Smoking and Lung Disease

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http://www.surgeongeneral.gov/library/tobaccosmoke
Morbidity and Mortality

Tobacco use is the leading preventable cause of death.

• Worldwide, tobacco use causes more than 5 million deaths per year, and current trends show that tobacco use will cause more than 8 million deaths annually by 2030.

• In the United States, tobacco use is responsible for about one in five deaths annually
  – 443,000 deaths per year
  – 49,000 of these tobacco-related deaths are the result of secondhand smoke exposure.

• On average, smokers die 13 to 14 years earlier than nonsmokers.

Morbidity and Mortality

Tobacco use leads to disease and disability.

- For every person who dies from a smoking-related disease, 20 more people suffer with at least one serious illness from smoking.

Tobacco Use in The US

- 20.6% of all adults (46.6 million people)
- 20% of high school students smoke cigarettes.
- 23.2% of American Indian/Alaska Native adults
- 22.1% of White adults
- 21.3% of African American adults
- 14.5% of Hispanic adults
- 12.0% of Asian American adults (excluding Native Hawaiians and other Pacific Islanders)
Tobacco Use in The US

Thousands of young people and adults begin smoking every day.

• Each day, about 1,000 persons younger than 18 years of age begin smoking on a daily basis.
• Each day, about 1,800 adults 18 years of age or older begin smoking on a daily basis.

Many adult smokers want or try to quit smoking.

• Approximately 70% of smokers want to quit completely.
• Approximately 45% of smokers try to quit each year.

Cost and Expenditures

The cigarette industry spends billions each year on advertising and promotions.

• $12.5 billion total spent in 2006
• $34 million spent a day in 2006

Tobacco use costs the United States billions of dollars each year.

• Cigarette smoking costs more than $193 billion (i.e., $97 billion in lost productivity plus $96 billion in health care expenditures).
• Secondhand smoke costs more than $10 billion (i.e., health care expenditures, morbidity, and mortality).
There is no safe level of exposure to tobacco smoke

• Cigarette smoke contains more than 7,000 chemicals and compounds. Hundreds are toxic and at least 69 cause cancer. Tobacco smoke itself is a known human carcinogen.

• Low levels of smoke exposure, including exposures to secondhand tobacco smoke, lead to a rapid and sharp increase in dysfunction and inflammation of the lining of the blood vessels, which are implicated in heart attacks and stroke.

Chemicals in cigarettes – some examples

• Cancer- causing chemicals
  – Formaldehyde
  – Benzene
  – Polonium
  – Vinyl oxide

• Toxic metals
  – Chromium
  – Arsenic
  – Lead
  – Cadmium

• Poisonous gases
  – CO
  – Hydrogen cyanide
  – Ammonia
  – Butane
  – Toluene
Damage from tobacco smoke is immediate

- Chemicals in tobacco smoke reach the lungs quickly with every inhalation and toxicants are vascularly delivered to every organ.
- Chemicals and toxicants in tobacco smoke damage DNA increasing cancer risk
  - Smoking causes 85% of all lung cancers.
- In addition, inhaling the complex mixture of combustible compounds in tobacco causes adverse health outcomes through mechanisms including DNA damage, inflammation and oxidative stress.

<table>
<thead>
<tr>
<th>Smoking</th>
<th>Chronic Blockers</th>
<th>Secondhand Smoke Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancers</td>
<td>Stroke</td>
<td>Middle ear disease</td>
</tr>
<tr>
<td></td>
<td>Lung cancer</td>
<td>Respiratory infections</td>
</tr>
<tr>
<td></td>
<td>Stroke</td>
<td>Impaired lung function</td>
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<tr>
<td></td>
<td>Asthma</td>
<td>Lower respiratory illness</td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
<td>Sudden infant death syndrome</td>
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<tr>
<td></td>
<td>Diabetes</td>
<td>Reproductive effects in women (including reduced fertility)</td>
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</table>

Smoking and Heart Disease

• People who smoke are up to **six times** more likely to suffer a **heart attack** than nonsmokers, and the risk increases with the number of cigarettes smoked.

Smoking and Cancer

• **Lung cancer is the leading cause of cancer death** among both men and women in the United States.
  – **90 percent** of lung cancer deaths among men and,
  – **80 percent** of lung cancer deaths among women are due to smoking.

• Smoking causes many other types of cancer, including cancers of the throat, mouth, nasal cavity, esophagus, stomach, pancreas, kidney, bladder, and cervix, and acute myeloid leukemia.
US Epidemiology

- 12 million have a COPD diagnosis
- NHANES III predicts 24 million US
- In 2005: number of deaths from COPD greater in women (65,193 F vs. 60,812 M)
- Mortality rates among women remain lower than among men (56.0 vs. 77.3 per 100,000 respectively in 2005)

MMWR 2008;57(45):1229-1232
New Definition of COPD

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease with some significant extrapulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by **airflow limitation that is not fully reversible**. The airflow limitation is usually **progressive** and associated with an abnormal **inflammatory response** of the lungs to noxious particles or gases.

*Global initiative for chronic Obstructive Lung Disease (GOLD)*
www.goldcopd.com

Risk Factors for COPD

- **Environmental**
  - Tobacco Smoke (includes passive smoking)
  - Occupational (Dusts and chemicals)
  - Ambient air pollution (indoor and outdoor)
  - Infections (Childhood, HIV)
  - Socioeconomic status
- **Host Factors**
  - Genes (Alpha,-antitrypsin deficiency)
  - Airway hyperresponsiveness
  - Lung Growth
Inflammation Destruction of Alveolar Architecture


Numbers of Inflammatory Cells and Mediators Increase as Disease Progresses

Future Mortality Worldwide

<table>
<thead>
<tr>
<th>1990</th>
<th>2020</th>
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<tbody>
<tr>
<td>Ischemic heart disease</td>
<td></td>
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<tr>
<td>Cerebrovascular disease</td>
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<tr>
<td>Lower resp infection</td>
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<tr>
<td>Diarrheal disease</td>
<td></td>
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<tr>
<td>Perinatal disorders</td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td></td>
</tr>
<tr>
<td>Road traffic accidents</td>
<td></td>
</tr>
<tr>
<td>Lung cancer</td>
<td></td>
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<tr>
<td>3rd</td>
<td>6th</td>
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</tbody>
</table>


However, the encouraging news is...

Data are from the Centers for Disease Control and Prevention.

Natural history of FEV1 decline with aging

COPD in the Never-Smoker

- 15-20% of COPD is in never-smokers
- In 3% of never-smokers: FEV1 <80% & ratio < .7
- History of asthma: strong risk factor for COPD-related mortality in never-smokers
- The population-attributable risk for COPD estimated to be due to occupational exposure is 15-20%

_Balmes et al. AJRCCM 2003;167:787-797_

Goals of Treatment

- Improve lung function
- Reduce exacerbations
- Improve quality of life
- Reduce the rate of decline of lung function
- Improve survival
COPD Therapy

• The only interventions shown to impact on survival in COPD are smoking cessation and oxygen therapy

• None of the currently available COPD meds alter the long-term decline in lung function

GOLD: Stepwise Approach to Management of COPD

<table>
<thead>
<tr>
<th>0: At Risk</th>
<th>I: Mild</th>
<th>II: Moderate</th>
<th>III: Severe</th>
<th>IV: Very Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance of risk factor(s); influenza vaccination</td>
<td>Add short-acting bronchodilator when needed</td>
<td>Add regular treatment with one or more long-acting bronchodilators</td>
<td>Add inhaled glucocorticosteroids if repeated exacerbations</td>
<td>Add long-term oxygen if chronic respiratory failure Consider surgical treatments</td>
</tr>
</tbody>
</table>

Morbidity after COPD exacerbation

Presentation 4 weeks 12 weeks 26 weeks

Months After Discharge

Spencer S et al. Thorax 2003;58:589-593

Smoking Cessation

Cumulative survival curves of continuing smokers (+) and ex-smokers (-). (From Postma DS, Sluiter HJ: Prognosis of chronic obstructive pulmonary disease: the Dutch experience. ARRD 104:S100-S105,1989; with permission. Courtesy of the American Lung Association)
Lung Volume Reduction Surgery

- Survival benefit in:
  - Upper lobe emphysema
  - Low exercise capacity
- No survival benefit in upper-lobe-predominant and high exercise-capacity but likely to improve exercise capacity and SGRQ
- Worse survival in:
  - FEV₁ < 20%, homogeneous emphysema, DLCO < 20%
  - Non-upper lobe emphysema
  - High exercise capacity


Management of COPD

- Interventions that impact survival in COPD:
  - Smoking cessation
  - Oxygen therapy
  - Lung volume reduction surgery (LVRS)
  - Combination of ICS & LABA?
  - Non-invasive ventilation (hypercapnic COPD)?
  - Rehabilitation?
- ICS and/or LABA may favorably alter the long-term decline in lung function
Management of COPD

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  – Rehabilitation?

• ICS and/or LABA may favorably alter the long-term decline in lung function

The importance of quitting smoking…

“Quitting smoking early in life is naturally important for maximum reductions in total mortality and mortality from lung cancer but, because of the long prodrome of clinical COPD (and the inevitable deterioration in lung function with age), it is probably even more important for COPD…”

Pride. Thorax 2001;56(Suppl II):ii7–ii10
Healthy People 2020 Objective

**Objective: Reduce tobacco use by adults > 18 yo**

<table>
<thead>
<tr>
<th></th>
<th>Baseline¹</th>
<th>2020 (target)</th>
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<tbody>
<tr>
<td>Cigarette smoking</td>
<td>20.6% (2008)</td>
<td>12.0%</td>
</tr>
<tr>
<td>Smokeless tobacco</td>
<td>2.3% (2005)</td>
<td>0.3%</td>
</tr>
<tr>
<td>Cigars</td>
<td>2.25% (2005)</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

¹Age adjusted to the year 2000 standard population
Data source: National Health Interview Survey (NHIS), CDC, NCHS
(http://healthypeople.gov/2020/topicsobjectives2020/pdfs/TobaccoUse.pdf)

State spending on tobacco control does NOT meet CDC-recommended levels

- Collectively, states have billions of dollars available to them—from tobacco excise taxes and tobacco industry legal settlements—for preventing and controlling tobacco use. States currently use a very small percentage of these funds for tobacco control programs.
- In 2008, $24.4 billion was available to states from tobacco taxes and legal settlements, but states spent less than 3% of the $24.4 billion on tobacco control programs.
- Investing only 15% (i.e., $3.7 billion) would have funded every state tobacco control program at CDC-recommended levels.

A big disappointment!

www.cdc.gov
Cleveland Clinic

Every life deserves world class care.