Faculty of Medicine
Public Health (31505291)

Lecture 5
Epidemiological Transition
Global Health Risks

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**Presentation outline 1-7-2018**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>Epidemiological Transition-Definitions</td>
<td>09:15 to 09:25</td>
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<td>Global Health Risks</td>
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<td>The Third Epidemiologic Transition</td>
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<td>Multidisciplinary approach required to improve global health</td>
<td>09:50 to 10:15</td>
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</tbody>
</table>
Epidemiological Transition

meaning, definition, explanation...
• **HEALTH TRANSITION** - changes *in health status plus* changes in economic, sociodemographic and environmental health determinants.

• **DEMOGRAPHIC TRANSITION** - changes *in population size and distribution*: birth and death rates and population pyramids.

• **EPIDEMIOLOGICAL TRANSITION** - *move from a* disease pattern dominated by infectious diseases to one characterized by noncommunicable diseases (cancers, cardiovascular and injury).
• **HEALTH RISK TRANSITION** - *changes in size and nature* of population strata exposed to risk behavior and risk exposures.

• **TECHNOLOGICAL TRANSITION** – *rapid advances* in science, biotechnology, information technology and health sciences
Epidemiological Transition

• Changing patterns in death and illness due to modernization are changed- from generally infectious, parasitic and nutritional diseases to western diseases chronic degenerative diseases.
Epidemiological Transition

• Most changes in epidemiological transition occur in relation to *substantial changes in living standards, and ways of life*.

• This includes access to medical care, preventative medicine and public health but also other factors such as adaptation of western lifestyle which includes stress, eating patterns, urbanized living etc.
Infections versus non-infectious disease

It has become conventional to *distinguish* between infectious and parasitic diseases *and* chronic or degenerative diseases.

- **Western Diseases/Diseases of Affluence (ترف)**/ Diseases of Civilization

Diseases which are often associated with first world nations many that *can be considered man-made* or factors of the environment including circulatory disease, neoplasms, congenital or *acquired* handicaps etc.
Infections versus non-infectious disease

- Diseases of Poverty / Tropical Diseases/3rd World Diseases

diseases classified in this category are essentially infectious, parasitic and nutritional diseases—many of which are considered curable in the West such as malaria and TB
• Age of declining cardiovascular mortality, ageing, lifestyle modifications, emergent and resurgent diseases

• Increases in life expectancy (which approach 80 to 85 years or longer, especially for females), with increased chronic diseases and ageing.

• Changes in lifestyle, cessation of smoking, low-fat diets, and regular and aerobic exercise, better nutrition and malnutrition).
Emergence of new diseases and resurgence of old diseases

- The WHO in 1998 listed some 30 such diseases recognized since 1970, Viral diseases are those caused by HIV, Hepatitis B and C, Ebola, Hanta pulmonary and renal syndromes, Monkeypox, Rift Valley fever and several hemorrhagic fevers.
The Health Transition

• Health transition: the shifts that have taken place in the *patterns and causes of death in many countries*

• Previously, the health transition has been covered by two separate terms:
  – demographic transition
  – epidemiological transition
The Health Transition ...

- **Demographic transition** - describing the change from high fertility and mortality rates in less developed societies to low fertility and low mortality rates in 'modern' societies.

- **Epidemiological transition** - which was introduced to describe the changes in mortality and morbidity patterns (from infectious to chronic diseases) as societies' demographic, economic and social structures change.

- The **health transition** is a more appropriate term, as it covers the full range of social, economic and ecological changes driving the epidemiological and demographic transition.
The Demographic Transition Theory

• The transition from a combination of high birth rate and high death rate to a combination of low birth rate and low death rate, with the decline in birth rate lagging behind the decline in death rate so that during the middle phase of the transition there is population explosion
The Demographic Transition Theory ...
The Epidemiologic Transition

- It comprises **three stages** characterized by categories in which fertility levels and causes of death are grouped.

1. The age of pestilence الماجعة and famine الوباء
2. The age of receding pandemics
3. The age of chronic diseases

- Epidemiologic transition comprises of the **first three stages** of the health transition.
1-The age of pestilence and famine

- This first stage of the health transition stage (the age of pestilence and famine) is characterized by the kind of mortality that has prevailed throughout most of human history.
- **Epidemic, famines and wars cause huge numbers of deaths.**
- The lack of sufficient infrastructure for most services high levels of mortality and fertility.
- Infectious diseases are dominant, causing high mortality rates, especially **among children.**
- **Life expectancy between 20-40 years**
- **Some developing countries are still in this stage.**
2-The age of receding pandemics

• This stage began in the mid-19th century in many of what are now developed countries.
• It involved a reduction in the prevalence of infectious diseases, and a fall in mortality rates.
• As a consequence, life expectancy at birth climbed rapidly from about 35 to 50.
• Increased economic growth leads to a sharp fall in deaths from infectious diseases, and from malnutrition.
• Finally, the introduction of modem healthcare and health technologies, e.g. immunization programs and the introduction of antibiotics enable the control and elimination of group of infectious diseases such as acute bronchitis, influenza and syphilis.
3-The age of chronic diseases

- In the third stage the elimination of infectious diseases makes way for chronic diseases among the elderly.
- While improved healthcare means that these are less lethal than infectious diseases, they nonetheless cause relatively high levels of morbidity.
- Increasingly, health patterns depend on social and cultural behavior, such as patterns of food consumption and drinking behavior.
- Due to low levels of mortality and fertility, there is little population growth.
- When the health transition is at an advanced stage, life expectancy may exceed 80 years.
The age of chronic diseases ...

• This stage occurs at **different rates in different nations:**
  – in **both** developed and developing countries, mortality rates are **driven by socially determined factors**;
  – in developed nations they are also driven by **medical technology**.

• It becomes necessary to ensure sufficient social and health-care investment for all age groups.

• At the same time, there is increased demand for healthcare related to the diseases of older people.
The Epidemiologic Transition

• The epidemiologic transition (MADE UP OF STAGES 1-3) has not been all blessing certain changes associated with the transition have given rise to as many problems which include:

1. nuclearization of the family
2. the destruction of group cohesion
3. rise in mental illness
4. crime, delinquency الانحراف
5. drug dependency which boost the demand/psychiatric help
6. alarming rise in medical costs
The next stage in the health transition: what lies ahead?

• In order to explore possible future global health transitions Martens (2002) developed a set of possible scenarios that paint pictures of possible futures and explore the various outcomes that might result if certain basic assumptions are changed.

• These scenarios can be used to explore the global and regional dynamics that may result from changes at a political, economic, demographic, technological and social level
The Scenarios

Four clusters of scenarios were developed and are defined along two main dimensions:

• Group A
  – The first dimension relates to the extent both of economic convergence and of social and cultural interactions across regions

• Group B
  – the second has to do with the balance between economic objectives and environmental and equity objectives.
The Scenarios - Group A1

• This group is characterized by fast economic growth, low population growth and the accelerated introduction of new, cleaner and more effective technologies.

• Under this scenario, social concerns and the quality of the environment are subsidiary to the principal objective: the development of economic prosperity.

• Underlying themes combine economic and cultural convergence, and the development of economic capacity with a reduction in the difference between rich and poor, regional differences in per capita income decrease in relative terms.
The Scenarios - Group A2

- This group envisages a future in which economic prosperity is the principal goal, but this prosperity is then expressed in a more heterogeneous world.

- Underlying themes include the reinforcement of regional identity with an emphasis on family values and local traditions, and strong population growth.

- Technological changes take place more slowly and in a more fragmented fashion than in the other scenarios.
- This is a world with greater diversity and more differences across regions.
The Scenarios - Group B1

• In this group, striving for economic prosperity is subordinate to the search for solutions to environmental and social problems (including problems of inequity).

• While the pursuit of global solutions results in a world characterized by increased globalization and fast-changing economic structures, this is accompanied by the rapid introduction of clean technology and a shift away from materialism.

• There is a clear transformation towards a more service and information-based economy.
The Scenarios - Group B2

• This envisions a world that advances local and regional solutions to social, economic and ecological problems.

• This is a heterogeneous world in which technological development is slower and more varied, and in which considerable emphasis is placed on initiatives and innovation from local communities.

• Due to higher than average levels of education and a considerable degree of organization within communities, the pressure on natural systems is greatly reduced.
Future stages of the health transition

Based on these scenarios Martens (2002) described the developments in the health status of populations according to three potential future 'ages' 4-6:

1. The age of pestilence and famine المَجاعة
2. The age of receding pandemics
3. The age of chronic diseases

4. the age of emerging infectious diseases
5. the age of medical technology
6. the age of sustained health.
Future stages of the health transition…

• These stages are imaginary (although some features are already recognizable in some countries) and are not sharply delineated- there is always a continuum.

• Of course, each country follows its own route to the 'ages' in question.
4- The age of emerging infectious diseases

• In this stage, the emergence of new infectious diseases or the reemergence of 'old' ones will have a significant impact on health.

• A number of factors will influence this development:
  – travel and trade
  – microbiological resistance
  – human behavior
  – breakdowns in health systems
  – increased pressure on the environment

The overuse of antibiotics and insecticides, combined with inadequate or deteriorating public health infrastructures will hamper or delay responses to increasing disease threats.
5- The age of medical technology

• To a large extent, increased health risks caused by changes in life-style and environmental changes will be offset by increased economic growth and technology improvements in the age of medical technology.

• If there is no long-term, sustainable economic development, increased environmental pressure and social imbalance may propel poor societies into the age of emerging infectious diseases.

• On the other hand, if environmental and social resources are balanced with economic growth, sustained health may be achieved.
6-The age of sustained health

- In the age of sustained health, investments in social services will lead to a sharp reduction in life-style related diseases, and most environmentally related infectious diseases are will be eradicated.

- Health policies will be designed to improve the health status of a population in such a way that the health of future generations is not compromised by, for example, the depletion of resources needed by future generations.
Health Transition – Developed Countries

- Currently, most developed countries are in the third stage of the health transition:
  - fertility rates are low
  - causes of diseases and deaths have shifted from infectious to chronic diseases.
Health Transition – Developing Countries

• The health situation in developing countries varies greatly from one country to another.

• In most, there is still very low life expectancy; this is due largely to malnutrition and the lack of safe drinking water, which are compounded by poor healthcare facilities.

• In other countries, however, particularly in Asia and Latin America, chronic diseases have now become more important than infectious diseases.
Health Transition – Developing Countries …

• The same large variation is reflected in the demographic situation.

• In countries such as China and Thailand, fertility rates are very low; in others they are very high.

• Due to sub-national differences of an economic, social or ecological nature, there may also be large differences within a single country.
Health Transition – Developing Countries …

• It is widely believed that, with increasing economic growth, developing countries will follow the same pattern of health transition as Europe and North America.

• Many countries, especially the poorest, will not 'trade' infectious diseases for chronic diseases; instead, they may even suffer a 'double burden' of disease.
Health Transition …

• Future developments will *not be the same for all countries, and developing countries are unlikely to follow the same transition path as the developed world.*
Health transition: demographic transition and epidemiologic transition

Industrialization & urbanization

- ↑ per cap. income, ↑ wealth
- ↑ levels of RF: fat, calories, tobacco, sedentary habits

↑ public sanitation, housing, health care

↑ nutrition

↑ technology for health care

↓ mortality (↓ infant mortality)

↑ life expectancy

→ ↓ fertility

Increasing and aging population

↑ NCD

↓ infectious diseases

↑ persons at risk of developing NCDs
<table>
<thead>
<tr>
<th>Disease or injury</th>
<th>2004 Deaths (%)</th>
<th>2004 Rank</th>
<th>Disease or injury</th>
<th>2030 Deaths (%)</th>
<th>2030 Rank</th>
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<td>Chronic obstructive pulmonary disease</td>
<td>8.6</td>
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<tr>
<td>Chronic obstructive pulmonary disease</td>
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<td>4</td>
<td>Lower respiratory infections</td>
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<td>Road traffic accidents</td>
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<td>HIV/AIDS</td>
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<td>6</td>
<td>Trachea, bronchus, lung cancers</td>
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<td>Tuberculosis</td>
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<td>7</td>
<td>Diabetes mellitus</td>
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<tr>
<td>Trachea, bronchus, lung cancers</td>
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<td>8</td>
<td>Hypertensive heart disease</td>
<td>2.1</td>
<td>8</td>
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<tr>
<td>Road traffic accidents</td>
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<td>Stomach cancer</td>
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<td>Prematurity and low birth weight</td>
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<td>Nephritis and nephrosis</td>
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<td>Neonatal infections and other*</td>
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<td>Self-inflicted injuries</td>
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<td>Diabetes mellitus</td>
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<td>Liver cancer</td>
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<td>Malaria</td>
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<td>Colon and rectum cancers</td>
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<td>Hypertensive heart disease</td>
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<td>Oesophagus cancer</td>
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<td>Birth asphyxia and birth trauma</td>
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<td>Self-inflicted injuries</td>
<td>1.4</td>
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<td>Alzheimer and other dementias</td>
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<td>Stomach cancer</td>
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<td>Cirrhosis of the liver</td>
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<td>Cirrhosis of the liver</td>
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<td>Breast cancer</td>
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<td>Breast cancer</td>
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<tr>
<td>Oesophagus cancer</td>
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<td>24</td>
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<td>Alzheimer and other dementias</td>
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* Comprises severe neonatal infections and other, noninfectious causes arising in the perinatal period.
Trends in Global Deaths 2002-30

Projected global deaths for selected causes of death, 2002–2030

Global Health Risks:
Selected figures and tables

Health Statistics and Informatics Department

World Health Organization
### Leading causes of attributable global mortality and burden of disease, 2004

<table>
<thead>
<tr>
<th>Attributable Mortality</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High blood pressure</td>
<td>12.8</td>
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<tr>
<td>2. Tobacco use</td>
<td>8.7</td>
</tr>
<tr>
<td>3. High blood glucose</td>
<td>5.8</td>
</tr>
<tr>
<td>4. Physical inactivity</td>
<td>5.5</td>
</tr>
<tr>
<td>5. Overweight and obesity</td>
<td>4.8</td>
</tr>
<tr>
<td>6. High cholesterol</td>
<td>4.5</td>
</tr>
<tr>
<td>7. Unsafe sex</td>
<td>4.0</td>
</tr>
<tr>
<td>8. Alcohol use</td>
<td>3.8</td>
</tr>
<tr>
<td>9. Childhood underweight</td>
<td>3.8</td>
</tr>
<tr>
<td>10. Indoor smoke from solid fuels</td>
<td>3.3</td>
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</table>

59 million total global deaths in 2004

<table>
<thead>
<tr>
<th>Attributable DALYs</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>1. Childhood underweight</td>
<td>5.9</td>
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<tr>
<td>2. Unsafe sex</td>
<td>4.6</td>
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<tr>
<td>3. Alcohol use</td>
<td>4.5</td>
</tr>
<tr>
<td>4. Unsafe water, sanitation, hygiene</td>
<td>4.2</td>
</tr>
<tr>
<td>5. High blood pressure</td>
<td>3.7</td>
</tr>
<tr>
<td>6. Tobacco use</td>
<td>3.7</td>
</tr>
<tr>
<td>7. Suboptimal breastfeeding</td>
<td>2.9</td>
</tr>
<tr>
<td>8. High blood glucose</td>
<td>2.7</td>
</tr>
<tr>
<td>9. Indoor smoke from solid fuels</td>
<td>2.7</td>
</tr>
<tr>
<td>10. Overweight and obesity</td>
<td>2.3</td>
</tr>
</tbody>
</table>

1.5 billion total global DALYs in 2004
Deaths attributed to 19 leading factors, by country income level, 2004
Percentage of disability-adjusted life years (DALYs) attributed to 19 leading risk factors, by country income level, 2004

- Childhood underweight
- Unsafe sex
- Alcohol use
- Unsafe water, sanitation, hygiene
- High blood pressure
- Tobacco use
- Suboptimal breastfeeding
- High blood glucose
- Indoor smoke from solid fuels
- Overweight and obesity
- Physical inactivity
- High cholesterol
- Occupational risks
- Vitamin A deficiency
- Iron deficiency
- Low fruit and vegetable intake
- Zinc deficiency
- Illicit drugs
- Unmet contraceptive need

Per cent of global DALYs (total: 1.53 billion)
Major causes of death in children under 5 with disease-specific contribution of undernutrition, 2004

- Pneumonia: 17%
- Diarrhoea: 17%
- Severe neonatal infections: 11%
- Measles: 4%
- Malaria: 7%
- Other infections: 12%
- Nutritional deficiencies: 2%
- Prematurity: 11%
- Birth asphyxia and trauma: 8%
- Non communicable: 7%
- Injuries: 4%

Shaded area indicates contribution of undernutrition to each cause of death.
Attributable DALY rates for selected diet-related risk factors by WHO region, 2004

- Western Pacific
- South-East Asia
- Europe
- Eastern Mediterranean
- Americas
- Africa
- High income

DALYs per 1000 population over age 30

- High cholesterol
- High body mass index
- High blood pressure
- All six risks
Burden of disease attributable to contraception by WHO region, 2004

- **Africa**: 
  - Unsafe abortion: 10
  - Other maternal conditions: 7
- **Americas**: 
  - Unsafe abortion: 3
  - Other maternal conditions: 4
- **Eastern Mediterranean**: 
  - Unsafe abortion: 4
  - Other maternal conditions: 7
- **Europe**: 
  - Unsafe abortion: 2
  - Other maternal conditions: 1
- **South-East Asia**: 
  - Unsafe abortion: 3
  - Other maternal conditions: 8
- **Western Pacific**: 
  - Unsafe abortion: 1
  - Other maternal conditions: 1

**DALYs per 1000 women aged 15–44**
Disease burden attributable to 24 global risk factors by income and WHO region, 2004

- High income
  - Not attributed to any risk factor: 100
  - Attributed to any risk factor: 100

- Western Pacific
  - Not attributed to any risk factor: 150
  - Attributed to any risk factor: 50

- Americas
  - Not attributed to any risk factor: 150
  - Attributed to any risk factor: 50

- Europe
  - Not attributed to any risk factor: 200
  - Attributed to any risk factor: 100

- South-East Asia
  - Not attributed to any risk factor: 250
  - Attributed to any risk factor: 50

- Eastern Mediterranean
  - Not attributed to any risk factor: 250
  - Attributed to any risk factor: 50

- Africa
  - Not attributed to any risk factor: 350
  - Attributed to any risk factor: 150

DALYs per 1000 population:

- 0
- 100
- 200
- 300
- 400
- 500
Potential life expectancy gain in the absence of selected risks to global health, 2004

- 8 CVD risks
- 7 child risks
- All 28 risks
- Top 10 risks

Top 10 risks to health by WHO region:
- Africa
- Eastern Mediterranean
- South-East Asia
- Europe
- Western Pacific
- Americas
- High income

Life expectancy at birth (years)
<table>
<thead>
<tr>
<th>Post 1(^{st})</th>
<th>2(^{nd}) transition</th>
<th>Post 2(^{nd}) transition</th>
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<tbody>
<tr>
<td>Pre 2(^{nd}) transition</td>
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<tr>
<td>High birth rate</td>
<td>Declining death rate</td>
<td>Reduced birth rate</td>
</tr>
<tr>
<td>High death rate</td>
<td>High birth rate</td>
<td>Reduced death rate</td>
</tr>
<tr>
<td>Stable population</td>
<td>Increasing population</td>
<td>Stable (or decreasing)</td>
</tr>
<tr>
<td>population</td>
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<td>population</td>
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</table>
Third Epidemiological Transition

Disease burden estimates - India 1990

- Injuries: 15%
- Non-communicable: 29%
- Communicable*: 56%

Disease burden projections - India 2020

- Injuries: 19%
- Non-communicable: 57%
- Communicable*: 24%
The Third Epidemiologic Transition

Characterized by:

1. Detection of new diseases
2. Reemergence of infectious disease
3. Rise of antimicrobial resistance
The Third Epidemiologic Transition: Detection of New Diseases

- Large number of new pathogens detected in past 40 years
  - Better surveillance
    - Legionnaire’s disease discovered in 1976, but now known to be responsible for previous deaths
  - Increased incidence of new pathogens worldwide:
    - HIV
    - Viral hemorrhagic fevers (Ebola, Marburg, Hanta)
    - Lyme disease
    - West Nile
The Third Epidemiologic Transition: Reemergence of Infectious Disease

• Climate change
  – Warmer climates create favorable environments for the cholera bacteria

• Urbanization + human encroachment on the natural environment
  – Dengue fever-carrying mosquitos thrive in slums
  – Avian influenza from wild poultry in China

• Other factors
  – TB: increased incidence in the US in the early 1990s, and continued high incidence in Eastern Europe
  – Pertussis (whooping cough): rise in the US despite vaccination
  – Recent epidemic of measles in France and remainder of Europe
The Third Epidemiologic Transition: Rise of Antimicrobial Resistance

Globally, antimicrobial resistance
• causes significant mortality
• hampers the control of infectious diseases
• threatens a return to the pre-antibiotic era
• increases the costs of health care
• jeopardizes health-care gains to society
• threatens health security, and damages trade and economies
Classifying Countries Today

• **First/second/third world**
  – Cold War-era political term
  – Imprecise

• **By development**
  – developed, developing (least developed)
  – definition from the International Monetary Fund (IMF)

• **By per capita income**
  – high income, upper middle income, lower middle income, low income
  – definition from the World Bank

• The “most developed” countries are members of the Organization for Economic Co-operation and Development (OECD)
First, Second, and Third World?

Cold War alliances:
• First World (Blue): Capitalist countries
• Second World (Red): Communist
• Third World (Green): Unallied/neutral

Sometimes used as a sliding scale to describe development → not recommended.
These are not useful terms in scientific or global health discourse.
Income Groups

Based on gross national income per person per annum

- **Low-income**: $1,035 or less
- **Lower middle-income**: $1,036 to $4,085
- **Upper middle-income**: $4,086 to $12,615
- **High-income**: $12,616 or above

Figure 2.8: World Population - 1950 to 2050

Top 10 causes of death in low-income countries (2011)

- Lower respiratory infections: 98 deaths per 100,000 population
- HIV/AIDS: 70 deaths per 100,000 population
- Diarrhoeal diseases: 69 deaths per 100,000 population
- Stroke: 56 deaths per 100,000 population
- Ischaemic heart disease: 47 deaths per 100,000 population
- Prematurity: 43 deaths per 100,000 population
- Malaria: 38 deaths per 100,000 population
- Tuberculosis: 32 deaths per 100,000 population
- Protein energy malnutrition: 32 deaths per 100,000 population
- Birth asphyxia and birth trauma: 30 deaths per 100,000 population

Top 10 causes of death in high-income countries (2011)

- Ischaemic heart disease: 119 deaths per 100,000 population
- Stroke: 69 deaths per 100,000 population
- Tracheobronchus, lung cancer: 51 deaths per 100,000 population
- Alzheimer disease and other dementias: 48 deaths per 100,000 population
- COPD: 32 deaths per 100,000 population
- Lower respiratory infections: 32 deaths per 100,000 population
- Colon rectum cancers: 27 deaths per 100,000 population
- Diabetes mellitus: 21 deaths per 100,000 population
- Hypertensive heart disease: 20 deaths per 100,000 population
- Breast cancer: 16 deaths per 100,000 population
Percent of urban population from 1970-2025 in industrialized and developing countries

- Developed countries
- Former socialist economies
- Developing countries

- 1970
- 1994
- 2025
Nutritional transition: rapid adoption of a high fat diet, China

- **Higher income earners**: 1989 - 20% | 1993 - 60%
- **Middle income earners**: 1989 - 20% | 1993 - 50%
- **Low income earners**: 1989 - 20% | 1993 - 35%

Proportion of persons with >30% fat diet (%)
Prevalence of overweight and obesity in children, age 5-17, in developed and developing countries (using same criteria)
Key Risk Factors for Various Health Conditions

- **Tobacco use** – related to the top ten causes of mortality worldwide
- **Poor sanitation and access to clean water** – related to high levels of diarrhoeal/water borne diseases
- **Low condom use** – HIV/AIDS, sexually transmitted infections
- **Malnutrition** – Under-nutrition (increased susceptibility to infectious diseases) and over-nutrition responsible for cardiovascular diseases, cancers, obesity etc.