Evidence-based Public Health

Slide show developed by:
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1.20.2016
Key Questions in Chapter 2

• How can we accurately describe a health problem?

• What do we need to know about disease rates?

• What is the burden of disease? Has it changed?

• Are there differences in the distribution of a disease? Can differences generate hypotheses about cause and effect?

• Are the differences or changes artificial or real?
Key Questions (cont.)

• What are the implications of a group association?

• Etiology: How do we establish contributing cause?

• What can we do if we cannot fulfill all three requirements of contributory cause?

• What does contributory cause imply?
Recommendations & Implementation

• Recommendations: What changes will work to reduce the health impact?

• Implementation: How do we get the job done?

• What happens after implementation?
Evidence-based Public Health: What is the PERIE Approach?

- Evaluation
  - How well does it work in the “real” world?
- Problem
- Etiology
  - Burden Distribution Hypothesis
- Implementation
  - Who? When? How?
- Recommendations
- Benefits Harms Costs


Figure 2.1 p. 21
Questions to Ask: Evidence-based Public Health Approach

- **Problem**—What is the health problem?
- What is the burden of disease and has it changed over time?
- Are there differences in the distribution of disease and can these differences generate ideas or hypotheses about their etiology?
- Are the differences or changes used to suggest group associations artificial or real?
Problem—What Is the Health Problem?

• What is the burden of a disease or other health problem?

• What is the course of a disease or other health problem?

• Does the distribution of the health problem help generate hypotheses?

Questions to Ask: Evidence-based Public Health Approach

- **Etiology**—What are the contributory cause(s)?
- Has an association been established at the individual level?
- Does the “cause” precede the “effect”?
- Has altering the “cause” been shown to alter the “effect” (if not use ancillary criteria)?
Fulfilling Requirements for Establishing Contributory Cause or Efficacy

1. Hypothesis Generation
   - Group Association
     - Population/Ecological Studies

2. Requirement #1
   - Individual Association
     - Case-Control Studies

3. Requirement #2
   - "Cause" Precedes "Effect"
     - Cohort Studies

4. Requirement #3
   - Altering the "Cause" Alters the "Effect"
     - Randomized Controlled Trials or Natural Experiments
       - Supportive Criterion
         - Consistency
         - Strength
         - Dose Response
         - Biological Plausibility
What are the Implications of Establishing a Contributory Cause?

• Existence of a contributory cause implies that the cause increases the chances that the effect will develop.

• Its presence does not guarantee that the disease will develop, nor does absence guarantee that the disease will not develop.
What Can We Do If All Three Requirements Don’t Definitively Establish Contributory Cause?

• Examine supportive or ancillary criteria:
  – **Strength of the relationship**
  – **Dose–response relationship**
  – **Consistency of the relationship**
  – **Biological plausibility**
Questions to Ask: Evidence-based Public Health Approach

• **Recommendations**—What works to reduce the health impacts?
• What is the quality of the evidence for the intervention?
• What is the impact of the intervention in terms of benefits and harms?
• What grade should be given indicating the strength of the recommendation?

Questions to Ask: Evidence-based Public Health Approach

- **Implementation**—How can we get the job done?
- When should the implementation occur?
- At whom should the implementation be directed?
- How should the intervention(s) be implemented?

Evaluation—How Well Does the Intervention Work in Practice?

- **Evaluation** – assessing the effectiveness of an intervention
- How well does the intervention work in practice on the intended or target population?
- How well does the intervention work in practice as actually used?
- How well is the intervention accepted in practice?

How Do We Evaluate the Results?

- Critical to measure how much of the problem has been eliminated by the intervention(s) and what the nature of the problem that remains is.
- A new framework, called the RE-AIM framework, is increasingly being used to evaluate how well specific interventions work and are accepted in practice.
  - RE-AIM stands for *reach, effectiveness, adoption, implementation, and maintenance*. 
## Ancillary or Supportive Criteria: Cigarettes and Lung Cancer

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Meaning of the criteria</th>
<th>Evidence for cigarettes and lung cancer</th>
<th>Cautions in using criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of the relationship</td>
<td>The relative risk for those with the risk factor is greatly increased compared to those without the risk factor</td>
<td>The relative risk is large or substantial. The relative risk is Greater than 10 for the average smoker implying that the average smoker has more than 10 times the probability of developing lung cancer compared to nonsmokers</td>
<td>Even relatively modest relative risks may make Important contributions to disease when the risk factor is frequently present. A relative risk of 2, for instance, implies a doubling of the probability of developing a disease.</td>
</tr>
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</table>

Table 2.1  p. 30
# Ancillary or Supportive Criteria: Cigarettes and Lung Cancer

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<tr>
<td>Dose-response relationship</td>
<td>Higher levels of exposure and/or longer duration of exposure to the “cause” is associated with increased probability of the “effect”</td>
<td>Studies of cigarette and lung cancer establish that smoking half a pack a day over an extended period of time increases the risk compared to no smoking. Smoking one pack per day and two packs per day further increases the risk.</td>
<td>No dose-response relationship may be evident between no smoking and smoking one cigarette a day or between smoking three and four packs per day</td>
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<tr>
<td>Consistency of the relationship</td>
<td>Studies at the individual level produce similar results in multiple locations among populations of Varying socioeconomic and cultural backgrounds</td>
<td>Hundreds of studies in multiple locations and populations consistently establish a individual association between cigarettes and lung cancer</td>
<td>Consistency requires the availability of numerous studies that may not have been conducted</td>
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Ancillary or Supportive Criteria: Cigarettes and Lung Cancer

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<tr>
<td>Biological plausibility</td>
<td>Known biological mechanisms can convincingly explain a cause-and-effect relationship</td>
<td>Cigarette smoke directly reaches the areas where lung cancer appears</td>
<td>Exactly which component(s) of cigarette smoking that produce lung cancer are just beginning to be understood</td>
</tr>
</tbody>
</table>
Cigarettes and Lung Cancer: Establishing Cause and Effect

<table>
<thead>
<tr>
<th>Requirements for Contributory cause</th>
<th>Meaning of the requirements</th>
<th>Types of studies that can establish the requirement</th>
<th>Evidence for Cigarette smoking and lung cancer</th>
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</thead>
<tbody>
<tr>
<td>Associated at a population level (Group association)</td>
<td>A group relationship between a “cause” and an “effect”</td>
<td>Ecological study or population comparison study: a comparison of population rates between an exposure and a disease</td>
<td>Men began mass consumption of cigarettes decades before women and their rates of lung cancer increased decades before those of women.</td>
</tr>
</tbody>
</table>

Table 2.2  p. 31
Cigarettes and Lung Cancer: Establishing Cause and Effect

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<th>Evidence for cigarette smoking and lung cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual association: “Requirement #1”</td>
<td>Individuals with a disease (“effect”) also have an increased chance of having a potential risk factor (“cause”).</td>
<td>Case-control studies: cases with the disease are compared to similar controls without the disease to see who had the exposure.</td>
<td>Lung cancer patients were found to have 10 times or greater chance of smoking Cigarettes Regularly compared to nonsmokers</td>
</tr>
</tbody>
</table>
# Cigarettes and Lung Cancer: Establishing Cause and Effect

## Requirements For contributory cause

- Prior association: “Requirement #2”

## Meaning of the requirements

- The potential risk factor precedes—in time—the outcome.

## Types of studies that can establish the requirement

- Cohort studies: exposed and similar Non-exposed individuals are followed over time to determine who develops the disease.

## Evidence for Cigarette smoking and lung cancer

- Large cohort studies found that those who smoke Cigarettes regularly have a 10 times or greater chance of Subsequently developing lung cancer.
Cigarettes and Lung Cancer: Establishing Cause and Effect

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<tr>
<td>Altering the cause alters the effect: “Requirement #3”</td>
<td>Active intervention to expose one group to the risk factor results in a greater chance of the outcome.</td>
<td>Randomized clinical trials allocating individuals by chance to be exposed or not exposed are needed to definitively establish contributory cause. Note: these studies are not always ethical or practical.</td>
<td>Alternatives to Randomized clinical trials, such as “natural experiments” established that those who quit smoking have greatly reduced chances of developing lung cancer. In addition, the four supportive criteria also suggest contributory cause.</td>
</tr>
</tbody>
</table>
## Classification System for Evidence-based Recommendations

### Magnitude of the impact

<table>
<thead>
<tr>
<th>Quality of the evidence</th>
<th>Net benefit: substantial</th>
<th>Net benefit: moderate</th>
<th>Net benefit: small</th>
<th>Net benefit: zero/negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Fair</td>
<td>B</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Poor (insufficient evidence)</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

A = must  
B = should  
C = may  
D = don’t use it  
I = Indeterminant

Table 2.3  p. 34
Recommendations: What Works to Reduce the Health Impact?

- Evidence-based recommendations combine the score for the quality of the evidence with the score for the impact of the intervention
  
  - These two aspects can be combined to produce a classification of the strength of the recommendation, graded as A, B, C, D, or I
## Framework of Options for Implementation

<table>
<thead>
<tr>
<th>Levels</th>
<th>When?</th>
<th>Who?</th>
<th>How?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1) Primary— Prior to disease or condition</td>
<td>1) Individual</td>
<td>1) Information (education)</td>
</tr>
<tr>
<td></td>
<td>2) Secondary—Prior to symptoms</td>
<td>2) At-risk group</td>
<td>2) Motivation (incentives)</td>
</tr>
<tr>
<td></td>
<td>3) Tertiary— Prior to irreversible complications</td>
<td>3) General population/community</td>
<td>3) Obligation (requirement)</td>
</tr>
</tbody>
</table>

Table 2.4  p. 37
# Framework of Options for Implementation

## When?
1) Primary—remove underlying cause, increase resistance, or reduce exposure
2) Secondary—post-exposure intervention, identify and treat risk factors or screen for asymptomatic disease
3) Tertiary—Reverse the course of disease (cure), prevent complications, restore function

## Who?
1) Individual often equals patient care
2) At-risk implies groups with common risk factors,
3) General population includes defined populations with and without the risk factor

## How?
1) Information—efforts to communicate information and change behavior on basis of information
2) Motivation—rewards to encourage or discourage without legal requirement
3) Obligation—required by law or institutional sanction

## Meaning of levels

1) **Primary**
   - remove underlying cause, increase resistance, or reduce exposure

2) **Secondary**
   - post-exposure intervention, identify and treat risk factors or screen for asymptomatic disease

3) **Tertiary**
   - Reverse the course of disease (cure), prevent complications, restore function
# Framework of Options for Implementation

<table>
<thead>
<tr>
<th>When?</th>
<th>Who?</th>
<th>How?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Primary—prevention of smoking, reduction in second-hand exposure</td>
<td>1) Individual smoker</td>
<td>1) Information—stop smoking campaigns, advertising, warning on package, clinician advice</td>
</tr>
<tr>
<td>2) Secondary—assistance in quitting, screening for cancer if recommended</td>
<td>2) At-risk—groups at risk of smoking or disease caused by smoking, e.g., adolescents as well as current and ex-smokers</td>
<td>2) Motivation—taxes on cigarettes, increased cost of insurance</td>
</tr>
<tr>
<td>3) Tertiary—health care to minimize disease impact</td>
<td>3) Population—Entire population including those who never have or never will smoke</td>
<td>3) Obligation—prohibition on sales to minors, exclusion from athletic eligibility, legal restrictions on indoor public smoking</td>
</tr>
</tbody>
</table>

**Cigarette smoking example**
Examples of Who and How Related to Cigarette Smoking

<table>
<thead>
<tr>
<th>Information</th>
<th>Motivation</th>
<th>Obligation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual</strong></td>
<td>Clinician provides patient with information explaining reasons for changing behavior</td>
<td>Clinician encourages patient to change behavior in order to qualify for a service or gain a benefit, e.g., status or financial</td>
</tr>
<tr>
<td>Example: Clinician distributes educational packet to a smoker and discusses his or her own smoking habit</td>
<td>Example: Clinician suggests that the financial savings from not buying cigarettes be used to buy a luxury item</td>
<td>Example: Clinician implements recommendation to refuse birth control pills to women over 35 who smoke cigarettes</td>
</tr>
</tbody>
</table>

Table 2.5  p. 38
Examples of Who and How Related to Cigarette Smoking

<table>
<thead>
<tr>
<th>Information</th>
<th>Motivation</th>
<th>Obligation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High-risk group</strong></td>
<td><strong>Information</strong></td>
<td><strong>Obligation</strong></td>
</tr>
<tr>
<td>Information is made available to all those who</td>
<td>Those who engage in a behavior are required to</td>
<td>Those who engage in a behavior are barred from an activity</td>
</tr>
<tr>
<td>engage in a behavior</td>
<td>pay a higher price</td>
<td>or job</td>
</tr>
<tr>
<td>Example: Warning labels on cigarette packages</td>
<td>Examples: Taxes on cigarettes</td>
<td>Example: Smokers banned from jobs that will expose them to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fumes that may damage their lungs</td>
</tr>
</tbody>
</table>
Examples of Who and How Related to Cigarette Smoking

<table>
<thead>
<tr>
<th>Population</th>
<th>Information</th>
<th>Motivation</th>
<th>Obligation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Information is made available to the entire population, including those who do not engage in the behavior</td>
<td>Incentives are provided for those not at risk to discourage the behavior in those at risk</td>
<td>An activity is required or prohibited for those at risk and also for those not at risk of the condition</td>
</tr>
<tr>
<td></td>
<td>Example: Media information on the dangers of smoking</td>
<td>Example: Lower health care costs for everyone results from lower percentage of smokers</td>
<td>Example: Cigarette sales banned for those under 18</td>
</tr>
</tbody>
</table>
Who Develops and Uses Evidence-based Recommendations?

• Federal government (FDA)
• Practitioner-oriented organizations (AMA)
• Consumer-oriented organizations (CRH)
• Organized health care systems (BCBS)
• For-profit organizations (CSI/TFI investment groups)
Recommendations: What Works to Reduce the Health Impact?

• Quality of the evidence is scored based on the types of investigations and how well the investigation was conducted
  – Well-conducted randomized controlled trials are the highest quality evidence

• Magnitude of the impact is the benefits minus the harms, or the net benefits
Implementation: How Do We Get the Job Done?

• To examine the options for implementation, we use the when-who-how approach
  – Deciding when and how to intervene and on whose behalf depends in large part upon the available options, the evidence that they work, and our attitudes toward different types of interventions
The End

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