Healthy People 2020: Who’s Leading the Leading Health Indicators?
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Healthy People 2020
ODPHP
Leading Health Indicators are:
- Critical health issues that, if addressed appropriately, will dramatically reduce the leading causes of preventable deaths and illnesses
- Linked to specific Healthy People objectives
- Intended to motivate action to improve the health of the entire population

1200 Healthy People objectives

LHIs are a subset of Healthy People objectives
Who’s Leading the Leading Health Indicators?

Featured Speakers:

■ **Carter Blakey** – Deputy Director, Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services

■ **Maria Mirabelli, PhD, MPH** – National Center for Environmental Health, Air Pollution and Respiratory Health Branch, Centers for Disease Control and Prevention

■ **Iyad Kheirbek, MS** – Director, Air Quality Program at New York City Department of Health and Mental Hygiene
Environmental Quality

- Environment Definition
  - The World Health Organization (WHO) defines environment, as it relates to health, as “all the physical, chemical, and biological factors external to a person, and all the related behaviors.”

- Impact on the population
  - Globally, an estimated 12.6 million deaths each year can be attributed to unhealthy environments.
Environmental Quality

- What is environmental health?
  - Preventing or controlling disease, injury, and disability related to interactions between people and the environment.

- Environmental factors include:
  - Exposure to hazardous substances in the air, water, soil, and food
  - Natural and technological disasters
  - Physical hazards
  - Nutritional deficiencies
  - Built environment
The HP2020 Environmental Health Objectives focus on 6 themes:

1. Outdoor air quality
2. Surface and ground water quality
3. Toxic substances and hazardous wastes
4. Homes and communities
5. Infrastructure and surveillance
6. Global environmental health
Environmental Quality - Leading Health Indicators

- Air Quality Index > 100
- Children exposed to secondhand smoke
Importance of Addressing Air Quality

- Poor air quality is linked to:
  - Premature death
  - Asthma
  - Decreased lung function
  - Effects on the nervous system
  - Cancer
  - Increased frequency, severity and susceptibility to respiratory symptoms
  - Aggravation of respiratory and cardiovascular disease
Importance of Addressing Air Quality

- In 2015, approximately 121 million people nationwide lived in counties with pollution levels that exceeded the national air quality standards.

- Impact of cleaner air:
  - Prevents premature deaths
  - Reduces heart attacks and hospital visits
  - Alleviates child asthma attacks
  - Prevents lost school and work days
Exposure to Unhealthy Outdoor Air

NOTE: The measure is the number of people potentially exposed to unhealthy air weighted by the magnitude of the Air Quality Index (AQI) and the number of days that the AQI exceeds 100. The population of all counties in the contiguous United States is multiplied by the AQI weight to produce weighted people-days.

SOURCE: Air Quality System (AQS), EPA.

HP2020 Target (1.98 billion)

Decrease Desired

NOTE: The measure is the number of people potentially exposed to unhealthy air weighted by the magnitude of the Air Quality Index (AQI) and the number of days that the AQI exceeds 100. The population of all counties in the contiguous United States is multiplied by the AQI weight to produce weighted people-days.

SOURCE: Air Quality System (AQS), EPA.
Exposure of Children to Second Hand Smoke, Ages 3-11, 2009–2012

NOTES: I = 95% confidence interval. Children aged 3-11 years are considered to be non-smokers if they had a serum cotinine level of less than or equal to 10 ng/ml. Children are considered to be exposed to second hand smoke if they had a cotinine level greater than or equal to 0.05 ng/ml and less than or equal to 10 ng/ml. Black and White exclude persons of Hispanic origin. Persons of Hispanic origin may be any race. Respondents were asked to select one or more races. Single race categories are for persons who reported only one racial group.

SOURCE: National Health and Nutrition Examination Survey (NHANES), CDC/NCHS

HP2020 Target: 47.0

Obj. TU-11.1
Decrease desired
Exposure of Children to Second Hand Smoke, Ages 3-11, 2009–2012

NOTES: I = 95% confidence interval. * Data are statistically unreliable. Children aged 3-11 years are considered to be non-smokers if they had a serum cotinine level of less than or equal to 10 ng/ml. Children are considered to be exposed to second hand smoke if they had a cotinine level greater than or equal to 0.05ng/ml and less than or equal to 10 ng/ml.

SOURCE: National Health and Nutrition Examination Survey (NHANES), CDC/NCHS

Obj. TU-11.1 Decrease desired
Outdoor PM$_{2.5}$ and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma

Maria C. Mirabelli, PhD, MPH
Senior Service Fellow
Air Pollution and Respiratory Health Branch

Healthy People 2020 Leading Health Indicators
November 17, 2016
Asthma

- Chronic disease of the airways
- Widespread, variable airflow obstruction
  - Often reversible, spontaneously or with treatment
- Symptoms include
  - Coughing
  - Wheezing
  - Chest tightness
  - Shortness of breath

Source: http://www.nhlbi.nih.gov/health/health-topics/topics/asthma
The Burden of Asthma in the United States

- **Current asthma prevalence:** 7.7%
  - Have you ever been told by a doctor or other health professional that you had asthma?
  - Do you still have asthma?

- **Individuals with asthma:** 24 million

- **44.7% of individuals with current asthma reported one or more asthma attacks in the past year**

- **1.8 million emergency department visits/year with primary diagnosis of asthma**

- **10.5 million physician office visits/year with primary diagnosis of asthma**

- **>3,000 deaths/year due to asthma**

Source: [http://www.cdc.gov/asthma/most_recent_data.htm](http://www.cdc.gov/asthma/most_recent_data.htm), updated March 2016
Prevalence of Current Asthma Varies by Age

Source: http://www.cdc.gov/asthma/most_recent_data.htm, updated March 2016
Common Risk Factors for Exacerbation of Existing Asthma

- Cat, dog
- Cockroach, house dust mite
- Mold, pollen (e.g., trees, grass, weeds)
- Secondhand tobacco smoke
- Ambient air pollution

Sources: Clearing the Air: Asthma and Indoor Air Exposures. Institute of Medicine, 2000. [www.nap.edu](http://www.nap.edu)
PM$_{2.5}$ has been linked to respiratory health

- Coughing
- Wheezing
- Chest tightness
- Shortness of breath
- Reduced lung function
- Asthma attacks

Sources: https://airnow.gov/index.cfm?action=aqibasicsparticle
Asthma Call-back Survey-PM$_{2.5}$ Study Objectives

- To evaluate associations between concentrations of PM$_{2.5}$ and exacerbation of existing asthma

Source: Mirabelli MC, Vaidyanathan A, Flanders WD, Qin X, Garbe P. Outdoor PM$_{2.5}$, Ambient Air Temperature, and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma. Environ Health Perspect. 2016 Jul 6 [Epub ahead of print].
Asthma Call-back Survey-PM$_{2.5}$ Study Methods

  - 56,509 respondents
  - 40 U.S. states and the District of Columbia
  - Symptoms during the past two weeks

- Environmental Public Health Tracking Network
  - Modeled estimates of PM$_{2.5}$
  - Linked by county and interview date
  - Averaged over the past 14 days

Source: Mirabelli MC, Vaidyanathan A, Flanders WD, Qin X, Garbe P. Outdoor PM$_{2.5}$, Ambient Air Temperature, and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma. Environ Health Perspect. 2016 Jul 6 [Epub ahead of print].
Results (1)

- 57% reported asthma symptoms within the past 14 days
- Across quartiles of PM\(_{2.5}\):

![Bar chart showing percentages of asthma symptoms across PM\(_{2.5}\) quartiles]

Source: Mirabelli MC, Vaidyanathan A, Flanders WD, Qin X, Garbe P. Outdoor PM\(_{2.5}\), Ambient Air Temperature, and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma. Environ Health Perspect. 2016 Jul 6 [Epub ahead of print].
Results (2)

- Adjusted for individual-level (age, educational attainment, race, sex, smoking status) and county-level (ozone, precipitation, geographic region, temperature, urbanicity)

<table>
<thead>
<tr>
<th>Quartile</th>
<th>PM$_{2.5}$ level (μg·m$^{-3}$)</th>
<th>PD (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.00 – 7.06</td>
<td>0.0 (referent)</td>
</tr>
<tr>
<td>2</td>
<td>7.07 – 8.97</td>
<td>4.4 (1.4, 7.4)</td>
</tr>
<tr>
<td>3</td>
<td>8.98 – 11.36</td>
<td>4.7 (1.6, 7.8)</td>
</tr>
<tr>
<td>4</td>
<td>11.37 – 19.98</td>
<td>4.9 (1.5, 8.2)</td>
</tr>
</tbody>
</table>

Source: Mirabelli MC, Vaidyanathan A, Flanders WD, Qin X, Garbe P. Outdoor PM$_{2.5}$, Ambient Air Temperature, and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma. Environ Health Perspect. 2016 Jul 6 [Epub ahead of print].
Results (3)

Source: Mirabelli MC, Vaidyanathan A, Flanders WD, Qin X, Garbe P. Outdoor PM$_{2.5}$, Ambient Air Temperature, and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma. Environ Health Perspect. 2016 Jul 6 [Epub ahead of print].
Main findings:

- Each unit increase in PM$_{2.5}$ may be associated with an increase in the prevalence of asthma symptoms, even at levels as low as 4.00 to 7.06 $\mu g/m^3$

Value of linking datasets:

- Representative sample survey data can be linked with estimates of ambient air quality to evaluate the relationship between PM$_{2.5}$ and exacerbation of existing asthma
- Future directions: evaluation within subpopulations (e.g., by age, race/ethnicity, or economic status)
- Air Quality Index (AQI) >100: air quality is considered to be unhealthy for sensitive groups of people

Source: Mirabelli MC, Vaidyanathan A, Flanders WD, Qin X, Garbe P. Outdoor PM$_{2.5}$, Ambient Air Temperature, and Asthma Symptoms in the Past 14 Days among Adults with Active Asthma. Environ Health Perspect. 2016 Jul 6 [Epub ahead of print].
Improving air quality in New York City through cleaner heating fuels

Healthy People Webinar on Strategies to Improve Air Quality

November 17, 2016

Iyad Kheirbek
Bureau of Environmental Surveillance and Policy, NYC Department of Health and Mental Hygiene
Air Pollution and Public Health in NYC

• Overall air quality is improving
• Health impacts occur at current levels
• Vulnerable communities most impacted
• Local hot spots remain
• Important local sources include building-related emissions and traffic
Air Pollution and Health Disparities in NYC

- Demographic and geographic variation in susceptible populations.
- Regulatory network not designed to capture spatial variation in air quality.
- Prior single-neighborhood studies showed elevated levels of pollutants (EC) associated with local truck traffic.
- The extent of pollutant spatial variation in NYC was unknown.
Common NYC pollutants

- Fine particles (PM$_{2.5}$)
  - Penetrate deep into the lungs
  - Worsen lung and heart diseases, premature deaths

- Nitrogen oxides (NO-NO$_2$-NO$_x$), Sulfur dioxide (SO$_2$), Ozone (O$_3$, secondary)
  - Lung irritants linked to ED visits and hospital admissions for asthma and other respiratory conditions
  - Associations with cardiovascular outcomes and mortality

- Health effects occur below federal standards.
- Most vulnerable: old, young, and those with chronic illness
- Emerging evidence of effects on birth outcomes and neurodevelopment
New York City’s Sustainability Plans

- Include ambitious sustainability and equity strategies
- Air sections, overall goal to reduce emissions from:
  - On-Road vehicles and other transportation
  - Buildings, energy, area sources
  - Capture benefits of greenhouse gas reduction strategies
- Understand the scope of the challenge
  - Collaborative local air quality study: New York City Community Air Survey (NYCCAS)
  - Understand the public health impacts of air pollutants
DOHMH air quality activities: Using data to inform local policy

Public health burden analysis

NYCCAS: Exposure assessment

Epidemiologic studies of risk

Quantify impacts of local sources, benefits of control

Disseminate results to stakeholders and science community
1. The Public Health Burden of PM\textsubscript{2.5}

- **Objective:** Quantify the public health burden of PM\textsubscript{2.5}, city-wide and by neighborhood
- Perform health impact calculations using:
  - Local monitor data
  - Local health outcome data by neighborhood
  - Locally relevant epidemiology studies for CR functions
- 3,000 deaths and 8,000 ED visits and hospitalizations each year, 2005-2007
- Higher share of burden in low SES communities
- Provided valuable public health context for pollution control
New York City Community Air Survey (NYCCAS)

- Launched in 2007 as part of PlaNYC: first comprehensive NYC survey of street-level AQ
- Assess year-round variation in multiple air pollutants across NYC neighborhoods.
- Identify sources contributing to intra-urban pollution patterns
- Inform City efforts to improve air quality and provide data to the public and stakeholders
- Provide air pollution exposure estimates for health surveillance and research
New York City Community Air Survey

• Largest ongoing urban street-level monitoring program in US
• Began in monitoring Winter 2008:
  – Years 1+2: 150 Sites
  – Years 3+4: 100 Sites
  – Years 5- now: 75 Sites
• 2-Week, street-level, integrated samples taken once per site/season
  – PM$_{2.5}$, BC, NOx, O$_3$, SO$_2$, PM$_{2.5}$-metals constituents
• Analyze by LUR:
  – predict at unmonitored locations
  – assess sources
NYCCAS: Winter 2008 results

- Released Winter 2009
- Showed significant variability across 150 sites for all pollutants
- PM$_{2.5}$, Ni, and SO$_2$ concentrations higher in areas with large oil burning boilers
- Strong associations with residual oil boilers: No. 6 and No. 4 oil
Residual Heating Oil in NYC

• Most commonly used heating fuels in NYC: No. 2, 4, 6 oil and natural gas

• No. 6 oil:
  – heaviest distillate of refined petroleum
  – Much higher pollutant emissions per energy content

• EDF 2010: 9,000 building in NYC burning No. 4 or 6 (1% of city buildings) contribute to 86% heating oil soot pollution

Source: Environmental Defense Fund
Local Studies Spurred Action

- City Council Legislation
  - 2012: No. 4 oil to 1500 ppm S
  - 2% biodiesel
- NYC DEP Regulation (2012)
  - #6 phased out by 2015
  - Full #4 phase out by 2030
- NY State sulfur limits
  - 2013: No. 2 oil to 15 ppm (ULSD) (State Regulation)
- Programs to accelerate implementation and assist with compliance

Source: EDF
NYC Clean Heat

- NYC Clean Heat
  - EDF/ICF/NYC
  - Collected data and conducted outreach to building owners
  - Provided incentives, loan programs, and assistance for early switching
  - NYCCAS Identified areas for targeted conversions
  - Became part of ‘retrofit accelerator’ a greenhouse gas reduction initiative

- Between 2012 and 2015: nearly 6,000 residual oil conversions
  - 65% reduction in PM$_{2.5}$ emissions
  - 75% of No. 6 conversions went directly to ULS2 or natural gas
3. Modeling the benefits of residual oil phase-out

- Air quality associated public health benefits of regulations to reduce emissions from heating oil
- Multi-agency partnership
  - Conversion status of boilers: ICF, NYC DEP, OLTPS
  - Emissions estimates: DOHMH
  - Air quality modeling: ICF
  - Health impact modeling, reporting: DOHMH, OLTPS
- Conducted high resolution air quality and health impact modeling
  - CMAQ 1km, health impacts at 42 neighborhoods
- Findings used to support city regulation, accelerate compliance, and understand benefits
Informing Policy: Clean Heat Example
Modeling air quality/health benefits

- Estimated benefits of heating oil programs
  - $\Delta \text{PM}_{2.5}$ annual average reduction: 0.71 mg/m$^3$ citywide (0.1-1.6 mg/m$^3$ across city)
  - 290 avoided deaths and 730 avoided hospitalizations and ED visits, annually (2030)
  - Larger benefits in low income neighborhoods with higher underlying disease rates
Program Benefits to Date

- NYCCAS Network is tracking air quality improvements
- Between 2009 to 2014
  - SO$_2$ levels fell by 68%
  - Ni levels have fallen by 35%
    (2009-2013)
  - PM$_{2.5}$ levels fell by 16%
  - Greatest improvements in most polluted neighborhoods
Thank you very much.

**Air Team:**

**DOHMH:** Iyad Kheirbek, Thomas Matte, Kazuhiko Ito, Sarah Johnson, Christopher Huskey, Dan Kass  
**Queens College:** Holger Eisl, John Gorczynski, Anna Tilles, Steves Vanderpool, Jung Kim, Steven Markowitz  
**ICF International:** Jay Haney, Sharon Douglas  
**Zev Ross Spatial Analysis:** Zev Ross

For more information about NYCCAS, visit:  
http://www.nyc.gov/health/nyccas

To download air quality and other environmental health data visit:  
http://www.nyc.gov/health/tracking
Roundtable Discussion

Please take a moment to fill out our brief survey.
Secretary’s Advisory Committee on National Health Promotion and Disease Prevention Objectives for 2030

■ Inaugural Meeting of the Committee
  – December 1-2, 2016 – Washington, DC
  – Register to attend at
    www.healthypeople.gov

■ For more information on the Secretary’s Advisory Committee on National Health Promotion and Disease Prevention, please visit www.healthypeople.gov
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