

Burden of Disease Approach to Prioritizing Environmental Policy Initiatives

A Case Study in the United Arab Emirates

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Questions

- Should the US (and NC) choose a portfolio of environmental investments to maximize public health returns?
- What are the pros and cons of such an approach?
- What tools are available to help?
 - Deliberative Method for Ranking Risks
 - Environmental Burden of Disease Model
 - Case study application in the United Arab Emirates
- Should NC undertake a project to demonstrate these tools in the US?

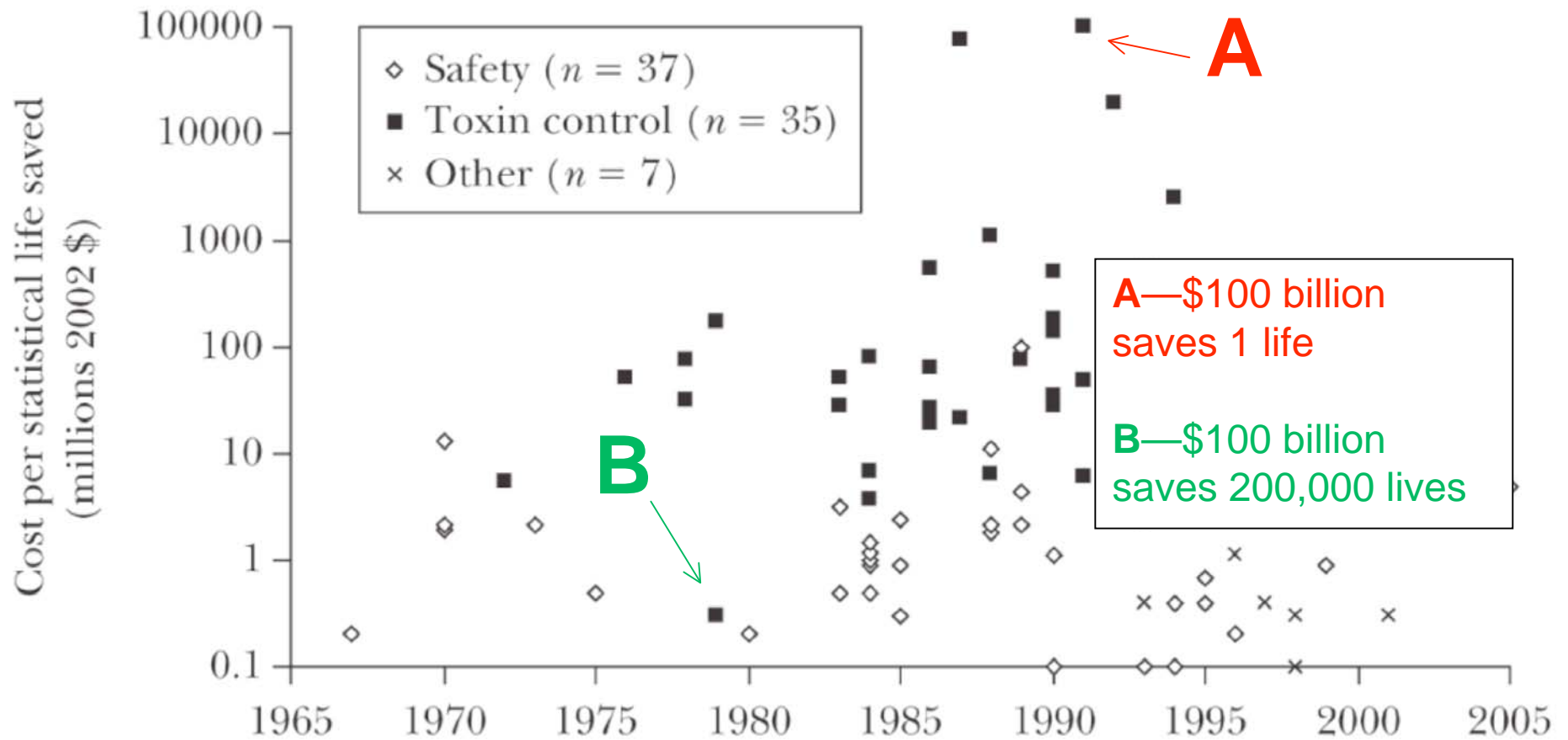
US Environmental Policy Reflects Fears, Not Risk

“The federal government’s efforts to achieve a cleaner environment have . . . been influenced more by fears than by scientific findings.

“The resulting patchwork of laws has made it all but impossible to address problems rationally and consistently.”

- Rep. J. Roy Rowland (D-Georgia, 1983-1995)

Previous Studies Show Mismatch Between Spending and Risk



Human Cognitive Limits Explain Gap Between Risk and Policy



Fears are not accurate indicators of risk.

Top Causes of Death in Children

1. Car accidents
2. Homicide (by someone the child knows)
3. Child abuse
4. Suicide
5. Drowning

Parents' Top Worries

1. Kidnapping
2. School snipers
3. Terrorists
4. Dangerous strangers
5. Drugs

Previous Efforts to Set Environmental Priorities Have Not Succeeded

- From about 1987-1997, the EPA and 33 states undertook projects to prioritize environmental risks.
- EPA's conclusion:
 - "EPA's priorities appear more closely aligned with public opinion [fears] than with estimated risk."
- Results of priority-setting projects never took hold.
 - Environmental regulatory system remains driven by patchwork of laws that do not necessarily address the worst problems.

Benefits of a “Worst Things First” Approach

Per dollar invested:

- Save more lives.
- Prevent more illnesses.
- Provide greater reduction in health-care costs.



“An ‘ability to smell fear’ is a quality I’ve never seen listed on a resume before.”

Key Arguments Against Priority-Setting Projects

1. Environmental priorities need to reflect values, not just risk.
 - Are risks to the elderly more or less important than risks to children?
 - Are risks over which individuals may have control more or less important than involuntary risks?
 - Are risks to the current generation more or less important than risks to future generations?
2. Quantifying comparative risks may not be possible--we may not know enough.

New Methods Address These Concerns

1. Environmental priorities need to reflect values, not just risk.
 - The “**Deliberative Method for Ranking Risks**” engages stakeholders to consider risk *and* values.
2. Quantifying comparative risks may not be possible--we may not know enough.
 - New concepts in **environmental burden of disease assessment**, plus more powerful desk-top computers, facilitate simulation of population risks.

Case Study in the United Arab Emirates (UAE)



- UNC employed the new methods in the UAE.
- These results will guide fledgling UAE environmental protection programs.

His Excellency Majid Al Mansouri, Secretary General, Environment Agency-Abu Dhabi

UAE: Confederation of Seven Emirates on Arabian Gulf



UAE and NC Have Similarities (and Differences)



Krispy Kreme, Abu Dhabi

	NC	UAE
Population	9.4 million	8.2 million
Per-Capita Income	\$47K	\$54K
Life Expectancy	75.6 yrs.	78.5 yrs.
Total Geographic Area	53,900 sq. mi.	32,300 sq. mi.
Annual Rainfall	42 in.	< 5 in.

UAE's Worries Are Similar to NC's

- Air pollution
 - Outdoor
 - Indoor
- Water pollution
- Food contamination
- Land pollution
- Waste management
 - Solid
 - Hazardous
 - Health care
- Climate change
- Noise pollution
- Chemical pollution in occupational environments
- Vector-borne disease
 - Rodents
- Electromagnetic fields
- Nonionizing radiation
- Built environment
- Ozone layer depletion

Method 1: Deliberative Method for Ranking Risks



- Five steps result in ranking that considers both risks *and* values:
 - A. Define and categorize the risks to be ranked.
 - B. Identify the risk attributes that should be considered.
 - C. Describe the risks in terms of the attributes in risk summary sheets.
 - D. Select participants and perform the risk rankings.
 - E. Describe the issues identified and the resulting rankings.

First described in scientific literature in 2001.

Example “Risk Summary Sheets”

ELECTROMAGNETIC FIELDS			
SUMMARY			
Electromagnetic fields (EMF) are produced by an electric charge or current, such as those found in power cords to household appliances or as a result of high voltage power lines. The strength of both electric and magnetic fields drops off steeply with distance from their source.			
The science linking exposure to EMF to health effects remains unconvincing. The only biological impact for which there is any correlation is childhood leukemia, but no cause and effect relationship has actually been shown. Therefore, these findings remain controversial, earning Extremely Low Frequency (ELF) magnetic fields the International Agency for Research on Cancer’s “possibly carcinogenic in humans” classification.			
Currently there is scant information available on the typical EMF levels for different locations in and around the UAE environment, workplaces, schools or residences. According to the Dubai Electricity and Water Authority, the utility does not allow buildings constructed within 50 meters of high voltage power lines, which are thought to be particularly strong producers of magnetic fields.			
Risk Characteristic	Low Estimate	Best Estimate	High Estimate
Fatalities			
Number of deaths per year	0	0.16	3.9
Chance in a million of death per year for the average resident	0	0.06	1.4
Chance in a million of death per year for the resident at highest risk	0	0.21	5.0
Greatest number of deaths in a single event		1	
Illness or Injury			
More serious long-term cases per year	0.5	2	14
Less serious long-term cases per year	0	0	0
More serious short-term cases per year	0	0	0
Less serious short-term cases per year	0	0	0
Other Factors			
Time between exposure and health effects	10 – 30 years		
Quality of scientific understanding	Low		
Combined uncertainty in death, illness, and injury	Low		
Ability of resident to control exposure to hazard	Moderate		

AMBIENT NOISE			
SUMMARY			
Noise is unwanted sound which results from many activities. In urban settings, common sources of noise include airplanes, trains, trucks and automobiles, construction and demolition activity, and industrial facilities. The most obvious effect from high noise levels is hearing impairment and its associated interference with general communication. Other impacts from continued noise exposure include cardiovascular effects and sleep disturbances. A 2006 ambient noise survey shows the noise level at monitoring sites in Abu Dhabi appears to be in excess of national and international standards, raising the concern that residents may be exposed to ambient noise pollution. But no systematic studies have been done to assess the noise levels in other Emirates.			
Risk Characteristic	Low Estimate	Best Estimate	High Estimate
Fatalities			
Number of deaths per year	0	Non-zero but low	Not reported
Chance in a million of death per year for the average resident	0	Non-zero but low	Not reported
Chance in a million of death per year for the resident at highest risk	0	Non-zero but low	Not reported
Greatest number of deaths in a single event		1	
Illness or Injury			
More serious long-term cases per year		Not reported	
Less serious long-term cases per year		Not reported	
More serious short-term cases per year		Not reported	
Less serious short-term cases per year		Not reported	
Other Factors			
Time between exposure and health effects	Weeks to Months		
Quality of scientific understanding	Low		
Combined uncertainty in death, illness, and injury	High		
Ability of resident to control exposure to hazard	Moderate		

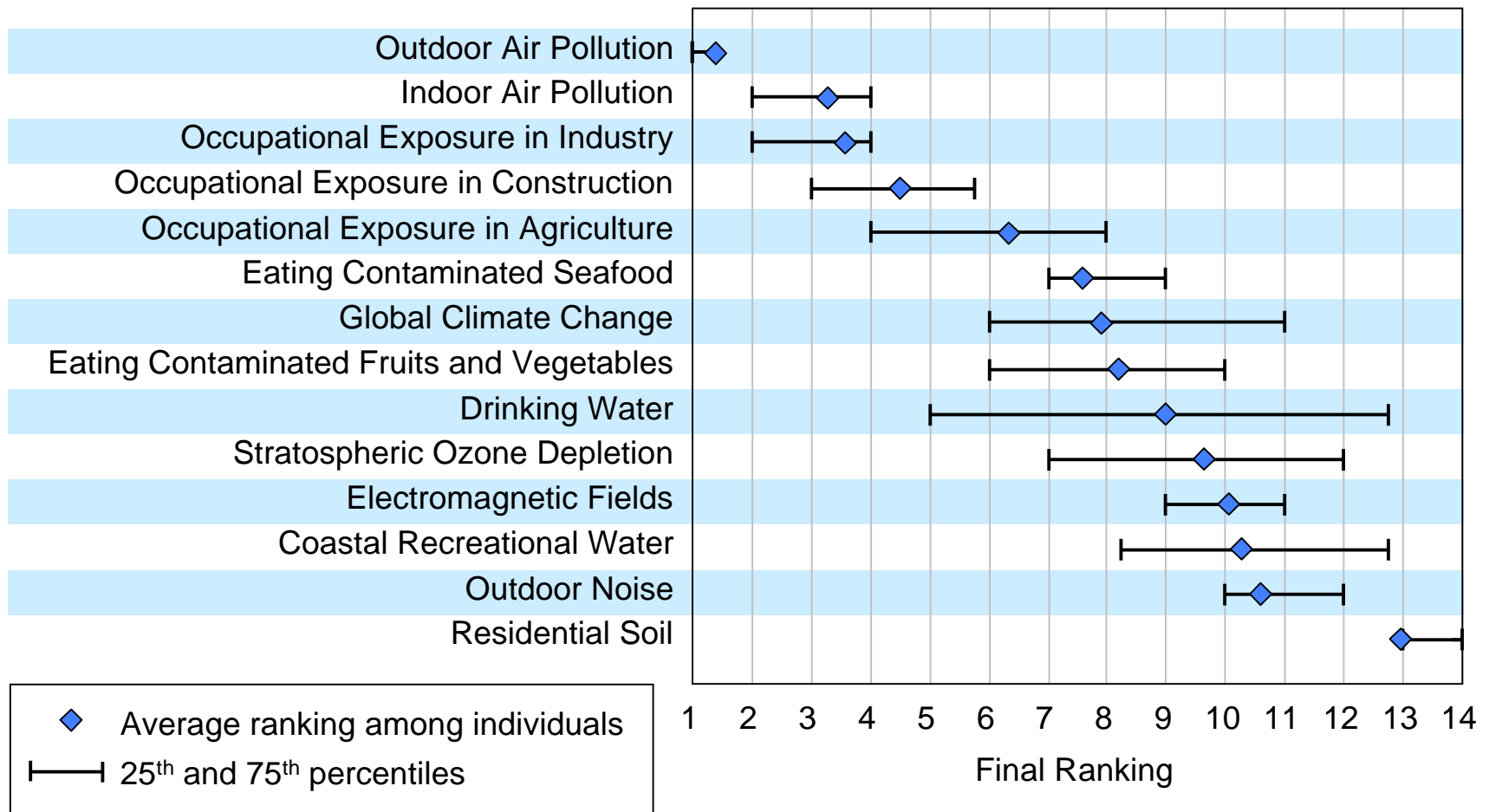
Research team compiles risk information in “summary sheets,” showing how risks measure along attributes.

Stakeholder Workshops



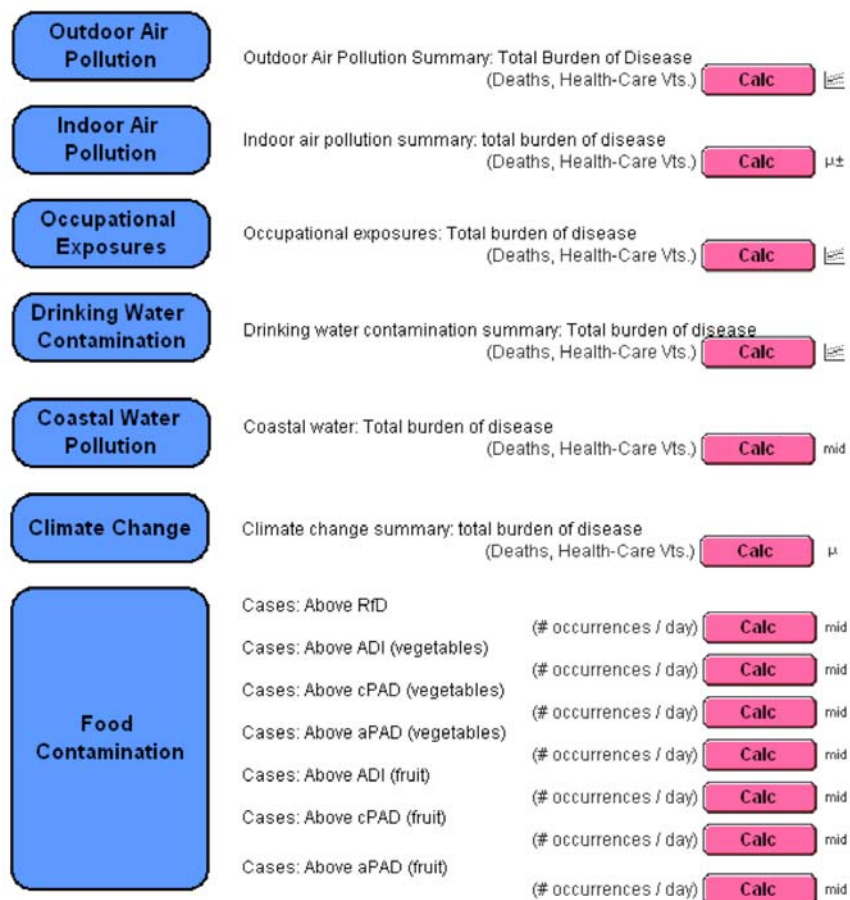
Workshops engage wide variety of stakeholders. UNC involved 73 stakeholders in 5 risk ranking workshops in the UAE.

Result: Prioritized List of Concerns, Showing Areas of Agreement

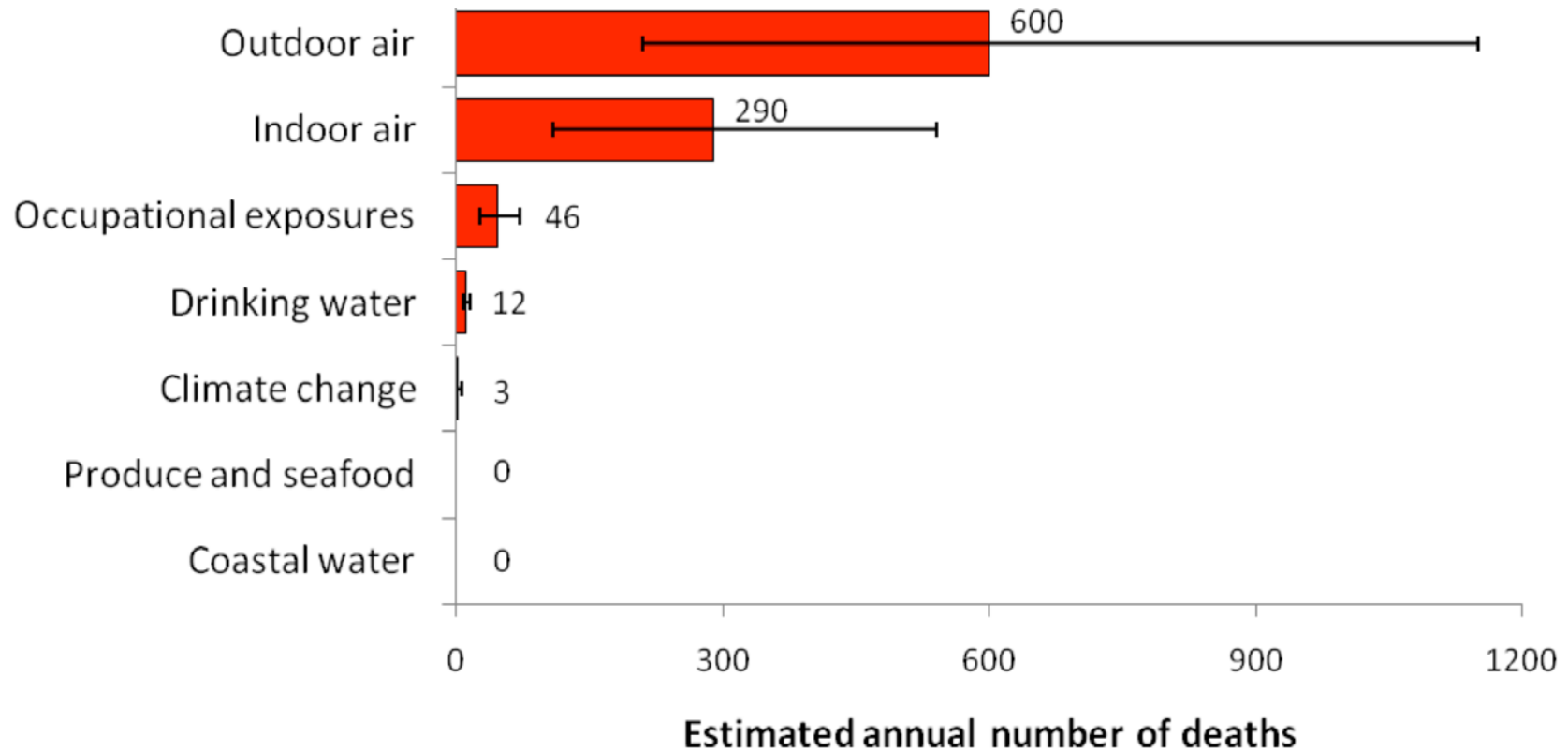


Method 2: Environmental Burden of Disease Simulation

- **Analytica** software
- **Monte Carlo** statistical simulation
- Data limitations contribute to **uncertainty** in results

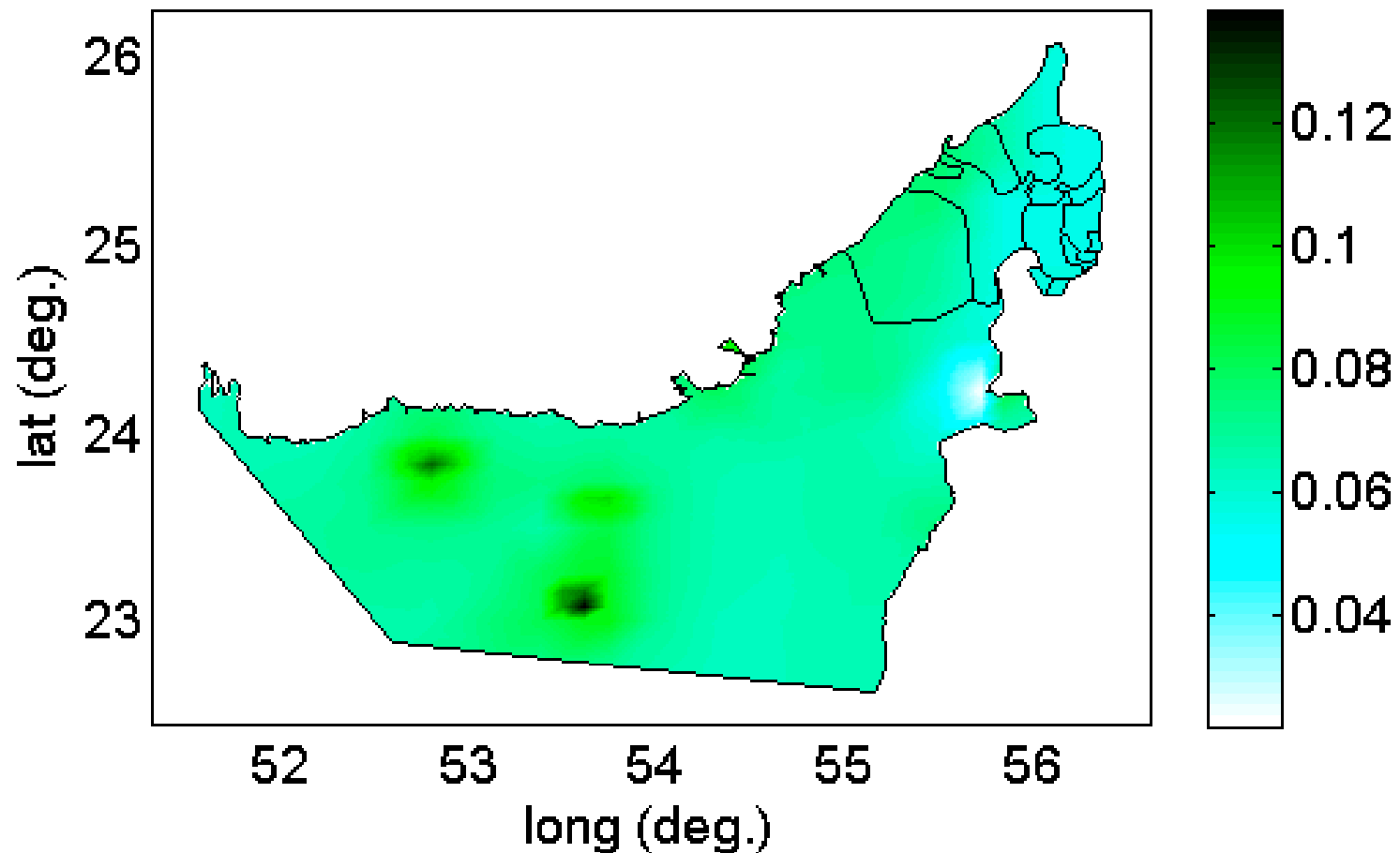


Model Shows Premature Deaths Attributable to Environmental Risks



Model Also Shows Geographic Variability in Risks

PM10 AF of all-cause mortality on Aug 12, 2008



Summary and Questions to Ponder

- As a society, we must and already do set priorities because our budget is limited. But the process for setting priorities is driven by fear and is not transparent.
- New tools are available that can advance our ability to systematically address environmental risks.
 - **Burden of disease modeling:** We may be able to show that in the long run, the state can save money by investing more in environmental protection.
 - **Deliberative method for ranking risks:** We can systematically consider health and environmental risks, as well as values, to develop a ranking of environmental risks.
- Should the US revisit the issue of prioritizing environmental problems, using these new tools?
- Can NC serve as an example?

Or, is the current priority-setting method good enough?



"I, too, want to preserve the environment, just as it is: acid rain, holes in the ozone layer, lots of crap in the air."

Additional Slides

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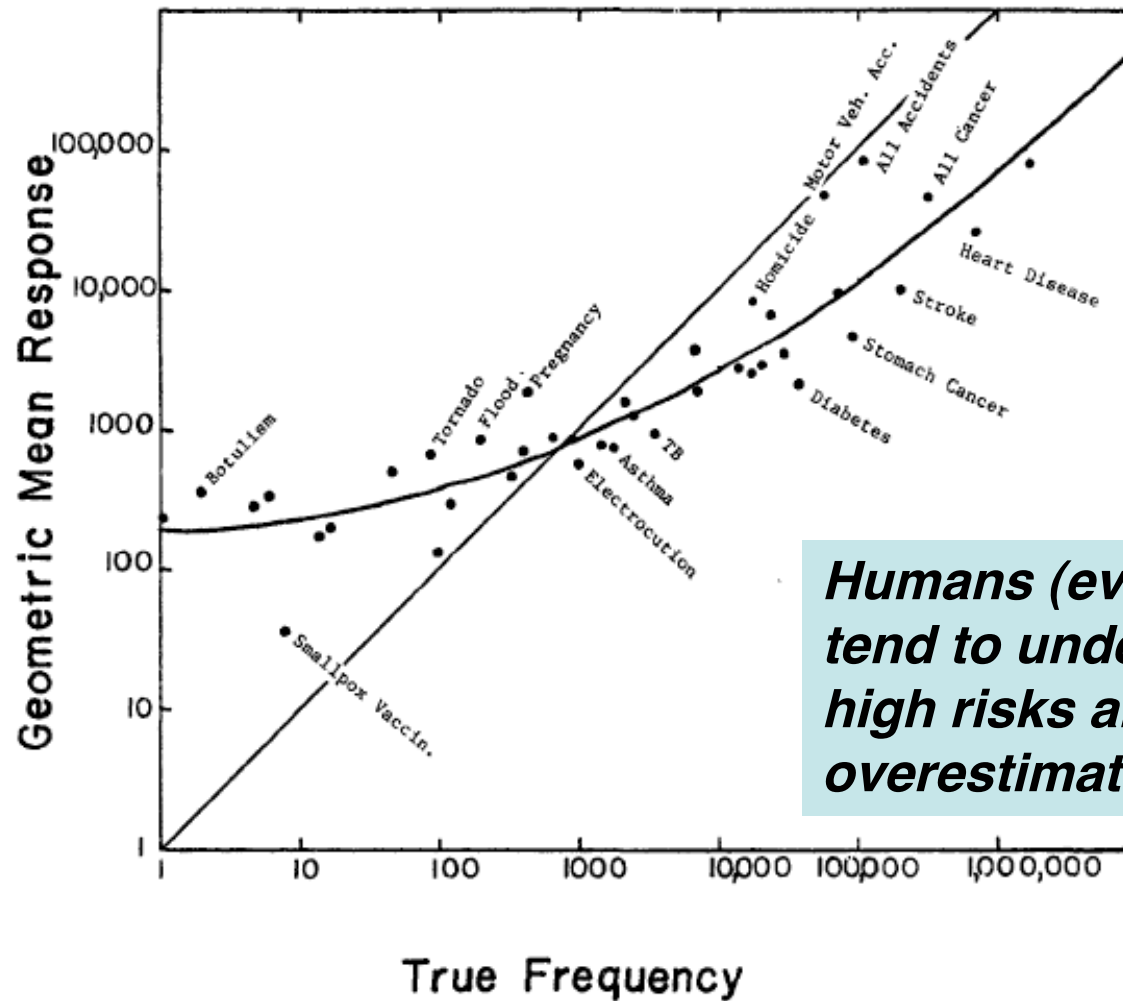


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UAE Environmental Health Project Team

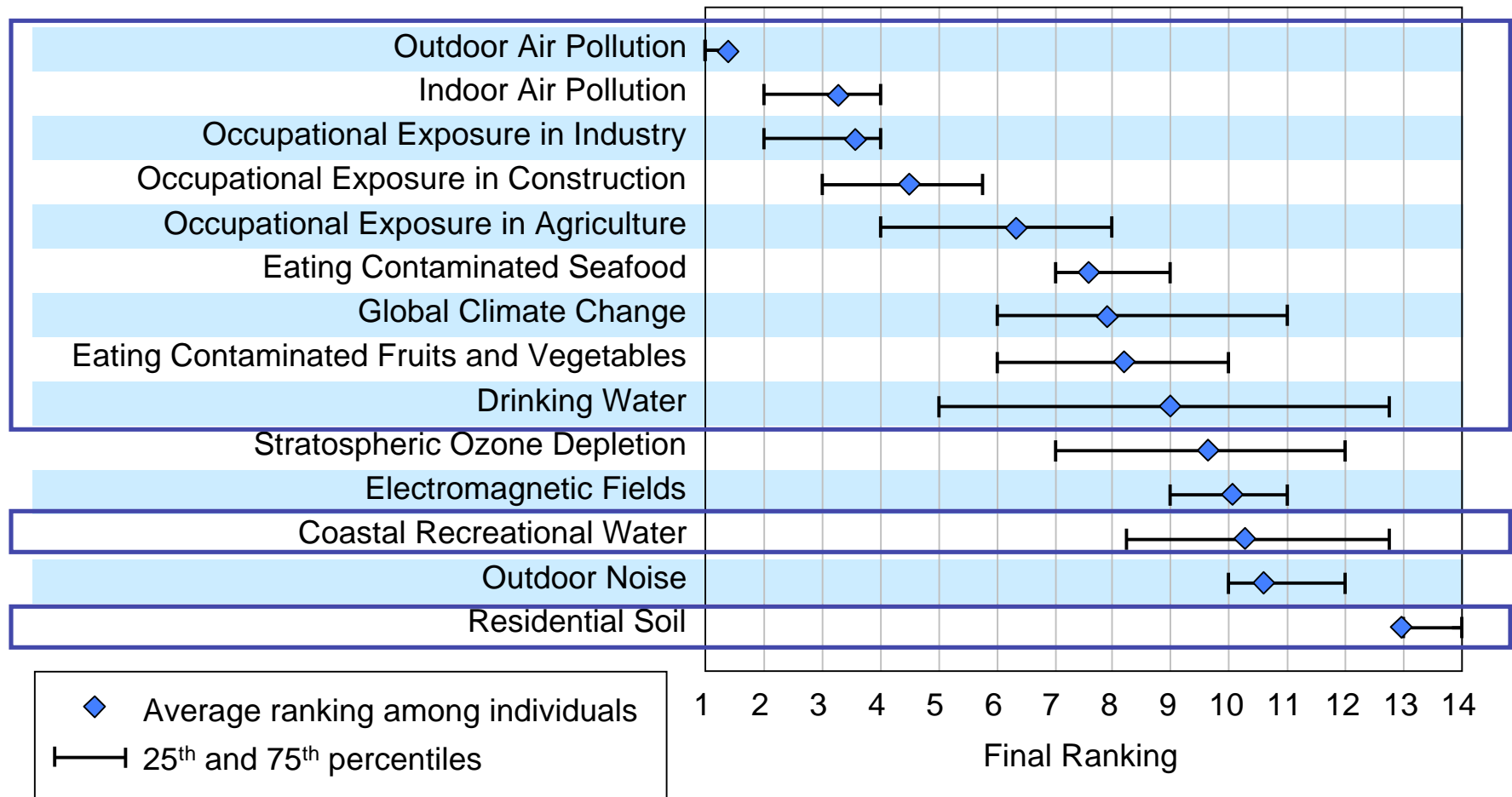
Mahmoud Abdulrahim	Gary Cecchine	Jianhui Hu	Hanine Salem
Aysha Abushahab	Ronna Chan	Prahlad Jat	Preethi Sama
Liz Adams	Greg Characklis	Harvey Jeffries	Marc Serre
Zac Adelman	Chidsanuphong Chart-a-sa	Leigh-Anne Krometis	Kenneth Sexton
Mike Aitken	Leslie Chinery	Alan Krupnick	Uma Shankar
Abdulla Al Aamri	Nancy Cohn	Lisa Lavange	Regina Shih
Salam Al Braiki	Aimee Curtright	David Leith	Stephanie Soucheray-Grell
Faisal Al Hammadi	Chris Davidson	Joe Lobuglio	David Steffen
Awatif Al Hosani	Ed Davis	Michael Mattock	Elizabeth Stewart
Jaber Al Jaber	Neil Davis	Ruqaya Mohamed	David Streets
Khaled Ateeq Al Mazrouki	Nicholas DeFelice	Karen Moore	Bob Sumner
Nabeel Al Olaqi	Rashed Ekaabi	Melinda Moore	Sarah Szambelan
Abdulla Al Rumaithi	Carl Ernst	David Nash	Kevin Talgo
Ayesha Al Suwaidi	Maria Falvo	Shu Wen Ng	Kunhikrishnan
Hazem Al Qawasmeh	Zeinab Farah	Leena Nylander-French	Thengumthara
Pete Andrews	Zuber Farooqui	Sarah Olmstead	Chris Trent
Saravanan Arunachalam	Mike Flynn	Andy Olshan	Natalya Vanchosovych
B.H. Baek	Bill Funk	Jennifer Platt	William Vizquete
Ahmed Bashir	Khalid Gelle	Barry Popkin	Binyu Wang
David Blackmore	Sandy Geschwind	Gavino Puggioni	Jason West
Maryanne Boundy	Adel Hanna	Joe Radzanowski	Aijun Xiu
Nicholas Burger	Mejs Hasan	Lisa Reeves	Yadong Xu
Diane Calleson	Sandra Hoffmann	Ivan Rusyn	Karin Yeatts

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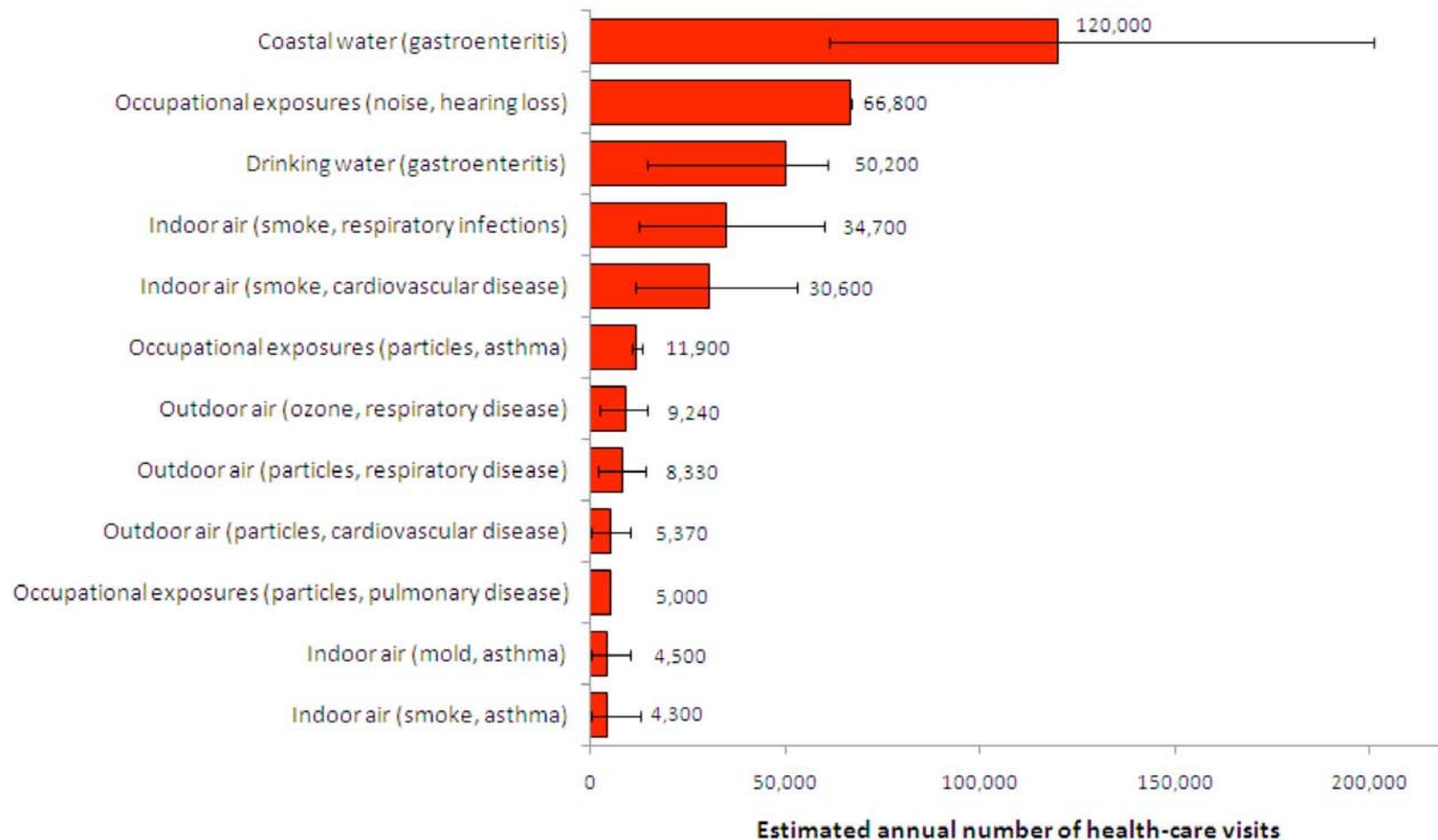


Humans (even “experts”) tend to underestimate high risks and overestimate low risks.

Some Low-Ranking Items Retained Due to UAE Agency Concerns



Illnesses Attributable to Environmental Risks in UAE



NC IOM Prevention Task Force Recommended An Assessment

“The Department of Environmental Sciences and Engineering in the University of North Carolina at Chapel Hill (UNC) . . . should work with appropriate state agencies . . . to develop an environmental assessment for the state that links environmental exposures/risks and health outcomes and includes strategies to address the exposures/risks.”

- NC IOM Task Force on Prevention

