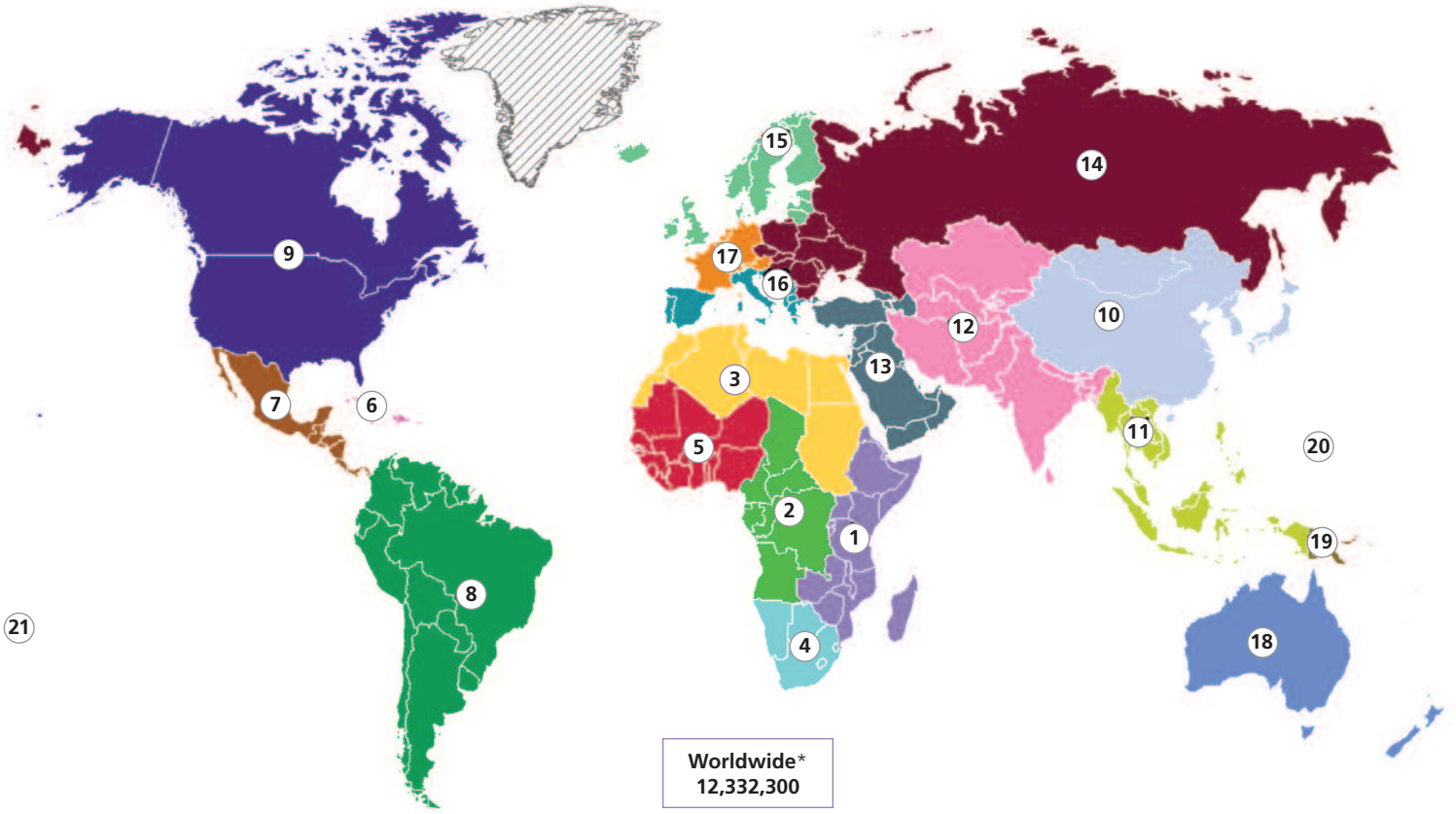
Global Cancer Facts & Figures 2007

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.

American Cancer Society®

Contents

This publication attempts to summarize current scientific information about cancer. Except when specified, it does not represent the official policy of the American Cancer Society.

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Cancer: Basic Facts

What Is Cancer?

Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells. If the spread is not controlled, it can result in death. Cancer is caused by both external factors (tobacco, chemicals, radiation, and infectious organisms) and internal factors (inherited mutations, hormones, immune conditions, and mutations that occur from metabolism). These causal factors may act together or in sequence to initiate or promote carcinogenesis. The development of most cancers requires multiple steps that occur over many years. Certain types of cancer can be prevented by eliminating exposure to tobacco and other factors that accelerate this process. Other potential malignancies can be detected before cells become cancerous or at an early stage, when the disease is most treatable. Cancer is treated by surgery, radiation, chemotherapy, hormones, and immunotherapy.

One in eight deaths worldwide is due to cancer. Worldwide, cancer causes more deaths than AIDS, tuberculosis, and malaria combined. Cancer is the second leading cause of death in economically developed countries (following heart diseases) and the third leading cause of death in developing countries (following heart diseases and diarrhoeal diseases) (Table 1). The burden of cancer is increasing in developing countries as childhood mortality and deaths from infectious diseases decline and more people live to older ages. Further, as people in developing countries adopt western lifestyle behaviors, such as cigarette smoking, higher consumption of saturated fat and calorie-dense foods, and reduced physical activity, rates of cancers common in western countries will rise if preventive measures are not widely applied.

New Cancer Cases and Deaths

It is estimated that there will be more than 12 million new cancer cases in 2007 worldwide, of which 5.4 million will occur in economically developed countries and 6.7 million in economically developing countries (Figure 1). The corresponding estimates for total cancer deaths in 2007 are 7.6 million (about 20,000 cancer deaths a day), 2.9 million in economically developed countries and 4.7 million in economically developing countries. By 2050, the global burden is expected to grow to 27 million new cancer cases and 17.5 million cancer deaths simply due

Table 1. Leading Causes of Death Worldwide and in Developing and Developed Countries, 2001 (thousands)

	Worldwide			Developing			Developed		
	Rank	Deaths	%	Rank	Deaths	%	Rank	Deaths	%
Heart diseases	1	11,004	19.6	1	8,746	18.1	1	2,258	28.6
Malignant neoplasms	2	7,021	12.5	3	4,955	10.2	2	2,066	26.2
Cerebrovascular diseases	3	5,390	9.6	4	4,608	9.5	3	781	9.9
Lower respiratory infections	4	3,753	6.7	5	3,408	7.0	4	345	4.4
Chronic obstructive pulmonary disease	5	2,676	4.8	8	2,378	4.9	5	297	3.8
HIV/AIDS	6	2,574	4.6	6	2,552	5.3		22	0.3
Perinatal conditions*	7	2,522	4.5	7	2,489	5.1		32	0.4
Diarrhoeal diseases	8	1,783	3.2	2	7,777	16.1		6	0.1
Tuberculosis	9	1,606	2.9	9	1,590	3.3		16	0.2
Road traffic accidents	10	1,108	2.0		1,069	2.2	9	121	1.5
Malaria	11	1,208	2.1	10	1,207	2.5		0	0.0
Diabetes mellitus	12	960	1.7		757	1.6	7	202	2.6
Suicide	13	875	1.6		749	1.5	8	126	1.6
Cirrhosis of the liver	14	771	1.4		654	1.4	10	118	1.5
Measles	15	763	1.4		762	1.6		1	0.0
All causes		56,242	100.0		48,351	100.0		7,891	100.0

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.

Source: Lopez AD, Mathers CO, Ezzati M, et al. Global and regional burden of disease and risk factors, 2001: Systematic analysis of population health data. *Lancet*. 2006;367(9524):1747-57.

to the growth and aging of the population. Table 2 provides the estimated number of total new cancer cases and deaths in 2007 by United Nations (UN) area.

In economically developed countries, the three most commonly diagnosed cancers are prostate, lung and bronchus, and colorectal among men and breast, colorectal, and lung and bronchus among women (Figure 1). In economically developing countries, the three most commonly diagnosed cancers are lung and bronchus, stomach, and liver in men, and breast, cervix uteri, and stomach in women. In both economically developed and developing countries, the three most common cancer sites are also the three leading causes of cancer death (Figure 1).

Trends in Cancer Incidence and Mortality

Several major cancers linked to chronic infectious conditions (including stomach and cervix) become less common as countries become economically developed, whereas cancers related to tobacco use and Western patterns of diet, physical inactivity, and reproduction (especially lung and bronchus, breast, and colorectal) increase with economic development.

Geographic Variation

Factors that contribute to regional differences in the types or burden of cancer include regional variations in the prevalence of major risk factors, availability and use of medical practices such as cancer screening, availability and quality of treatment, completeness of reporting, and age structure. Currently, two of the three leading cancers in men (stomach and liver) and women (cervix and stomach) in developing countries are related to infection. Stomach cancer continues to be the most common infection-related cancer worldwide, followed closely by liver and cervix (Figure 1). Approximately 15% of all incident cancers worldwide are attributable to infections.[1] This percentage is about three times higher in developing countries (26%) than in developed countries (8%) (Figure 2).

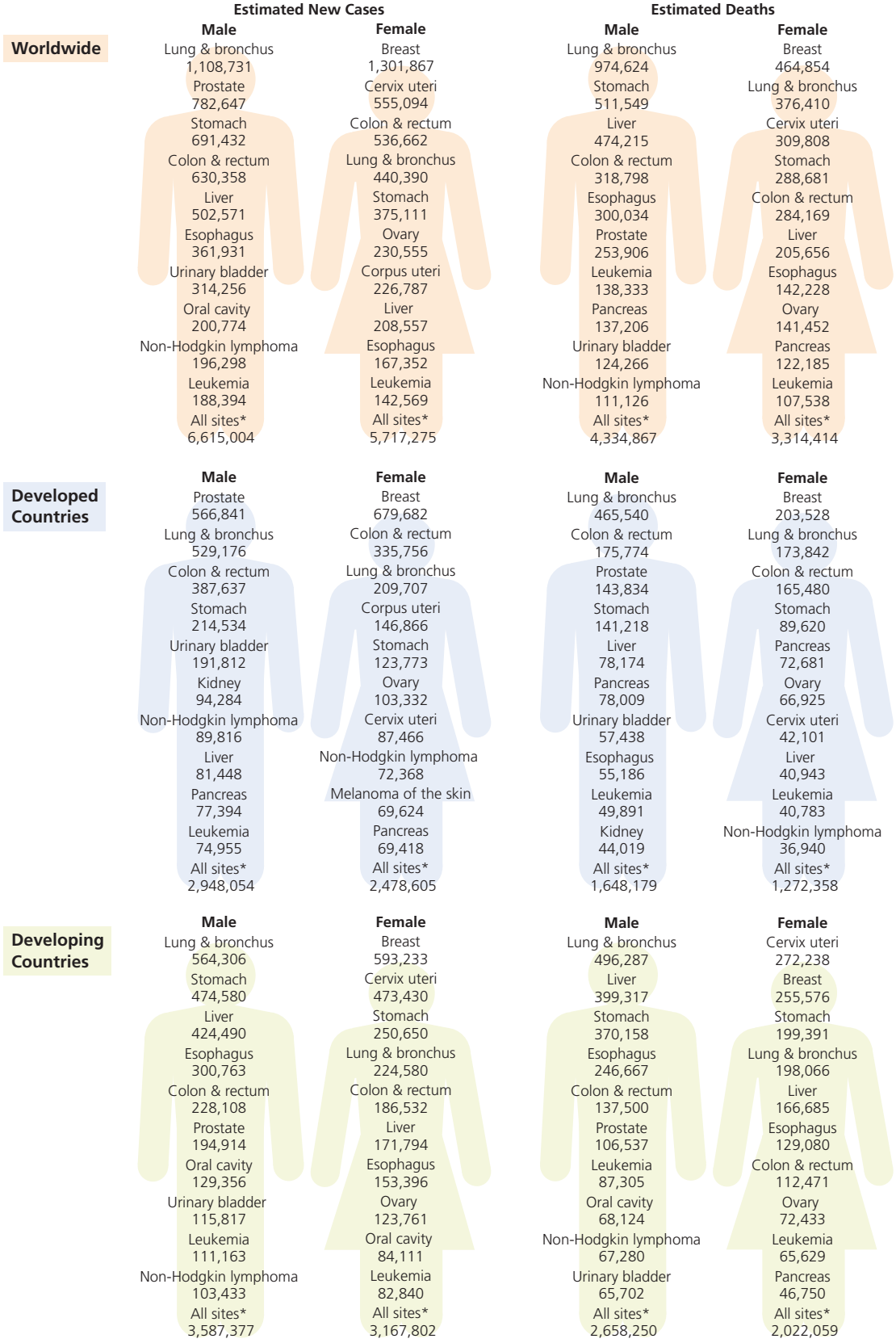
Table 2. Estimated Number of New Cancer Cases and Deaths by World Area, 2007*

	Cases			Deaths		
	Male	Female	Overall	Male	Female	Overall
Eastern Africa	138,879	151,173	290,052	112,949	116,105	229,054
Middle Africa	44,022	43,737	87,759	36,921	35,300	72,221
Northern Africa	71,569	70,500	142,069	58,940	53,261	112,201
Southern Africa	39,074	39,011	78,085	29,018	25,226	54,244
Western Africa	73,059	93,235	166,294	58,046	69,992	128,038
Eastern Asia	2,003,760	1,309,862	3,313,622	1,479,263	847,252	2,326,515
South-Central Asia	687,977	763,746	1,451,723	499,186	475,437	974,623
South-Eastern Asia	299,109	319,714	618,823	232,325	198,323	430,648
Western Asia	116,706	109,182	225,888	82,701	62,843	145,544
Caribbean	37,840	35,695	73,535	26,513	21,693	48,206
Central America	83,348	101,458	184,806	53,010	58,213	111,223
North America	934,509	810,866	1,745,375	370,052	329,978	700,030
South America	357,374	375,708	733,082	215,808	201,334	417,142
Eastern Europe	485,390	454,120	939,510	375,331	288,130	663,461
Northern Europe	227,867	220,844	448,711	134,983	118,724	253,707
Southern Europe	383,958	291,006	674,964	229,937	152,970	382,907
Western Europe	521,567	428,913	950,480	295,197	226,106	521,303
Australia/New Zealand	64,068	53,657	117,725	28,458	22,126	50,584
Melanesia	3,425	4,242	7,667	2,439	2,604	5,043
Micronesia	319	353	672	239	213	452
Polynesia	455	460	915	337	278	615

*Excludes nonmelanoma skin cancer.

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

Figure 1. Leading Sites of New Cancer Cases and Deaths Worldwide and by Level of Economic Development, 2007



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.

The frequency of commonly diagnosed cancer cases or deaths also varies by geographic areas (Table 3), and counties and parishes within countries. For example, the most commonly diagnosed cancer is cervix uteri in Eastern and Southern Africa, Kaposi sarcoma in Middle Africa, and breast cancer in Northern and Western Africa. The geographic variations in a number of specific cancer sites are presented in the Selected Cancers section of this document (page 10).

Can Cancer Be Prevented?

It is estimated that more than half of all new cancers and cancer deaths worldwide are potentially preventable (Figure 2). Cancers related to tobacco use, heavy use of alcohol, and obesity are most effectively prevented through a combination of education and social policies that encourage healthy behaviors and discourage unhealthy practices. Certain cancers that are related to infectious agents, such as hepatitis B (HBV), human immunodeficiency virus (HIV), human papilloma virus (HPV), and *helicobacter pylori* (*H. pylori*), could be prevented through known interventions such as vaccines, antibiotics, improved sanitation, and education. Some cancers (colorectal and cervix) can be avoided by detection and removal of pre-cancerous lesions through regular screening examinations by a health care professional.

Early detection of cancer is important, as it provides a greater chance that treatment will be successful. Cancers that can be detected at an early stage through screening include breast, cervix, colorectal, prostate, oral cavity, and skin.[2] Screening has been proven to be effective in reducing the severity of disease and mortality for all of these sites except prostate and skin. Screening and early treatment services for most of these cancers are not available in developing countries because of limited resources.

Who Is at Risk of Developing Cancer?

Anyone can develop cancer. However, the risk of being diagnosed with cancer increases with age. In economically developed countries, 78% of all newly diagnosed cancer cases occur at age 55 and older, compared with 58% in developing countries. The difference is largely due to variations in age structure of the populations. The populations of developing countries are younger and have a smaller proportion of older individuals in whom cancer most frequently occurs.

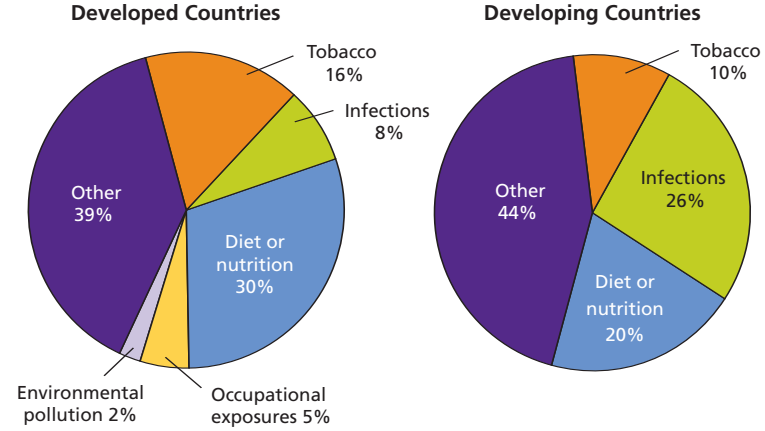
Table 4 shows the lifetime risk of developing or dying from various types of cancer before age 65 by sex and level of economic development in 2002. The risk of

Risk

Cancer researchers use the term "risk" in two common ways: lifetime risk or relative risk. Lifetime risk refers to the probability that an individual will develop or die from cancer over the course of a lifetime. For example, the lifetime risk of developing some type of invasive cancer among men in the United States is 45%.

Relative risk is a measure of the strength of the association between a risk factor and a particular type of cancer. It compares the risk of developing cancer in persons with a certain exposure or trait to the risk in persons who do not have this characteristic. For example, male smokers are about 23 times more likely to develop lung cancer than nonsmokers, thus their relative risk is 23. Most relative risks are not this large. For example, women who have a first-degree relative (mother, sister, or daughter) with a history of breast cancer have about twice the risk of developing breast cancer compared to women who do not have a family history.

Figure 2. Proportion of Cancer Causes by Major Risk Factors and Level of Economic Development



Source: Cancer Atlas, 2006.[4]

Table 3. The Four Most Common Types of New Cancer Cases and Deaths by World Area, 2007

Cancer Cases

	First		Second		Third		Fourth	
Eastern Africa	Cervix uteri	13.7%	Kaposi sarcoma	13.6%	Liver	8.2%	Esophagus	6.7%
Middle Africa	Kaposi sarcoma	17.9%	Liver	15.8%	Cervix uteri	10.4%	Stomach	8.9%
Northern Africa	Breast	13.8%	Bladder	12.1%	Lung	6.9%	Cervix uteri	6.9%
Southern Africa	Cervix uteri	11.8%	Breast	10.1%	Prostate	8.1%	Kaposi sarcoma	6.3%
Western Africa	Breast	15.2%	Cervix uteri	14.9%	Liver	10.6%	Prostate	7.1%
Caribbean	Prostate	14.0%	Lung	10.1%	Breast	9.6%	Cervix uteri	9.4%
Central America	Cervix uteri	11.1%	Breast	9.3%	Prostate	8.8%	Stomach	8.3%
South America	Breast	12.2%	Prostate	10.2%	Stomach	8.7%	Cervix uteri	7.7%
North America	Prostate	16.7%	Breast	14.6%	Lung	14.5%	Colon and rectum	11.7%
Eastern Asia	Stomach	18.9%	Lung	17.1%	Liver	14.1%	Esophagus	9.6%
South-Eastern Asia	Lung	13.3%	Breast	11.1%	Liver	9.2%	Colon and rectum	8.7%
South Central Asia	Cervix uteri	12.6%	Breast	10.6%	Oral cavity	9.5%	Lung	6.2%
Western Asia	Breast	12.9%	Lung	12.8%	Colon and rectum	7.3%	Stomach	6.2%
Eastern Europe	Lung	16.0%	Colon and rectum	12.4%	Breast	11.1%	Stomach	10.0%
Northern Europe	Breast	14.5%	Lung	13.1%	Colon and rectum	13.0%	Prostate	11.2%
Southern Europe	Lung	13.1%	Colon and rectum	12.9%	Breast	11.6%	Prostate	7.8%
Western Europe	Breast	14.1%	Colon and rectum	14.4%	Prostate	11.6%	Lung	11.1%
Australia/New Zealand	Colon and rectum	14.4%	Breast	13.0%	Prostate	13.2%	Melanoma of skin	9.6%
Melanesia	Oral cavity	15.8%	Cervix uteri	13.4%	Liver	8.4%	Breast	7.4%
Micronesia	Lung	18.4%	Breast	18.6%	Colon and rectum	8.5%	Prostate	5.3%
Polynesia	Breast	10.8%	Stomach	10.4%	Cervix uteri	9.2%	Colon and rectum	7.7%

Cancer Deaths

	First		Second		Third		Fourth	
Eastern Africa	Kaposi sarcoma	15.8%	Cervix uteri	13.9%	Liver	10.2%	Esophagus	8.3%
Middle Africa	Liver	19.0%	Kaposi sarcoma	18.8%	Stomach	10.3%	Cervix uteri	10.3%
Northern Africa	Bladder	13.9%	Breast	12.4%	Lung	8.5%	Cervix uteri	7.0%
Southern Africa	Cervix uteri	10.0%	Lung	9.5%	Esophagus	8.7%	Kaposi sarcoma	8.6%
Western Africa	Cervix uteri	15.6%	Breast	13.7%	Liver	13.5%	Prostate	7.5%
Caribbean	Lung	15.0%	Prostate	11.6%	Colon and rectum	8.3%	Cervix uteri	7.0%
Central America	Lung	11.1%	Stomach	10.6%	Cervix uteri	8.9%	Prostate	7.5%
North America	Lung	28.4%	Colon and rectum	10.5%	Breast	7.6%	Prostate	5.8%
South America	Lung	12.0%	Stomach	11.5%	Breast	7.1%	Colon and rectum	6.7%
Eastern Asia	Lung	20.9%	Stomach	19.2%	Liver	18.6%	Esophagus	10.8%
South-Eastern Asia	Lung	17.8%	Liver	14.2%	Colon and rectum	7.9%	Breast	7.3%
South Central Asia	Cervix uteri	10.3%	Lung	8.2%	Esophagus	8.1%	Breast	8.0%
Western Asia	Lung	18.1%	Breast	8.5%	Stomach	8.0%	Colon and rectum	6.9%
Eastern Europe	Lung	20.7%	Stomach	12.2%	Colon and rectum	11.8%	Breast	7.1%
Northern Europe	Lung	21.1%	Colon and rectum	11.4%	Breast	8.1%	Prostate	7.1%
Southern Europe	Lung	20.4%	Colon and rectum	11.5%	Stomach	7.5%	Breast	7.0%
Western Europe	Lung	18.9%	Colon and rectum	12.8%	Breast	8.1%	Prostate	6.4%
Australia/New Zealand	Lung	19.6%	Colon and rectum	13.6%	Breast	7.5%	Prostate	7.3%
Melanesia	Oral cavity	13.6%	Liver	12.2%	Cervix uteri	11.1%	Breast	5.2%
Micronesia	Lung	25.2%	Breast	12.8%	Colon and rectum	8.4%	Liver	5.3%
Polynesia	Stomach	9.5%	Colon and rectum	7.5%	Breast	7.3%	Cervix uteri	7.2%

Source: GLOBOCAN 2002 and Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2004 Revision and World Urbanization Prospects: The 2003 Revision. (February 5, 2007).

Table 4. Lifetime Probability (%) of Developing or Dying from Cancer Before Age 65 by Sex, Cancer Site, and Level of Economic Development, 2002

	Males				Females			
	Developed Countries		Developing Countries		Developed Countries		Developing Countries	
Site	Incidence	Mortality	Incidence	Mortality	Incidence	Mortality	Incidence	Mortality
Bladder	0.81	0.15	0.26	0.12	0.17	0.03	0.09	0.04
Brain, nervous system	0.38	0.26	0.20	0.15	0.26	0.17	0.15	0.11
Breast					4.81	1.12	1.79	0.74
Cervix uteri					0.76	0.25	1.48	0.84
Colon and rectum	1.87	0.68	0.53	0.29	1.27	0.47	0.43	0.23
Corpus uteri					0.98	0.13	0.22	0.06
Hodgkin lymphoma	0.16	0.04	0.06	0.03	0.13	0.02	0.03	0.01
Kidney, etc.	0.60	0.22	0.13	0.06	0.28	0.09	0.08	0.04
Larynx	0.48	0.20	0.27	0.16	0.05		0.04	0.02
Leukemia	0.47	0.24	0.27	0.21	0.32	0.16	0.21	0.16
Liver	0.44	0.37	1.17	1.08	0.12	0.11	0.42	0.40
Lung	2.78	2.21	1.32	1.11	0.92	0.66	0.50	0.42
Melanoma of skin	0.54	0.10	0.04	0.02	0.51	0.07	0.04	0.02
Multiple myeloma	0.16	0.08	0.05	0.04	0.11	0.06	0.04	0.03
Nasopharynx	0.05	0.02	0.17	0.11			0.07	0.05
Non-Hodgkin lymphoma	0.58	0.20	0.27	0.16	0.35	0.12	0.16	0.11
Oesophagus	0.40	0.32	0.74	0.55	0.06	0.05	0.36	0.28
Oral cavity	0.54	0.18	0.38	0.21	0.13	0.03	0.23	0.13
Other pharynx	0.39	0.18	0.21	0.15	0.05	0.02	0.05	0.04
Ovary, etc.					0.70	0.33	0.36	0.21
Pancreas	0.42	0.38	0.15	0.13	0.22	0.21	0.10	0.09
Prostate	2.20	0.19	0.27	0.12				
Stomach	1.09	0.64	1.18	0.84	0.47	0.28	0.56	0.41
Testis	0.32	0.02	0.06	0.02				
Thyroid	0.16	0.02	0.07	0.02	0.40	0.02	0.19	0.05
All sites*	14.79	7.19	8.51	6.06	13.07	4.79	8.13	4.89

*Excludes nonmelanoma skin cancer.
Source: GLOBOCAN 2002.

developing any form of cancer is nearly twice as high in economically developed countries as in economically developing countries in both men (14.8% vs. 8.5%) and women (13.1% vs. 8.1%). In contrast, the risk of dying before age 65 from cancer is similar between developed and developing countries (7.2% vs. 6.1% in men and 4.8% vs. 4.9% in women). These differences relate to variations in the type of major cancers and to the availability of early detection and treatment services between economically developed and developing countries.

What Is Meant by Genetic Factors?

All cancers involve the malfunction of genes that control cell growth, division, and death. However, most of the genetic abnormalities that affect cancer risk are not hereditary, but instead result from damage to genes (mutations) that occur throughout one's lifetime. Damage to genes may be due to internal factors, such as hormones or the metabolism of nutrients within cells, or external factors, such as tobacco, chemicals, and sunlight. (These nonhereditary mutations are called somatic mutations). It is estimated that 5%-10% of all cancers are strongly hereditary, meaning that individuals who inherit a specific genetic alteration have a very high risk of developing a particular cancer. It is thought that many cancers result from a combination of hereditary and environmental factors.

How Many People Alive Today Have Ever Been Diagnosed with Cancer?

The total number of cancer survivors in the world is unknown because many areas lack cancer registries and

information on survival. However, the International Agency for Research on Cancer (IARC) estimates that in 2002 there were approximately 24.6 million cancer survivors worldwide who had been diagnosed within the past five years. Some of these individuals were cancer-free, while others still had evidence of cancer and may have been undergoing treatment. The number of people with a history of cancer is expected to increase during the coming years because of improvements in survival and the anticipated growth and aging of the population.[3]

What Percentage of People Will Survive Cancer?

Survival from a specific cancer is usually measured as the proportion of people diagnosed with cancer who are still alive five years after diagnosis. Cancer survival rates in a population are affected by a number of factors, most importantly, the types of cancer that occur, the stages at which cancers are diagnosed, and whether treatment is available (Table 5).

For certain cancers, there are large survival differences between economically developed and developing countries. For example, five-year survival rates for breast cancer in the United States are approximately 81%, compared to 32% in Sub-Saharan Africa.[3] This is mostly due to the greater availability of early detection and more effective treatments in North America than in Sub-Saharan Africa. It is also due, in part, to detecting cancers earlier in the course of disease through screening (lead time bias) and detecting some cancers that might not progress. Similar worldwide variations are noted for cancers of the colon, uterine cervix, and prostate, also for which both early detection and improved treatment are responsible for improved survival. For childhood and other cancers (such as lymphocytic leukemia, non-Hodgkin lymphoma, and testis) availability of treatment is mainly responsible for better survival in developed countries.

For some cancer sites without early detection or effective treatment (poor prognosis), such as esophagus, liver, lung, and pancreatic cancer, survival rates vary little between developing and developed countries. Primary prevention is currently the most effective defense against such cancers with known risk factors.

How Is Cancer Staged?

Staging describes the extent or spread of the disease at the time of diagnosis. It is essential in determining the choice of therapy and in assessing prognosis. Stage is based on the primary tumor's size and location and whether it has spread to other areas of the body. A number of different staging systems are used to classify tumors. The TNM staging system assesses tumors in three ways: size and extent of the primary tumor (T), absence or presence of regional lymph node involvement (N), and absence or presence of distant metastases (M). Once the T, N, and M are determined, a stage of I, II, III, or IV is assigned, with stage I being early stage and stage IV being advanced. Summary staging (in situ, local, regional, and distant) is the most simplistic way to categorize how far a cancer has spread from its point of

Table 5. Five-Year Relative Survival (%) for Selected Cancers Among Men and Women Aged 15 and Older in Europe and the United States

	United States (1996-2002)		Europe (1990-1994)	
	Males	**Females**	**Males**	**Females**
Acute lymphocytic leukemia	32.0	31.3	24.2	21.6
Brain	23.4	25.8	16.4	18.5
Breast (female)	–	88.5	–	76.1
Colon	65.2	62.4	49.2	51.0
Corpus uteri	–	84.1	–	76.0
Esophagus	15.4	15.9	8.5	10.5
Hodgkin lymphoma	82.8	86.2	75.2	81.5
Kidney	65.2	64.6	54.2	57.2
Larynx	65.9	57.5	60.7	59.4
Chronic lymphocytic leukemia	72.6	75.2	62.2	66.4
Liver	9.9	11.5	6.2	6.7
Lung & bronchus	13.1	17.2	9.7	9.6
Melanoma of the skin	90.1	93.1	74.8	84.3
Multiple myeloma	35.4	30.1	28.5	33.0
Non-Hodgkin lymphoma	59.9	64.8	47.7	53.7
Oral cavity & pharynx	57.5	61.1	28.7	43.5
Ovary	–	44.4	–	36.7
Prostate	99.9	–	65.4	–
Stomach	22.7	25.6	20.0	25.4
Testis	95.7	–	91.4	–
Thyroid	94.5	97.3	71.8	81.4
Urinary bladder	82.8	75.4	69.5	67.1
Uterine cervix	–	71.6	–	62.1
All sites	65.2	64.7	39.8	51.2

Source: Ries LAG, Harkins D, Krapcho M, et al;[94] Sant M, Aareleid T, Berrino F et al.[95]

origin. It is useful for descriptive and statistical analysis of tumor registry data. If cancer cells are present only in the layer of cells where they originated and have not penetrated the basement membrane of the tissue, the stage is in situ; otherwise it is invasive. Stage is categorized as local if cancer cells are confined to the organ of origin, regional if the cells have spread beyond their original (primary) site to nearby lymph nodes or tissues, and distant if they have spread from the primary site to distant organs or distant lymph nodes. Table 6 illustrates the wide variation in stage at diagnosis for cancer of the uterine cervix among different cities around the world. Only about 17% of women diagnosed with this cancer in Cape Town, South Africa and Zagreb, Croatia had early stage disease (stage I) compared to more than 60% in Amsterdam, Netherlands and Carlton, Australia.

What Are the Costs of Cancer?

In addition to the human toll of cancer, the financial cost of cancer is substantial. The direct costs include payments and resources used for treatment, as well as the costs of care and rehabilitation related to the illness. Indirect costs include the loss of economic output due to days missed from work (morbidity costs) and premature death (mortality costs). There are also hidden costs of cancer, such as health insurance premiums and non-medical expenses (transportation, child or elder care, housekeeping assistance, wigs, etc.).[4] Data limitations do not allow estimating the worldwide economic costs of cancer. However, the costs of cancer are staggering. With the growth and aging of the population, prevention efforts are important to help reduce new cancer cases, human suffering, and economic costs.

Table 6. Stage Distribution (%) for Cervical Cancer in Selected Countries Among Patients Treated in 1999-2001

	Stage I	Stage II	Stage III	Stage IV
Argentina (Buenos Aires)	46.5	39.5	10.0	4.0
Australia (Carlton)	61.5	14.3	15.4	6.6
Brazil (Sao Paolo)	52.6	26.2	19.4	1.8
Canada (Montreal)	55.0	26.1	8.1	9.9
China (Guangzhou)	36.4	42.5	17.9	0.9
Thailand (Bangkok)	32.6	30.7	32.8	2.4
Croatia (Zagreb)	17.0	38.0	35.3	9.7
Poland (Warsaw)	22.0	36.1	36.8	3.8
Peru (Arequipa)	25.2	30.4	29.6	14.8
Netherlands (Amsterdam)	60.4	21.2	14.0	4.4
South Africa (Cape Town)	16.6	25.0	43.0	15.5
United States (Nashville)	57.0	20.6	17.8	2.8

Percentages do not sum to 100 because there are cases for which stage is unknown.

Source: Quinn MA, Benedet JL, Odicino F et al. Carcinoma of the Cervix Uteri. 26th Annual Report on the Results of Treatment in Gynecological Cancer. Int Gynecol Obst.2006;95(Suppl 1):S43-S103.

Interventions for Cancer Prevention and Control

A balanced approach to cancer control includes prevention, early detection, and effective treatment.[5] Successful national cancer control policies and programs raise awareness of cancer, reduce exposure to cancer risk factors, provide information and support for the adoption of healthy lifestyles, and increase the proportion of cancers detected early. The World Health Organization (WHO) emphasizes that, when developing national strategies for controlling cancer, countries should consider the following four broad approaches based on their economic development.[2]

Primary prevention. The goal of primary prevention is to reduce or eliminate exposure to cancer-causing factors, which include modifiable factors related to tobacco use, nutrition, physical inactivity, occupational exposures, and chronic infections. Primary prevention offers the greatest public health potential and the most cost-effective long-term method of cancer control. Approaches to primary prevention include immunization against, or treatment of, infectious agents that cause certain cancers; application of effective tobacco control measures; reduction of excessive alcohol consumption; maintenance of healthy body weight and physically active lifestyles; dietary intervention; sun/UV avoidance; reduction in occupational exposure to carcinogens; and pharmacological intervention.

Early detection and secondary prevention. The main objective of early detection or secondary prevention through screening is to detect pre-cancerous changes or early stage cancers when they can be treated most effectively. Early detection is only valuable if it leads to timely diagnostic follow up and effective treatment. There are two strategies for early detection: 1) opportunistic screening requested sporadically by a physician or an individual or 2) organized screening in which a defined population is contacted and invited to be screened at regular intervals. In practice, many cancer

screening programs have elements of each of these approaches.[6]

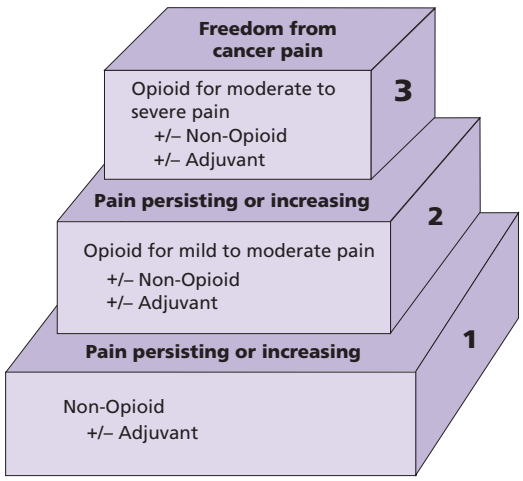
Cancers that have proven early detection methods include cervix, colon and rectum, and breast. However, wide implementation of screening for these cancers has not been fully achieved even in economically developed countries.

The Institute of Medicine of the National Academies recommends that low-resource countries that cannot afford the infrastructure required for organized screening programs should focus on increasing awareness of signs and symptoms of cancer in the general population leading to earlier diagnosis and treatment.[7] If Pap test screening for cervical cancer is considered in developing countries, it should focus primarily on women between 35 and 50 years of age since these women are generally at highest risk of developing the disease or precancerous lesions.[8] Once-in-a-lifetime screening between the ages of 35 and 40 can reduce lifetime cervical cancer risk by 25%-35%.[9] New low-tech methods of screening for cervical cancer with direct visualization, acetic acid, and oftentimes immediate treatment, have been shown to be cost-effective in developing countries.[10]

Diagnosis and treatment. Cancer diagnosis, including careful clinical and pathological assessments, is the first step to cancer management. Once a diagnosis is confirmed, it is necessary to determine cancer stage, where the main goals are to aid in the choice of therapy, to determine prognosis, and to standardize the design of research treatment protocols. The primary modalities of cancer treatment are surgery, chemotherapy, and radiotherapy; these may be used alone or in combination. There is increasing emphasis worldwide on the development of specialized cancer centers that apply evidence-based multimodal therapies, and provide rehabilitation and palliative care.

Palliative care. In most parts of the world, the majority of cancer patients present with advanced disease. For these patients, the only realistic treatment option is pain relief and palliative care. The most basic approach to palliative care for terminally ill cancer patients, especially in low-resource settings, involves using inexpensive oral analgesics, ranging from aspirin to opiates, depending on individual patients' needs. Unfortunately, sufficient supplies of opioid drugs for use in palliative care are often not available in developing countries because of regulatory or pricing obstacles, lack of knowledge, or false beliefs. The World Health Organization (WHO) has developed guidelines for cancer pain management based on the three-step analgesic ladder. These steps comprise a sequential approach according to the individual pain intensity, which begins with non-opioid analgesics and progresses to opioids for moderate pain and then for severe pain. In many countries, national drug laws have been evaluated and found to interfere with cancer pain relief. In many developing countries, cancer pain management is also limited by geographical barriers, medical infrastructure, and financial resources. In some countries, stringent regulations and negative perceptions associated with heroin trafficking further limit appropriate medical use of opioids. The WHO also elaborated guidelines for assessing national drug policies to ensure availability of opioids for medical and scientific use, while at the same time safeguarding against abuse and diversion.[11] The WHO has played an important role in encouraging effective pain management and monitoring the availability of opioids internationally.[12]

Pain Relief Ladder



Source: World Health Organization, 1990.

Selected Cancers

Female Breast

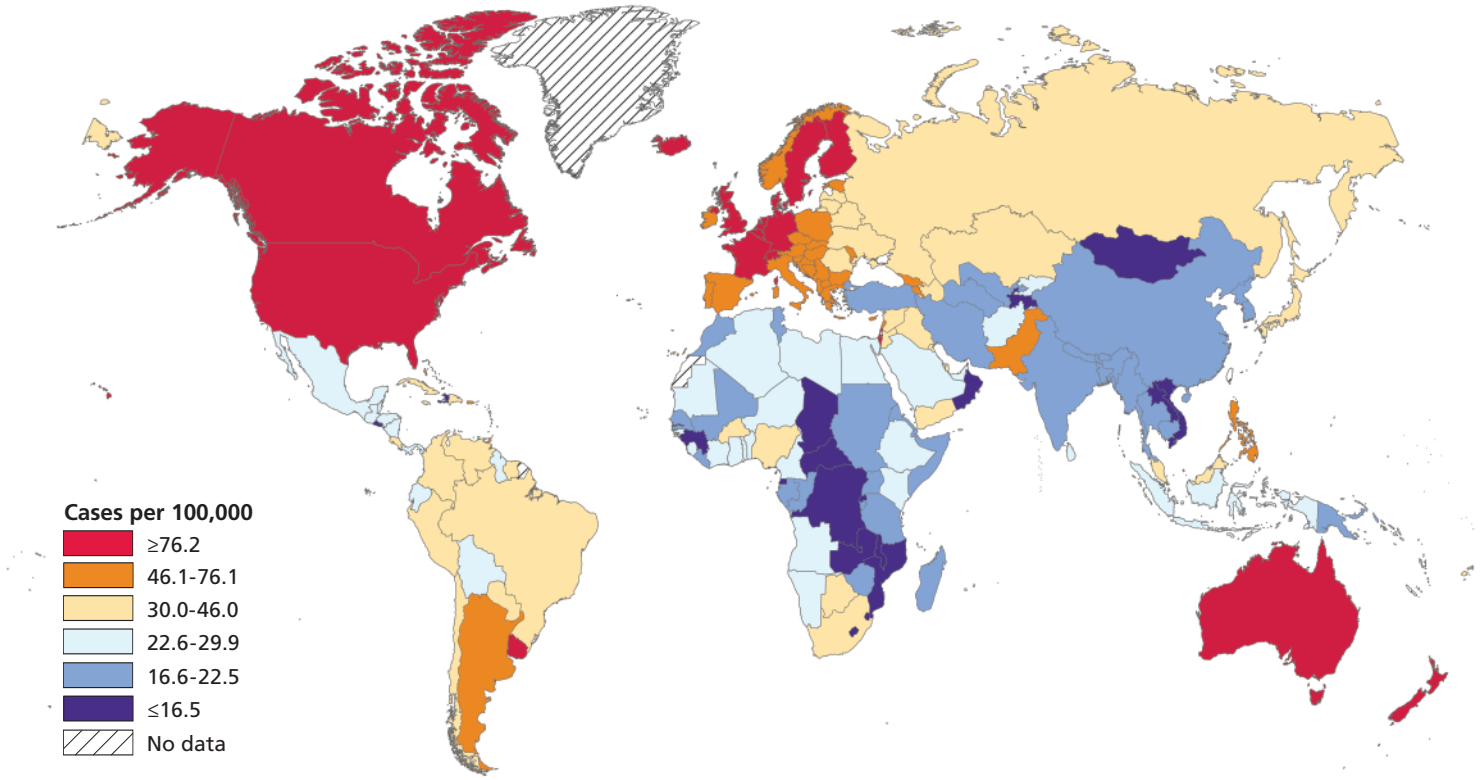
New cases: An estimated 1.3 million new cases of invasive breast cancer are expected to occur among women in 2007. Worldwide, breast cancer is the most frequently diagnosed cancer in women. Female breast cancer incidence rates for 2002 vary internationally by more than 25-fold, ranging from 3.9 cases per 100,000 in Mozambique to 101.1 in the United States. This in part reflects low screening rates and incomplete reporting in developing countries (Figure 3). North America, Australia, and Northern and Western Europe have the highest incidence of breast cancer; intermediate levels are reported in Eastern Europe. Large parts of Africa and Asia have the lowest rates.

Deaths: An estimated 465,000 breast cancer deaths in women are expected in 2007. Breast cancer is the leading cause of cancer death among women worldwide.

Global trends: Over the past 25 years, breast cancer incidence rates have risen approximately 30% in westernized countries because of changes in reproductive patterns and more recently because of increased screening.[13] However, incidence rates in the United States decreased from 2001-2004, in part due to reductions in hormone replacement therapy (HRT) use and mammography utilization. Breast cancer incidence rates have been rising in many developing countries, including Asian and African countries. Reasons for these trends are not completely understood but likely reflect changes in reproductive patterns, nutrition, physical inactivity,[13] and some breast cancer screening activity. Although breast cancer incidence is on the rise worldwide, breast cancer mortality over the past 25 years has been stable or decreasing in some countries (Figure 4). Mortality rate reductions in developed countries have been attributed to early detection through mammography and to improved treatment.[14]

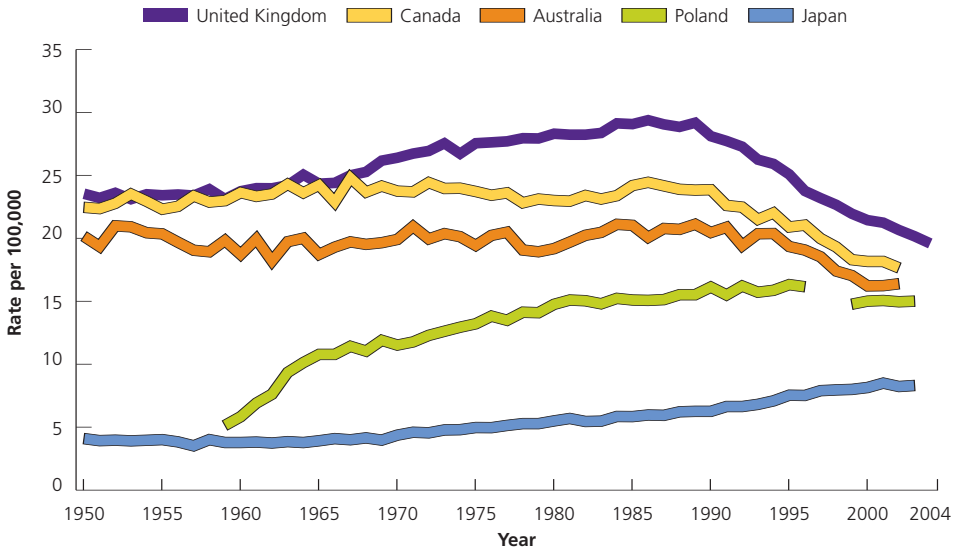
Signs and symptoms: Early stage breast cancer typically produces no symptoms when the tumor is small and most treatable. When breast cancer has grown to a size when it can be felt, the most common physical sign is a painless mass. Less common signs and symptoms include breast pain and persistent changes to the breast, such as thickening, swelling, skin irritation or distortion, and nipple abnormalities such as spontaneous discharge, erosion, inversion, or tenderness. All women

Figure 3. International Variation in Age-Standardized Breast Cancer Incidence Rates



Source: Globocan 2002.

Figure 4. Trends in Age-Standardized Death Rates of Breast Cancer in Five Countries



Note: Break in trend indicates missing data.
Source: WHO Mortality Database.

should become familiar with both the appearance and feel of their breasts so they can promptly report[1,2] any changes to a doctor or nurse.[15]

Risk factors: Aside from being female, age is the most important factor affecting breast cancer risk. Risk is also increased by inheritance of two genetic mutations (BRCA1 and BRCA2), a personal or family history of breast cancer, high breast tissue density (a mammographic measure of the amount of glandular tissue relative to fatty tissue in the breast), biopsy-confirmed hyperplasia of breast tissue (especially atypical hyperplasia), and high-dose radiation to the chest as a result of medical procedures. However, factors that contribute to the striking international variation in incidence rates include differences in reproductive and hormonal factors. Reproductive factors that increase risk include a long menstrual history (menstrual periods that start earlier and/or end later in life), never having children, recent use of oral contraceptives, and having one's first child after age 30. Some potentially modifiable factors that increase risk include being overweight or obese after menopause, use of postmenopausal hormone therapy (especially combined estrogen and progestin therapy), physical inactivity, and consumption of one or more alcoholic beverages per day. (Being overweight also adversely affects survival for postmenopausal women.) Breast feeding, moderate or vigorous physical activity, and maintaining a healthy body weight are all associated with lower risk of breast cancer.

Prevention and early detection: The best available strategy to reduce the risk of developing breast cancer is to reduce known risk factors as much as possible by maintaining a healthy body weight, increasing physical activity, and minimizing alcohol intake. Methods for early detection of breast cancer include screening by mammography, clinical breast examination (CBE), and breast self-examination (BSE). Mammography is especially valuable as an early detection tool because it can identify breast cancer at a stage when treatment may be more effective. Numerous studies have shown that early detection saves lives and increases treatment options. However, implementation of population-based, organized mammography screening programs may be cost prohibitive in many developing countries.[16]

Treatment: Taking into account tumor size, stage, other clinical characteristics, and patient preference, treatment may involve lumpectomy (surgical removal of the tumor with clear margins) or mastectomy (surgical removal of the breast) with removal of some of the axillary (underarm) lymph nodes (to obtain accurate information on stage of disease); radiation therapy; chemotherapy; or hormone therapy (tamoxifen, aromatase inhibitors). Two or more methods are often used in combination. Numerous studies have shown that, unless cancer has spread to the skin, chest wall, or distant organs, long-term survival rates after lumpectomy plus radiation therapy are similar to survival rates after modified radical mastectomy.

Survival: Five-year survival from breast cancer is about 89% in the United States and 76% in Europe. Survival rates in developing countries are generally lower than in Europe and North America. The stage at diagnosis is the

most important prognostic variable. For instance, the overall five-year relative survival among US women diagnosed with breast cancer at early stage is 98%, compared to 84% and 28% when the disease is spread to regional lymph nodes or distant organs, respectively.[17]

Colon and Rectum

New cases: Colorectal cancer is the fourth most common cancer in men and the third in women. Worldwide, nearly 1.2 million cases of colorectal cancer are expected to occur in 2007. The highest incidence rates are found in Japan, North America, parts of Europe, New Zealand, and Australia (Figures 5a and 5b). Rates are low in Africa and South-East Asia. Rates are substantially higher in men than in women.

Deaths: About 630,000 deaths from colorectal cancer are expected to occur in 2007 worldwide, accounting for 8% of all cancer deaths.

Global trends: The incidence of colorectal cancer is increasing in certain countries where risk was historically low (Japan, Puerto Rico). In high-risk countries, trends are either gradually increasing (England), stabilizing (New Zealand), or declining (United States) with time. The greatest increases in the incidence of colorectal cancer are in Asia (Japan, Hong Kong, Singapore), Eastern Europe (Hungary, Poland), Israel, and Puerto Rico. In contrast to the recent decrease in rates seen in some western and northern European countries, relatively large increases have been observed in Spain. The decrease in incidence in the United States partially reflects the increase in detection and removal of precancerous lesions; the increase in several Asian and Eastern European countries may reflect changes in the prevalence of obesity and dietary patterns.[18,19]

Signs and symptoms: Advanced disease may cause rectal bleeding, blood in the stool, a change in bowel habits, and cramping pain in the lower abdomen. Early stage colorectal cancer is often asymptomatic.

Risk factors: The risk of colorectal cancer increases with age. In developed countries, more than 90% of cases are diagnosed in individuals older than 50. Risk is also increased by certain inherited genetic mutations (FAP and HNPCC), a personal or family history of colorectal cancer and/or polyps, or chronic inflammatory bowel disease. However, lifestyle factors are important determinants of colorectal cancer risk. Modifiable factors associated with increased risk of colorectal cancer are obesity, physical inactivity, smoking, heavy alcohol consumption, a diet high in red or processed meat, and inadequate intake of fruits and vegetables. Studies indicate that men and women who are overweight are more likely to develop and die from colorectal cancer. Some studies suggest that regular use of nonsteroidal anti-inflammatory drugs (such as aspirin) and hormones, such as estrogen and progestin, may reduce colorectal cancer risk. Currently, however, these drugs are not recommended for the prevention of cancer because they can have other adverse health effects.

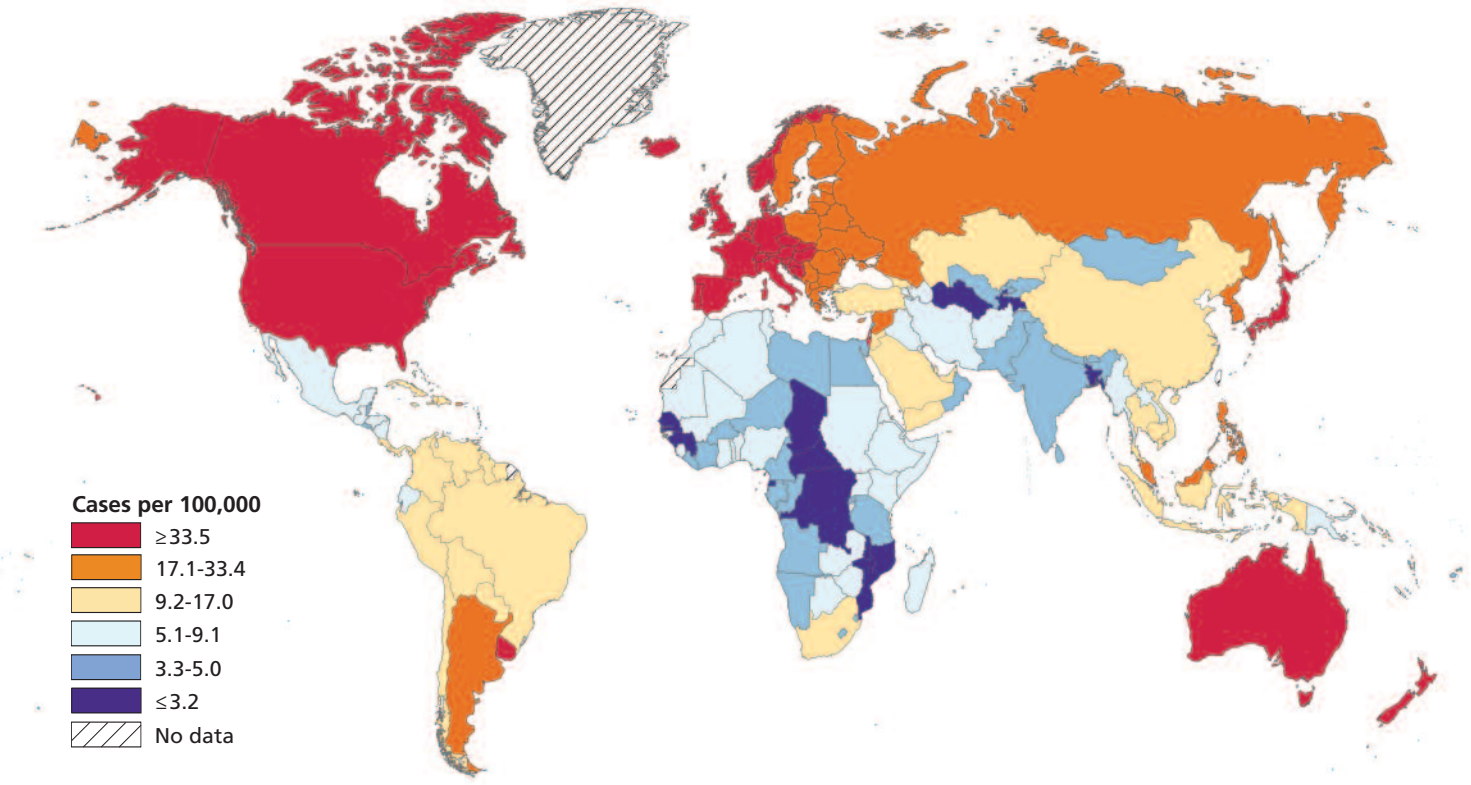
Prevention and early detection: Preventive measures for colorectal cancer include maintaining a healthy body weight, being physically active, and minimizing consumption of red meat and alcohol.[20] Colorectal cancer screening can result in the detection and removal of colorectal polyps before they become cancerous, as well as the detection of colorectal cancer at an early stage. Therefore, screening reduces mortality from colorectal cancer both by decreasing incidence and by detecting a higher proportion of cancers at early and more treatable stages. Despite these benefits, only a few countries have implemented organized national or regional colorectal cancer screening programs. Many other countries are either pilot testing or considering organized colorectal cancer screening programs.[21]

The current guideline for colorectal cancer screening in most countries is to begin screening at age 50 for men and women who are at average risk for developing colorectal cancer. Persons at higher risk should begin screening at a younger age and may need to be tested more frequently. There are several accepted colorectal cancer screening methods (fecal occult blood test [FOBT], flexible sigmoidoscopy, double-contrast enema, and colonoscopy) and recommendations of screening methods or schedules vary among countries.[22]

Treatment: Surgery is the most common treatment for colorectal cancer. For cancers that have not spread, surgical removal may be curative. A permanent colostomy (creation of an abdominal opening for elimination of body wastes) is very rarely needed for colon cancer and is infrequently required for rectal cancer. Chemotherapy alone, or in combination with radiation (for rectal cancer), is given before or after surgery to most patients whose cancer has penetrated the bowel wall deeply or spread to the lymph nodes.

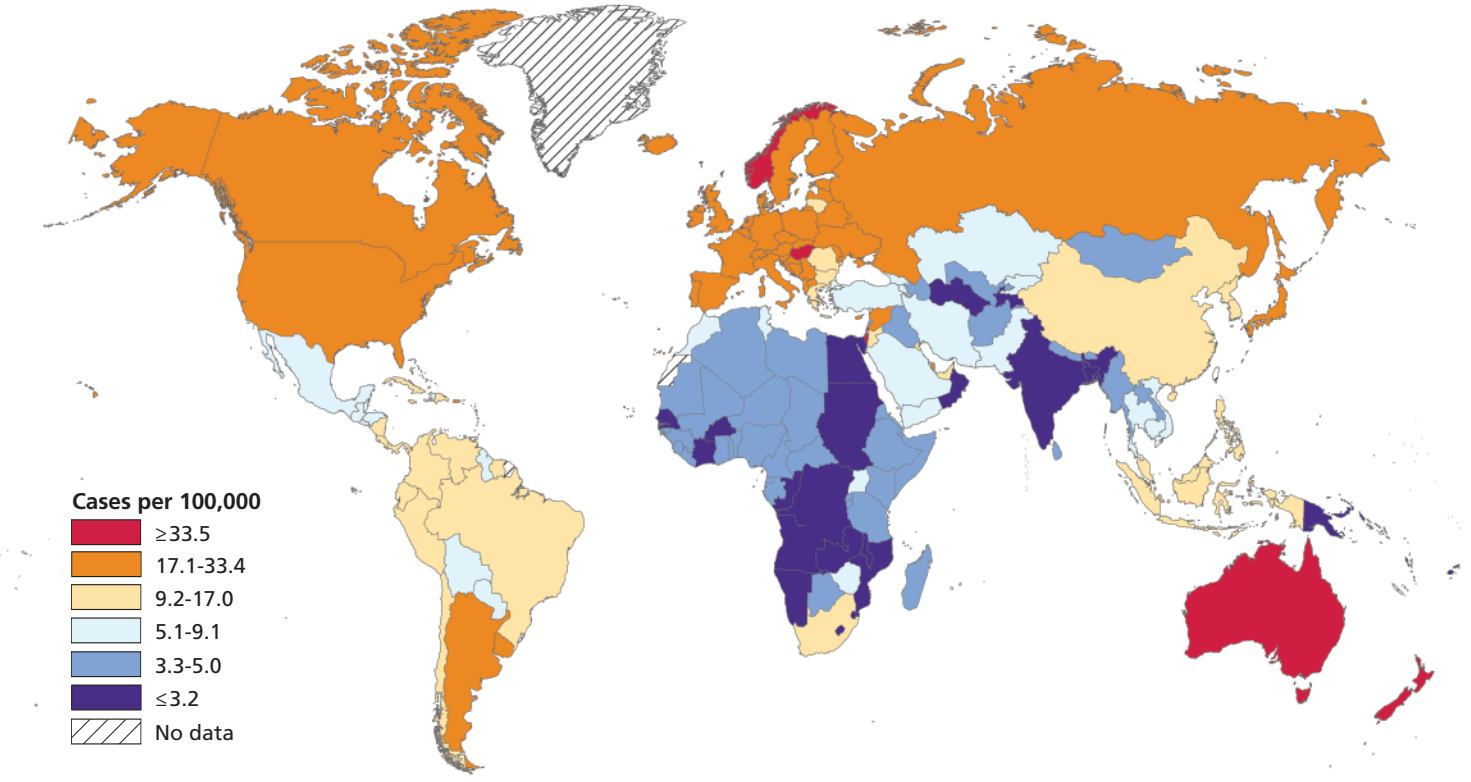
Survival: The five-year survival for persons with colorectal cancer is 64% in the United States. When colorectal cancers are detected at an early, localized stage, the five-year survival rate increases to 90%;

Figure 5a. International Variation in Age-Standardized Colorectal Cancer Incidence Rates Among Males



Source: Globocan 2002.

Figure 5b. International Variation in Age-Standardized Colorectal Cancer Incidence Rates Among Females



Source: Globocan 2002.

however, only 39% of colorectal cancers are diagnosed at this stage, mainly due to low rates of screening. Relative survival rates for men diagnosed with colorectal cancer during 1982-1992 in five developing countries – China, Cuba, India, the Philippines, and Thailand – range from 28%-42%.[23]

Lung and Bronchus

New cases: An estimated 1.5 million new cases are expected in 2007, accounting for about 12% of total cancer diagnoses. In men, the highest lung cancer incidence rates are in Eastern Europe, North America, and Russia, and the lowest rates are in Africa, Melanesia, and South Central Asia (Figure 6a). In women, the highest lung cancer rates are found in North America, the Scandinavian countries, and China (Figure 6b). Lung cancer rates in Chinese women (19.0 cases per 100,000 women) are higher than the rates among women in many European countries, including Germany and France (fewer than 13.0 cases per 100,000 women), despite their lower prevalence of smoking.[24] This is thought to reflect indoor air pollution from unventilated coal-fueled stoves and from cooking fumes.[25]

Deaths: Worldwide, lung cancer is the leading cause of cancer death in men and the second leading cause of cancer death in women, with about 975,000 men and 376,000 women projected to die from it in 2007.

Global trends: Trends in lung cancer incidence and mortality rates over time reflect historical patterns of smoking, albeit with a 20- to 30-year lag time. Thus, variations in temporal trends in lung cancer rates between countries reflect differences in the stage of the tobacco epidemic. Among men, lung cancer incidence and mortality rates have peaked and are decreasing in the United States, Canada, England, Denmark, and Australia and have plateaued in Spain because of reductions in male smoking (Figure 7). The lung cancer trend in women differs from that in men because the uptake of widespread cigarette smoking among women lagged behind that in men by approximately 25 years, even in industrialized countries. Thus, in many parts of the world, lung cancer mortality rates in women continue to increase, though they have begun to plateau in some countries, such as the US and the UK (Figure 7).

Signs and symptoms: Symptoms may include persistent cough, sputum streaked with blood, chest pain, voice change, and recurrent pneumonia or bronchitis.

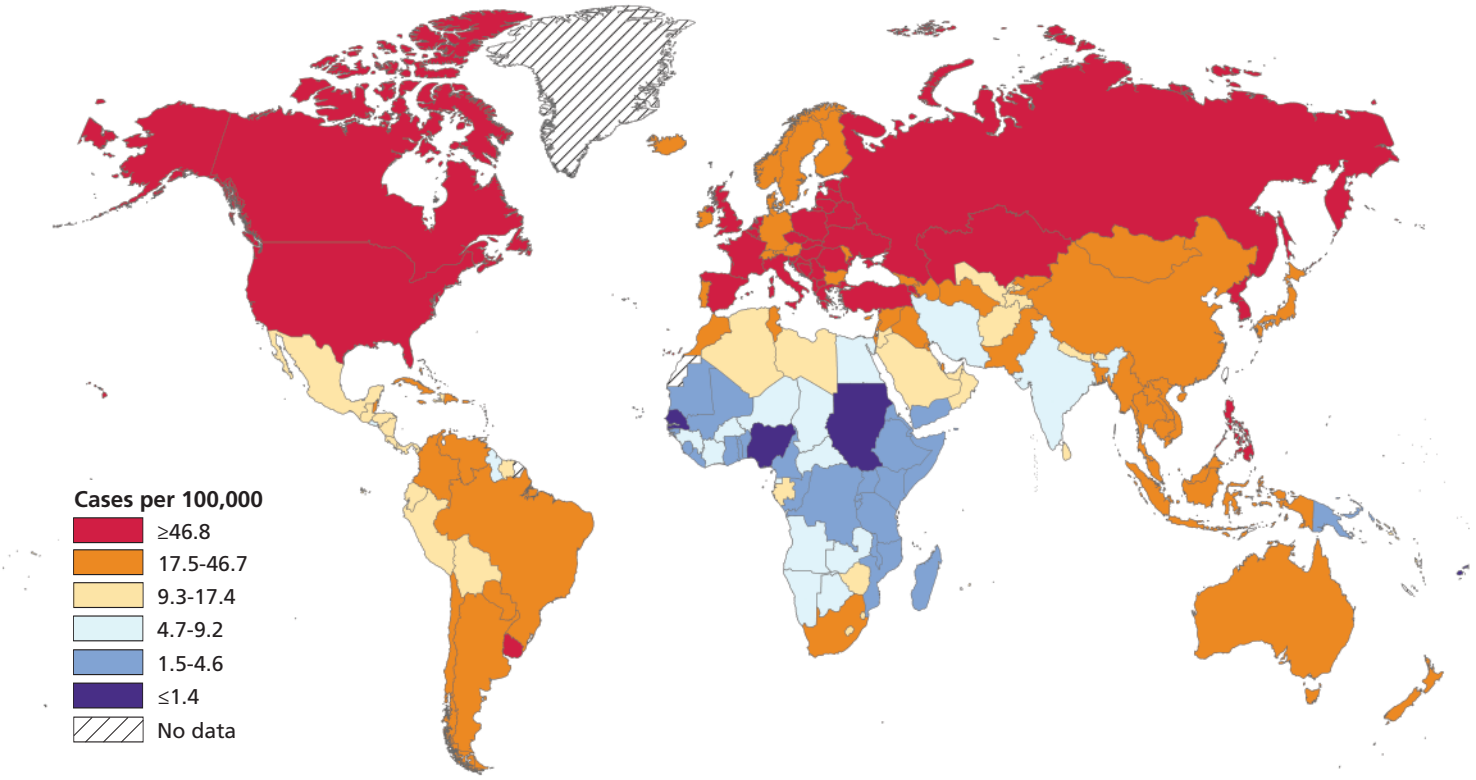
Risk factors: Cigarette smoking is the most important risk factor for lung cancer, accounting for about 80% of lung cancer cases in men and 50% in women worldwide.[4] Other risk factors include secondhand smoke, occupational or environmental exposures to radon and asbestos (particularly among smokers), certain metals (chromium, cadmium, arsenic), some organic chemicals, radiation, air pollution, coal smoke, and indoor emissions from burning other fuels. Genetic susceptibility contributes to risk, especially in those who develop the disease at a younger age.[26,27]

Prevention and early detection: Lung cancer is one of the most preventable cancers. Most lung cancers could be prevented by reducing smoking initiation among adolescents and increasing smoking cessation among adults. This requires a comprehensive tobacco control program that includes raising the price of tobacco products through excise taxes, banning smoking in public places, restricting tobacco advertising and promotion, counter advertising, and providing treatment and counseling for tobacco dependence. In the United States, comprehensive tobacco control programs in many states have markedly decreased smoking rates and accelerated the reduction in lung cancer occurrence, particularly in California.

The early detection of lung cancer has not yet been proven to reduce mortality. Chest x-ray, analysis of cells in sputum, and fiberoptic examination of the bronchial passages have shown limited effectiveness in reducing lung cancer mortality. Newer tests, such as low-dose spiral computed tomography (CT) scans and molecular markers in sputum, have produced promising results in detecting lung cancers at earlier, more operable stages when survival is better. However, there are considerable risks associated with lung biopsy and surgery and the net benefit of screening has not been established. Randomized clinical trial evidence is needed regarding the effect of CT screening on mortality, either with whole population screening or for particular subgroups. One such trial in the United States is currently recruiting 50,000 participants and is scheduled to end in 2009; however, final follow up will not be complete until around 2014.[28]

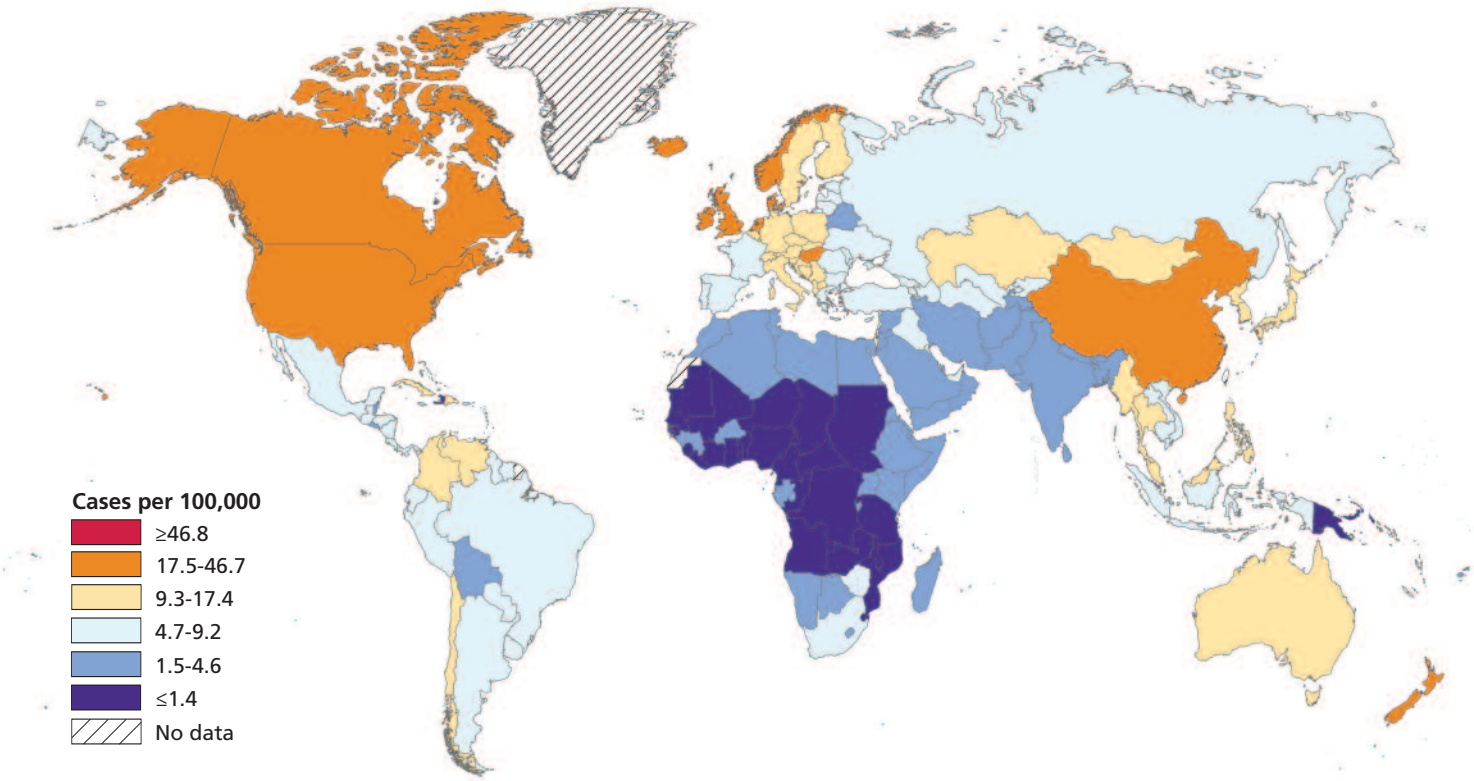
Treatment: Treatment options are determined by the type of lung cancer (small cell, non-small cell) and stage at diagnosis. Treatments include surgery, radiation therapy, chemotherapy, and targeted biological therapies. For localized cancers, surgery is usually the treatment of choice. Recent studies indicate that survival with early stage non-small cell lung cancer is improved by chemotherapy following surgery. Because the disease has usually spread by the time it is discovered, radiation therapy and chemotherapy are often used, sometimes in

Figure 6a. International Variation in Age-Standardized Lung Cancer Incidence Rates Among Males



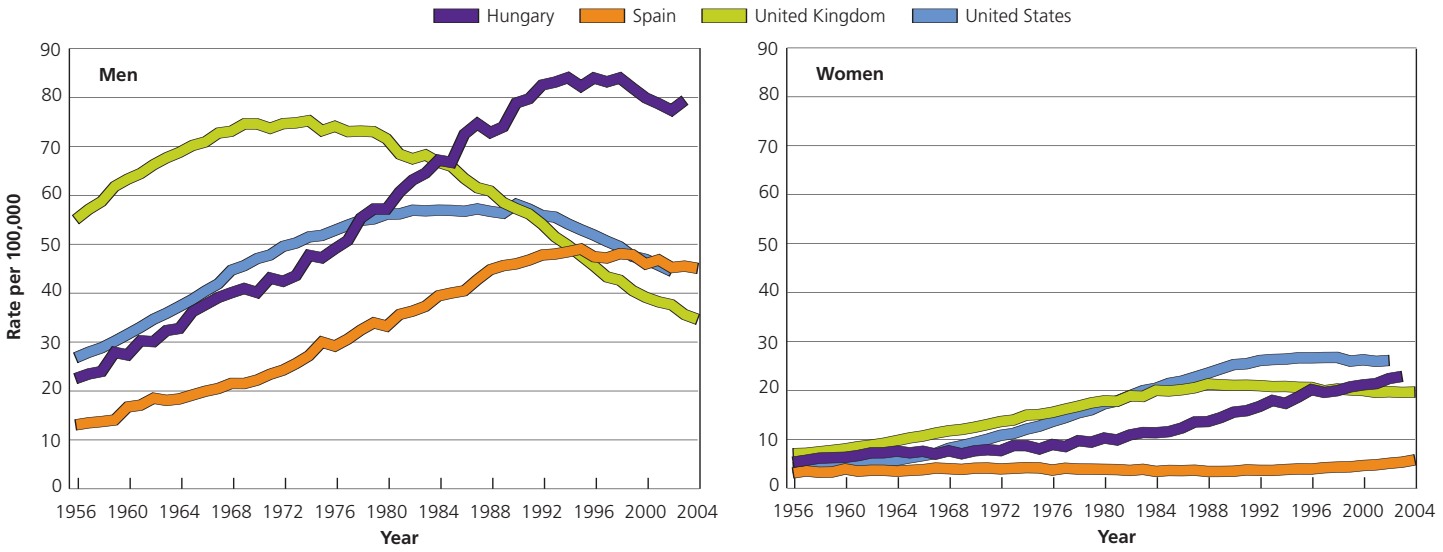
Source: Globocan 2002.

Figure 6b. International Variation in Age-Standardized Lung Cancer Incidence Rates Among Females



Source: Globocan 2002.

Figure 7. Trends in Age-Standardized Death Rates of Lung Cancer in Males and Females in Four Countries



Source: WHO Mortality Database.

combination with surgery. Chemotherapy alone or combined with radiation is the treatment of choice for small cell lung cancer.

Survival: Despite some improvements in surgical techniques and combined therapies over the last several decades, lung cancer is one of the most lethal cancers. The five-year survival rate for all stages combined is about 15% in the United States and Europe.

Prostate

New cases: Prostate cancer is the second most frequently diagnosed cancer in men, with 782,600 new cases projected to occur in 2007. Nearly three-quarters of these cases are expected to be diagnosed in economically developed countries. Incidence rates of prostate cancer vary by more than 50-fold worldwide (Figure 8). The highest rates are recorded in the United States, largely because prostate specific antigen (PSA) testing is widely used and detects clinically important tumors as well as other slow-growing cancers that might otherwise escape diagnosis. The lowest rates are in many parts of Asia and Africa. PSA testing is widely practiced in North America and Australia, but not in Africa or Asia.

Deaths: With an estimated 254,000 deaths in 2007, prostate cancer is the sixth leading cause of cancer death in men. African American men and Jamaican men of African descent have the highest prostate cancer mortality rates in the world. Men in the Caribbean region have almost twice the age-standardized prostate cancer mortality rate of the overall male population in North America and nearly 15 times the rate of men in Eastern Asia. The reason men of African descent have high prostate cancer risk is still poorly understood.

Global trends: Temporal trends in prostate cancer death rates are easier to interpret than trends in incidence rates because they are less affected by changes in PSA screening rates. Death rates for prostate cancer have been decreasing in many developed countries, including the United States, the UK, and Canada.[29] In contrast, mortality rates are rising in some Asian countries, such as Japan and Singapore. While the decrease in prostate cancer death rates in Western countries has been attributed in part to improved treatment and early detection, the increase in Asian countries has been thought to reflect Westernization, including increased consumption of animal fat, obesity, and physical inactivity.[30]

Signs and symptoms: Early prostate cancer usually has no symptoms. With more advanced disease, individuals may experience weak or interrupted urine flow; inability to urinate or difficulty starting or stopping the urine flow; the need to urinate frequently, especially at night; blood in the urine; or pain or burning with urination. Continual pain in the lower back, pelvis, or upper thighs may be an indication of metastatic disease. Many of these symptoms, however, are similar to those caused by benign conditions.

Risk factors: The only well-established risk factors for prostate cancer are older age, race (black), and family history of the disease. More than 65% of all prostate cancer cases in the US are diagnosed in men 65 and

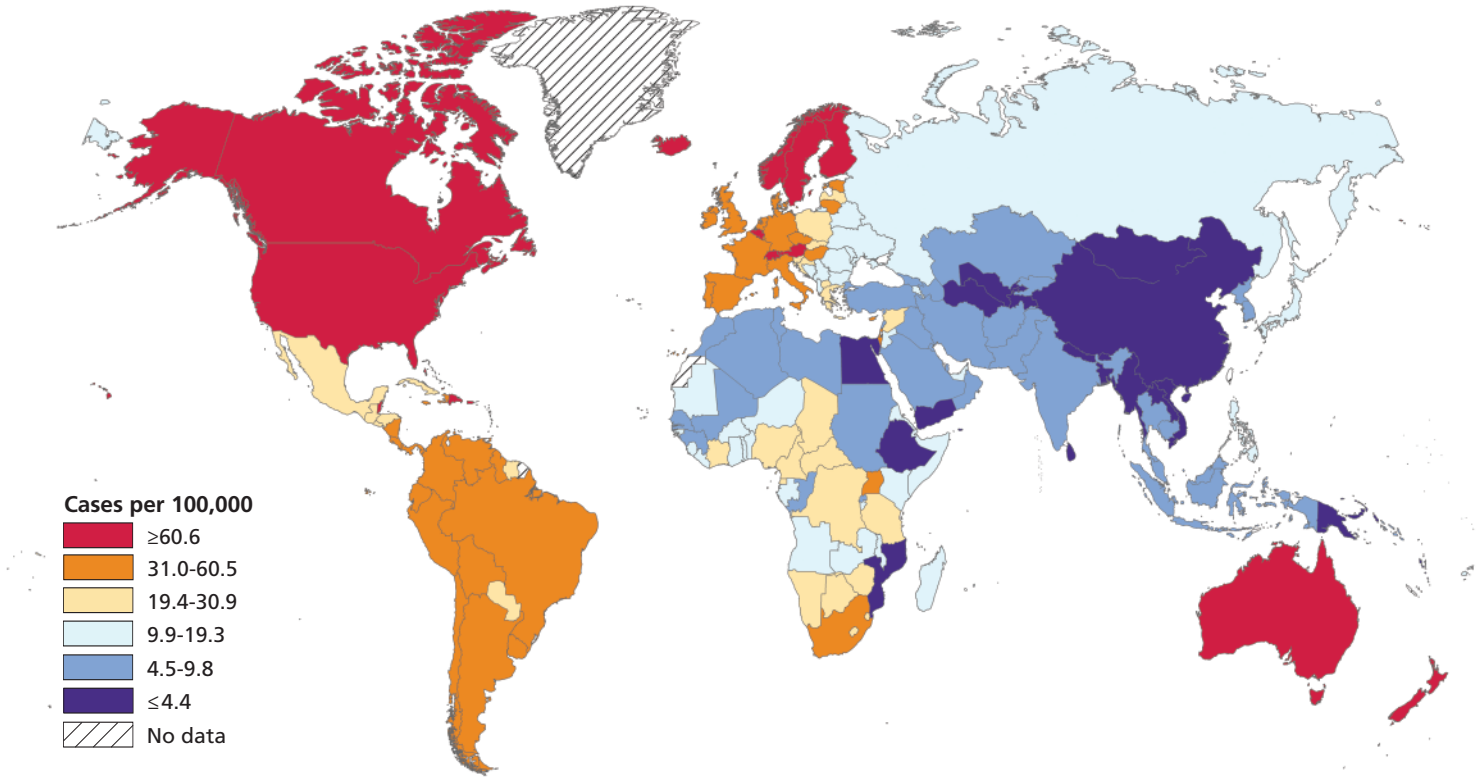
older. Recent genetic studies suggest that strong familial predisposition may be responsible for 5%-10% of prostate cancers. International studies suggest that a diet high in saturated fat may also be a risk factor, but findings from analytical studies do not consistently support this. There is some evidence that the risk of dying from prostate cancer is increased by obesity.

Prevention and early detection: Although modifiable risk factors for prostate cancer are not understood well enough to make definitive recommendations for preventive measures, factors that may reduce risk include maintaining a healthy body weight, getting regular physical activity, and consuming a diet low in animal fat and high in fruits and vegetables. Evidence about the value of testing for early prostate cancer detection is insufficient to recommend for or against screening with PSA for men at average risk.[31] However, PSA is widely used in North America, Australia, and Western and Northern Europe.[29] Clinical trials designed to weigh the benefits and risks of prostate cancer screening (the US National Cancer Institute's Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial and the European Randomized Study of Screening for Prostate Cancer) are underway.[32]

Treatment: Treatment options vary depending on age, stage of the cancer, and other medical conditions. Surgery and external beam radiations or radioactive seed implants, called brachytherapy, may be used to treat early stage disease. Hormonal therapy, chemotherapy, and radiation (or combinations of these treatments) are used for metastatic disease and as a supplemental or additional therapy for early stage disease. Hormone treatment may control prostate cancer for long periods by shrinking the size of the tumor, thus relieving pain and other symptoms. Careful observation ("watchful waiting") rather than immediate treatment may be appropriate for some men with less aggressive tumors, especially older men with limited life expectancy and/or other health considerations.

Survival: Over the past 25 years, a dramatic improvement in survival has been observed, partly attributable to earlier diagnosis of asymptomatic cancers (some of which would never have become clinically evident) and improvements in treatment. The five-year survival rate for patients diagnosed with prostate cancer in the 1990s approaches 100% in the United States, ranges from 40%-80% in Europe, and is less than 40% in most Sub-Saharan African and South-East Asian countries.[33]

Figure 8. International Variation in Age-Standardized Prostate Cancer Incidence Rates



Source: Globocan 2002.

Stomach

New cases: Stomach cancer is expected to remain the fourth most common malignancy in the world in 2007, with an estimated one million new cases. Nearly 70% of new cases will occur in developing countries.[34] Generally, stomach cancer rates are about twice as high in men as in women. Stomach cancer incidence rates vary widely across countries, ranging from 0.6 cases per 100,000 in Cameroon to 69.6 in Korea for men and from 0.6 in Gabon to 30.6 in Peru for women (Figures 9a and 9b). In general, the highest incidence rates are found in Asia and parts of South America (Costa Rica, El Salvador, and Colombia) in both men and women and in some African countries (Mali, Congo, and Rwanda) in women. In contrast, the lowest rates are reported for North America and in most parts of Africa in both men and women.

Deaths: Stomach cancer is the second leading cause of cancer death in men and the fourth among women. About 800,000 people worldwide are projected to die from stomach cancer in 2007.

Global trends: A steady decline in stomach cancer rates has been observed in most developed countries over the past 50 years, with rates dropping by more than 80%. Similar decreasing trends have been noted in some developing countries, including China, though the decrease is smaller and began later.[18] Factors that have contributed to these remarkable decreases are thought to include increased availability of fresh fruits and vegetables, decreased reliance on salted and preserved foods, reduction in chronic *H. pylori* infection due to sanitation and antibiotics,[1] and increased screening.[35]

Signs and symptoms: Stomach cancer has few symptoms in the early stages (i.e., indigestion or a burning sensation). As it progresses, symptoms may include nausea, abdominal pain or discomfort in the upper abdomen, diarrhea or constipation, bloody stools, vomiting blood, loss of appetite, weight loss, anemia, and feelings of fullness or pressure in the stomach.

Risk factors: An estimated 59% of cases in developing countries and 63% of cases in developed countries can be attributed to *H. pylori* infection. *H. pylori* is a bacterium that colonizes the stomach. It is not known with absolute certainty how *H. pylori* is transmitted, but the most likely route of spread is from person to person through fecal-oral or oral-oral routes. Possible environmental sources include water contaminated with human waste. Symptoms of initial infection include gastric discomfort and vomiting, but not all infected persons experience these symptoms. Diets rich in smoked foods, salted meat or fish, and pickled vegetables and low in fresh vegetables have also been associated with an increased risk of stomach cancer.

Prevention and early detection: The primary prevention strategy for stomach cancer is to reduce the intake of foods preserved by salting, pickling, or smoking; to increase consumption of fresh fruits and vegetables; and to reduce the prevalence of *H. pylori* infection by improving hygienic conditions and increased use of antibiotics. Stomach cancers are believed to develop slowly over many years. Before a true cancer develops, there are usually pre-cancerous changes that occur in the lining of the stomach. These early changes rarely produce symptoms and often go undetected. Screening for stomach cancer is widely practiced in Japan and has reduced the death rate from stomach cancer.[35] General population screening is not recommended in low-incidence countries such as the United States.

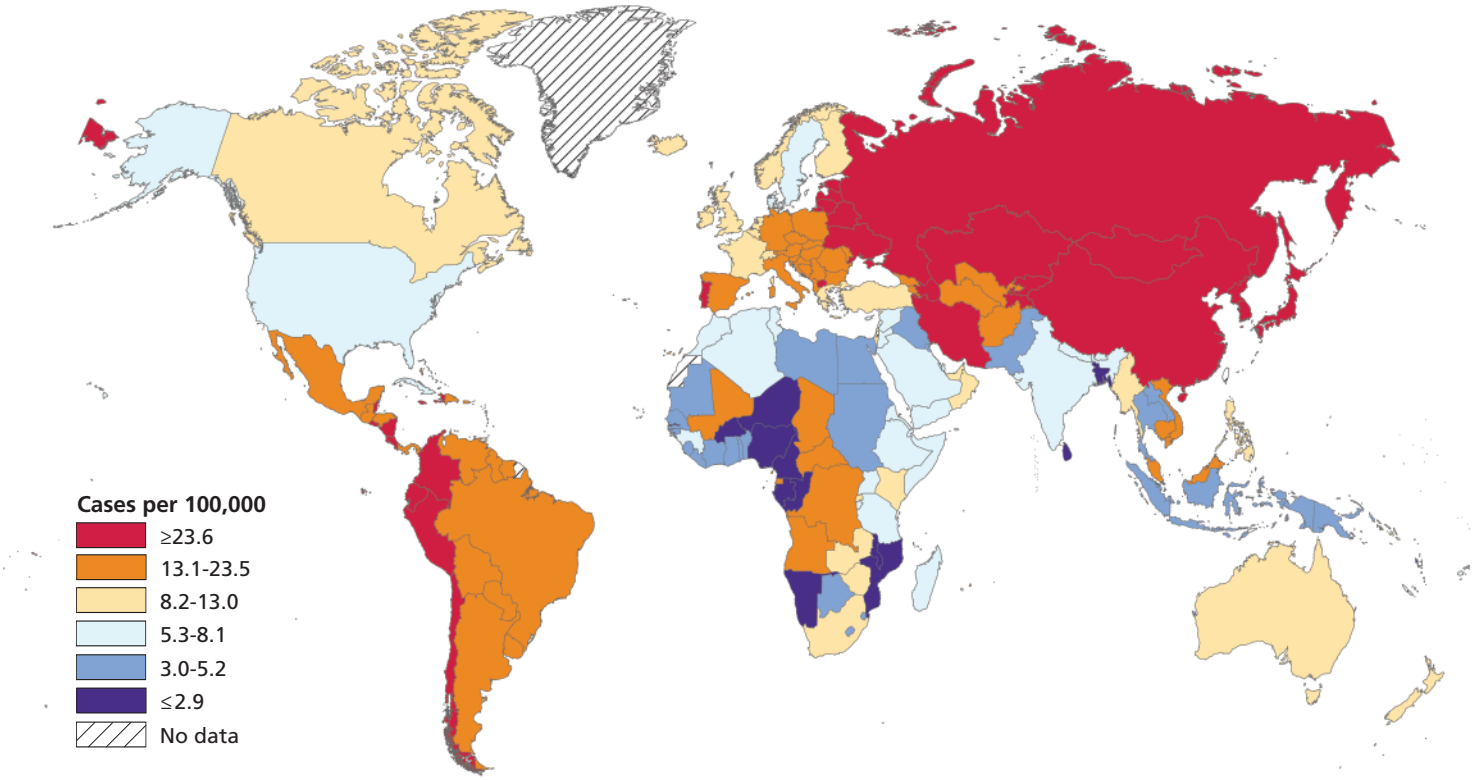
Treatment: Cancer of the stomach is difficult to cure unless it is found in an early stage. Unfortunately, because early stomach cancer causes few symptoms, the disease is usually advanced when the diagnosis is made. The main treatments for stomach cancer are surgery, chemotherapy, and radiation therapy. Often the best approach uses two or more of these treatment methods. If a cure is not possible, treatment is aimed at relieving symptoms.

Survival: In the United States, the five-year survival rate for stomach cancer is 24%. Survival rates improve to 61% if cancer is detected at early stages of the disease. However, less than 25% of stomach cancers are diagnosed at an early stage. In contrast, the disease is diagnosed frequently at early stages in Japan due to early detection services. In Europe, the five-year relative survival is about 20% in men and 25% in women.

Liver

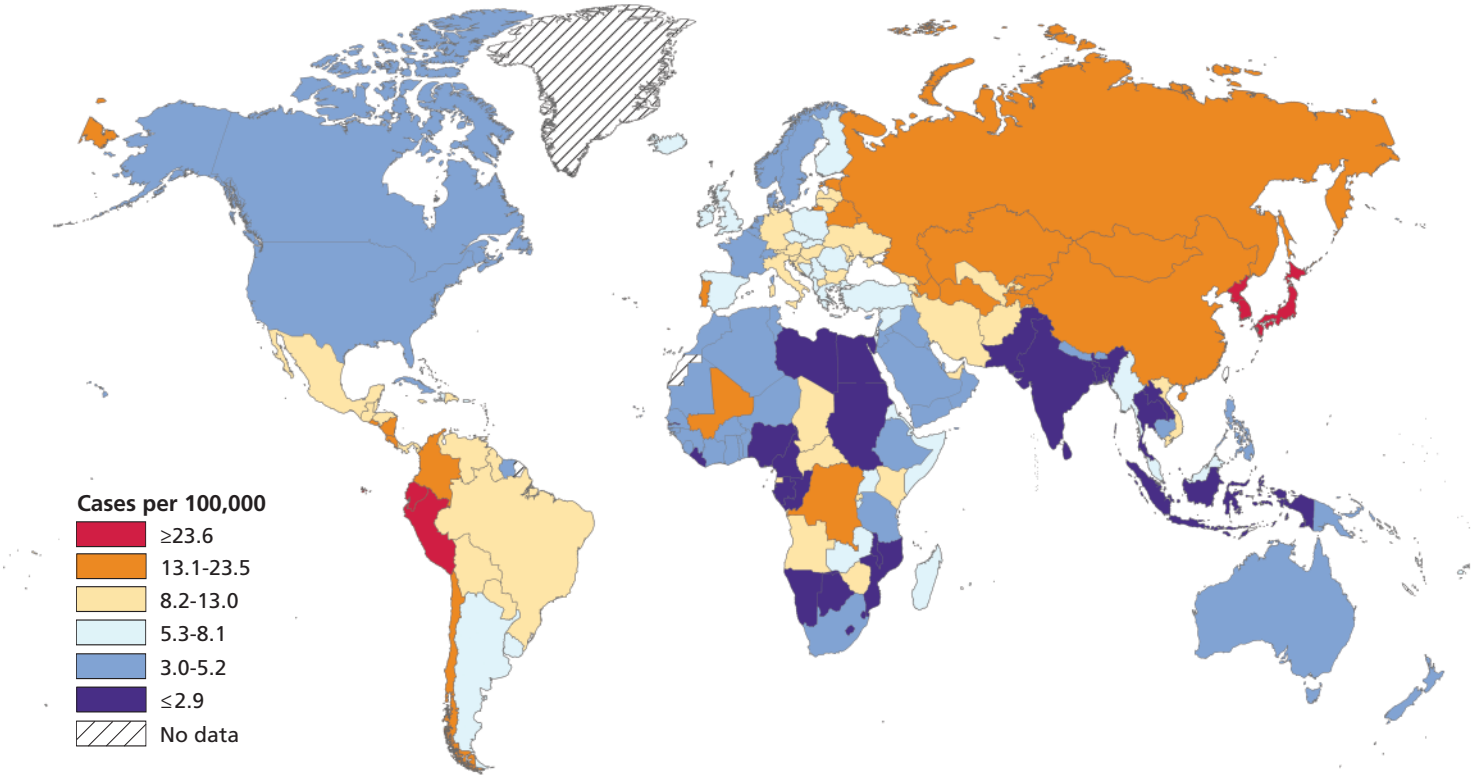
New cases: Liver cancer is the fifth most common cancer in men and the eighth in women. An estimated 711,000 new liver cancer cases will occur in the world during 2007. More than 80% of these cases occur in developing countries, with China alone accounting for over 55% of the total. Rates are more than twice as high in men as in women. Liver cancer rates are the highest in West and Central Africa and in Asia (Figures 10a and 10b). In contrast, incidence rates are lowest in developed countries, with the exception of Japan. Among primary liver cancers occurring worldwide, hepatocellular

Figure 9a. International Variation in Age-Standardized Stomach Cancer Incidence Rates Among Males



Source: Globocan 2002.

Figure 9b. International Variation in Age-Standardized Stomach Cancer Incidence Rates Among Females



Source: Globocan 2002.

carcinoma represents the major histologic type and likely accounts for 70%-85% of cases.[36]

Deaths: Liver cancer is the third leading cause of cancer death in men and the sixth among women. About 680,000 people worldwide are projected to die from liver cancer in 2007.

Global trends: Liver cancer incidence is increasing in areas with historically low rates, including Oceania, Central Europe, and North America, and it is decreasing in historically high-rate areas, including China, Singapore, and India. Reasons for these trends are not entirely clear, but are thought to reflect increased prevalence of hepatitis C virus infection.[37]

Signs and symptoms: Most people do not experience symptoms in the early stages of liver cancer. Symptoms may include weight loss, lack of appetite, sense of fullness after a small meal, a mass that can be felt in the area of the liver, ongoing stomach pain, swelling in the area of the stomach, or yellow-green color to the skin and eyes (jaundice).

Risk factors: Liver cancer is strongly associated with chronic infection of hepatitis B virus (HBV) or hepatitis C virus (HCV). Both HBV and HCV are transmitted by intimate person-to-person contact or direct contact with infectious blood or blood-derived body fluids. This can occur through contaminated injections, sexual intercourse with an infected partner, birth to an infected mother, or contact with contaminated surfaces. HBV infection is endemic in Southeast Asia and Sub-Saharan Africa (Table 7); HCV is also most prevalent in the African and Eastern Mediterranean WHO regions (Table 8). Excessive alcohol consumption and consuming foods contaminated with aflatoxins (a toxin produced by a fungus that infests grains, peanuts, soybeans, and corn that have been stored in warm, moist conditions) are also important causes of liver cancer worldwide. There is growing evidence that obesity, with its association with increased risk of diabetes mellitus and nonalcoholic steatohepatitis, is a risk factor for liver cancer. In developing countries, 59% of liver cancers are attributable to HBV and 33% are attributable to HCV. In developed countries, 23% of liver cancers are attributable to HBV, while 20% are attributed to HCV.[1]

Prevention and early detection: Preventive strategies for liver cancer include routine vaccination of all infants against hepatitis B infection, screening of blood products, measures to prevent injections with needles contaminated with hepatitis B and C, avoidance of excessive alcohol consumption, and policies to reduce aflatoxin contamination of the food supply.

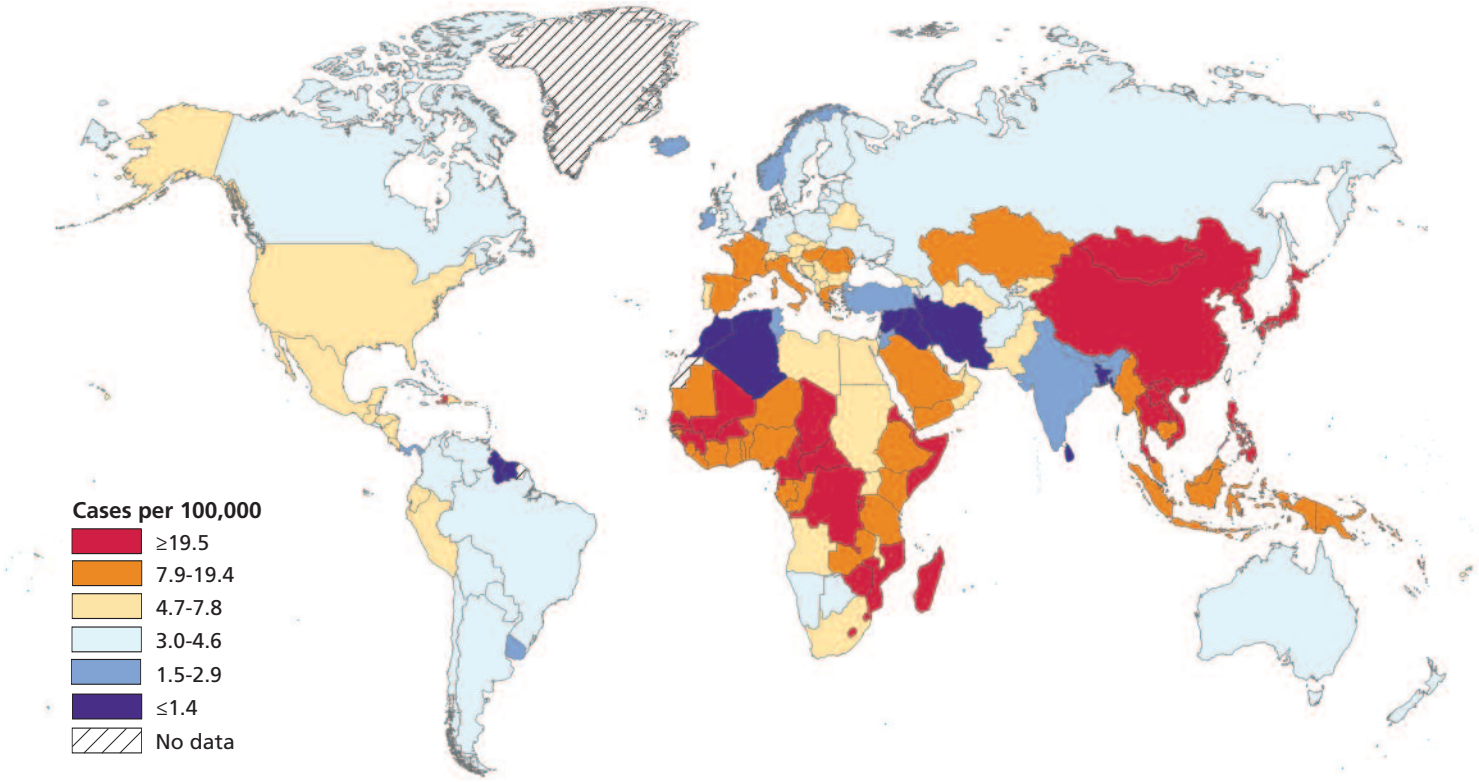
In 1992, WHO recommended that all countries include hepatitis B vaccine in routine infant immunization programs. Due to lack of resources, however, universal infant hepatitis B immunization programs have not been implemented in most high-risk areas, especially in most Sub-Saharan African countries. The Global Alliance for Vaccines and Immunization is a major initiative launched in 2000 to bring together WHO, national governments, manufacturers, nongovernmental organizations, and donors, such as the Bill and Melinda Gates Foundation, to fund and implement vaccination programs in low-income countries. Vaccination for hepatitis B is being added to national immunization programs. As of 2005, a total of 158 countries have implemented mass vaccination of newborns and infants (55% coverage worldwide) (Figure 11). Other key primary prevention strategies include screening blood donors and maintaining infection control practices (sterilization of injection equipment) to prevent the transmission of health care-

Table 7. Global Patterns of Chronic HBV Infection

	High	Intermediate	Low
Prevalence	≥8%	2%-7%	<2%
Geographic distribution	Southeast Asia; China; Pacific Islands; Sub-Saharan Africa; Alaska; Peru; Northwest Brazil	Mediterranean basin; Eastern Europe; Central Asia; Japan; Amazon basin; Middle East	United States and Canada; Western and Northern Europe; Australia; New Zealand
% of global population	45%	43%	12%
Predominant age at infection	Perinatal and early childhood	All age groups	Adult
Predominant mode of infection	Maternal-infant; percutaneous	Percutaneous; sexual	Sexual; percutaneous
Lifetime risk of infection	>60%	20%-60%	<20%

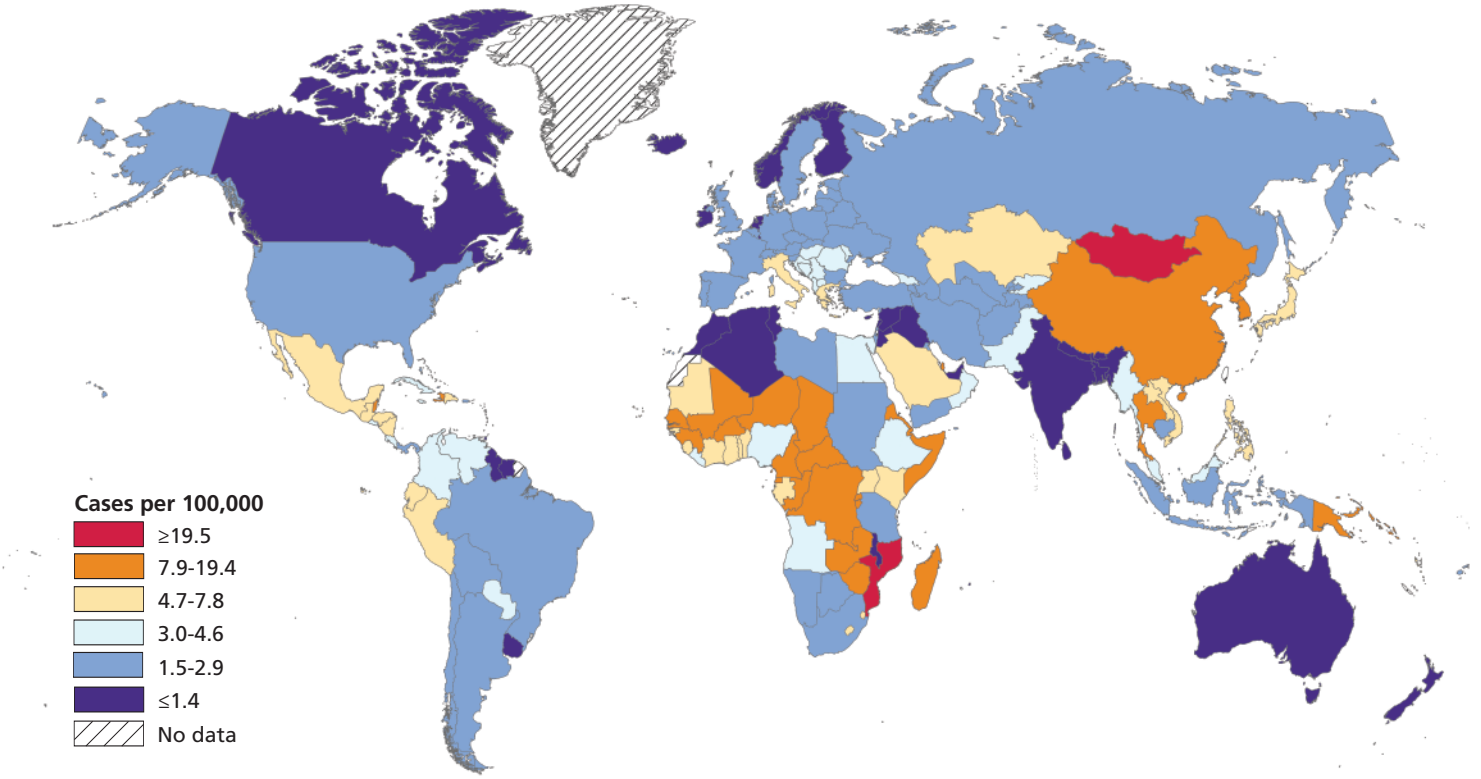
Sources: Seef LB, Hoofnagle JH. Epidemiology of hepatocellular carcinoma in areas of low hepatitis B and hepatitis C endemicity. *Oncogene*. 2006 Jun 26;25(27):3771-7. CDC: http://www.cdc.gov/ncidod/diseases/hepatitis/slideset/hep_b/hep_b.pdf.

Figure 10a. International Variation in Age-Standardized Liver Cancer Incidence Rates Among Males



Source: Globocan 2002.

Figure 10b. International Variation in Age-Standardized Liver Cancer Incidence Rates Among Females



Source: Globocan 2002.

Table 8. Estimated Prevalence of HCV Infection

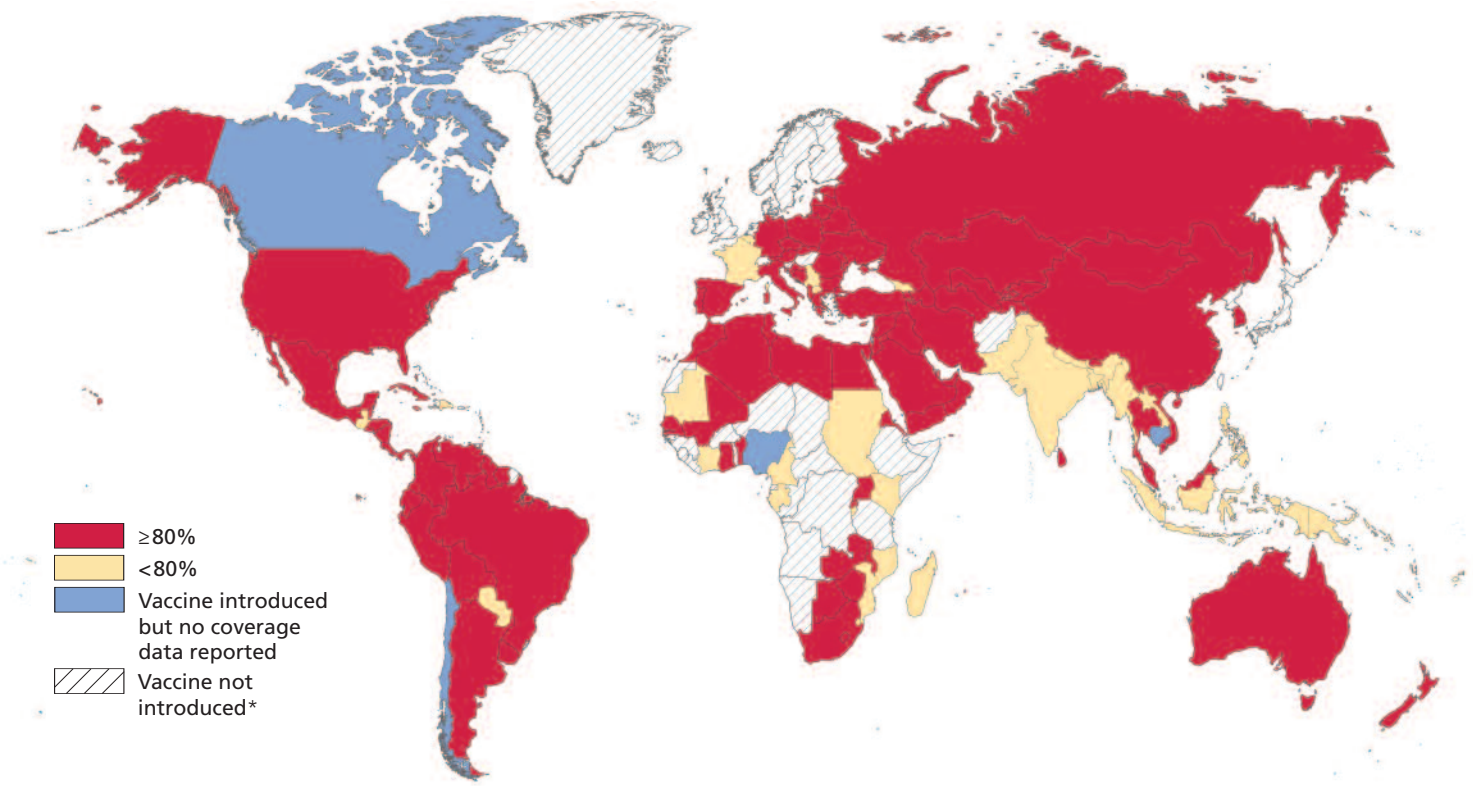
WHO Region	Total Population (Millions)	Prevalence of Hepatitis C Rate %	Infected Population (Millions)	Countries Where Data Are Not Available
Africa	602	5.3	31.9	12
Americas	785	1.7	13.1	7
Eastern Mediterranean	466	4.6	21.3	7
Europe	858	1.0	8.9	19
Southeast Asia	1 500	2.2	32.3	3
Western Pacific	1 600	3.9	62.2	11
Total	5 811	3.1	169.7	57

Source: Weekly Epidemiological Record. N° 49, 10 December 1999, WHO.

related HBV and HCV infections. Screening programs should be given high priority in countries where such activities have not been fully implemented.

In most developed countries, injection drug use and high-risk sexual behaviors are the major risk factors for HCV infection and HBV infection, respectively. There is no vaccine against hepatitis C virus. Needle and syringe exchange programs are used to reduce exposure to the virus among injection drug users. These have been shown to reduce rates of HCV infection in several studies. Screening of blood, organ, tissue, and semen donors for antibodies to HCV and instituting adequate infection control practices during all medical, surgical, and dental procedures are other important measures of primary prevention. However, these preventive measures have not been implemented in many developing countries due to resource constraints. Individuals already infected with HBV or HCV may reduce their risk of liver cancer with antiviral treatments.

Figure 11. Proportion of Infants Covered by National Hepatitis B Immunization Program, 2005



*Includes some countries that have introduced hepatitis B in adolescent immunization schedules.

Source: WHO/UNICEF coverage estimates, 1980-2006, August 2006.

Another approach to reduce liver cancer in some areas of the world is to reduce consumption of foods contaminated with aflatoxins. Crop substitution and improved grain storage practices have been used to reduce contamination with aflatoxin in areas such as Sub-Saharan Africa. Additionally, heavy alcohol consumption and cirrhosis increase the risk for liver cancer. Individuals who consume alcohol should limit their intake to no more than two drinks per day for men and one drink per day for women.[37]

Treatment: Treatment of liver cancer depends on the size and stage of the tumor and whether there is cirrhosis. Treatment may include surgery, chemotherapy, radiation therapy, or percutaneous ethanol injection. Liver transplantation may be recommended as an alternative for some patients.

Survival: Liver cancer is one of the most fatal cancers, with five-year relative survival rates less than 11% even in developed countries.

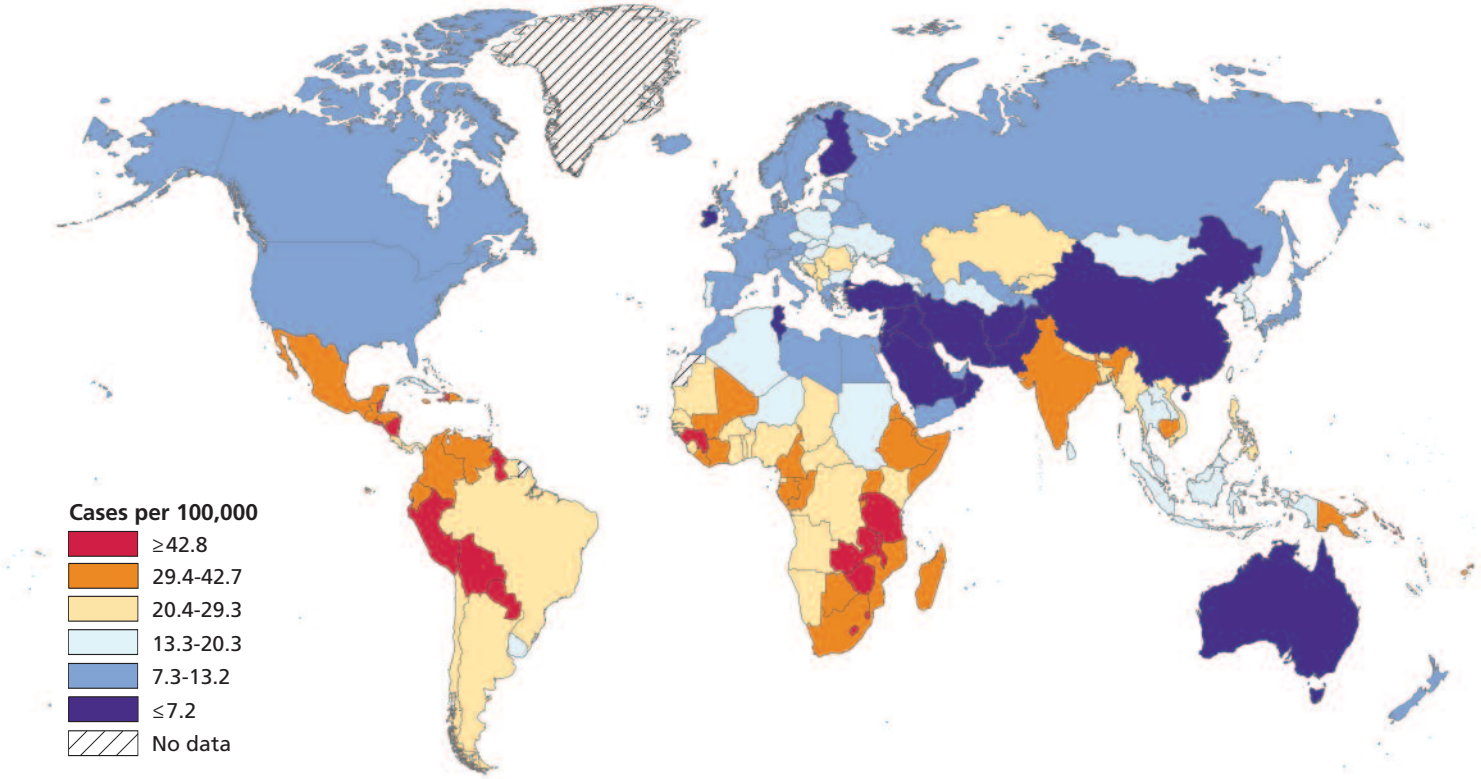
Cervix Uteri

New cases: Cervical cancer is the second most commonly diagnosed cancer in women. An estimated 555,100 new cases will occur in the world during 2007. More than 80% of these cases will occur in developing countries. Worldwide, the highest incidence rates are in Central and South America, the Caribbean, Sub-Saharan Africa, and Southern Asia. Rates are lowest in the Middle East, most of China, and Australia (Figure 12). The disproportionate burden of cervical cancer in developing countries and elsewhere in medically underserved populations is mainly due to lack of screening.

Deaths: Cervical cancer is the third leading cause of cancer death in women worldwide. An estimated 309,800 deaths are expected to occur in 2007. Cervical cancer kills more women in the developing world than any other cancer. More than 85% of annual cervical cancer deaths occur in developing parts of the world: 70,000 cases in Africa, 48,000 in Latin America, and 160,000 in Asia. India, the second most populous country in the world, accounts for 27% of the total cases.

Global trends: Cervical cancer incidence and mortality rates have been declining since the 1960s in many developed countries due to widespread screening and intervention (Figure 13). The incidence and mortality rates from cervical cancer remain high in many parts of Central and South America, Africa, and Asia.

Figure 12. International Variation in Age-Standardized Cervical Cancer Incidence Rates



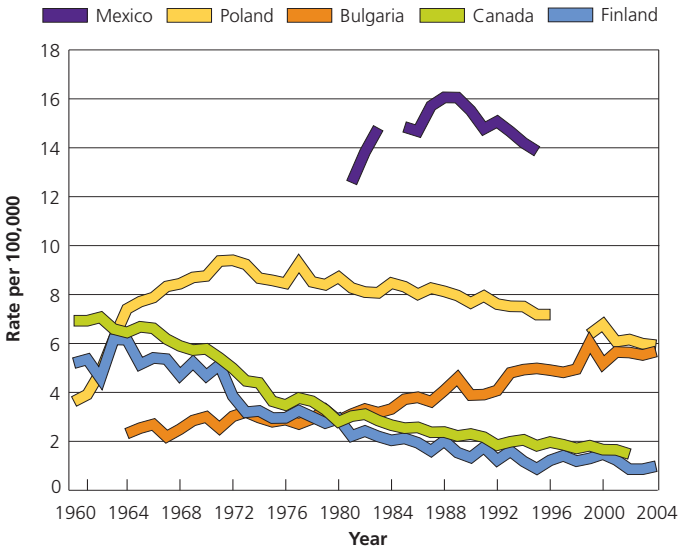
Source: Globocan 2002.

Vaccination against human papilloma virus (HPV) could have a major impact on future rates in these regions.

Signs and symptoms: Symptoms usually do not appear until abnormal cervical cells become cancerous and invade nearby tissue. When this happens, the most common symptom is abnormal vaginal bleeding. Bleeding may start and stop between regular menstrual periods, or it may occur after sexual intercourse, douching, or a pelvic exam. Menstrual bleeding may last longer and be heavier than usual. Bleeding after menopause or increased vaginal discharge may also be symptoms.

Risk factors: Nearly 100% of women with cervical cancer have evidence of cervical infection with HPV, the main cause of cervical cancer. About 40 of the almost 200 HPV types have been found to infect the anogenital tract. A recent pooled analysis of case-control studies from eight countries identified 15 HPV types that are associated with a more than 200-fold increased risk of cervical cancer.[39] Among these, HPV 16 and 18 are most common among cervical cancer patients (associated with 50.5% and 13.1% of cervical cancers, respectively). The cumulative lifetime probability of acquiring a cervical infection with at least one type of HPV is extremely high for sexually active individuals. However, most HPV infections disappear spontaneously within two to four years, and only a small percentage progress to precancer, histologically confirmed cervical intra-epithelial neoplasia grade 3 (CIN3), or carcinoma in situ.

Figure 13. Trends in Age-Standardized Death Rates of Cervical Cancer in Selected Countries



Source: WHO Mortality Database.

Persistence of the infection and progression to cancer may be influenced by many factors, such as immuno-suppression, cigarette smoking, and nutritional factors.

Prevention and early detection: Up to 80% of cervical cancer could be prevented if comprehensive Papanicolaou (Pap) test screening programs were made available. The Pap test is a simple procedure in which a small sample of cells is collected from the cervix and examined under a microscope. It detects both pre-cancerous lesions and early stage cancer. However, many low-resource countries do not have the technical and public health infrastructure to support Pap testing for cervical cancer (Table 9). Therefore, increasing access to and improving quality of screening programs in the high-risk age group of 35-50 years has been identified as a key component of effective programs for the early detection of cervical cancer in low-resource settings. Cost-effective screening methods that are gaining prominence in resource-poor settings include visual inspection using either acetic acid (VIA) or Lugol's iodine (VILI) and DNA testing for human papilloma virus (HPV) in cervical cell samples.[10]

Two companies, the US-based Merck and the UK-based GlaxoSmithKline, have developed vaccines to prevent infection with the most common types of HPV. Merck's Gardasil (which protects against HPV 6, 11, 16, and 18) was approved for use by the US Food and Drug Administration in 2006 for girls and women aged nine to 26. It has also been recommended for approval in the European Union by the European Medicines Agency Committee for Medicinal Product. GlaxoSmithKline's Cervarix is approved in Europe while it is still going through the approval process in the United States. Gardasil showed complete protection against viral strains for women who completed a three-dose course, with no reports of serious side effects. Cost and logistics may limit population-wide vaccination programs in developing countries, at least in the short term. The recommended three doses of vaccine cost about $360 in the United States and 300 euros in Europe.[40]

Treatment: Pre-invasive lesions may be treated by electrocoagulation (the destruction of tissue through intense heat by electric current), cryotherapy (the destruction of cells by extreme cold), laser ablation, or local surgery. Invasive cervical cancers generally are treated by surgery, radiation, or both, as well as chemo-therapy in some cases.[41]

Survival: Relative survival for women with pre-invasive lesions is nearly 100%. When detected at an early stage,

Table 9. Percentage of Women Who Have Ever Been Screened for Cervical Cancer, Selected Developing Countries

	Year of Survey	Age	Total
Central America			
Ecuador	2004	15-49	49.6
El Salvador	2002/2003	15-49	84.7
Guatemala	2002	15-49	36.2
Honduras	2001	15-49	60.9
Paraguay	2004	15-44	70.0
Eastern Europe/EuroAsia			
Albania	2002	15-44	3.0
Romania	1999	15-44	17.0
Azerbaijan	2001	15-44	2.0
Georgia	1999	15-44	4.0
Moldova	1999	15-44	43.0

Source: www.cdc.gov/reproductivehealth/surveys/index.htm [accessed March 14, 2007].

invasive cervical cancer is one of the most successfully treated cancers. The relative five-year survival rate for cervical cancer patients diagnosed at localized stage in the United States is 92%. For all stages combined, survival rates vary widely from less than 30% in Africa to 70% in North America and Northern Europe.

Esophagus

New cases: An estimated 529,000 new cases are expected to occur in 2007 worldwide. The incidence rates of esophageal cancer vary internationally by more than 50-fold. Highest rates are found in East and South Africa and Asia, including China and Central Asia. Lowest rates are found in Western Africa and Southeast Asia in both men and women and in the United States and parts of South America in women (Figures 14a and 14b). This disease is three to four times more common among men than women.

Deaths: About 442,000 people will die from esophageal cancer in 2007, with 85% of these deaths occurring in developing countries.

Global trends: Cancer of the esophagus usually occurs as either squamous cell carcinoma in the middle or upper third of the esophagus, or as adenocarcinoma in the lower third or junction of the esophagus and stomach. The geographic and temporal variations in the incidence of esophageal cancer are larger than for any other cancer. The highest risk areas of the world are in Asia, stretching from northern Iran through the central Asian republics to North-Central China. Here and in other high-risk areas in South Africa and Northern France, most cases are squamous cell carcinomas. The incidence of adenocarcinomas of the lower esophagus has been increasing rapidly in Western countries in recent decades, concomitant with increases in overweight/obesity, chronic gastric reflux, and the pre-malignant condition Barrett esophagus. The decline in chronic *H. pylori* infection has also been hypothesized to contribute to risk by increasing gastric acidity.

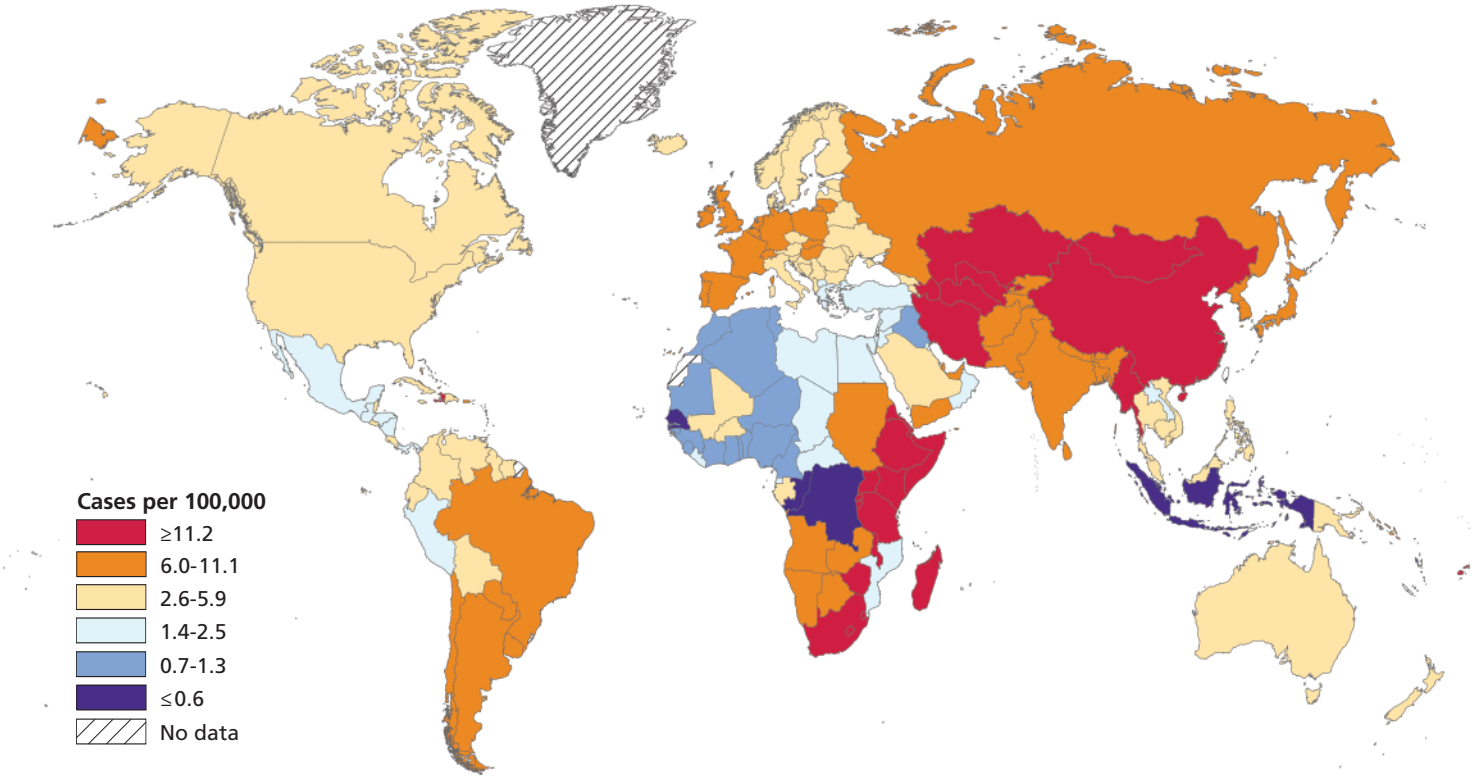
Signs and symptoms: It is unusual to have signs and symptoms of esophageal cancer in the early stages of the disease. When cancer is more advanced, the most common signs of esophageal cancer are painful or difficult swallowing and weight loss.

Risk factors: The greatest risk factors for esophageal cancer are heavy drinking and smoking, accounting for almost 90% of total cases. A diet lacking fresh fruits and vegetables also increases risk. Chronic gastric reflux (stomach contents entering the lower section of the esophagus) irritates the esophagus and, over time, can lead to Barrett's esophagus, a condition in which the cells lining the lower part of the esophagus have changed or been replaced with abnormal cells that could lead to cancer of the esophagus. Chronic gastric reflux is more common in overweight men and women.

Prevention and early detection: Reducing the use of tobacco and alcohol can reduce the incidence of squamous cell carcinoma of the esophagus. At least 90% of cases of squamous cell esophageal cancer in the United States may be attributable to alcohol and tobacco use and low fruit and vegetable consumption.[41] A diet high in green and yellow fruits and vegetables and cruciferous vegetables (such as cabbage, broccoli, and cauliflower) may lower the risk of developing squamous cell cancer of the esophagus. The strongest risk factors for adenocarcinoma of the esophagus are overweight and obesity, chronic gastroesophageal reflux disease, smoking, and low fruit and vegetable consumption. Together, these account for about 80% of the cases of adenocarcinoma of the esophagus in the United States.[42] Some studies have shown that the use of nonsteroidal anti-inflammatory drugs (such as aspirin and other drugs that reduce fever, swelling, pain, and redness) is associated with a reduced risk of developing adeno-carcinoma of the esophagus.

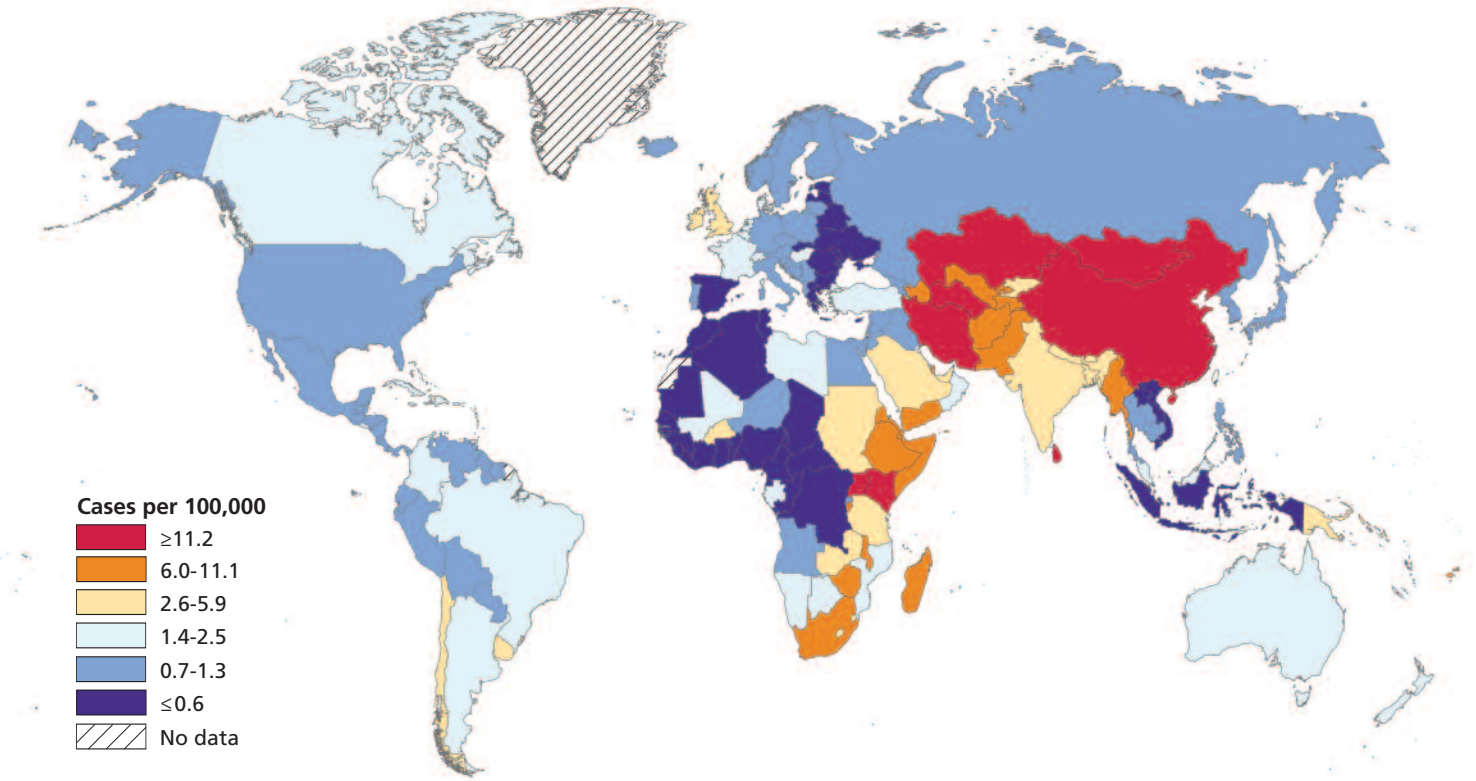
Treatment: Surgery, chemotherapy, and radiation are used to treat early cancer of the esophagus. There are also treatments to help relieve pain and help with symptoms.

Figure 14a. International Variation in Age-Standardized Esophagus Cancer Incidence Rates Among Males



Source: Globocan 2002.

Figure 14b. International Variation in Age-Standardized Esophagus Cancer Incidence Rates Among Females



Source: Globocan 2002.

Survival: Because esophageal cancer is usually diagnosed at a late stage, most people with esophageal cancer eventually die of this disease and, thus, survival rates vary little between developing and developed countries. In the United States, 17% of white patients and 10% of African American patients survive at least five years after diagnosis. In Europe, less than 15% of patients survive five years after diagnosis.

Childhood Cancer

Childhood cancers account for no more than 2% of all cancers, yet they are a leading cause of childhood death in developed countries such as the United States. About 12% of childhood deaths in the US are due to cancer. It is more difficult to measure the incidence of childhood cancer accurately in developing countries, where cases are often unreported due to the greater frequency of deaths from infectious diseases and malnutrition. However, the great majority of children, and 80% of children with cancer, live in developing countries.[43] Leukemia is the most common form of cancer for children in most countries except in Africa, where Kaposi sarcoma and Burkitt lymphoma are predominant (Figure 15).

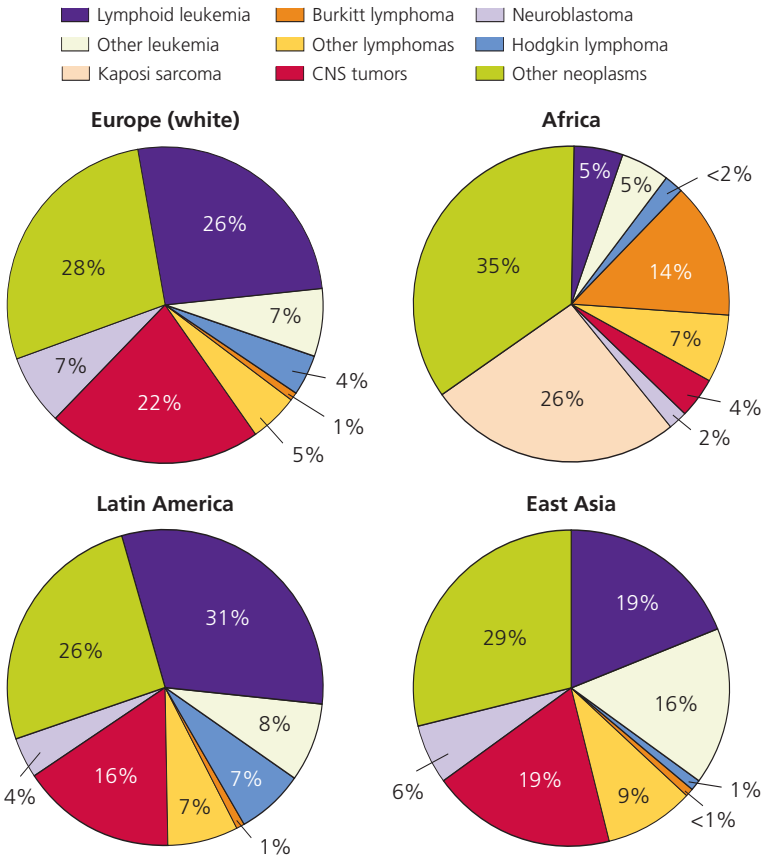
New cases: An estimated 161,000 new cancer cases are expected to occur among children aged 0-14 in 2007. Generally, the incidence rates are higher in developed than in developing countries, partly because of more complete diagnoses. High rates are also reported in Latin America.

Deaths: Worldwide, about 87,000 children will die from cancer in 2007. Mortality rates are lowest in developed countries, despite higher incidence rates. This reflects better diagnosis and access to improved treatments.[44] Cancer is emerging as a major cause of childhood death in Asia, Central and South America, northwest Africa, and the Middle East, where fewer children are now dying from preventable infectious diseases.

Global trends: Mortality from childhood cancer in general, and childhood leukemia in particular, has sharply declined in economically developed countries over the past 40 years.[45] Declines in mortality for childhood cancers are due largely to current treatment modalities. Concern has been raised in the United States and Europe that overall rates of childhood cancer have been increasing since 1970. In the US, the childhood (0-14 years) cancer incidence rate has increased from 11.5 per 100,000 in 1975 to 14.8 per 100,000 in 2004. Although these trends in part are recognized to be the result of improved diagnosis and reporting methods, investigators in some regions have found a true increase in the occurrence of some childhood cancers.[46]

Risk factors: The causes of most childhood cancers are unknown. Some relatively rare cancers are known to be attributable to inherited genetic conditions. Exposure to ionizing radiation is a risk factor for several types of leukemia. Worldwide, the most common examples of infection-related childhood cancers are Burkitt lymphoma, Hodgkin disease, and nasopharyngeal carcinoma (all associated with Epstein-Barr virus), liver carcinoma (HBV), and Kaposi sarcoma (HIV and Human Herpes Virus 8). Some of these cancers, such as Burkitt lymphoma, are common regionally in developing

Figure 15. Distribution of Cancers in Children Younger than 15 Years, Selected Populations



Source: Cancer Atlas, 2006.

countries, but these account for a very small proportion of childhood cancer in western countries.

Signs and symptoms: Symptoms include unusual mass or swelling; unexplained paleness and loss of energy; sudden tendency to bruise; a persistent, localized pain; prolonged, unexplained fever or illness; frequent headaches, often with vomiting; sudden eye or vision changes; and excessive, rapid weight loss.

Prevention and early detection: Early symptoms are usually non-specific. Parents should make sure their children have regular medical checkups and should be alert to any unusual symptoms that persist.

Treatment: Childhood cancers can be treated by a combination of therapies (surgery, radiation, chemotherapy) chosen based on the type and stage of the cancer. Treatment is coordinated by a team of experts including pediatric oncologists, pediatric nurses, social workers, psychologists, and others who assist children and their families. Treating childhood cancer does not have to be expensive. By developing treatment regimens that account for the capacity of a country's medical facilities and providing proper training and advice to local doctors, progress can be made on relatively limited funds. However, more than 60% of the world's children with cancer have little or no access to effective therapy. The geographic and socioeconomic inequalities in cancer treatment pose challenges that have only begun to be addressed.[47]

Survival: Survival from childhood tumors largely depends on the availability of effective treatment.[48] Significant advances have been made in diagnosis and therapy during the past four decades and childhood cancer can largely be cured if detected early. In the economically developed world, overall five-year childhood cancer survival rates are around 75%. Among the 11 main childhood cancer types, European five-year survival rates are similar to those in the United States with the exception of neuroblastoma, renal tumors, bone tumors, and soft tissue sarcomas, for which survival is higher in the US[49] (Table 10). In contrast, overall survival rates are much lower in the developing world. In a large study conducted recently in seven Central American countries, more than 2,000 children affected by all types of malignancies were followed to assess three-year survival; the three-year survival ranged from 48%-62%, with marked variations across the seven countries.[50]

Childhood cancer is generally not a public health priority in developing countries. With the burden of HIV/AIDS, malaria, and other infectious diseases – even the lack of clean drinking water – treatment for cancer is often regarded as unaffordable. In developing countries, many children who have cancer are never diagnosed, are diagnosed too late, or are diagnosed where treatment is limited or not available. Poverty contributes to the poor outcomes for children with cancer in many ways. The International Union Against Cancer (UICC) My Child Matters initiative aims to improve the early diagnosis, treatment, care, and support of children with cancer in the developing word. Projects focus on the dissemination of information about cancer in children to health professionals, children's organizations, and the general public; improving early diagnosis and access to health care; and strengthening support for children with cancer and their families.[51]

In addition, the International Network for Cancer Treatment and Research (INCTR) has established networks of various types around several childhood cancers: acute lymphocytic leukemia, retinoblastoma, and Burkitt lymphoma. INCTR also has helped to establish "cooperative groups" that work together toward specific goals. These include the Leukemia Study Group of India, the Middle East Children's Cancer Group, and the Retinoblastoma Group of Mexico.

Table 10. Observed Five-Year Survival Rates (%) for Childhood Cancer (0-14 years) in Europe and the US, 1988-1997

	Europe*	US†
Leukemia	73	76
Lymphomas	84	85
CNS tumors	64	67
Neuroblastoma	59	68
Retinoblastoma	93	96
Renal tumors	84	91
Hepatic tumors	57	55
Malignant bone tumors	61	69
Soft tissue sarcoma	65	75
Germ-cell tumors	84	86
Carcinomas	89	90
All diagnostic groups	72	76

Survival is based on cases diagnosed from 1988-1997 and followed through 2000. CNS=central nervous system.

*Sankila R, Martos Jimenez MC, et al. Geographical comparison of cancer survival in European children (1988-1997): report from the Automated Childhood Cancer Information System project. *Eur J Cancer*.2006;42:1972-80.

†Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov) SEER*Stat Database: Incidence – SEER 9 Regs Limited-Use, Nov 2002 Sub (1973-2000), National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2003, based on the November 2002 submission.

Special Section: The Tobacco Epidemic

Tobacco use is the single most preventable cause of death worldwide, responsible for the deaths of approximately half of all long-term users.[52] An estimated five million people died from tobacco use in 2000, representing about 12% of adult deaths.[53] Of these, about 30% (1.42 million deaths) resulted from cancer, with 850,000 annual deaths from lung cancer alone.[54] The number of deaths attributable to tobacco use is increasing rapidly due to widespread smoking in populous developing countries. If current smoking patterns continue, the number of tobacco-related deaths will rise to 8.3 million deaths per year by 2030, with more than 70% of these deaths occurring in developing countries.[55] Overall, tobacco killed about 100 million people globally in the 20th century, and use of tobacco is largely responsible for the "cancer epidemic" observed in industrialized countries in the latter part of the century. Tobacco is projected to kill more than one billion people in the 21st century, with the great majority of these deaths occurring in developing countries.[56] Halting the rapid increase in tobacco consumption in developing countries is an urgent global health priority.

The World Health Organization (WHO) estimates that there are approximately 1.3 billion smokers in the world. This represents about one-third of the global population aged 15 and older, with approximately 84% of smokers living in countries with a developing or transitional economy.[57] If current smoking prevalence patterns remain unchanged, by 2030 there will be two billion smokers worldwide.[24] This is largely due to the population expansion in developing countries. Projections based on data from the Food and Agriculture Organization of the United Nations indicate that tobacco consumption will rise in most developing countries but fall in most high-income countries, such as Britain, Canada, the United States, Australia, and northern Europe.[58]

Tobacco Products

There is no safe way to use tobacco, regardless of whether it is smoked, chewed, sucked, sniffed into the nose, or mixed with other ingredients. Among different types of tobacco use, cigarettes account for the largest share of manufactured tobacco products in the world (96% of total sales).

Chewing tobacco is used widely throughout the world, especially in South and Southeast Asia. In Mumbai, India, for example, 56% of women chew tobacco, although few smoke cigarettes. Tobacco is frequently consumed as *paan* in India and neighboring countries. Paan is a prepartion of tobacco and various other ingredients, usually including lime and betel nut (*Areca catechu*), wrapped in the leaves of the betel pepper (*Piper betle*) vine and fastened with a toothpick or clove. *Gutkha*, a concoction of crushed betel nut, tobacco, and molasses or other flavors, is another form of oral tobacco found in India. These tobacco products are often marketed as digestive aids, breath fresheners, or, in the case of gutkha, as candy for children. *Bidis* – conical cigarettes made with flaked tobacco hand-wrapped in a dried temburni leaf and tied with string – are the most commonly smoked tobacco products in India. Bidis can deliver more tar and carbon monoxide than a manufactured cigarette. In Sudan, the use of smokeless tobacco called *toombak* is widespread. Toombak is dipped in the saliva of the oral cavity or, less frequently, sniffed into the nasal cavities.

In the current era of economic globalization, some forms of tobacco consumption historically localized to specific regions of the world have spread far beyond their area of origin. For instance, the waterpipe (also known as hookah, shisha, or nargile) has become increasingly popular in the United States and Europe. The rise in waterpipe use in the United States may be a result of marketing for hookah cafés geared toward 18- to 24-year-olds. These young adults appear to be the fastest-growing population of hookah users, especially in and around colleges and universities.[59] Regional forms of tobacco use, such as waterpipes, may gain footholds in new markets based on their exotic cachet, but they rarely, if ever, displace the overwhelming market share held by manufactured cigarettes. Instead, they frequently serve as a gateway to addiction, luring youth and other fad smokers into a lifelong dependence on cigarettes.

Health Effects

In 1964, the United States Surgeon General's report publicized epidemiological research conclusively showing that cigarette smoking was a definite cause of cancers of the lung and larynx in men and chronic bronchitis in both men and women.[60] Since then, the number of diseases associated with smoking has continued to grow. Tobacco use causes approximately 15

different types of cancer (lung, larynx, oral cavity, pharynx, lip, nasopharynx, nasal cavity and paranasal sinuses, esophagus, bladder, kidney, pancreas, uterine cervix, stomach, and acute myeloid leukemia), cardiovascular diseases, adverse reproductive outcomes, cataracts, pneumonia, abdominal aortic aneurysm, and periodontitis.[61]

Among the world's current smokers, about 50%, or 650 million people, will die from their habit – each losing an average of about 20 years of life.[62] This number is expected to rise in the near future as more people in low- and middle-income countries take up smoking regularly.

Figure 16 illustrates the stages of the tobacco epidemic and the time lag between uptake of smoking and deaths. In countries where prevalence is on the rise, the full impact of the resulting burden of disease on their economic and social well-being is enormous. The capacity of developing countries to undertake significant tobacco control measures varies according to social, cultural, political, and economic factors related to tobacco and tobacco products. There is an urgent need for concerted global action to combat this epidemic.

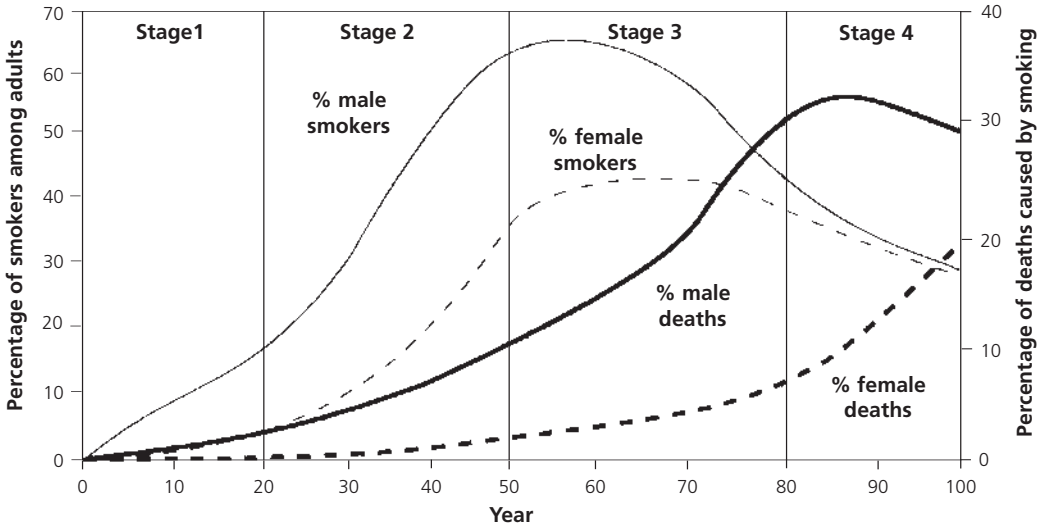
Between 2002-2030, tobacco-attributable deaths are projected to double from 3.4 million to 6.8 million in low- and middle-income countries.[55] In countries such as India and China, the tobacco epidemic seems to be unfolding much as it did in the United States and in Europe some 40 years ago, particularly among men. China's per capita consumption of cigarettes more than quadrupled between 1965-1995. Today, there are about 350 million smokers (60% of men and 3% of women) in China – more than the entire population of the United States. If the current smoking patterns in China continue, around 100 million Chinese men now aged 0-29 will die as a result of their tobacco use.

Tobacco also produces severe negative economic impacts on developing countries and on poor households, such as the cost of tobacco resulting in less money to purchase food. In 2004, the price of a pack of Marlboro cigarettes or an equivalent brand would buy a dozen eggs in Panama, a kilogram of fish in Ghana, or six kilograms of rice in Bangladesh.[24] One study in Bangladesh found that the typical poor smoker could add more than 500 calories to the diet of one or two children with his or her daily tobacco expenditure. Applied to the whole country, an estimated 10.5 million people who are currently malnourished could have an adequate diet if money spent on tobacco were instead spent on food, saving the lives of 350 children per day.[63]

The Risks of Secondhand Smoke

Nonsmokers may be exposed to smoke within their own homes, in workplaces, or in social situations such as bars or restaurants. Smokers damage not only their own health, but also the health of those around them. Adults chronically exposed to others' tobacco smoke also face increased risk of lung cancer and cardiovascular disease. Although the relative risks are much smaller than those for active smokers (on the order of 1.2-1.4), the impact on

Figure 16. Stages of the Worldwide Tobacco Epidemic



Source: Lopez AD, Collishaw NE, Piha T. A descriptive model of the cigarette epidemic in developed countries. *Tob Control*. 1994;3:242-7.

Table 11. Exposure* to Secondhand Smoke (SHS) Among Students Aged 13-15 Years Who Had Never Smoked Cigarettes†, by World Area

	All students who never smoked		Exposed to SHS at home		Exposed to SHS in places other than home	
	%	95%CI	%	95%CI	%	95%CI
Africa	79.3	75.5-82.7	22.6	19.5-26.1	38.2	34.2-42.4
Americas	54.9	50.8-59.0	39.1	31.6-47.2	41.7	36.9-46.6
Eastern Mediterranean	84.4	80.2-87.8	37.0	33.7-40.4	42.9	39.0-47.0
Europe	68.0	66.0-70.8	71.5	64.6-76.0	79.4	73.9-83.7
Southeast Asia	87.4	83.8-90.2	42.8	35.2-49.7	38.8	35.9-41.7
Western Pacific	69.8	66.1-73.2	57.3	48.5-65.3	52.6	49.2-56.1
Total	80.3	76.7-83.4	46.8	39.9-52.5	47.8	44.1-51.3

*Determined by answers to two questions: "During the past seven days, on how many days have people smoked in your home, in your presence?" and "During the past seven days, on how many days have people smoked in your presence, in places other than in your home?" Students who answered one or more days were considered exposed to SHS; †Defined as a response of "no" to the question, "Have you ever smoked a cigarette, even one or two puffs?"

Adapted from: Centers for Disease Control and Prevention. Exposure to secondhand smoke among students aged 13-15 years – worldwide, 2000-2007. MMWR. 2007;56:497-500.

Source: Global Youth Tobacco Survey, 2000-2007.

the population's health is large because of the number of people exposed to environmental tobacco smoke (Table 11). For example, secondhand smoke exposure at home causes about 5,200 and 6,350 deaths from ischaemic heart disease annually in the UK and New Zealand, respectively (Table 12).

Babies born to smoking mothers are significantly more likely than babies of nonsmokers to have a low birth weight and up to 35% more likely to die in infancy.[64] Recent research has shown that a carcinogen found only in tobacco smoke is present in the urine of newborn babies born to smokers.[65] Children residing in smoking households also face higher risks of respiratory disease, asthma, and middle ear infections.

Table 12. Annual Deaths Caused by Exposure to Secondhand Smoke at Home in the United Kingdom and New Zealand

UK	
Lung cancer	1,372
Ischaemic heart disease	5,239
Stroke	4,074
New Zealand	
Lung cancer	1,412
Ischaemic heart disease	6,369
Stroke	626‡

‡Deaths before age 75.

Sources: Jamrozik K. Estimate of deaths attributable to passive smoking among UK adults: database analysis. *BMJ*. 2005;330:812. Woodward A, Laugesen M. How many deaths are caused by second hand cigarette smoke? *Tob Control* 2001;10:383-8.

Health Benefits of Smoking Cessation

Smoking cessation has large immediate and long-term health benefits for smokers of all ages. The excess risk of death from smoking decreases soon after cessation and continues to fall for at least 10-15 years.[66] Former smokers live longer than continuing smokers, no matter what age they stop smoking, though the impact of quitting on mortality is greatest at younger ages. For smokers who stop before age 35, life expectancy is about the same as that for nonsmokers.

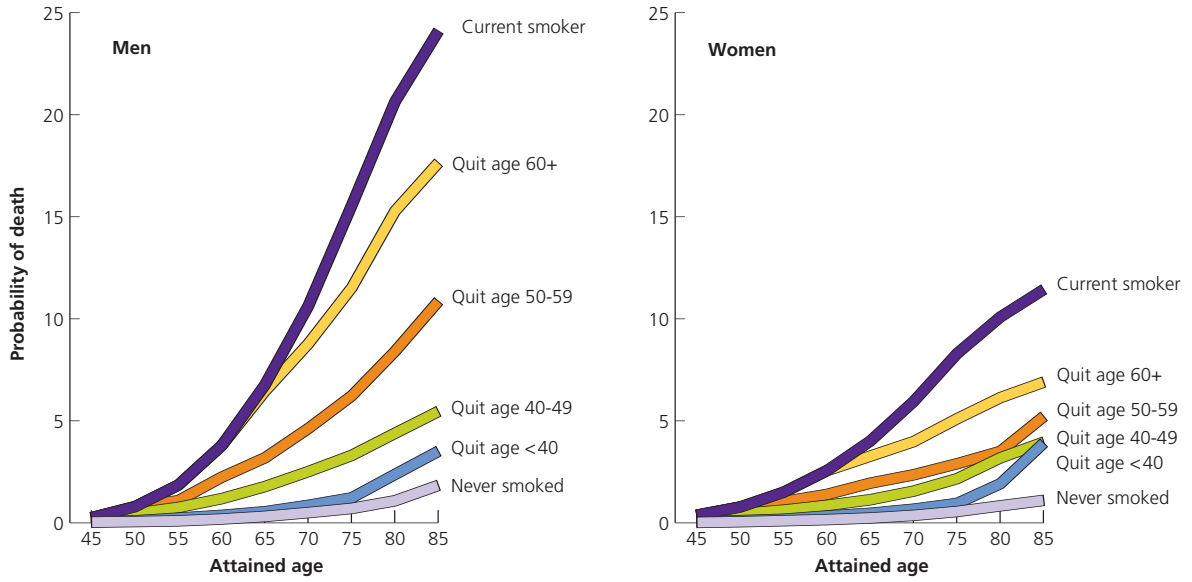
The rate and extent of reduction of risk varies between diseases – for lung cancer the risk falls over 10 years to about 30%-50% that of continuing smokers, but the risk remains elevated even after 20 years of abstinence (Figure 17). There is a benefit from quitting at all ages, but stopping before age 30 removes 90% of the lifelong risk of lung cancer. The excess risk of oral and esophageal cancer caused by smoking is halved within five years of cessation.

Smoking Patterns

Adults

Almost one billion men in the world smoke – about 35% of men in developed countries, and 50% in developing countries. In most high-income countries, the number of smokers has been declining for decades, although it

Figure 17. Probability of Death from Lung Cancer: CPS-II Men and Women, 1984-1991



CPS (Cancer Prevention Study) is a cohort study of more than one million participants in the US. CPS II was launched in the early 1980s by the American Cancer Society.

Source: Thun MJ et al, 2002.[51]

continues to rise in some population groups. In low- and middle-income countries, by contrast, the number of smokers has been increasing. Trends in both developed and most developing countries show that male smoking prevalence has now peaked and is slowly declining worldwide. Due to population growth in developing countries and increases in female smoking prevalence in some parts of the world, the overall number of smokers has been increasing.

About 250 million women in the world are daily smokers, 22% of women in developed countries and 9% of women in developing countries. In some parts of South Asia, the prevalence of smokeless tobacco use is estimated to be as high as 30% in females, compared with 25% in males.

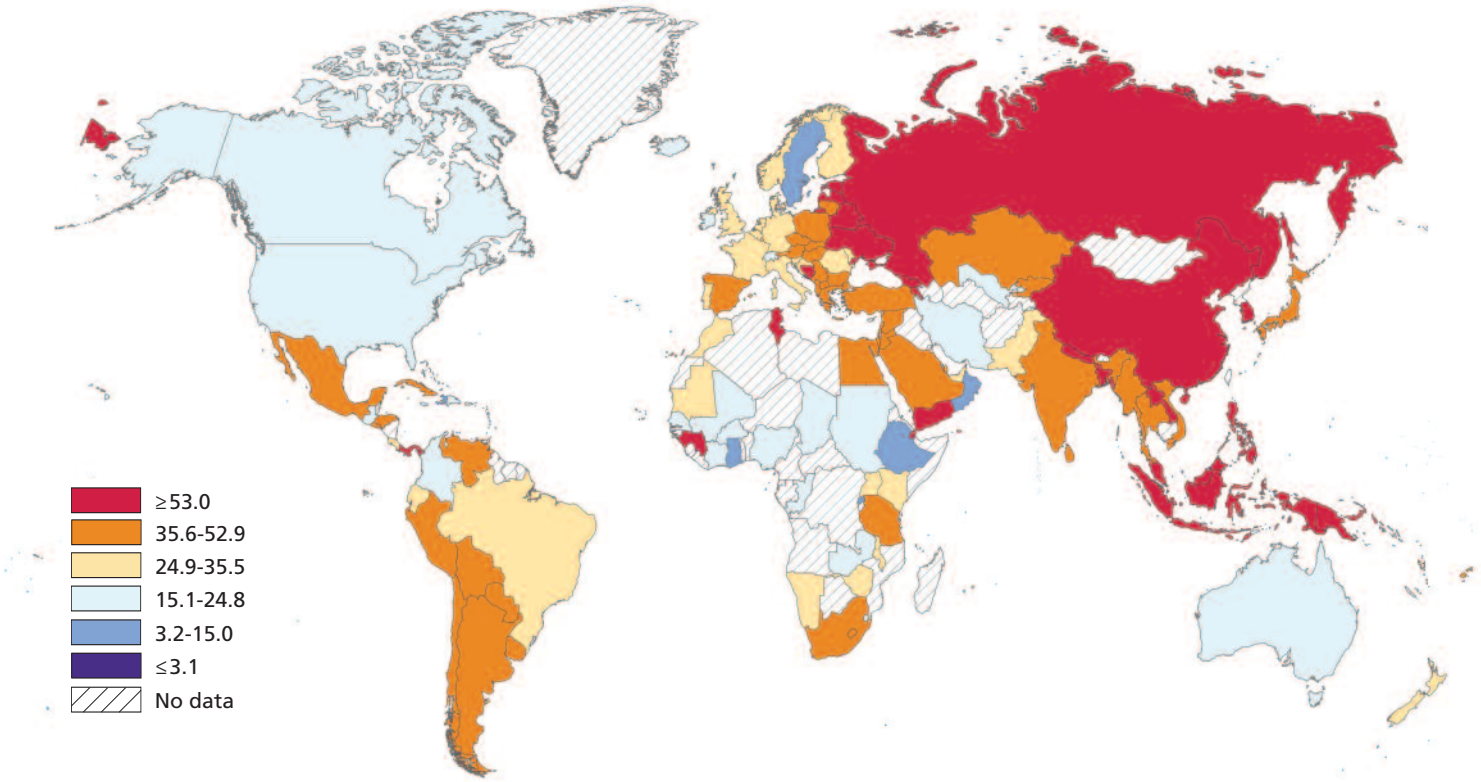
Cigarette smoking among women is declining in some developed countries, notably Australia, Canada, the UK, and the United States. However, in several southern, central, and eastern European countries, cigarette smoking among women is either still increasing or has not shown any decline. Female smoking rates in both developing and developed nations are expected to converge at 20%-25% by 2030.

Although worldwide fewer women smoke than men, the number of women smokers has been increasing, particularly in developing countries.[67] The tobacco industry is targeting women with marketing strategies calculated to tap the large population of women who do not use tobacco. Recent increases in smoking prevalence by women have been reported in Cambodia, Malaysia, and Bangladesh. Women's smoking rates are higher than those in men in some countries, including the Cook Islands, Nauru, Norway, Papua New Guinea, and Sweden. The trend in Norway and Sweden reflects the substantial decline in male smoking prevalence while the decline among women has been less dramatic. Figures 18a and 18b show current adult smoking prevalence by country. Among men, smoking prevalence is the highest in China, Russia, and Eastern Europe and lowest in most parts of Africa, the Middle East, and North America. Among women, prevalence is highest in Eastern Europe and some parts of South America and lowest in most parts of Africa and Asia.

The percentage of adults who have quit smoking varies greatly between high-income countries and the rest of the world. The prevalence of former smokers is the most reliable indicator of smoking cessation rates within a population. In the United States, the number of former smokers is now approximately equal to the number of current smokers.[68] In contrast, only 11.5% of Chinese reported that they had quit smoking in 2002.[69]

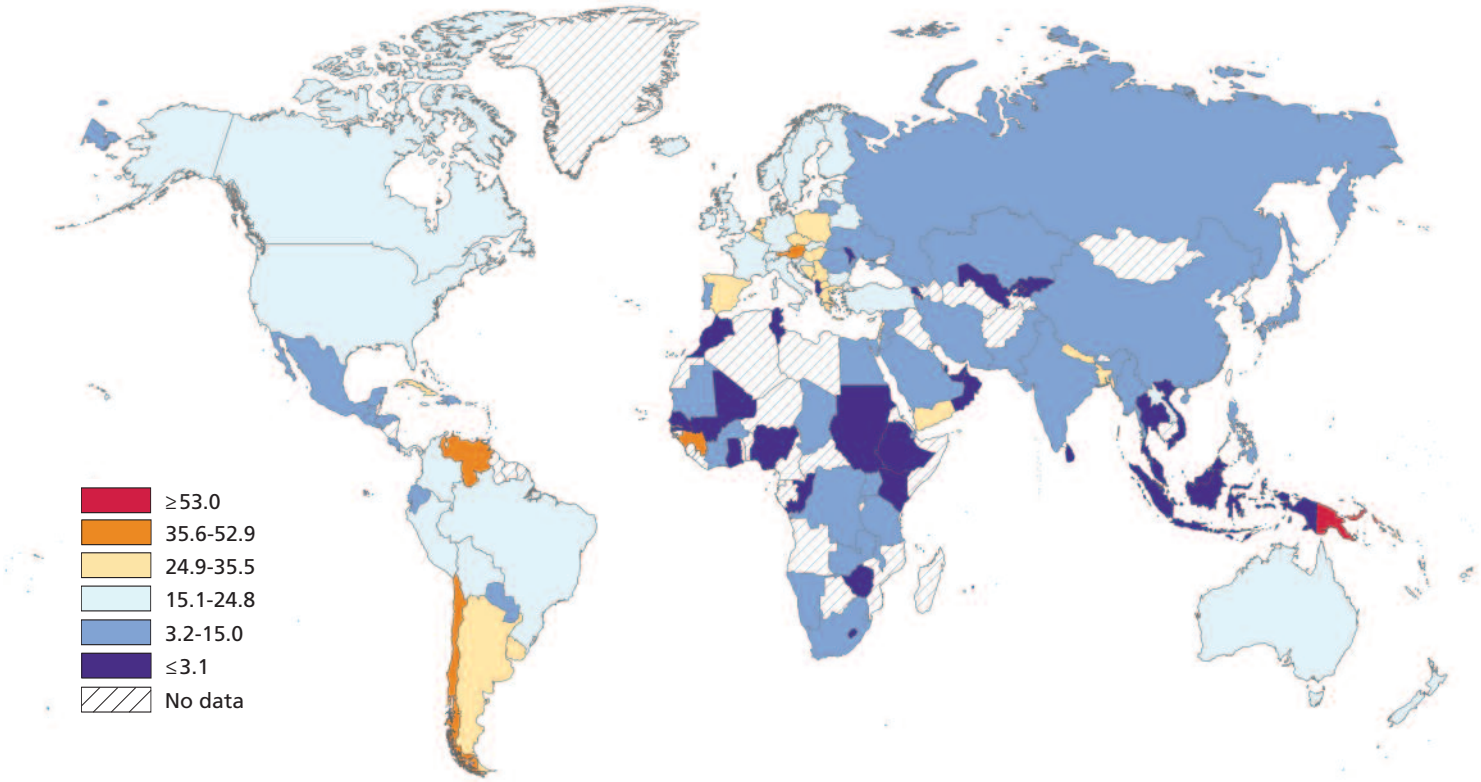
About 75% of adult smokers in the developed world say they intend to quit, while in the developing world the intention to quit is much lower (26% in China and 31% in India). This may be related to sociocultural differences in the acceptability of smoking between countries.[69,70]

Figure 18a. Smoking Prevalence (%) Among Adult Males, Worldwide



Source: WHO Tobacco Control Databases.

Figure 18b. Smoking Prevalence (%) Among Adult Females, Worldwide



Source: WHO Tobacco Control Databases.

Table 13. Tobacco Use Among Students Aged 13-15 Years by Sex and World Area, 1999-2005

	Current Use of Any Tobacco Product*						Current Cigarette Smoking†					
	Boys		Girls		Total		Boys		Girls		Total	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Africa	19.7	15.8-23.6	13.9	10.8-17.0	16.8	14.1-19.5	13.0	9.4-16.6	5.8	3.5-8.1	9.2	7.0-11.4
Americas	24.0	21.0-27.0	20.4	17.6-23.2	22.2	19.8-24.6	17.4	14.7-20.1	17.5	14.9-20.1	17.5	15.2-19.8
Eastern Mediterranean	18.8	15.2-22.4	11.3	8.0-14.6	15.3	12.7-17.9	6.7	4.4-9.0	3.2	1.1-5.3	5.0	3.3-6.7
Europe	22.3	18.0-26.7	17.0	13.8-20.2	19.8	16.6-23.0	19.9	16.1-23.7	15.7	13.6-18.8	17.9	15.2-20.6
Southeast Asia	18.4	14.3-22.5	7.1	4.7-9.5	12.9	10.2-15.6	5.8	4.4-7.5	1.9	1.0-2.8	4.3	3.1-5.5
Western Pacific	15.0	12.2-17.8	7.8	5.8-9.8	11.4	9.5-13.3	9.9	7.1-12.7	3.3	2.1-4.5	6.5	4.9-8.1
Total	20.1	16.7-23.5	14.3	11.5-17.1	17.3	14.8-19.8	10.5	8.1-12.9	6.7	5.0-8.4	8.9	7.2-10.6

Data from the Global Youth Tobacco Survey.

*Smoked cigarettes or used other tobacco products (e.g., chewing tobacco, snuff, dip, cigars, cigarettes, little cigars, pipes, and shisha) during the past 30 days.

†Smoked cigarettes on one or more days in the past 30 days.

Adapted from: Centers for Disease Control and Prevention. Use of cigarettes and other tobacco products among students aged 13-15 years, worldwide, 1999-2005. MMWR 2006;55: 553-6.

Adolescents

Most smokers begin to use tobacco before age 18. According to the Global Youth Tobacco Survey (GYTS), nearly one-quarter of young people who smoke had their first cigarette before the age of 10. Globally, the difference in smoking rates between boys and girls is not as large as the difference in adult smoking prevalence (Table 13). Boys are more likely than girls to smoke, but in half the countries covered by the GYTS from 2000 to 2005, there was no gender difference.

Factors that increase the risk of adolescents smoking are tobacco industry promotion; easy access to tobacco products; low prices; peer pressure; use of tobacco and/or approval of smoking by peers, parents, or siblings; and the misperception that smoking enhances social popularity. In addition, girls report smoking to stay thin, even though cigarette smoking is not associated with a lower body mass index in younger women. Smoking prevention and cessation programs designed for girls may benefit from the inclusion of content related to body image.

Health Professionals

Health professionals play a key role in the global effort to reduce tobacco consumption. To lead tobacco control initiatives, health professionals should set an example by not smoking. Evidence indicates that if health professionals are smokers, then they are less likely to intervene and to deter their patients from smoking. Thus, in countries where smoking rates are high among health care and public health professionals, interventions should target these key social leaders.

In many parts of the world, smoking prevalence among health professionals is the same or higher than in the general population. In China, 61.3% of male physicians smoke, compared to 66.9% of the general male population. Notably, smoking prevalence among Chinese female physicians is nearly three times that of the general female population (12.2% vs. 4.2%).[71]

Surveys on smoking prevalence among medical doctors in the WHO European Region revealed that countries with a long history of raising awareness for tobacco control have a relatively low smoking prevalence among health professionals (e.g., Sweden and the UK). In other countries, smoking prevalence among health professionals more or less reflects that of the general population, especially in males (e.g., Georgia, Romania).[72]

Among third-year health profession students around the world, cigarette smoking prevalence was greater than 20% in seven of 10 countries surveyed. An estimated 87%-99% of the students believed that they should have a role in counseling patients to quit smoking; however, only 37% had actually received formal training on cessation counseling. Health professional education should provide training in smoking cessation counseling for all students.[73]

Tobacco control initiatives among health care practitioners and public health professionals benefit from broad policy approaches as well as medical approaches. In 2004, participants at the WHO Informal Meeting on Health Professionals and Tobacco Control adopted and signed a Code of Practice on Tobacco Control for Health Professional Organizations. The code of practice lists 14

action items with the collective goal of contributing actively to the reduction of tobacco consumption and including tobacco control in the public health agenda at the national, regional, and global levels.

Interventions for Tobacco Control

Many governments, particularly those of tobacco-producing nations, have avoided taking action to control smoking because of misplaced concern for potential economic harm. For example, some policymakers fear that reduced sales of cigarettes would mean the permanent loss of thousands of jobs, particularly in agriculture, and that higher tobacco taxes would result in both lower government revenues and massive cigarette smuggling.

However, the World Bank reports that reduced tobacco consumption does not adversely affect economies because money formerly spent on tobacco is spent on other goods or services.[64] Regional or national economic studies provide evidence to counteract claims of economic harm from tobacco control. In fact, tobacco control reduces the negative economic impact of tobacco use on health.

In many countries, the health care costs related to smoking range from 0.1%-1.1% of the national gross domestic product (GDP). More comprehensive studies suggest that these costs could be even higher, reaching up to 1.39% of the GDP in the European Union.

Figure 19 ranks European countries by the tobacco control scale, which is based on the price of cigarettes, smoking bans in public places, advertising bans, health warning labels, and treatment for tobacco dependence. Ireland, the UK, Norway, and Iceland had the highest tobacco control measures, while Luxembourg, Romania, and Latvia had the lowest measures.

Tobacco control aims to reduce the harm caused by tobacco use through preventing initiation, increasing cessation, reducing consumption by smokers who continue to smoke, and protecting nonsmokers from exposure to secondhand tobacco smoke. There are two main approaches to tobacco control: decreasing demand for tobacco products and reducing the supply of tobacco products.

Interventions to Reduce Demand for Tobacco

Numerous studies, mostly from high-income countries, have examined the effect of interventions aimed at reducing the demand for tobacco products on smoking and other kinds of tobacco use. A small but growing number of studies from low- and middle-income countries highlight some differences in the effect of these interventions under various economic conditions.

Tobacco Tax Policies

Raising the price of tobacco through taxation is the single most effective measure in reducing tobacco demand. There are significant differences across countries regarding the levels of tobacco taxes. Taxes tend to be higher and account for a greater share of price (two-thirds or more) in high-income countries (other than the United States). In low-income countries, taxes are generally much lower and account for less than half of the price of a pack of cigarettes.[74]

More than 100 studies from high-income countries demonstrate clearly that increases in cigarette and other tobacco product taxes lead to significant reductions in tobacco consumption. The reductions in tobacco use that result from higher taxes and prices reflect the combination of increased smoking cessation, reduced relapse, lower smoking initiation, and decreased consumption among continuing tobacco users.[74]

Estimates of the impact of price on cigarette demand vary widely depending on the population studied, the data employed, and the methods used to estimate demand. Evidence from developed countries suggests that a 10% increase in cigarette prices will result in a 2.5%-5% reduction in cigarette demand. Estimates of the price responsiveness of populations living in low- and middle-income countries suggest that the impact of increased price on tobacco use would be at least as large.[75]

Youth, minorities, and low-income smokers are two to three times more likely than other smokers to quit or to smoke less in response to price increases. Because price is an especially powerful determinant of smoking initiation in youth, it significantly modulates long-term trends in cigarette consumption.[76-78]

Consumer Information

Policies to improve the quality and availability of health information can reduce smoking, especially in low- and middle-income countries, where baseline levels of awareness about the extent of tobacco's deleterious effects are still low. Research from high-income countries indicates that the reports by the British Royal College of Physicians in 1962 and the US Surgeon General in 1964, as well as the publicity that followed

about the health consequences of smoking, led to significant reductions in tobacco consumption. Initial declines in smoking prevalence were between 4%-9% and longer-term cumulative declines reached 15%-30%.[79] In addition, mass media antismoking campaigns have generated reductions in cigarette smoking and other tobacco use.[80] Similarly, prominent warning labels on cigarette packs also reduce consumption.[81]

Bans on Advertising and Promotion

Tobacco advertising and marketing play an important role in smoking initiation among teenagers by appealing directly to adolescent aspirations.[82] However, measuring the impact of tobacco advertising on consumption rates is problematic because the volume of advertising is so high that it is nearly impossible to measure the incremental impact of additional advertising. Examining advertising bans is a more informative way of determining the impact on consumption.[83] Comprehensive bans on tobacco advertising can reduce tobacco consumption. Partial advertising bans have little or no effect because of opportunities for advertising in unregulated media.[84,85]

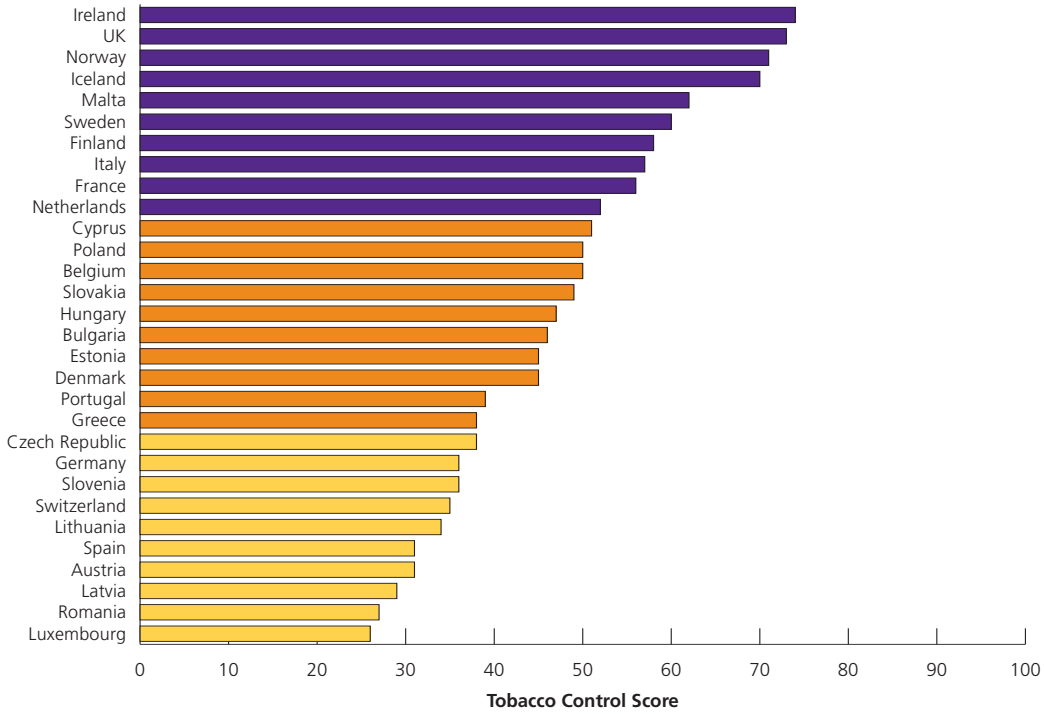
Smoke-Free Areas

Smoking bans benefit nonsmokers and smokers alike. They significantly reduce nonsmokers' and smokers' exposure to secondhand smoke while motivating smokers to smoke less and develop their confidence in the ability to quit, which alternatively leads to greater cessation success. These effects are more significant under a full ban than under a partial one. When designated indoor smoking areas are allowed, ventilation is not a viable option because it is inadequate for the complete elimination of secondhand smoke and because the reduction in smoking is less significant.[86]

A review of 26 studies of the effects of smoke-free workplaces concluded that a smoke-free environment was associated with a reduction in smoking prevalence of about 4%.[87] Another study showed that people in workplaces that changed to – or maintained – smoke-free policies between 1993-2001 were almost twice as likely to stop smoking than people whose work places did not do so.[88]

In 2004, Ireland became the first country in the world to require that all workplaces be smoke-free. The success of

Figure 19. European Countries Ranked by Total Tobacco Control Score



The scale score is based on (maximum possible score per policy): price (30) + public place bans (22) + public information campaign spending (15) + advertising bans (13) + health warnings (10) + treatment (10) = total (100).

Source: Joosens L, Raw M. The Tobacco Control Scale: a new scale to measure country activity. *Tob Control*. 2006;15:247-53.

this intervention led many other countries, states, and cities to take similar action (Figure 20). In the past three years, countries such as Uruguay, Scotland, Iran, and New Zealand, and states and territories within the United States and Australia have adopted smoke-free laws.[88] As of July 1, 2007, laws requiring smoke-free areas are estimated to protect more than 200 million people from secondhand smoke.[89]

Smoking Cessation Treatments

Many of the adverse health effects of smoking are reversible, and smoking cessation treatments represent some of the most cost-effective of all health care interventions. Reducing tobacco consumption by 50% now would avert 150 million premature deaths by 2050.[90] The most effective methods for helping smokers to quit smoking combine advice and behavioral support with pharmacotherapy (such as nicotine replacement or bupropion). These two components contribute about equally to the success of the intervention.

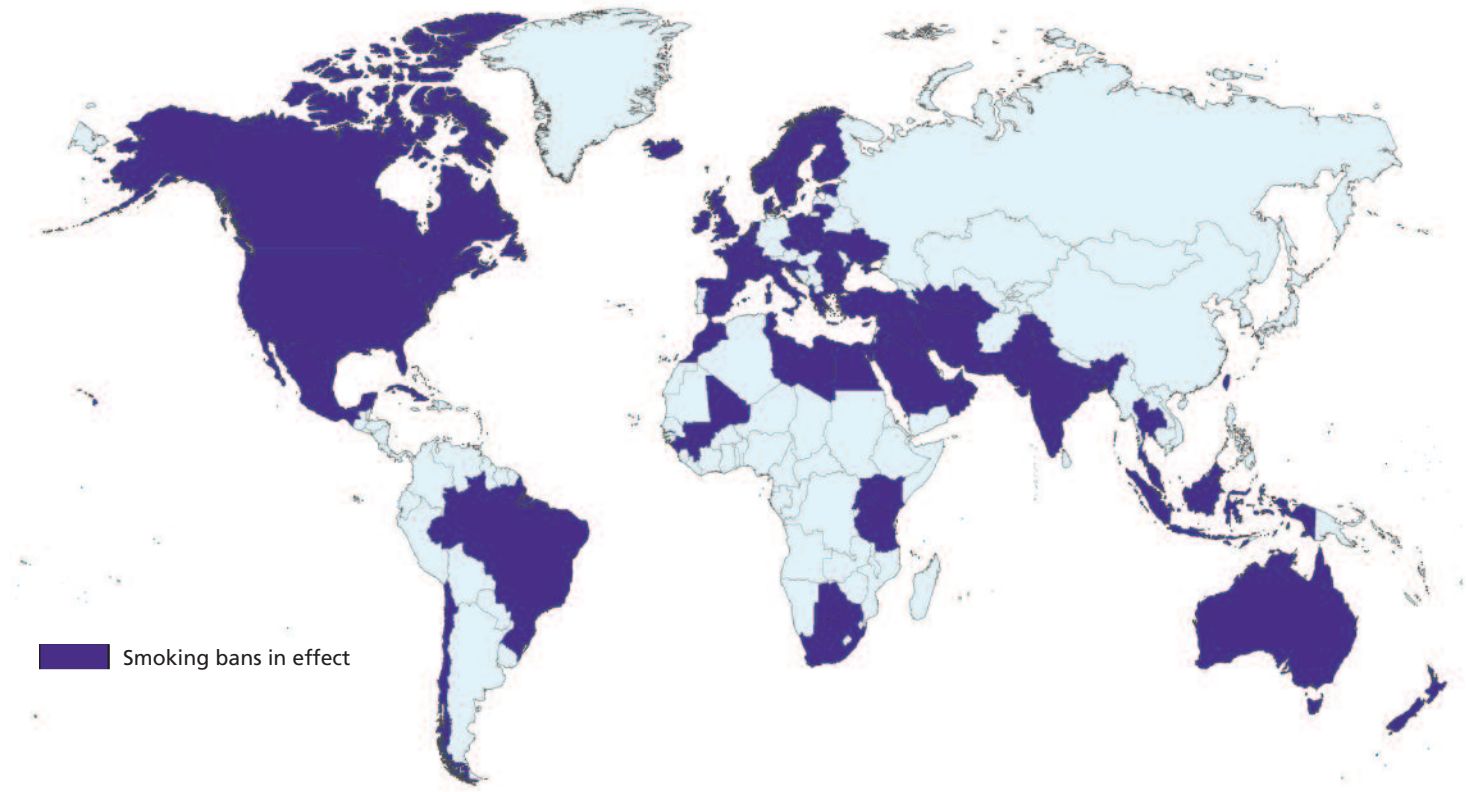
Doctors and other health professionals should become familiar with available cessation strategies, encourage smokers to use them, and be able at least to provide simple advice and behavioral support to smokers. Physicians and other health professionals should also become familiar with other sources of support, such as written materials, telephone cessation services, and strategies for preventing relapses.

It is feasible and cost-effective to integrate smoking cessation into other public health and health care delivery programs, such as tuberculosis, HIV/AIDS, cancer control, cardiovascular disease control, and family planning and maternal health programs. Brief counseling interventions by pharmacists are another effective cessation strategy in areas where self-medication is common and pharmacists are primary providers of health information.

Interventions to Reduce Tobacco Supply

Interventions to regulate the supply of tobacco are difficult for a single country to implement effectively because of the global nature of the tobacco economy. This is particularly evident in the case of illegal activities on the tobacco markets. Recent estimates suggest that

Figure 20. Smoking Bans Around the World



Source: Schmidt, CA. A change in the air. *Environmental Health Perspectives*. 2007;115:A413-A415.

6%-8% of cigarettes consumed globally are smuggled. Countries such as Bosnia and Herzegovina, Brunei, Croatia, Cyprus, Lebanon, Republic of Korea, and the United Arab Emirates report cigarette imports that far exceed the combination of exports and plausible domestic consumption, suggesting the need for controls to ensure that these products are not shipped illegally to other markets.[91] Effective measures against smuggling include prominent tax stamps that cannot be counterfeited easily and local language warnings on cigarette packs, as well as the aggressive enforcement of anti-smuggling measures and consistent application of tough penalties to deter smugglers. Some jurisdictions have adopted other measures aiming to reduce the supply of tobacco. These include restriction of access to minors, crop diversification programs, and trade restrictions. However, there is very little research evidence to support the effectiveness and efficacy of such interventions.

The Framework Convention on Tobacco Control

The spread of the tobacco epidemic is exacerbated by a variety of complex factors with cross-border effects, including trade liberalization; direct foreign investment; global marketing; transnational tobacco advertising, promotion, and sponsorship; and the international movement of contraband and counterfeit cigarettes. Because it is difficult for any one nation to fight this epidemic alone, nations have united behind the Framework Convention on Tobacco Control (FCTC), the first health treaty negotiated under the auspices of the WHO. The FCTC provides a framework for national legislation and enforcement of tobacco control measures. The FCTC was promulgated in May 2003 in response to the global tobacco pandemic with the objective of substantially reducing the worldwide prevalence of tobacco use and exposure to tobacco smoke. As of August 2007, 149 countries have ratified the treaty, representing about 80% of the world's population.

FCTC provisions establish international standards for tobacco taxation; tobacco advertising and sponsorship; regulation of tobacco products; tobacco product disclosure; packaging and labeling; education, communication, training, and public awareness; cessation measures; measures to eliminate illicit trade; sales to minors; support for economically viable alternatives; liability issues; and scientific and technical cooperation and exchange of information.

Notable progress in tobacco control has been made in many countries that have ratified the treaty. Successful tobacco control legislation includes India's introduction of comprehensive tobacco advertising bans; banning smoking in public places in Spain, Ireland, Italy, Norway, and Uruguay; and introducing highly visible graphic warnings on cigarette packs in Australia, Brazil, Canada, Thailand, Singapore, and Uruguay. However, more effort is required to ensure full implementation and enforcement of the FCTC standards. Tobacco control advocates supported by solid research evidence will play a crucial role in this process.

The International Fight Against Cancer

Cancer is potentially the most preventable and the most curable of the major chronic, life-threatening diseases. Unfortunately, it remains a leading killer worldwide, accounting for approximately one in eight deaths. According to WHO, people in low- and middle-income countries tend to develop chronic diseases "at younger ages, suffer longer – often with preventable complications – and die sooner than those in high-income countries."[92]

Effective measures to reduce cancer morbidity and mortality require the active participation of cancer survivors and their local communities; the mobilization and appropriate allocation of resources; the formulation of evidence-based policies and proven interventions; and the commitment of organizations and institutions in the nonprofit, for-profit, and governmental sectors. Ultimately, cancer control goes hand in hand with efforts to promote human and economic development and to improve standards of health, education, and medical care throughout the world.

Recognizing the growing global cancer crisis, the American Cancer Society established its International Affairs department in 2004. The American Cancer Society's international efforts include advocacy, information delivery, and capacity building.

Advocacy

The American Cancer Society works with local partners in key regions of the world to support policies that promote health and empower individuals touched by cancer. Top priorities include tobacco control and patients' rights. The American Cancer Society also seeks to raise awareness about cancer among policymakers and to establish cancer as a priority for development and aid. The Society works with numerous partners to

advance these goals, including the International Union Against Cancer (UICC), International Network for Cancer Treatment and Research (INCTR), World Health Organization (WHO), International Agency for Research on Cancer (IARC), International Atomic Energy Agency (IAEA), the US National Cancer Institute (NCI) and Centers for Disease Control and Prevention (CDC), and consortia including the Framework Convention Alliance (FCA), Stop Cervical Cancer, and the Comprehensive Cancer Control Leadership Forum.

Framework Convention on Tobacco Control

The American Cancer Society plays a significant role in global tobacco control by supporting the adoption and implementation of the Framework Convention on Tobacco Control (FCTC), the world's first public health treaty. In collaboration with Cancer Research UK and the International Development Research Centre's Research for International Tobacco Control program, the Society has funded more than 200 grants in over 70 countries in support of FCTC implementation and enforcement. To date, more than 149 nations, which represent more than three-fourths of the world's countries, have ratified the treaty.

Global Smokefree Partnership

In 2007, the Society became the co-host, along with the Framework Convention Alliance, of the Global Smokefree Partnership (GSP) – a multi-partner initiative dedicated to promoting smoke-free policies worldwide. The GSP leads efforts to secure strong global guidelines for smoke-free policies and is working to ensure their effective implementation.

Africa Tobacco Control Regional Initiative

In March 2008, the Society, along with Cancer Research UK, will launch the Africa Tobacco Control Regional Initiative (ATCRI). The ATCRI aims to promote effective tobacco control policies in Sub-Saharan Africa through advocacy, research, surveillance, and training, in order to prevent and reverse the spread of tobacco use in the region.

International Patient Summits and Campaigns

The American Cancer Society extends its support for the global fight against cancer by supporting patients' efforts to promote healthy lifestyles, early detection and screening, access to health care, and high-quality treatment. The Society hosts international summits and meetings to raise the visibility of patients regionally and to empower them in their fight.

Capacity Building

The American Cancer Society's capacity building activities help to develop and strengthen the knowledge, skills, abilities, processes, and resources that organizations and communities need to achieve their mission. The Society's major capacity building efforts include ACS University, International Relay For Life®, and National Cancer Planning.

The American Cancer Society University

The American Cancer Society University (ACSU) is an intensive training and development program designed to enhance nonprofit management practices and public health skills among cancer control leaders around the world. To date, more than 500 scholars from over 80 countries have graduated from the American Cancer Society University.

International Relay For Life

The American Cancer Society's signature fundraising program is quickly spreading around the world. International Relay For Life enables cancer organizations to raise their profiles and increase income and capacity through survivorship programs, volunteerism, and advocacy. More than 20 countries have implemented Relay programs, empowering tens of thousands of cancer patients, caregivers, families, and friends.

Cancer Planning

To promote best practices in cancer control planning, the American Cancer Society, in collaboration with the National Cancer Institute and the Centers for Disease Control and Prevention, hosts international leadership forums for key leaders in the public health community. The Society also creates state-of-the-art guidelines for effective cancer control planning and advocacy. These guidelines provide partners with proven approaches and tactics for achieving and implementing cancer control policies.

Information

Through print publications, its Web site, and its National Cancer Information Center, the American Cancer Society is a leading source of cancer information worldwide. The Society's cancer information program provides information on health, wellness, and all aspects of cancer prevention and control to patients, clinicians, researchers, policymakers, journalists, and members of the general public.

Worksite Initiatives

The American Cancer Society collaborates with multinational business partners to deliver cancer information and wellness programs to employees in the United States and throughout the world. The Society's Quitline® is the largest tobacco cessation service in the United States and will be launching globally in the near future.

Cancer.org and Cancer Information Translations

The American Cancer Society's Web site, www.cancer.org, serves millions of individuals throughout the world. Cancer information is currently available in English, Spanish, Mandarin, and several other Asian languages. In addition, the Society is creating online tools and resources for health care professionals.

Media Outreach and Journalist Trainings

The Society helps raise awareness about cancer and tobacco control through trainings and fellowships for journalists from low- and middle-income countries. The Society also conducts media outreach in priority countries and promotes media coverage across leading television, print, and online venues.

Data Sources and Methods

Information on cancer incidence is from the International Agency for Research on Cancer (IARC) and covers about 21% of the world population (http://www-dep.iarc.fr). In countries with no cancer registry, as is the case in most developing countries, incidence rates are estimated based on mortality data or incidence rates in neighboring countries.[93] Limitations of this method include the assumption that no important differences exist in incidence among neighboring countries and that their survival rates are equal. Cancer incidence rates for each country can be accessed through GLOBOCAN 2002.[94]

Mortality data are collected in all industrialized countries and some developing countries. These data, covering approximately 30% of the world population, are abstracted from death certificates and compiled in a WHO mortality database (http://www.who.int/whosis). The quality of mortality data vary by country, with high accuracy of underlying cause of death in developed countries and low accuracy in developing countries.

Incidence and mortality rates

Incidence and mortality rates are the two most frequently used measures of cancer occurrence. These statistics quantify the number of newly diagnosed cancer cases or deaths, respectively, in a specified population over a defined time period. Incidence and death rates are usually expressed per 100,000 people per year.

Age standardization

Age standardization simplifies comparisons of incidence and mortality rates among populations that have different age compositions. The usual approach to age standardization in surveillance data is to apply the age-specific rates in the populations of interest to a standard set of weights based on a common age distribution. This eliminates the effect of the differences in age structure among the populations being compared and provides a hypothetical rate that would be observed in each population had its age composition been the same as that of the standard population. An age-standardized rate (ASR) is a summary measure of a rate that a population would have if it had a standard age structure. Age-standardized rates are only comparable when the same age standard is applied to each of the populations being compared. This is not the case currently in surveillance data from different sources. The international data presented in this publication are all standardized to the 1960 world standard population used by IARC. In contrast, cancer incidence and mortality data in the United States and several European countries published elsewhere are standardized to the 2000 US and European standard populations, respectively. Therefore, data presented in this publication cannot be compared with those published elsewhere using a different standard population for age-adjustment.

New cancer cases and deaths

Another measure of the cancer burden in a population is the total number of new cases and deaths that occur in a given year. These counts reflect the absolute number of affected individuals and patients who require medical care and social services.

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

Survival rates

The survival rate reflects the proportion of people alive at a specified period after a diagnosis, usually five years. The two basic measures of survival are observed and relative. The observed survival rate quantifies the proportion of cancer patients alive after five years of follow up since diagnosis, irrespective of deaths from conditions other than cancer. In contrast, relative rate reflects the proportion of people alive five years after diagnosis compared to that in a population of equivalent age and sex without cancer. This accounts for deaths from other causes. Survival data are available for countries in North America and Europe and for some developing countries.[23,95,96] For countries with no survival data, five-year relative survival is approximated by computing the ratio of the mortality rate to the incidence rate.[3] The large variation in survival rates across countries/regions reflects a combination of differences in the mix of cancer types, the prevalence of screening and diagnostic services, and/or the availability of effective and timely treatment.[96]

Developed vs. developing countries

Globocan 2002 and United Nations

More economically developed regions' rates have been estimated as the population-weighted average of Northern America, Japan, Eastern Europe, Northern Europe, Southern Europe, Western Europe, and Australia/New Zealand.

Less developed regions' rates have been estimated as the population-weighted average of Eastern Africa, Middle Africa, Northern Africa, Southern Africa, Western Africa, Caribbean, Central America, South America, Eastern Asia (less Japan), South-East Asia, South-Central Asia, Western Asia, Melanesia, Micronesia, and Polynesia.

World Bank

Income group

Economies are divided according to 2006 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, $905 or less; lower-middle income, $906-$3,595; upper-middle income, $3,596-$11,115; and high income, $11,116 or more.

Low-income economies: Afghanistan, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Congo Dem. Rep, Côte d'Ivoire, Eritrea, Ethiopia, Gambia, The Ghana, Guinea, Guinea-Bissau, Haiti, India, Kenya, Korea Dem Rep, Kyrgyz, Republic, Lao PDR, Liberia, Madagascar, Malawi, Mali, Mauritania, Mongolia, Mozambique, Myanmar, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Rwanda, São Tomé and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Sudan, Tajikistan, Tanzania, Timor-Leste, Togo, Uganda, Uzbekistan, Vietnam, Yemen Rep., Zambia, Zimbabwe.

Lower-middle economies: Albania, Algeria, Angola, Armenia, Azerbaijan, Belarus, Bhutan, Bolivia, Bosnia and Herzegovina, Cameroon, Cape Verde, China, Colombia, Congo Rep., Cuba, Djibouti, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Fiji, Georgia, Guatemala, Guyana, Honduras, Indonesia, Iran, Islamic Rep., Iraq, Jamaica, Jordan, Kiribati, Lesotho, Macedonia, FYR Maldives, Marshall Islands, Micronesia Fed. Sts., Moldova, Morocco, Namibia, Nicaragua, Paraguay, Peru, Philippines, Samoa, Sri Lanka, Suriname, Swaziland, Syrian Arab Republic, Thailand, Tonga, Tunisia, Turkmenistan, Ukraine, Vanuatu, West Bank and Gaza.

Upper-middle economies: American Samoa, Argentina, Belize, Botswana, Brazil, Bulgaria, Chile, Costa Rica, Croatia, Dominica, Equatorial Guinea, Gabon, Grenada, Hungary, Kazakhstan, Latvia, Lebanon, Libya, Lithuania, Malaysia, Mauritius, Mayotte, Mexico, Montenegro, Northern Mariana Islands, Oman, Palau, Panama, Poland, Romania, Russian Federation, Serbia, Seychelles, Slovak Republic, South Africa, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Turkey, Uruguay, Venezuela, RB

High income economies: Andorra, Antigua and Barbuda, Aruba, Australia, Austria, Bahamas The, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Channel Islands, Cyprus, Czech Republic, Denmark, Estonia, Faeroe Islands, Finland, France, French Polynesia, Germany, Greece, Greenland, Guam, Hong Kong (China), Iceland, Ireland, Isle of Man, Israel, Italy, Japan, Korea Rep., Kuwait, Liechtenstein, Luxembourg, Macao (China), Malta, Monaco, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Norway, Portugal, Puerto Rico, Qatar, San Marino, Saudi Arabia, Singapore, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, United States, Virgin Islands (US).

UN Areas

Eastern Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Somalia, Tanzania, Uganda, Zambia, Zimbabwe

Middle Africa: Angola, Cameroon, Central African Republic, Chad, Congo Brazzaville, Congo, Equatorial Guinea, Gabon

Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia

Southern Africa: Botswana, Lesotho, Namibia, South African Republic, Swaziland

Western Africa: Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo

Caribbean: Bahamas, Barbados, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago

Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama

South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela

North America: Canada, United States of America

Eastern Asia: China, Japan, Democratic Republic of Korea, Republic of Korea, Mongolia

South-East Asia: Brunei Darussalam, Cambodia, Indonesia, Lao People Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam

South-Central Asia: Afghanistan, Bangladesh, Bhutan, India, Iran, Kazakhstan, Kyrgyzstan, Nepal, Pakistan, Sri Lanka, Tajikistan, Turkmenistan, Uzbekistan

Western Asia: Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, Yemen

Eastern Europe: Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russian Federation, Slovakia, Ukraine

Northern Europe: Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, United Kingdom

Southern Europe: Albania, Bosnia Herzegovina, Croatia, Greece, Italy, Macedonia, Malta, Portugal, Slovenia, Spain, Serbia and Montenegro

Western Europe: Austria, Belgium, France, Germany, Luxembourg, The Netherlands, Switzerland

Australia/New Zealand: Australia, New Zealand

Melanesia: Fiji, Papua New Guinea, Solomon Islands, Vanuatu

Micronesia: Guam

Polynesia: Samoa

WHO Regions

African Region: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe

Region of the Americas: Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, United States of America, Uruguay, Venezuela

Eastern Mediterranean Region: Afghanistan, Bahrain, Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen

European Region: Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Luxembourg, Malta, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, The former Yugoslav Republic of Macedonia, Turkey, Turkmenistan, Ukraine, United Kingdom of Great Britain and Northern Ireland , Uzbekistan

South-East Asia Region: Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste

Western Pacific Region: Australia, Brunei Darussalam, Cambodia, China, Cook Islands, Fiji, Japan, Kiribati, Lao People's Democratic Republic, Malaysia, Marshall Islands, Micronesia (Federated States of), Mongolia, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Singapore, Solomon Islands, Tonga, Tuvalu, Vanuatu, Viet Nam.

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