“Breathing is truly a strange phenomenon of life, caught midway between the conscious and unconscious and peculiarly sensitive to both.”

Dickenson Richards, M.D.
Columbia University College of Physicians and Surgeons
Nobel Laureate in Medicine, 1956

Roses are red,
Violets are blue;
Without your lungs,
Your blood would be, too
Goals and objectives for the pulmonary section:

I

• Understand important categories and causes of lung disease in the United States and around the world

• Understand lung mechanics in health and disease
  – Lung mechanics determination efficiency of ventilation
    • Work of breathing
    • Compliance
      – $\Delta V/\Delta P$
    • Resistance
      – $P_{\text{alv}} - P_{\text{mouth}}/\text{flow}$
  • PEEP and Auto-PEEP

Goals and objectives for the pulmonary section:

II

• Understand gas exchange in health and disease
  – Alveolar air equation and calculation of alveolar-arterial (A-a) gradient
    • $P_{\text{O}_2} = P_{\text{O}_2} - (P_{\text{CO}_2}/R)$
  – Oxygen delivery to tissues
    • Oxyhemoglobin dissociation curve
    • $DO_2 = CO \times CaO_2$
    • $CaO_2 = ([Hgb] \times 1.39 \times \%\text{sat}) + (pO_2 \times .0036)$
  – Mechanisms of hypoxemia
    • Shunt
      – Does not correct with oxygen breathing
    • V/Q mismatch
      – Corrects with oxygen breathing
      – Exacerbated by exercise
    • Alveolar hypoventilation
      – Normal A-a gradient
      – Corrects with oxygen breathing
    • Diffusion limitation
      – Corrects with oxygen breathing
      – Exacerbated by exercise
Goals and objectives for the pulmonary section: III

• Understand symptoms and signs of pulmonary disease
  – Symptoms
    • Dyspnea
      – Onset
      – Severity
      – Triggers
      – Progression
  – Signs
    • Wheezing
    • Crackles (rales and rhonchi)
    • Diminished breath sound
    • Hyperresonant breath sounds
• Understand use of diagnostic testing in pulmonary disease
  – Pulmonary function testing
  – Restrictive and obstructive physiology
  – Arterial blood gas analysis
  – Chest radiograph
  – Lung pathology
    • Major types and patterns of injury and abnormality

Goals and objectives for the pulmonary section: IV

• Understand treatment approaches to patients with lung diseases
  – Symptomatic treatments
    • Oxygen therapy
    • Bronchodilators
    • Mechanical ventilation and PEEP
  – Disease specific treatments
    • Understand cellular and molecular basis of treatments for specific diseases
      – Steroids
      – Other immunosuppressives
      – Antibiotics
      – Anti-neoplastic
      – Pulmonary vasodilators
Leading causes of global mortality

WHO, World Health Report, 2004

Impact of respiratory illness on global mortality

WHO, World Health Report, 2004
Global deaths due to acute respiratory infections

Source: WHO Global Disease Burden Report

Yearly prevalence (in 000s) of acute respiratory infections (ARI), by WHO region

Source: WHO Global Disease Burden Report
Deaths due to ARI, by WHO region

Source: WHO Global Disease Burden Report

Deaths due to ARI, by age and sex, worldwide

Source: WHO Global Disease Burden Report
Cause of death among children less than 5 years of age

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Africa</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute respiratory infection</td>
<td>16</td>
<td>18</td>
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<tr>
<td>Diarrheal disease</td>
<td>14</td>
<td>15</td>
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<tr>
<td>Malaria</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Measles</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>HIV or AIDS</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Neonatal deaths</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>Other causes</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>All causes</td>
<td>4.5 million</td>
<td>10.9 million</td>
</tr>
</tbody>
</table>

Source: NEJM, WHO

Serotypes of *S. pneumoniae* and *H. influenzae* in bacteremia-related isolates from Kenya

- **S. pneumoniae** serotypes
  - 1 (66 patients)**
  - 14 (39 patients)*
  - 6A (26 patients)
  - 6B (24 patients)*
  - 23F (21 patients)*
  - 18C (13 patients)*
  - 4 (11 patients)*
  - 3 (10 patients)
  - 19F (10 patients)*
- **H. influenzae**
  - 113/136 (83%) type B

*Serotype included in commercially available 7-valent conjugate pneumococcal vaccine

**Serotype included in 9-valent conjugate pneumococcal vaccine

Overall, 298/398 (75%) isolates were of serotypes covered by vaccines

Notice of Prevnar Price Increase

Effective 9/25/04, Wyeth Pharmaceuticals will charge $326 for a 5 dose package (an increase of $5 per dose) of Prevnar (CPT 90669 pneumococcal conjugate vaccine, for children under 5 years, for intramuscular use).

American Academy of Pediatrics website

Influenza
**Influenza**

- Roughly 20% of children and 5% of adults develop symptomatic influenza infections each year.
- Infection is continuous in tropics, seasonal elsewhere.
- Three types of influenza virus: A, B, C.
- Only types A and B cause outbreaks.
- Two major surface proteins:
  - Hemagglutinin: facilitates entry into host cells through sialic acid receptors.
  - Neuraminidase: catalyzes cleavage of glycosidic linkages to sialic acid and assists in release of progeny virions from infected cells; drug target.
- Influenza A:
  - 15 hemagglutinin subtypes.
  - 9 neuraminidase subtypes.

**Natural hosts of influenza viruses**

At present, only H1N1 and H3N2 are in circulation among humans.
Pandemic influenza

• Caused by sudden appearance of a new subtype: antigenic shift
  • 1918-1919
    - H1N1 “Spanish flu”
    - Arose in swine (?)
    - 20 million deaths in first year; 50 million deaths total
  • 1957-1958
    - H2N2 “Asian flu”
    - Arose in fowl
    - Severe pandemic: 70,000 deaths in U.S.
  • 1968-1969
    - H3N2 “Hong Kong flu”
    - Arose in fowl
    - Moderately severe: 34,000 deaths in the U.S.
• Future pandemics-
  - ?H5N1 (“Avian flu”)
  - ? H7N7
  - Both are highly lethal, though little if any person-to-person transmission yet documented

Strategies for controlling influenza

• Surveillance
• Vaccination
• Treatment
Leading causes of death in the U.S., 1980 and 1997

1980
1. Heart disease
2. Cancer
3. Cerebrovascular disease
4. Unintentional injuries
5. COPD
6. Pneumonia and influenza
7. Diabetes
8. Chronic liver disease
9. Atherosclerosis
10. Suicide

1997
1. Heart disease
2. Cancer
3. Cerebrovascular disease
4. COPD
5. Unintentional injuries
6. Pneumonia and influenza
7. Diabetes
8. Suicide
9. Renal disease
10. Chronic liver disease


National Center for Health Statistics
FIGURE 3: ASTHMA PREVALENCE BY AGE, 1982-1996(1)

<table>
<thead>
<tr>
<th></th>
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<td>&lt;18</td>
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<td>33.4</td>
<td>36.4</td>
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<td>45-64</td>
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<td>40.2</td>
<td>50.5</td>
<td>39.5</td>
<td>45.5</td>
</tr>
</tbody>
</table>

SOURCE: NATIONAL CENTER FOR HEALTH STATISTICS. NATIONAL HEALTH INTERVIEW SURVEY, 1982-1996

NOTE: (1) Because these estimates are based on a sample, they may differ from figures that would be obtained from a census of the population. Each rate point reported is an estimate of the true population value and subject to sampling variability.

FIGURE 1: ASTHMA: AGE-ADJUSTED DEATH RATE BY SEX, 1979-1996

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<tr>
<td>BOTH SEXES</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
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</tr>
<tr>
<td>MALE</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
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</tr>
<tr>
<td>FEMALE</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

SOURCE: NATIONAL CENTER FOR HEALTH STATISTICS. ANNUAL SUMMARY OF VITAL STATISTICS, 1979-1996
Deaths due to pneumonia and influenza, U.S., by year and sex

Source: National Center for Health Statistics

Age-specific mortality for ARI, US, 2001

Source: National Center for Health Statistics
Risk factors for community acquired pneumonia

- Advancing age
- Tobacco use
- Air pollution
- Underlying chronic disease
- Malnutrition
- Alcohol use
- Chronic obstructive pulmonary disease
- Others including immunodeficiency, treatment with immunosuppressive drugs, malignancy, etc.

Influenza vaccine coverage, United States, 2004-2005

FIGURE. Monthly influenza vaccination coverage among selected priority populations, by month — Behavioral Risk Factor Surveillance System, United States, 2004-05 influenza season

*Interventions were conducted during February 1–27, 2006.
*Does not include persons in households with infants aged <6 months, out-of-home caregivers of infants aged <6 months, or others with rare, high-risk conditions.
*Asthma: other lung, heart, or kidney problems; diabetes; weakened immune system; anemia; or aspirin therapy for chronic conditions.
*Asthma: other lung, heart, or kidney problems; diabetes; weakened immune system; anemia; or pregnancy.

MMWR 2005; 54: 304-307
FIGURE 6: EMPHYSEMA PREVALENCE, BY SEX, 1982-1996 (1)

![Graph showing emphysema prevalence by sex, 1982-1996.](image)

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<thead>
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</thead>
<tbody>
<tr>
<td>MALE</td>
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<td>8.6</td>
<td>9.7</td>
<td>8.1</td>
<td>7.4</td>
</tr>
<tr>
<td>FEMALE</td>
<td>5.4</td>
<td>4.9</td>
<td>5.8</td>
<td>5.2</td>
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<td>5.8</td>
<td>6.7</td>
<td>6.0</td>
<td>6.2</td>
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</tr>
</tbody>
</table>

FIGURE 1: COPD AGE-ADJUSTED DEATH RATE, BY SEX, 1979-1998 (1)

![Graph showing COPD age-adjusted death rate by sex, 1979-1998.](image)

<table>
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</thead>
<tbody>
<tr>
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<td>14.0</td>
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<td>MALE</td>
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<tr>
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### Estimated New Cases

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>33%</td>
</tr>
<tr>
<td>Lung and Bronchus</td>
<td>14%</td>
</tr>
<tr>
<td>Colon and Rectum</td>
<td>11%</td>
</tr>
<tr>
<td>Urinary Bladder</td>
<td>6%</td>
</tr>
<tr>
<td>Melanoma of the Skin</td>
<td>4%</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>4%</td>
</tr>
<tr>
<td>Kidney</td>
<td>3%</td>
</tr>
<tr>
<td>Oral Cavity</td>
<td>3%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>3%</td>
</tr>
<tr>
<td>Pancreas</td>
<td>2%</td>
</tr>
<tr>
<td>All Other Sites</td>
<td>17%</td>
</tr>
<tr>
<td>Breast</td>
<td>32%</td>
</tr>
<tr>
<td>Lung and Bronchus</td>
<td>12%</td>
</tr>
<tr>
<td>Colon and Rectum</td>
<td>11%</td>
</tr>
<tr>
<td>Uterine Corpus</td>
<td>6%</td>
</tr>
<tr>
<td>Ovary</td>
<td>4%</td>
</tr>
<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>4%</td>
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<tr>
<td>Melanoma of the Skin</td>
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<tr>
<td>Thyroid</td>
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<tr>
<td>Pancreas</td>
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</tr>
<tr>
<td>Urinary Bladder</td>
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<tr>
<td>All Other Sites</td>
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</table>

(Ca 2003; 53:5--26)

### Estimated Deaths

<table>
<thead>
<tr>
<th>Tumor Type</th>
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<td>Lung and Bronchus</td>
<td>31%</td>
</tr>
<tr>
<td>Prostate</td>
<td>10%</td>
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<tr>
<td>Colon and Rectum</td>
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<tr>
<td>Pancreas</td>
<td>5%</td>
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<tr>
<td>Non-Hodgkin Lymphoma</td>
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<td>4%</td>
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<tr>
<td>Esophagus</td>
<td>4%</td>
</tr>
<tr>
<td>Liver</td>
<td>3%</td>
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<td>Urinary Bladder</td>
<td>3%</td>
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<tr>
<td>Kidney</td>
<td>3%</td>
</tr>
<tr>
<td>All Other Sites</td>
<td>22%</td>
</tr>
<tr>
<td>Lung and Bronchus</td>
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<td>Breast</td>
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</tr>
<tr>
<td>Pancreas</td>
<td>6%</td>
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<tr>
<td>Ovary</td>
<td>5%</td>
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<tr>
<td>Non-Hodgkin Lymphoma</td>
<td>4%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>4%</td>
</tr>
<tr>
<td>Uterine Corpus</td>
<td>3%</td>
</tr>
<tr>
<td>Brain</td>
<td>2%</td>
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<tr>
<td>Multiple Myeloma</td>
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<tr>
<td>All Other Sites</td>
<td>23%</td>
</tr>
</tbody>
</table>

(Ca 2003; 53:5--26)


National Center for Health Statistics
Tobacco-related deaths annually, U.S.

- Lung Cancer: 124,813
- Chronic Lung Disease: 64,735
- Stroke: 17,445
- Coronary Heart Disease: 81,876
- Other Cancers: 30,948
- Other Diagnosis: 82,000
- Secondhand smoke: 38,053

Source: CDC, ALA
Smoking prevalence in Europe: men

Source: World Health Organization
Smoking prevalence in Europe: women

Source: World Health Organization

Current Smokers
Nationwide – Grouped by Age

Source: CDC, National Center for Chronic Disease Prevention and Health Promotion, 2002
**Summary**

It is important to know as much as possible about teenage smoking patterns and attitudes. Today's teenager is tomorrow's potential regular customer, and the overwhelming majority of smokers first begin to smoke while still in their teens. In addition, the ten years following the teenage years is the period in which most people are initiated into smoking.

Because of our high share of the market among the youngest smokers, Philip Morris will suffer more than the other companies from the decline in the number of teenage smokers. For at least the next decade, however, the population trends will have a much more powerful influence, and in this regard we would appear to be the least vulnerable of all the companies, as will be discussed later in this report.

*Philip Morris Co. memorandum, March 31, 1981*
FIGURE 5: CURRENT CIGARETTE SMOKING AMONG ADULTS, BY LEVEL OF EDUCATION, 1998

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>&lt;8 Yrs.</th>
<th>9-11 Yrs.</th>
<th>12 Yrs.</th>
<th>13-15 Yrs.</th>
<th>16+ Yrs.</th>
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<tr>
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<td>27.7</td>
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<td>31.5</td>
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<tr>
<td>FEMALE</td>
<td>16.7</td>
<td>34.3</td>
<td>24.1</td>
<td>22.8</td>
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</tr>
<tr>
<td>ALL</td>
<td>21.9</td>
<td>36.8</td>
<td>27.4</td>
<td>24.6</td>
<td>11.3</td>
</tr>
</tbody>
</table>
Limiting morbidity and mortality from tobacco use

- **Medical model**
  - Smoking cessation
  - Early detection and treatment of smoking-related illness:
    - Lung cancer screening
    - Prevention and treatment of COPD

- **Public health model**
  - Limiting access to tobacco
    - Raising cigarette tax
    - Enforcing age limits for purchase
    - Smoking restrictions in workplaces and public facilities
  - Discouraging use of tobacco
    - School-based initiatives
    - Counter advertising

---

**FIGURE 10: SUCCESS RATES FOR VARIOUS CESSATION METHODS, 1998**

<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self Help Only</td>
<td>4.0</td>
</tr>
<tr>
<td>Patch</td>
<td>8.0</td>
</tr>
<tr>
<td>Gum</td>
<td>14.0</td>
</tr>
<tr>
<td>Behavioral</td>
<td>15.0</td>
</tr>
<tr>
<td>Inhaleer</td>
<td>19.0</td>
</tr>
<tr>
<td>Nicotine + Bhr</td>
<td>27.5</td>
</tr>
<tr>
<td>Prescriptions</td>
<td>28.0</td>
</tr>
<tr>
<td>Nasal Spray</td>
<td>30.0</td>
</tr>
</tbody>
</table>

Source: CDC Office on Smoking & Health - Cessation Division
Hutchinson Smoking Prevention Project: Long-Term Randomized Trial of School-Based Tobacco Use Prevention

- 40 school districts in Washington State randomized to provide comprehensive anti-tobacco curriculum (based on CDC and NCI recommendations) in grades 3-12 or standard health curriculum
- Main study endpoints were smoking in grade 12 and 2 years after high school
- 8388 students entering third grade were subjects in the study; follow-up data available on 93%
- Prevalence of daily smoking at study conclusion: 24.66% in control districts, 24.41% in experimental districts

You've got 6 months to live.

A reading the above sentence startled you, imagine hearing it from your doctor. Unfortunately, you are not a rare case. You are one of the 1.5 million Americans who are told they have a terminal illness each year. In reality, the majority of these terminal illnesses are caused by preventable factors, especially those related to tobacco prevention and control, access to health care, and poverty. Smoking-related disease costs America more than $200 billion a year. According to the Centers for Disease Control and Prevention, cigarette smoking is the leading cause of preventable death in the United States, responsible for the deaths of more than 480,000 people every year. For more information, visit www.smokefree.org.

WARNING: Secondhand smoke kills more than 40,000 Americans each year — more than 100 people every day.

WARNING: Just 30 minutes of exposure to secondhand smoke can greatly increase your risk of heart attack.

WARNING: Secondhand smoke can increase your risk of getting lung cancer by 20%.

Secondhand smoke kills.

WARNING: Tobacco smoke contains arsenic, carbon monoxide, ammonia, methanol, butane and more than 50 other poisons.

WARNING: Mothers whose parents smoke have much more asthma, bronchitis and bronchitis, and are more likely to die from sudden infant death syndrome (SIDS).

You don't have to smoke to die from it.

For more information about secondhand smoke, visit the New York State Tobacco Control Program at www.health.ny.gov.

Smokefree Health
New York State Department of Health, World Trade Center, New York, N.Y. 10048, USA
THERE'S NO SUCH THING AS A NON-SMOKING SECTION

Just 30 minutes of exposure to second-hand smoke increases the risk of heart disease in non-smokers. Bartenders who work an 8-hour shift in a noisy bar inhale the same amount of cancer-causing chemicals as if they'd smoked more than half a pack of cigarettes.

Second-hand smoke kills.

For more information, call the New York State Department of Health 1-800-OK-STOP.

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APHA, 2002
Smoke-Free Workplace Act of 2002 (NYC Local Law 47)

- Law took effect March 30, 2003
- Bans smoking in all indoor workplaces in New York City, including bars and restaurants of any size.
- Exemptions for 7 currently existing cigar bars.
- Exemptions for owner operated bars.
- Restaurants will be allowed to build completely enclosed, negative pressure ventilated smoking rooms into which no employee will be allowed until the last customer of the day has left. Clause sunsets after three years.
- New York State has adopted a similar law that covers the entire state
Legislators Pass Smoking Ban in New Jersey

By RICHARD LEZIN JONES and JOSH BENSON
Published: January 10, 2006

TRENTON, Jan. 9 - New Jersey lawmakers approved a far-reaching ban Monday on smoking in indoor public places that includes virtually all of the state's bars and restaurants but not the gambling areas of Atlantic City's 12 casinos.

Workplace smoking ban, Ireland

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