

## Lines of scientific research relevant to cumulative impacts

Presentation to the Cal EPA CIPA Workgroup  
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Amy D. Kyle, PhD MPH  
University of California Berkeley  
School of Public Health  
<adkyle@berkeley.edu>

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## Current policy model

- Control individual pollutants to achieve public health for the group
  - Level without appreciable risk
  - Each one separately
- Adopted based on science of 1970s
- Has led to great progress
- Uses quantitative methods

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## Agreement we need to rethink

- National Academy of Sciences -- Science and Decisions
- Recommends development of capacity to address cumulative risks and impacts
- Include non-chemical stressors, vulnerability, defaults

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Public Participation in Environmental Assessment and Decision Making (Free Executive Summary)  
<http://www.nap.edu/catalog/12434.html>

### Free Executive Summary

#### Public Participation in Environmental Assessment and Decision Making

Thomas Dietz and Paul C. Stern, Editors, Panel on Public Participation in Environmental Assessment and Decision Making, National Research Council

ISBN: 978-0-309-12398-3, 322 pages, 6 x 9, paperback (2008)



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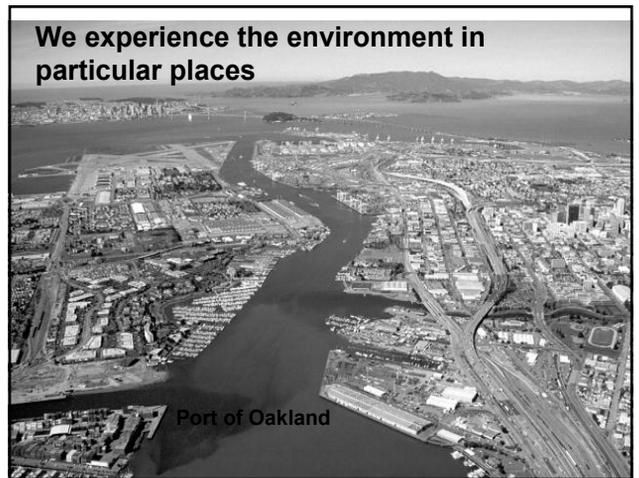
**Conclusion 1:** When done well, public participation improves the quality and legitimacy of a decision and builds the capacity of all involved to engage in the policy process. It can lead to better results in terms of environmental quality and other social objectives. It also can enhance trust and understanding among parties. Achieving these results depends on using practices that address difficulties that specific aspects of the context can present.

The panel found that participatory processes have sometimes made matters worse. However, it also found that across a wide variety of environmental assessment and decision contexts, there are practices that can simultaneously promote quality, legitimacy, and capacity.

**Recommendation 1:** Public participation should be fully incorporated into environmental assessment and decision-making processes, and it should be recognized by government agencies and other organizers of the processes as a requisite of effective action, not merely a formal procedural requirement.

**Recommendation 4:** Environmental assessments and decisions with substantial scientific content should be supported with collaborative, broadly based, integrated, and iterative analytic-deliberative processes, such as those described in *Understanding Risk* and subsequent National Research Council reports. In designing such processes, the responsible agencies can benefit from following five key principles for effectively melding scientific analysis and public participation:

1. ensuring transparency of decision-relevant information and analysis,
2. paying explicit attention to both facts and values,
3. promoting explicitness about assumptions and uncertainties,
4. including independent review of official analysis and/or engaging in a process of collaborative inquiry with interested and affected parties, and
5. allowing for iteration to reconsider past conclusions on the basis of new information.



## Lines of research

- Environmental health
- Health disparities
- Social determinants of health
- Environmental justice research
- Community health

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## Environmental health research

- May not be thresholds for populations response
- Similar mechanisms may lead to multiple diseases
  - And be stimulated by multiple stressors
- Responses to stressors vary
  - Some are much more sensitive
- Positive factors matter (e. g., open space)

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## Is there a "safe" level?

- Research may not show threshold for dose-response in populations
- Better studies -> lower dose matters
  - Metals (lead, probably mercury)
  - Air pollutants (ozone, PM)
  - Endocrine disruptors

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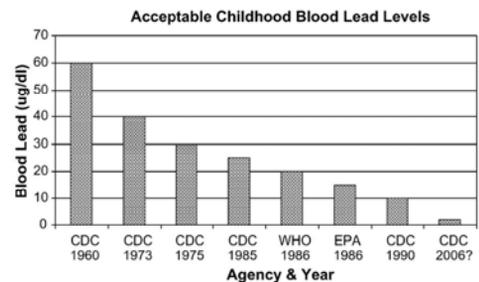


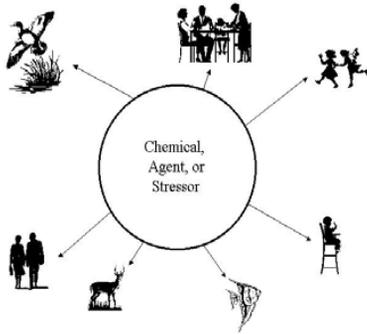
FIG. 1. The gradual decline in acceptable blood lead levels in children. The 2006 number is the recommend value based on current scientific knowledge.

Gilbert and Weiss. 2006. Neurotoxicology. 27(5)

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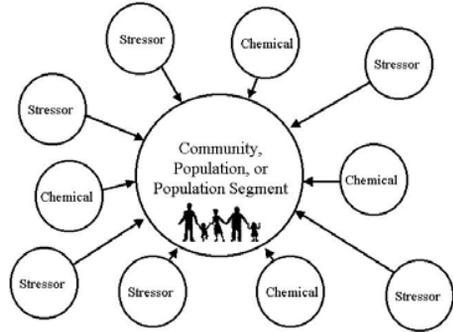
Change focus: from “single agent or stressor”



US EPA Framework for Cumulative Risk Assessment 2003

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Change focus: to what happens in communities



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## Cal EPA Working definitions

Cumulative impacts means exposures, public health or environmental effects from the combined emissions and discharges, in a geographic area, including environmental pollution from all sources . . . Impacts will take into account sensitive populations and socio-economic factors, where applicable and to the extent data are available.

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## Responses vary greatly

- Key genetic differences affect many aspects of response to environment
  - Gene-environment interaction
  - e. g., metabolism
- Life stage approaches emerging
  - Great differences at life stages
  - “imprinting” of what will happen later
  - Epigenetics - heritable non-genetic changes

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## Sensitivity

- Key concept for CIPA project
- Reflects this idea of variability in response
- Intrinsic susceptibility

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## Environmental factors I

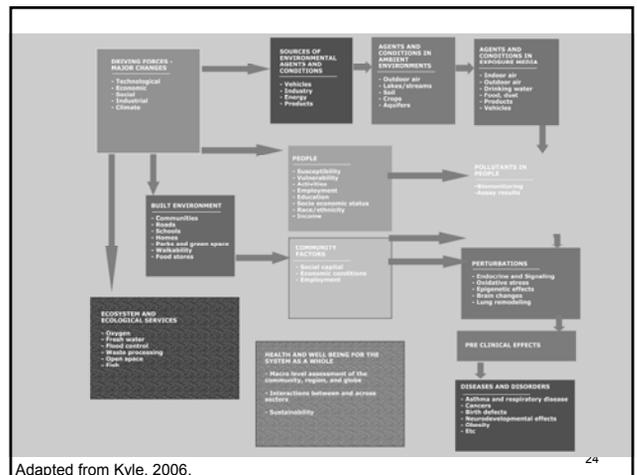
- Contaminant sources
  - Air pollution (indoor and outdoor), water pollution, drinking water, land contamination (sites)
  - Dusts (indoors) and soils (outdoors)
  - Consumer products, workplaces
- Positive factors
  - Green space, access to recreation areas, walkability

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## Environmental factors II

- Positive factors
  - Green space and natural areas
    - Increase markers related to health and well-being
    - Very recent results (2008)
  - Design of built environment
    - access to recreation areas
    - walkability

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Adapted from Kyle, 2006.

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## Beyond environmental factors

- People and communities
  - Vulnerability (e. g., poverty)
  - Health status (elevated disease)
  - Resources and resiliency
- All interact with environment

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## Health disparities

- Enormous research effort to understand disparities in health and address them
- Mainstream focus

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### National Institutes of Health



#### Fact Sheet

#### Health Disparities

##### Thirty Years Ago

- Americans enjoyed improved health and longer lives during the latter part of the 20<sup>th</sup> century. However, African Americans, Hispanics, Native Americans, and Asian Pacific Islanders, who represented 25 percent of the U.S. population, continued to experience striking health disparities, including shorter life expectancy and higher rates of diabetes, cancer, heart disease, stroke, substance abuse, and infant mortality and low birth weight.
- Scientists believed these health disparities resulted from the complex interaction among several factors such as biology, the environment, and specific behaviors that were significantly impacted by a shortage of racial and ethnic minority health professionals, discrimination, and inequities in income, education, and access to health care.
- To achieve its strategic plan goals, NIH activities include 1) research focused on health disparities experienced by racial and ethnic minorities, the rural and urban poor, and other medically underserved populations; 2) conducting population-specific community-based research; 3) enhancing the capacity to conduct health disparities research nationally; 4) recruiting and retaining racial and ethnic minorities and other underrepresented groups into the scientific research workforce; 5) establishing health education programs for special populations; and 6) promoting the inclusion of women, minorities and other medically underserved groups in clinical trials.
- Research at the NIH advances the understanding of the development and progression of diseases and disabilities that disproportionately affect racial and ethnic minorities.

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## Social determinants of health

- Social factors affect health status
- Extensive research over long time periods

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## Environmental justice research

- Shows disparities in exposures

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## Communities and individuals

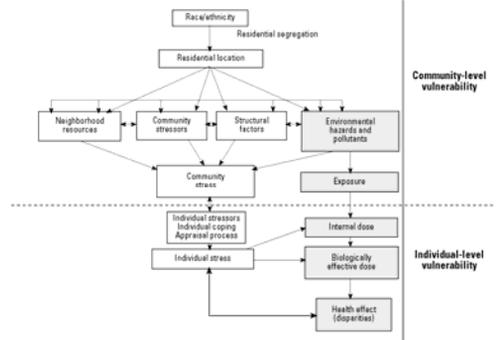


Figure 1. Exposure-disease-stress model for environmental health disparities.

G Gee and D Payne-Sturges. 2004. Environmental Health Perspectives

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## Considering inequality?

- Differences among groups
  - Race/ethnicity, income or socio economic status
- How to take this into account

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## What to do differently?

- Target resources
- Limit new stressors
- Enhance positive factors
- Remediate existing burden
- Enforce laws
- Develop new standards
- Etc.

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## Conclusion

- Several lines of research support new approaches
- Science is moving beyond "one pollutant at a time"
- Qualitative but broader methods may be more scientifically valid than quantitative but narrower ones

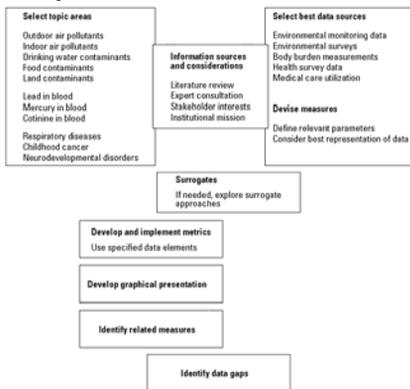
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Amy D. Kyle <adkyle@berkeley.edu>

<http://envirohealth.berkeley.edu/>

Thanks!

## Combine analysis and deliberation



AD Kyle et al. 2006. Environmental Health Perspectives 114(3)

## Vulnerability

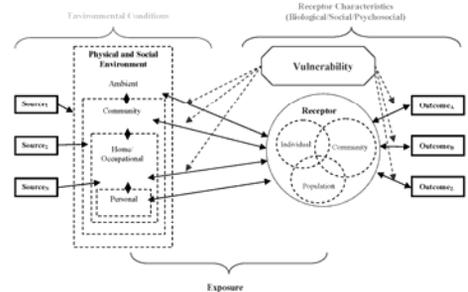


Figure 1. Conceptual Model for Incorporating Vulnerability Factors into Cumulative Risk Assessment.

Peter deFur et al 2007, Environmental Health Perspectives.

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