

The Health Effects of Diesel:
Global Burdens, Local Impacts...
...and Hope for the Future

Dan Greenbaum, President
Health Effects Institute

Mexico
July 24, 2013

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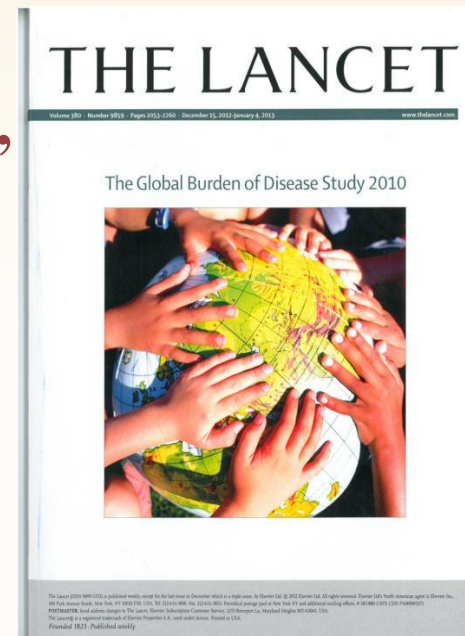


The Global Burden of Disease (GBD 2010)

- *A systematic scientific effort to measure the magnitude of health loss from disease and injuries in 187 countries around the world from 1990 to 2010*
- *Analyzed risk factors associated with disease such as smoking, diet, high blood pressure, air pollution, overweight*
- *Newest version published in December, 2012 special triple issue of *The Lancet**
 - *HEI led outdoor air pollution analysis*

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

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GBD 2010 Air Pollution Analysis: Focused on Particulate Matter (PM)

- High levels of PM ($> 500 \mu\text{g}/\text{m}^3$) known to cause premature death
 - e.g. London 1952
- *Many* studies in US, Europe, have found association of PM with mortality at much lower levels
 - No evidence of a “threshold” (safe level)
- ***Key new information:***
 - *Increasing local studies in Asia, Latin America confirm local effects*

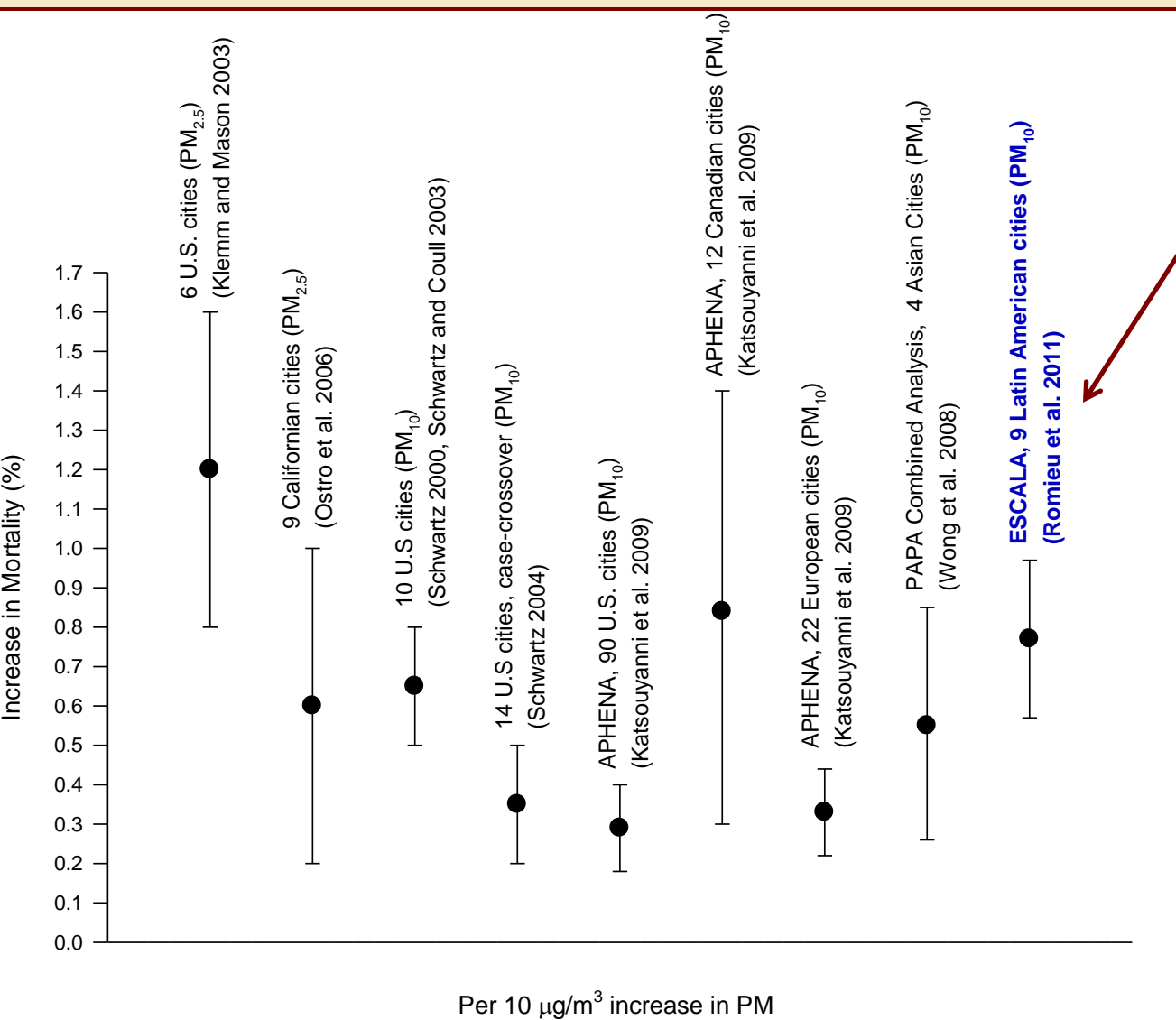


*London at Noon,
December 1952*



Latin America in a Global Context

(Worldwide results on Daily Changes in PM_{10} and Daily Mortality)



ESCALA-Estudio de Salud y Contaminación del Aire en Latinoamérica
(HEI Study in 9 Cities in Brazil, Mexico, Chile)

The effects of air pollution in Latin America are *very similar to those around the world ...*

HEI



New GBD 2010

Results:

(Based on local and global studies of PM Effects)

Significant Effects in Mexico:

Mexico:

13,600 Premature deaths
320,000 Healthy Years of Life Lost (DALYs)

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

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 S Lim[†], Theo Vos, Abraham D Flaxman, Goodarz Danaei, Kenji Shibuya, Heather Adair-Rohani*, Markus Amann*, H Ross Anderson*, Kathryn G Andrews*, Martin Aryee*, Charles Atkinson*, Loraine J Bacchus*, Adil N Bahalim*, Kalpana Balakrishnan*, John Balines*, Suzanne Barker-Collo*, Amanda Baxter*, Michelle L Bell*, Jed D Blore*, Fiona Blyth*, Carissa Bonner*, Guilherme Borges*, Rupert Bourne*, Michel Boussinesq*, Michael Brauer*, Peter Brooks*, Nigel G Bruce*, Bert Brunekreef*, Claire Bryan-Hancock*, Chiara Bucello*, Rachelle Buchbinder*, Fiona Bull*, Richard T Burnett*, Tim E Byers*, Bianca Calabria*, Jonathan Carapetis*, Emily Carnahan*, Zoe Chafe*, Fiona Charlson*, Hanglei Chen*, Jian Shen Chen*, Andrew Tai-Ann Cheng*, Jennifer Christine Child*, Aaron Cohen*, K Ellicott Colson*, Benjamin C Cowie*, Sarah Darby*, Susan Darling*, Adrian Davis*, Louisa Degenhardt*, Frank Dentener*, Don C Des Jarlais*, Karen Devries*, Mukesh Dherani*, Eric L Ding*, E Ray Dorsey*, Tim Driscoll*, Karen Edmond*, Suad Elkahir Ali*, Rebecca E Engell*, Patricia J Erwin*, Saman Fahimi*, Gail Falder*, George A Mensah*, Alize Ferrari*, Mariel M Finucane*, Seth Flaxman*, Francis Gerry R Fowkes*, Greg Freedman*, Michael K Freeman*, Emmanuela Gakidou*, Santu Ghosh*, Edward Giovannucci*, Gerhard Gmel*, Kathryn Graham*, Rebecca Grainger*, Bridget Grant*, David Gunnell*, Hialy R Gutierrez*, Wayne Hall*, Hans W Hoek*, Anthony Hogan*, H Dean Hosgood III*, Damian Hoy*, Howard Hu*, Bryan J Hubbell*, Sally J Hutchings*, Sydney E Ibeanusi*, Gemma L Jacklyn*, Rashmi Jasrasaria*, Jost B Jonas*, Haidong Kan*, John A Kanis*, Nicholas Kassebaum*, Norito Kawakami*, Young-Ho Khang*, Shahab Khatibzadeh*, Jon-Paul Khoo*, Cindy Kok*, Francine Laden*, Ratilal Laloo*, Qing Lan*, Tim Lathlean*, Janet L Leasher*, James Leigh*, Yang Li*, John Kent Lin*, Steven E Lipschutz*, Stephanie London*, Rafajal Lozano*, Yuan Lu*, Joelle Mak*, Reza Malekzadeh*, Leslie Mallinger*, Wagner Marcenes*, Lyn March*, Robin Marks*, Randall Martin*, Paul McGale*, John McGrath*, Sumi Mehta*, George A Mensah*, Tony R Meriman*, Renata Micha*, Catherine Michaud*, Vinod Mishra*, Khayriyah Mohd Hanafiah*, Ali A Mokdad*, Lidia Morawska*, Dariusz Mozaffarian*, Tasha Murphy*, Mohsen Naghavi*, Bruce Neal*, Paul K Nelson*, Joan Miquel Nolla*, Rosana Norman*, Casey Olives*, Saad B Omer*, Jessica Orchard*, Richard Osborne*, Bart Ostro*, Andrew Page*, Kiran D Pandey*, Charles D H Parry*, Erin Passmore*, Jayadev Patra*, Neil Pearce*, Pamela M Pelizzari*, Max Petzold*, Michael R Phillips*, Dan Pope*, C Arden Pope III*, John Powles*, Mayuree Rao*, Harmie Razzavi*, Eva A Rehfuess*, Jürgen T Rehm*, Beate Ritz*, Frederick P Rivara*, Thomas Roberts*, Carolyn Robinson*, Jose A Rodriguez-Portales*, Isabelle Romieu*, Robin Room*, Lisa C Rosenfeld*, Ananya Roy*, Lesley Rushton*, Joshua A Salomon*, Uchechukwu Sampson*, Lidia Sanchez-Riera*, Ella Samman*, Amir Sapkota*, Soraya Seedat*, Peilin Shi*, Kevin Shield*, Rupak Shivakoti*, Gitanjali M Singh*, David A Sleet*, Emma Smith*, Kirk R Smith*, Nicolas J C Stapelberg*, Kyle Steenland*, Heidi Stockl*, Lars Jacob Stovner*, Kurt Straif*, Lahn Straney*, George D Thurston*, Jimmy H Tran*, Rita Van Dingenen*, Aaron van Donkelaar*, J Lennert Veerman*, Lakshmi Vijayakumar*, Robert Weintraub*, Myrina M Weissman*, Richard A White*, Harvey Whiteford*, Steven T Wiersma*, James D Wilkinson*, Hywel C Williams*, Warwick Williams*, Nicholas Wilson*, Anthony D Woolf*, Paul Yip*, Jan M Zielinski*, Alan D Lopez†, Christopher J L Murray†, Majid Ezzati†

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% [6·8–9·4]), household air pollution from solid fuels (HAP; 7·0% [5·6–8·3]), and tobacco smoking including second-hand smoke (6·1% [5·4–6·8]). Dietary risk factors and physical inactivity collectively accounted for 10·0% (95% UI 9·2–10·8) 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

Lancet 2012; 380: 2224–60

See Comment pages 2053, 2054, 2055, 2058, 2060, 2062, and 2063

See Special Report page 2067

See Articles pages 2071, 2095, 2129, 2144, 2163, and 2197

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See Online for appendix

For interactive versions of figures 3, 4, and 6 see <http://healthmetricsandevaluations.org/gbd/visualizations/regional>

Institute for Health Metrics and Evaluation

(S S Lim PhD, A D Flaxman PhD, K G Andrews MPH, C Atkinson BS, E Carnahan BA, K E Colson BA, R E Engell BA, G Freedman BA, M K Freeman BA, E Gakidou PhD, R Jasrasaria BA,

A Major Source of PM (...AND Black Carbon): Old Diesel



- Primary health concern: *effects on the heart from exposure to PM from older diesel*
 - Significant effects on mortality, life expectancy
- Strong evidence of respiratory effects:
 - *reduced lung function, respiratory irritation, asthma exacerbation*
- *New: IARC (WHO) Review of diesel carcinogenicity June 2012*
 - *Diesel now classified as a “Known Human Carcinogen”*

- Exposure to old diesel pervasive in developing countries



WHO says diesel exhaust causes cancer

By Caleb Hellerman, CNN

Tue June 12, 2012

STORY HIGHLIGHTS

- The decision could pressure governments to impose stricter limits on emissions
- Previously, there was no clear evidence linking diesel exhaust to higher cancer rates

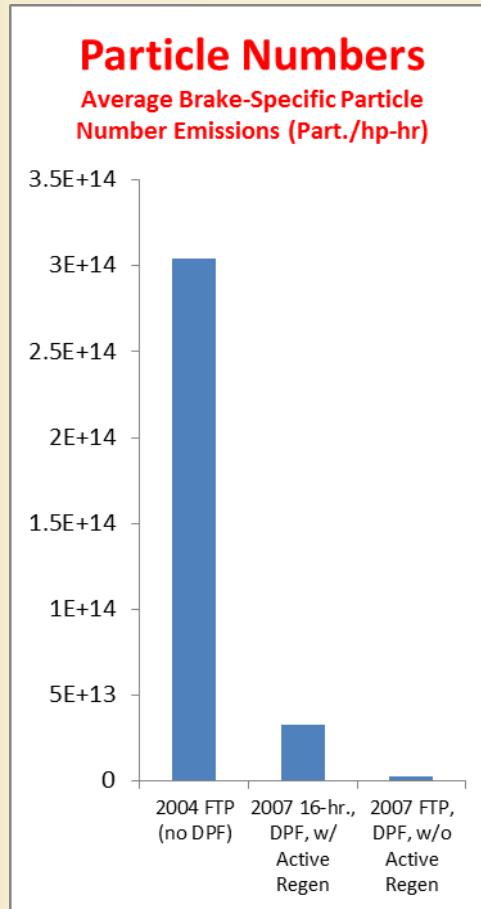
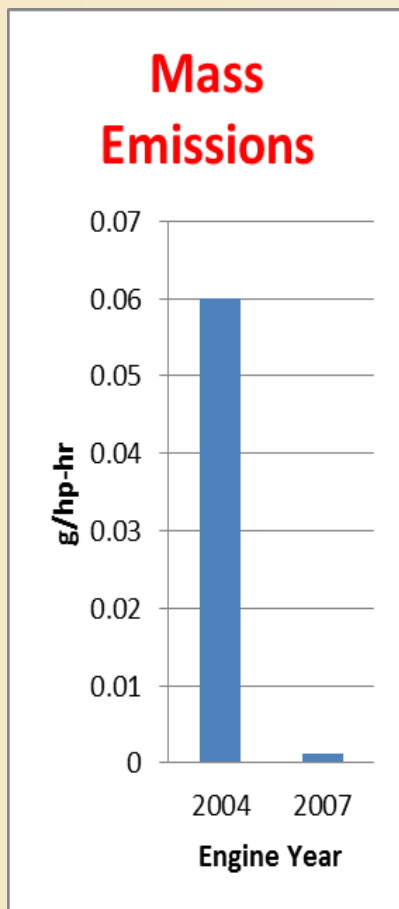
(CNN) -- Exhaust from diesel engines can cause cancer, a prominent global cancer group that's part of the World Health Organization said Tuesday.

The decision could put pressure on governments to introduce stricter limits on emissions, especially to protect workers who are exposed to diesel exhaust while on the job.

New Diesel: Hope for the future

HEI Tests: New Diesel Technology* vs. Old Diesel

(*Requires ultralow sulfur diesel, particle filters)



Dramatic Reductions

- *98% reduction in mass*
- *90% - 99% reduction in Ultrafines*
- *Substantial reduction in carbon*
- *Most cancer-causing chemicals now below “limits of detection”*



Source: Khalek 2011

Muchas Gracias

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