中—美合作肿瘤预防与控制培训班

资助：复旦大学公共卫生学院

加州大学洛杉矶分校/Fogarty艾滋病国际培训与研究项目

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3月11日

http://www.ph.ucla.edu/epi/faculty/zhang/Webpages/zhang/chinese-full-program.htm
Cancer Incidence and Mortality and Risk Factors in the World

Zuo-Feng Zhang, M.D., Ph.D.
Fogarty International Training Workshop on Cancer Epidemiology Prevention and Control
Shanghai, March, 11-13, 2008
Table 1. Leading Causes of Death Worldwide and in Developing and Developed Countries, 2001 (thousands)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Worldwide Rank</th>
<th>Worldwide Deaths</th>
<th>Worldwide %</th>
<th>Developing Rank</th>
<th>Developing Deaths</th>
<th>Developing %</th>
<th>Developed Rank</th>
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<td>960</td>
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<td>771</td>
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<td>All causes</td>
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<td>56,242</td>
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<td>All causes</td>
<td>48,351</td>
<td>100.0</td>
<td>All causes</td>
<td>7,891</td>
<td>100.0</td>
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</table>

The number zero in a cell indicates a non-zero estimate of less than 500 deaths.

*This cause category includes “causes arising in the perinatal period” as defined in the International Classification of Diseases, principally low birthweight, prematurity, birth asphyxia, and birth trauma, and does not include all causes of deaths occurring in the perinatal period.

FIGURE 4  Incidence, Mortality, and Prevalence by Location.
### Figure 1. Leading Sites of New Cancer Cases and Deaths Worldwide and by Level of Economic Development, 2007

<table>
<thead>
<tr>
<th></th>
<th>Estimated New Cases</th>
<th>Estimated Deaths</th>
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<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worldwide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>1,108,731</td>
<td>974,624</td>
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<tr>
<td>Prostate</td>
<td>782,647</td>
<td>511,549</td>
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<tr>
<td>Stomach</td>
<td>691,432</td>
<td>318,798</td>
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<tr>
<td>Colon &amp; rectum</td>
<td>630,358</td>
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<td>Liver</td>
<td>502,571</td>
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<td>Esophagus</td>
<td>361,931</td>
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<td>Urinary bladder</td>
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<td>Non-Hodgkin lymphoma</td>
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<td>Leukemia</td>
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<td><strong>Female</strong></td>
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<td>Worldwide</td>
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</tr>
<tr>
<td>Breast</td>
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<tr>
<td>Cervix uteri</td>
<td>555,094</td>
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<tr>
<td>Colon &amp; rectum</td>
<td>536,662</td>
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<tr>
<td>Lung &amp; bronchus</td>
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<td>Stomach</td>
<td>375,111</td>
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<tr>
<td>Ovary</td>
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<tr>
<td>Corpus uteri</td>
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<td>141,452</td>
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<tr>
<td>Liver</td>
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<tr>
<td>Esophagus</td>
<td>167,352</td>
<td>107,538</td>
</tr>
<tr>
<td>Leukemia</td>
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<td>107,538</td>
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<tr>
<td>All sites*</td>
<td>5,717,275</td>
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<tr>
<td>Developing Countries</td>
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<td>---------------------</td>
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<tr>
<td></td>
<td>Breast</td>
<td>593,233</td>
</tr>
<tr>
<td></td>
<td>Cervix uteri</td>
<td>272,238</td>
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</tbody>
</table>

Estimates were produced by applying age-specific cancer rates of a defined geographic region worldwide, developed, and developing countries) from GLOBOCAN 2002 to the corresponding age-specific population for the year 2007 from the United Nations population projections (2004 revision). Therefore, estimates for developed and developing countries combined do not sum to worldwide estimates.

*Excludes nonmelanoma skin cancer.
Estimated Number of New Cancer Cases by World Area, 2007

Worldwide*  
12,332,300

1 Eastern Africa (290,100)  
2 Middle Africa (87,800)  
3 Northern Africa (142,100)  
4 Southern Africa (78,100)  
5 Western Africa (166,300)  
6 Caribbean (73,500)  
7 Central America (184,800)  
8 South America (733,100)  
9 North America (1,745,400)  
10 Eastern Asia (3,313,600)  
11 South-Eastern Asia (618,800)  
12 South Central Asia (1,451,700)  
13 Western Asia (225,900)  
14 Eastern Europe (939,500)  
15 Northern Europe (448,700)  
16 Southern Europe (675,000)  
17 Western Europe (950,500)  
18 Australia/New Zealand (117,700)  
19 Melanesia (7,700)  
20 Micronesia (700)  
21 Polynesia (900)

*Region estimates do not sum to worldwide estimate due to calculation method.
## Age Standardized Incidence Rates (/100,000)

<table>
<thead>
<tr>
<th>Site</th>
<th>US</th>
<th>China</th>
<th>World</th>
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<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
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<tr>
<td>Stomach</td>
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<tr>
<td>Lung</td>
<td>61.9</td>
<td>36.1</td>
<td>42.4</td>
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<tr>
<td>Liver</td>
<td>5.5</td>
<td>2.0</td>
<td>37.9</td>
</tr>
<tr>
<td>Esophagus</td>
<td>4.9</td>
<td>1.3</td>
<td>27.4</td>
</tr>
<tr>
<td>Colon/Rectum</td>
<td>44.6</td>
<td>33.1</td>
<td>13.6</td>
</tr>
<tr>
<td>Breast</td>
<td>—</td>
<td>101.1</td>
<td>—</td>
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<tr>
<td>Leukemia</td>
<td>11.2</td>
<td>7.4</td>
<td>5.7</td>
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<tr>
<td>Pancreas</td>
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<td>6.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Cervix</td>
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<td>7.7</td>
<td>0</td>
</tr>
<tr>
<td>Brain</td>
<td>6.5</td>
<td>4.5</td>
<td>3.9</td>
</tr>
<tr>
<td>Prostate</td>
<td>124.8</td>
<td>0</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Source: GLOBOCAN 2002
The Major Cancers

- Lung (ICD-10 C33 and C34)
- Breast (female, C50)
- Colon/rectum (C18-C20)
- Stomach (C16)
- Prostate (C61)
- Liver (C22)
- Cervix uteri (C53)
- Esophagus (C15)
Lung cancer

- 1.35 million new cases and 1.18 million deaths worldwide estimated in 2002
- 50% new cases occurred in more developed countries (previously 69%)
- more common in males (2.9 male:female ratio)
- patterns of lung cancer occurrence determined largely by past exposure to tobacco smoking
Age-standardized incidence rates for lung cancer

<table>
<thead>
<tr>
<th>Region</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
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<tr>
<td>Eastern Europe</td>
<td>65.7</td>
<td>8.7</td>
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<tr>
<td>Northern America</td>
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<tr>
<td>Southern Europe</td>
<td>56.9</td>
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<td>China</td>
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<td>Australia/New Zealand</td>
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<td>Micronesia/Polynesia</td>
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<td>Caribbean</td>
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</table>

Source: Figure 5: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Incidence of Lung cancer: Age-standardized Rates (World)-Male (All ages)

GLOBOCAN 2002
Lung cancer incidence trends

- in countries where smoking was first established (UK, US, Australia, etc.), rates declining among men
- in most other countries, rates rising
- rates in women generally increasing since tobacco habit is fairly recent, except in countries where their smoking prevalence is declining

Fig. 8. Lung cancer: (a) incidence trends (source: CI5/SEER); (b) mortality trends (source: WHO/NCIS).
Lung cancer mortality trends

- similar to incidence trends

Fig. 8. (continued).
Risk Factors for Lung Cancer

- Tobacco smoking
- ETS
- Asbestos
- Radon exposure
- Occupational exposures
- Air pollution
- Other radiation
- Recurring inflammation
- Family history of cancer
- Insufficient diet and poor nutritional factors
Lung Cancer Primary Prevention

- Reducing smoking initiation among adolescents

- Increasing smoking cessation among adults: increasing price of tobacco, restricting tobacco advertising and promotion, banning smoking in public places, counter advertising, provide treatment and counseling for tobacco dependence
Lung Cancer Secondary Prevention: Early Detection

- Screening has not yet been proven to reduce mortality

- Spiral CT scan and molecular markers in sputum may be effective.
**Stomach cancer**

- 934,000 new cases and 700,000 deaths worldwide estimated in 2002
- ranked 4th in number of new cancers but 2nd in most common cause of deaths from cancer
- almost two-thirds of cases occur in developing countries
- more common in males (1.75 male:female ratio)
- however, in younger age groups (<40 years) rates in women are greater than men
- Five year survival rate is around 18%-53%
Epidemiology of Stomach Cancer

- In the US
  - Estimate 22,280 incident cases and 11,430 death in both sexes in 2006
  - The five-year survival rate is 23%.

- In China
  - The 2nd most frequent cancer in both sexes, which accounts for 42% of cases worldwide
  - The 3rd cancer killer in China, accounts for 19% of total deaths
Risk and Protective Factors of Stomach Cancer

- **Risk factors**
  - Helicobacter pylori
  - Chronic atrophic gastritis
  - Cigarette smoking
  - Alcohol drinking
  - Consumption of salted meat, cured meat, smoked food, fried food, fish sauce, and fermented beans
  - Diets high in salt

- **Protective factors**
  - Refrigeration of food
  - Consumption of fruit and vegetables
  - Consumption of milk
  - Green tea drinking
  - Garlic consumption
Age-standardized incidence rates for stomach cancer

Source: Figure 8: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Stomach cancer incidence trends

- General decline in rates among both developed and developing countries because of improved food preservation practices (refrigerators) and better nutrition (higher vegetable and fruit intake).
Stomach cancer mortality trends

- generally declining in both less and more developed regions
Esophageal cancer

- 462,000 new cases and 386,000 deaths worldwide estimated in 2002
- 84% of cases occur in developing countries
- Generally, more common in males (male:female ratio over 2), but female predominance in some areas of “esophageal cancer belt”
Epidemiology of Esophageal Cancer

- **Worldwide**
  - The 8th incidence cancer and 6th most common cancer death worldwide
  - Five year survival rate is 16%
  - 80% of the total cases occurred in developing countries

- **In the US**
  - The number 7th ranked cancer death in male in 2006
  - Five year survival rate is 15% estimated from 1995-2001

- **In China**
  - The 4th common both cancer morbidity and mortality.
  - A total of 253,752 new cases would occur each year, which accounts for 54.9% of world
Major Risk and Protective Factors of Esophageal Cancer

- Risk factors
  - Alcohol
  - Smoke
  - HPV (?)
  - Gastric-esophageal reflux (Adenocarcinoma)
  - Age and race
  - Infrequent consumption of raw fruits and vegetable
  - High consumption of hot soup for northern Italian
  - “Majoweh” or "majum" in pregnant women in Iran

- Protective factors
  - Diets high in fruits and vegetables
  - Olive oil
  - Black raspberry
Age-standardized incidence rates for esophageal cancer

Esophageal cancer incidence trends

- trends vary from increasing (Eastern Europe and US), stabilized (Southern Europe), to decreasing (Finland and China)
Esophageal cancer mortality trends

- inconsistent trends like incidence
Liver cancer worldwide

- The 6th most common cancer (626,000 new cases) and the 3rd most common cause of death from cancer (598,000 deaths) worldwide.
- Sex ratio (male/female) is around 2~3
- Age standardized incidence (per 100,000 population): males: 15.7; females: 5.8
- Occurred in younger population in high risk areas with the peak at the age of 50
- Poor survival rate: 5-year survival below 10%
- Over 80% occurred in developing countries
Liver cancer in China

- 345,844 new cases and 321,800 deaths in 2002 (55% of worldwide)
- The 3rd most common cancer and 1st most common death from cancer in men
- The 2nd most common cancer and the 4th most common death from cancer in women
- 5-year survival rate: 2% in Qidong, 5% in Shanghai
Risk/Protective Factors

- **Risk Factors**
  - Hepatitis B Virus (HBV)
  - Hepatitis C Virus (HCV)
  - Aflatoxin B1 (AFB1)
  - Alcohol
  - Tobacco
  - Oral contraceptives

- **Protective Factors**
  - Dietary antioxidants (selenium and retinoids)
  - HBV vaccination
Dietary antioxidants

- Among HBsAg carriers, low retinol is associated with higher risk of hepatocellular carcinoma (HCC) (OR, 14.1)
- Among HBV/HCV carriers, high selenium is associated with lower risk of HCC in low retinol group (OR, 0.2)

Vaccination

- HBV immunization provides protection against infection in more than 90% of healthy people
- HCC incidence in 6-14 years of age children has declined after 10 years of implementing HBV vaccine program in Taiwan
Age-standardized incidence rates for liver cancer

Source: Figure 10: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Liver cancer incidence trends

- Difficult to interpret because of ICD revisions
  - 7th revision includes gall bladder cancer
  - 9th revision includes category of "unspecified 1 or 2"

- ↓ among Chinese because of ↓ in prevalence of HBV

- ↑ in Japan because of ↑ alcohol consumption and HCV prevalence

- ↑ in developed countries possibly from ↑ HCV infection (from transfusions and drug use)

Fig. 20. Liver cancer: (a) incidence trends (source: CI5/SEER); (b) mortality trends, males (source: WHO, NCHS); (c) mortality trends, females (source: WHO, NCHS).
Liver cancer mortality trends

- similar to incidence trends
- increase in mortality among developed countries not necessarily from alcohol (since mortality from liver cirrhosis is decreasing)
Fig. 20. (continued).
Breast cancer

- 1.15 million new cases and 410,000 deaths worldwide estimated in 2002
- most common cancer in women
- Over half of new cases occurred in more developed countries
- stage of disease at diagnosis is most important prognostic factor
- most prevalent cancer in world because of its good prognoses
- risk increases with age but slows at about 50 years because of menopause and lower estrogen levels
Age-standardized incidence and mortality rates for breast cancer

Source: Figure 6: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Fig. 12. Trends in breast cancer incidence by age in different populations.
Breast cancer incidence trends

- generally increasing at all ages
Breast cancer mortality trends

- may be declining in recent years (like in US, Canada, and some European countries) due to screening and detection of early stage cancers and more effective treatment
BRCA1-2 Mutations Increase the Risk of Cancer More Than Other Factors

Bar chart showing the relative risks of various factors:
- BRCA1-2 mutation: Risk is significantly higher compared to other factors.
- Early menarche, Late age at birth of 1st child, Benign breast disease, Hormone replacement therapy, Alcohol use, Family history: Risk is lower compared to BRCA1-2 mutation.
Colorectal cancer

- About 1 million new cases and 529,000 deaths worldwide estimated in 2002
- 3rd most common cause of cancer in world but 2nd most common in developed countries.
- Good prognoses (40-50% 5-year survival) makes it the 2nd most prevalent cancer
- Males and females have similar rates
Age-standardized incidence rates for colorectal cancer

Source: Figure 7: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Colorectal cancer incidence trends

- increasing trend in low-risk areas
- stabilized or decreasing trends in high-risk areas
- greatest increases observed in Asia (especially Japan) and Eastern Europe (possibly from “westernization” of lifestyle/diet)
Colorectal cancer mortality trends

- decreasing trend in developed countries may be due to decreasing in incidence, improved treatment, and improvements in early detection (from screening)
Prostate cancer

- 679,000 new cases and 221,000 deaths worldwide estimated in 2002
- 2nd most common new cancer and most prevalent form of cancer among males
- 75% of cases occur in men aged 65+
- prostate-specific antigen assay introduced in mid to late ‘80s
Age-standardized incidence rates for prostate cancer

Source: Figure 5: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Prostate cancer incidence trends

- in many developed countries incidence increased greatly, especially among younger men (<65 yrs)
- most dramatic increases are in high-risk areas partly due to detection of prevalent latent cancers using PSA
- less developed countries also increasing
Prostate cancer mortality trends

- generally increasing but not as dramatically as incidence
- since 1990s, decline in several developed countries attributed to earlier detection and improved treatment
Cervical cancer

- 493,000 new cases and 274,000 deaths worldwide estimated in 2002
- 2nd most common new cancer among women
- 83% of cases occur in developing countries
- Rates are very low in developed countries
- Generally, incidence rises at age 20-29 and peaks around 45-49 in developed countries, but usually later in developing countries
Age-standardized incidence and mortality rates for cervical cancer

Source: Figure 11: Parkin DM, et al. CA Cancer J Clin [2005]; 55: 74-108
Incidence of Cervix uteri cancer: Age-standardized Rates (World) (All ages)

GLOBOCAN 2002
Fig. 25. Trends in cervical cancer incidence by age in different populations.
Cervical cancer incidence trends

- decreases in many developed countries because of screening programs
- in developing countries, trends vary, but generally, rates (including mortality) are stabilized or decreasing
Cervical cancer mortality trends

- decreases in many developed countries also because of diagnoses at earlier stages and improved treatment
Figure 2. Proportion of Cancer Causes by Major Risk Factors and Level of Economic Development

Developed Countries
- Tobacco: 16%
- Infections: 8%
- Other: 39%
- Diet or nutrition: 30%
- Environmental pollution: 2%
- Occupational exposures: 5%

Developing Countries
- Tobacco: 10%
- Infections: 26%
- Other: 44%
- Diet or nutrition: 20%

Source: Cancer Atlas, 2006.⁴
Figure 1B. Annual Number of Cancer Deaths Attributable to Smoking, Males and Females, by Site, US, 1997-2001


American Cancer Society, Surveillance Research
Figure 2B. Adult Obesity*, by Gender, Ages 20-74, US, 1960-2004†

*Body mass index of 30 kg/m² or greater. †Age adjusted to the 2000 US standard population.


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Resources

