The effects of PM_{10} and $PM_{2.5}$ on health of children in Dhaka

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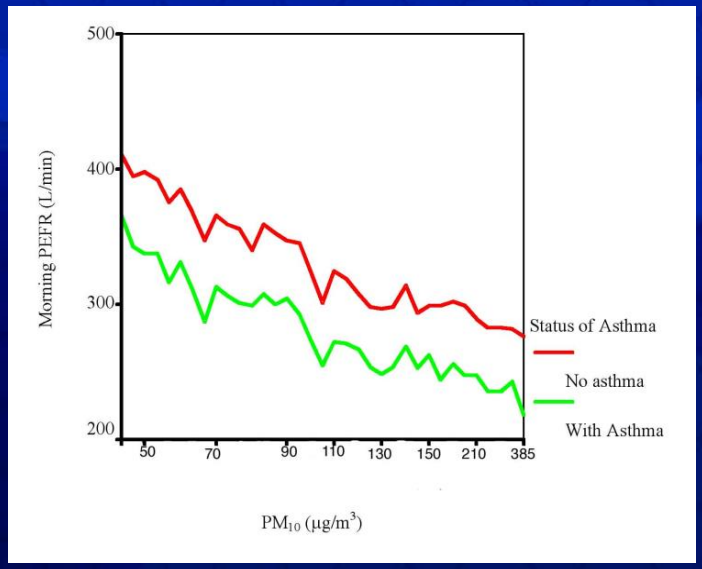
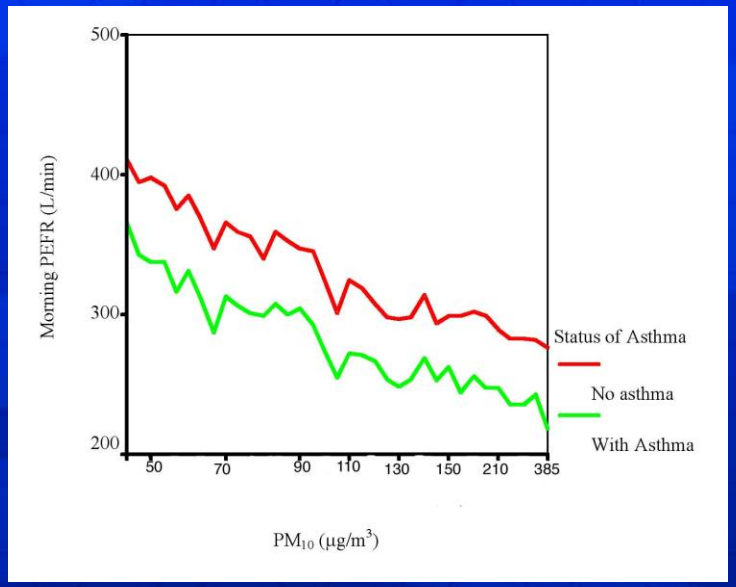
Major findings of the study

The results of the study show that there is a relationship between Peak Expiratory Flow Rate (PEFR - a measure of lung function) in both asthmatic and non-asthmatic children and PM_{10} and $PM_{2.5}$ concentrations.

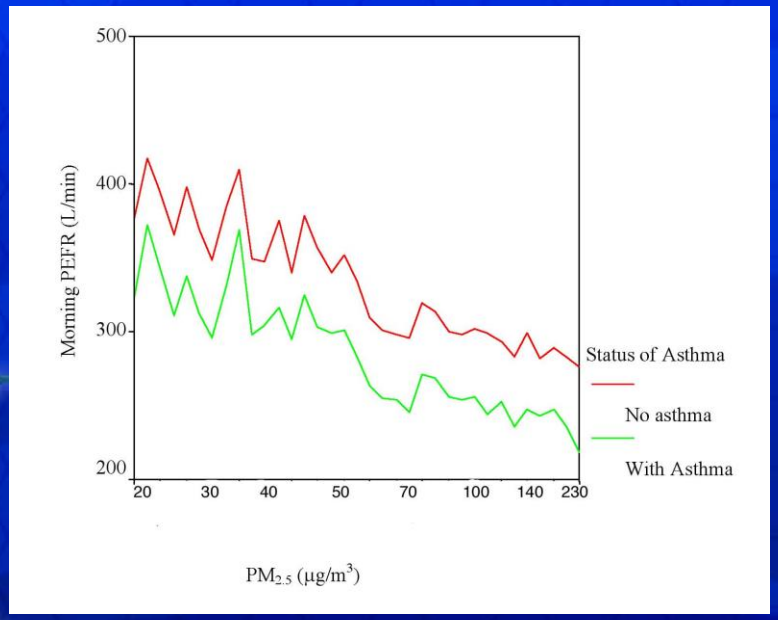


PEFR decreased when PM_{10} increased



- PEFR decreased by about 40% in both asthmatic and non-asthmatic children when PM_{10} increased from its lowest level of 38 $\mu g/m^3$ to its highest daily mean of 385 $\mu g/m^3$.
- Asthmatic children had a 10% lower PEFR than non-asthmatic children
- This difference was maintained across the range of PM_{10} concentrations.

PEFR decreased when $PM_{2.5}$ increased



PEFR decreased by about 30% in both asthmatic and non-asthmatic children when PM_{10} increased from its lowest level of 18 $\mu g/m^3$ to its highest daily mean of 233 $\mu g/m^3$.

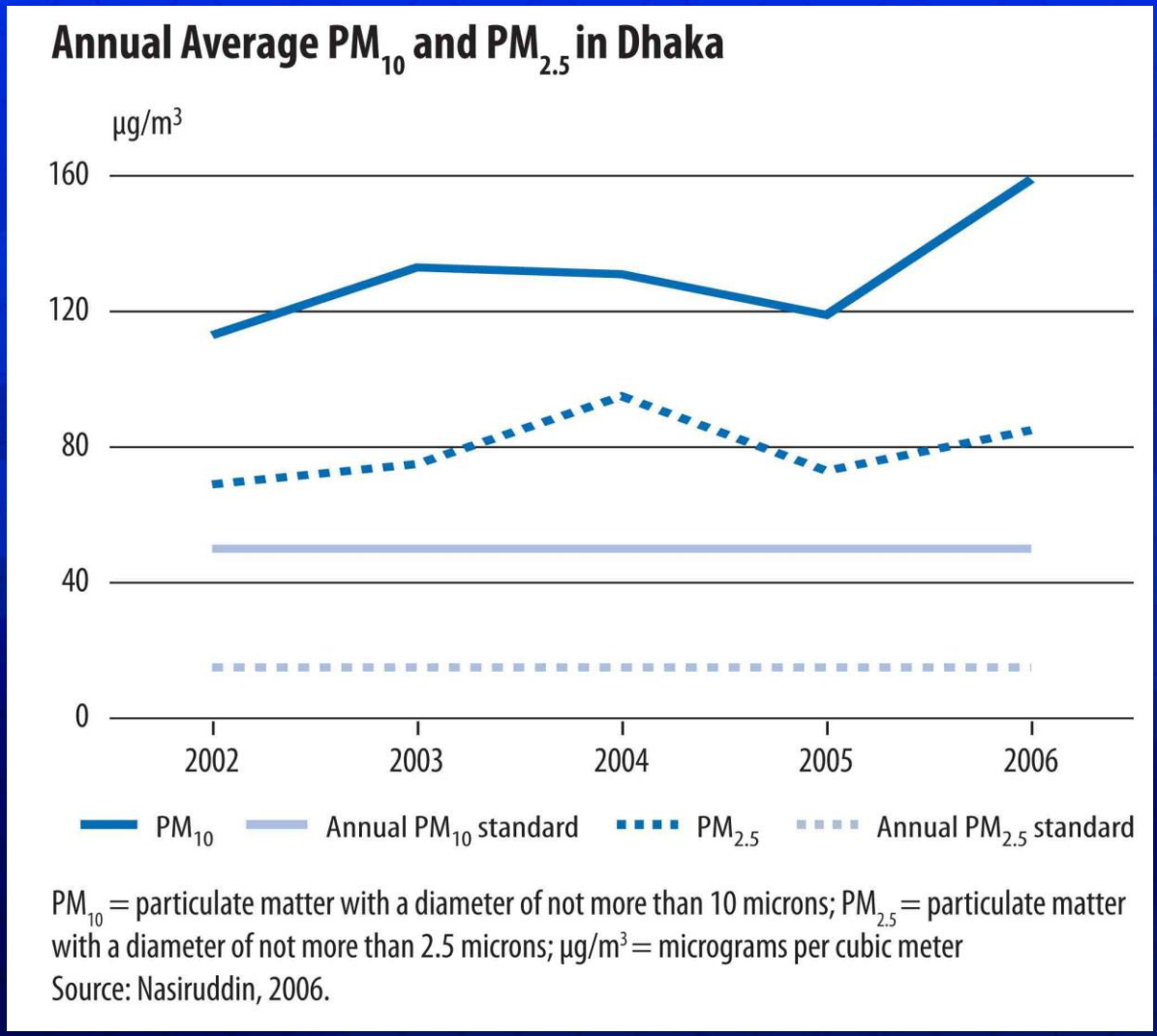
Some perspective - Comparison with adult female smokers and non-smokers - only 16% reduction

	PEFR L/min	
Non-smokers	Range Mean	330-340 332
Heavy smokers	Range Mean	270-300 280

Both groups were 100 women, 30-40 years old of similar height and weight from Nepal

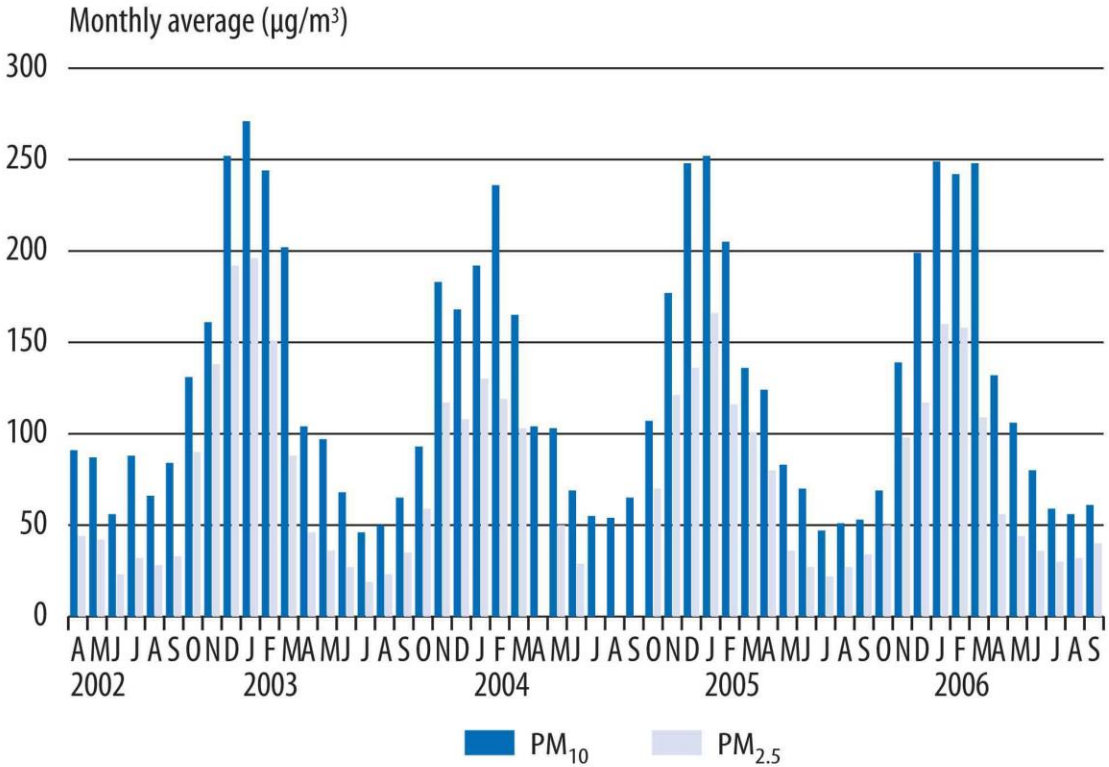
Source: Prasad et al, 2003

How high are PM levels in Dhaka?



Source: CAI-Asia 2007

Season variation in PM in Dhaka

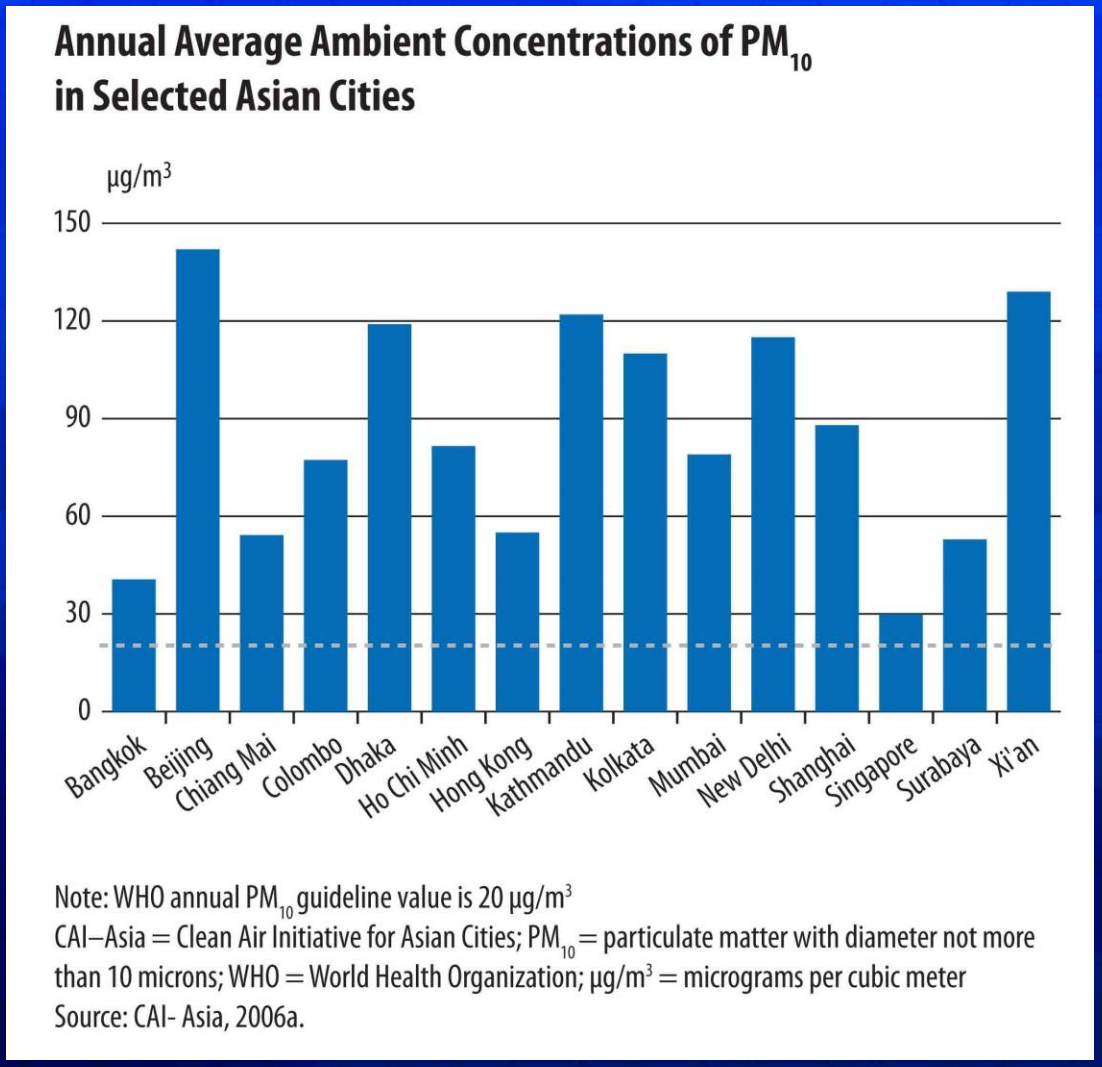


PM_{10} = particulate matter with a diameter of not more than 10 microns; $PM_{2.5}$ = particulate matter with a diameter of not more than 2.5 microns; $\mu g/m^3$ = micrograms per cubic meter

Source: Nasiruddin, 2006.

Source: CAI-Asia 2007

Comparison of PM_{10} in Dhaka with PM_{10} in other Asian cities



Source: CAI-Asia 2007

Sources of PM in Dhaka

Average Mass Contribution to Particulate Pollution in Dhaka, 1993–1994 (%)

Source Type	Coarse (PM_{10})	Fine ($PM_{2.5}$)
Resuspended Soil	54.7 ± 2.4	8.88 ± 5.04
2-stroke engine	6.07 ± 1.8	2.03 ± 3.24
Construction works	7.09 ± 3.36	
Motor vehicles	31.2 ± 6.1	29.1 ± 4.6
Sea salt	0.22 ± 3.69	4.11 ± 2.48
Refuse burning	0.74 ± 5.96	
Natural gas/diesel burning		45.7 ± 8.3
Metal smelting		10.2 ± 8.1

PM_{10} = particulate matter with a diameter of not more than 10 microns; $PM_{2.5}$ = particulate matter with a diameter of not more than 2.5 microns; % = percent

Source: Biswas *et al.*, 2000.

Source: CAI-Asia 2007

The results are consistent with other studies

- The finding that increases in PM_{10} levels are associated with impaired lung function in children with and without asthma is in agreement with studies in Mexico City, the Netherlands, Bangkok and studies in the USA
- The severity of the changes in PEFR with increases in PM is an important new finding

Impacts on children with asthma

Although data from Dhaka are not readily available, based on data from the USA and assuming the same health outcome ratios apply to Dhaka, the 0.61 million children in Dhaka with asthma will have

- 12 million restricted activity days,
- 1.5 million school absence days, (2.48 days per child with asthma), and
- 51 school age children will die of asthma per year.

Children's Health Study in Southern California

A large long term study of 5500 children found:

- Air pollution harms children's lungs for life
- Children exposed to high levels of PM had significantly reduced lung growth and development. This may have permanent adverse effects in adulthood.
- Children with asthma and exposed to high PM were much more likely to develop bronchitis
- Children who moved from areas of high air pollution to areas with low air pollution showed some recovery in lung development
- Children who moved from areas of low air pollution to areas with high air pollution had decreased lung development

Conclusion

If ambient concentrations of PM_{10} and $PM_{2.5}$ in Dhaka and similar cities could be reduced these harmful impacts on the respiratory health of children could be substantially decreased

Thanks to….

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Thank you