



# GHEC

Global Health Education Consortium

## **Cancer Control in Low and Middle Income Countries**

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Global Health Education Consortium  
and collaborating partners

# Outline

- **Describe the burden of cancer in low and middle income countries**
- Geographic variation of the cancer burden worldwide
- Etiologic agents associated with the increasing incidence of many cancers worldwide
- Mortality from cancer in low and middle income countries
- Cancer control in low and middle income countries: challenges and potential policy solutions

# Burden of Cancer in Low and Middle Income Countries

- **11 million** cases of cancer occur annually worldwide, **six million** of which occur in low and middle income countries
- **4 million** cancer deaths - *one million more than deaths from AIDS* - have occurred annually in recent years in low and middle income countries

# Measuring Cancer Burden Globally

## Major challenges:

- Significant limitations due to only a small portion of the population worldwide being covered by cancer registries
- Quality of registries and information systems
- Accessing rural populations

# Double Burden of Disease

Many developing countries are currently undergoing an epidemiological transition in which they now face the “double burden” of both infectious disease and chronic diseases such as cancer, heart disease, stroke, chronic respiratory diseases, and diabetes.

Lopez et al. 2006, Global burden of disease and risk factors

# Vulnerable Populations

- Prevalence of cancer risk factors is highest in low socioeconomic (SES) groups
  - Low SES populations are more likely to use tobacco, consume high-fat and energy dense foods, and are less likely to be physically active
- Unhealthy living conditions
- Low SES populations lack access to health care services and care
  - In India, people are more likely to borrow money and sell their assets during hospitalization if they are tobacco users
  - Economic burden of illness on family

## Incidence and Prevalence of Cancer Worldwide, both sexes, Globocan 2000 (WHO database)

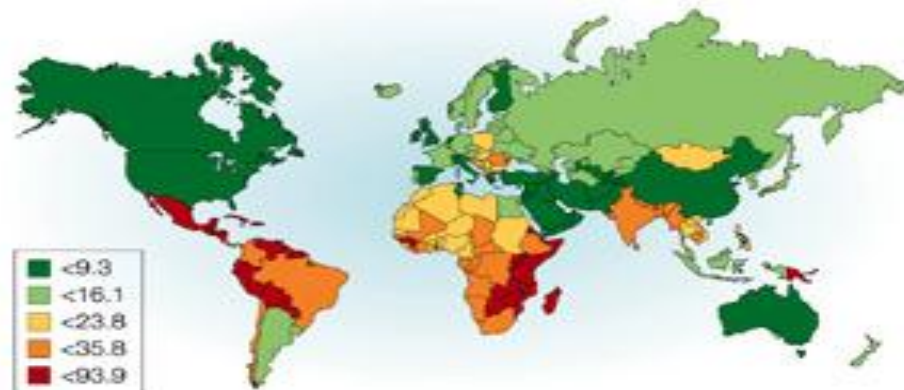
Cancer site	Incidence (# new cases)	Prevalence (5-year, cases)
Lung	1,238,900	1,394,400
Breast	1,050,300	3,860,300
Colon/Rectum	944,700	2,379,000
Stomach	876,300	1,398,100
Liver	564,300	268,000
Prostate	543,000	1,554,700

Parkin, D.M., et al., *Descriptive Epidemiology Unit, IARC*. 2001

**a** Incidence of stomach cancer



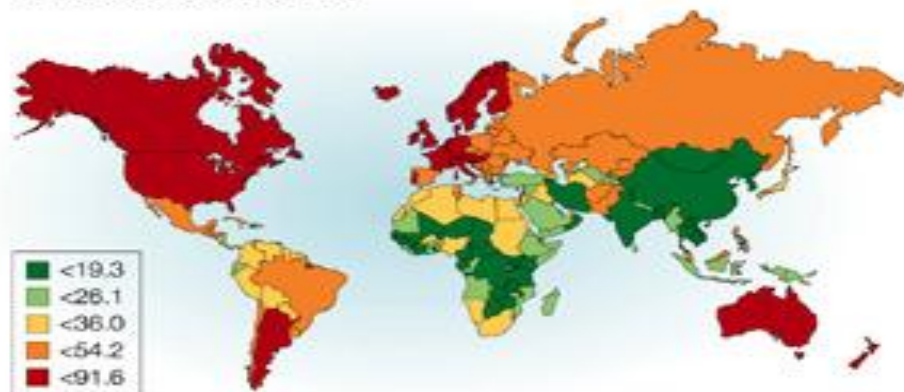
**b** Incidence of cervical cancer



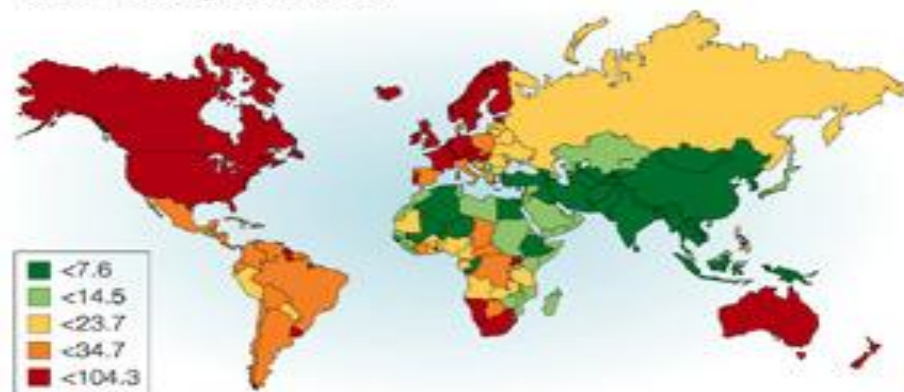
**c** Incidence of lung cancer



**d** Incidence of breast cancer



**e** Incidence of prostate cancer





# Cancer burden in the year 2000.

## Cancer burden in the year 2000. The global picture

D.M. Parkin<sup>a,\*</sup>, F.I. Bray<sup>a</sup>, S.S. Devesa<sup>b</sup>

<sup>a</sup>*International Agency for Research on Cancer, Lyon, France*

<sup>b</sup>*National Cancer Institute, Bethesda, MD, USA*

Received 27 October 2000; accepted 30 July 2001



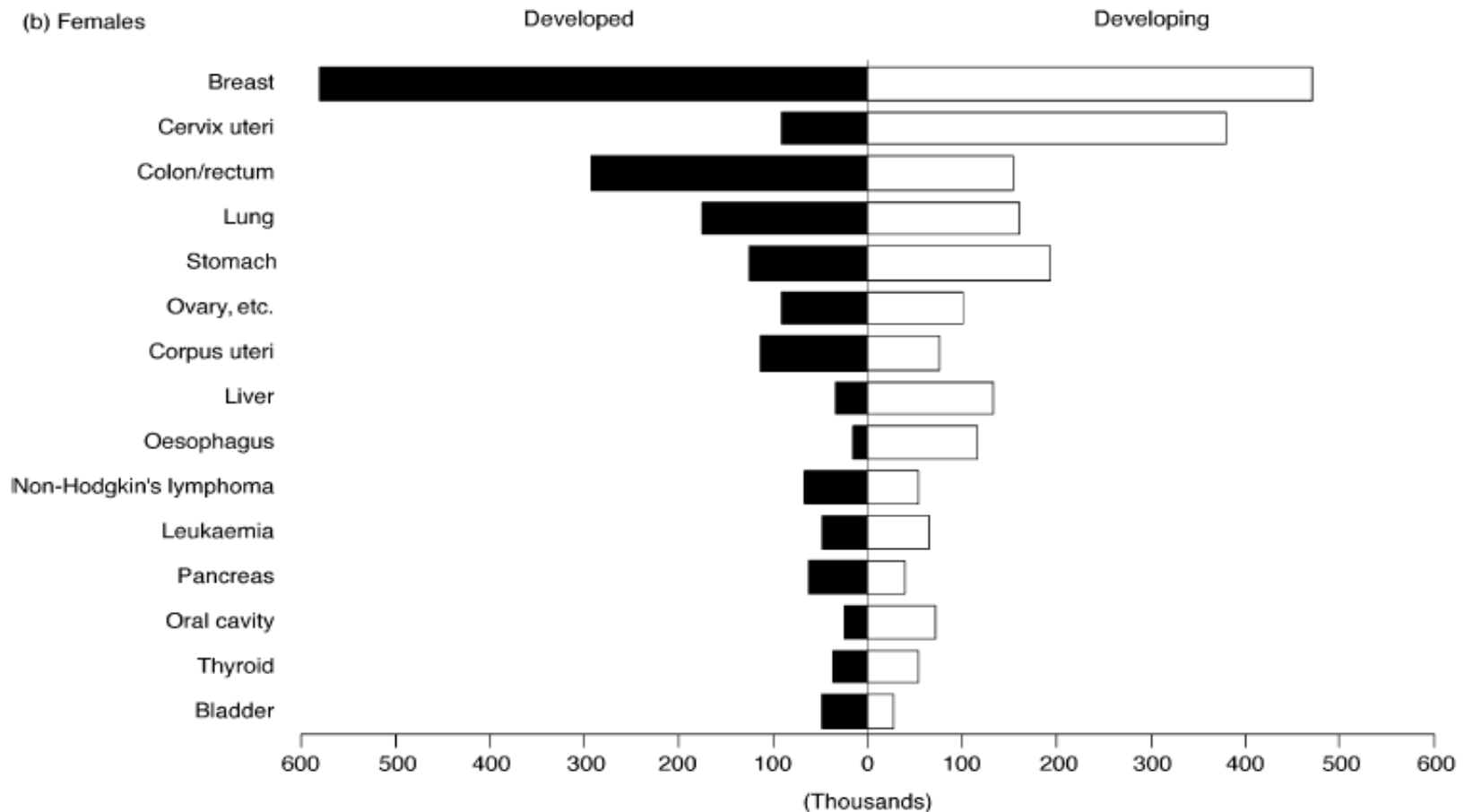


Fig. 2. Number of new cases of the 15 most common cancers in (a) males, 2000, (b) females, 2000.

Parkin, D.M., Bray, F.I., & Devesa, S.S. Cancer burden in the year 2000. The global picture., *European Journal of Cancer*, 2001.

# In developing countries...

- Populations are vulnerable to cancers in which infectious agents play a significant role
- Vaccine coverage is very low to nonexistent
- Around 25% of tumors are associated with infectious agents

Sources: IARC, World Cancer Report, 2003. & IOM, Cancer Control Opportunities in Low and Middle-Income Countries, 2007

# Changes in developing countries that impact behavioral risk factors for cancer

- *Globalization*: global market integration introduces modern technologies which impact individual behaviors in both positive and negative ways
  - Information technologies for health-care systems, technological advances in food production
- *Urbanization*: increased exposure to heavy marketing, particularly for unhealthy foods, reduced levels of physical activity and promotes unhealthy nutrition
- *Policy environment*: includes trade subsidies (e.g. corn subsidies that are cheap but result in unhealthy food products)

WHO, Preventing Chronic Diseases, 2005

# The Nutrition Transition Hypothesis: an effect of globalization

- An apparent shift from traditional diet to a more Western diet
- Changes include increases in consumption of animal-source foods and energy dense foods in low-income nations
- Shifts are reflected in nutrition-associated outcomes such as average stature and composition
- Possible health consequences: chronic disease (obesity, diabetes, heart disease, cancer)

Astrup, A. et al., *Obes. Rev.* 2008

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## **Cancers of particular relevance to certain regions of the less developed world**

<b>Type</b>	<b>Region</b>
• Oral cancer	South Central Asia
• Liver cancer	Sub-Saharan Africa and parts of Asia
• Bladder cancer	Northern Africa and Western Asia
• Stomach cancer	South America



# Reasons for variations

- In different regions and within the same country
  - Differences tend to reflect exposure to distinct causative environmental factors
  - Socioeconomic and racial/ethnic factors
  - Geographic factors (e.g. urban sprawl, green spaces, toxic exposures)

IARC, World Cancer Report, 2003

# Cancer in Africa

- Sub-Saharan Africa
  - 582,000 new cases of cancer in 2002
- Cancer mortality in 2002
  - 412,100 people died of cancer
- 2020 projection
  - With no interventions, the number of cancer cases is projected to rise to 804,000 and the number of deaths to 626,400

Louazani, A. The Burden of Chronic Diseases in the African Region, WHO Preventing Chronic Disease.

# Energy Balance Associated Risk Factors in Context

-- overweight/obesity in Nigeria --

In 2005    Nearly 40% of women (30 years old and above) are overweight

By 2015    ~50% projected to be overweight

WHO, Preventing Chronic Diseases: a vital investment, 2005

# Energy Balance Associated Risk Factors in Context

-- overweight/obesity in China --

In 2005 ~ 30% of women (30+ years) are overweight

By 2015 Over 45 % projected to be overweight

WHO, Preventing Chronic Diseases: a vital investment, 2005

# Energy Balance Associated Risk Factors in Context

-- overweight/obesity in Brazil --

In 2005 Over 60% of women (30+ years) are overweight

By 2015 ~ 73% projected to be overweight

WHO, Preventing Chronic Diseases: a vital investment, 2005

# Lifestyle and Energy Balance Associated Risk Factors in Context

-- example of China --

- 300 million adult males in China smoke cigarettes
- More than 20% of youth ages 7-17 years old in urban areas are either overweight or obese

IARC, World Cancer Report, 2003

# Lifestyle Factors in Context

-- example of India --

- The world's second largest producer and consumer of tobacco
- The largest rates of oral cancer in the world
- Treatment costs for tobacco-related diseases are an estimated \$7.2 billion U.S. dollars for the year 2002-2003 alone

IARC, World Cancer Report, 2003

# Lung Cancer in the Developing World

- Most commonly occurring cancer and most common cause of cancer-associated death.
- Stronger association with countries on the “more developed” side of developing countries (East Asia) than in the least developed countries.
- 80% of the world’s 1.1 billion smokers live in low and middle-income countries.

Adami, H., et al., Textbook of Cancer Epidemiology, 2002



# Lung Cancer in the Developing World

- High rates in Southeast Asia and Sub-Saharan Africa: regions that also have significant prevalence of hepatitis B and C viruses (carcinogenic)
- Main cofactor is exposure to dietary aflatoxin that contaminates improperly stored food
- Relatively high rates in Brazil and other South American countries
  - Possibly reflecting both viral and chemical exposures

Adami, H., et al., Textbook of Cancer Epidemiology, 2002

# Stomach Cancer in the Developing World

- Particularly common in Brazil and Colombia
- **Associated with adverse socioeconomic conditions** that facilitate early infection with *H. pylori*
- High consumption of foods from plant origins may be responsible for low incidence of stomach cancer in many African countries
- Cofactors include highly salted foods and foods preserved in nitrites

# Cervical Cancer in the Developing World

- Approximately 80% of cases occur in developing countries (in many regions, this is the most common cancer among women)
- Highest rates: Latin America, the Caribbean, sub-Saharan Africa, South Asia, South-east Asia
- Majority of cases are squamous cell carcinomas (80-90% of all malignancies of the cervix)
  - However, adenocarcinoma is becoming increasingly common

## Cervical Cancer (cont.)

- HPV is responsible for the initiation of the disease in the vast majority of cases: notably types 16, 18, 31, and 45
- Can be prevented if detected early:
  - Cytology screening
  - Screening programs more effective in preventing squamous cell carcinomas than adenocarcinomas

Parkin DM, Unit of Descriptive Epidemiology, IARC. 2004  
Adami H et al., Textbook of Cancer Epidemiology, 2002  
Parkin, D.M., et al., *European Journal of Cancer*, 2001.

# Breast Cancer in the Developing World

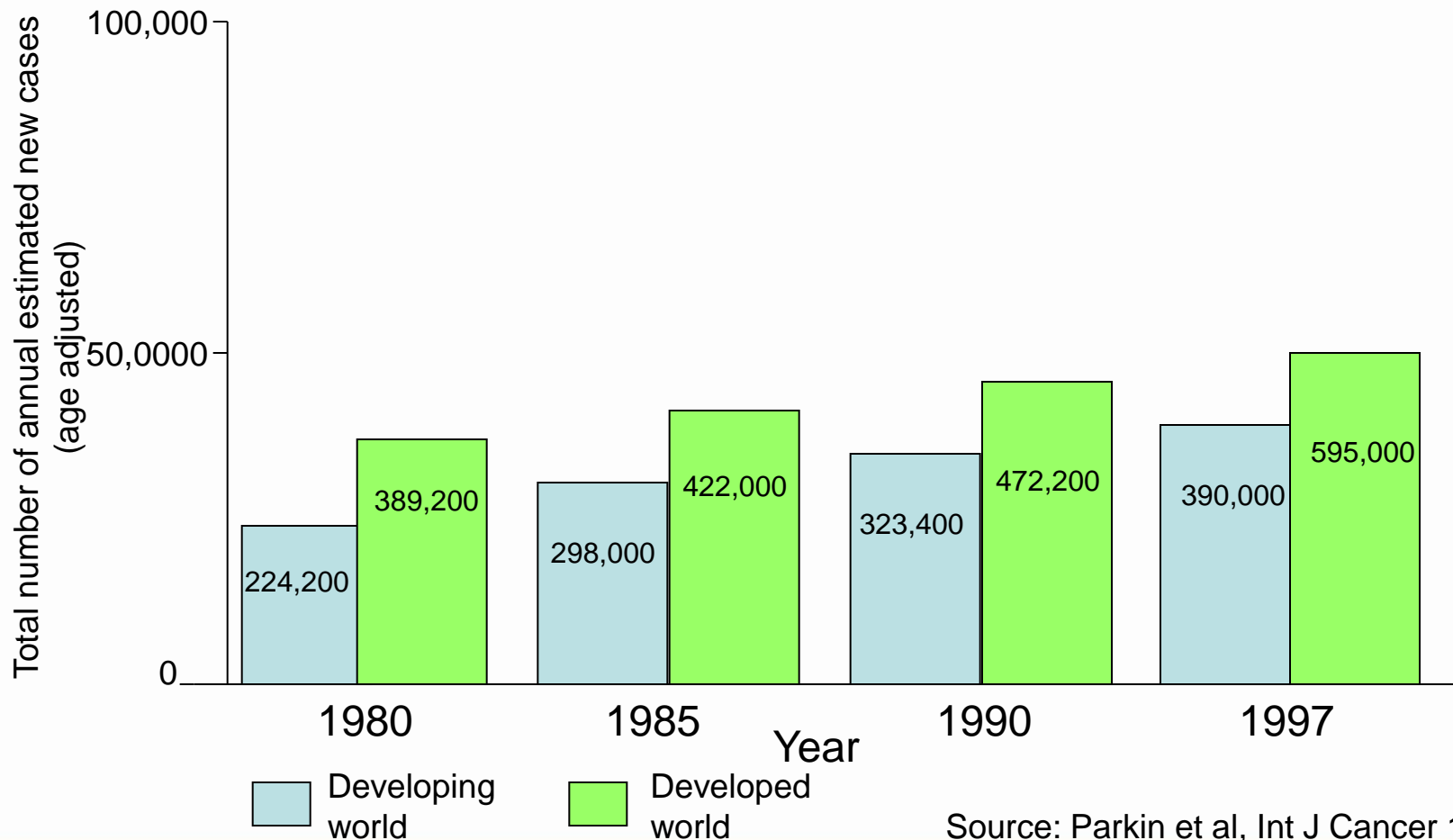
- Most frequent cancer in women worldwide
- Modifiable risk factors:
  - Body size/obesity
  - Diet, physical activity
  - Alcohol consumption
- Other risk factors:
  - Reproductive factors (e.g., age at menarche, age at first live birth)

More than 55% of breast-cancer related deaths occur in low and middle income countries

**Commonly cited reason for the spread of breast cancer: “Westernization” of the developing world**

Porter P, New England J Med 2008

# Breast Cancer Incidence Rates by Developing vs. Developed World



Source: Parkin et al, Int J Cancer 1999

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# Key etiologic agents associated with the increasing cancer incidence worldwide

- **Lifestyle risk factors:**
  - tobacco use
  - energy balance-related exposures (diet, physical activity)
- **Environmental exposures:**
  - occupational hazards, radiation exposures, chemicals, exogenous hormones, pollution of water, environmental tobacco smoke and air



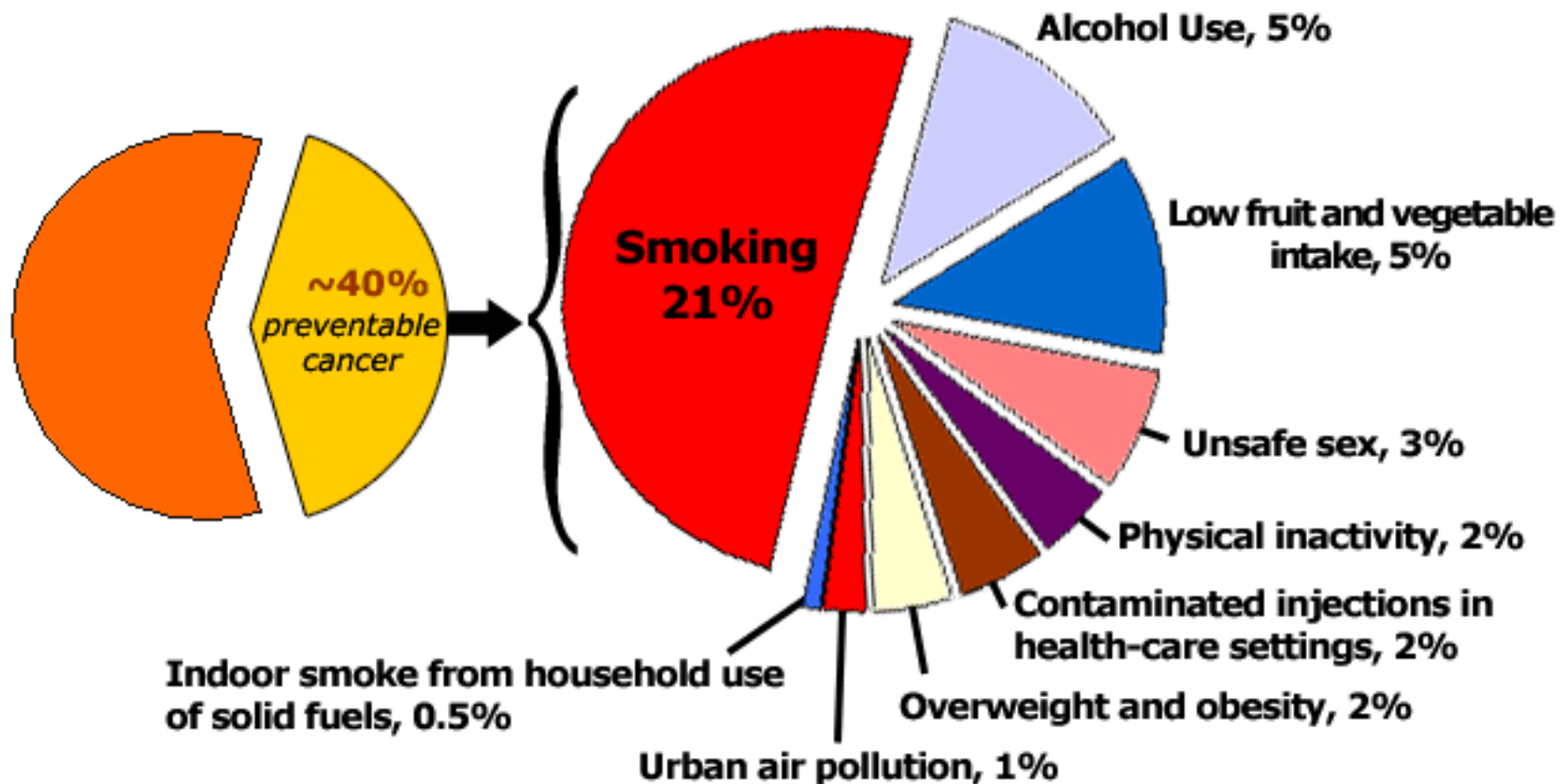
# Infectious agents and cancer in low and middle income countries

Agent	Cancer
HPV	Cervix
Hepatitis B and Hepatitis C viruses	Liver
HIV T-lymphotropic viruses/ HHV-8	Kaposi Sarcoma and Non-Hodgkin lymphoma
Epstein-Barr virus (EBV)	Nasopharynx
Helicobacter pylori (HP)	Stomach
Schistosomes	Bladder
Liver flukes	Liver

Tobacco is the main preventable cause of cancer worldwide



Estimated proportion of preventable cancer associated with 9 leading modifiable risk factors



Danaei G, Vander Hoorn S, Lopez AD, Murray CJ, Ezzati M. Causes of cancer in the world: comparative risk assessment of nine behavioural and environmental risk factors *The Lancet*, 2005, 366:1784-1793

# Outline

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## Worldwide Trends in Cancer Mortality

- Estimated global deaths from cancer, all ages (2005): 7,586,000
  - More than infectious disease deaths
  - Global cancer deaths are projected to increase to 9 million by 2015 and increase to 11.5 million in the year 2030
- Estimated DALYs (Disability adjusted life years) caused by cancer, all ages (2005): 5%
  - A measure of the global burden of disease

Mathers & Loncar, 2006, <http://www.who.int/cancer/nccp/en/>

“More than 70% of all cancer deaths already occur in low and middle income countries. This figure is rising due to increased life expectancy, increased tobacco use and chronic viral infection.”

Professor David Kerr

Oxford University, UK, and AfrOx

# Projections of Global Mortality and Burden of Disease from 2002 to 2030

Colin D. Mathers<sup>\*</sup>, Dejan Loncar

Evidence and Information for Policy Cluster, World Health Organization, Geneva, Switzerland

# Projected Global Tobacco-Associated Deaths, by Cause, 2015



Cause	Tobacco-Caused Deaths	
	Number (Millions)	Percent of Total
<b>All causes</b>	6.43	100
Tuberculosis	0.09	1
Lower respiratory infections	0.15	2
<b>Malignant neoplasms</b>	2.12	33
Trachea, bronchus, lung cancers	1.18	18
Mouth and oropharynx cancers	0.18	3
Oesophagus cancer	0.17	3
Stomach cancer	0.12	2
Liver cancer	0.10	2
Other malignant neoplasms	0.34	5
<b>Diabetes mellitus</b>	0.13	2
<b>Cardiovascular diseases</b>	1.86	29
Ischaemic heart disease	0.93	14
Cerebrovascular disease	0.52	8
Other cardiovascular diseases	0.24	4
<b>Respiratory diseases</b>	1.87	29
COPD	1.76	27
<b>Digestive diseases</b>	0.20	3

Source: Mathers & Loncar, 2006.



## Top 10 leading causes of death in middle income countries, 2030

	Rank	Disease or injury	% of total deaths
Middle-income countries	1	Cerebrovascular disease	14.4
	2	Ischaemic heart disease	12.7
	3	COPD	12.0
	4	HIV/AIDS	6.2
	5	* Trachea, bronchus, lung cancers	4.3
	6	Diabetes mellitus	3.7
	7	* Stomach cancer	3.4
	8	Hypertensive heart disease	2.7
	9	Road traffic accidents	2.5
	10	* Liver cancer	2.2

Source: Mathers & Loncar, 2006.

## 4 million deaths annually in low and middle-income countries

- 4 million deaths annually in low and middle-income countries
  - Yet cancer is low on the health agenda in these countries and is rarely addressed by global health efforts in low and middle-income countries

# Survival

- Patients with cancer in low and middle-income countries tend to have additional co-morbid conditions and therefore less chance of survival than those in higher income countries
- 85% of 300,000 deaths from cervical cancer per year occur in low and middle-income countries

IOM, Cancer Control Opportunities in Low and Middle-Income Countries, 2007

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# Global Cancer Control

Key priorities include:

- Prevention
- Screening and early detection
- Cancer management
  - ‘Resource-level appropriate’ treatment for curable malignancies
  - Palliative care
  - Psychosocial support
- Surveillance and monitoring
- Raising awareness and public health action in the global community

Sources: IOM, *Cancer Control Opportunities in Low and Middle-Income Countries*, 2007, Goldie S et al., *Vaccine*, 2006.

# Prevention Example

## Cost efficient vaccines:

- Hepatitis B vaccinations during childhood immunizations to prevent liver cancer
- Vaccinations for human papilloma virus to protect from cervical cancer
  - 3 dose series costs less than \$2 through UNICEF

# Resource-level appropriate solutions

Effective and cost-effective solutions needed to:

- Maximize public health benefits
- Minimize opportunity costs (time invested versus outcome check the wording in the source)
- Smear tests
- Create organized immunizations programs
- Improve clinical information systems

Sources: Goldie, S. *J Natl Cancer Institute Monographs*. No. 31, 2003, Goldie, S. et al., *Vaccine* 2006

# Cancer Control

“From high-income countries, it is obvious that the array of cancer control interventions is huge once basic infrastructure is in place and financing is plentiful. In low- and middle-income countries, where those conditions do not exist, cancer control must build starting with interventions that are highly effective, cost-effective, and resource-level appropriate”.

Institute of Medicine, Cancer Control Opportunities in Low- and Middle- Income Countries, 2007



# Cancer Control Challenges in Developing Countries

- In many developing countries some cancers, such as breast cancer, may have not yet be identified as national health care priorities
  - With limited resources, most developing countries have focused on infectious diseases
- Other urgent needs: clean water, sanitation

Masood S, The Breast Journal, 2007

# WHO Approach to Cancer Control

- “...Emphasis on the rising impact of cancer on developing countries and the disproportionate suffering it causes poor and disadvantaged populations”
- National-level strategy for reducing morbidity and mortality from cancer:
  - review current disease state and health care situation
  - evaluation of disease control strategies
  - set priorities and goals as well as allocate resources

# Challenges

- Inadequate access to quality diagnostic and clinical prevention services
- Insufficient response from the health-care system
- Limited accessibility to care in rural areas
- Opposition to tobacco-free initiatives

# History of Cancer Control in Costa Rica

- Cytology screening available to women ages 15 years and older since 1970
  - 250,000 smears conducted every year, more than 85% of eligible women have been screened at least once
  - 3.6% annual decrease in incidence of cervical cancer from 1993-1997 as compared to 1988-1992
  - Coverage in rural areas is inadequate, nationwide coverage varies greatly

WHO, Preventing Chronic Diseases: a vital investment, 2005

# History of Cancer Control in India

- National Cancer Control Program began in 1975
  - Goals include:
    1. health education for primary prevention of cancer,
    2. early detection for secondary prevention,
    3. strengthened treatment, and
    4. improved palliative care
  - established 13 cancer registries and increased clinical capacity
- Comprehensive law for tobacco control was enacted in 2003

[www.whoindia.org](http://www.whoindia.org)

# Food, Nutrition, and Physical Activity

Public health goals worldwide:

- Median adult body mass index to be within normal range
  - Proportion of the population that is overweight or obese to be no more than the current level, or preferably lower, in 10 years
- Proportion of population that is sedentary to be halved every 10 years
- Average energy density of diets to be lowered toward 125kcal per 100g
- Increase intake of plant foods and decrease intake of animal foods
- Limit alcoholic drinks
  - Proportion of the population drinking more than the recommended limits reduced by one third every 10 years
  - 2 for men and 1 for women a day
- Limit consumption of salt
  - Population average consumption of salt from all sources, <5 gm/day

World Cancer Research Fund 2007

**Basic causes**

Carcinogens in the physical environment

National and international policies: health, agriculture, economic, urbanization, recreation, transport

**Underlying factors**

Environmental factors that affect carcinogenesis, toxins infections, physical radiation

Access to safe water, air and healthy foods

Energy intake and expenditure

Interactions between individual susceptibility and environment

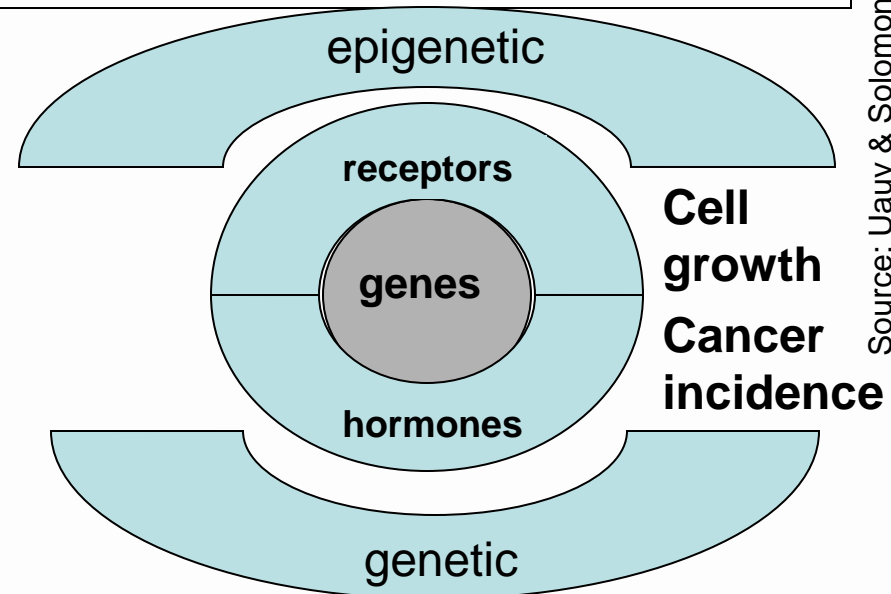
**Nutrition related Susceptibility (life course exposure)**

Rate of growth; Body composition

Macro/micro nutrient quantity and quality

Obesity and consequences; Metabolic syndrome

Gene/nutrient interactions



**Future preventive strategies**

**Present efforts**

Source: Uauy & Solomons. J Nutr, 2005

# Moving forward

Comprehensive and integrated action at country level, led by governments

- Complementary policies, plans, and action programs developed at state level, and local levels
- Legal and Regulatory Action
  - Legislation
    - Mandatory vaccinations
    - Economic incentives, e.g., taxes or subsidies

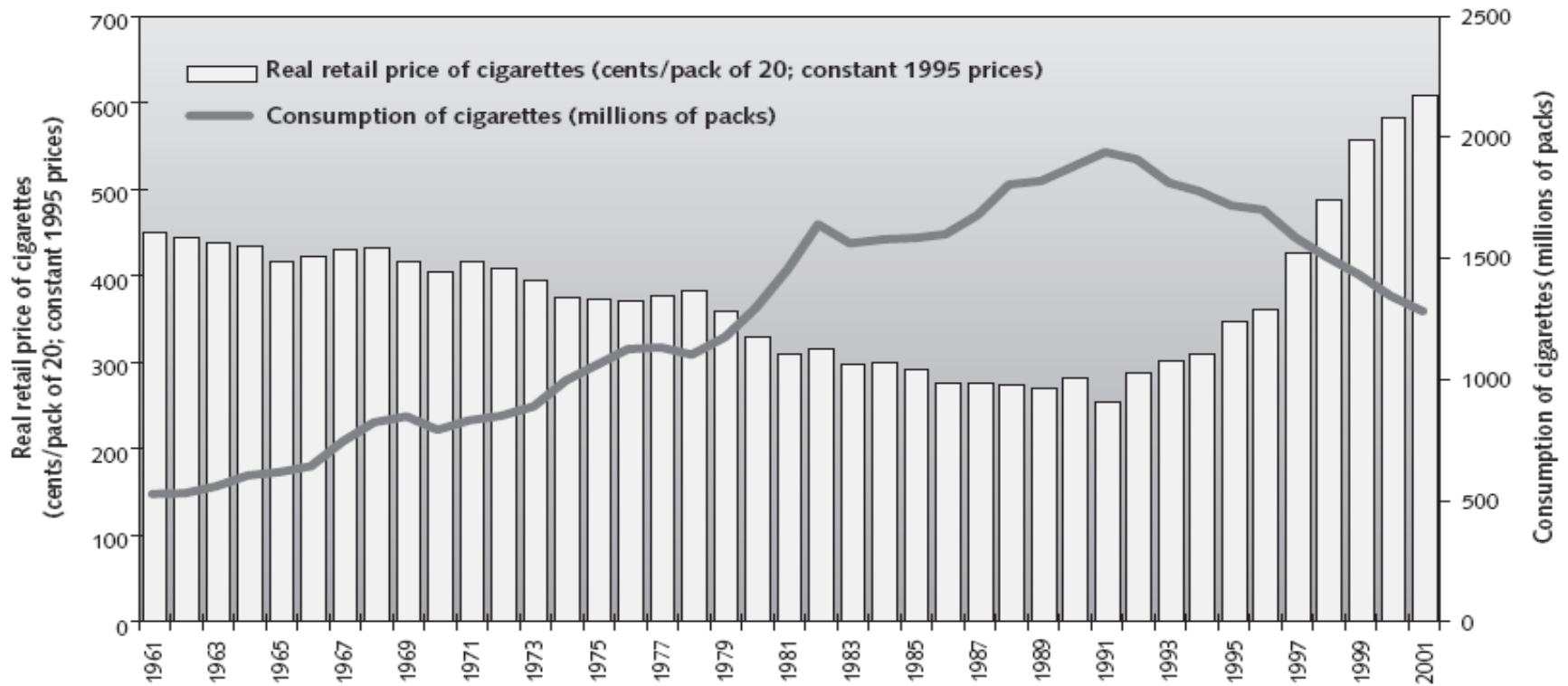


# Potential policy solutions

- Tax and Price Increases
  - Prices affect dietary behavior
    - Subsidies should lower the price of healthier food options rather than highly-processed foods and edible oils (as is status quo)
    - Higher prices of tobacco and soft drinks have lowered consumption patterns
  - Food and drink taxes can generate revenue that can be earmarked for diet, physical activity, and obesity-prevention initiatives

1994: tobacco tax increase to 50% of retail price contributed to 33% reduction in tobacco use

Cigarette consumption and real prices of cigarettes in South Africa, 1961 to 2001



[http://www.who.int/tobacco/training/success\\_stories/en/best\\_practices\\_south\\_africa\\_taxation.pdf](http://www.who.int/tobacco/training/success_stories/en/best_practices_south_africa_taxation.pdf)

# Sources

## Textbooks / core readings

Adami, H., et al., Textbook of Cancer Epidemiology, 2002

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Porter P, *New England J Med* 2008

WHO, Preventing Chronic Diseases, 2005

[www.who.int/tobacco/training/success\\_stories/en/best\\_practices\\_south\\_africa\\_taxation.pdf](http://www.who.int/tobacco/training/success_stories/en/best_practices_south_africa_taxation.pdf)

# Sources

## Optional reading

[www.whoindia.org](http://www.whoindia.org)

World Cancer Research Fund 2007

Astrup, A. et al., *Obes. Rev.* 2008

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[http://www.who.int/tobacco/training/success\\_stories/en/best\\_practices\\_south\\_africa\\_taxation.pdf](http://www.who.int/tobacco/training/success_stories/en/best_practices_south_africa_taxation.pdf)

## Credits

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