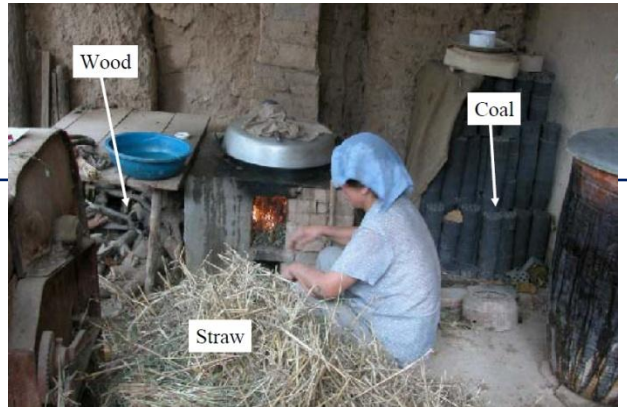
Household and Ambient Air Pollution: India faces a double burden

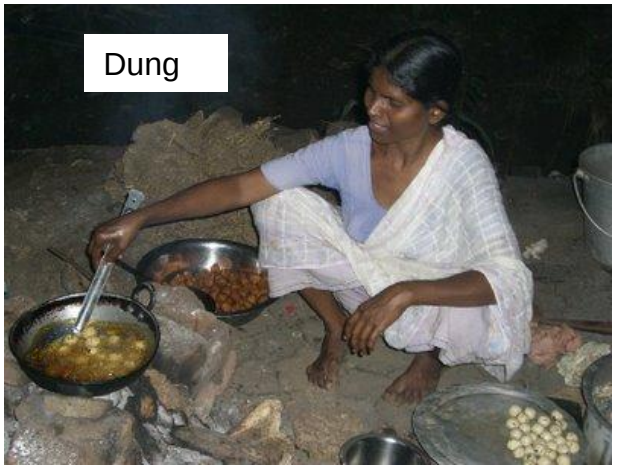
- Household air pollution (HAP) and ambient $PM_{2.5}$ were the second and sixth leading risk factors for mortality in India in 2010: 1 million and 620 thousand deaths, respectively
- HAP contributes to ambient $PM_{2.5}$ and so is responsible for some proportion of the burden of disease attributed to ambient $PM_{2.5}$
- Reducing household air pollution is necessary in some settings in order to improve outdoor air quality

Why is household biomass fuel use an important public health issue?

- High prevalence of biomass fuel use for everyday energy need
  - 50% of world's population use bio mass (80% in India)

- Recognized as an important contributor to the burden of disease especially in developing countries (WHO 2004)

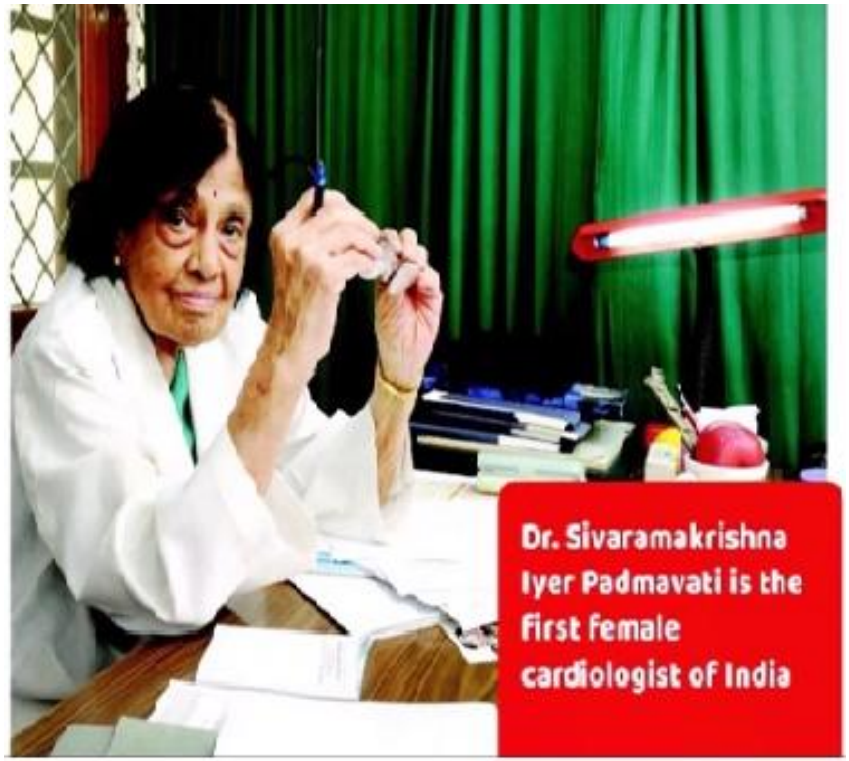




Emissions from combustion of solid fuels

- Incomplete combustion of such fuels results in emissions of thousands of pollutants that include a **cocktail of aerosols** in the respirable range (0.1-10 μm in aerodynamic diameter), gases such as **carbon monoxide**, small amounts of **nitrogen dioxide** , and vapours including **HCs** and **aldehydes**.
- At least 28 pollutants have been shown to be toxic in animal studies
  - 14 carcinogenic compounds, 6 cilia –toxic and mucous coagulating agents and 4- co-carcinogenic s have been identified in solid fuel smoke.
- IARC- indoor emissions from household combustion of coal as Group 1 carcinogen ; Biomass fuel (mainly wood) as "probably carcinogenic to humans" **(Group 2A carcinogen**)

Biomass use and Corpulmonale among non smoking women



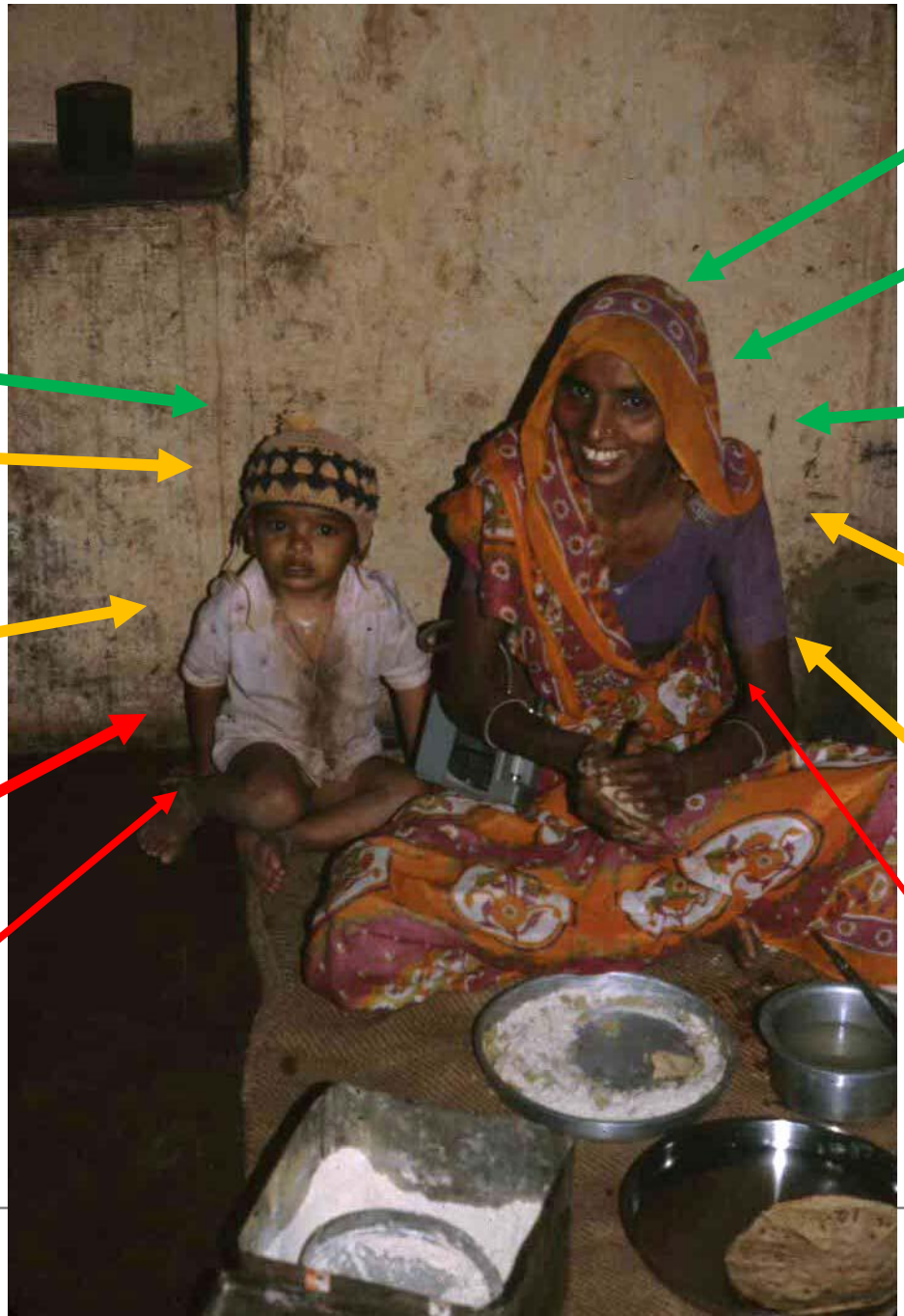
Padmavibhushan, still practising at the age of 101

•Padmavati, an elected fellow of the National Academy of Medical Sciences

• First woman cardiologist in India in 1954 and established the first cardiac clinic and cardiac cath lab in North India.

•Association of chronic corpulmonale with cow dung smoke in early 1950s.. Published in circulation and British J of Diseases Chest in 1976

IAP and Health outcomes



ALRI/ Pneumonia

Asthma

Low birth weight

Early infant death

Cognitive Impairment?

COPD

Interstitial lung disease

Cancer (lung, NP)

Blindness (cataracts, trachoma)

Tuberculosis

Heart disease?

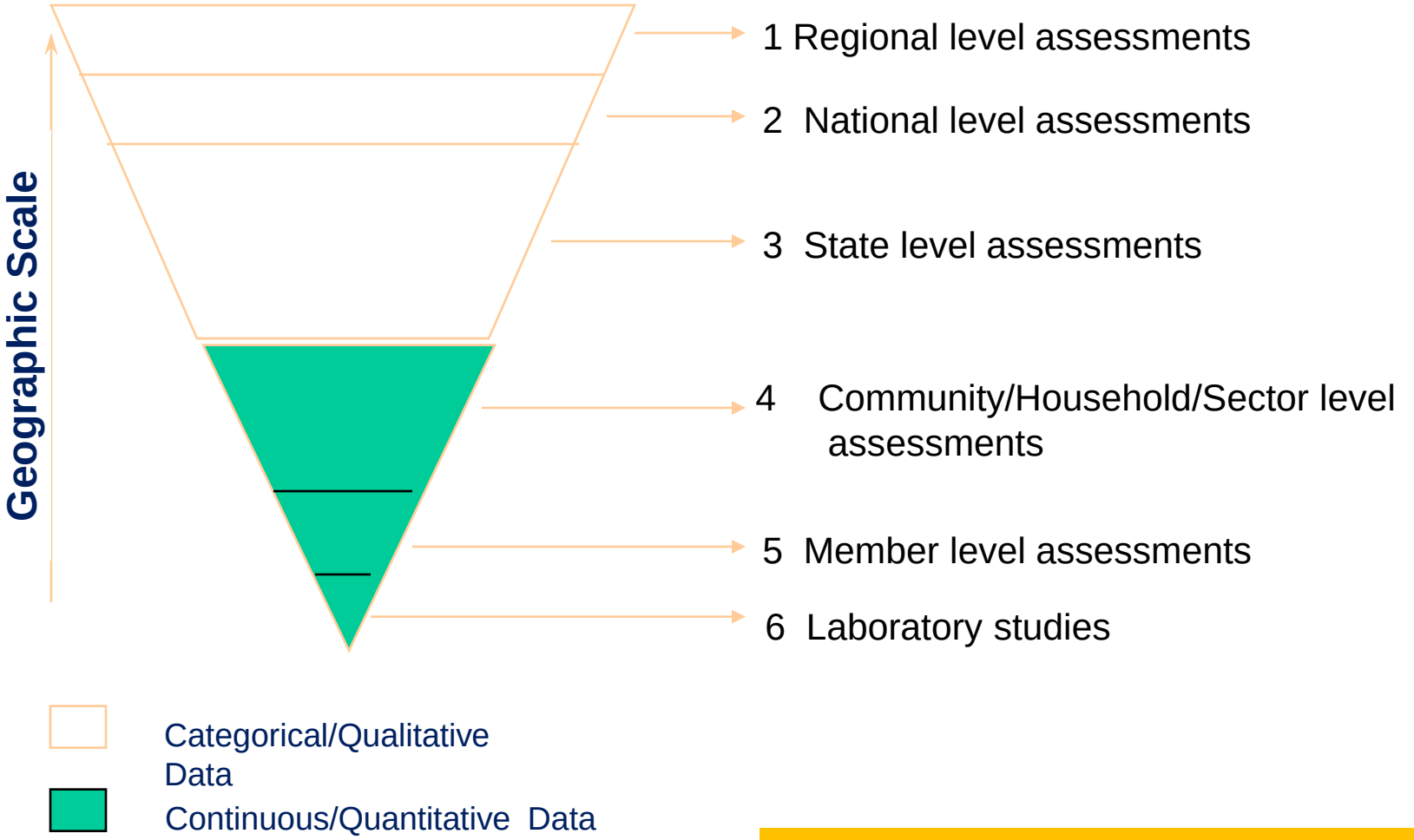
Air Pollution and Health Studies

- **Ecologic study** – Examines the association between exposure rates and disease rates in a group over time. In ecologic studies, the exposure and disease status of individuals in the group are unknown. Therefore, one limitation of this study design is that those exposed and those with the disease may not be the same individuals.

- **Time-series study** – Analyzes a series of data points that results from repeated measurements over time. Adjustments are made for cyclical or seasonal trends such as daily peaks in PM levels or annual influenza trends in order to identify larger trends that demonstrate the association between exposure and disease.

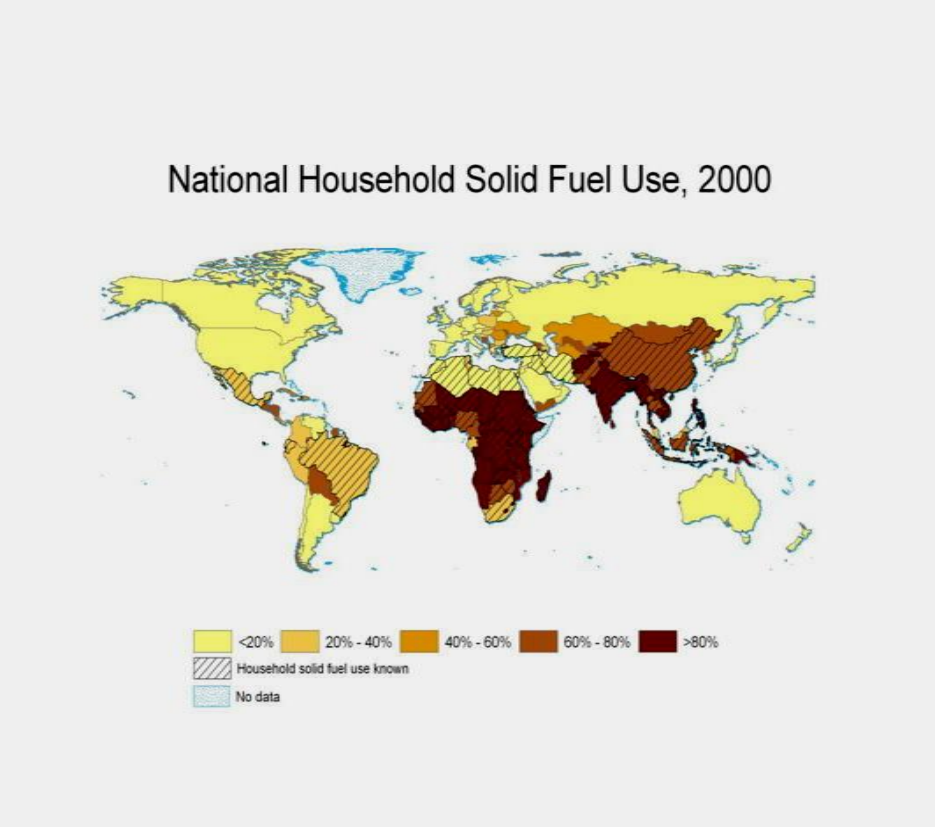
- **Cohort study** – The health status of individuals in a cohort (i.e., group of study participants) whose exposure status is known at the start of the study is monitored over time to see if there is an association between their exposure and particular health outcomes.

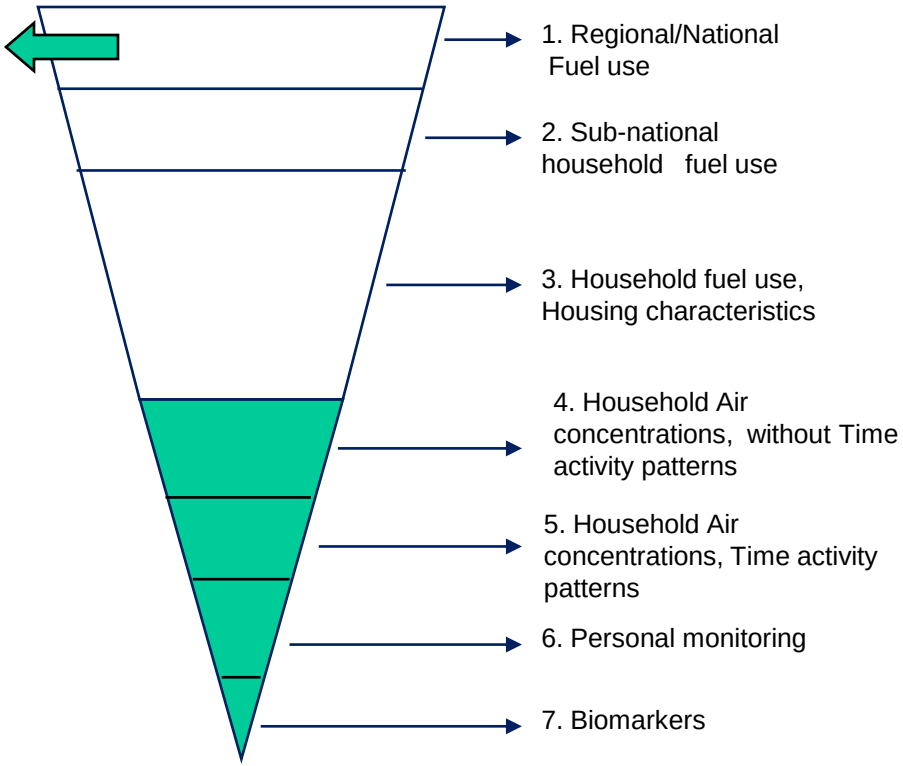
Our research paradigm



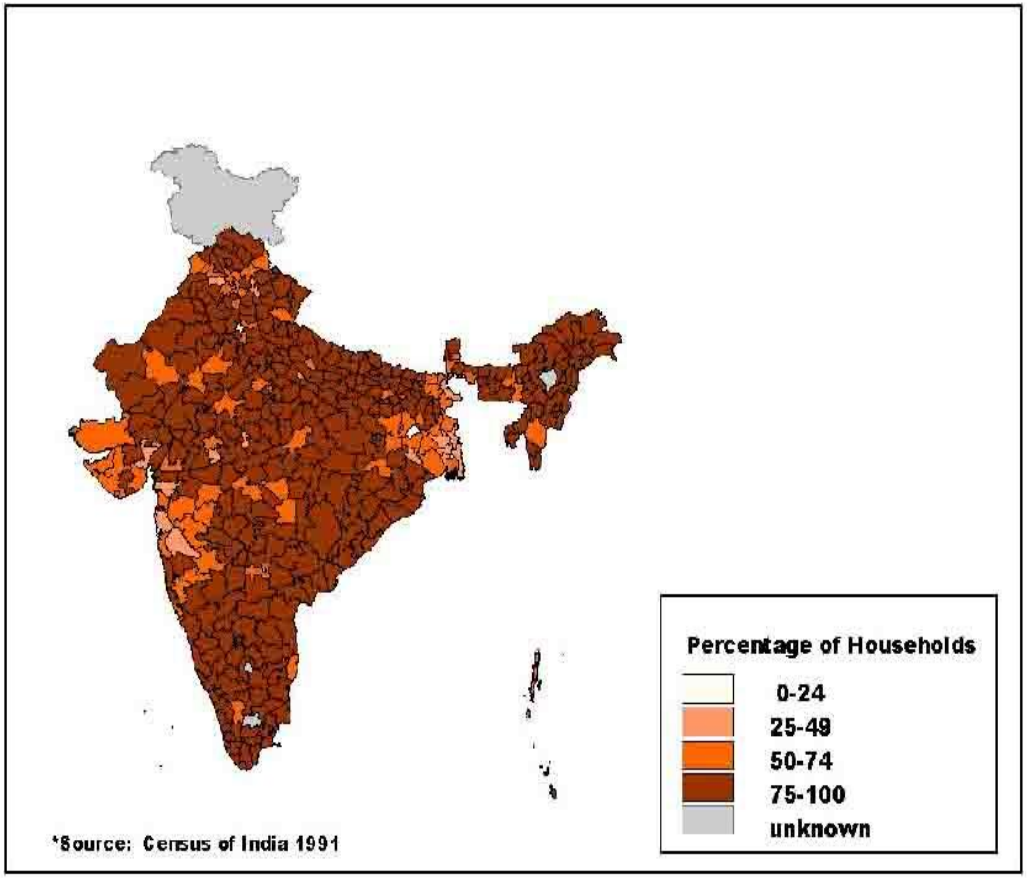
Dept. of EHE -ICMR and WHO center

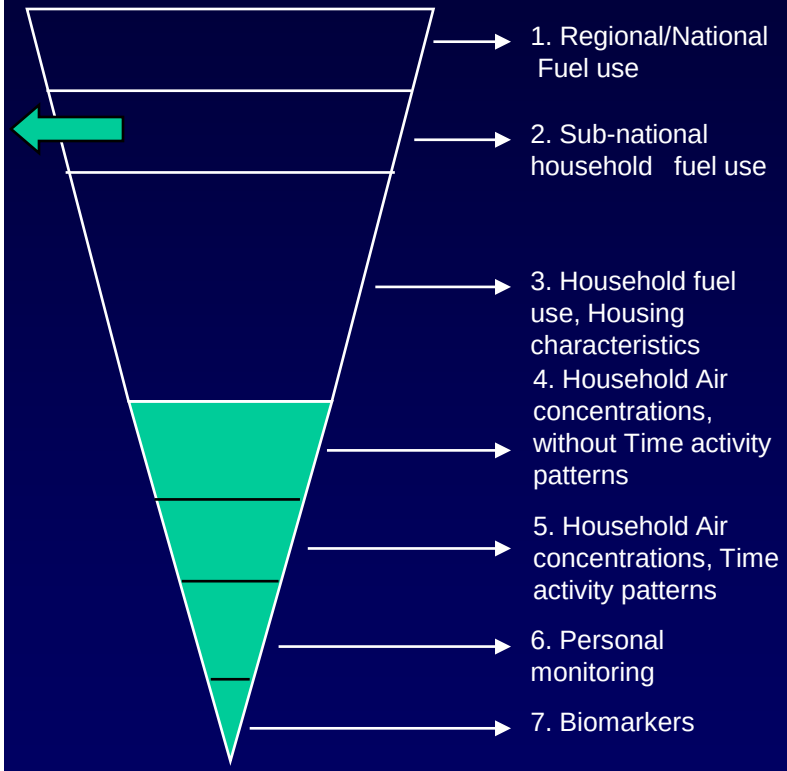
Regional level





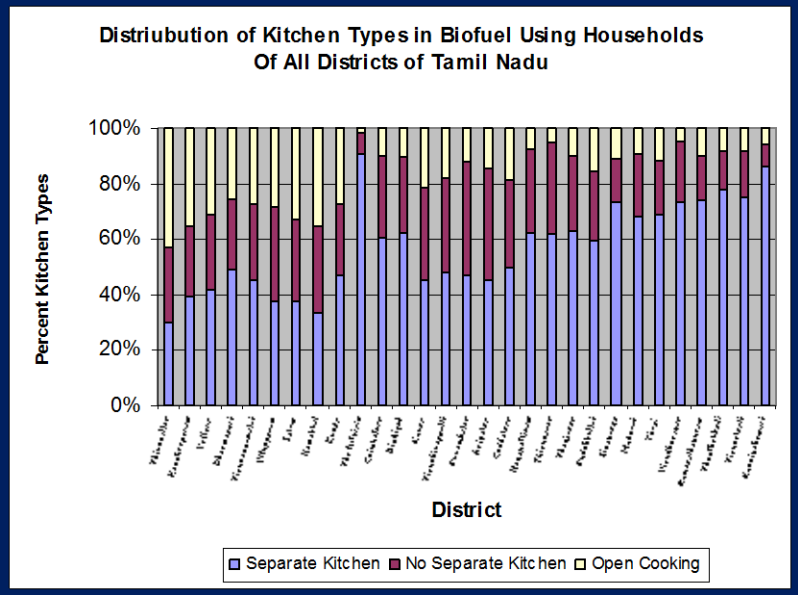
Balakrishnan et. al. 2000

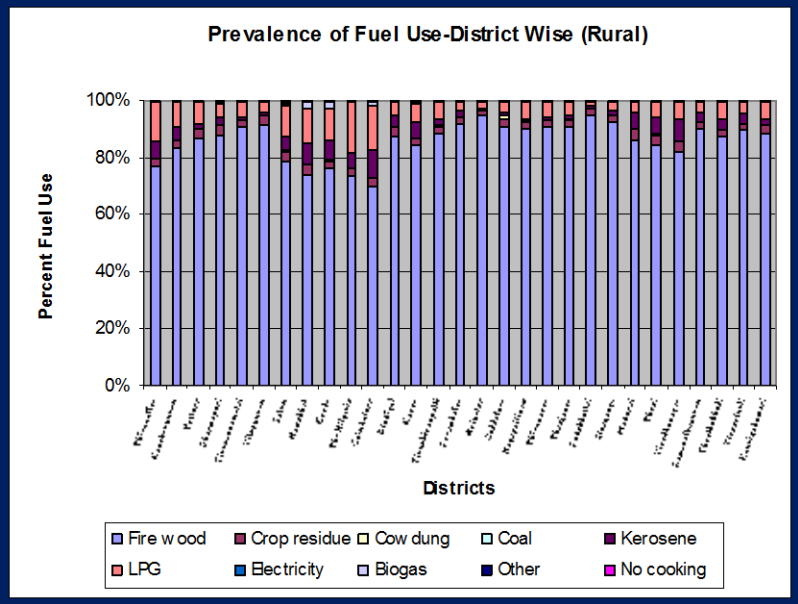


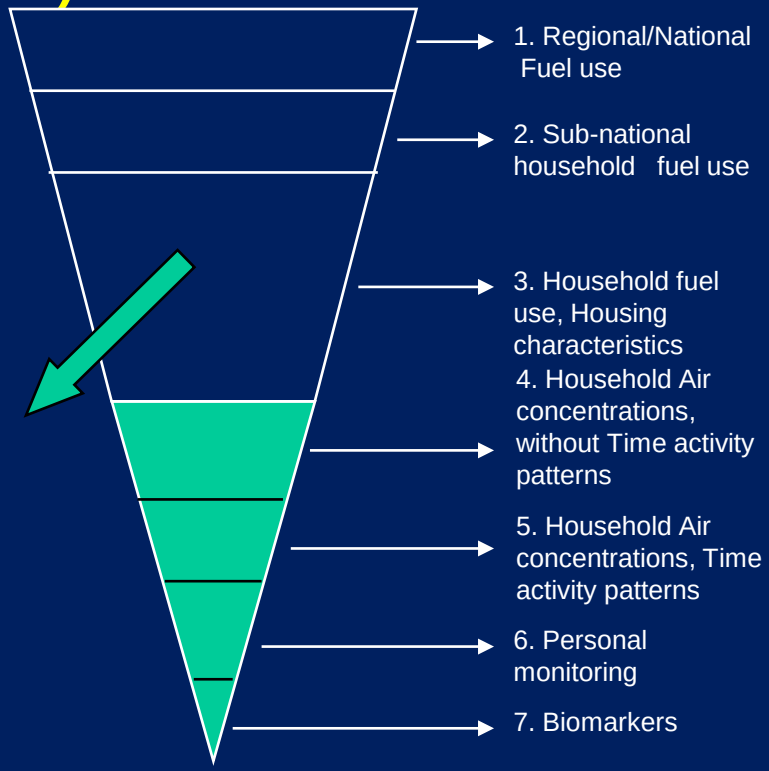


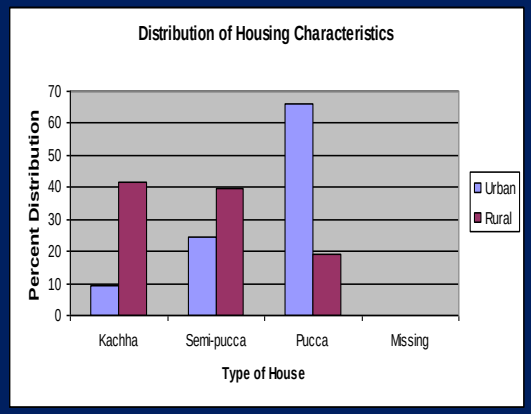
Courtesy: K. Smith

DISTRICT LEVEL DISTRIBUTION OF SELECT IAP DETERMINANTS (USEPA-IES)









Balakrishnan , Padmavathi et. al. 2004

Exposure Determinants

- PROXIMAL
  - Type of fuels
  - Type of stoves
  - Cooking vs. heating use
  - Household layout
  - Ventilation
  - Room volume
  - Duration of cooking
  - Fuel quantity
  - Time-activity profiles
  - Other IAP sources

DISTAL

Income

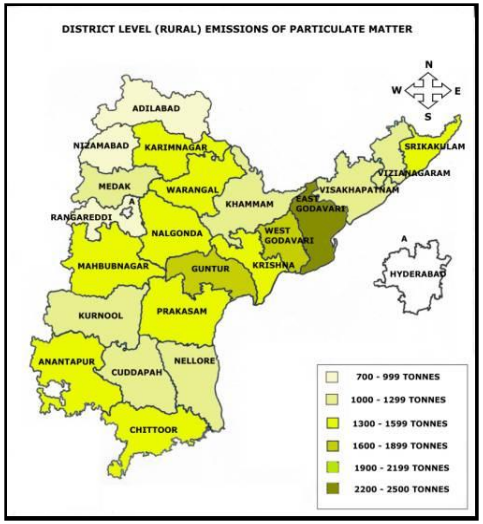
Education

Climate

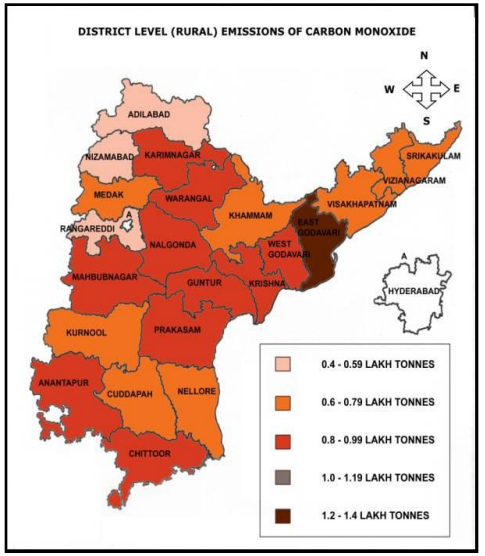
Socio-cultural factors

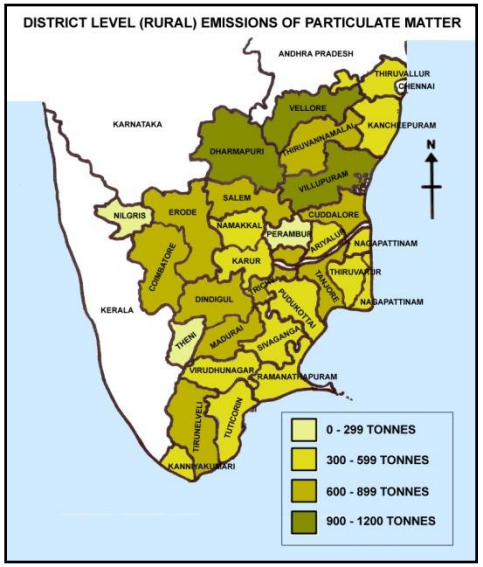
Energy market structures

District level emissions of health damaging pollutants in Southern India (USEPA-IES)

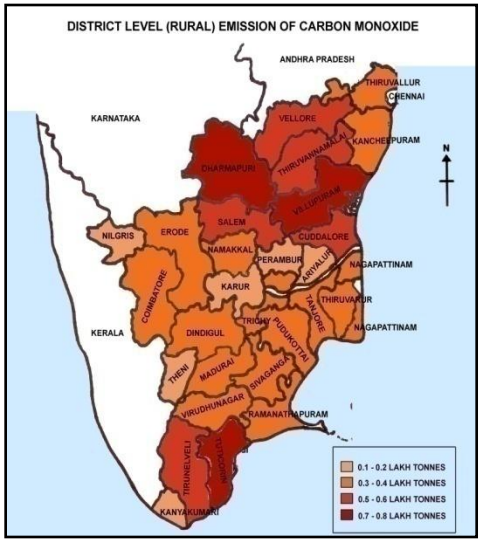


Andhra Pradesh

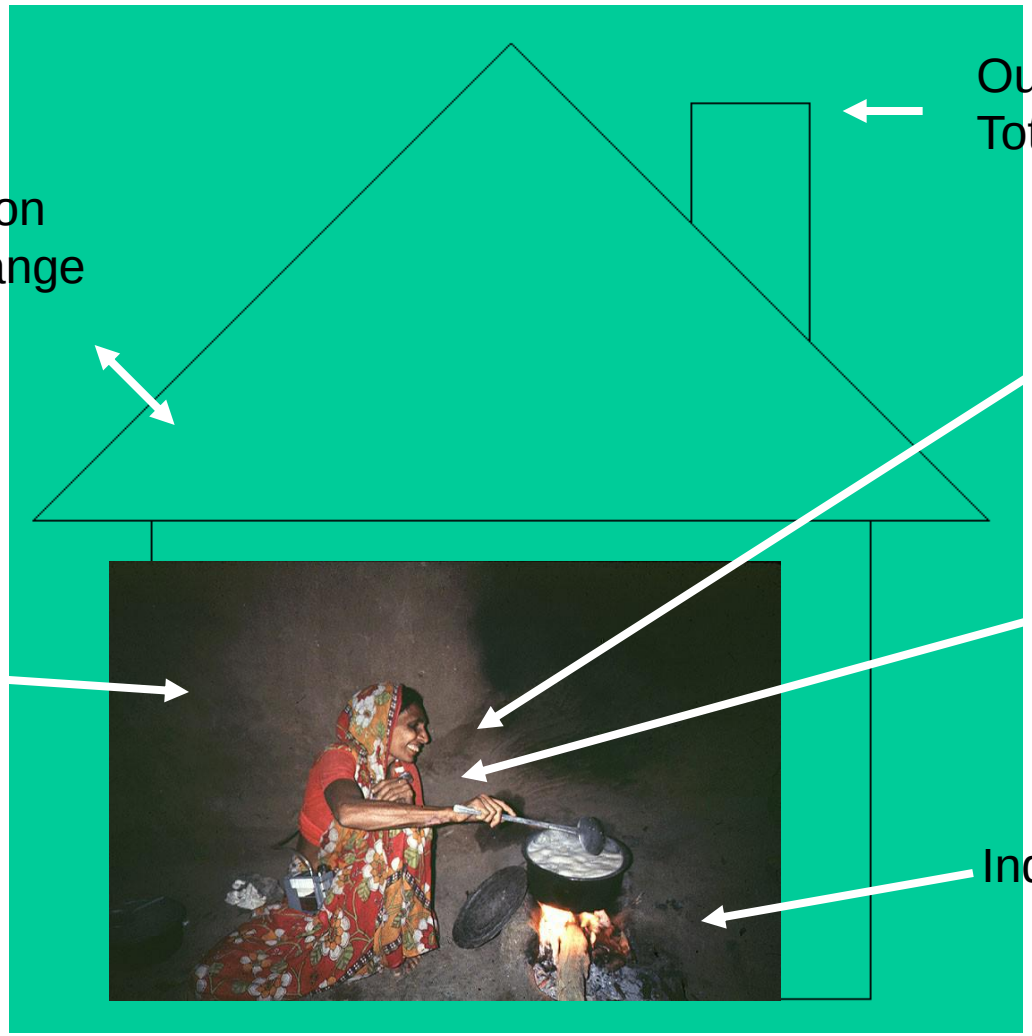




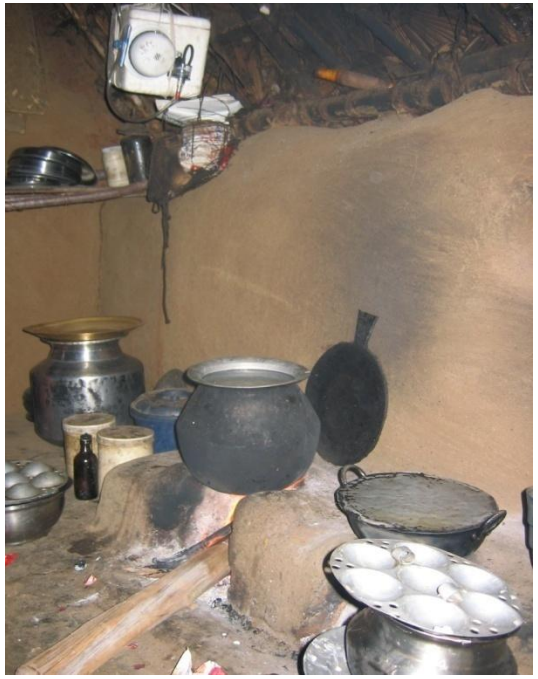
Tamil Nadu



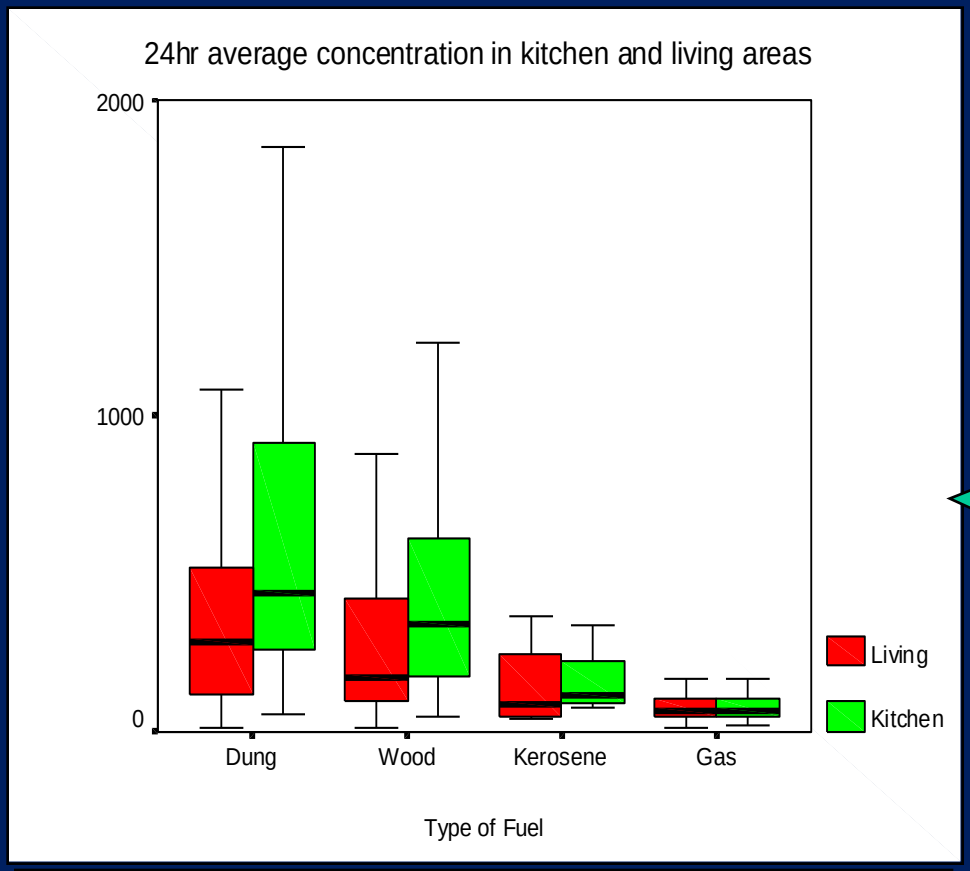
What Characteristics Can Be Measured?



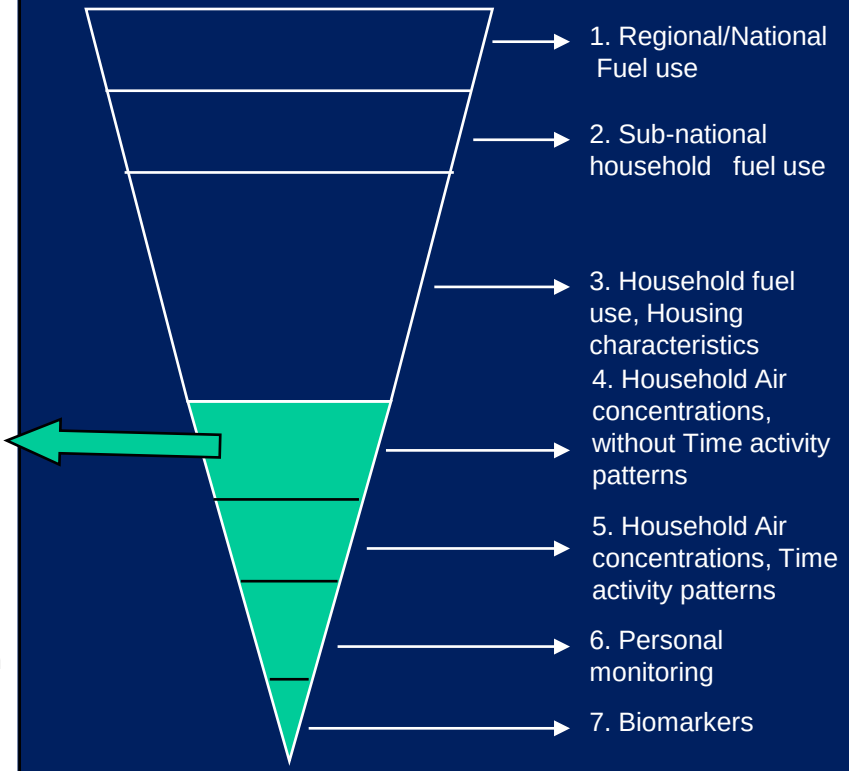
Fuel & stove use patterns; Time-activity patterns



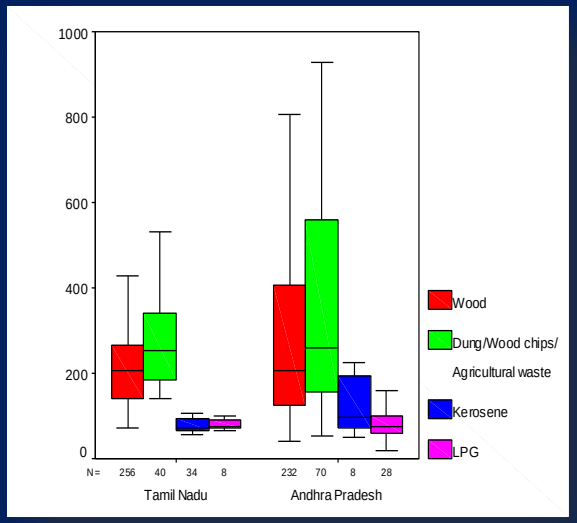
Area Concentrations (UNDPCap21)

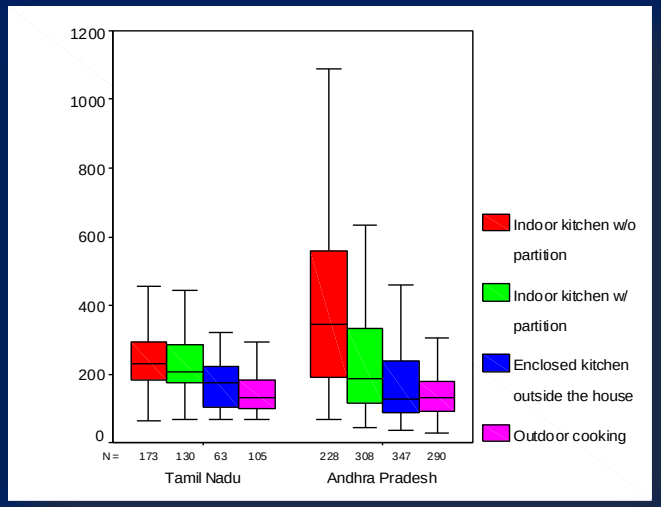


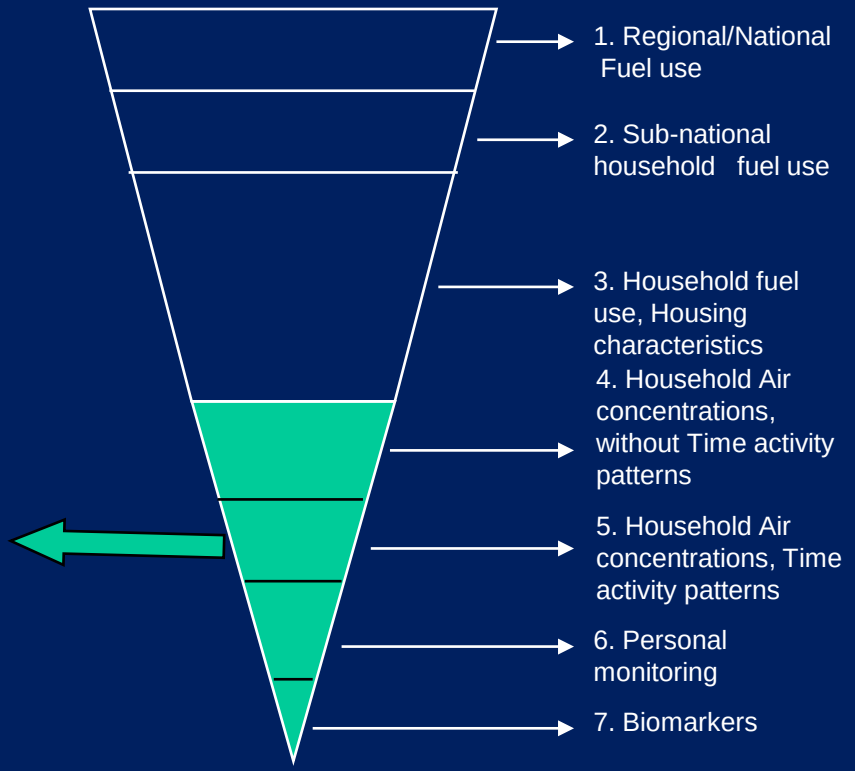
Balakrishnan, Padmavathi et.al 2000



Exposures

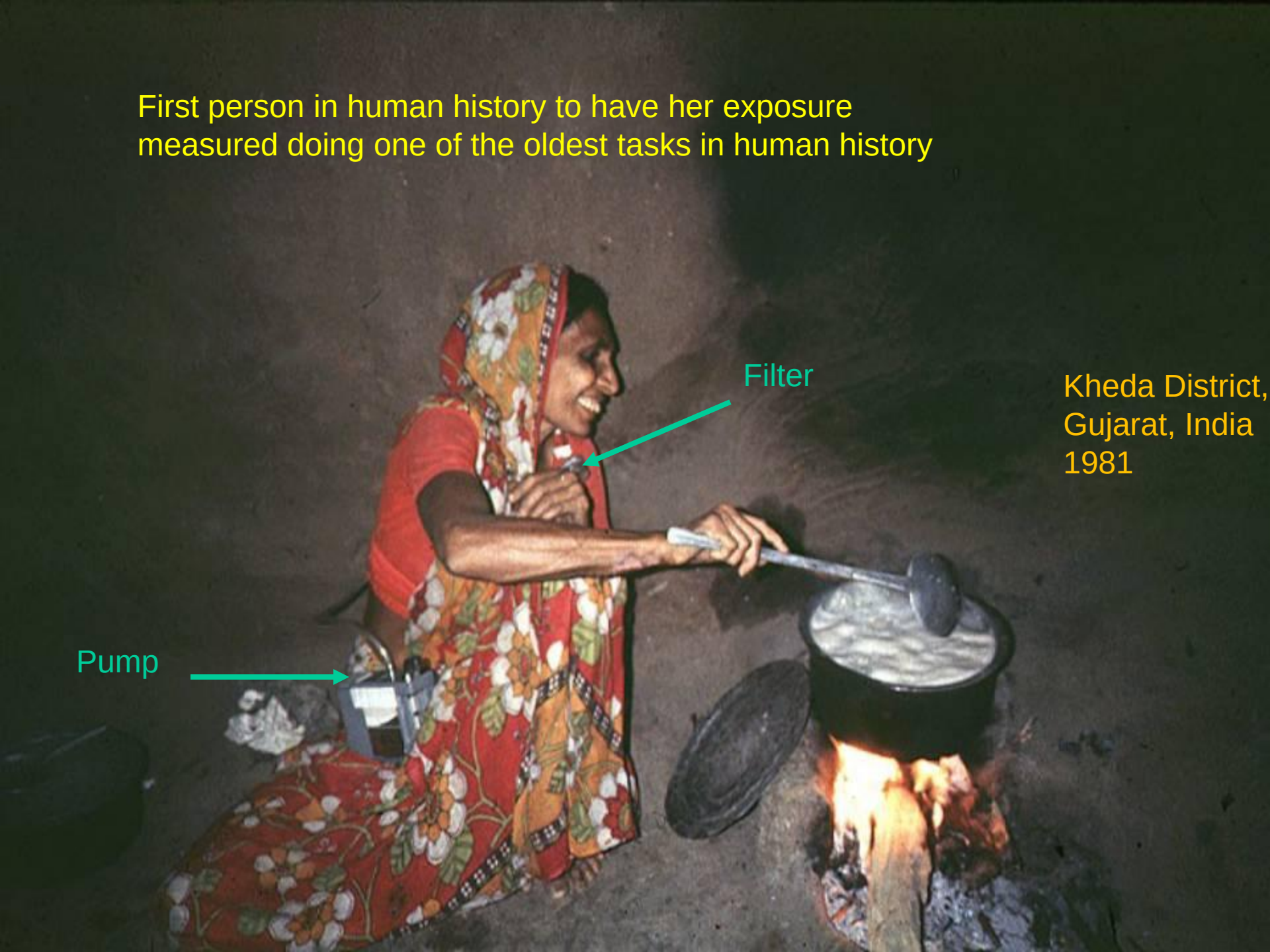




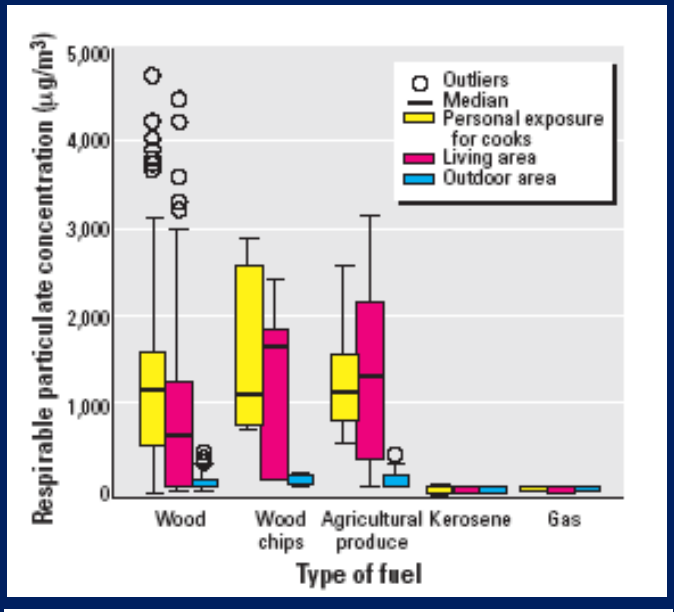


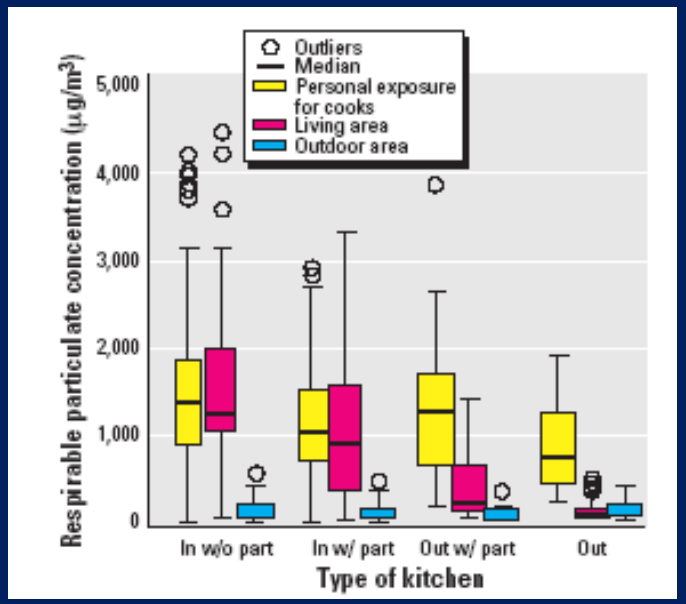
Balakrishnan, Padmavathi et.al 2000; 2002

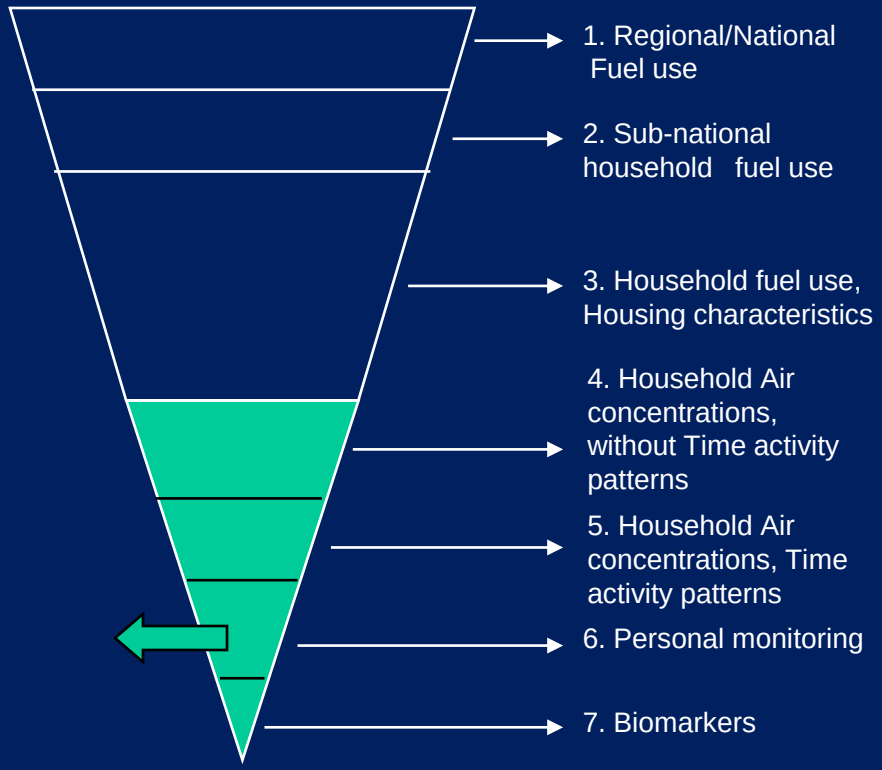
First person in human history to have her exposure measured doing one of the oldest tasks in human history



Kheda District,
Gujarat, India
1981







Balakrishnan, Padmavathi et.al 2002 Global Health Action 2011, 4: 7226

Epidemiological studies – Health outcomes

Completed

- TB
- ALRI
- COPD
- Stove intervention studies

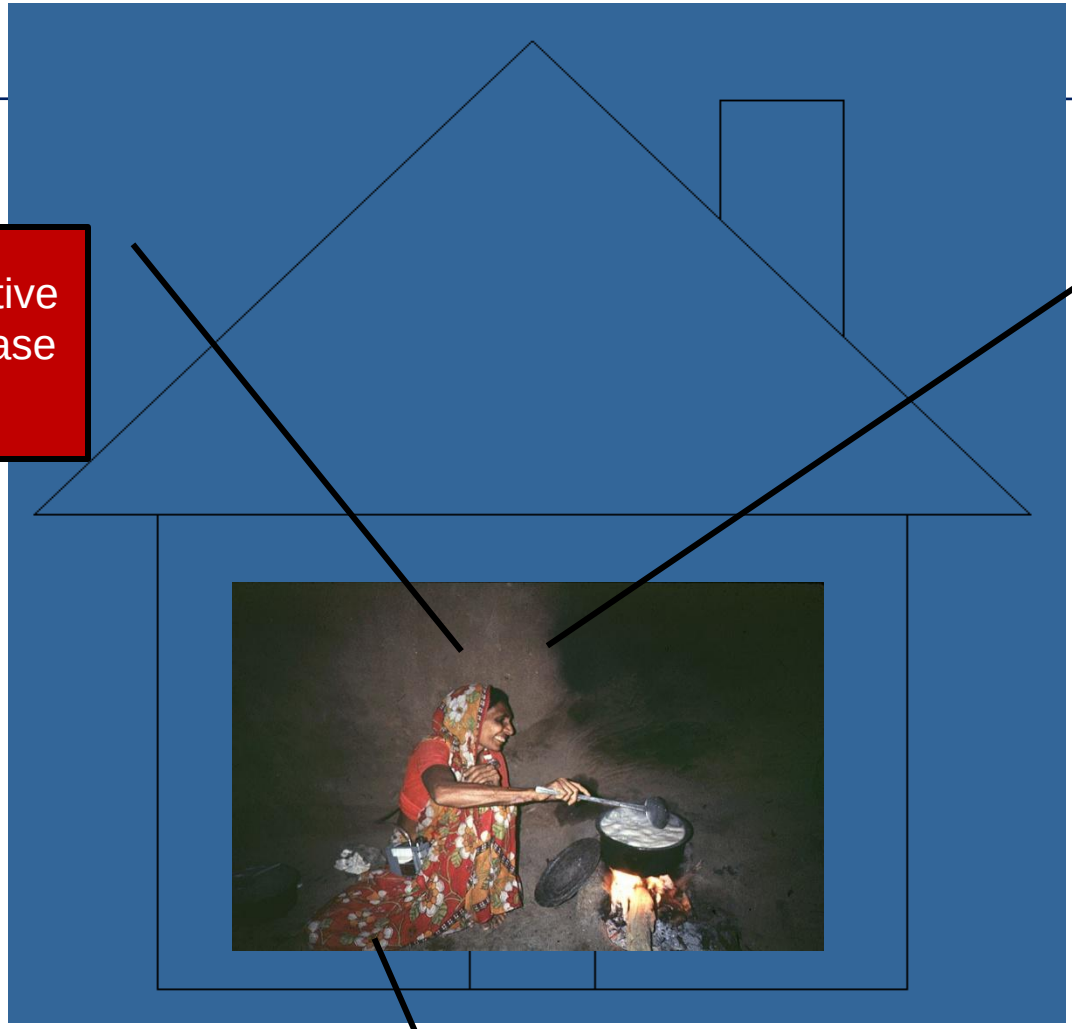
TAPHE study -ICMR urban-rural cohort

- Asthma
- LBW
- COPD
- Currently in progress – HAPIN - Intervention study

Rationale

Chronic Obstructive Pulmonary Disease
RR: 2.0-4.0

Acute Lower Respiratory Infection
RR: 2.0 -5.0



Studies in non smoking rural women using biomass from South India were very few

Two studies from India examining association between biomass and ARI in children and none from South India

Tuberculosis
RR: 1.5-3.0

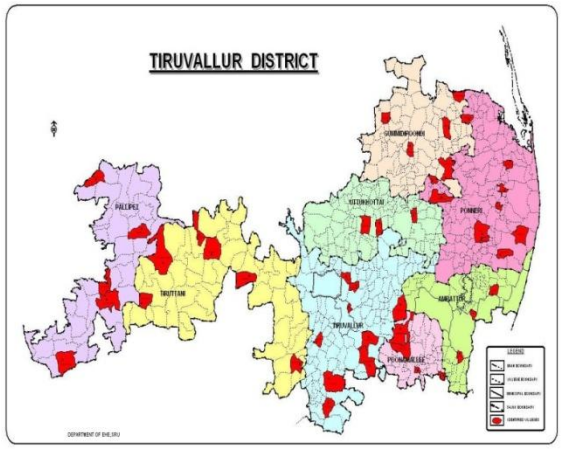
Previous studies shows equivocal evidence

Summary of the Respiratory studies

Study - I	Study - II	Study - III
Acute Respiratory tract infection	COPD	Tuberculosis
Cohort study design children under 5	Cross Sectional Study Adult rural women	Case control study Hospital based
RR -1.38	Prevalence -2.4%	OR not significant

Materials & Methods - COPD

- Study design: Cross sectional study; January – May 2007
- Sample size: 900 subjects based on the based on expected 10% prevalence of COPD; α of 0.05; power of 0.80
- Study Area: Thiruvallur District in Tamil Nadu
- Sampling method – cluster sampling (20 females from 45 villages)
- Data collection – As per GOLD criteria



Results: Prevalence rate of COPD in the study population

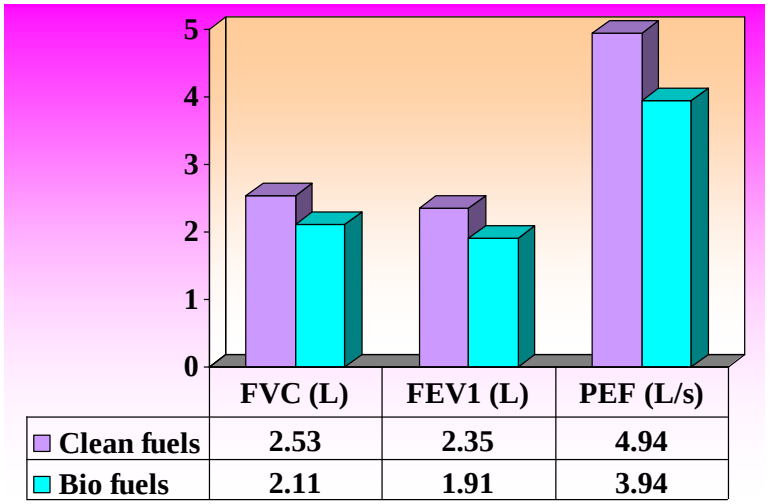
Variables		Prevalence rate (%)
Overall prevalence		2.44% (1.43, 3.45)
Age	30 -50	1.8 (0.73, 2.87)
	51 -70	3.6 (1.49, 5.70)
Main occupation	Outdoor	2.25 (0.87, 3.63)
	Indoor	2.63 (1.16 ,4.1)
Literacy status	Literate	1.5 (0.19, 3.19)
	Illiterate	2.7 (1.5, 3.9)
Fuel type	Clean	2.0 (0.26,4.26)
	Biomass	2.5 (1.38,3.61)

Priscilla,Balakrishnan, Padmavathi et.al ; Global Health Action 2011, 4: 7226

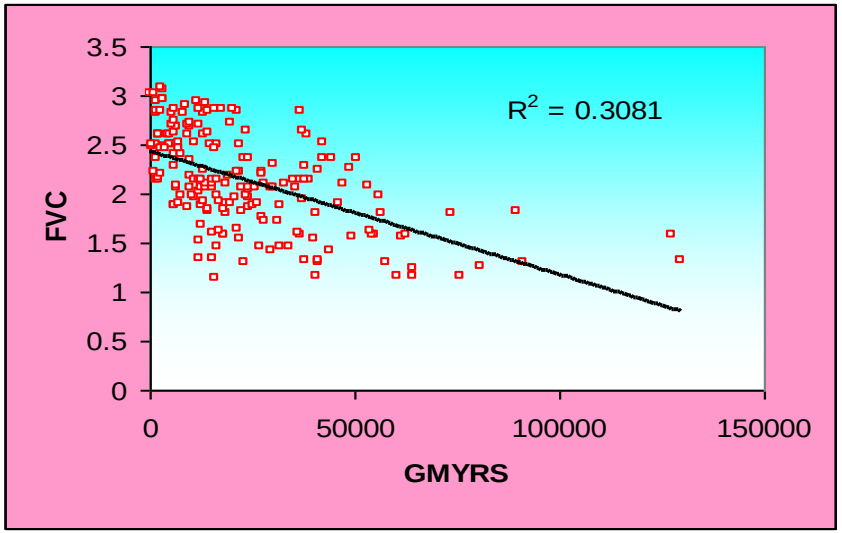
Air pollution and Health Studies – SRMC & RI

Exposure to respirable particulate matter from bio-fuel combustion and pulmonary function in women

Area	Methods	Key Results
IAP - PFT	Exposure assessment (Area concentration and years of cooking) and PFT Cross sectional study	•Lung functions were significantly higher in clean fuel users than biofuel users •Significant negative association of FVC, FEV1 & PEF and Microgram years with r value of -0.59, -0.59 and -0.54



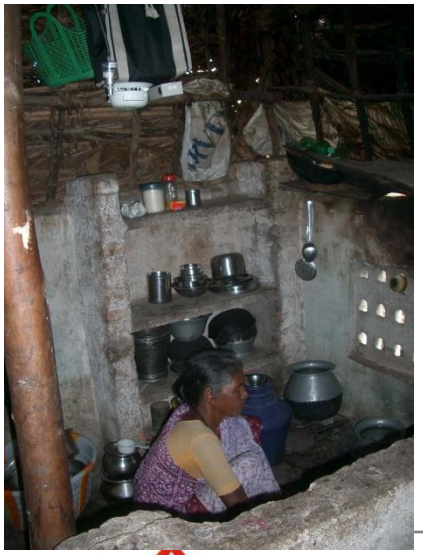
	FVC (L)	FEV1 (L)	PEF (L/s)
Clean fuels	2.53	2.35	4.94
Bio fuels	2.11	1.91	3.94



Exposure response relationship– ICMR Urban – Rural Cohort - TAPHE study (Yet to be published)

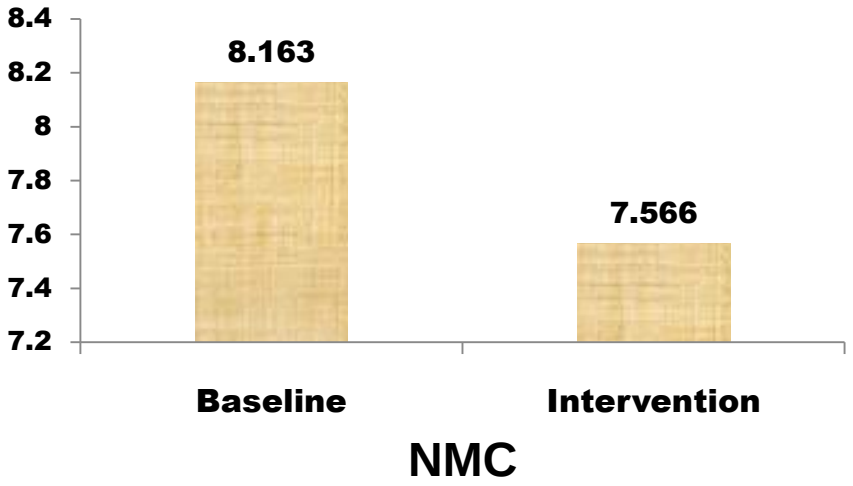
- Established a rural-urban cohort of adult men and women for air pollution related health effects - chronic respiratory symptoms and lung function in Tamil Nadu – *can serve as baseline for future comparisons.*
- Overall Prevalence of any chronic respiratory symptoms in subjects of the adult cohort – ranged from 2 to 16%
- 10% increase in prevalence of respiratory symptoms per 10µg/m3 change in 24-hr PM2.5 concentrations
- 10µg/m3 change in 24-hr PM2.5 concentrations was significantly associated with a lower FVC (17ml) and a lower FEV1 (15ml)

Intervention studies- Stove Users



Air pollution and Health Studies – SRU
Interventional Studies – Improved Cook stoves

Area	Methods	Key Results
IAP – NMC	Exposure assessment and NMC Cross sectional study	•Significant reduction in particulate matter levels. •Significant improvement in health indicators
IAP-PFT Ongoing	Cohort study –AP – two year	•PM levels and PFT



SRMC & RI's involvement in IAP

Exposure assessment
in nearly 2000 households in the states of
TN, AP, Karnataka,
MP, WB, Uttaranchal

Exposure efficacy /M&E
for stove /fuel interventions

Co-benefits for health and climate change

Health assessment for members of a subset of these households

GBD 2000,GBD 2002,
WHO AQG 2006, IARC 2007
GBD 2008,GEA 2008;
BMC;Lancet articles

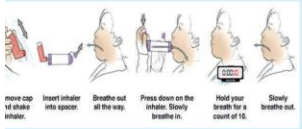
ICMR Mother child Cohort- TAPHE study

Currently in progress
Intervention study - HAPIN study

Reduction of Indoor air pollution

- Substitute solid fuels with LPG or electricity
- Locate kitchen outside living/sleeping areas
- Adequately ventilate kitchens
- Minimize exposure (e.g., smokeless chullahs)
- Behavioural changes

Recent Initiative by SRIHER
Pulmonary Rehabilitation center



SRI RAMACHANDRA
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(DEEMED TO BE UNIVERSITY)

PULMONARY REHABILITATION CENTRE

Pulmonary Rehabilitation Centre

GROUND FLOOR,
FACULTY OF PHYSIOTHERAPY BUILDING,
(Behind 'G' Block)
PHONE : 044-24675512 – 15
EXTN : 8135 / 434 / 8083
Email : pulrehab@gmail.com

Department of Pulmonary Medicine
Sri Ramachandra Medical College and Research Institute
Porur, Chennai - 600 116

WHAT IS PULMONARY REHABILITATION (PR)?

ulmonary rehabilitation is an outpatient program
or patients with chronic lung diseases, who have
espiratory symptoms that result in decreased
aily activities or a decrease in health related
uality of life. Chronic lung diseases are chronic
bstructive pulmonary disease (COPD), interstitial
ung disease, bronchial asthma, bronchiectasis
nd cystic lung disease.

he pulmonary rehabilitation program is
onducted by a multidisciplinary team which
ncludes Chest physician, physiotherapist,
espiratory therapist, psychiatrist, psychologist,
utritionist, social worker, nurse ,educationist and
yoga therapist .They are all trained in pulmonary
ehabilitation.

**he pulmonary rehabilitation program is
esigned to improve health related quality of
fe, improve exercise tolerance, and decrease
ospitalization.**

**WHICH PATIENT NEEDS PULMONARY
EHABILITATION?**

ulmonary rehabilitation is for people with chronic
ung diseases, pre & post lung transplant patients
nd people who are exposed to indoor/outdoor
ollution, having breathlessness, cough, reduced
bility to walk or work.

**WHY DO YOU NEED PULMONARY
EHABILITATION?**

you have been diagnosed with any one of the

find it difficult to do day to day activities, you may benefit from this program.

First you will be examined by a qualified Chest physician and after assessment ,you will be referred to the rehabilitation team members.

Pulmonary rehabilitation program consists of one hour of supervised exercises like treadmill, weight training equipment and one hour of education on nutrition, medications, wellness and living with lung disease. for 2 to 3 times a week, for 6 to 12 weeks.

The exercise will improve your breathing and functional ability.

You will be educated about breathing exercises, sputum clearance, oxygen therapy, inhaler technique and emotional support which will improve your ability to care for yourself.

WHAT BENEFIT YOU GET?

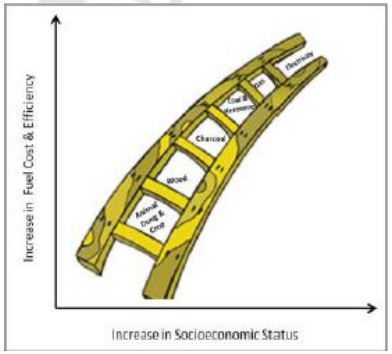
Pulmonary rehabilitation helps you to improve

- symptoms like breathlessness decreases
- muscle strength improves, endurance improves.
- Nutrition improves with healthy eating
- better management of anxiety and depression
- Reduction or cessation of cigarette / beedi smoking .

By Dr.Vijayalakshmi Thanasekaraan
Pulmonolgist, SRIHER

Feasible

Realistic target setting makes the feasible more effective



Holistic capacity building makes the effective more feasible

Effective

To conclude……

Finally the public and policy-makers should be encouraged to understand by Medical Fraternity that it is neither necessary nor acceptable to wait for people to be healthy until people become wealthy.

Indeed, addressing such public health risks is an essential element for ensuring equity in quality of life among populations, and it is hoped that the information presented here represents a small, incremental step toward achieving that goal.

Thank you