

Department of  
Environmental Health  
Engineering



World Health Organization  
Collaborating Centre for Occupational Health



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On Environmental Health  
Indian Council of Medical Research

# Health impacts related to air quality and transport in India

## *Some challenges, many opportunities*

Dr. Kalpana Balakrishnan  
Professor & Director

Center for Advanced Research on Environmental Health, (ICMR, Govt. of India)

WHO Collaborating Center for Occupational and Environmental Health

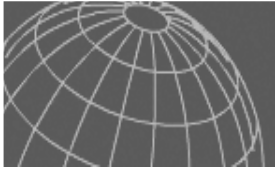
Department of Environmental Health Engineering

**Sri Ramachandra University**

**Chennai**

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## The Global Burden of Disease Study 2010



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### Articles

## A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010

Stephen O'Dell, Thean Yin, Abraham D Flaxman, Gordon Danaei, Kiryl Malyov, Heather Adnan-Rubini, Markus Anstey, Alissa Anderson, Kathryn G Andrews, Martin Arora, Charles Atkinson, Lorraine Baecher, Adil N Baharwal, Rajanya Balakrishnan, John Balmer, Susanna Barker-Cobb, Anandhi Barua, Michelle L Bell, Joel D Bensen, Fiona Blyth, Camilla Bower, Guillermo Bragos, Rupert Brasseur, Mihail Brucanov, Michael Brown, Peter Bruck, Ajay C Buse, Bert Brunckow, Chari Byers Hancock, Chana Buzali, Nichole Bushbinder, Fawaz Bull, Richard J Burnett, Tim E Byers, Blanca Calzadilla, Jonathan Caspers, Emily Carahan, Zia Chedy, Fawaz Chaudhry, Hanyang Chen, Jian Shen Chen, Andrew Tai-Aun Cheng, Jennifer Christine Chik, Aaron Cohen, Elizabeth Colburn, Benjamin C Cowie, Sarah Crosby, Susan Dalling, Ashkan Davari, Lucina Deegenhardt, Frank Dentener, Joon C Deo Jureka, Karen Dennis, Mahesh Desai, Eric J Ding, E Roy Dwyer, Tim Dwyer, Karen Edmund, David Ezzamel, Rebecca E Engel, Patricia Evans, Simon Evans, Gail Fisher, Priscilla Forastiere, Alice Fournier, Marjolijn Frencken, Sathya Prakash, Frank Geyrhofer, Greg Gething, Michael E Gosselin, Simon Harris, Gidon Hawthorn, Samira Ghosh, Edward Giovannucci, Gerhard Gmel, Kathryn Guthrie, Rebecca Gustavsson, Bridget Green, David Gunnell, Holly R Gutierrez, Wayne Hall, Hans W Haast, Anthony Hanger, In-Sun Haeghebaert, Jianxin Han, Howard Ho, Bryan Hubbard, Sally Hutchinson, Sydney Hwang, Gemma Jackson, Rachael Janssens, Joel R Jones, Haidong Kang, John A Kasim, Nicholas Karamchandani, Nadia Kashef, Young Hee Kwon, Shehuk Khatibzadeh, Jon Paul Kwan, Cindy Koh, Francisco Lopez, Rashid Lutfar, Qing Lan, Tim Leachman, Janet L Leachman, James Leigh, Yang Li, John Kent Liu, Steven J Lipschutz, Stephanie Linder, Rafael Lozano, Yuan Lu, Jialin Ma, Ross Mahabadi, Laila Mallapaty, Wayne Manning, Lyn March, Robin Marks, Randall Martin, Paul McGuire, John McGee, Suresh Mohan, George A Monson, Tony R Morrison, Renato Muela, Catherine Michael, Vinod Mishra, Khayrullah Mohd Haniffah, Ali A Mubaidi, Laila Mousavizadeh, Danish Muzaffar, Tejas Muralidhar, Mahan Naghavi, Bruce Neal, Paul Nelson, Juan Miguel Nolas, Ruzana Norman, Corey Olsen, Saad B Omer, Jessica Orchard, Richard Osborne, Bart Oren, Andrew Page, Kieran D Parry, Charles D M Parry, Eric Paterson, Jansheng Peiris, Neil Pebody, Pamela M Phillips, Alan Pittschi, Michael R Phillips, Dan Pope, C Andrew Pope III, John Powell, Mayana Rao, Hanna Rezza, Ewa A Rylska, Jigang T Rubin, Beate Ritz, Frederic P Rivara, Thomas Roberts, Carolyn Robinson, Jose A Rodriguez-Portillo, Isabelle Romieu, Robin Room, Jose C Rosengren, Ananya Roy, Lindsey Rubin, Joshua A Salomon, Uthchachwan Sereyem, Lilia Sanchez-Romero, Eric Savarise, Anne Sepkowitz, Suman Soodan, Philip Soto, Ramin Soudki, Rajesh Srinivasan, Gargani M Singh, David A Sliker, Emma Smith, Erik Sorensen, Nicholas C Stocking, Ryo Sudo, Heidi Stucki, Lars Jacob Svendsen, Kurt Stein, Luke Straney, George D Thwaiter, James H Toor, Rita Van Dongen, Armin von Döbeln, J Linnert Veerman, Lakshmi Vijayarajasekaran, Robert Woodhead, Myra M Williams, Richard A White, Harvey Whiteford, Susan T Williams, James D Williams, Howard C Williams, Warwick Williams, Nicholas Williams, Anthony Woodall, Paul Yin, Jan M Zelenka, Alan D Lopez, Christopher J L Murray, Majid Ezzou

**Summary**  
Background Quantification of the disease burden caused by different risks informs prevention by providing an account of health loss different to that provided by a disease-by-disease analysis. No complete revision of global disease burden caused by risk factors has been done since a comparative risk assessment in 2000, and no previous analysis has assessed changes in burden attributable to risk factors over time.

**Methods** We estimated deaths and disability-adjusted life years (DALYs; sum of years lived with disability [YLD] and years of life lost [YLL]) attributable to the independent effects of 67 risk factors and clusters of risk factors for 21 regions in 1990 and 2010. We estimated exposure distributions for each year, region, sex, and age group, and relative risks per unit of exposure by systematically reviewing and synthesising published and unpublished data. We used these estimates, together with estimates of cause-specific deaths and DALYs from the Global Burden of Disease Study 2010, to calculate the burden attributable to each risk factor exposure compared with the theoretical minimum-risk exposure. We incorporated uncertainty in disease burden, relative risks, and exposures into our estimates of attributable burden.

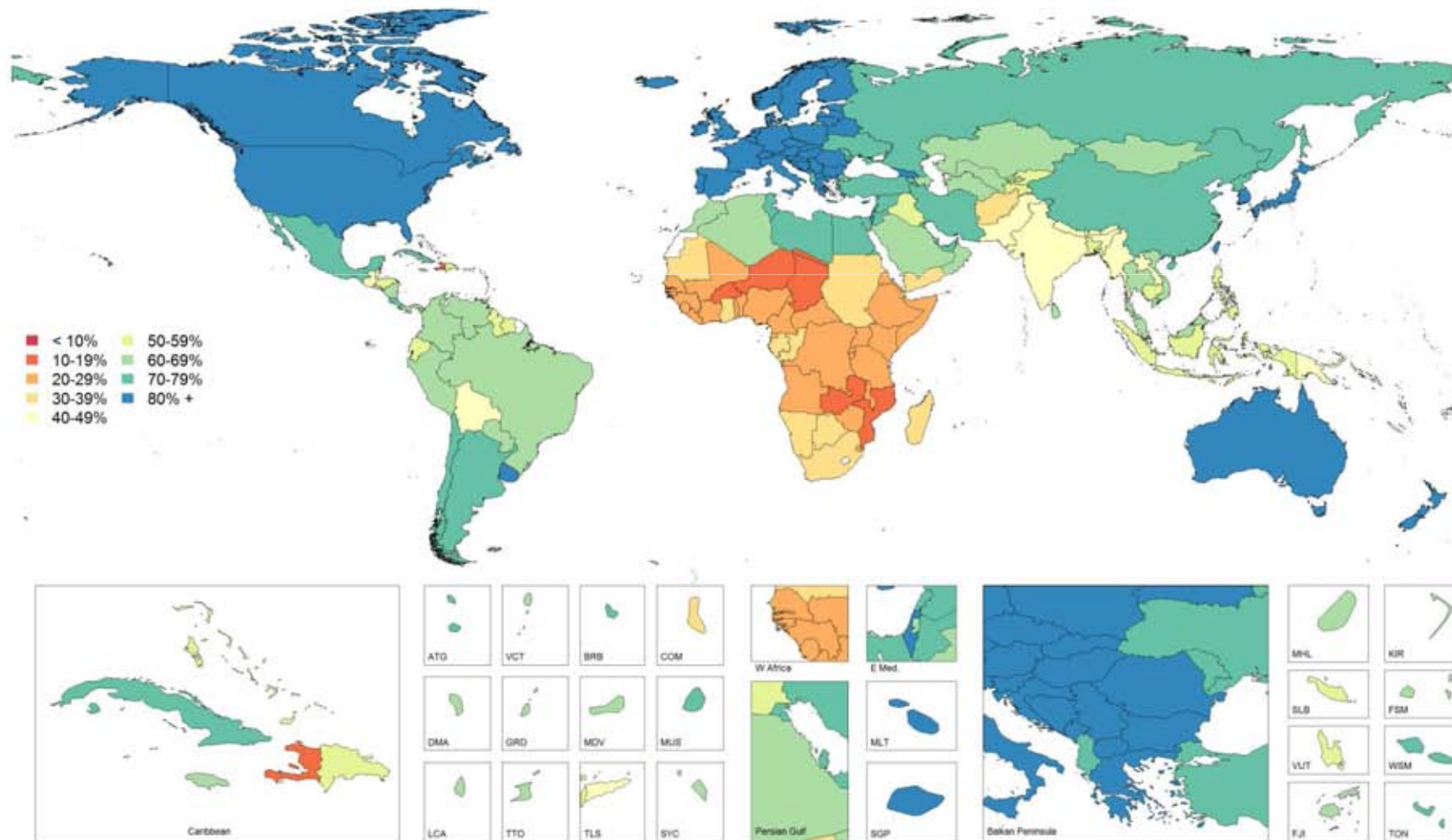
**Findings** In 2010, the three leading risk factors for global disease burden were high blood pressure (7.0% [95% uncertainty interval 6.2-7.7] of global DALYs), tobacco smoking including second-hand smoke (6.3% [5.5-7.0]), and alcohol use (5.5% [5.0-5.9]). In 1990, the leading risks were childhood underweight (7.9% [6.4-9.4]), household air pollution from solid fuels (HAP; 7.0% [5.4-8.3]), and tobacco smoking including second-hand smoke (6.1% [5.4-6.8]). Dietary risk factors and physical inactivity collectively accounted for 10.8% (95% UI 9.2-10.3) of global DALYs in 2010, with the most prominent dietary risks being diets low in fruits and those high in sodium. Several risks that primarily affect childhood communicable diseases, including unimproved water and sanitation and childhood micronutrient deficiencies, fell in rank between 1990 and 2010, with unimproved water

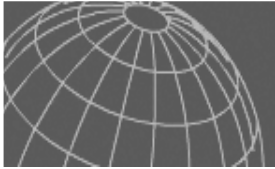
<http://www.thelancet.com/themed/global-burden-of-disease>

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# Percent of DALYs from Non-Communicable Diseases in 2010: Over 60% in Nearly All Countries Outside of Sub-Saharan Africa





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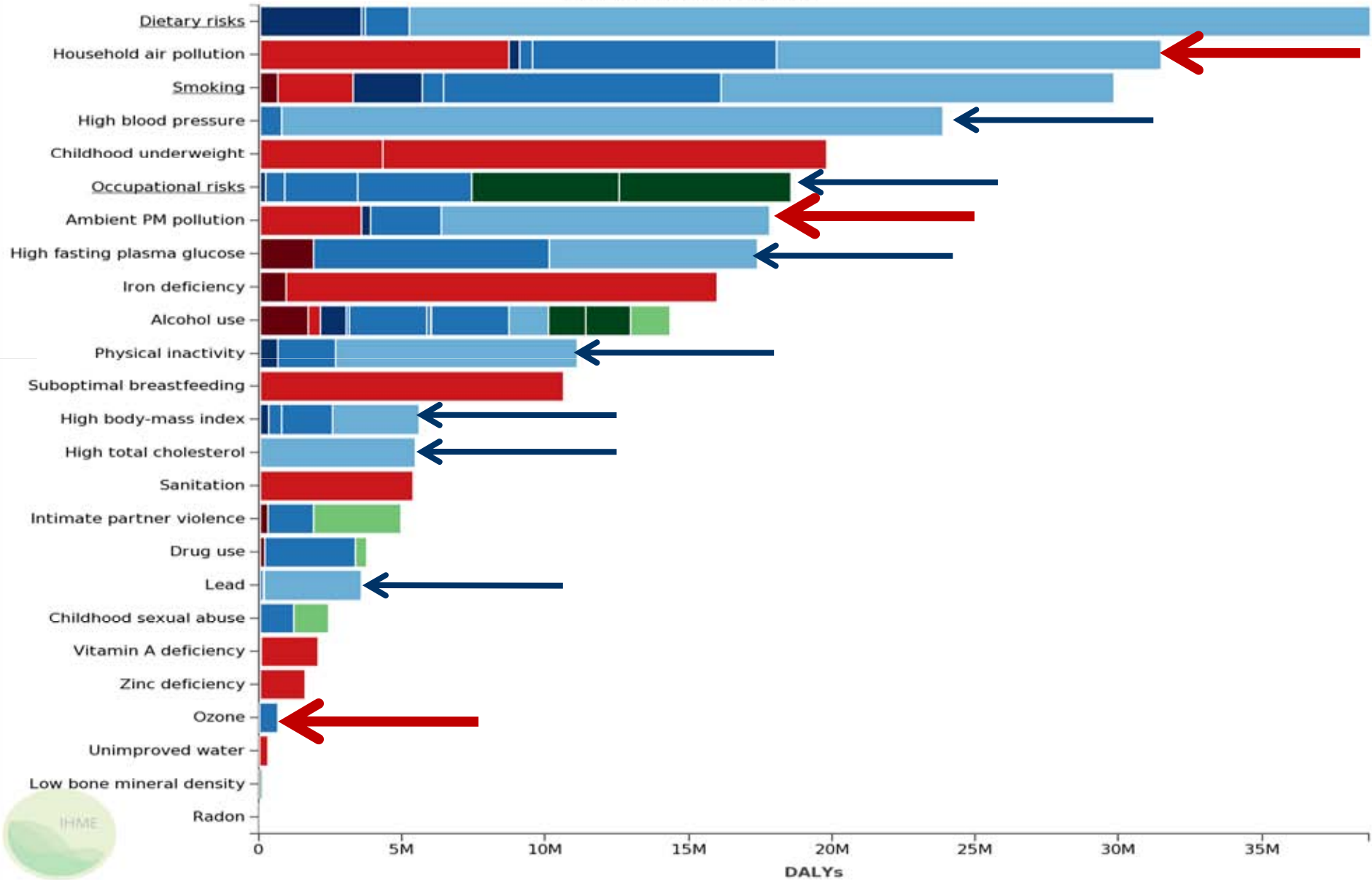


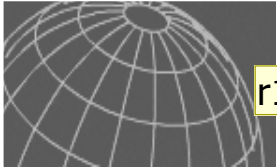
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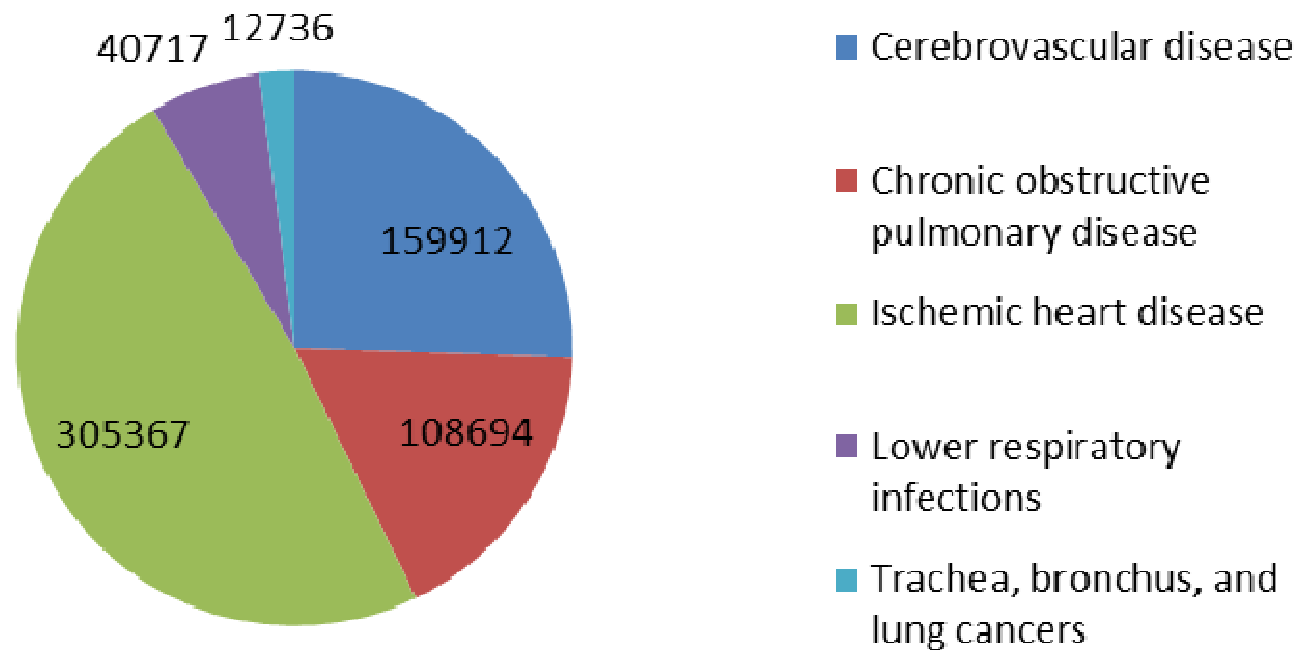
India, DALYs  
Both sexes, All ages, 2010





## 627,000 Deaths Attributable to Ambient PM<sub>2.5</sub> by Cause in India in 2010

### Deaths Attributable to Ambient Particulate Matter Pollution in India in 2010



## Slide 5

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r1

yea! good to lead with the main number

rokeefe, 2/12/2013



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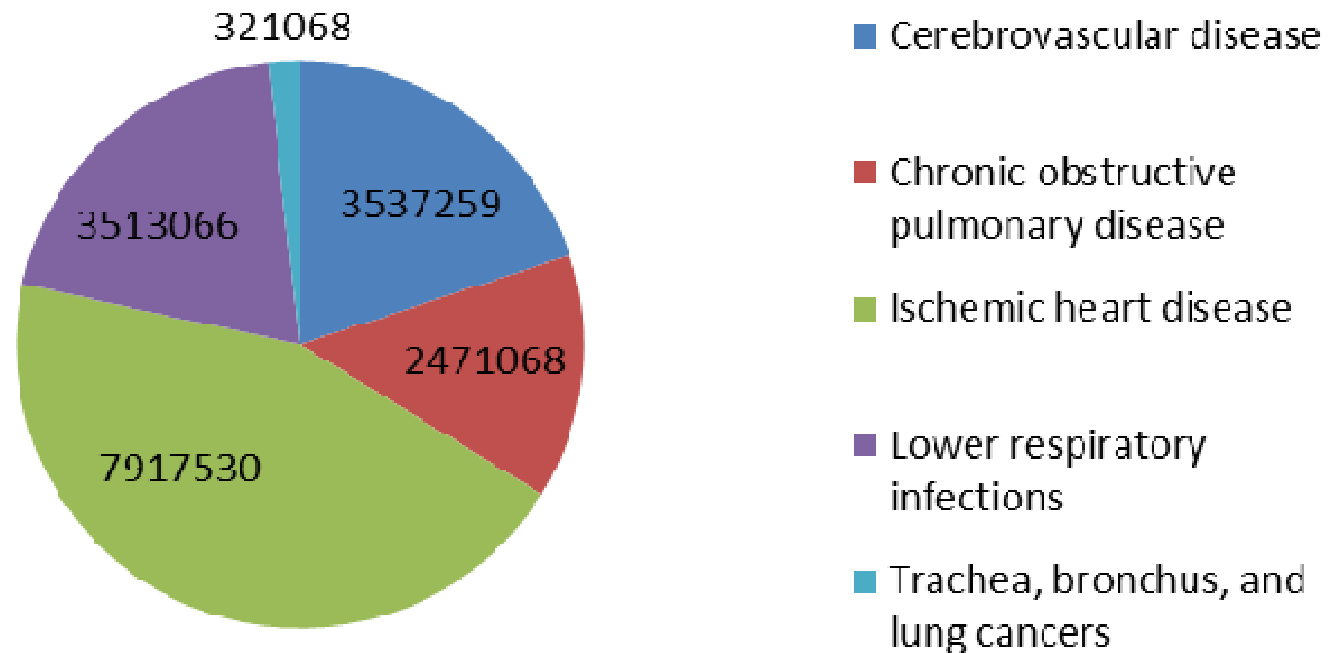
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## 17.7 million DALYs Attributable to Ambient PM<sub>2.5</sub> by Cause in India in 2010

### DALYs Attributable to Ambient Particulate Matter Pollution in India in 2010



**Slide 6**

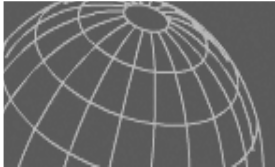
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**DG1**

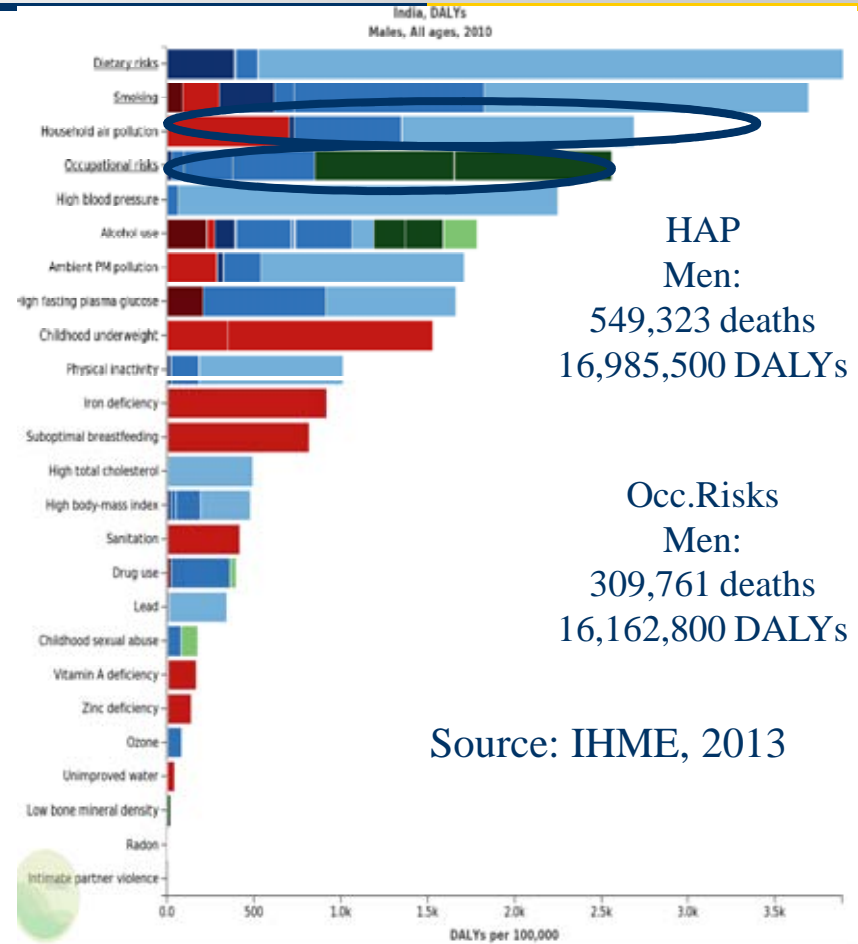
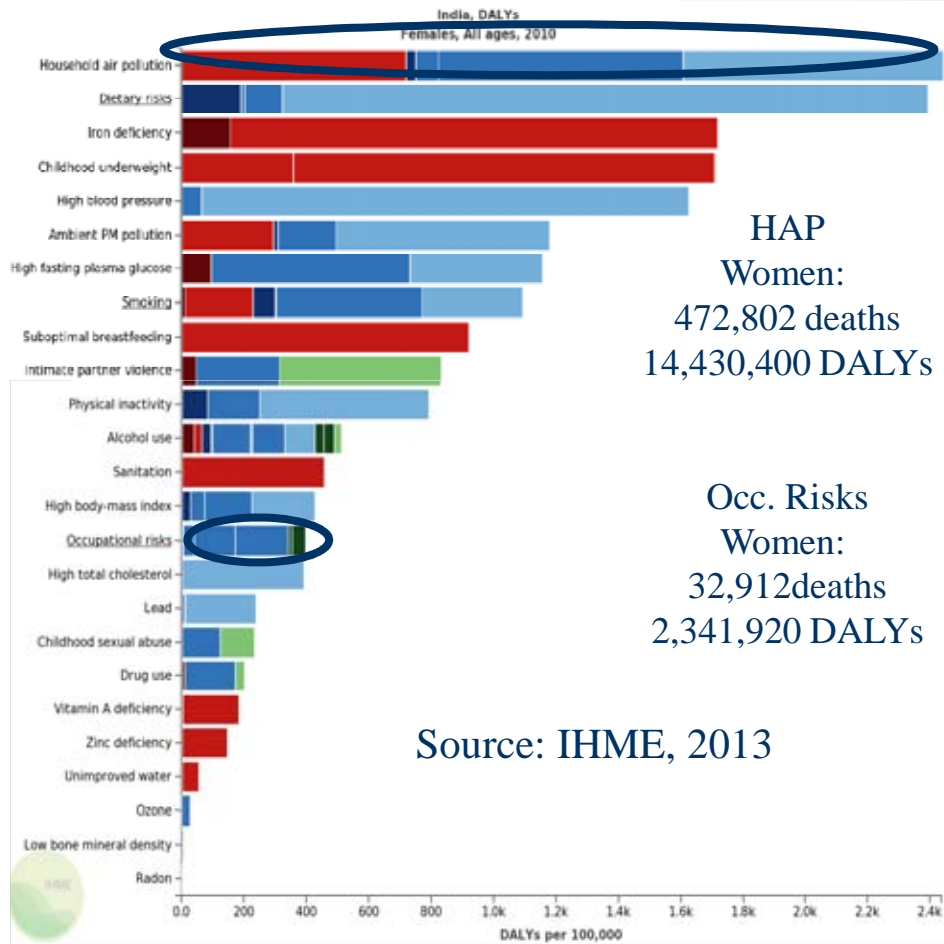
**Added the total in title**

Dan Greenbaum, 2/12/2013

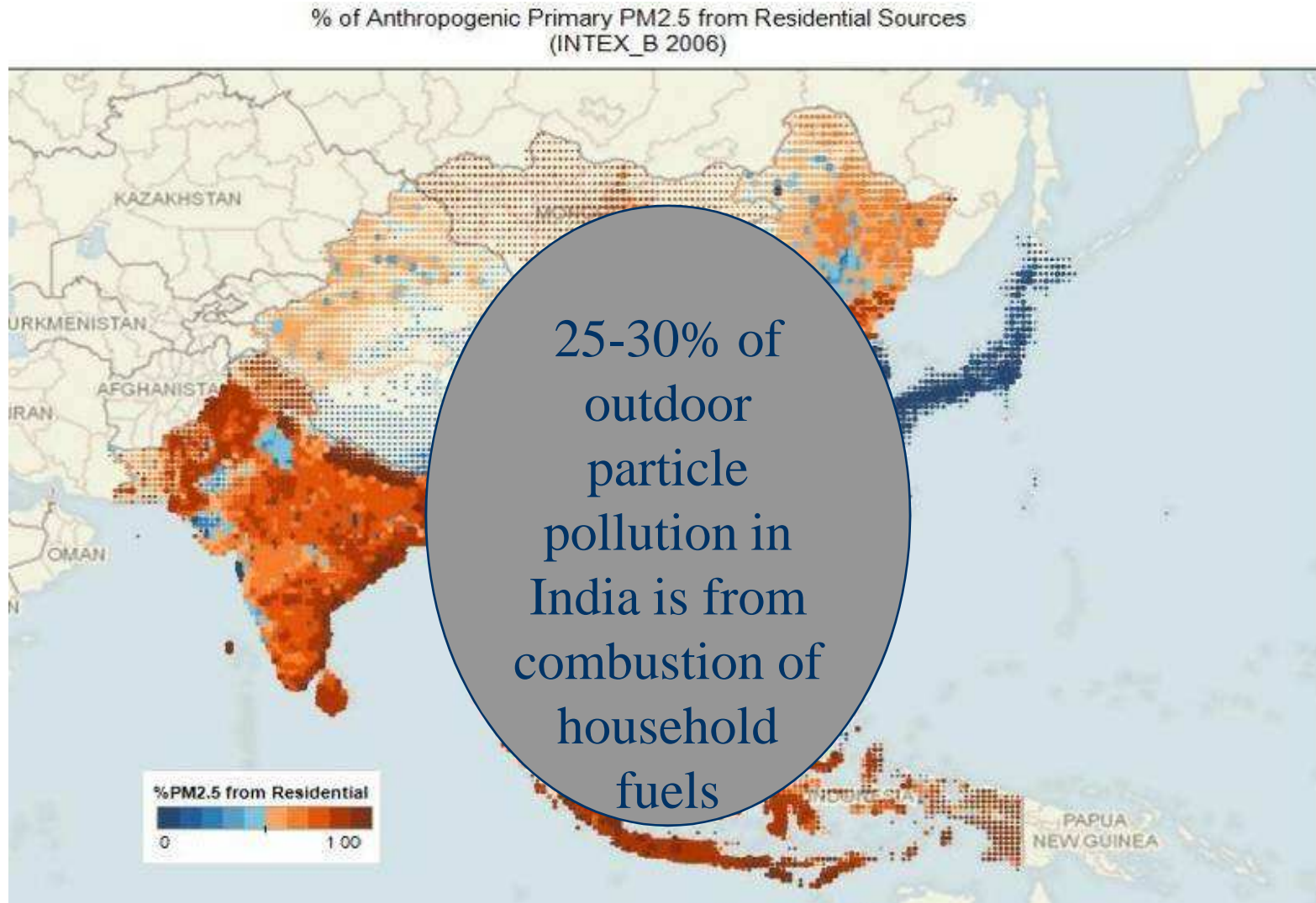




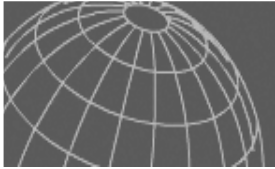
## GBD 2010: Results from country level estimates (India)



# %PM<sub>2.5</sub> from “Residential” Emissions from INTEX\_B



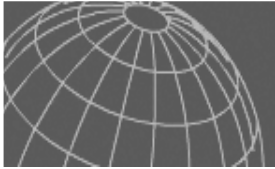
Source: Asian Emission Inventory for NASA INTEX\_B 2006 (accessed 11/11/10) Chafe, 2010



## The Challenge

- *The burden is not decreasing and the evidence is unequivocal !*
- *The burden is seamless across rural –urban boundaries*
- *Interventions to tackle OAP and HAP would have to be in sink(at least in some measure)*
- *WHO-AQGs are universally applicable for defining counterfactuals but NAAQM focused only on the urban*
- *Density of intervention efforts would need to be substantively increased to achieve and demonstrate health benefits*
- *Range of health effects are broader and magnitudes bigger than previously estimated (more chronic outcomes included in the ambit)*
- *Multitude of competing risk factors*

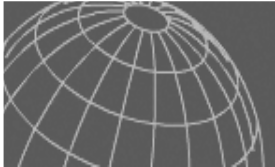




## The Opportunities

- *Extensive base of ground level air quality monitoring information for both validating models and interpolation on exposure –response curves (At least 6 long-term studies have been completed in collaboration with TNPCB)*
- *Some in-country exposure response for short-term health effects*
- *First ever maternal, child and adult air pollution cohorts launched by ICMR to both develop integrated IERs and develop exposure models for use in on-going cohorts*
- *Multiple CVD /Chronic disease cohorts underway allowing an examination of air pollution as a risk factor*
- *Increasing base of geo-coded health information*





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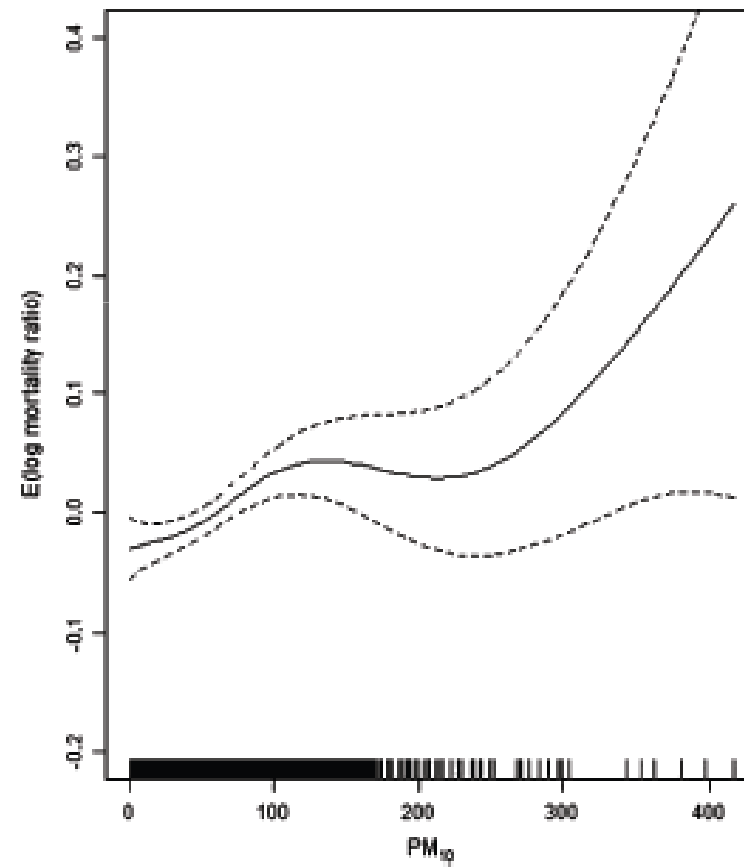
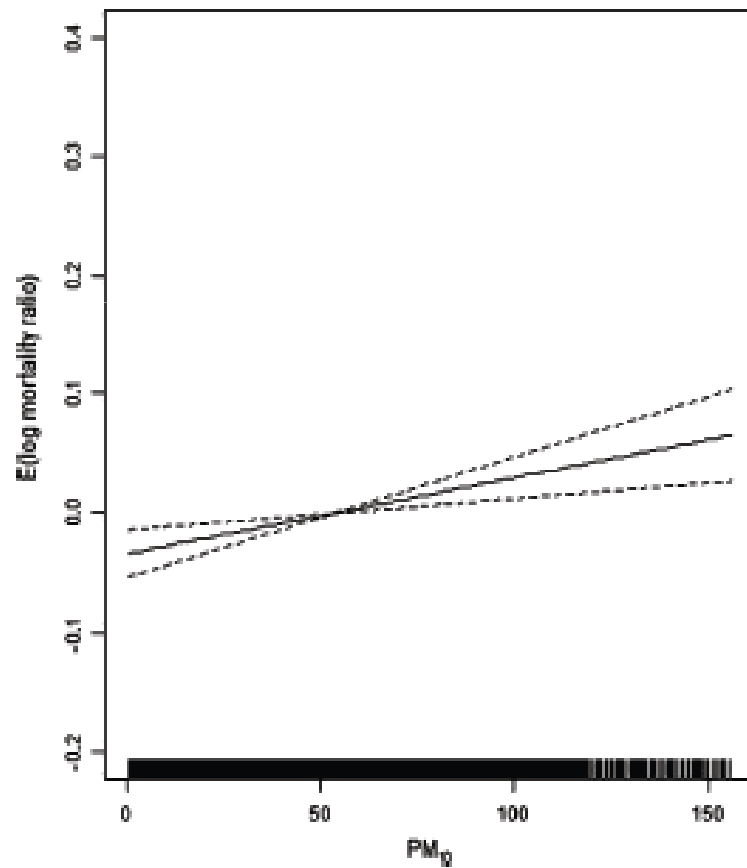


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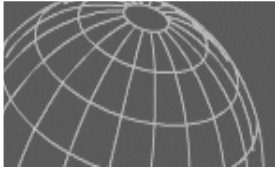
## HEI-PAPA-Chennai (SRU-TNPCB) results



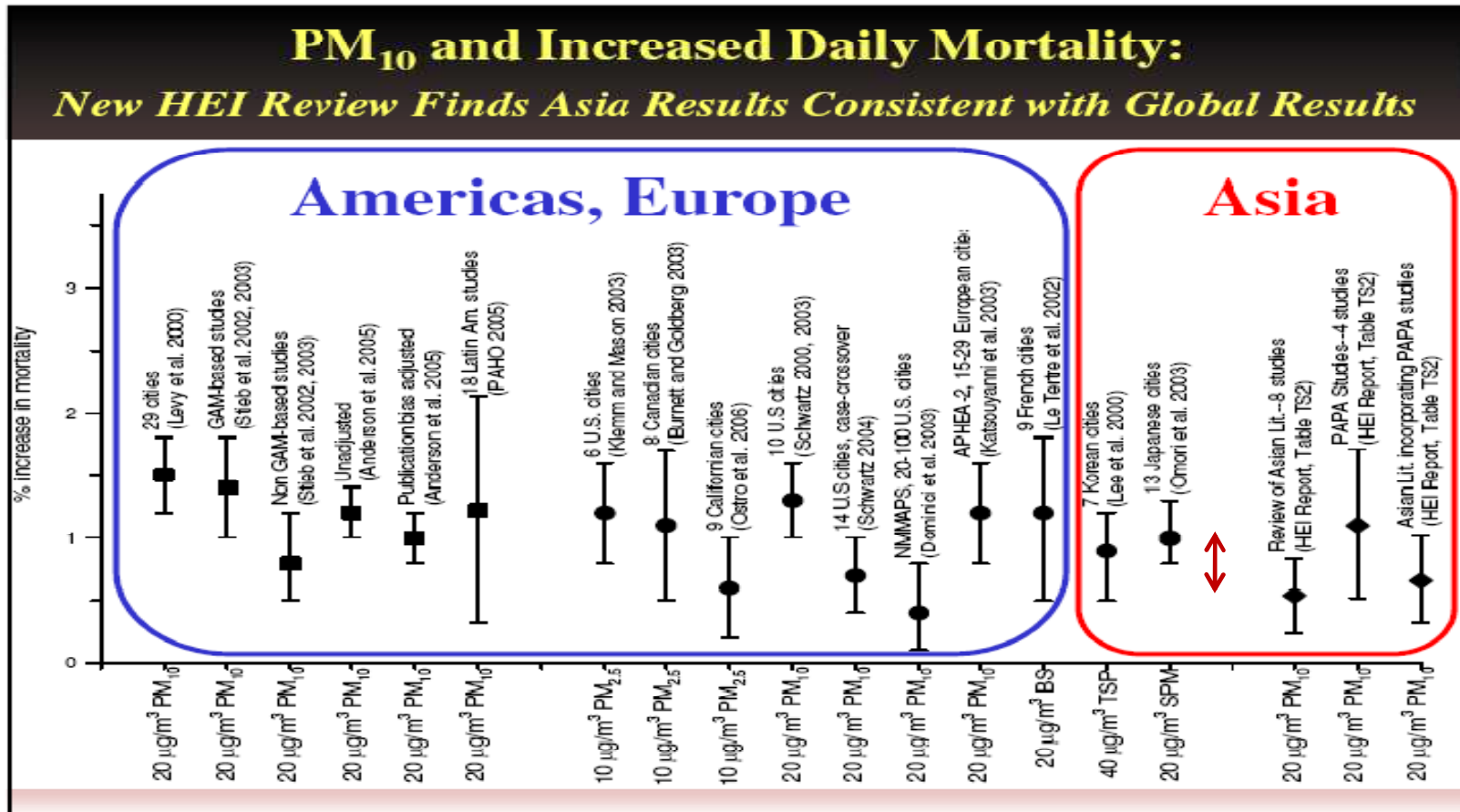
Balakrishnan et al., 2011

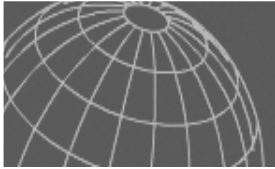
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# India and Chennai now figure in the global repository of air quality and health studies





## ICMR-CAR Air Pollution related health outcomes (On-going Studies that also involve TNPCB)

- **Pregnancy outcomes**
  - Primary : Birth Weight
  - Secondary: Gestational Age; Spontaneous/missed abortions; Intrauterine fetal demise (IUFD) ;Intrauterine growth retardation (IUGR);Premature birth; Still birth
  - Exploratory: Birth defects
- **Child Health Outcomes**
  - Primary: Acute Respiratory tract infection
  - Secondary: Neonatal & Infant mortality
- **Adult Outcomes**
  - Primary: Pulmonary Function
  - Exploratory: Inflammatory Biomarkers; Endovascular Changes





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**We don't have a magic bullet  
but**

.....

**trying get closer to the target by  
sharpening our focus!!**

***Thank You***

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