Chapter 6

Non-Communicable Diseases
Public Health Framework for Disease and Disability

Determinants of Disease → Actual Causes →

Non-communicable Disease

Communicable Disease

Environmental Disease and Injuries

Figure 1 Section 3 Introduction
Key Issues in This Chapter

• What Is the extent of the burden of non-communicable diseases?

• How can screening for disease address the burden of non-communicable diseases?

• How can identification and treatment of Multiple Risk Factors be used to address the burden of non-communicable diseases?
More Questions…

• How can cost-effective interventions address the burden of non-communicable diseases?

• How can genetic counseling and early intervention address the burden of non-communicable diseases?

• What can we do when highly effective interventions do not exist?

• How can we combine strategies to address problems of non-communicable diseases?

Medical Technology

John’s knee injury from skiing continued to produce swelling and pain, greatly limiting his activities. His physician let him know that these days the procedure is to look inside with a flexible scope and do any surgery that is needed through the scope. It’s simpler, cheaper and does not even require hospitalization. “We call it cost-effective,” his doctor said. John wondered what cost effective really means.
Jennifer and her husband George were tested for the cystic fibrosis gene and both were found to have it. Cystic fibrosis causes chronic lung infections and greatly shortens length of a person’s life. They now ask: “what does this mean for our chances of having a child with cystic fibrosis? Can we find out whether our child has cystic fibrosis early in pregnancy?”
Alzheimer’s Disease

Fred’s condition deteriorated slowly but persistently. He just could not remember and repeated himself endlessly. The medications helped for a short time but before long he didn’t recognize his family and could not take care of himself. The diagnosis was Alzheimer’s and he was not alone. Almost everyone in the nursing home seemed to be affected. No one seems to understand the cause of Alzheimer’s. The family asked: “what else can be done not only for Fred but for those who come after Fred?”
Key Definitions Related to Non-Communicable Diseases

- Epidemiological Transition
- Health Screenings
- Lead-time Bias
- Risk Factors
More Definitions…

- Sensitivity
- Specificity
- Asymptomatic
- False positives
- False negatives
- Sequential Testing
How Can Screening for Disease Address the Burden of Noncommunicable Disease?

• Screening for disease can result in detection at an early stage under the assumption that early detection will allow for treatment that will improve outcomes
  – Successful for hypertension, diabetes, colon cancer, vision, hearing, etc.

• Successful screening programs will reduce disability and/or death due to these diseases
What are the Four Criteria for Conducting a Health Screening Program?

1. The disease produces substantial death and/or disability
2. Early detection is possible and improves outcome
3. There is a feasible testing strategy for screening
4. Screening is acceptable in terms of harms, costs, and patient acceptance
**Examples of Heart Disease and Cancer and Ideal Criteria**

<table>
<thead>
<tr>
<th>Hypertension</th>
<th>Substantial mortality and/or morbidity</th>
<th>Early detection possible and alters outcome</th>
<th>Screening is feasible (can identify a high-risk population and a testing strategy)</th>
<th>Screening acceptable in terms of harms, costs, and patient acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributory cause of strokes, Myocardial infarctions, kidney disease</td>
<td>High blood Pressure precedes bad outcomes often by decades and effective treatment is available</td>
<td>Test everyone desirable range has been established</td>
<td>Screening itself is free of harms, low cost, and acceptable to patients</td>
<td>Treatments, however, may be complicated and have harms, costs, side effects, and compliance issues</td>
</tr>
</tbody>
</table>

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# Examples of Heart Disease and Cancer and Ideal Criteria

<table>
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<tr>
<th>LDL cholesterol</th>
<th>Substantial Mortality and/or morbidity</th>
<th>Early Detection possible and Alters outcome</th>
<th>Screening is feasible (can identify a high-risk population and a testing strategy)</th>
<th>Screening acceptable in terms of harms, costs, and patient acceptability</th>
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<tr>
<td>Contributory cause of strokes, heart attack, and other vascular diseases</td>
<td>Precedes the development of disease by decades and treatment is effective in altering outcome</td>
<td>Test everyone: desirable range has been established</td>
<td>Screening itself is free of harm, low cost, and acceptable to patients</td>
<td>Treatment has rare side effects, which can be detected by symptoms and low-cost blood tests</td>
</tr>
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## Examples of Heart Disease and Cancer and Ideal Criteria

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<th>Breast cancer</th>
<th>Substantial Mortality and/or morbidity</th>
<th>Early Detection possible and Alters outcome</th>
<th>Screening is feasible (can identify a high-risk population and a testing strategy)</th>
<th>Screening acceptable in terms of harms, costs, and patient acceptability</th>
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<tr>
<td>2nd most common fatal cancer among women and most common for women under 70</td>
<td>Early detection improves outcome</td>
<td>For those 50 and over, combination of mammography and follow-up biopsy shown to be feasible</td>
<td>Harm may occur due to false positives, low risk of harm from radiation, patient acceptance good, but test can be somewhat uncomfortable</td>
<td>Screening younger women increases costs and the occurrence of false positives</td>
</tr>
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<td>Cervical cancer</td>
<td>If undetected And Untreated: may be fatal</td>
<td>Early treatment Dramatically reduces the risk of death</td>
<td>Pap results in substantial number of false positives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pap smear and follow-up testing have be extremely successful</td>
<td>New DNA testing may be used to separate true and false positives.</td>
</tr>
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<tr>
<td>Colon cancer</td>
<td>Early detection of polyps reduces development of cancer and early detection of cancer Improves chances of survival</td>
<td>Men and women 50 and older, plus those with high risk types of colon disease Options for screening include: fecal occult blood testing, plus flexible sigmoidoscopy, colonoscopy, and virtual colonoscopy</td>
<td>Patient acceptance has been major barrier, small probability of harm from procedure, substantial cost for colonoscopy and virtual colonoscopy</td>
</tr>
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<td>2nd most common fatal cancer in men and third in women</td>
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Colon cancer is the 2nd most common fatal cancer in men and third in women. Early detection of polyps reduces development of cancer and early detection of cancer improves chances of survival. Screening is feasible (can identify a high-risk population and a testing strategy). Screening is acceptable in terms of harms, costs, and patient acceptability.
How Can Identification and Treatment of Multiple Risk Factors Be Used to Address the Burden of Noncommunicable Disease?

- Multiple risk factor reduction is a strategy to intervene simultaneously on a series of risk factors, all of which contribute to a particular outcome
  - Most effective when there are constellations, or groups of risk factors that cluster in definable groups of people
- Useful strategy when the presence of two or more risk factors increases the risk more than would be expected by adding the impact of each risk factor

Sedentary lifestyle → obesity → smoking → heart disease
How Can Cost-Effective Interventions Help Us Address the Burden of Non-communicable Disease?

- Cost-effectiveness combines issues of benefits and harms with issues of financial costs.
- Compares a new intervention to the current or standard intervention (2 questions to ask):
  1. Is the additional net-effectiveness of an intervention worth the additional cost?
  2. Is a small loss of net-effectiveness worth the considerable savings in cost?
The 4 Quadrants of Cost and Net-Effectiveness

- Increased Costs, Decreased Effectiveness: (Not cost effective)
- Decreased Costs, Decreased Effectiveness: (May be cost-effective if decreased costs are worth small decrease in effectiveness.)
- Increased Costs, Increased Effectiveness: (May be cost-effective if increased costs are worth large increase in effectiveness.)
- Decreased Costs, Increased Effectiveness: (Cost-effective)
How Can Cost-Effective Interventions Help Us Address the Burden of Noncommunicable Disease?

• Applying cost-effectiveness analysis to routine clinical interventions is often coupled with efforts to better predict the outcome of disease and treatment
  – Improving the ability to predict the outcome of diseases and interventions can help us know when, how, and whether to intervene
Common Genetic Disorders

• Recessive gene problems
  – Tay-Sachs Disease
  – Phenylketonuria (PKU)
  – Cystic Fibrosis

• Chromosomal Disorder
  – Down Syndrome
Tay-Sachs Disease

Unaffected “carrier” father

Unaffected “carrier” mother

Unaffected 1 in 4 chance

Unaffected carrier 2 in 4 chance

Affected 1 in 4 chance

Video
Phenylketonuria (PKU)

Because a child with PKU lacks the normally functioning enzyme necessary to break down phenylalanine (PHE), it accumulates in the blood and body tissues.

This excess PHE can prevent normal brain development and result in mental retardation.
Health Problems with Cystic Fibrosis

- Sinus Problems
- Nose Polyps (growths)
- Frequent lung Infections
- Salty sweat
- Enlarged heart
- Trouble breathing
- Gallstones
- Abnormal pancreas function
- Trouble digesting food
- Fatty BM's
Down Syndrome
Genetic Applications

• Genetic prevention
• Early genetic detection
  – Phenotypic expression of genes
• Gene-environmental protection
• Genotypic-based screenings
What are the Pros and Cons of Genetic Testing?

**Advantages**
- Family planning and counseling
- Early recognition
- Early management
- Life support groups
- Early planning for health-care services
- Agapé

**Disadvantages**
- Costs
- Discrimination
- Rejection
- Anxiety/worry
- Stress
- Depression
- Self-isolation
How Can Genetic Counseling and Intervention Be Used to Address the Burden of Chronic Diseases?

• Genetic prevention
  – Incorporates efforts to prevent the occurrence of single genes or multiple gene combinations that are likely to produce disease

• Genetic detection prior to disease
  – Efforts aimed at the detection of genetic defects and the implementation of early intervention to prevent phenotypic expression of genes
How Can Genetic Counseling and Intervention Be Used to Address the Burden of Chronic Diseases?

- Gene-environment protection
  - Identify individuals who are especially likely to develop disease when they experience specific environmental exposures

- Genotypic-based screening for early disease
  - Combinations of genes may identify groups that are at a high risk for common diseases
What are the Major Strategies for a Population Health Approach to Non-communicable Disease Prevention?

- Screening for early detection and treatment of disease.
- Multiple risk factor interventions.
- Identification of cost-effective treatments.
- Genetics counseling and intervention.
- Research.
What Can We Do When Highly Effective Interventions Do Not Exist?

• Public health efforts encourage the use of existing interventions, especially when there is evidence that they allow individuals to function on their own or with limited assistance for longer periods of time

• Additional epidemiological and biological research is needed to prevent progression, improve treatment, and understand the causes of a disease currently without effective interventions
How Can We Combine Strategies to Address Complex Problems of Noncommunicable Diseases?

- Multiple interventions combining health care, traditional public health approaches, and social interventions are often needed
  - The population health approach requires the combined and integrated use of multiple interventions
The End

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