HEALTH IMPACT OF AIR POLLUTION

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AIR POLLUTION

Outdoor

Indoor

Vehicular	Industrial Thermal power Stations	Pesticides	Biomass burning
NOx, SOx, CO, PM, VOCs, PAHs, trace metals	CO, SOx, NOx, PM, trace metals	OC, OP, C	NOx, SOx, CO, PM, VOCs, PAHs, trace metals

Particulate Matter (PM)
the prime concerned pollutant

PM_{10} : diameter < 10 microns

$PM_{2.5}$: diameter < 2.5 microns

Ultra Fine Particles(UFPs) : diameter < 0.1 microns

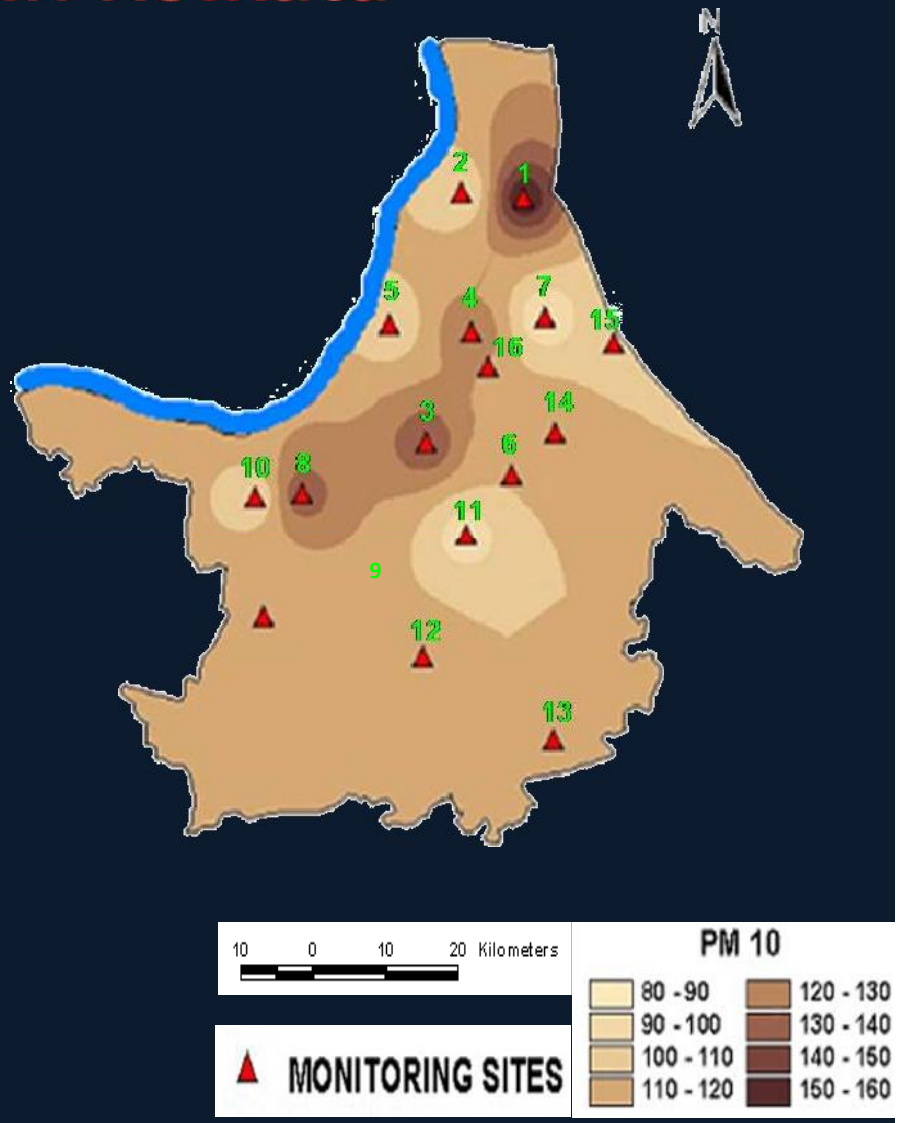
Smaller the size, greater the health risk

Air pollution in Kolkata

1. Ultadanga
2. Shyambazar
3. Minto Park
4. Moulali
5. Raj Bhavan
6. Picnic Garden

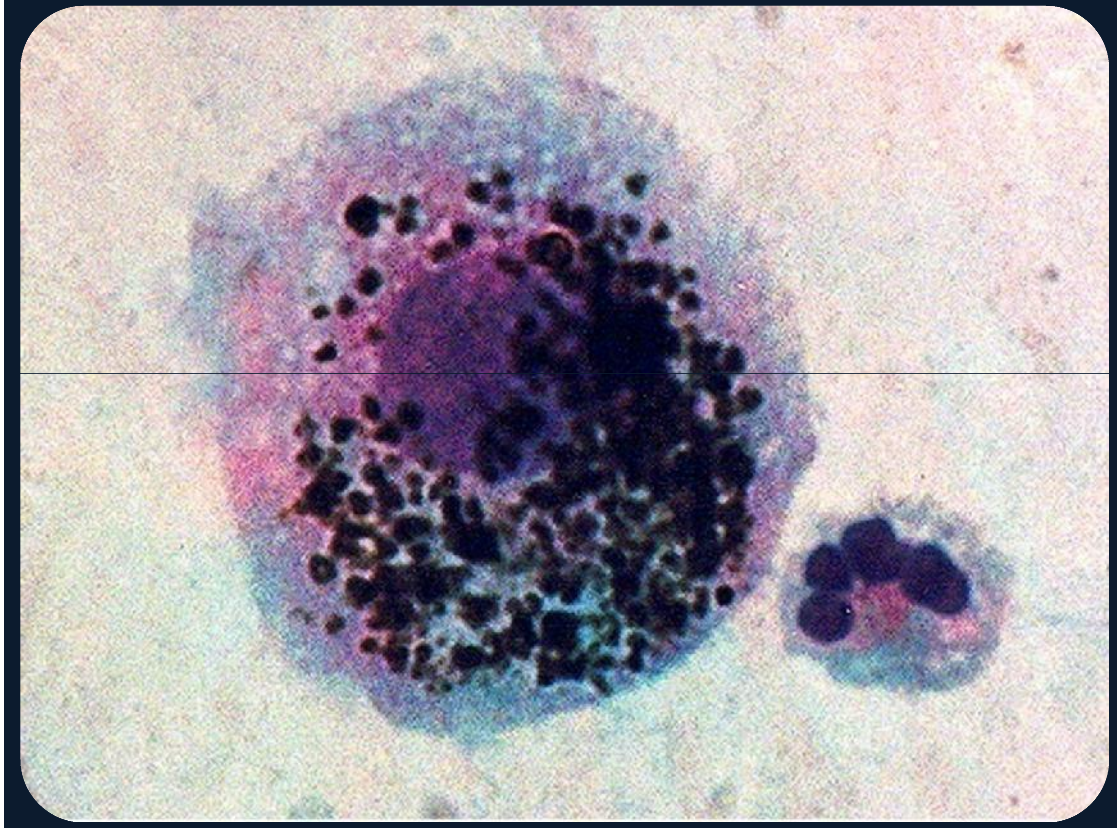
7. Beliaghata
8. Mominpur
9. Behala
10. Hyde Road
11. Gariahat
12. Tollygunge

13. Baishnabghata
14. Topsia
15. PCB
16. Park Circus



Annual average PM_{10} conc. during (2002-2005)

Alveolar macrophage - the big eater - a biomarker of pollution exposure



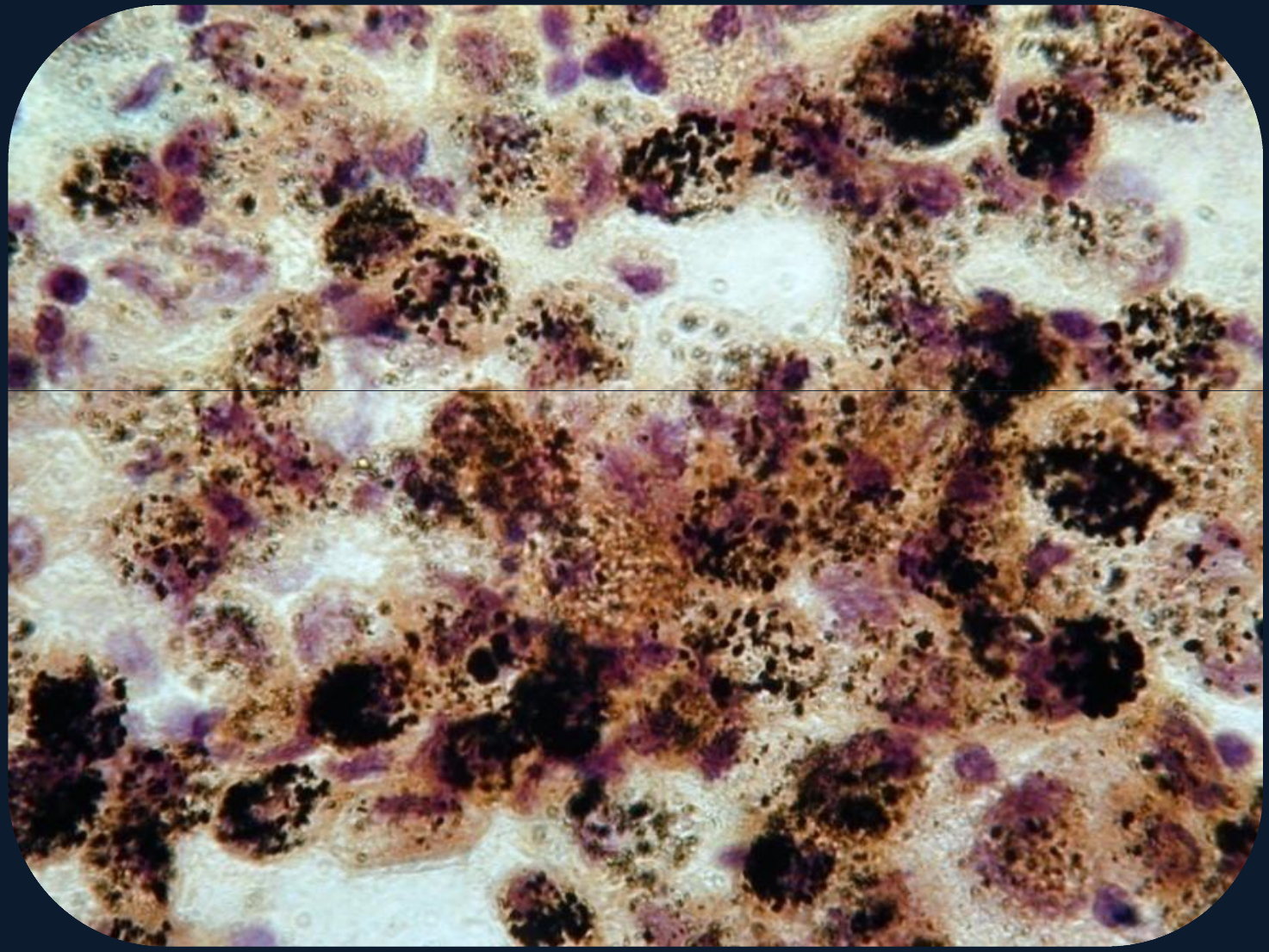
AM is the first line of defence in the lung & interact directly with toxic particles and gases

Phagocytosis, migration & secretion of AM is pivotal in pathogenesis of lung diseases

AM response varies with the level of pollutants

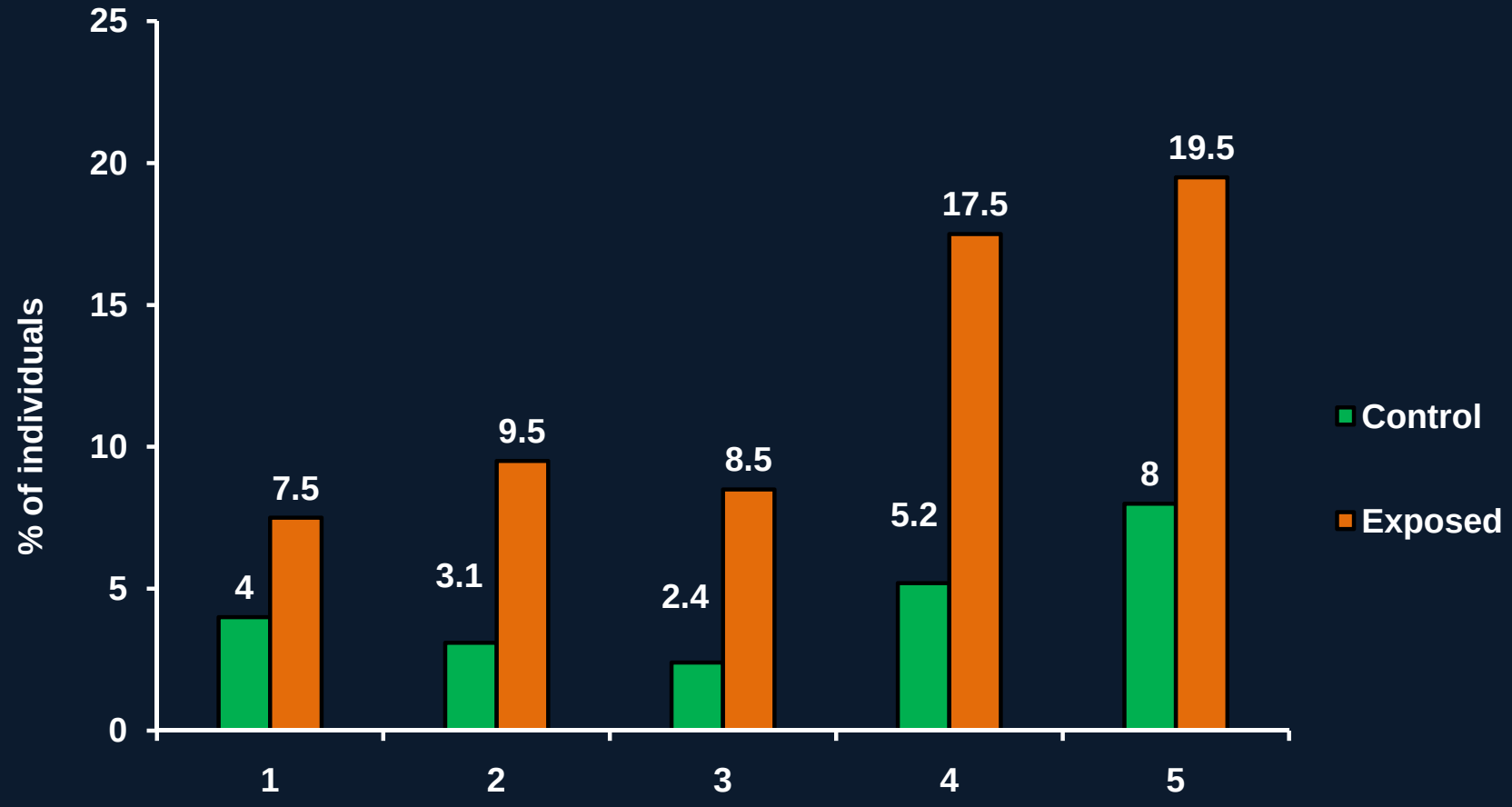
Easily accessible by non-invaisve procedure.

Alveolar macrophage filled with PM



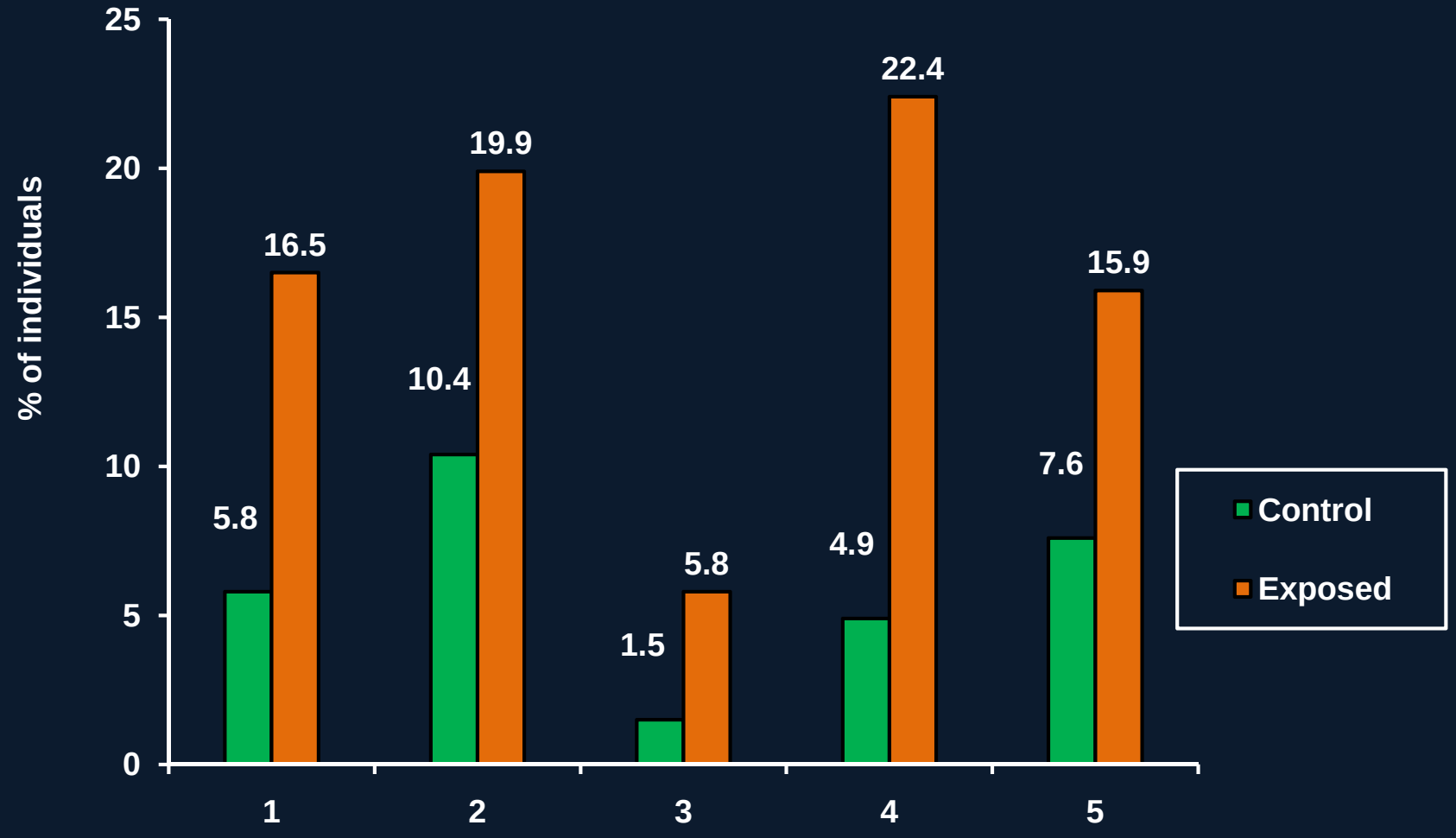
Air Pollution

Increases prevalence of upper respiratory symptoms



1. Sinusitis 2. Running/stuffy nose 3. Sneezing 4. Sore throat 5. Common cold & fever

Air pollution and lower respiratory symptoms



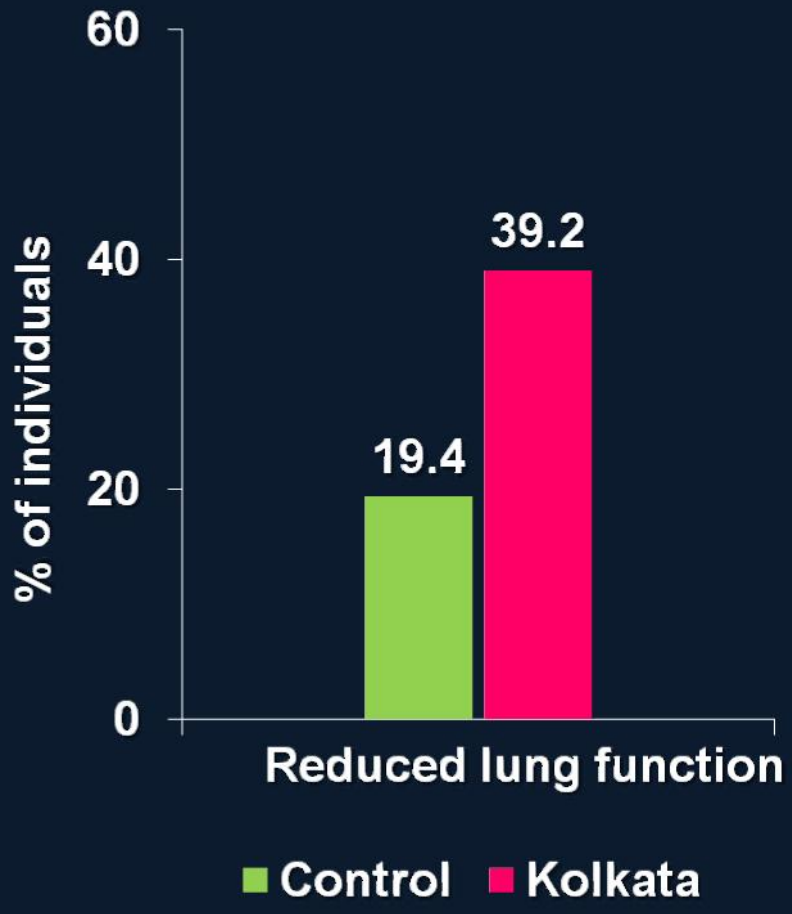
1. Dry cough 2. Cough with phlegm 3. Wheeze 4. Breathlessness 5. Chest discomfort

Children - the 'soft' target

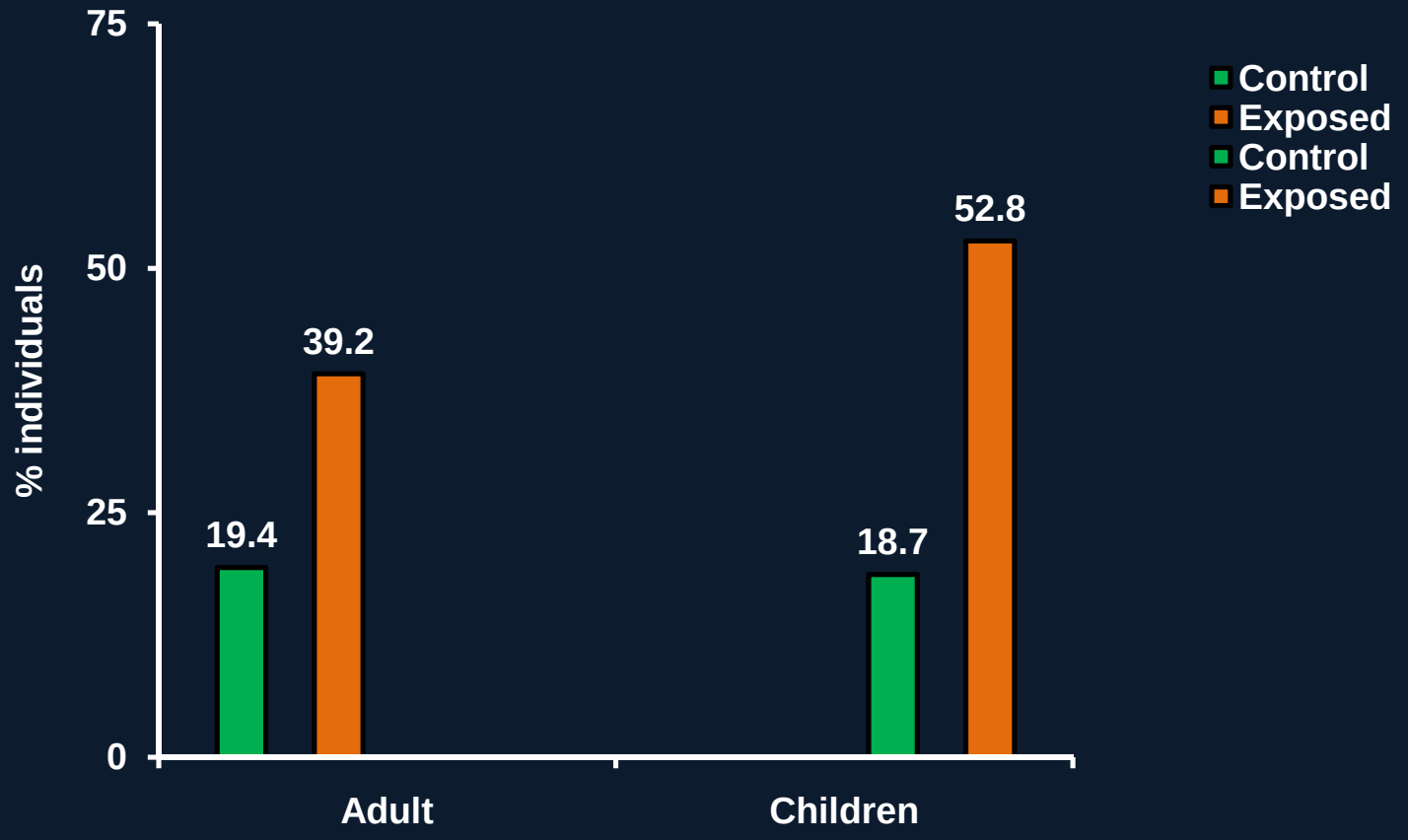
Children are the most vulnerable group

- Lower breathing zone and greater oxygen consumption
- Immunity not fully operational thus more susceptible target organs

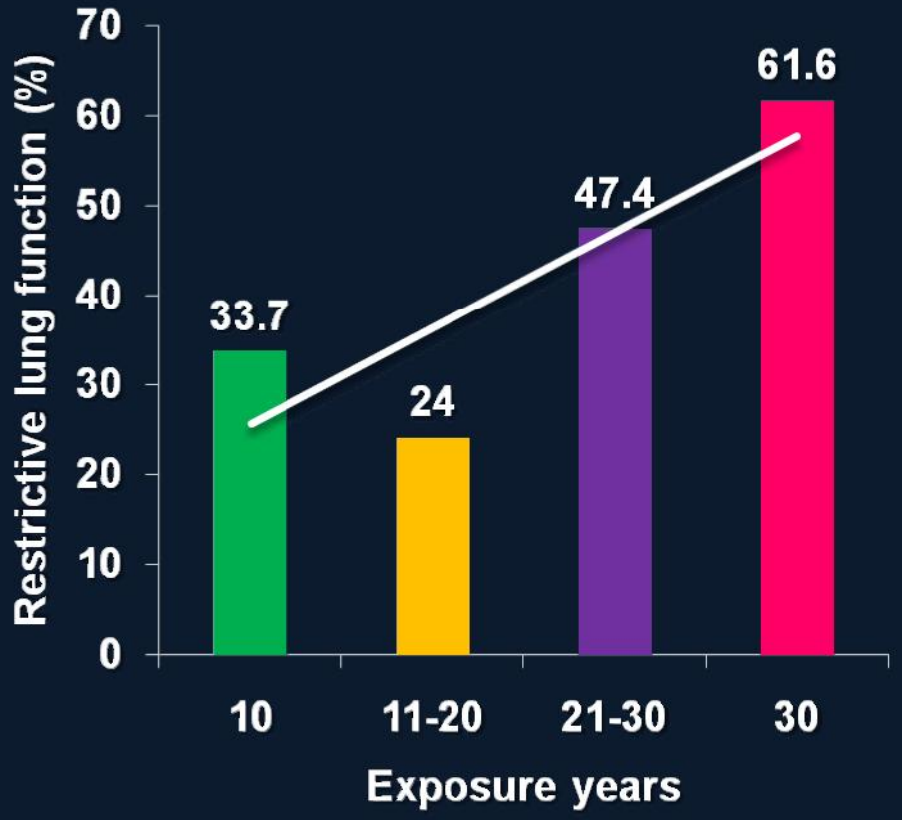
Pulmonary function test

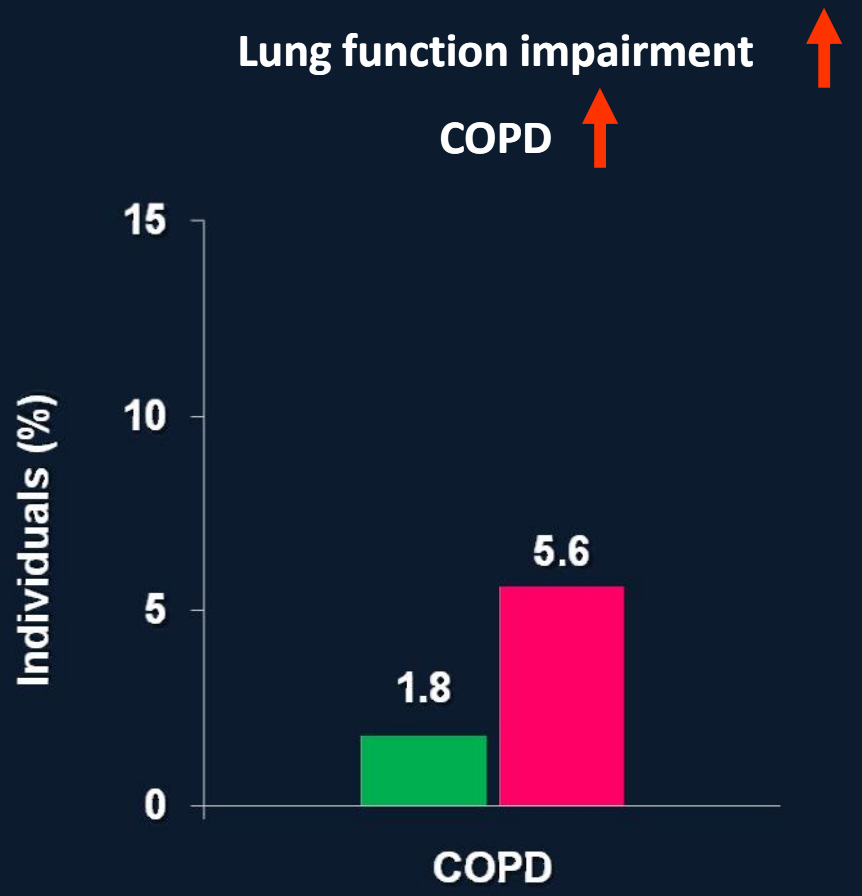


Air pollution adversely affects lung function



Lung function impairment

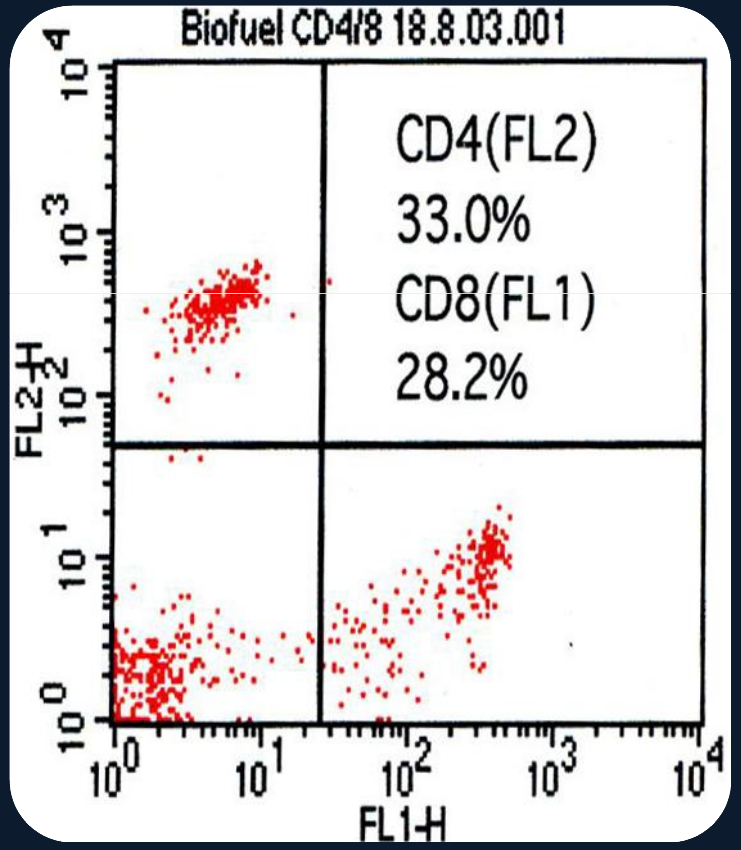




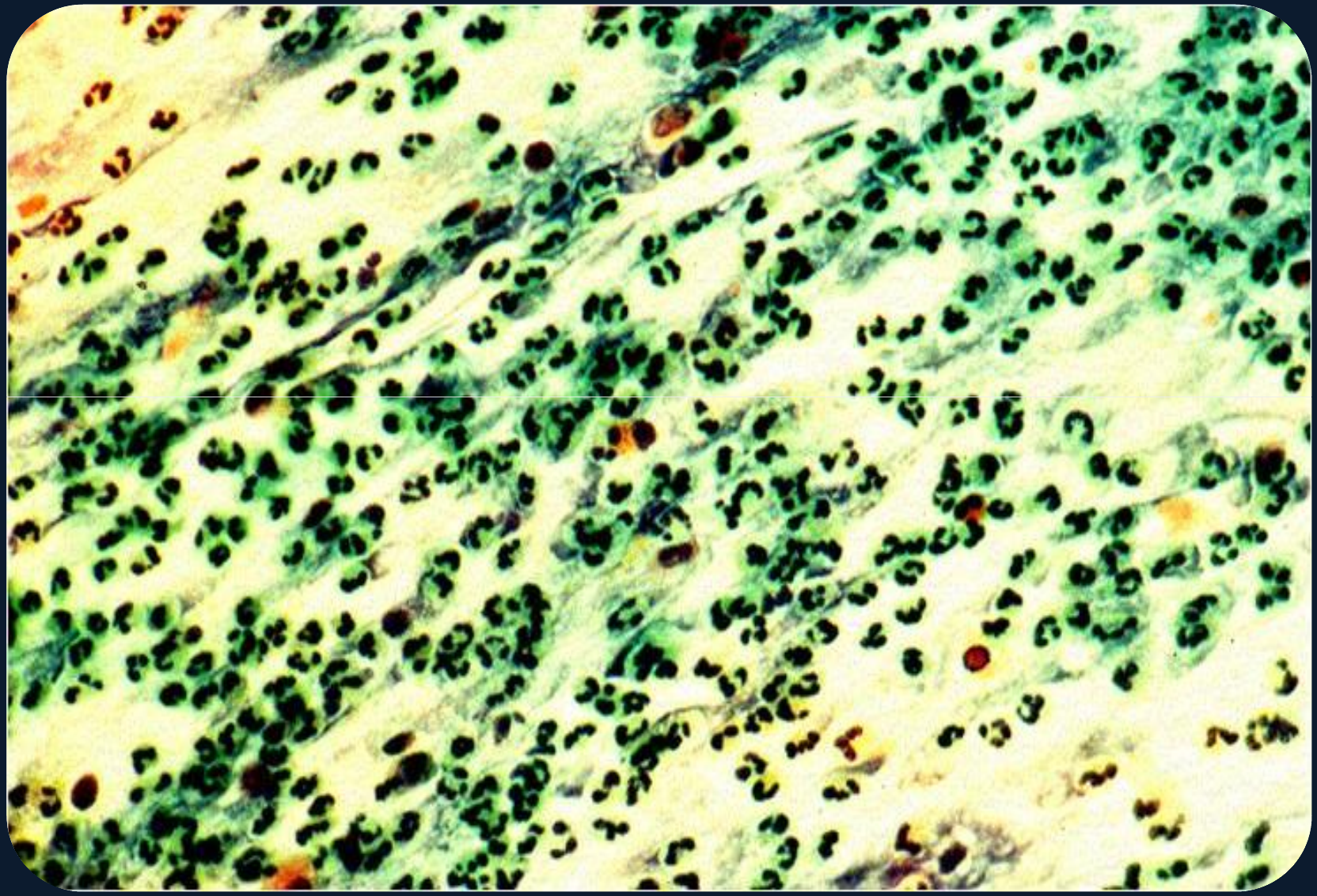
Alteration in immune status

increased susceptibility to disease

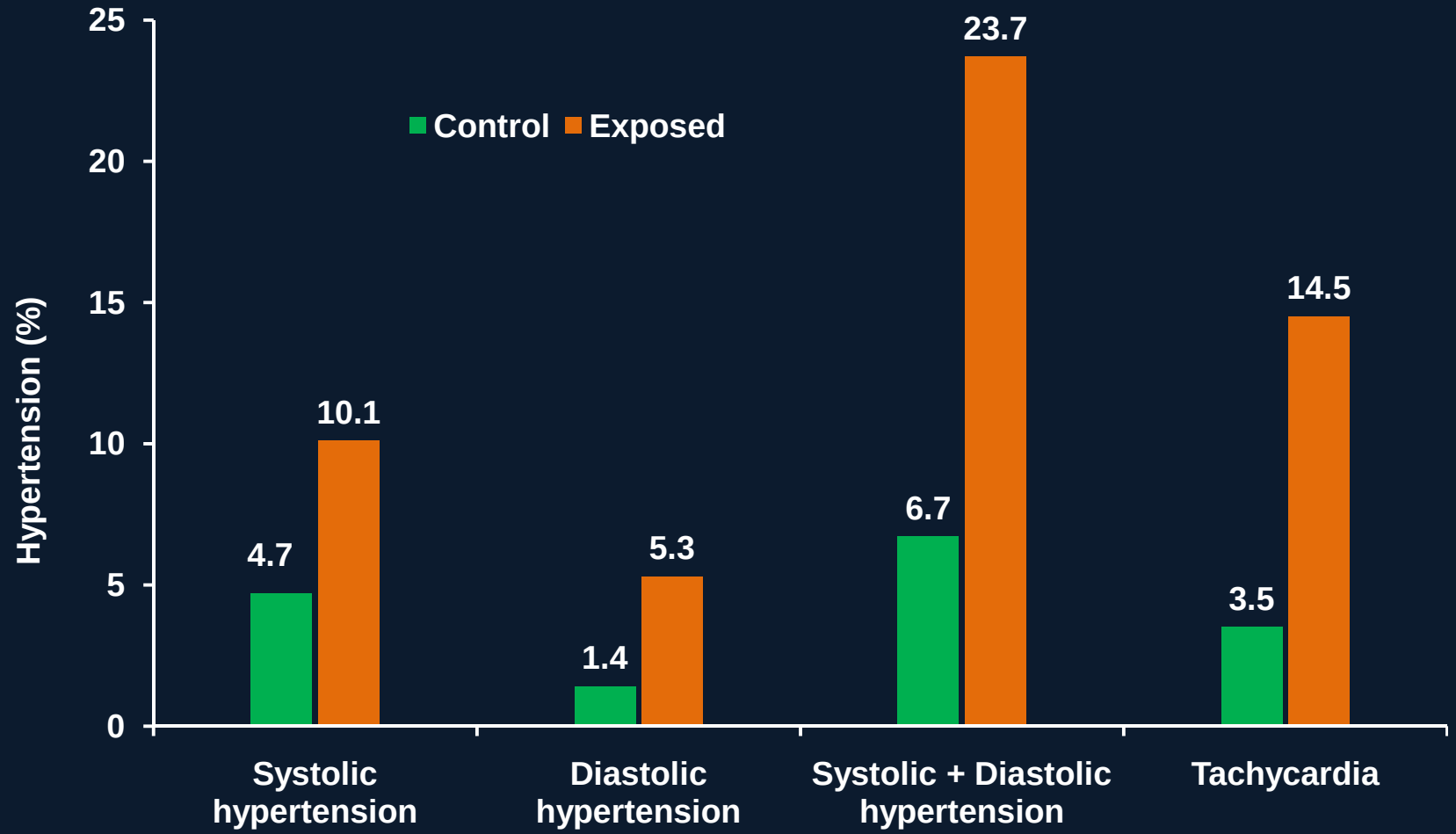
- ↓ suppression of CD4+ Th cells
- ↑ increase in CD 8+ Tc
- CD4:CD8 ratio 2:1 → 1:1
- ↓ decrease in CD19+ B cells
- ↑ increase in CD16+56+ NK cells



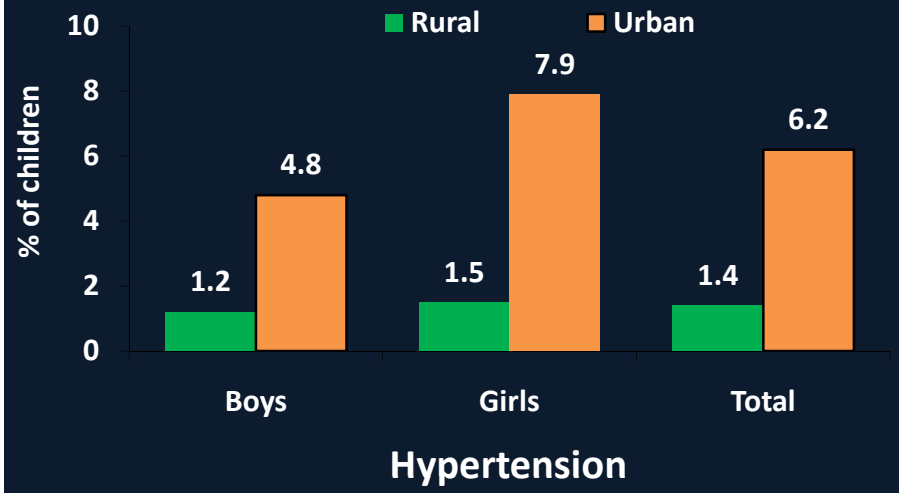
Airway Inflammation

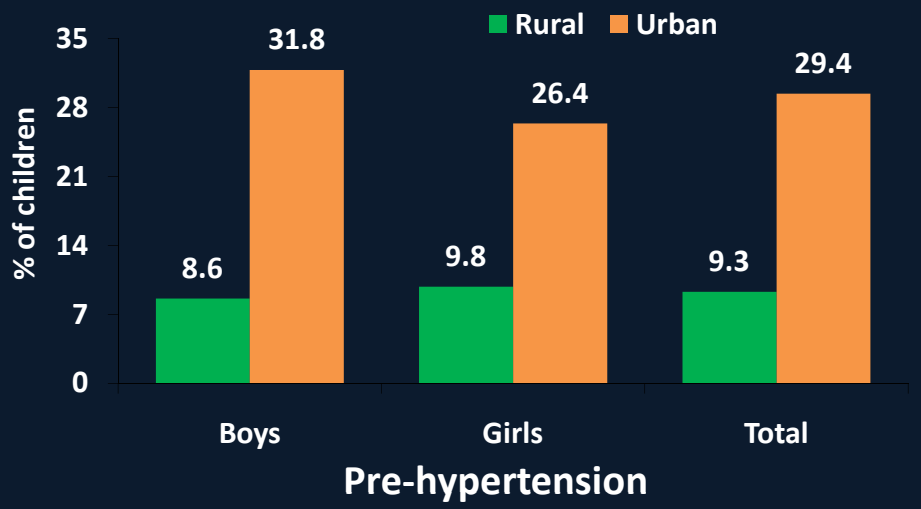


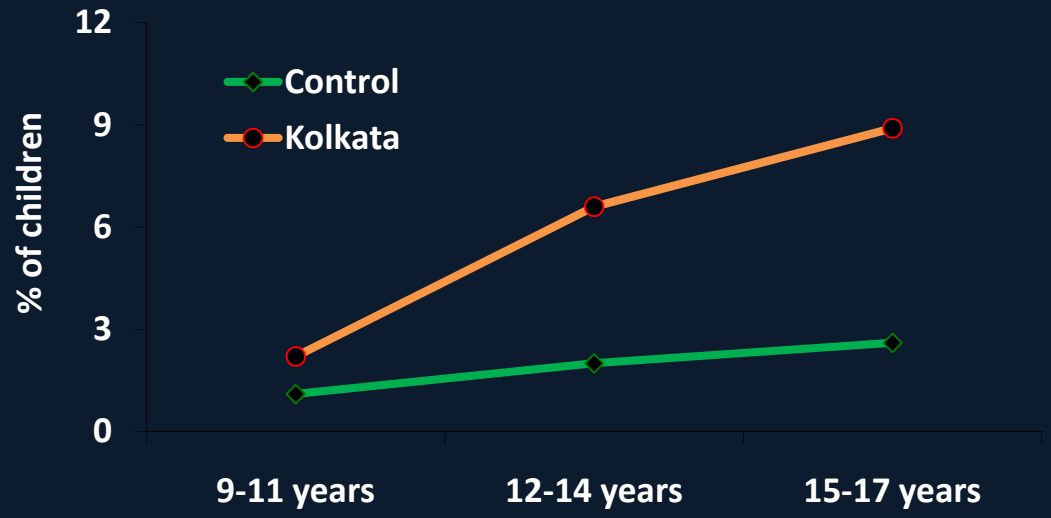
Air Pollution increases prevalence of Hypertension



Hypertension in children

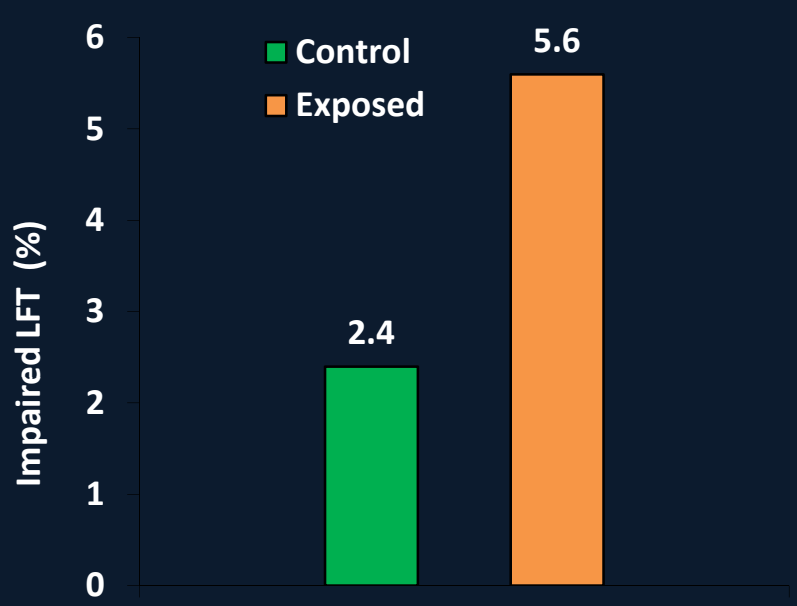


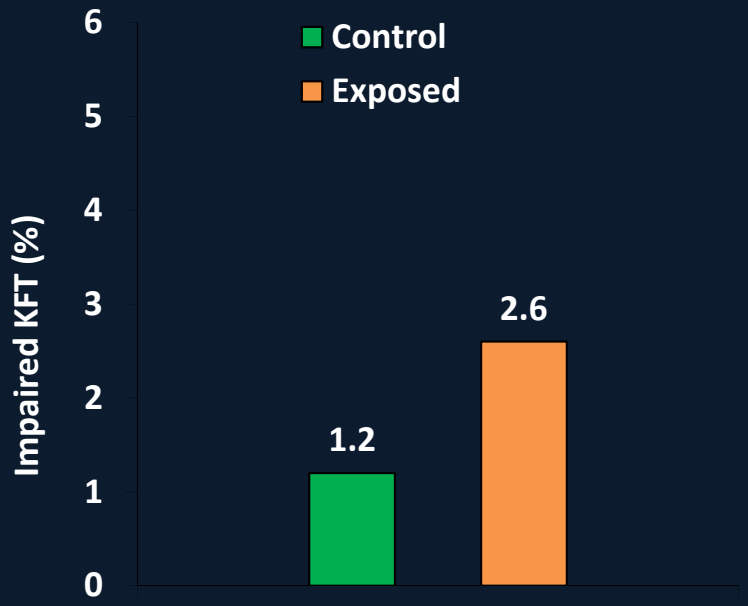




Prevalence of hypertension increased progressively with age

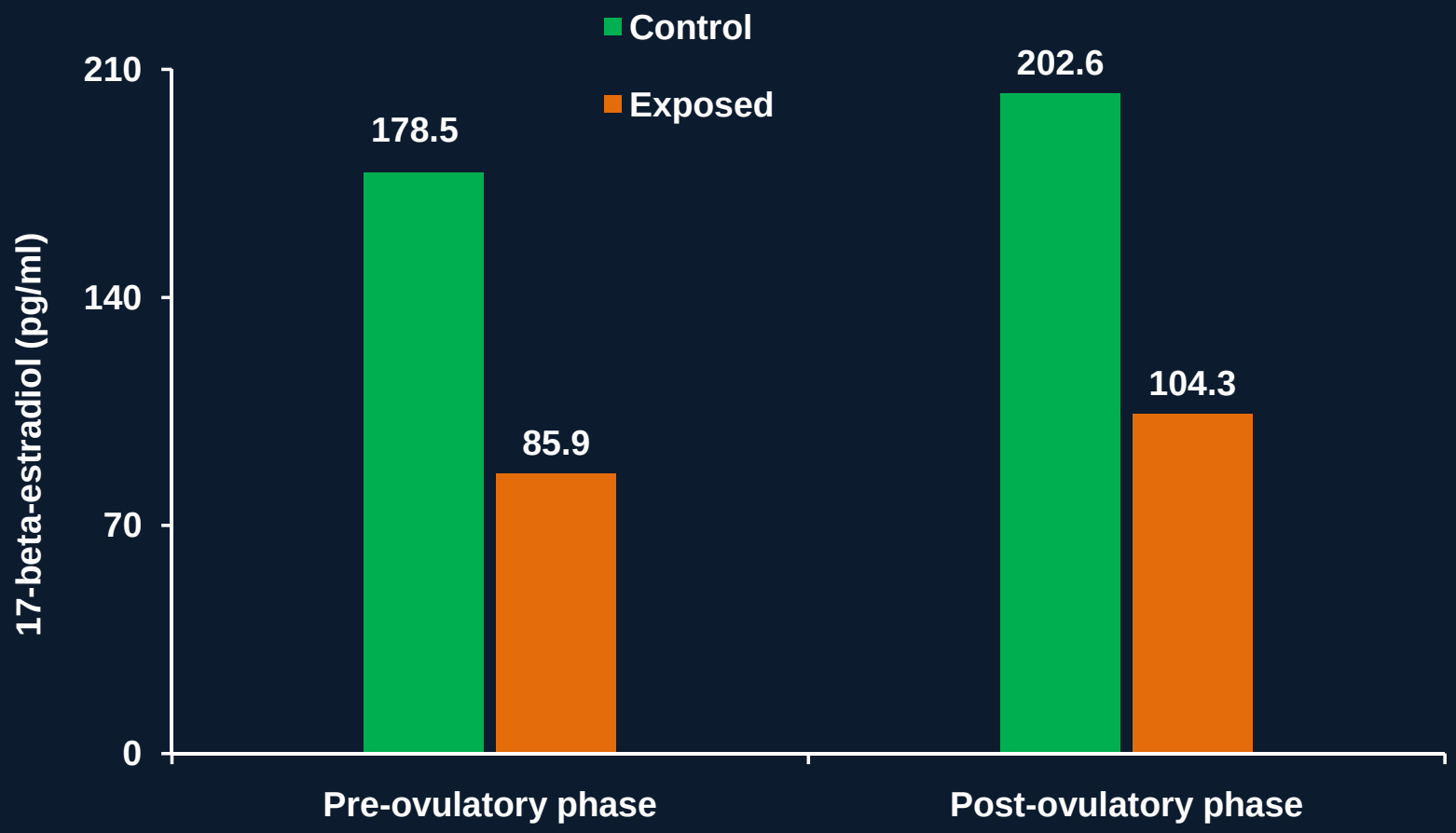
Liver and kidney function



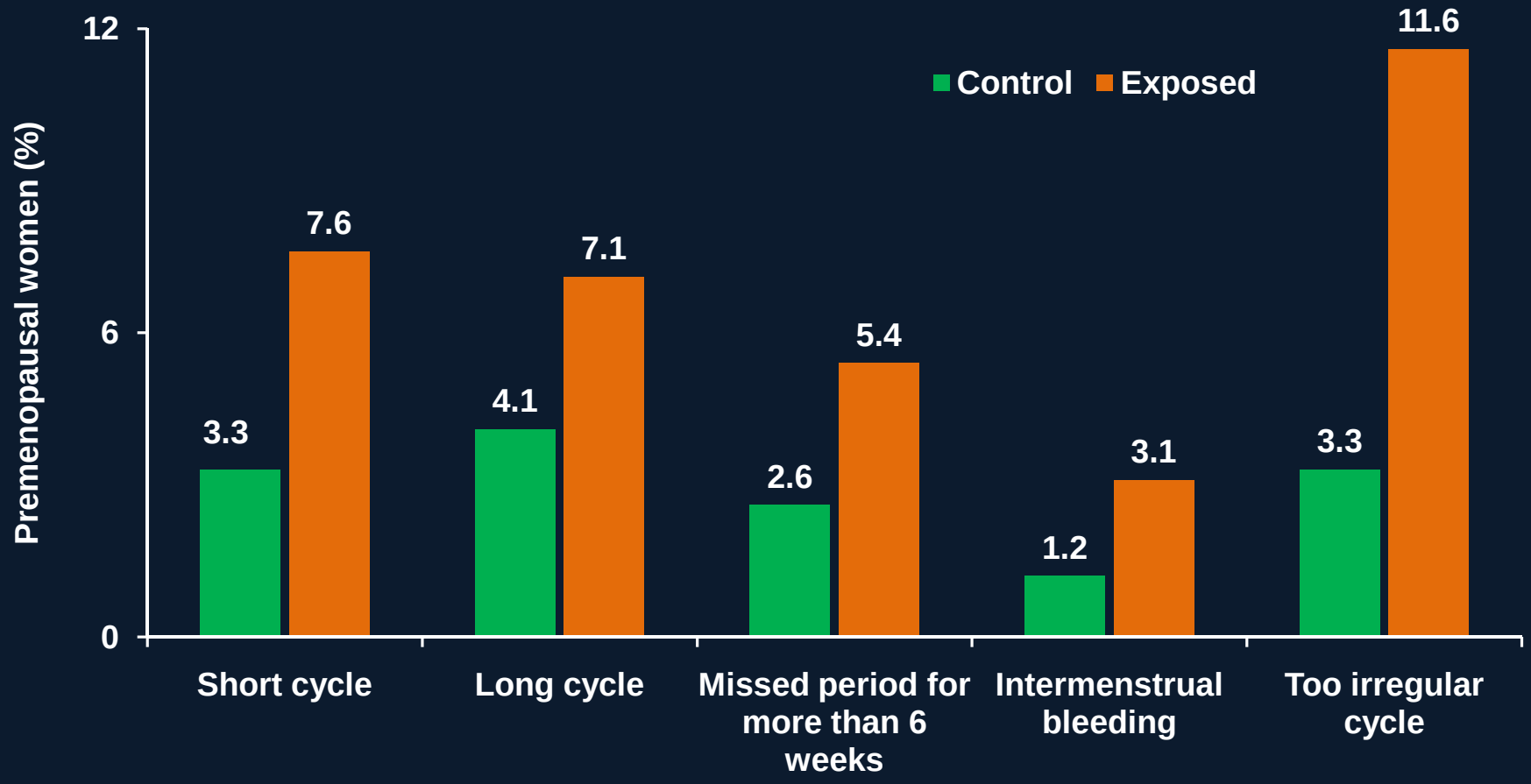


- 2-fold rise in liver and kidney function impairments
- 4-fold rise in diabetes: 7.2% in Kolkata vs. 1.8% in control

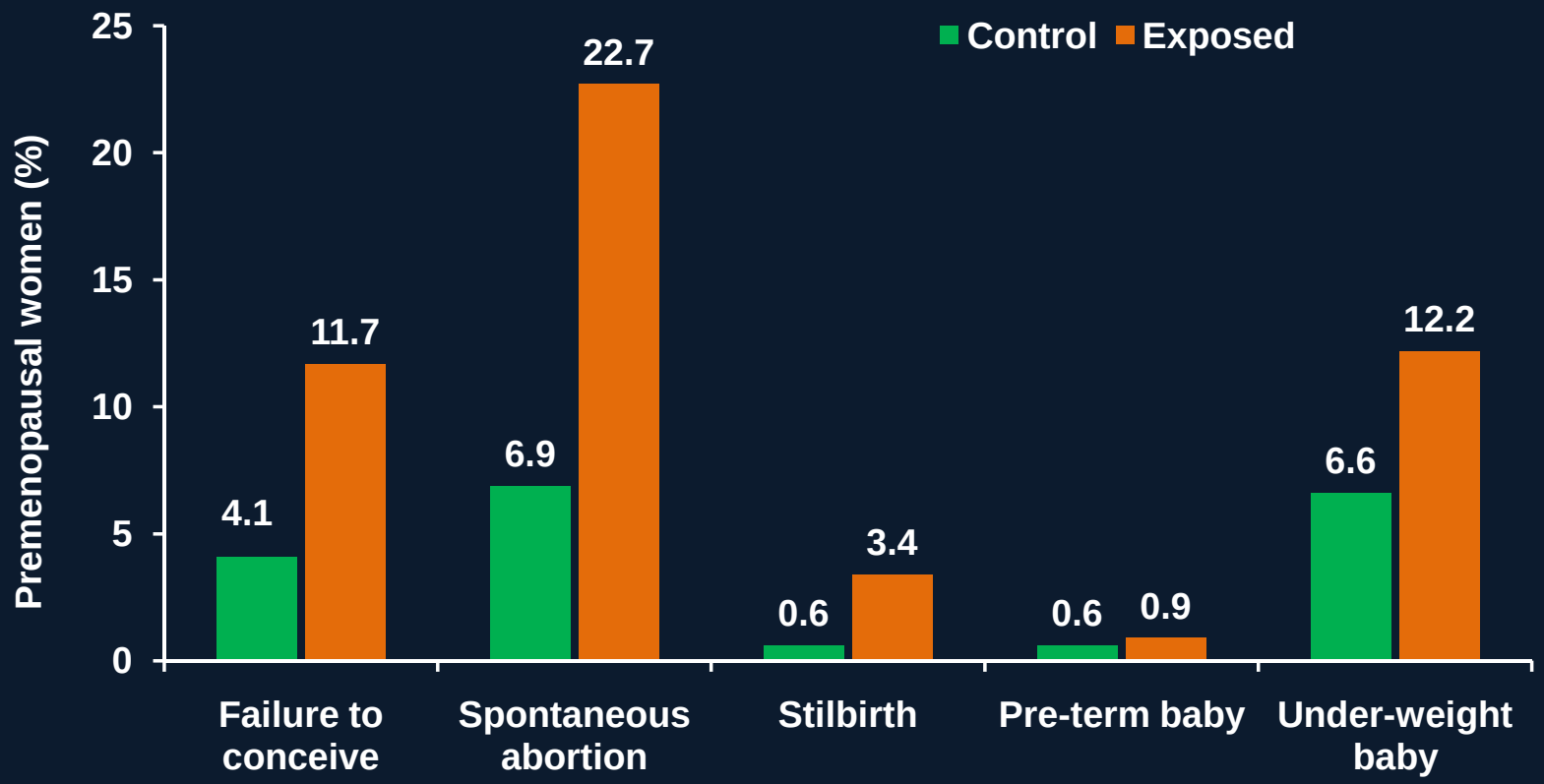
Air Pollution decreases serum estrogen



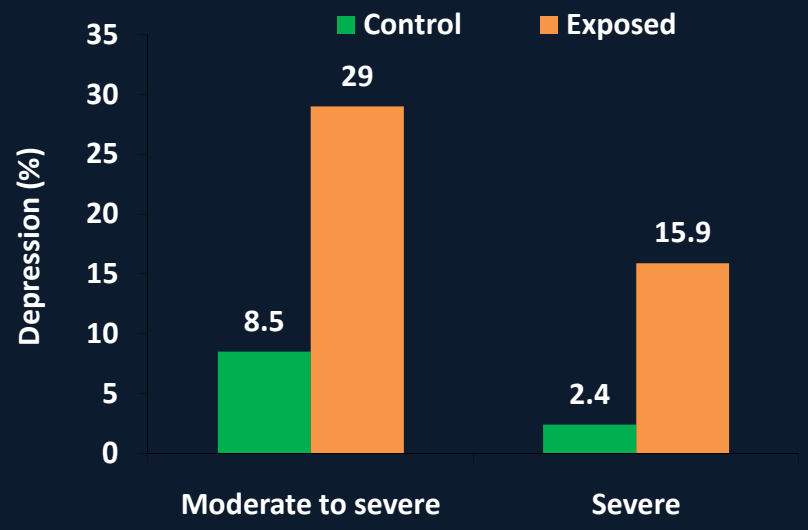
Air pollution causes change in menstrual cycle length in women



Air Pollution and adverse reproductive outcome in women



Neurobehavioral symptoms

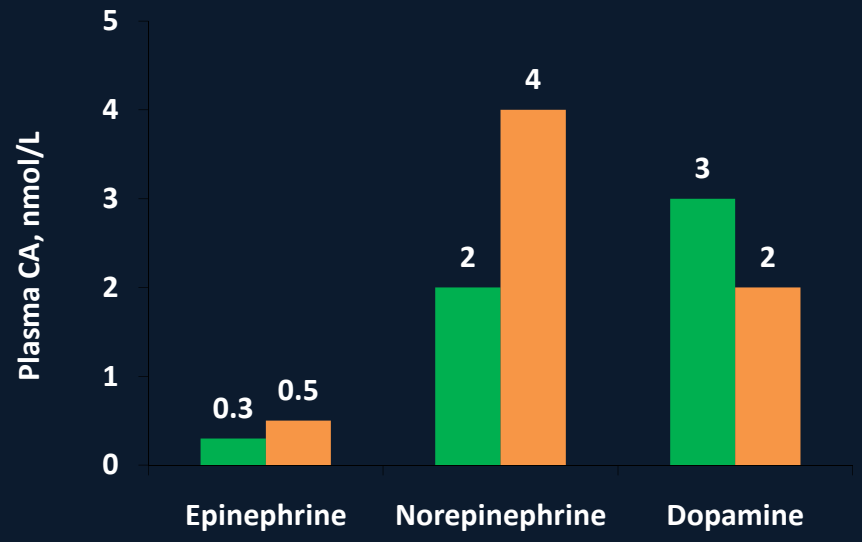


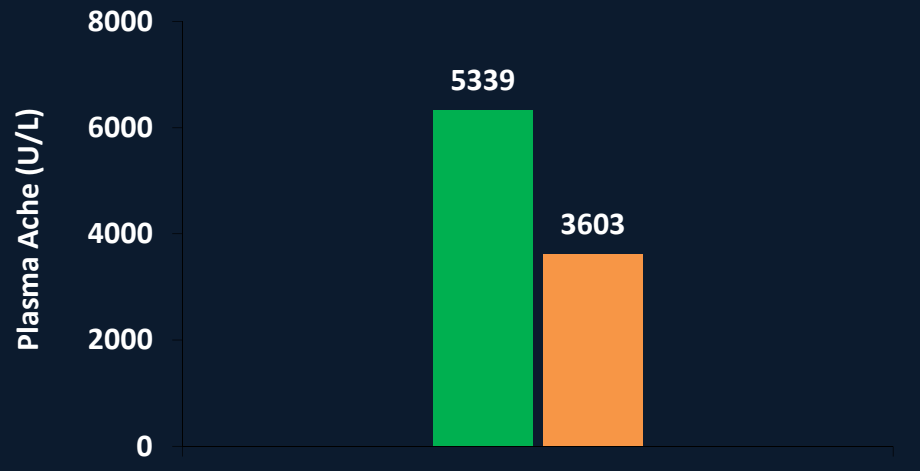
Depression: 2-times more in exposed

Significant alteration in plasma neurotransmitter level

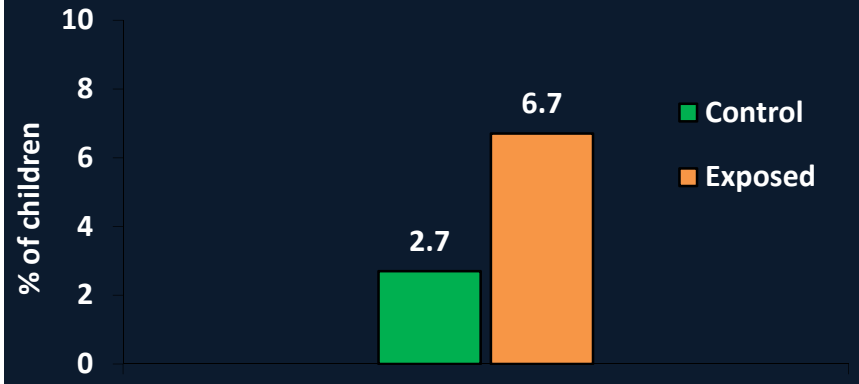
Marked fall in plasma acetylcholinesterase activity

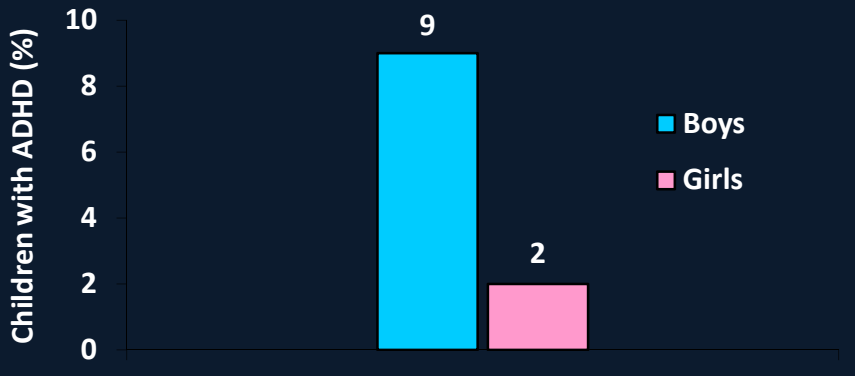
A positive association between PM_{10} and depression (OR=1.83)



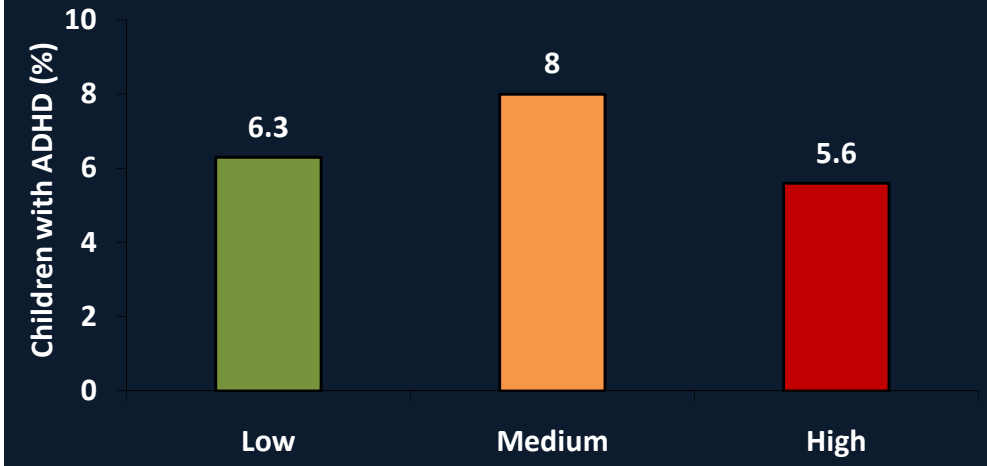


Attention Deficit Hyperactivity Disorder (ADHD)



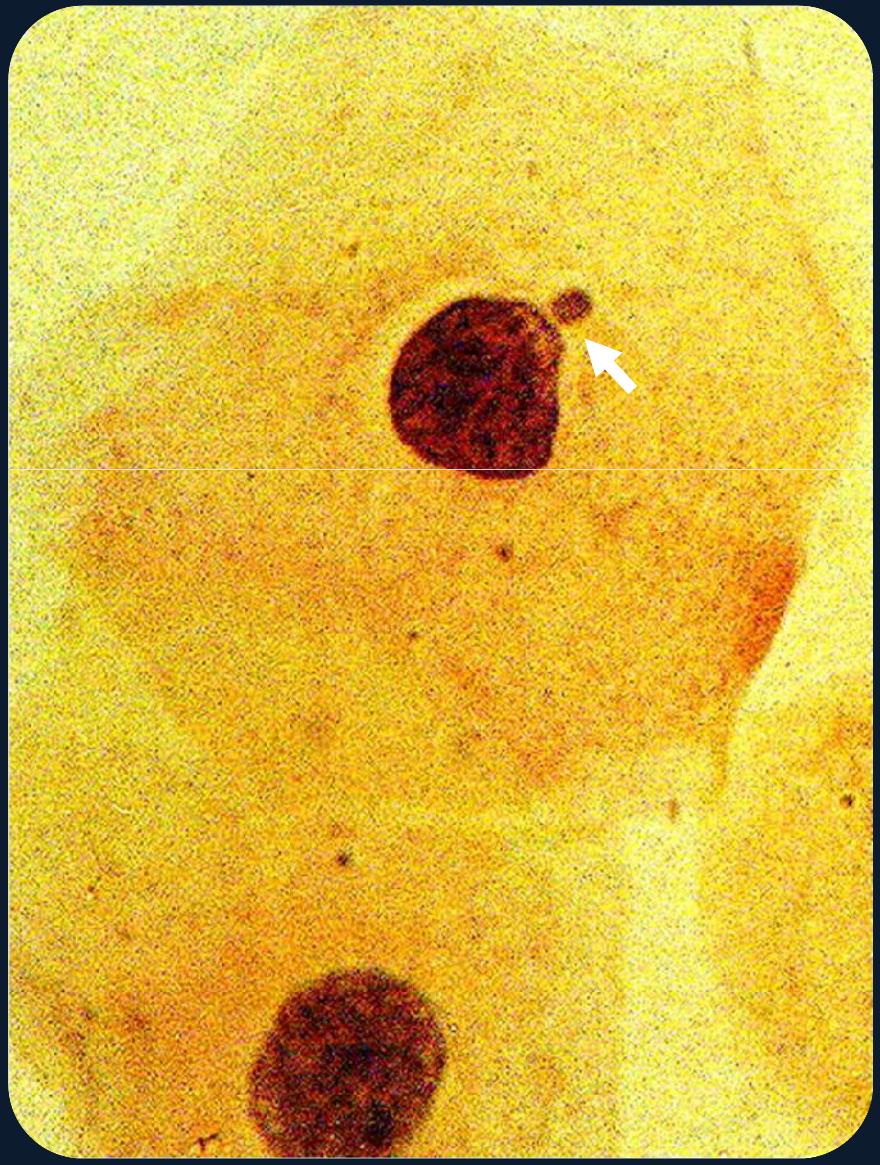


9% of the boys in cities had ADHD against 2% of the girls, giving a male: female ratio of 4.5:1

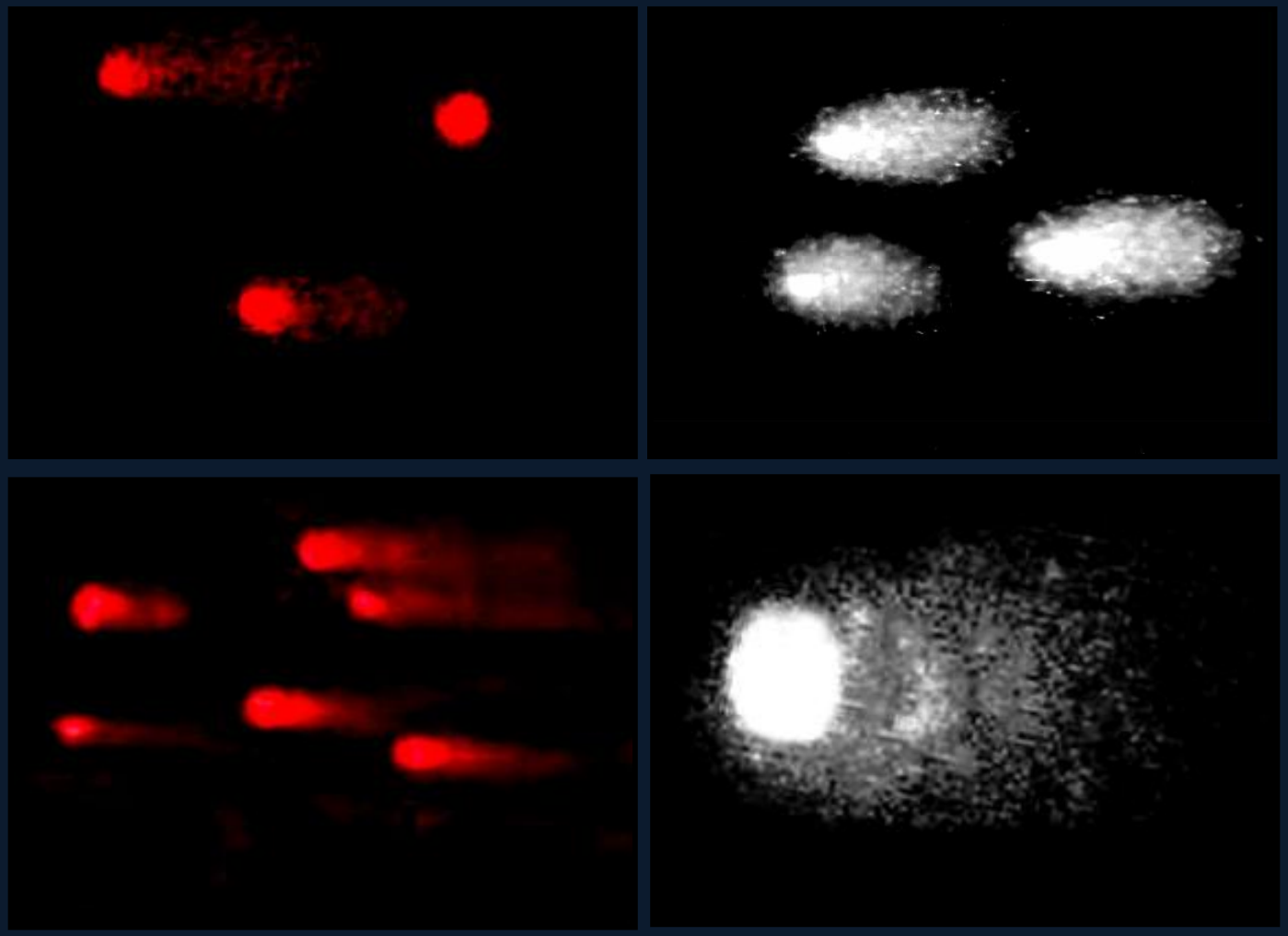


Children with ADHD are impulsive, forgetful, restless, prone to fail, unable to follow tasks, unpredictable and moody

MN (Chromosomal breaks)

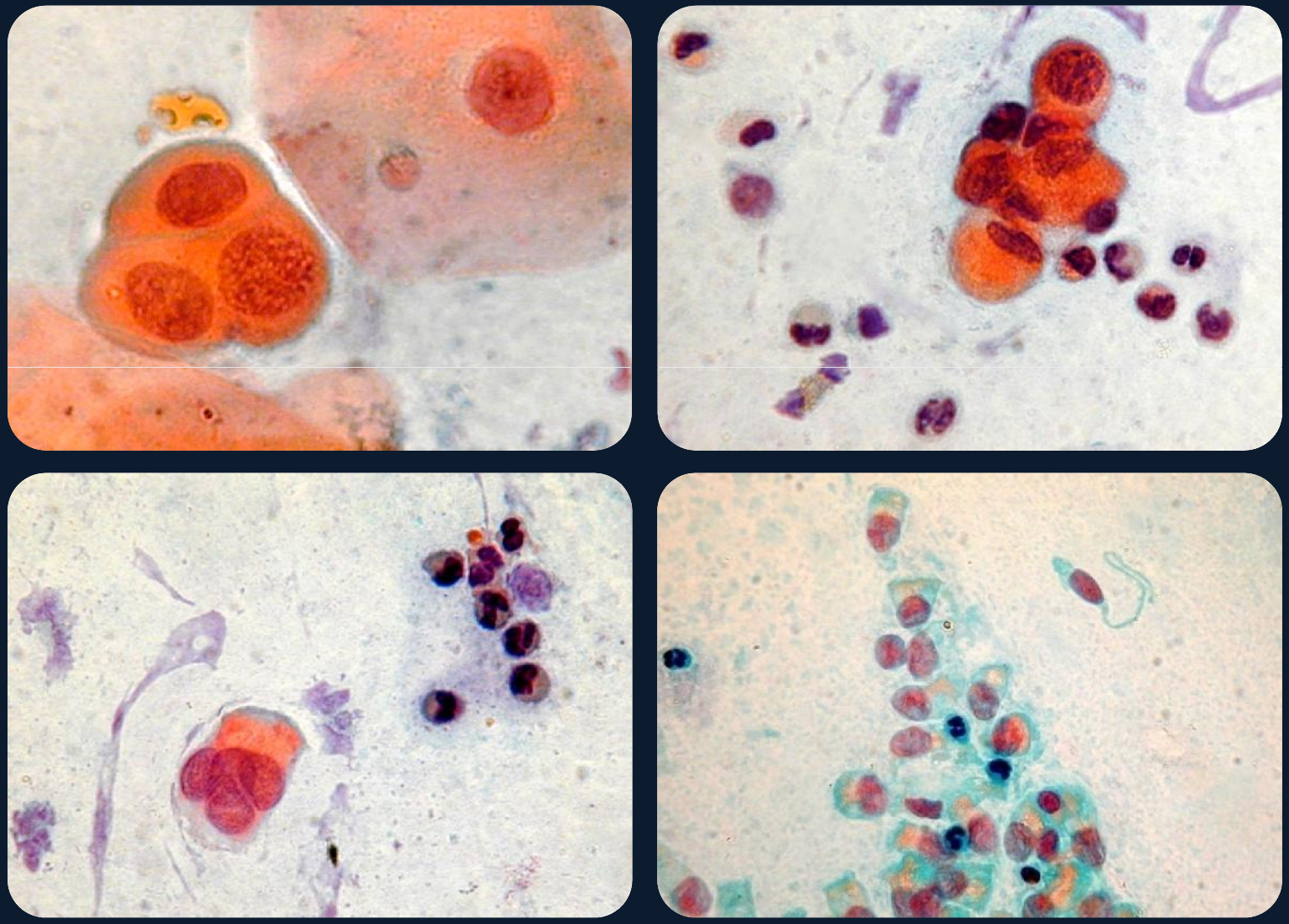


Metabolically active carcinogens induce DNA damage



Comet assay in PBL & AEC

Airway cells following DNA damage, precancerous changes



Health impact of air pollution

Every 10µg increase in ambient PM_{10} causes increase in:

Overall mortality	0.5 - 1%
Cardiovascular mortality	1.4%
Respiratory mortality	3.4%
Hospitalization for respiratory diseases	0.8%
Hospitalization for asthma	1.9%

Source: Laden et al., 2000; Samet, 2000

Response to air pollution across population differs due to

- extent & nature of exposure
- co-exposure of different pollutant mixtures
- population structure
- nutritional & socio economic status
- susceptibility factors

Recommendations for Children

- Regular monitoring of PM 2.5 and ground level ozone
- Air quality monitoring of class room, and PFT at least once/yr
- No outdoor games during mid day (12.00 noon-3.00 pm)
- School buses should be run by cleaner fuels
- Sale of fast food and aerated beverages should be stopped at school canteens
- Consumption of fresh fruit should be encouraged in tiffin
- Forecasting of high pollution days

Let us join hands to curb air pollution for a better tomorrow

THANK YOU