Workshop Goals & Objectives: Why We are Here

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Why We’re Here Today

• Focus on preventing air pollution-related cardiopulmonary illnesses

• Identifying new opportunities
  – transitions in health care and
  – new developments in data and technology

• Tapping diverse disciplines to collaborate
  – moving environmental evidence into health care practice

• Initial steps underway at EPA

• Workshop goals and objectives
Population Health & Wellbeing – A Common Goal

Who is Here?
Shared Mission of Many Stakeholders

Trans-disciplinary Collaborations to Improve Health

Local & State Government and NGOs
Academic Organizations
Healthcare Systems
Health Care Providers & Professional Organizations
Health Insurers
Environmental Health
Philanthropic Organizations
Federal Agencies
Public Health
Key Facts

- High attributable health burden
- Vulnerable subpopulations are at higher risk
- No established threshold level for safe long-term exposure
- Mechanisms of health effects are now known
- Decreased long-term air pollutant exposures associated with improved cardiovascular outcomes

Average PM$_{2.5}$ 2001-2010


Giles LV et al. *Environmental Health Perspectives* 2011
High blood pressure
Household air pollution from solid fuels
High body-mass index
Tobacco smoking, including second-hand smoke
High fasting plasma glucose
Diet low in fruits
Childhood underweight
Alcohol use
Physical inactivity and low physical activity
Ambient particulate matter pollution
Iron deficiency
Diet high in sodium
Suboptimal breastfeeding
Diet low in nuts and seeds
High total cholesterol
Intimate partner violence
Diet low in whole grains
Diet low in vegetables
Diet low in seafood omega 3 fatty acids

Household air pollution from solid fuels
Ambient particulate matter pollution

3.7 million excess deaths globally due to ambient air pollution - WHO
Air pollution is a significant U.S. public health problem

- Estimated excess mortality 134,700 deaths/year
- Over 1.1 million life years lost

Impacts are worsening with global climate change

Fann et al. *Risk Analysis* 2011
Public Health Action Needed along with EPA Standards

• EPA’s air pollution standards for particulate matter provide the largest health benefits of any federal regulation

• EPA regularly evaluates the standards, health risks, and issues stricter standards when needed

• Health risks remain – and need to be addressed through integrated efforts of public health, health care, environmental health, individual & community action

  - Disproportionate air pollution impacts on overburdened communities
Particulate matter (PM) – “soot”

- from combustion sources
- mixture of solid particles and liquid droplets found in the air

National Ambient Air Quality Standards (NAAQS)

- 35 µg/m³ - 24 hours
- 12 µg/m³ - annual average
Air Pollution 101

Other Major Air Pollutants

• Ozone
  - Key component of smog
  - Best known for triggering respiratory complaints
  - Also associated with cardiovascular health effects

• Nitrogen dioxide
  - Largely from traffic
  - Important in the near-road environment
  - Associated with acceleration of atherosclerosis

• Others (CO, lead, SO₂, volatile organics)
  - Can be significant locally, less widespread impact
Cardiovascular Mortality - Leading Cause of Death in US

- Over 740,000 people die of cardiovascular disease & stroke each year
- Since 2011, improvements in mortality from CVD, heart disease & stroke have slowed
- Obesity and diabetes are on the rise

**Recent Trends in Cardiovascular Mortality in the United States and Public Health Goals**

Stephen Sidney, MD, MPH; Charles P. Quesenberry Jr, PhD; Marc G. Jaffe, MD; Michael Sorel, MPH; Mai N. Nguyen-Huynh, MD; Lawrence H. Kushi, ScD; Alan S. Go, MD; Jamal S. Rana, MD, PhD

**Conclusions and Relevance** Deceleration in the decline of all CVD, HD, and stroke mortality rates has occurred since 2011. If this trend continues, strategic goals for lowering the burden of CVD set by the American Heart Association and the Million Hearts Initiative may not be reached.

*JAMA Cardiol.* doi:10.1001/jamacardio.2016.1326Published online June 29, 2016.

Sidney S, et al. JAMA Cardiol 2016
Long-term air pollution exposure accelerates atherosclerosis

Short-term air particle pollution exposure triggers myocardial infarction, stroke, CHF, DVT

Traditional risk factors fail to explain 25% of the incidence of coronary heart disease
The World is Changing: New Opportunities to Improve Health

- Healthcare systems changes – Value-based payment
- Affordable Care Act (ACA)
  - Electronic medical records
  - Accountable care organizations
    - Focus on quality metrics & costs
  - Community benefits programs
  - Medicare/Medicaid (CMS)
    - Hospital readmissions reduction program
- Predictive analytics and population health surveillance
- Environmental and physiological sensors
One Example: Hospital Readmissions Reduction Program

- Under ACA, CMS must reduce payments to hospitals with excess readmissions
- Readmissions start from the patient’s home
  - Are the home or local community environments contributing?

Modern Healthcare
The leader in healthcare business news, research & data

Most hospitals face 30-day readmissions penalty in fiscal 2016
By Sabriya Rice | August 3, 2015
Most U.S. hospitals will get less money from Medicare in fiscal 2016 because too many patients return within 30 days of discharge.
Populations at Higher Risk
Air Pollution and Readmissions

CMS Readmission Reduction Program

Conditions evaluated for excess readmissions:

- Cardiovascular disease
  - Myocardial infarction
  - Heart failure
- Pulmonary disease
  - COPD
- Pneumonia
- Hip and/or Knee Arthroplasty

EPA – Sensitivity to PM Air Pollution

Populations showing increased sensitivity include those having:

- Cardiovascular disease
  - Ischemic heart disease
  - Heart failure
  - Ventricular arrhythmia
- Pulmonary disease
  - COPD
- Diabetes
Populations at Higher Risk
Air Pollution and Readmissions

EPA ISA - Air Pollution

*Populations showing increased sensitivity to the adverse health effects of short-term air particle pollution include those having:*

- Cardiovascular disease
  - *Ischemic heart disease*
  - *Heart failure*
  - *Ventricular arrhythmia*
- Pulmonary disease
  - COPD
- Diabetes

CMS Bundled Payments Program

*Accelerating the shift to value-based payment*

*Mandatory in 98 markets across the U.S.*

*Conditions covered:*

- Cardiovascular disease
  - *Myocardial infarction*
  - *Coronary artery by-pass*
- Hip and/or Knee Arthroplasty
New community benefit requirements in the Affordable Care Act (ACA)

- Non-profit hospitals must improve transparency and accountability
- Strategy to address ACA’s priorities of preventive care and population health through community health improvement activities
- Focusing on air pollution concerns could be part of community health improvement activities

EPA provides the AQI nationwide on www.airnow.gov

Index reports daily air quality & related health effects

https://airnow.gov/index.cfm?action=aqibasics.aqi

https://www.epa.gov/air-research/healthy-heart-toolkit-and-research

www.epa.gov/air-sensor-toolbox
Informing Health Care Providers

- Medical poster for patient education
- Fact sheet for patient education
- Web CME courses for healthcare providers:
  - “Ozone and Your Patient’s Health”
  - PM course nearly completed
The Environmental “Buckets” of Prevention Framework

National Ambient Air Quality Standards specified by the Clean Air Act protect Public Health

Total Population Community-Wide Prevention

- PM NAAQS
  - 24-hour Standard: 35 µg/m³
  - Annual Standard: 12 µg/m³

Innovative Clinical Prevention

- Currently no traditional “evidence-based” clinical prevention management strategies

Traditional Clinical Prevention

Public Health

Health Care

• Identify and discuss barriers to the inclusion of environmental health data and tools for the prevention and management of disease

• Imagine and discuss actionable approaches to improve health and clinical outcomes by integrating environmental health data and tools into public health and health care services for at-risk patients
Opportunities to Improve Individual and Population Health

PM causes CV mortality/morbidity

High Prevalence of Individuals At Risk

Aging population, more obesity & diabetes

Millions exposed to PM-\(O_3\) above the NAAQS

Movement towards value-based payment

Electronic Medical Records

Predictive Analytics

Sensors & Social Media

Environmental tools & data

Healthy People Need Healthy Environments
Workshop Questions

• Is evidence sufficient to incorporate environmental data/tools into health promotion & disease management strategies? For an individual? For a community? If not, what will it take?

• What are the barriers to the development & implementation of interventions to decrease adverse health effects from air pollution exposures among people at-risk?

• What novel approaches could improve health outcomes?

• What collaborative efforts could address barriers and test new integrated environmental health-healthcare approaches to improve cardiopulmonary and decrease health disparities?
This is a Working Meeting

- Hear from everyone
- Think boldly and creatively
- Intentionally small meeting designed to be very interactive
- Let’s conclude with potential for real collaborations, pilot efforts, innovative approaches
- The time is Now
Back-up Slides
Air Pollution and Health Effects

Estimating disease burden & benefits is challenging

Subclinical Effects with No Symptoms (e.g. asymptomatic decrease in lung function, heart rate variability or endothelial function)

Deaths

Hospitalization:
- ED, Urgent Care, & Physician Office Visits
- Restricted Activity Days

Respiratory, Cardiovascular, Other Symptoms, and/or Medication Use

Size of Population Affected by Exposure to Smoke

Increasing air pollution concentration, and/or increasing susceptibility

Increasing economic, individual and societal burden
**Air Quality Index**

Transitioning from Public to Patient Education

<table>
<thead>
<tr>
<th>Descriptors</th>
<th>Cautionary Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good 0 – 50</td>
<td>No message</td>
</tr>
<tr>
<td>Moderate 51 – 100</td>
<td>Unusually sensitive individuals</td>
</tr>
<tr>
<td>Unhealthy for Sensitive Groups 101 - 150</td>
<td>Identifiable groups at risk - different groups for different pollutants</td>
</tr>
<tr>
<td>Unhealthy 151 - 200</td>
<td>General public at risk; sensitive groups at greater risk</td>
</tr>
<tr>
<td>Very Unhealthy 201 - 300</td>
<td>General public at greater risk; sensitive groups at greatest risk</td>
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- Index for reporting daily air quality and related health effects
- Health-based descriptors reflect a range of effects
- Pollutant-specific health messages
- Uniform across the U.S. – red in Boston same as in Los Angeles
- Used by Federal, State, Tribal and local government agencies
- Air quality forecasts most important for reducing exposures and emissions
Informing the Public

- EPA provides the AQI nationwide on [www.airnow.gov](http://www.airnow.gov)

- Local air quality conditions also often part of local weather reports

- Emergence of mobile phone apps that provide local AQI information
Relevance:
• Ambient PM triggers heart attacks, strokes, abnormal heart rhythms and sudden death
• More than 1 million heart attacks each year in US
• ~5% of heart attacks attributed to PM exposure
• 42 million Americans >60 years old with cardiovascular disease
• Heart disease costs ~$480 billion/yr
• Will approach ~$1 trillion/yr by 2030

Approach:
• Provide an environmental health message for individuals at high-risk for cardiac events
EPA actively engaged in new sensor technologies for:
- personal use
- community engagement
- research
USEPA Environmental Quality Index (EQI) - Air, Water, Land, Built, and Sociodemographic Domains Transformed Variables Dataset as Input for the USEPA EQI, by County for the United States

Metadata Updated: Mar 31, 2016

The US Environmental Protection Agency’s (EPA) National Health and Environmental Effects Research Laboratory (NHEERL) in the Environmental Public Health Division (EPHD) is currently engaged in research aimed at developing a measure that estimates overall environmental quality at the county level for the United States. This work is being conducted as an effort to learn more about how various environmental factors simultaneously contribute to health disparities in low-income and minority populations, and to better estimate the total environmental and social context to which humans are exposed. This dataset contains the finalized transformed variables chosen to represent the Air, Water, Land, Built, and Sociodemographic Domains of the total environment. Six criteria air pollutants and 81 hazardous air pollutants are included in this dataset. Data sources are the EPA's Air Quality system (http://www.epa.gov/ttn/airs/airsaqsl/) and the National-scale Air Toxics Assessment (http://www.epa.gov/nata/). Variables are average pollutant concentrations or emissions for 2000-2005 at the county level for all counties in the United States. Data on water impairment, waste permits, beach closures, domestic water source, deposition for 9 pollutants, drought status, and 60 chemical contaminants. Data sources are the EPA's WATERS (Watershed Assessment, Tracking and Environmental ResultS) Database (http://www.epa.gov/waters/), the U.S. Geological Survey Estimates of Water Use in the U.S. for 2000 and 2005
• Nationally consistent dataset and approach for combining environmental and demographic indicators
• EJSCREEN users choose a geographic area; the tool then provides demographic and environmental information for that area
• EJSCREEN indicators are publicly-available data
• EJSCREEN provides a way to display this information and includes a method for combining environmental and demographic indicators into EJ indexes