

**The Macroeconomic Consequences of Chronic Diseases in
Emerging Market Economies: Phase I Report**

Submitted to

**Novartis Corporation
January 22, 2009**

By

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I. Purpose of the Study

Most cost studies in international health have been done on parasitic and infectious diseases. They were directed at the principal recipients of external health assistance: ministries of public health in the developing world. But today, some 70% of the developing world receives their healthcare through the private sector, subordinating the primacy of ministries of public health and shifting it to ministries of finance. That percentage is even higher within emerging market economies. The epidemiological and demographic transitions have brought in their wake a new burden of chronic diseases as the main causes of morbidity and mortality. These diseases strike the workforce directly and indirectly, causing increasing societal costs which inevitably lead to a decline in national productivity and a slowdown in overall national development. To address this new burden, these economies have to formulate their national health policies for the future within a macroeconomic context. As an initial step in that direction, this study focuses on three chronic diseases that constitute 53% of the total chronic disease burden: cardiovascular diseases, cancers, and diabetes—a percentage projected to increase dramatically by 2030.

II. Methodology

This study has two phases: in Phase One, Hudson Institute conducted an exhaustive literature search to determine the extent of published works that address the macroeconomic consequences of chronic diseases in emerging market economies. This included literature on:

- illness and productivity;
- the role of risk factors in chronic diseases;
- age-specific trends in morbidity and mortality;
- the burden of chronic diseases in working-age populations;
- projections of mortality and disability by age, sex and cause;
- the economic consequences of early retirement due to disability;
- the impact of illness and its treatment on workplace productivity;
- the effects of health status on work performance;
- the costs of excessive absenteeism from work;
- projections and estimates on the future macroeconomic costs;
- the cost to productivity of employer provided treatment vs. non-treatment in the workplace; and,
- the long-term consequences borne by industry or society as a whole and at what costs to either or both.

A Medline search was conducted on the countries considered as emerging market economies against key search terms as listed above. Studies that met the project criteria were selected from available publications. More recent studies were given precedence

over those more than 10 years old, with the exception of key benchmark studies. Studies prior to 1995 were generally not included. Searches were also conducted on EconLit and WHOSIS. Studies from these searches were included as appropriate, as well as from the Library of Congress. In addition, peer-reviewed studies were selected as a priority for inclusion from professional journals such as, but not limited to:

- *The Lancet*
- *the British Medical Journal*
- *Journal of Internal Medicine*
- *Diabetes Research and Clinical Practice*
- *Diabetes Care; Bulletin of the World Health Organization*
- *Pan American Journal of Public Health*
- *International Journal of Clinical Pharmacology and Therapeutics*
- *The Journal of the Association of Physicians of India*
- *National Medical Journal of India*
- *The Medical Journal of Malaysia*
- *Annals of Saudi Medicine*
- *PharmacoEconomics*
- *Annals of Oncology*
- *Journal of the National Cancer Institute*
- *Brazilian Journal of Pulmonology*
- *PLoS Medicine*
- *South African Medical Journal*
- *Journal of the American Medical Association*
- *The European Journal of Cardiovascular Prevention and Rehabilitation*
- *The New England Journal of Medicine*

In those instances where articles from the United States or the European Union were selected, the purpose was to indicate the expected trajectory of chronic diseases and their associated costs that emerging market economies can expect in the very near future.

The citations in the text below are keyed to the Bibliography and thus do not appear in numerical order. Chart I in the Appendix is a numerical listing of each citation, permitting the reader to see which ones addressed chronic diseases in general, then more specifically the three diseases in question. Lastly, for those studies which detailed a monetary value of macroeconomic costs, in addition to DALYs (disability adjusted life years lost), they are checked for the reader.

In Part II, Hudson will follow-up and distill lessons learned from the literature review. Then, it will develop a strategy by which specific leadership from graduate schools of business and economics could be convened for an initial consultation. The purpose will be to: a) develop the parameters for a methodology that would establish the macroeconomic consequences in select countries; b) determine their interest in country-specific assessments on behalf of ministries of finance; and c) identify ministers of finance that would host field studies.

III. General Summary of Key Findings

There is a general recognition that chronic diseases constitute today's leading cause of morbidity and mortality in emerging market economies. The onset of the three targeted diseases has generated great interest in addressing them, but documentation of their macroeconomic consequences is more established in the West than elsewhere. For instance, in the United States, 75% of every dollar spent on health care is for treatment of patients with one or more chronic conditions. In public programs, it is 96% of every dollar spent in Medicare, and 83% of every dollar in Medicaid. For the seven most common chronic conditions, 80% of expenditures are for indirect costs, e.g., productivity losses, absenteeism, etc., while 20% is for direct costs, e.g., health care costs associated with treatment of chronic disease. Nearly one-half of all Americans suffer from one or more chronic diseases. The West can be seen as a proxy in terms of understanding how its disease burden patterns will soon be repeated in emerging market economies.

In 1996, WHO, the World Bank and the Harvard School of Public Health collaborated on a landmark publication, *The Global Burden of Disease and Injury Series*, a ten-volume study. They produced a comprehensive, internally consistent and comparable set of estimates of current patterns of mortality and disability from disease and injury for all regions of the world, with projections to the year 2020. Their publication became the template for alerting global health policymakers to the emerging burden of chronic diseases, though the study itself focused on expanding rates of morbidity and mortality and did not project macroeconomic costs. It did, though, amply use DALYs to give a sense of their imputed costs. Among the key findings that seized the attention of policymakers (11):

- Deaths from noncommunicable diseases are expected to climb from 28.1 million a year in 1990 to 49.7 million by 2020—an increase in absolute amounts of 77%;
- adults under the age of 70 in sub-Saharan Africa today face a higher probability of death from a noncommunicable disease than adults of the same age in the established market economies;
- by 2020, noncommunicable diseases will cause seven out of every 10 deaths in the developing world;
- and, by 2020, tobacco is expected to kill more people than any single disease, surpassing even the HIV epidemic.

Many of the citations in this literature search reference *The Global Burden of Disease*. All of the 235 citations show an increasing knowledge about the surge in chronic diseases, but only 13% exhibit an understanding about their macroeconomic implications and DALYs, either for direct or indirect costs. Given these facts, there is every reason for ministries of finance to focus attention more closely on the overall societal burden of these diseases:

- Cardiovascular Diseases - Presently this disease is the leading cause of global mortality. It will affect people in developing countries at younger ages than in developed countries; cause higher age-specific death and disability rates among

- them than those reported from developed countries and increasingly impact poor people. Ischemic heart disease alone is anticipated to increase by 120% for women and 137% for men in developing countries, compared to age-related increases of between 30– 60% in developed countries. (7)
- Diabetes – Approximately 110 million people in the world have this disease, but this number will reach 220 million by 2010 and 300 million by 2025, with the major part of this increase in Type 2 diabetes in the developing world. By 2025, 75% of people with diabetes will reside in developing countries. In those countries, the majority of people with diabetes are in 45–64 year age range. (3 & 17)
 - Cancer – The International Agency for Research on Cancer (IARC) stated in December 2008 that cancer will surpass cardiovascular diseases as the leading cause of death by 2020. More than one-half of this burden will be in the developing world. By extrapolation of current data, it can be conservatively expected that by 2030 there will be approximately 26.4 million cases of cancer and 17 million deaths a year. (76) Lung cancer alone is the second leading cause of death in Brazil, and is higher among women. In Chile, cancer is the second leading cause of mortality. (88, 98 & 99) Out of a population of 73.2 million in Turkey, there are 150,000 new cases of cancer each year. Cancer is the second leading cause of death in Hungary, after cardiovascular disease. (76)

In a study of 15 developing countries across all three chronic diseases: the estimated age-standardized death rates for chronic diseases in 2005 were:

- 54% higher for men than for men in high-income countries; (1)
- 86% higher for women than for women in high-income countries. (1)

The adult population is the productive sector of all societies; nearly 90% of children in developing countries survive to be adults, even in some of the poorest countries of Sub-Saharan Africa. This is the population that ultimately becomes the macroeconomic responsibility of ministries of finance. The consequences of adult ill-health are substantial and larger than the consequences of illness with non-adults. They go beyond direct suffering of individuals and include effects that harm society indirectly. These increase the cost of adult ill-health and make its amelioration important to the economic well being of emerging market economies.

IV. Specific Key Findings on Cardiovascular Diseases

Cardiovascular diseases (CVD) collectively includes hypertension, stroke, ischaemic heart disease, and cerebrovascular diseases. In a 2002 study, it was projected that during the last half century, CVD had burgeoned from a relatively minor disease worldwide to a leading cause of morbidity and mortality. By 2020, it is projected that CVD will surpass infectious disease as the world's leading cause of death and disability. (167) However, as cited above, a 2008 study by IARC says that cancer will be the leading cause of death by 2020. (76)

CVD hits the workforce directly and indirectly and undermines family viability in emerging market economies. Retired people will experience CVD as a cause of morbidity and mortality as populations age and the ranks of those aged 65+ increase dramatically in the next 20 years. Health services and social security systems will be especially affected. As illustrated in Table 1 below for the year 2000, age-specific (35–64) male and female working-age CVD death rates in emerging market economies were significantly higher than in the United States or Portugal. Within the working-age population of these countries, mortality rates from CVD are often equal to or greater than rates for the same age group in the United States before it embarked on aggressive CVD prevention and management initiatives that have greatly reduced mortality. (158)

Table 1. CVD death rate per 100,000 population, ages 35–64 (2000)

	S. Africa	Brazil	India	Russia	U.S.	Portugal
Males	96.9	71	81	256.6	55.9	51.7
Females	66.2	48.9	55.9	63.7	27.9	17.9

In 2007, Brazilian researchers published a study on the costs of severe CVD cases, based on hospitalized case lethality and total CVD mortality rates for the year 2004. They found: (180)

- approximately 2 million cases of severe CVD were reported, accounting for 5.2% of the population over 35 years of age;
- the annual cost was at least \$10.5 billion;
- of the annual cost, 36.4% was for health care, 8.4% was for social security and employers' reimbursement, and 55.2% was due to loss in productivity;
- direct costs for health care services for severe CVD accounted for 8% of total national expenditures on health and 0.52% of 2004 GNP, or \$602 billion.

The study concluded that this sub-group of CVD patients was expected to escalate as the population ages and the prevalence of severe cases increases. When one adds in mild and easily treatable CVD, a full picture of this situation emerges for Brazil.

A substantial portion of the increasing global impact of CVD is attributable to economic, social, and cultural changes that have led to increasing risk factors. Because the majority of the world's population lives in the developing world, the increasing rate of CVD in these countries is the driving force behind the continuing dramatic worldwide increase. (167)

Globally, a main risk factor in CVD is high blood pressure. In 2008, *The Lancet* published the burden of death and disability-adjusted life years (DALYs) on a worldwide basis, finding that high blood pressure accounted for: (164)

- 7.6 million premature deaths, or 13.5 % of the global total;
- 92 million DALYs (about 6 % of the global total);
- 54% of stroke and 47% of ischaemic heart disease patients; and

- 80% of the attributable burden occurred in low-income and middle-income countries in people 45–69 years of age.

On a regional basis, in Latin America and the Caribbean, CVDs are already the leading cause of death and disability. Predictions for the next two decades include a near tripling of ischemic heart disease and stroke mortality. (169) The discordant trend of rising CVD mortality rates in Eastern Europe, however, is in sharp contrast to the decline in Western Europe. (165) About half of the world's burden of CVD is carried by countries in the Asia-Pacific region, where up to 66% of some subtypes of CVD can be attributed to hypertension. (175) CVD is the leading cause of death in those over the age of 45 in Africa, leading to billions of lost dollars due to healthcare costs and reduced productivity from disabling and fatal outcomes. (175)

Country-specific data bear out the global burden. Brazil has been conducting extensive studies on the cost of CVD measured in terms of DALYs. An estimate was made of the number of productive years of life lost to premature mortality (ages 15–59) based on those actually engaged in work activities: (183)

- Crude results showed a loss of 481,052 years of productive life for men and 333,912 for females.
- The average years of productive life lost per person was 12.5 for men and 13.4 for females.
- The data show that death by CVD occurs earlier in persons engaged in work activities than in the population outside of the workforce.

In China, CVD has become the principle cause of death and disability among the middle-aged and elderly in both urban and rural areas: (186)

- The average annual direct medical cost and direct non-medical costs were \$529.80 and \$19.20 in urban areas and \$278.10 and \$50.30 in rural areas.
- This disease burden led to \$26.1 billion in direct costs in 2003.

In India, heart disease is occurring 5–10 years earlier than in other populations around the world, producing devastating consequences for individuals, families, and society. (198) A World Bank study reported that 53% of heart patients were among the lowest paid employees in an aerospace company, and 48% were manual laborers. (235)

In South Africa, in a study dated back to 1991, the estimated total cost of CVDs was between \$11.4 billion and \$13.9 billion, not including the cost of rehabilitation and follow-up for CVD patients. About three quarters of the direct costs were carried by the private sector. Direct healthcare costs were estimated to be approximately 42% of the total costs. The rest reflects the indirect cost of earnings foregone as a result of premature morbidity and mortality. (214) Given how much the South African economy has changed in the past 18 years, one can only imagine how both the CVD rates and costs have dramatically increased.

Macroeconomic studies on cardiometabolic risk factors were conducted in the United States in 2007. They showed that individuals with these risks missed 179% more work days and spent 147% more days in bed than those without risks. Lost work days and bed days resulted in \$17.3 billion annually in lost productivity attributable to cardiometabolic risk clusters. (227)

Age-specific rates for ischaemic heart disease and stroke have been falling steadily for at least two decades in emerging market economies, which means that people are getting these diseases at younger ages, which affects the working age population and the international competitiveness of these economies. The government entities that will feel the burden of these diseases more profoundly than any other are the ministries of finance, which bear total societal costs. They are also best equipped by their professional training to place this emerging disease burden within a macroeconomic context.

Several studies looked at inexpensive ways to reduce risk factors for CVD. Authors in a 2007 article in *The Lancet* proposed a global goal of reducing CVD rates by an additional 2% per year. Scaling up evidence-based interventions in high-risk individuals could play a major part in reaching this goal. The study estimated the cost for 23 countries of scaling up a multidrug regimen for prevention of cardiovascular disease (a statin, aspirin, and two blood-pressure lowering medicines) and how many deaths could be averted: (164)

- Over a 10-year period, scaling up this multidrug regimen could avert 17.9 million deaths from CVD, of which 56% would be in those younger than 70 years of age.
- The financial cost would be \$47 billion, or an average yearly cost per head of between \$0.54 to \$2.93 in middle-income countries and between \$0.43 to \$0.90 in low-income countries.

In another study, it was demonstrated that systolic blood pressure above 115 mm Hg accounts for two-thirds of strokes and almost half of ischaemic heart disease. Non-personal health interventions, including government action to stimulate a reduction in the salt content of processed foods, are cost-effective ways to limit CVD and could avert more than 21 million DALYs per year worldwide. Combination treatment is cost-effective for people at risk of a CVD event over the next 10 years, leading to substantial additional health benefits by averting an additional 63 million DALYs per year worldwide. (232)

V. Specific Key Findings on Cancer

Increased life expectancy and lifestyle changes associated with westernization—including smoking and high-fat diets—have led to an increase in the prevalence of cancer in the developing world. This trend is expected to continue. By 2020, the total number of new cancer cases in developing countries is expected to increase 73%, compared to 29% in developed countries. (80) Table 2 below shows the projections for 2030.

Table 2. Worldwide cancer burden for 2000 and projections into 2030 in millions

	2000	2030
New cases	10.4 million	26.4 million
Deaths	6.5 million	16.4 million
Living with cancer	25 million	75 million

A study published in the Public Library of Science ranked the leading causes of death in 2002 and projected the leading causes for 2030. Lung cancer, stomach cancer, color cancer and liver cancer were all predicted to increase and cause more deaths in the future. Interestingly, diseases that are currently receiving international attention, such as TB, malaria and other infectious diseases, are predicted to decline. Table 3 below is reproduced from this study, with the cancers highlighted. (2)

Table 3. Leading Causes of Death, 2002 and 2030

Disease/Injury	2002 Rank	2030 Rank	Change in Rank
Ischaemic heart disease	1	1	0
Cerebrovascular disease	2	2	0
Lower respiratory infections	3	5	-2
HIV/AIDS	4	3	+1
Chronic obstructive pulmonary disease	5	4	+1
Perinatal conditions	6	9	-3
Diarrheal diseases	7	16	-9
Tuberculosis	8	23	-15
Trachea, bronchus, lung cancers	9	6	+3
Road traffic accidents	10	8	+2
Diabetes	11	7	+4
Malaria	12	22	-10
Hypertensive heart disease	13	11	+2
Self-inflicted injuries	14	12	+2
Stomach cancer	15	10	+5
Nephritis and nephrosis	17	13	+4
Colon and rectum cancers	18	15	+3
Liver cancers	19	14	+5

Certain cancers, including lung, breast and colorectal cancer, are more common in developed nations due to increased risk factors such as smoking, fertility patterns that influence breast cancer (fewer children and later age at first birth for women), and the prevalence of high-fat, low-fiber diets. Cancer risk also rises with increasing age; hence increased life expectancy in developing countries can be expected to lead to an increase the prevalence of cancer. Accordingly, these “western” cancers are increasing across the developing world:

- Female mortality from lung and breast cancer increased from 1970–2000 in most Latin American countries; (82)
- Breast cancer is the most common malignancy affecting women in Nigeria; (130)
- In Brazil, lung cancer is the second leading cause of death; 40% of men and 25% of women 15 and older smoke; (88)
- In Rio de Janeiro, Brazil 7% of all disability-adjusted life years lost were due to smoking. Of the total disease burden, smoking attributed 72.2%; (90)
- In China, the prevalence of breast cancer is growing due to increasing risk factor. Between 2000–2005, there were 470,000 more new breast cancer cases and 120,000 more deaths from breast cancer; (111)
- Years of life lost to lung cancer in Mexico between 1985–1996 were estimated to be 391,865. (126)

South Korea offers a microcosm of the impact of cancer on an emerging market economy: (139)

- Cancer accounted for 26.3% of all deaths in Korea in 2004.
- In 2002, the Korean National Health Insurance Agency estimated cancer-related payments to be \$699.4 million.
- The total cost of medical care related to cancer amounted to \$1.260 billion (the national health insurance agency paid for 49.6%), with inpatient costs making up 77.2% to the total.
- The morbidity costs were estimated at \$1.3 billion, or \$4,362 per patient.
- Premature mortality costs were estimated at \$6.14 billion, with 19.5 life years lost per death.
- In 2002, the total economic cost of cancer was \$9.4 billion (1.72% of GDP), of which 13.7% was medical care, 14.5% morbidity costs, and 65.3% mortality costs.
- Additionally, 47% of cancer patients lost their job upon diagnosis. (142)

One of the few studies that looked at cancer costs in Turkey found the total cost of lung cancer per patient per year to be \$18,000. (143) Hospitalization and examination only amounted to 4.6% of the total, perhaps because few patients received surgery or were hospitalized. Based on figures from developed countries, the authors estimate the future annual cost of lung cancer to be \$3–4 billion.

Direct cancer costs in the United States were reported to be \$60.9 billion dollars and \$15.5 billion for indirect morbidity costs. The mean monthly costs ranged from \$2,187 dollars to \$7,616, depending on the type of cancer (151). A recent study estimated that in 2000 the value of life lost in the United States from cancer deaths amounted to \$960.6 billion. According to this analysis, lung cancer accounted for 25% of this cost. If current mortality rates continue, the value of life lost from all cancer in the United States alone will increase to \$1,472.5 billion in the 2020. (234)

The prognosis for many cancers can be improved with early diagnosis. However, most developing nations lack regular screening protocols for common cancers such as cervical cancer, breast cancer and colorectal cancer. For instance, implementation of routine Pap test screening for cervical cancer in the United States led to a decrease in the mortality rate from 7.5 per 100,000 women in 1969 to 2.5 per 100,000 women in 2000. (81) Screening even once a decade can reduce cervical cancer mortality by 61%.

Colorectal cancer prognosis can be improved with early detection; population-based screening may reduce mortality by 16% (76). Breast cancer detection is the first step in addressing the increased prevalence of breast cancer in developing countries. Regular mammography screening can reduce breast cancer mortality by 40–45%. (76)

Decreasing the prevalence of lung cancer in developing countries must focus on decreasing tobacco consumption (81). Smoking is projected to kill 50% more people in 2015 than AIDS. (2) Measures such as taxing tobacco products to decrease cigarette consumption should be considered in developing countries, as they have been in industrialized countries. Studies show that increasing the price of tobacco effects cigarette consumption: a 10% increase in the price of cigarettes results in a 2.5–5% decline in smoking in high-income countries. This effect is larger in low-middle-income countries, such as China, where the same price increase resulted in a 5.4–6.6% decrease in smoking. (76)

VI. Specific Key Findings on Diabetes

Diabetes is unquestionably one of the world's most explosive chronic health challenges. People with poorly controlled blood sugar levels are at risk for a number of serious health complications, including heart disease and stroke, kidney disease, blindness, diabetic neuropathy and foot problems that may lead to amputation. These complications can impair a diabetic's quality of life and ability to work, are expensive to treat and lead to increased mortality. The excess global mortality attributable to diabetes in 2000 was estimated at nearly three million, or 5.2% of all deaths. (19)

The World Health Organization has made predictions regarding chronic diabetes: (17)

- There will be a 35% increase in the worldwide prevalence of diabetes between 1995 and 2025 (from 4.0% to 5.4%) driven by an increase in the risk factors for diabetes, which include obesity, lack of exercise and western diets.
- Proportionally, this increase will be greatest in developing countries—48%, from 3.3% to 4.9%.
- As a result, developing countries will see a 170% increase in the number of people with diabetes to 228 million by 2025. By this time, more than 75% of people with diabetes will be in the developing world.
- The areas that are predicted to face the largest increase in the number of diabetics are India (195% to 57.2 million), the Middle Eastern Crescent (193% to 54 million), and sub-Saharan Africa (185% to 8 million).

Table 4. Top 10 counties for number of people with diabetes, 1995 and 2025

1995	2025
Country/# of diabetics (millions)	Country/# of diabetics (millions)
1. India (19.4)	1. India (57.2)
2. China (16.0)	2. China (37.6)
3. United States (13.9)	3. United States (21.9)
4. Russia (8.9)	4. Pakistan (14.5)
5. Japan (6.3)	5. Indonesia (12.4)
6. Brazil (4.9)	6. Russia (12.2)
7. Indonesia (4.5)	7. Mexico (11.7)
8. Pakistan (4.3)	8. Brazil (11.6)
9. Mexico (3.8)	9. Egypt (8.8)
10. Ukraine (3.6)	10. Japan (8.5)

Not only will developing countries face the greatest increase in the number of people with diabetes, but the diabetic population in these countries will be markedly different from the diabetic population in developed countries. In the developed world, diabetes is typically a disease of the elderly; the largest number of diabetics are in the 65+ age group. In developing countries, however, the largest number of diabetics are in the 45- to 65-year-old age group, an age bracket in which most people are in their most productive years. In sub-Saharan Africa, the greatest number of diabetics will be in the 20- to 44-year-old age group and the 45- to 65-year-old age group. Younger diabetics will not only affect the workforce, but having diabetes at a younger age also gives people more time to develop complications, which has serious implications for health care costs and utilization. (17)

India has the highest prevalence of diabetes and the largest number of diabetics in the world, driven in part by the country's increasing urbanization and related lifestyle changes and the genetic predisposition of Asian Indians to insulin resistance. It is estimated that currently only 10% of diabetes patients in India receive appropriate care. As in many developing countries, awareness of diabetes is low and routine monitoring of the disease is sub-optimal. One study found that the annual indirect costs of diabetes in India, including loss of income and productivity, were Rs.12,756 (\$290) per person, while direct costs to the health care system, including complications and hospitalizations were Rs.4,724 (\$107) per person. (39)

Another study found that diabetes occurred before 50 years of age in 54.1% of patients in India, suggesting that these subjects developed diabetes in their most productive years and had a higher chance of developing severe chronic complications such as retinopathy (35). According to one study, more than one-third of diabetic patients in south India had retinopathy. At the 1995 level of 20 million diabetics, the annual cost of diabetes in India was estimated to \$2.2 billion, with the bulk of that paid for out-of-pocket by patients and their families. (35)

A study of diabetic patients in Hong Kong estimated the annual cost of care to be \$1,725– 2,044, with the government paying for 78.4% of the costs. Costs increased 1.1-

fold for patients with microvascular or macrovascular complications and were 1.3-fold higher in patients with both microvascular and macrovascular complications. (31)

Diabetes was found to be responsible for the loss of 757,096 discounted years of productive life among individuals under the age of 65 in Latin American and the Caribbean at a cost of \$3 billion. (25) A study of the cost and the expected change in demand for health care services in Mexico over a three-year period as a result of diabetes found a 26% increase in financial requirements for the Mexican health care system, with the demand largest among the insured population of salaried workers covered by the Institute for Social Security and Services for State Workers. (58)

Much of the burden of diabetes is due to uncontrolled blood sugar levels, which leads to a variety of vascular complications, including cardiovascular disease, retinopathy and nephropathy. Improvements in patient management to promote better control of blood sugar levels have the greatest potential for reducing diabetic complications, hospitalizations and mortality. Studies from developing countries should that diabetes is generally poorly controlled and treated. A study of diabetics in India with a mean age at onset of 44 years found approximately half the patients had poorly controlled blood sugar and more than half the patients had severe late complications of diabetes. Few patients monitored their own blood sugar levels, only four percent were on diet therapy, just over half were receiving oral hypoglycemic agents and only 22% were receiving insulin. (44)

A study of diabetic patients at private primary healthcare in Malaysia found that only 12% of patients had had their blood sugar levels measured in the past 12 months and only 20% had satisfactory blood sugar control. Not surprisingly, the study also found high rates of diabetic complications, including neuropathy (30%) and retinopathy (23.5%). (54)

Diabetes in the developing world is characterized by poor levels of blood glucose control and patient monitoring as well as high rates of complications, which further increase health care costs and decrease productivity and quality of life. Primary prevention in the form of exercise, diet and weight control will help control the development of new cases of diabetes, although predictions are that obesity and sedentary lifestyles will continue to rise throughout the developing world. Oral hypoglycemic agents and insulin are not broadly deployed in many developing countries.

VII. Summary of Findings

These three chronic diseases in emerging market economies are the inevitable consequence of populations having passed through the demographic and into the epidemiological transition. The decrease in infant mortality rates and increase in life expectancy have contributed greatly to this transition. The significance of these changes was ignored by almost all of the international health development agencies. Their program resources were directed to reductions in infant mortality rates without any attention being given to those who survived premature death.

The World Health Organization did recognize early on that something was amiss in its global mortality projections. In a 1982 *World Health Statistics Report*, researchers commented: “One manifestation of our failure to adapt to the changed nature of population age structure is our exclusive reliance on mortality data in infancy and childhood to measure health attainment with and between countries.”

However, it took until 2005 for the WHO to alert the wider public to the emerging problem. In the publication *Preventing Chronic Disease: A Vital Investment*, WHO startled its Member States by announcing that 388 million people would die of chronic diseases by 2015. In this same publication, China proclaimed that it would forego \$558 billion in national income over the next ten years as a result of premature deaths caused by heart disease, stroke and diabetes. (13)

In response to this onslaught, WHO recommended a set of preventive measures as the main intervention on chronic diseases. For the tens of millions already in a chronic disease, prevention is too late. More importantly, prevention doesn’t prevent the onset of a chronic disease in the same way that an immunization does for an infectious or parasitic disease. For chronic diseases, low cost treatment regimens help patients to manage an existing health problem more effectively and to have more years of a healthy life.

Still, many of the citations in this Bibliography have helped to create a new reality on an aging population and subsequent chronic disease within emerging market economies: it is about the pernicious effects this onset has on the labor force. As the working age population expands, and if high death rates from chronic disease continue, the burden will rest on the shoulders of workers. (158) For instance, in Brazil between 2000 and 2030, 28% of CVD deaths will be among the workforce, compared to 12% in the United States. In 2000 alone, the number of productive years of life lost due to CVD in Brazil was 1.1 million; it was 9.2 million in India. Table 5 demonstrates this for economies with the largest populations: (158)

Table 5. Percent population aged 35–65, 2000 and 2020

	India	Brazil	China	U.S.
2000	27.0	29.5	33.2	38.5
2020	33.6	37.9	41.0	37.9

VIII. The Importance of Empowering Ministries of Finance

In June 2007, the World Bank published a paper on the pervasive use of substandard and counterfeit drugs and the role they play in accelerating drug resistance, accompanied by increased costs. It commented that “within the UN family of specialized agencies, the World Bank has a recognized leadership role to engage ministries of finance on macroeconomic issues. While ministries of public health will be subjected to the health consequences, it will be ministries of finance that bear fiduciary responsibilities for their governments’ [overall] societal costs.” (233)

Brazil has the 10th largest economy in the world. It is considered one of the top emerging market economies. Brazil has also been a leader in support of WHO's Intergovernmental Working Group on Public Health, Innovation and Intellectual Property (IGWG), which succeeded in the May 2008 World Health Assembly to have Type I diseases added to the IGWG process.

Along with Thailand, Brazil remains a major proponent of compulsory licensing for AIDS drugs, pleading to the world community that their cost is prohibitive. Yet, as this study shows, Brazil expended 8% of its national health budget on severe CVD—for direct costs alone, covering 5.2% of the population over age 35. (180) In contrast, it spent less than 0.8% of this same budget on the provision of free and open access to AIDS treatment and care for 0.9% of its population.

The emerging market economies aren't hemorrhaging in their national health budgets from the ever-decreasing burden of infectious and parasitic diseases. But, the attention drawn to them by international agencies has diverted these countries from the unfunded, macroeconomic liabilities being set in train by the sequential increase in the number of chronically sick people in their working age populations. The central policy issued faced by emerging market economies lies not in the realm of a continued focus on communicable diseases. Rather, by failing to assign a proper value to the consequences of post-demographic and epidemiological changes, policy-makers drastically underestimate the societal costs involved in sustaining a competitive economy in the 21st Century by addressing chronic diseases within a macroeconomic context.

The cost to do so isn't as overwhelming as it may seem, though it does increase exponentially when treatment is delayed. Early treatment with aspirin, cholesterol lowering therapies, life-style and diet changes, tobacco cessation, etc. has dramatic effects on the improvement of healthy lives at very low costs. The World Bank recommends that "the use of pharmaceuticals will be needed to control symptoms of chronic diseases, since they are generally acknowledged as the most cost-effective means to achieve that goal." (233)

In the past five years, the international health community has disbursed more than \$60 billion to combat three parasitic and infectious diseases—only to have the infection rates continue on an upward arc, and to incur unanticipated rates of drug resistance. WHO has stated that there were 9.5 million new TB infections in 2008, with a 5% of them becoming MDR-TB long term cases. For every new patient placed on an antiretroviral therapy, 6 more become infected with HIV/AIDS. At the field level, these diseases were managed by ministries of public health and the donor community.

Ministries of finance cannot afford to have this track record replicated with chronic diseases. They understand that an inept management of these diseases would greatly affect their international competitiveness, trade balance, and national economic productivity. A failure to step up to this challenge would subordinate the responsibility for Type 1 diseases to ministries of public health—with assistance from the international donor community.

The global financial crisis downturn is producing enough of a negative impact on emerging market economies without added strains. Their economies face a bleak future of unfunded liabilities from just three chronic diseases. Ministries of finance need to be empowered and engaged on an issue that is central to their nations' economic survival.

The World Bank has found that policy development in the area of adult health is weak, and the research necessary to support sound policy decisions has been neglected. (235) Cost studies on the macroeconomic consequences of chronic diseases can serve to bridge this gap and help ministries of finance to confront a reality that if left unattended can thwart future national development efforts.

The citations in the Bibliography graphically illustrate that while there is increased knowledge about the significance of chronic diseases, this fact is not yet accompanied by a macroeconomic understanding of their consequences. Key to that understanding is the role which has to be played by ministries of finance in emerging market economies. They have to control progress toward solutions that are largely economic in nature, yet engage political and social institutions that are beyond the health sector itself—if together, these countries are to avoid a macroeconomic pandemic of rising costs due to adult ill-health in their labor forces. From a political perspective, there will be waning support for the infectious and parasitic diseases affecting the young if there isn't increased support for the vast majority of adult populations burdened by chronic diseases.

Chart I

Article #	All Chronic	Cardiovascular	Cancer	Diabetes	Macroeconomic/DALYs
1	X				
2	X				
3	X				
4	X				
5	X				
6	X				
7	X				
8	X				
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10	X				
11	X				
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18				X	
19				X	
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21				X	
22				X	
23				X	X
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25				X	X
26				X	
27				X	
28				X	
29				X	
30				X	X
31		X		X	X
32				X	X
33				X	
34				X	
35				X	X
36				X	X
37				X	X
38				X	
39				X	X
40				X	
41				X	
42				X	X
43				X	
44				X	
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231		X			
232		X			
233		X			X
234				X	X
235	x				X

The Macroeconomic Consequences of Chronic Diseases in Emerging Market Economies

Bibliography

Global Consequences of Chronic Disease

1. Abegunde DO, Mathers CD, Adam T. The burden and cost of chronic diseases in low-income and middle income countries. *The Lancet* 2007; 370(9603): 1929–38.

This paper estimates the disease burden and loss of economic output associated with chronic diseases—mainly cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes—in 23 selected countries which account for around 80% of the total burden of chronic disease mortality in developing countries. In these 23 selected low-income and middle-income countries, chronic diseases were responsible for 50% of the total disease burden in 2005. For 15 of the selected countries where death registration data are available, the estimated age-standardized death rates for chronic diseases in 2005 were 54% higher for men and 86% higher for women than those for men and women in high-income countries. If nothing is done to reduce the risk of chronic diseases, an estimated US\$84 billion of economic production will be lost from heart disease, stroke, and diabetes alone in these 23 countries between 2006 and 2015. Achievement of a global goal for chronic disease prevention and control—an additional 2% yearly reduction in chronic disease death rates over the next 10 years—would avert 24 million deaths in these countries, and would save an estimated \$8 billion, which is almost 10% of the projected loss in national income over the next 10 years.

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Global and regional projections of mortality and burden of disease by cause for the years 2000, 2010, and 2030 were published by Murray and Lopez in 1996 as part of the Global Burden of Disease project. These projections, which are based on 1990 data, continue to be widely quoted, although they are substantially outdated; in particular, they substantially underestimated the spread of HIV/AIDS. To address the widespread demand for information on likely future trends in global health, and thereby to support international health policy and priority setting, we have prepared new projections of mortality and burden of disease to 2030 starting from World Health Organization estimates of mortality and burden of disease for 2002. This paper describes the methods, assumptions, input data, and results.

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There are at present approximately 110 million people with diabetes in the world but this number will reach over 220 million by the year 2010, the majority of them with type 2 diabetes. Thus there is an urgent need for strategies to prevent the emerging global epidemic of type 2 diabetes to be implemented. Tackling diabetes must be part of an integrated program that addresses lifestyle related disorders. The prevention and control of type 2 diabetes and the other major noncommunicable diseases (NCDs) can be cost- and health-effective through an integrated (i.e. horizontal) approach to noncommunicable diseases disease prevention and control. With the re-emergence of devastating communicable diseases including AIDS, the Ebola virus and tuberculosis, the pressure is on international and regional agencies to see that the noncommunicable disease epidemic is addressed. The international diabetes and public health communities need to adopt a more pragmatic view of the epidemic of type 2 diabetes and other noncommunicable diseases. The current situation is a symptom of globalization with respect to its social, cultural, economic and political significance. Type 2 diabetes will not be prevented by traditional medical approaches; what is required are major and dramatic changes in the socio-economic and cultural status of people in developing countries and the disadvantaged, minority groups in developed nations. The international diabetes and public health communities must lobby and mobilize politicians, other international agencies such as UNDP, UNICEF, and the World Bank as well as other international nongovernmental agencies dealing with the noncommunicable diseases to address the socio-economic, behavioral, nutritional and public health issues that have led to the type 2 diabetes and noncommunicable diseases epidemic. A multidisciplinary Task Force representing all parties which can contribute to a reversal of the underlying socio-economic causes of the problem is an urgent priority. Lifestyle changes, focusing on diet, exercise and weight loss are effective in preventing diabetes in such people. However, more information is required about the long-term sustainability of these changes and programs need to be adapted to meet the needs of developing countries.

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Chronic diseases are the largest cause of death in the world. In 2002, the leading chronic diseases--cardiovascular disease, cancer, chronic respiratory disease, and diabetes--caused 29 million deaths worldwide. Despite growing evidence of epidemiological and economic impact, the global response to the problem remains inadequate. Stakeholders include governments, the World Health Organization and other United Nations bodies, academic and research groups, nongovernmental organizations, and the private sector. Lack of financial support retards capacity development for prevention, treatment, and research in most developing countries. Reasons for this include that up-to-date evidence related to the nature of the burden of chronic diseases is not in the hands of decision makers and strong beliefs persist that chronic diseases afflict only the affluent and the elderly, that they arise solely from freely acquired risks, and that their control is ineffective and too expensive and should wait until infectious diseases are addressed. The influence of global economic factors on chronic disease risks impedes progress, as does the orientation of health systems toward acute care. We identify 3 policy levers to address

these impediments elevating chronic diseases on the health agenda of key policymakers, providing them with better evidence about risk factor control, and persuading them of the need for health systems change. A more concerted, strategic, and multisectoral policy approach, underpinned by solid research, is essential to help reverse the negative trends in the global incidence of chronic disease.

5. Boutayeb A., Boutayeb S. The burden of non communicable diseases in developing countries. *International Journal for Equity in Health* 2005, 4: 2.

By the dawn of the third millennium, non communicable diseases are sweeping the entire globe, with an increasing trend in developing countries where, the transition imposes more constraints to deal with the double burden of infective and non-infective diseases in a poor environment characterized by ill-health systems. By 2020, it is predicted that these diseases will be causing seven out of every 10 deaths in developing countries. Many of the non communicable diseases can be prevented by tackling associated risk factors. Methods: Data from national registries and international organisms are collected, compared and analyzed. The focus is made on the growing burden of non communicable diseases in developing countries. Results: Among noncommunicable diseases, special attention is devoted to cardiovascular diseases, diabetes, cancer and chronic pulmonary diseases. Their burden is affecting countries worldwide but with a growing trend in developing countries. Preventive strategies must take into account the growing trend of risk factors correlated to these diseases. Conclusion: Noncommunicable diseases are more and more prevalent in developing countries where they double the burden of infective diseases. If the present trend is maintained, the health systems in low-and middle-income countries will be unable to support the burden of disease. Prominent causes for heart disease, diabetes, cancer and pulmonary diseases can be prevented but urgent (preventive) actions are needed and efficient strategies should deal seriously with risk factors like smoking, alcohol, physical inactivity and western diet.

6. Beaglehole R, Yach D. Globalization and the prevention and control of noncommunicable disease: the neglected chronic diseases of adults. *Lancet* 2003; 362: 903–908.

The growing global burden of non-communicable diseases in poor countries and poor populations has been neglected by policy makers, major multilateral and bilateral aid donors, and academics. Despite strong evidence for the magnitude of this burden, the preventability of its causes, and the threat it poses to already strained health care systems, national and global actions have been inadequate. Globalization is an important determinant of noncommunicable disease epidemics since it has direct effects on risks to populations and indirect effects on national economies and health systems. The globalization of the production and marketing campaigns of the tobacco and alcohol industries exemplify the challenges to policy makers and public health practitioners. A full range of policy responses is required from government and non-governmental agencies; unfortunately the capacity and resources for this response are insufficient, and governments need to respond appropriately. The progress made in controlling the tobacco industry is a modest cause for optimism.

7. Raymond S, Greenberg HM, Liu H et al. Civil Society Confronts the Challenge of Chronic Illness. *Development* 2004; (2): 97–103.

The rise of cardiovascular diseases in developing nations poses challenges for public health and growing economies. The epidemic will hit the working ages with greatest force just when falling dependency rates promise greater returns to a productive workforce. By encouraging citizen associations and open flows of information, civil society and globalization could create opportunities for the policy change and voluntary participation necessary for risk factor reduction.

8. Greenberg HM, Farmer RG. Global health assistance: a new perspective. *Annals of Noninvasive Electrophysiology* 2002; 7(1): 73–7.

Health care priorities for many emerging economies have undergone a dramatic transition in the recent past because of the rise in chronic illness, increased longevity, and lessened infant mortality. Two additional major societal forces, democratization and the information revolution, will alter the nature of global health assistance. Because of democratization, governments will feel increasing pressure to provide adequate health care. Because of the information revolution, all practitioners will know what is available. The convergence of these three forces will create an enormous financial burden for emerging economies. Adapting to these new realities will be the challenge to donor organizations. What is likely to emerge as a critical health care problem around the world is the need to balance priorities between acute care and prevention or modification of chronic disease. These efforts will be directed at different populations, one manifestly ill and one potentially so, and each will need to be recognized politically as having valid claims on governmental resources. External support will need to include demonstration within the recipient communities that data collection permits an accurate identification of disease burden, that risk factor modification ameliorates the impact of disease, that continuity of care is essential to long term outcomes, and that therapy of developed disease can be rationally carried out utilizing evidence based medicine to insure efficiency and appropriateness.

9. Tu, HT. *Rising Health Costs, Medical Debt and Chronic Conditions*. Issue Brief No. 88, Center for Studying Health System Change, September 2004.

About 57 million working-age Americans—18-64 years old—live with chronic conditions, such as diabetes, asthma or depression. In 2003, more than one in five, or 12.3 million people with chronic conditions, lived in families with problems paying medical bills, according to a new study by the Center for Studying Health System Change (HSC). Rising health costs have hit low-income, privately insured people with chronic conditions particularly hard. Between 2001 and 2003, the proportion of low-income, chronically ill people with private insurance who spent more than 5 % of their income on out-of-pocket health care costs grew from 28 % to 42 %. For the 6.6 million uninsured, chronically ill Americans, the financial consequences are especially grave—nearly half reported medical bill problems, making them much more likely to forgo or delay needed medical care. Among the 3 million uninsured, chronically ill people with medical bill

problems, four in 10 went without needed care, two in three put off care and seven in 10 did not fill a prescription in the past year because of cost concerns.

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Interventions to prevent morbidity and mortality from chronic diseases need to be cost effective and financially feasible in countries of low or middle income before recommendations for their scale-up can be made. We review the cost-effectiveness estimates on policy interventions (both population-based and personal) that are likely to lead to substantial reductions in chronic diseases—in particular, cardiovascular disease, diabetes, cancer, and chronic respiratory disease. We reviewed data from regions of low, middle, and high income, where available, as well as the evidence for making policy interventions where available effectiveness or cost-effectiveness data are lacking. The results confirm that the cost-effectiveness evidence for tobacco control measures, salt reduction, and the use of multidrug regimens for patients with high-risk cardiovascular disease strongly supports the feasibility of the scale-up of these interventions. Further assessment to determine the best national policies to achieve reductions in consumption of saturated and trans fat—chemically hydrogenated plant oils—could eventually lead to substantial reductions in cardiovascular disease. Finally, we review evidence for policy implementation in areas of strong causality or highly probable benefit—eg, changes in personal interventions for diabetes reduction, restructuring of health systems, and wider policy decisions.

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Diabetes

Global/Regional

17. King H, Aubert R, Herman W. Global burden of diabetes, 1995-2025. *Diabetes Care* 1998; 21(9): 1414-31.

Objective: To estimate the prevalence of diabetes and the number of people with diabetes who are > or =20 years of age in all countries of the world for three points in time, i.e., the years 1995, 2000, and 2025, and to calculate additional parameters, such as sex ratio, urban-rural ratio, and the age structure of the diabetic population. Methods: Age-specific diabetes prevalence estimates were applied to United Nations population estimates and projections for the number of adults aged > or =20 years in all countries of the world. For developing countries, urban and rural populations were considered separately. Results: Prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995 and to rise to 5.4% by the year 2025. It is higher in developed than in developing countries. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. The major part of this numerical increase will occur in developing countries. There will be a 42% increase, from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. Thus, by the year 2025, >75% of people with diabetes will reside in developing countries, as compared with 62% in 1995. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China, and the U.S. In developing countries, the majority of people with diabetes are in the age range of 45-64 years. In the developed countries, the majority of people with diabetes are aged > or =65 years. This pattern will be accentuated by the year 2025. There are more women than men with diabetes, especially in developed countries. In the future, diabetes will be increasingly concentrated in urban areas. Conclusions: This report supports earlier predictions of the epidemic nature of diabetes in the world during the first quarter of the 21st century. It also provides a provisional picture of the characteristics of the epidemic. Worldwide surveillance of diabetes is a necessary first step toward its prevention and control, which is now recognized as an urgent priority.

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Much of the burden of diabetes is due to the development of vascular complications, including cardiovascular diseases, retinopathy and nephropathy. Improvements in patient management to promote tight control of glycemia have helped reduce the prevalence of microvascular complications, but cardiovascular diseases continue to be the leading cause of death in patients with type 2 diabetes. Globally, the number of people with diabetes is predicted to almost double over the next 30 years, with much of this increase occurring in the developing countries. The growing prevalence of obesity is the major factor driving the increasing prevalence of type 2 diabetes. Consequently, the overall number of people with vascular complications of diabetes is also predicted to increase. Prevention of diabetes is the best strategy for reducing the risk of complications and screening of high-risk individuals is also being promoted in some countries.

19. Roglic G, Unwin N, Bennett PH et al. The burden of mortality attributable to diabetes: realistic estimates for the year 2000. *Diabetes Care* 2005; 28(9): 2130–35.

Objective: To estimate the global number of excess deaths due to diabetes in the year 2000. Methods: We used a computerized generic formal disease model (DisMod II), used by the World Health Organization to assess disease burden through modeling the relationships between incidence, prevalence, and disease-specific mortality. Baseline input data included population structure, age- and sex-specific estimates of diabetes prevalence, and available published estimates of relative risk of death for people with diabetes compared with people without diabetes. The results were validated with population-based observations and independent estimates of relative risk of death. Results: The excess global mortality attributable to diabetes in the year 2000 was estimated to be 2.9 million deaths, equivalent to 5.2% of all deaths. Excess mortality attributable to diabetes accounted for 2-3% of deaths in poorest countries and over 8% in the U.S., Canada, and the Middle East. In people 35-64 years old, 6-27% of deaths were attributable to diabetes. Conclusions: These are the first global estimates of mortality attributable to diabetes. Globally, diabetes is likely to be the fifth leading cause of death.

20. Wild S, Roglic G, Green A et al. Global prevalence of diabetes: estimates for the year 2000 and projects for 2030. *Diabetes Care* 2004; 27(5): 1047–53.

Objective: The goal of this study was to estimate the prevalence of diabetes and the number of people of all ages with diabetes for years 2000 and 2030. Methods: Data on diabetes prevalence by age and sex from a limited number of countries were extrapolated to all 191 World Health Organization member states and applied to United Nations' population estimates for 2000 and 2030. Urban and rural populations were considered separately for developing countries. Results: The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between 2000 and 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people >65 years of age. Conclusions: These findings indicate that the “diabetes epidemic” will continue even if levels of obesity remain constant. Given the increasing prevalence of obesity, it is likely that these figures provide an underestimate of future diabetes prevalence.

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The prevalence of type 2 diabetes is rising rapidly in all non-industrialized populations. By 2025, three-quarters of the world's 300 million adults with diabetes will be in non-industrialized countries, and almost a third in India and China alone. There is strong evidence that this epidemic has been triggered by social and economic development and urbanization, which are associated with general improvements in nutrition and longevity,

but also with obesity, reduced physical exercise and other diabetogenic factors. There is evidence too that fetal growth retardation and growth failure in infancy, both still widespread in non-industrialized populations, increase susceptibility to diabetes. An additional factor may be intergenerational effects of gestational diabetes occurring in mothers who grew poorly in early life and become obese as adults. Prevention of type 2 diabetes will require measures to promote exercise and reduce obesity in adults and children, alongside programs to achieve healthy fetal and infant growth.

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The increase in obesity worldwide will have an important impact on the global incidence of cardiovascular disease, type 2 diabetes mellitus, cancer, osteoarthritis, work disability, and sleep apnea. Obesity has a more pronounced impact on morbidity than on mortality. Disability due to obesity-related cardiovascular diseases will increase particularly in industrialized countries, as patients survive cardiovascular diseases in these countries more often than in non-industrialized countries. Disability due to obesity-related type 2 diabetes will increase particularly in industrializing countries, as insulin supply is usually insufficient in these countries. As a result, in these countries, an increase in disabling nephropathy, arteriosclerosis, neuropathy, and retinopathy is expected. Increases in the prevalence of obesity will potentially lead to an increase in the number of years that subjects suffer from obesity-related morbidity and disability. A 1% increase in the prevalence of obesity in such countries as India and China leads to 20 million additional cases of obesity. Prevention programs will stem the obesity epidemic more efficiently than weight-loss programs. However, only a few prevention programs have been developed or implemented, and the success rates reported to date have been low. Obesity prevention programs should be high on the scientific and political agenda in both industrialized and industrializing countries.

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The private and social costs of obesity have many causes, and their consequences can be grimly predicted with only rough accuracy. Among the most devastating is the increased incidence of diabetes, of which 60% can be directly attributed to weight gain. There are now about one billion people worldwide who are overweight or obese, compared with 850 million who are chronically underweight. It is estimated that the number of people worldwide with diabetes will increase from 175 million in 2000 to 353 million in 2030, with India and China together accounting for 24% of the total in 2050. Obesity and its economic costs are borne on three levels. At an individual level, obesity imposes costs by limiting personal opportunity in many ways, only some of which can be quantified. In the workplace (assuming the obese are employed, which they may not be, due in part to their condition), costs are borne by employers due to lost productivity, absences, underperformance, and higher insurance premiums, which in the aggregate are quite large. Finally, obesity affects expenditures by local, state, and national governments, where programs compensate for or cover some of the private and workforce costs of illness and unemployment.

24. Lee C, Huxley R, Lam T. Prevalence of diabetes mellitus and population attributable fractions for coronary heart disease and stroke mortality in the WHO South-East Asia and Western Pacific regions. *Asia Pacific Journal of Clinical Nutrition* 2007;16: 187–92.

The aims of this study were to obtain the most recent representative data for the prevalence of diabetes in adult populations in the World Health Organization's South-East Asia and Western Pacific regions and to quantify the contribution of diabetes to the burden of mortality from cardiovascular diseases in these regions. Previous reports indicate that there are 83 million individuals with diabetes in the Asia-Pacific region, but since many of the country-specific estimates were not from nationally representative studies, this figure may not accurately reflect the current burden of diabetes. Information on the prevalence of diabetes was obtained by searching Medline and government health websites. Data were available from 12 countries representing 78% of the total population of the Asia-Pacific region. Six of 10 countries with complete data reported a prevalence of diabetes exceeding those estimates currently cited by the World Health Organization; three of which have also already exceeded the World Health Organization projections for 2030. In the 12 countries in the region with nationally representative data, the prevalence of diabetes ranged from 2.6% to 15.1%. Hazard ratios from the Asia Pacific Cohort Studies Collaboration were used to calculate population attributable fractions for diabetes for fatal cardiovascular diseases in the region. Population attributable fractions ranged from 2% to 12% for coronary heart disease, 1% to 6% for hemorrhagic stroke, and 2% to 11% for ischemic stroke. Accurate estimates of the prevalence of diabetes are of great importance and standard methods are needed for periodic surveillance across the Asia-Pacific region and elsewhere.

Brazil

25. Barcelo A, Aedo C, Rajpathak S et al. The Cost of Diabetes in Latin American and the Caribbean (includes Brazil, Chile, Colombia, Mexico). *Bulletin of the World Health Organization* 2003;81:19–27.

Objective: To measure the economic burden associated with diabetes mellitus in Latin America and the Caribbean. Methods: Prevalence estimates of diabetes for the year 2000 were used to calculate direct and indirect costs of diabetes mellitus. Direct costs included costs due to drugs, hospitalizations, consultations and management of complications. The human capital approach was used to calculate indirect costs and included calculations of forgone earnings due to premature mortality and disability attributed to diabetes mellitus. Mortality and disability attributed to causes other than diabetes were subtracted from estimates to consider only the excess burden due to diabetes. A 3% discount rate was used to convert future earnings to current value. Findings: The annual number of deaths in 2000 caused by diabetes mellitus was estimated at 339 035. This represented a loss of 757 096 discounted years of productive life among persons younger than 65 years (>US\$ 3 billion). Permanent disability caused a loss of 12 699 087 years and over US\$ 50 billion, and temporary disability caused a loss of 136 701 years in the working population and over US\$ 763 million. Costs

associated with insulin and oral medications were US\$ 4720 million, hospitalizations US\$ 1012 million, consultations US\$ 2508 million and care for complications US\$ 2 480 million. The total annual cost associated with diabetes was estimated as US\$ 65 216 million (direct US\$ 10 721; indirect US\$ 54 496). Conclusion: Despite limitations of the data, diabetes imposes a high economic burden to individuals and society in all countries and to Latin American and the Caribbean as whole.

26. Barreto SM, Passos VM, Almeida SK et al. The Increase of diabetes mortality burden among Brazilian adults. *Pan American Journal of Public Health* 2007; 22(4): 239–45.

Objective: To estimate diabetes-related deaths among Brazilian adults between 1999 and 2003 and to investigate demographic factors associated with reporting diabetes as an associated cause of death. Methods: All deaths with diabetes as the underlying or associated cause were identified using the Brazilian Mortality Data System. Analysis was performed by sex, age, year, state of residence, and place of death. Mortality rates were age standardized by the 2000 Brazilian population. Findings: A total of 237,946 deaths (8.8%) were related to diabetes; in 4.2% of deaths it was the underlying cause and in 4.6% of deaths it was an associated cause. Between 1999 and 2003, age-standardized mortality rates for diabetes as the underlying cause increased 14% among males and 9% among females, while mortality with diabetes and associated cause increased 22% and 28%, respectively. Diabetes appeared more often as an associated cause in death certificates among older individuals and those residing in Sao Paulo State; it appeared less often as an associated cause among women, brown- and black-skinned populations, and in deaths occurring outside of hospitals. Cardiovascular diseases accounted for 54.5% of the underlying causes of death when diabetes was an associated cause. Conclusion: Diabetes was related to almost 9% of the deaths in the South and Southeast regions of Brazil. Mortality from diabetes is increasing, especially deaths with diabetes as an associated cause. The probability of having diabetes as the underlying cause of death is greater among women and nonwhite individuals. Our results reinforce the importance of using multiple causes of death to monitor diabetes, because half the individuals with the disease will die of another cause, especially cardiovascular disease.

27. Salles GF, Bloch KV, Cardoso CR. Mortality and predictors of mortality in a cohort of Brazilian type 2 diabetic patients. *Diabetes Care* 2004; 27(6): 1299–305.

Objective: To investigate mortality rates and predictors of mortality in Brazilian type 2 diabetic patients. Methods: A prospective follow-up study was carried out with 471 type 2 diabetic outpatients. Primary end points were all-cause, diabetes-related, and cardiovascular deaths. Excess mortality in this cohort was evaluated by calculating standardized mortality ratios (SMRs) in relation to those of the Rio de Janeiro population. Results: During a median follow-up of 57 months, 121 (25.7%) patients died, 91 (75.2%) from diabetes-related causes and 44 (36.4%) from cardiovascular diseases. After adjusting for age and sex, the all-cause SMR was 3.28. The predictors of mortality were old age, preexisting cardiovascular disease, presence of frequent ventricular premature contractions and prolonged maximum heart rate-corrected QT interval on baseline electrocardiogram, and decreased serum HDL cholesterol. Conclusion: Brazilian type 2

diabetic patients had more than threefold excess mortality than the general population, largely because of increased cardiovascular mortality risk. Several clinical, laboratory and electrocardiographic predictors of mortality were identified that could possibly be modified to decrease the mortality burden of type 2 diabetes in Brazil.

Chile

28. Nutrition transition in Chile: determinants and consequences. *Public Health Nutrition* 2002; 5(1A): 123–7.

Objectives: The purpose of this study was to analyze the determinants and consequences of the nutrition transition in Chile and describe the related health promotion policies. Design: This is a descriptive, population-based study including data on demographic, diet, nutrition and biomedical related variables. Data came from the Food and Agriculture Organization (FAO), the National Institute of Statistics (INE), the Ministries of Planning, Health and Education surveillance systems, and national surveys. Results: As malnutrition decreased during the 1980s, obesity increased rapidly in all age groups. In adults, currently about 25% of women are obese (body mass index $>30 \text{ kg m}^{-2}$); particularly those from low socio-economic levels. Among preschoolers, obesity is now 10% while in 6-year-old children it is 17.5% (weight/height greater than two standard deviations ($>2SD$) of the World Health Organization reference). Nutritional risk factors are prevalent, diet is changing to a 'Western diet' with an increasing fat consumption, and sedentarianism is constant in all groups. High blood pressure ($>140/90$) is greater than 10% in adults. Diabetes is increasing in urban areas, including in the indigenous population, and more than 40% of adults have a cholesterol level of more than 200 mg ml^{-1} . Conclusions: Promotion of healthy lifestyles is the main strategy to cope with this situation, particularly changing behavior in food habits, physical activity and psychosocial factors. Changes in lifestyles will not only allow the prolonged life expectancy to be of better quality, but also will favor a decrease in the morbidity and mortality from chronic diseases, mainly cardiovascular diseases.

China

29. Popkin BM. Will China's nutrition transition overwhelm its health care system and slow economic growth? *Health Affairs* 2008; 27(4): 1064–76.

Rapid social and economic change is transforming China, with enormous implications for its population and economy. More than a fifth of China's adult population is overweight, related to changing dietary and physical activity patterns. Overweight and poor diets are becoming a greater burden for the poor than for the rich, with subsequent large increases in hypertension, stroke, and adult-onset diabetes. The related economic costs represent 4–8 % of the economy. Public investments are needed to head off a huge increase in the morbidity, disability, absenteeism, and medical care costs linked with this nutritional shift.

30. Zhao W, Zhai Y, Hu J. Economic burden of obesity-related chronic diseases in Mainland China. *Obesity Reviews* 2008; 9 Suppl 1: 62–7.

The objectives of the present study are: (i) to estimate annual direct medical costs of chronic diseases attributable to overweight and obesity among adults in China and (ii) to predict the medical costs if the epidemic continues developing. Using 2002 National Nutrition and Health Survey (n = 39,834), the prevalence of overweight [24 > or = body mass index (BMI) < 28] and obesity (BMI > or = 28), and population attributable risks (PARs) for hypertension, type 2 diabetes, coronary heart disease and stroke were calculated. The 2003 third National Health Services Survey (n = 143,521) was used to derive direct medical costs including costs for outpatient visits, physician services, inpatient stays, rehabilitation services, nursing fees and medications. The medical costs attributable to overweight and obesity were estimated by multiplying the disease costs by PAR for each disease. The total medical cost attributable to overweight and obesity was estimated at 21.11 billion Yuan (RMB) (approximately \$2.74 billion) accounting for 25.5% of the total medical costs for the four chronic diseases, or 3.7% of national total medical costs in 2003. The medical cost associated with overweight and obesity could increase to 37 billion Yuan (RMB) (approximately \$4.8 billion), a 75% increase, if the epidemic developed speedily and the ratio of overweight to obesity approached 1.1:1. The high economic burden of overweight and obesity suggests an urgent need to develop effective interventions for controlling the obesity epidemic and consequently the prevention of chronic diseases.

31. Chan BS, Tsang MW, Lee VW, Lee KK. Cost of Type 2 Diabetes mellitus in Hong Kong Chinese. *International Journal of Clinical Pharmacology and Therapeutics* 2007; 45(8): 455–68.

Objective: Hong Kong (HK) is a special administrative region of China as well as being a metropolitan city. In HK, like in many developed countries, Diabetes mellitus, with over 97% of diabetic patients having Type 2 Diabetes mellitus (Type 2 DM), is a growing public health problem but the local financial burden has never been investigated. The primary objectives of this study were to evaluate from the social perspective the costs of Type 2 DM, to identify the major cost drivers, and the proportion of the burden shared by the government, patient and the society. The study was carried out in a group of Hong Kong Chinese patients attending a government hospital. The economic impact of Type 2 DM on local and governmental healthcare expenditure was also examined. Methods: A retrospective cohort observational study was conducted in Type 2 DM patients attending the Diabetes Mellitus Outpatient Clinic at a public hospital in the period January 2004 to May 2004, in which 204 patients were randomly selected and invited to join this study. A total of 147 patients were subsequently enrolled giving an inclusion rate of 72%. Results: Annual total cost of Type 2 DM in a patient was US\$ 1,725 +/- 2,044 (HK\$ 13,457 +/- 15,943) with direct costs accounting for > 87.9%. The government was the major payer with over 78.4% of the total costs. Annual total direct medical costs per patient were US\$ 1,492 +/- 1,716 (HK\$ 11,638 +/- 13,386) of which the government paid 90.6%. Direct medical costs increased markedly if complications were present. In patients with microvascular or macrovascular complications only, the costs increased 1.1-fold compared to those for patients without complications. If both microvascular and macrovascular complications were present in the same patient, the costs were 1.3-fold higher than in patients without complications. Conclusion: Costs of Type 2 DM have a

significant impact on the local healthcare budget. It contributed in 2004 up to 3.9% of the total HK healthcare expenditure and 6.4% of the HK Hospital Authority's (public sector) expenditures on health.

32. Popkin BM, Horton S, Kim S et al. Trends in diet, nutritional status, and diet-related noncommunicable diseases in China and India: the economic costs of the nutrition transition. *Nutrition Reviews* 2001; 59(12): 379–90.

Undernutrition is being rapidly reduced in India and China. In both countries the diet is shifting toward higher fat and lower carbohydrate content. Distinct features are high intakes of foods from animal sources and edible oils in China, and high intakes of dairy and added sugar in India. The proportion of overweight is increasing very rapidly in China among all adults; in India the shift is most pronounced among urban residents and high-income rural residents. Hypertension and stroke are relatively higher in China and adult-onset diabetes is relatively higher in India. Established economic techniques were used to measure and project the costs of undernutrition and diet-related noncommunicable diseases in 1995 and 2025. Current WHO mortality projections of diet-related noncommunicable diseases, dietary and body composition survey data, and national datasets of hospital costs for healthcare, are used for the economic analyses. In 1995, China's costs of undernutrition and costs of diet-related noncommunicable diseases were of similar magnitude, but there will be a rapid increase in the costs and prevalence of diet-related noncommunicable diseases by 2025. By contrast with China, India's costs of undernutrition will continue to decline, but undernutrition costs did surpass overnutrition diet-related noncommunicable disease costs in 1995. India's rapid increase in diet-related noncommunicable diseases and their costs projects similar economic costs of undernutrition and overnutrition by 2025.

Egypt

33. el-Shazly M, Zaki A, Nicolucci A. Care-related risk factors for chronic diabetic complications in developing countries: a case from Egypt. *Public Health* 2002; 116(5): 289–96.

This work was the second phase of a wider study aiming at defining a plan for the improvement of health care services for diabetic patients and to decrease the incidence of its complications. The aim of this phase of the study was to define preventable risk factors for chronic diabetic complications, especially care-related factors. A total of 472 diabetic patients with chronic complications were compared with 528 control patients, free from complications, in a multicentric case-control study. Multivariate logistic regression analysis revealed that diabetic patients over 49 years of age, and female gender were more likely to develop chronic diabetic complications. Among clinical variables, type and duration of diabetes, glycemic control, and hypertension were significant predictors of diabetic complications. Regarding patient and system practices, non-health-insurance, need of help to reach health care facility, irregularity of follow-up visits and attending more than one clinic for follow-up, sources of health information other than physician and nurse, non-practicing leisure physical activities, and smoking were

statistically significant risk factors. The study helped to identify preventable risk factors for serious complications of diabetes. It also identified groups of patients who needed priorities of screening programs for potential development of complications since they were likely to develop such type of complications.

34. Herman WH, Aubert RE, Engelgau MM. Diabetes mellitus in Egypt: glycemic control and microvascular and neuropathic complications. *Diabetic Medicine* 1998; 15(12): 1045–51.

We performed a cross-sectional, population-based survey of persons 20 years of age and older living in Cairo and surrounding rural villages. The purpose was to describe glycemic control and the prevalence of microvascular and neuropathic complications among Egyptians with diagnosed diabetes, previously undiagnosed diabetes, impaired glucose tolerance, and normal glucose tolerance. A total of 6052 households were surveyed. The response rate was 76% for the household survey and 72% for the medical examination. Among people with previously diagnosed diabetes, mean hemoglobin A1c, was 9.0%. Forty-two per cent had retinopathy, 21% albuminuria, and 22% neuropathy. Legal blindness was prevalent (5%) but clinical nephropathy (7%) and foot ulcers (1%) were uncommon in persons with diagnosed diabetes. Among people with diagnosed diabetes, microvascular and neuropathic complications were associated with hyperglycemia. Retinopathy was also associated with duration of diabetes; albuminuria with hypertension and hypercholesterolemia; and neuropathy with age, female sex, and hypercholesterolemia. Albuminuria was as common in people with previously undiagnosed diabetes (22%) as those with diagnosed disease (21%). Mean hemoglobin A1c was lower (7.8%) and retinopathy (16%) and neuropathy (14%) were less prevalent in people with previously undiagnosed disease. Ocular conditions, blindness, and neuropathy were prevalent in the non-diabetic population. The microvascular and neuropathic complications of diabetes are a major clinical and public health problem in Egypt.

India

35. Ramachandran A. Socio-economic burden of diabetes in India. *The Journal of the Association of Physicians of India* 2007; 55(Suppl): 9–12.

The period between 1989-95 showed a 40% rise in the prevalence and subsequently a further increase of 16.4% was seen in the next 5 years. A national survey of diabetes conducted in six major cities in India in year 2000 showed that the prevalence of diabetes in urban adults was 12.1%. Prevalence of impaired glucose tolerance (IGT) was also high (14.0%).⁴ A younger age at onset of diabetes had been noted in Asian Indians in several studies.^{4,5} In the national study, onset of diabetes occurred before the age of 50 years in 54.1% of cases, implying that these subjects developed diabetes in the most productive years of their life and had a greater chance of developing the chronic complications of diabetes. Long standing diabetes mellitus is associated with an increased prevalence of microvascular and macrovascular diseases. With the rising prevalence of diabetes, the number suffering from the vascular complications of diabetes will also increase.

36. Kapur A. Economic analysis of diabetes care. *The Indian Journal of Medical Research* 2007; 125(3): 473–82.

Many socioeconomic factors and health care system related issues impact the outcome of diabetes and consequently its costs and vice versa. Factors that influence delay in diagnosis also determine complication rates and thus costs. Presence and severity of complications as well as co-morbid conditions are the most important determinants of treatment and monitoring regimen as well as the need for hospitalization and are therefore important factors related to costs. The average annual direct costs of hospitalized patients are more than double to those not hospitalized. Complications are also responsible for indirect costs in terms of productivity loss and absenteeism. Our studies show that the cost of providing routine care is only a fraction of the overall costs and is perhaps still manageable; however when this is not available or its quality is poor the overall direct and indirect costs, escalate with disastrous health and economic consequences to the individual, his family and society. Effective intervention means prevention both primary (health promotion and awareness) as well as secondary prevention (reducing the burden of complications by early diagnosis and effective care). Everyone involved in diabetes care need to be aware of what drives cost: proper effective treatment of diabetes is not but not treating diabetes or treating it ineffectively is very costly.

37. Ramachandran A, Ramachandran S, Snehalatha C et al. Increasing expenditure on health care incurred by diabetic subjects in a developing country: a study from India. *Diabetes Care* 2007; 30(2): 252–6.

Objective: This study aimed to assess the direct cost incurred by diabetic subjects who were in different income groups in urban and rural India, as well as to examine the changing trends of costs in the urban setting from 1998 to 2005. Methods: A total of 556 diabetic subjects from various urban and rural regions of seven Indian states were enrolled. A brief uniform coded questionnaire (24 items) on direct cost was used. Results: Annual family income was higher in urban subjects (rupees [Rs] 100,000 or \$2,273) than in the rural subjects (Rs 36,000 or \$818) ($P < 0.001$). Total median expenditure on health care was Rs 10,000 (\$227) in urban and Rs 6,260 (\$142) in rural ($P < 0.001$) subjects. Treatment costs increased with duration of diabetes, presence of complications, hospitalization, surgery, insulin therapy, and urban setting. Lower-income groups spent a higher proportion of their income on diabetes care (urban poor 34% and rural poor 27%). After accounting for inflation, a secular increase of 113% was observed in the total expenses between 1998 and 2005 in the urban population. The highest increase in percentage of household income devoted to diabetes care was in the lowest economic group (34% of income in 1998 vs. 24.5% in 2005) ($P < 0.01$). There was a significant improvement in urban subjects in medical reimbursement from 2% (1998) to 21.3% (2005). Conclusions: Urban and rural diabetic subjects spend a large percentage of income on diabetes management. The economic burden on urban families in developing countries is rising, and the total direct cost has doubled from 1998 to 2005.

38. Mohan V, Shanthirani CS, Deepa M et al. Mortality rates due to diabetes in a selected urban south Indian population--the Chennai Urban Population Study. *The Journal of the Association of Physicians of India* 2006; 54: 113–7.

Objective: The aim of this study was to determine the mortality rate in diabetic and non-diabetic subjects in urban south India. Methods: The Chennai Urban Population Study is an ongoing epidemiological study in Chennai [formerly Madras, in south India]. All individuals ≥ 20 years of age living in two residential colonies in Chennai were invited to participate in the study. Of the total 1399 eligible subjects, 1262 individuals responded [90.2%] at baseline, and of these, 1140 individuals [90.3%] could be followed annually from 1997 to 2003-04. Mortality rates and causes of death were the main outcome measures. Results: The median follow up period was six years. The overall mortality rate was higher in diabetic compared to non-diabetic subjects [18.9 vs.5.3 per 1000 person-years, $p=0.004$]. Mortality due to cardiovascular [diabetic subjects, 52.9%; non-diabetic subjects, 24.2%, $p=0.042$] and renal causes [diabetic subjects, 23.5%; non-diabetic subjects, 6.1%, $p=0.072$] was higher among diabetic subjects whereas mortality due to gastrointestinal [12.1%], respiratory [9.1%], lifestyle related [6.1%] and unnatural causes [18.2%] were observed only among non-diabetic subjects. Hazards ratio [HR] for all cause mortality for diabetes was 3.6, [95% Confidence Interval [CI]: 2.02-6.53, $p<0.001$] and this remained significant even after adjusting for age [HR:1.9, 95% CI:1.04-3.45, $p=0.038$]. Light grade physical activity was associated with higher mortality rate [$p=0.008$], but the significance disappeared when adjusted for age. Smoking was also associated with increased mortality. Conclusions: In urban India, mortality rates are two fold higher in people with diabetes compared to nondiabetic subjects. Cardiovascular and renal diseases are the commonest causes of death among diabetic subjects.

39. Bjork S, Kapur A, Sylvest C et al. The economic burden of diabetes in India: results from a national survey. Presentation made at Forum 9, Mumbai, India, 12–16 September 2005.
40. Sadikot SM, Nigam A, Das S et al. The burden of diabetes and impaired glucose tolerance in India using the WHO 1999 criteria: prevalence of diabetes in India study. *Diabetes Research and Clinical Practice* 2004; 66(3): 301–7.

This random multistage cross-sectional population survey was undertaken to determine the prevalence of diabetes mellitus (DM) and impaired glucose tolerance (IGT) in Xsubjects aged 25 years and above in India. The study was carried out in 77 centers (40 urban and 37 rural). 18363 (9008 males and 9355 females) subjects were studied. 10617 (5379 males and 5238 females) were from urban areas and 7746 (3629 males and 4117 females) from rural areas. Blood samples were taken after a fast of 10-12 h and 2 h after 75 g of oral glucose. Subjects were categorized as having IGT or DM using the World Health Organization (WHO) (1999) criteria. The standardized prevalence rate for DM in the total Indian, urban and rural populations was 4.3, 5.9 and 2.7%, respectively. The corresponding IGT rates in the three populations was 5.2, 6.3 and 3.7%, respectively. The urban prevalence of DM and IGT was significantly greater than in the rural population ($P < 0.001$ in both instances). The prevalence of DM was significantly, more than that of

IGT ($P < 0.001$) within both the rural and urban populations. Type 2 diabetes is a major health problem in India.

41. Bhansali A, Chattopadhyay A, Dash RJ. Mortality in diabetes: a retrospective analysis from a tertiary care hospital in North India. *Diabetes Research and Clinical Practice* 2003; 60(2): 119–24.

Cause(s) of death in patients with diabetes mellitus (DM) admitted to a tertiary care hospital in North India was analyzed from classified information in patients' death records and case file. Of the 306652 total admissions from 1991 to 1999, 21584 patients died (7.04%), 592 of whom (355 men and 237 women) had DM (2.7%). Information from 92 patients with diabetes could not be retrieved and six patients with hyperglycemia of short duration (two with gestational DM, three with post-transplant diabetes and one with stress hyperglycemia) were excluded. Of the 494 patients, 456 (92.3%) had T2DM and 38 (7.7%) had T1DM. Four hundred and forty patients had diabetes related mortality: infections (230, 46.5%), cardiovascular events (86, 17.4%), chronic renal failure (CRF) (48, 9.7%), stroke (30, 6%), diabetic ketoacidosis (DKA) (15, 3%), hyperosmolar coma (11, 2.2%), and hypoglycemia (5, 1%), while others (54 patients) had diabetes unrelated deaths. Cause of death could not be ascertained in six patients (1.2%). Death was attributed to a single cause in 301 (60.9%), to two causes in 175 (35.4%) and to three or more causes in 12 (2.4%) patients. Analysis of the cause of death in DM versus hospital in-patients in general, showed infection ($P < 0.02$), coronary artery disease (CAD) ($P < 0.001$), and CRF ($P < 0.001$) to be more frequent in diabetes.

42. Popkin BM, Horton S, Kim S et al. Trends in diet, nutritional status, and diet-related noncommunicable diseases in China and India: the economic costs of the nutrition transition. *Nutrition Reviews* 2001; 59(12): 379–90.

Undernutrition is being rapidly reduced in India and China. In both countries the diet is shifting toward higher fat and lower carbohydrate content. Distinct features are high intakes of foods from animal sources and edible oils in China, and high intakes of dairy and added sugar in India. The proportion of overweight is increasing very rapidly in China among all adults; in India the shift is most pronounced among urban residents and high-income rural residents. Hypertension and stroke are relatively higher in China and adult-onset diabetes is relatively higher in India. Established economic techniques were used to measure and project the costs of undernutrition and diet-related noncommunicable diseases in 1995 and 2025. Current WHO mortality projections of diet-related noncommunicable diseases, dietary and body composition survey data, and national datasets of hospital costs for healthcare, are used for the economic analyses. In 1995, China's costs of undernutrition and costs of diet-related noncommunicable diseases were of similar magnitude, but there will be a rapid increase in the costs and prevalence of diet-related noncommunicable diseases by 2025. By contrast with China, India's costs of undernutrition will continue to decline, but undernutrition costs did surpass overnutrition diet-related noncommunicable disease costs in 1995. India's rapid increase in diet-related noncommunicable diseases and their costs projects similar economic costs of undernutrition and overnutrition by 2025.

43. Ramachandran A, Snehalatha C, Kapur A et al. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. *Diabetologia* 2001; 44(9): 1094–101.

There has been no reported national survey of diabetes in India in the last three decades, although several regional studies show a rising prevalence of diabetes. The aim of this study was to assess the prevalence of diabetes and impaired glucose tolerance in six major cities, covering all the regions of the country. Methods: Using a stratified random sampling method, 11216 subjects (5288 men; 5928 women) aged 20 years or above, representative of all socio-economic strata, were tested by OGTT. Demographic, anthropometric, educational and social details were recorded using a standard proforma. Physical activity was categorized using a scoring system. Body mass index (BMI) and waist-to-hip ratio (WHR) were calculated. Glucose tolerance was classified using the 2-h values (WHO criteria). Prevalence estimations were made taking into account the stratified sampling procedure. Group comparisons were done by t-test or analysis of variance or Z-test as relevant. Univariate and multiple logistic regression analyses were used to study the association of variables with diabetes and impaired glucose tolerance. Results: Age standardized prevalences of diabetes and impaired glucose tolerance were 12.1% and 14.0% respectively, with no gender difference. Diabetes and impaired glucose tolerance showed increasing trend with age. Subjects under 40 years of age had a higher prevalence of impaired glucose tolerance than diabetes (12.8% vs 4.6%, $p < 0.0001$). Diabetes showed a positive and independent association with age, BMI, WHR, family history of diabetes, monthly income and sedentary physical activity. Age, BMI and family history of diabetes showed associations with impaired glucose tolerance. Conclusions: This national study shows that the prevalence of diabetes is high in urban India. There is a large pool of subjects with impaired glucose tolerance at a high risk of conversion to diabetes.

44. Raheja BS, Kapur A, Bhoraskar A et al. DiabCare Asia--India Study: diabetes care in India--current status. *The Journal of the Association of Physicians of India* 2001; 49: 717–22.

Aim: To investigate the relationship between diabetes control, management and late complications in a subset of urban Indian diabetes population treated at tertiary diabetes care centers and measure the quality of management to set benchmarks for future improvement. Methodology: The study population consisted of 100 consecutive review patients treated for more than one year at each of the 26 participating centers. HbA1c was estimated centrally by Bio-Rad Variant method. The methods used to diagnose diabetic complications varied among centers, depending on the doctor's standard clinical examination. A more detailed methodology was eschewed for reason of brevity of the data collection form, and lack of standardization of methods. Similarly, the assessment of renal function was performed via a variety of methods, namely dipstick proteinuria, a 24 hour urinary excretion assay, presence of microalbuminuria and serum creatinine concentration; retinopathy was detected using fundoscopy. Data was collected in a standardized data collection form, entered into an SAS database, validated and descriptive analysis performed. RESULTS: A total of 2,269 subjects with valid relevant

data formed the study population. Subjects had a mean age of 53.3 +/- 13 years. The mean age at onset of diabetes was 43.6 +/- 12.2 years, with a mean diabetes duration of 10.0 +/- 6.9 years. Type 2 diabetics constituted 90.6% of the patients. Approximately half the patients had poor control (HbA1c > 2% points above upper limit of normal and FBG > 139 mg/dl). Mean HbA1c (central laboratory) was 8.9 +/- 2.1% and FBG 150 +/- 59 mg/dl. Over 54% patients had severe late complications, apart from a high frequency of associated hyperlipidemia. Mean HbA1c level and frequency of complications was higher in patients with longer diabetes duration. Frequency of self-monitoring was low. Only 4% of patients were on diet therapy, 53.9% were receiving oral hypoglycemic agents (OHAs), 22% were receiving insulin and 19.8% a combination of insulin and OHAs. Frequency of insulin usage was higher amongst patients with longer diabetes duration. Conclusions: This large multi-centre collaborative observational study shows that type 2 diabetes begins at an early age amongst Indians. With increasing duration of diabetes, glycemic control deteriorates leading to late complications. Diabetes care in India leaves much to be desired. Concerted efforts to increase awareness amongst health professionals to improve diabetes care are urgently needed. The study by increasing awareness about the current status of diabetes care provides a useful benchmark to plan future improvements.

45. Shobhana R, Rao PR, Lavanya A et al. Foot care economics--cost burden to diabetic patients with foot complications: a study from southern India. *The Journal of the Association of Physicians of India* 2001; 49: 530–3.

Objective: To estimate the direct cost burden of diabetic patients with foot complications. Methods: An illustrative sample of 270 subjects with type two diabetes were seen at the clinic selected for the study. Among them 164 were without any complication (Group I) and 106 patients were with foot complications (Group II). In the latter group 83 (Group IIA) required in-patient (IP) care and 23 (Group IIB) required out-patient (OP) care. Annual expenses on medical care were estimated by a questionnaire method. Validation of the questionnaire data was verifying the amount spent by checking up the bills. Result: Group I spent Rs.4373 (US \$ 104 Approx.), Group II spent Rs.15450 (US \$ 343 Approx.), Group IIA spent Rs.7200 (US \$ 171 Approx.) and Group IIB spent Rs.16910 (US \$ 403 Approx.) in the study year. In the total sample of 270 subjects 61% were without foot problems, 22% had foot problems requiring OP treatment only (Group IIA), and 78% had foot problems requiring IP treatment (Group IIB). Conclusion: Group IIB spent significantly greater percentage of their income than Group IIA, and both groups spent greater percentage of their income than Group I. All differences were statistically significant.

46. Shobhana R, Rama Rao P, Lavanya A et al. Expenditure on health care incurred by diabetic subjects in a developing country--a study from southern India. *Diabetes Research and Clinical Practice* 2000; 48(1): 37–42.

The objective of the study was to estimate the direct costs of diabetes care to patients attending secondary care facilities in Madras, India. A total of 596 subjects were studied, at the Private Hospital for Diabetes Mellitus (PHD) (n = 422), and at the Government

General Hospital (GGH) (n = 174). A simple interview schedule enabled a face to face interaction with the patients by the research investigator which elicited a frank and true response. The validity of the data collected was established by independent scrutiny of financial records in a sub sample. Payment bills for expenses of 140 subjects chosen on a random basis from the total sample of 422 PHD patients were compared with the costs reported by the subjects. There were no statistically significant differences both in the inpatient and the outpatient cases between the reported cost and actual cost. Median bill value (total costs)=Rs.1010=\$23* (range 195(\$4.5)-16700(\$372)) reported value=880=\$20 (110(\$2.5)-20355(\$454)) Z = -0.97, P = 0.33 and, for outpatients, median bill value=Rs.800=\$18 (195(\$4.4)-4560(\$102)) reported value=Rs. 740=\$17 (110(\$2.3)-6320 (\$141)) Z = -1.56, P = 0.12. For inpatients, median bill value = Rs. 4235 (1289-16700) reported value=Rs.5459=\$122 (1285(\$28.7)-20355(\$454)), Z = -1.27, P5 years duration of diabetes spent more than those who had <5 years of duration; Rs.5570=\$129 (360(\$8.0)-75200(\$1678)) and Rs.3220=\$71.8, (460(\$10.3)-25600(\$571)), respectively. All differences between these sub-groups were statistically significant. Within the ambit of economic aspects of the population in a developing country, the direct cost on diabetes health care is very high for many people.

*1 Indian Rupee = .02231 US\$

47. Ramachandran A, Snehalatha C, Latha E et al. Impacts of urbanization on the lifestyle and on the prevalence of diabetes in native Asian Indian population. *Diabetes Research and Clinical Practice* 1999; 44(3): 207–13.

Recent studies from the Asian subcontinent show an increasing prevalence of diabetes. This increase has been attributed to factors related to lifestyle changes related to modernization. A peri-urban rural population resembling the rural in their occupation, but with access to certain urban facilities was chosen for this study. The aim of the study was to assess the impact of modernization on the rising prevalence of diabetes in the native Indians. A total of 1637 adults aged 20 years and above (749 men and 888 women) were tested for diabetes and impaired glucose tolerance (IGT) by 2 h post-glucose challenge. Demographic, anthropometric, dietary and occupational details, were recorded. Dietary habits were similar in all categories of socio-economic strata. In the present study group, the age standardized prevalence of Type 2 diabetes was 5.9%, which was intermediate to that in the urban (11.6%) and rural (2.4%) populations. The prevalence data of the latter two population were available from previous surveys. Prevalence of impaired glucose tolerance (IGT) was high (6.9%) and similar in all three population samples. In the peri-urban population, a large percentage of subjects were doing only routine household work and had a sedentary life-style. After correcting for the age and BMI, sedentary work and occupation had a significant association with diabetes, suggesting that sedentary lifestyle may be an important determinant for the higher prevalence of diabetes in an urbanizing population.

48. Zargar AH, Wani A, Masoodi SR et al. Mortality in diabetes mellitus--data from a developing region of the world. *Diabetes Research and Clinical Practice* 1999; 43(1): 67–74.

This retrospective study presents the mortality trends in diabetic patients in a developing region of the world. The data were collected by screening the hospital records of all diabetic patients who died over a period of a decade at Institute of Medical Sciences, a tertiary care medical centre in Kashmir Valley of India. Of 133,374 patients admitted to the centre from January 1987 to December 1996, 9627 died, of whom 269 (151 males and 118 females) were recorded to have diabetes mellitus. The mean \pm -S.D. age at the time of death was 51.61 \pm -13.77 years for males and 51.50 \pm -15.50 years for females. The common causes contributing to death were infections (33.83%), chronic renal failure (30.85%), coronary artery disease (16.36%), cerebrovascular disease (13.75%), hypoglycemia (7.81%), diabetic ketoacidosis (6.69%) and hyperosmolar coma (2.23%). In 7.43% patients the cause of death could not be ascertained. Death was attributed to single cause in 60.22%, to two causes in 26.39% and to three or more causes in 5.95%. Most (59.11%) of these diabetic patients died within a week of hospitalization. We conclude that mortality trends in diabetes mellitus differ in developing regions as compared to developed regions reflecting poor healthcare in general and diabetic care in particular. Unlike in west, where the major killers in diabetic patients are coronary artery disease and cerebrovascular disease, infections and chronic renal failure continue to be leading causes of death in patients with diabetes mellitus in developing regions like ours.

49. Menon VU, Guruprasad U, Sundaram KR et al. Glycemic status and prevalence of comorbid conditions among people with diabetes in Kerala. *National Medical Journal of India* 2008; 21(3): 112–5.

We aimed to assess the glycemic status and prevalence of comorbid conditions such as obesity, hypertension and dyslipidemia in people with diabetes in a southern Indian community. Methods: A cross-sectional community survey of adults > 18 years of age was done in central Kerala. Among the 3069 subjects surveyed, 276 were known to have diabetes. Of these, 169 who had type 2 diabetes underwent a detailed physical examination and anthropometric measurements, and determination of levels of fasting blood glucose, glycosylated hemoglobin, fasting lipid, serum creatinine and urine protein. Data of 164 subjects who had glycosylated haemoglobin levels were included for final analysis. Results: The mean (SD) duration of diabetes was 5.5 (5.04) years and the mean age was 56.9 (11.4) years. Among the patients, 28 (17.2%) were receiving no treatment for diabetes, 24 (14.7%) were on diet control and 111 (68%) on pharmacotherapy. Only 6 patients were on insulin. The mean fasting blood glucose was 153 (63) mg/dl and the mean glycosylated haemoglobin level was 8.1 (2.34)%. In 60% of patients, the glycosylated haemoglobin level was above the recommended target of 7%. Obesity (31%), hypertension (51%), low-density lipoprotein cholesterol > 100 mg/dl (90%) and serum triglyceride levels > 150 mg/ dl (38%) were present in the study population. Only 29% of patients were on antihypertensive treatment and 5% on lipid-lowering agents. Conclusion: In this population, only 40% of people with diabetes had adequate glycemic control. The use of insulin was infrequent. Comorbid conditions were common and inadequately treated. This indicates a lack of proper diabetic care in this community, which could lead to an increase in the burden of cardiovascular disease in the future.

Jordan

50. Zindah M, Belbeisi A, Walke H, Mokdad AH. Obesity and diabetes in Jordan: findings from the behavioral risk factor surveillance system, 2004. *Preventing Chronic Disease* 2008; 5(1): A17.

Introduction: Chronic diseases are the leading cause of morbidity and mortality in Jordan. The Jordanian Ministry of Health, in collaboration with the Centers for Disease Control and Prevention, established a behavioral risk factor surveillance system to monitor the behavioral risk factors associated with chronic diseases. Methods: We used a multistage sampling design to select households from which we then randomly selected and interviewed one adult aged 18 years or older. A random subsample of the adults interviewed were then invited to visit the local health clinic, where we obtained medical measurements, including blood lipids (low-density lipoprotein, high-density lipoprotein, and triglycerides) and fasting blood glucose. Results: Approximately 9% of the participants in the subsample who underwent medical testing reported having been diagnosed with diabetes previously, compared with 16.9% diagnosed in our laboratory testing. About 12.3% of the participants were glucose intolerant, and about 35% were obese. Obesity was significantly associated with diabetes, high blood pressure, high cholesterol, and asthma. Compared with adults of normal weight, obese adults had an adjusted odds ratio of 3.27 (95% CI, 1.58-6.76) for diabetes, 3.69 (95% CI, 2.13-6.39) for high blood pressure, 3.45 (95% CI, 1.68-7.10) for high cholesterol, and 5.12 (95% CI, 1.53-17.19) for asthma. Discussion: Obesity, poor diet, and physical inactivity create a major chronic disease burden in Jordan that is likely to increase substantially in the next few years. Our findings argue for establishment of a more preventive orientation in health care and public health systems in Jordan.

51. Al-Till MI, Al-Bdour MD, Ajlouni KM. Prevalence of blindness and visual impairment among Jordanian diabetics. *European Journal of Ophthalmology* 2005; 15(1): 62-8.

Purpose: To investigate the prevalence of blindness and visual impairment among a population of Jordanian diabetics. Methods: A total of 986 diabetic patients were fully assessed, including complete history, examination, and laboratory tests. All patients underwent detailed eye examination, which included visual acuity, slit-lamp examination, tonometry, funduscopy, and fundus fluorescein angiography (FFA). Results: Of all patients examined, 53.2% were male and 46.8% were female. The mean age and duration of diabetes were 55.3 and 11.9 years. Of all patients, 93.3% had type 2 while 6.7% had type 1 diabetes mellitus (DM). Over half (50.3%) were on oral hypoglycemic agents, 34% on insulin, and 14.5% on both types of treatment, whereas only 1.2% were on diet alone. The mean value for HbA1c was 7.7%. The prevalence of blindness among participants was found to be 7.4%, while 10.1% were visually impaired. Diabetic retinopathy (DR) was present in 64.1%, 37.8% had cataract, and 8.7% had undergone cataract surgery. Using multivariate logistic regression analysis, visual impairment was significantly associated with age, treatment of diabetes, and DR, while only age and retinopathy were significantly related to blindness. Conclusions: DM is a common

disease in Jordan and DR is highly prevalent among Jordanian diabetics. National screening and educational programs are highly needed to reduce the risk of blindness and visual impairment among diabetic patients.

52. Centers for Disease Control and Prevention. Prevalence of selected risk factors for chronic disease--Jordan, 2002. *Morbidity and Mortality Weekly Report* 2003; 52(43): 1042-4.

In Jordan, the average life expectancy in 2002 was 72 years, and chronic diseases are becoming increasingly prevalent. Because personal behavior can influence the occurrence and progression of many chronic diseases, the Jordan Ministry of Health established surveillance for behavioral risk factors, particularly those related to cardiovascular diseases and diabetes. This report summarizes the key findings of the 2002 Behavioral Risk Factor Survey, the first reporting segment in Jordan's surveillance program for chronic diseases. The findings indicate that smoking, physical inactivity, and obesity contribute substantially to the burden of chronic disease in Jordan and underscores the need for effective public health interventions.

Malaysia

53. Mafauzy M. Diabetes control and complications in public hospitals in Malaysia. *The Medical Journal of Malaysia* 2006; 61(4): 477-83.

The Diabcare-Asia project was initiated to study the status of diabetes care and prevalence of diabetic complications in Asia and this study was done to evaluate the above in public hospitals in Malaysia and compare to a similar study done in 1998. A total of 19 public hospitals participated in this study from which a total of 1099 patients were included and analyzed. The majority of patients (94.8%) had type 2 diabetes mellitus and 66.5% were overweight or obese. As for glycemic control only 41.0% of the patients had HbA1c < 7% and 18% had FPG < 6.1 mmol/L. As for lipid levels, only 32.0% of the patients had total cholesterol < 4.8 mmol/L; 59.6% had HDL-cholesterol > 1.1 mmol/L and 51.1% had triglycerides < 1.7 mmol/L. Despite the high proportion of patients having dyslipidemia, only 52.8% of the patients were on lipid lowering therapy. As for blood pressure, 15.0% of the patients had blood pressure < 130/80 mmHg. Although 75.9% of the patients were on antihypertensive medication only 11.3% had blood pressure < 130/80 mmHg. Only 54.8% of patients admitted to adhering to a diabetic diet regularly and 38.9% exercised regularly. As for glucose monitoring, only 26.8% of the patients did home blood glucose monitoring and 1.8% did home urine glucose testing. There was also a high complication rate with the commonest being neuropathy (19.0%) followed by albuminuria (15.7%), background retinopathy (11.1%) and microalbuminuria (6.6%). Compared to the 1998 study, there was some improvement in the percentage of patients achieving target levels and a reduction in the prevalence of complications. In conclusion, the majority of diabetic patients treated at the public hospitals were still not satisfactorily controlled and this was still associated with a high prevalence of complications. There is still an urgent need to educate both patients and

health care personnel on the importance of achieving the clinical targets and greater effort must be made to achieve these targets.

54. Mafauzy M. Diabetes control and complications in private primary healthcare in Malaysia. *The Medical Journal of Malaysia* 2005; 60(2): 212–7.

This Diabcare-Asia project was initiated to study the status of diabetes care and prevalence of diabetic complications in Asia and this study was done to evaluate the above in primary private healthcare in Malaysia. A total of 49 private clinics participated in this study from which a total of 438 patients were included and analyzed. The majority of patients (96.5%) had type 2 diabetes mellitus and 81.4% had BMI \geq 23 kg/m². Only 12.0% of the patients had their HbA_{1c} measured in the preceding 12 months. As for glycemic control only 20% of the patients had HbA_{1c} $<$ 7% and 11% had FPG $<$ 6.7 mmol/L. As for lipid levels, only 12.3% of the patients had total cholesterol $<$ 4.8 mmol/L; 30.9% had HDL-cholesterol $>$ 1.2 mmol/L and 49.8% had triglycerides $<$ 1.7 mmol/L. Despite the high proportion of patients having dyslipidemia, only 12.4% of the patients were on lipid lowering therapy. As for blood pressure, 55.9% of the patients had systolic pressure \geq 140 mmHg and 40.9% had diastolic pressure \geq 90 mmHg. However, only 32.4% of the patients were on antihypertensive medication. Only 37.4% of the patients admitted to adhering to diabetic diet regularly and 32.0% exercised regularly. As for glucose monitoring only 6.9% of the patients did home blood glucose monitoring and 6.2% did home urine glucose. There was also a high complication rate with the commonest being neuropathy (30.1%) followed by background retinopathy (23.5%), albuminuria (22.9%) and microalbuminuria (20.4%). In conclusion, the majority of diabetic patients treated at the primary care level were not satisfactorily controlled and this was associated with a high prevalence of complications. There is an urgent need to educate both patients and health care personnel on the importance of achieving the clinical targets and greater effort must be made to achieve these targets.

55. Zaini A. Where is Malaysia in the midst of the Asian epidemic of diabetes mellitus? *Diabetes Research and Clinical Practice* 2000; 50 Suppl 2: S23–8.

Population studies all over the world have clearly showed that the prevalence of Type 2 diabetes mellitus (DM) is escalating at phenomenal scale and very likely we are heading towards epidemic proportions. In 1985, the estimated population of diabetic individuals in the world was 30 million but by 1995 this figure soared to 135 million. Based on current trends, epidemiologists predict that the population of diabetic individuals will swell up to a staggering 300 million by the year 2025. Almost half of that will be in the Asia Oceania region alone. Dr Hilary King of WHO pointed out that there will be a projected rise of about 42% in developed countries whereas the developing countries will see an escalation to the magnitude of 170% (H. King, R.E. Aubert, W.H. Herman, Global burden of diabetes, 1995-2025: prevalence, numerical estimates and projections, *Diabetes Care* 21 (1998) 1414-1431; WHO Health Report 1997, WHO Switzerland). There will be a 3-fold rise of the disease in Asia and much of these will be seen in China (40 million) and India (55 million) by virtue of the massive population of these countries. Nevertheless, the other rapidly developing Asian nations like Singapore, Malaysia,

Thailand and those making up Indochina will experience the surge. At the same time the prevalence and incidence of diabetes complications will also increase. Based on recent WHO prediction (WHO Newsletter, The global burden of diabetes 1995–2025. World Diabetes 3 (1997) 5–6), it is estimated that by the year 2000 the following figures will be seen: Diabetes complications are major causes of premature death all over the world and most of these are avoidable. DCCT and UKPDS are landmark studies showing strong evidence that major complications can be drastically reduced by maintaining near normal glycemic control.

Mexico

56. Arredondo A, Zúñiga A, Parada I. Health care costs and financial consequences of epidemiological changes in chronic diseases in Latin America: evidence from Mexico. *Public Health* 2005; 119(8): 711–20.

Objective: To determine the costs of health services and the financial consequences of changes in the epidemiological profile of chronic diseases in Latin America. Design: We conducted longitudinal analyses of costs and of the economic impact of the epidemiological transition in healthcare services for diabetes and hypertension in the Mexican health system. The study population included both the insured and uninsured populations. Methods: The cost-evaluation method was based on the instrumentation and consensus techniques. To estimate the epidemiological changes and financial consequences for 2004–2006, six models were constructed according to the Box-Jenkins technique, using confidence intervals of 95% and the Box-Pierce test. Findings: Costs ranged from US\$613 to US\$887 for diabetes, and from US\$485 to US\$622 for hypertension. Regarding epidemiological changes for 2004 compared with 2006, an increase is expected in both cases, although results predict a greater increase for diabetes, 10–15% in all three institutions ($P < 0.05$). Comparing the financial consequences of health services required by insured and uninsured populations, the greater increase (17%) will be for the insured population ($P < 0.05$). The financial requirements for both diseases will amount to 9.5% of the total budget for the uninsured population and 13.5% for the insured population. Conclusions: If the risk factors and the different healthcare models remain as they are at present, the economic impact of expected epidemiological changes on the social security system will be particularly strong. Another relevant financial factor is the appearance of internal competition in the use and allocation of financial resources among the main providers in the health services; this factor becomes even more complicated within each provider. In effect, within each institution, hypertension and diabetes programs must compete for resources with other programs for chronic and infectious diseases.

57. Nutrition transition in Mexico and in other Latin American countries. *Nutrition Reviews* 2004; 62(7) Pt 2: S149–57.

Mexico and other Latin American countries are currently undergoing important demographic, epidemiologic and nutrition transitions. Noncommunicable chronic diseases such as obesity, type 2 diabetes mellitus, and high blood pressure are

becoming public health problems as the population experiences an important reduction in physical activity and an increase in energy-dense diets. In contrast, the prevalence of undernutrition is declining in most countries, although several decades will be needed before the prevalence drops to acceptable values. The objective of this article is to discuss the characteristics of the nutrition transition with emphasis in data from Mexico, Brazil, and Chile.

58. Arredondo A, Zúñiga A. Economic consequences of epidemiological changes in diabetes in middle-income countries: the Mexican case. *Diabetes Care* 2004; 27(1): 104–9.

Objective: To identify the costs and economic consequences of expected changes in the demand for health care services for type 2 diabetes in the three main public institutions of the Mexican health care system. Methods: The cost evaluation method to estimate direct and indirect costs was based on instrumentation and consensus techniques. To estimate the costs and epidemiological changes for 2003–2005, three probabilistic models were constructed according to the Box-Jenkins technique. Results: Comparing the economic impact in 2003 versus 2005 ($P < 0.05$), there is a 26% increase in financial requirements. The total amount for diabetes in 2005 (in U.S. dollars) will be 317,631,206, dollars including 140,410,816 dollars in direct costs and 177,220,390 dollars in indirect costs. The total direct costs, representing financial requirements to provide health care for expected cases of type 2 diabetes and its main complications in the three main public institutions in Mexico, up to 2005, will be 37,079,587 dollars for the Ministry of Health (or Secretaría de Salud [SSA], serving the uninsured population) and 103,331,235 dollars for the Mexican Social Security Institute, or Instituto Mexicano del Seguro Social (IMSS), and the Institute for Social Security and Services for State Workers, or Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE), both of which serve the insured population. Conclusions: Our data suggest that changes in the demand for health care services for patients with diabetes will continue with an increasing trend, mainly in the insured population. In economic terms, the results of direct and indirect costs are one of the main challenges to be solved to decrease the economic burden that diabetes represents for the population, the health care institutions, and for society as a whole

59. Barquera S, Tovar-Guzmán V, Campos-Nonato I. Geography of diabetes mellitus mortality in Mexico: an epidemiologic transition analysis. *Archives of Medical Research* 2003; 34(5): 407–14.

The worldwide prevalence of diabetes mellitus (DM) will increase from 135 to 300 million cases by the year 2025. In Mexico, DM is the third cause of general mortality and the primary cause of mortality in the 55- to 64-year-old age group. The purpose of this study was to analyze the characteristics of DM mortality trends in Mexico from 1980 to 2000 in the context of this epidemiologic transition. Methods: Age-adjusted mortality rates were estimated for DM as underlying cause of death using World Health Organization (WHO) reference population. To evaluate magnitude of risks, standardized mortality ratio (SMR) was calculated; prematurity of mortality was evaluated by means

of potential lost life years index (PLLYI). Diabetes mortality trends in the U.S. were calculated with information from the Centers for Disease Control (CDC) public registry and were age-adjusted for comparison. Results: Total number of deaths due to DM during the period was 582,826. Standardized mortality ratio by state showed higher mortality in the northern Mexican states; PLLYI was higher in the northern states. Mortality trends in Mexico showed a rapid increase during the 1980s followed by a less acute increment in the 1990s. Age-adjusted mortality rate trends in the U.S. were lower than those in Mexico. Conclusions: This study shows an increase in DM age-adjusted mortality trends during the years 1980-2000 in Mexico. The observed pattern of mortality varies widely throughout the country, probably due to differences in socioeconomic conditions and in access to healthcare.

60. Villarreal-Ríos E, Salinas-Martínez AM, Medina-Jáuregui A. The cost of diabetes mellitus and its impact on health spending in Mexico. *Archives of Medical Research* 2000; 31(5): 511–4.

The objective of this study was to determine the cost of diabetes mellitus, its impact on health spending in Mexico, and its percentage of the gross domestic product (GDP). Methods: There was a four-stage approach: identification of the epidemiology of the use of health services; estimate of treatment cost; determination of the diabetic population, and calculation of the percentage of health spending. Results: The average annual cost per diabetic patient was \$708 U.S. dollars (USD), the total annual cost of diabetics was \$2,618,000 USD, the percentage of health spending was 15.48%, and the percentage of the GDP was 0.79%. Conclusions: It is necessary to seek strategies that allow for a more efficient use of resources designated for type 2 diabetes treatment.

Nigeria

61. Ogbera O. Burden of diabetic illness in an urban hospital in Nigeria. *Tropical Doctor* 2007; 37(3): 153–4.

This is a retrospective study that set out to determine the mortality patterns and case fatality rates of people with diabetes mellitus (DM) in a Nigerian hospital. The sources of data were the medical records, ward admissions, deaths register and death certificates. Of a total of 13,797 medical admissions made over a period of 11 years (1990–2000), 1423 (10.3%) were DM related and the documented case fatality rate of DM was 22.6%.

Saudi Arabia

62. Alwakeel JS, Sulimani R, Al-Asaad H et al. Diabetes complications in 1952 type 2 diabetes mellitus patients managed in a single institution in Saudi Arabia. *Annals of Saudi Medicine* 2008; 28(4): 260–6.

Diabetes mellitus is emerging as a major public health problem in Saudi Arabia in parallel with the worldwide diabetes pandemic, which is having a particular impact upon the Middle East and the third world. This pandemic has accompanied the adoption of a

modern lifestyle and the abandonment of a traditional lifestyle, with a resultant increase in rates of obesity and other chronic noncommunicable diseases. The indigenous Saudi population seems to have a special genetic predisposition to develop type 2 diabetes, which is further amplified by a rise in obesity rates, a high rate of consanguinity and the presence of other variables of the insulin resistance syndrome. We highlight the epidemiology, clinical and complications profiles of diabetes in Saudi people. Diabetes is well studied in Saudi Arabia; however, there seems to be little research in the area of education and health care delivery. This is of paramount importance to offset the perceived impact on health care delivery.

Singapore

63. Cutter JL. Diabetes mortality in Singapore, 1991. *Singapore Medical Journal* 1998; 39(7): 311–8.

Objectives: The study was undertaken to estimate the contribution of diabetes mellitus to total mortality in Singapore and to study the mortality experience among known diabetics in Singapore by sex, age-group and ethnic group. Methods: Death certificates of all persons who died in Singapore between 1 January 1991 and 31 August 1991 (n = 9,197) were reviewed. Records which mentioned diabetes mellitus as an underlying or contributory cause of death were selected as being a diabetic case (n = 1,010). Results: If all diabetes related deaths were considered, diabetes mellitus would account for 9.3% of all deaths in Singapore in 1991, i.e. four times higher than the figure of 2.3% in the official statistics. Ischaemic heart disease was the leading cause of death in all age-groups. Renal failure was a major cause of death before the age of 55 while cerebrovascular disease and respiratory tract infections were important causes of death after the age of 64. Renal failure was the leading cause of death among Chinese diabetics below the age of 65. Ischaemic heart disease was the main cause of death among Indian and Malay diabetics. As compared to the general population, Chinese diabetics were more likely to die from renal failure while Indian and Malay diabetics were more likely to die from ischaemic heart disease.

South Africa

64. Bradshaw D, Norman R, Pieterse D et al. Estimating the burden of disease attributable to diabetes in South Africa in 2000. *South African Medical Journal* 2007; 97(8): 700–6.

Objectives: To estimate the burden of disease attributable to diabetes by sex and age group in South Africa in 2000. Design: The framework adopted for the most recent World Health Organization comparative risk assessment (CRA) methodology was followed. Small community studies used to derive the prevalence of diabetes by population group were weighted proportionately for a national estimate. Population-attributable fractions were calculated and applied to revised burden of disease estimates. Subjects: Adults 30 years and older. Outcome measures: Mortality and disability-adjusted life years (DALYs) for ischaemic heart disease (IHD), stroke, hypertensive disease and

renal failure. Results: Of South Africans aged ≥ 30 years, 5.5% had diabetes which increased with age. Overall, about 14% of IHD, 10% of stroke, 12% of hypertensive disease and 12% of renal disease burden in adult males and females (30+ years) were attributable to diabetes. Diabetes was estimated to have caused 22,412 (95% uncertainty interval 20,755 - 24,872) or 4.3% (95% uncertainty interval 4.0 - 4.8%) of all deaths in South Africa in 2000. Since most of these occurred in middle or old age, the loss of healthy life years comprises a smaller proportion of the total 258,028 DALYs (95% uncertainty interval 236,856 - 290,849) in South Africa in 2000, accounting for 1.6% (95% uncertainty interval 1.5 - 1.8%) of the total burden. Conclusions: Diabetes is an important direct and indirect cause of burden in South Africa. Primary prevention of the disease through multi-level interventions and improved management at primary health care level are needed.

65. Levitt NS, Steyn K, Lambert EV et al. Modifiable risk factors for type 2 diabetes mellitus in a peri-urban community in South Africa. *Diabetic Medicine* 1999; 16(11): 946–50.

Aims: To investigate the prevalence of Type 2 diabetes mellitus (DM) and its risk factors in a working class peri-urban community in South Africa. Methods: A cross-sectional descriptive study was conducted in 1996, where all persons aged 15 years and older, who were resident in randomly selected houses in Mamre, 55 km from the centre of Cape Town, were sampled. Subjects underwent a 75-g oral glucose tolerance test. Socio-demographic and anthropometric data were obtained and physical activity was assessed using a 7-day activity recall questionnaire. The 1985 WHO criteria were used to define diabetes. Results: The response rate was 64.5% (n = 974). The participants comprised 56% women, 44% men, mean age 37.6 (range 15-86) years. The crude prevalence of Type 2 DM was 7.1% and impaired glucose tolerance (IGT) 8.0%. The age-adjusted prevalence of Type 2 DM was 10.8% (95% confidence interval (CI) 8.2-13.5%) and IGT 10.2% (95% CI 7.7-12.8%). Regression analysis indicated that age (risk ratio (RR) 7.40, 95% CI 3.45-15.86), waist circumference (RR 4.53, 95% CI 2.04-10.05), low total energy expenditure (RR 1.75, 95% CI 1.07-2.56) and family history of diabetes (RR 2.31, 95% CI 1.42-3.77) were independent risk factors for Type 2 DM, while sex, obesity and regular alcohol consumption were not. Conclusions: This previously unstudied community has an intermediate prevalence on the international scale of Type 2 DM, which is linked to potentially modifiable risk factors.

66. Pepper DJ, Levitt NS, Cleary S et al. Hyperglycemic emergency admissions to a secondary-level hospital: an unnecessary financial burden. *South African Medical Journal* 2007; 97(10): 963–7.

Diabetes affects approximately 1 million South Africans. Hospital admissions, the largest single item of diabetes expenditure, are often precipitated by hyperglycemic emergencies. A recent survey of a 200-bed hospital, serving approximately 1.3 million Cape Town residents, showed that hyperglycemic emergencies comprised 25.6% of high-care unit admissions. A study was undertaken to determine the reasons for, and financial cost of, these admissions. Methods: All hyperglycemic admissions during a 2-month period (1

September - 31 October 2005) were surveyed prospectively. Admissions were classified using the American Diabetes Association classification of hyperglycemic emergencies. Demographic data, and the reason for, duration of and primary outcome of admission, were recorded. The following costs per admission were calculated using public sector pricing: (i) total costs; (ii) patient-specific costs; (iii) nonpatient-specific costs; and (iv) capital costs. Results: Sepsis (36%), non-compliance with therapy (32%) and a new diagnosis of diabetes (11%) were the predominant reasons for admission of 53 hyperglycemic emergency cases. Mean duration of hospital stay was 4 days, with an in-hospital mortality of 7.5%. Mean cost per admission was R5 309. Clinical staff (25.8%), capital (25.6%) and overhead (34%) costs comprised 85.4% of expenditure. Recommendations: Hyperglycemic admissions, costing more than R5 300 per patient, represent a health burden that has remained unchanged over the past 20 years. Urgently required primary care preventive strategies include early diagnosis of diabetes, timely identification and treatment of precipitating causes, specifically sepsis, and education to improve compliance.

South Korea

67. Choi YJ, Cho YM, Park CK et al. Rapidly increasing diabetes-related mortality with socio-environmental changes in South Korea during the last two decades. *Diabetes Research and Clinical Practice* 2006; 74(3): 295–300.

Diabetes mellitus is the result of complex interactions involving many genes and environmental factors, and rapid socio-environmental changes have been strongly associated with the development of diabetes. In this study, we examined the trends in diabetes mortality and associated socio-environmental changes that have occurred in South Korea over the last 20 years. Data from a national database and government reports for the years from 1983 to 2001 were analyzed. The data included mortality, socio-economic changes, physical activity and dietary pattern indicators. Deaths from diabetes per 100,000 people increased from 5.3 in 1983 to 18.4 in 2001. Along with increasing diabetes-related mortality, many socio-economic indices (gross domestic production, proportion of tertiary industry and urbanization rate), proxies for physical activity (numbers of cars and time spent watching television) and diet indices (animal protein intake and fat intake) showed remarkable changes. To counter increasing prevalence of diabetes and its related mortality in South Korea, multidirectional efforts including lifestyle modification should be mandatory features of future public health policy.

68. Kim Y, Suh YK, Choi H. BMI and metabolic disorders in South Korean adults: 1998 Korea National Health and Nutrition Survey. *Obesity Research* 2004; 12(3): 445–53.

Objective: The prevalence of overweight, obesity, and metabolic disorders and their relationship with BMI were studied in South Korean adults. The appropriate BMI categories for overweight and obesity for Koreans were evaluated. Methods: The 1998 Korea National Health and Nutrition Examination Survey was the first such survey, to our knowledge, conducted on a cross-sectional and nationally representative population. The survey provided data on body weight; height; fasting serum glucose; triacylglycerol;

total, low-density lipoprotein, and high-density lipoprotein cholesterol; blood pressure; and various other questions that were incorporated into this study. A total of 39,060 persons over the age of 1 year from 12,283 households participated in the Health and Nutrition Interview Survey. Of these, 10,876 people over the age of 10 years old participated in the Health Examination. We analyzed data from 7962 adults over the age of 20 years old. Results: The overweight (BMI, ≥ 25.0 to < 30.0) and obesity (BMI, ≥ 30) rates were low among Korean adults: 23.4% and 1.7% in men and 24.9% and 3.2% in women, respectively. However, the prevalences of diabetes, hypertension, and abnormal concentrations of serum triacylglycerol and total, low-density lipoprotein, and high-density lipoprotein cholesterol were high at 10.5%, 27.1%, 29.0%, 34.5%, 28.4%, and 37.4%, respectively. These disorders were age dependent, and, in general, there was a strong linear relationship between BMI and the disorders. The relative risk of disorders doubled at a BMI of 23.0 to 24.0 and tripled at a BMI of 26.0, compared with a baseline BMI of 18.5 to 22.0. Discussion: High rates of diabetes, hypertension, and dyslipidemia were noted in middle-aged and elderly Koreans even at relatively low BMI. It might be appropriate to lower the BMI classification from the current ≥ 25.0 for overweight and ≥ 30.0 for obesity for this group of Koreans.

Tunisia

69. Bouguerra R, Alberti H, Salem LB et al. The global diabetes pandemic: the Tunisian experience. *European Journal of Clinical Nutrition* 2007; 61(2): 160–5.

Objective: The prevalence of diabetes mellitus is known to be increasing rapidly worldwide, but few population-based surveys have been undertaken in Africa or the Middle East. The aims of this study are to report the prevalence of diabetes mellitus and impaired fasting glucose (IFG) in Tunisia, to compare the prevalence to previous studies and to analyze the relationship between diabetes and age, sex, area of residency and body mass index (BMI). Method: We have used data from the Tunisian National Nutrition Survey, a cross-sectional health study providing a large nationally representative sample of the Tunisian population including 3729 adults. We used the American Diabetes Association diagnostic criteria to determine the prevalence of diabetes mellitus and IFG. Results: The overall diabetes prevalence was 9.9% (9.5% in men and 10.1 in women) giving age-adjusted prevalence of diabetes of 8.5% (7.3% in men and 9.6% in women). Step-wise logistic regression showed age of more than 40 years, urban residency and high BMI to each be significantly and independently related to diabetes prevalence. The prevalence of diabetes mellitus has more than doubled in Tunisia over a 15-year period. Conclusions: Our study has demonstrated a high prevalence of diabetes in the adult population with a wide difference among the rural and urban areas with an increased prevalence compared to previous studies. The results underline the need to increase public awareness and to emphasize the benefit of lifestyle modification in order to prevent type II diabetes.

Turkey

70. Satman I, Yilmaz T, Sengül A et al. Population-based study of diabetes and risk characteristics in Turkey: results of the Turkish diabetes epidemiology study. *Diabetes Care* 2002; 25(9): 1551–6.

Objectives: To investigate for the first time the prevalence of diabetes and impaired glucose tolerance (IGT) nationwide in Turkey; to assess regional variations and relationships between glucose intolerance and lifestyle and physical risk factors. **Methods:** The Turkish Diabetes Epidemiology Study (TURDEP) is a cross-sectional, population-based survey that included 24,788 subjects (age \geq 20 years, women 55%, response 85%). Glucose tolerance was classified according to World Health Organization recommendations on the basis of 2-h blood glucose values. **Results:** Crude prevalence of diabetes was 7.2% (previously undiagnosed, 2.3%) and of IGT, 6.7% (age-standardized to world and European populations, 7.9 and 7.0%). Both were more frequent in women than men ($P < 0.0001$) and in those living in urban rather than rural communities ($P < 0.001$). Prevalence rates of hypertension and obesity were 29 and 22%, respectively. Both were more common among women than men ($P < 0.0001$). Prevalence of diabetes and IGT increased with rising BMI, waist-to-hip ratio (WHR), and waist girth ($P < 0.0001$). Multiple logistic regression analysis revealed that age, BMI, WHR, familial diabetes, and hypertension were independently associated with diabetes, age, BMI, WHR, familial diabetes, and hypertension with IGT (except for familial diabetes in women with IGT). Education was related to diabetes in men but was protective for diabetes and IGT in women. Socioeconomic status appeared to decrease the risk of IGT in men while it increased the risk in women. Smoking had a protective effect for IGT in both sexes. **Conclusions:** Diabetes and IGT are moderately common in Turkey by international standards. Associations with obesity and hypertension have been confirmed. Other lifestyle factors had a variable relationship with glucose tolerance.

United Arab Emirates

71. Saadi H, Carruthers SG, Nagelkerke N et al. Prevalence of diabetes mellitus and its complications in a population-based sample in Al Ain, United Arab Emirates. *Diabetes Research and Clinical Practice* 2007; 78(3): 369–77.

Aims: To determine the prevalence of diabetes mellitus (DM) and its complications in the adult population of the United Arab Emirates (UAE) and assess the degree of metabolic control in subjects with diagnosed DM. **Methods:** A random sample of houses of Emirati citizens living in Al Ain, UAE was surveyed. Fasting blood glucose was determined by glucose meter and an oral glucose tolerance test (OGTT) was conducted if blood sugar was < 7 mmol/l. DM was defined according to the WHO criteria. Pre-diabetes status was based on fasting venous blood glucose concentration of 5.6–6.9 mmol/l or 2h post-OGTT venous blood glucose level of 7.8–11.0 mmol/l. **Results:** There were 2455 adults (> 18) living in the 452 surveyed houses of which 10.2% reported having the diagnosis of DM. A total of 373 men and non-pregnant women underwent testing, and after adjustment for factors affecting participation probability the prevalence of diagnosed DM, undiagnosed DM and pre-diabetes was 10.5, 6.6 and 20.2%, respectively. Age-standardized rates for DM (diagnosed and undiagnosed) and pre-diabetes among 30–64 years old were 29.0 and

24.2%, respectively. Logistic regression analysis showed that only age and body mass index (BMI) were significantly independently related to undiagnosed DM. In patients with diagnosed DM, the prevalence rates for retinopathy, neuropathy, nephropathy, peripheral vascular disease and coronary heart disease were 54.2, 34.7, 40.8, 11.1 and 10.5%, respectively. A significant proportion of subjects with undiagnosed DM and pre-diabetes also had micro- and macro-vascular complications. The proportion of subjects with diagnosed DM who achieved internationally recognized targets for HbA1c (<7%), LDL-C (<2.6 mmol/l) and blood pressure (<130/80 mmHg) was 33.3, 30.8 and 42.1%, respectively. Conclusion: This study confirms the previously reported high prevalence of DM in the UAE. Diabetic complications were highly prevalent among subjects with diagnosed and undiagnosed DM. Metabolic control was suboptimal in most subjects with diagnosed DM. Greater efforts are urgently needed to screen early and effectively treat DM in the UAE in order to prevent long-term complications.

Diabetes costs—US and miscellaneous

72. American Diabetes Assoc. Economic costs of diabetes in the US in 2007. *Diabetes Care* 2008; 31(3): 596–615.

The objectives of this study are to quantify the economic burden of diabetes caused by increase health resource use and lost productivity and provide a detailed breakdown of costs attributed to diabetes. The total estimated cost of diabetes in 2007 is \$174 billion, including \$116 in excess medical expenditures and \$58 billion in reduced national productivity. Medical costs attributed to diabetes include \$27 billion for care to directly treat diabetes, \$58 billion to treat the portion of diabetes-related chronic complications that are attributed to the diabetes, and \$31 billion in excess general medical costs. People diagnosed with diabetes incur average expenditures of \$11,744 per year, of which \$6,649 is attributed to diabetes. People with diagnosed diabetes, on average, have medical expenditures that are approximately 2.3 times higher than what expenditures would be in the absence of diabetes. Approximately \$1 in \$5 health care dollars in the US is spent caring for someone with diagnosed diabetes, which approximately \$1 in \$10 health care dollars is attributed to diabetes. Indirect costs include increased absenteeism (\$2.6 billion) and reduced productivity while at work (\$20 billion) for the employed population, reduced productivity for those not in the labor force (\$0.8 billion), unemployment for disease-related disability (\$7.9 billion), and lost productive capacity due to early mortality (\$26.9 billion).

73. Vijan S, Hayward RA, Langa KM. The impact of diabetes on workforce participation: results from a national survey. *Health Services Research* 2004; 39(6): 1653–69.

Diabetes is a highly prevalent condition with substantial associated morbidity. The economic impact of diabetes is dramatic, with estimated total costs of \$98 billion in 1997. We sought to investigate the effects of diabetes on work-force participation, including absenteeism, retirement, and disability. Methods: We used the first wave of the Health and Retirement Study (HRS) as a data source. The likelihood of falling into various work-related categories, by diabetes status, was estimated using logistic regression;

duration of being in different states of participation was estimated using OLS regression. We then estimated the economic impact of diabetes using the estimates of lost time due to disability, absenteeism, and early retirement combined with median salaries in the HRS sample. Results. Diabetes is a significant predictor of self-rated disability (OR = 3.1), of not working due to health impairments (OR = 2.4), and of receiving Social Security Disability or VA disability (OR = 2.6 and 3.0, respectively). Subjects with diabetes also missed more work time than those without (incremental missed days per year = 2.7). These changes in work-force participation equate to (up until wave 1 of the HRS) to an incremental loss of \$57.8 billion in income, and another \$7.8 billion in disability payments. Conclusion. Diabetes has a profound economic impact in the US. These figures should be considered when evaluating the cost-effectiveness of diabetes interventions and to inform and improve the allocation of resources for chronic disease management.

74. Lavigne J, Phelps C, Mushlin A. Reductions in individual work productivity associated with type 2 diabetes mellitus. *Pharmacoeconomics* 2003; 21(15): 1123–34.

Background: Chronic diseases and their treatments may cause symptoms that impair performance but are too mild to affect outcome measures such as absences and workforce exit. Objective: To assess the effect of type 2 diabetes mellitus on individuals Methods: Subjects were identified from claims data and enrolled over the phone. A telephone survey was used to elicit information about productivity at work, absences, diabetes history, comorbidities, job characteristics, employment history, demographics and healthcare utilization. The sample consisted of 472 employed residents of New York state, USA, of whom, 445 worked at one major US corporation. Of the 472 participants, 78 had type 2 diabetes. All participants agreed to release their claims data for this study; participants with diabetes also consented to the release of clinical records. All data were linked at the individual level. Tobit regression was used to model work efficiency losses, the total productivity time lost and the value of that time. Absences were modeled using Poisson regression. Productivity was measured using absences from work and work efficiency. Work efficiency was assessed using the Osterhaus model. Main outcome measures and results: Using the Osterhaus model of work productivity, type 2 diabetes was associated with a reduction in productivity at work. These productivity losses increased with the length of exposure to diabetes. Surprisingly, higher productivity losses among employees with diabetes did not translate into significantly higher productivity costs because the group with diabetes earned less. This likely reflects the prevalence of diabetes in populations. Among salaried people, very few reported working extra hours to make up for reduced productivity. Self-report biases may have been a factor in this finding. Type 2 diabetes was not associated with more frequent absences. Other factors that have strong effects on work efficiency are depression and colds, and job satisfaction. Conclusions: People with type 2 diabetes appear to experience incremental decrements in work performance that may affect their current and future health and performance. Lower incomes of participants with diabetes suggest that both people with diabetes and their employers bear the cost of any work efficiency losses.

Cancer

Global/regional

75. Sankaranarayanan R, Swaminathan R, Black RJ. Global variations in cancer survival. Study Group on Cancer Survival in Developing Countries. *Cancer* 1996; 78(12): 2461–4.

Population-based cancer registries from Algeria, China, Costa Rica, Cuba, India, the Philippines, and Thailand are collaborating with the International Agency for Research on Cancer in a study of cancer survival in developing countries. Comparisons with the SEER program results of the National Cancer Institute in the United States, and the EURO CARE study of survival in European countries revealed considerable differences in the survival of patients with certain tumors associated with intensive chemotherapeutic treatment regimes (Hodgkin's disease and testicular tumors), more modest differences in the survival of patients with tumors for which early diagnosis and treatment confer an improved prognosis (carcinomas of the large bowel, breast, and cervix), and only slight differences for tumors associated with poor prognosis (carcinomas of the stomach, pancreas, and lung). With limited resources to meet the challenge of the increasing incidence of cancer expected in the next few decades, health authorities in developing countries should be aware of the importance of investing in a range of cancer control activities, including primary prevention and early detection programs as well as treatment.

76. World Health Organization. *World Cancer Report 2008*. World Health Organization, 2008.

77. Sankaranarayanan R, Ferlay J. Worldwide Burden of Gynecological Cancer: the size of the problem. In: *Best Practice & Research Clinical Obstetrics & Gynecology - Special issue on Screening and the Prevention of Gynecological Cancer* 2006; 20(2): 207–225.

The estimation of cancer burden is valuable to set up priorities for disease control. The comprehensive global cancer statistics from the International Agency for Research on Cancer indicate that gynecological cancers accounted for 19% of the 5.1 million estimated new cancer cases, 2.9 million cancer deaths and 13 million 5-year prevalent cancer cases among women in the world in 2002. Cervical cancer accounted for 493 000 new cases and 273 000 deaths; uterine body cancer for 199 000 new cases and 50 000 deaths; ovarian cancer for 204 000 new cases and 125 000 deaths; cancers of the vagina, vulva and choriocarcinoma together constituted 45 900 cases. More than 80% of the cervical cancer cases occurred in developing countries and two-thirds of corpus uteri cases occurred in the developed world. Political will and advocacy to invest in healthcare infrastructure and human resources to improve service delivery and accessibility are vital to reduce the current burden in low- and medium-resource countries.

78. Ferlay J, Sankaranarayanan R. Global Burden of Breast Cancer. In: Li C et al. *Breast Cancer Epidemiology*, Springer Science 2008. (In press)

79. Magrath I, Litvak J. Cancer in developing countries: opportunity and challenge. *Journal of the National Cancer Institute* 1993; 85(11): 862–74.

Epidemiologic observations indicate that environment and lifestyle are the major determinants of the geographical patterns of cancer. The developing countries, which account for 75% of the world's population, have lower incidence rates of cancer compared with the industrialized nations but bear more than half the global cancer burden. Demographic trends resulting from economic progress (decreasing incidence of infectious diseases, population growth, aging, and urbanization), coupled with increased tobacco consumption and dietary changes, indicate that developing countries will bear a continually increasing proportion of the world's cancer burden and its accompanying demand for the provision of costly treatment programs. Yet the developing countries command only 5% of the world's economic resources, and health care programs are already fully extended and frequently inadequate. Thus, cancer control in the developing countries, including preemptive prevention of the anticipated increases in cancers presently more common in the industrialized nations (e.g., lung, breast, and colon), should include much greater emphasis on cancer prevention than is presently the case. But there is another perspective. The developing countries, with their dramatic contrasts in lifestyles and environments and equally diverse patterns of cancer, provide an unparalleled, and often neglected, opportunity for studies directed toward understanding the mechanisms of environmental carcinogenesis. Such an understanding should eventually lead to the development of novel intervention approaches. Unfortunately, cancer research is much more difficult to conduct in the developing countries because of the lack of population-based registries, poor communication and transportation systems, and deficiencies in infrastructure, financial support, and the training of health professionals. These difficulties could be overcome, to the benefit of all, if the extent of collaboration in cancer research between the developing and industrialized nations were to be greatly expanded.

80. Kanavos P. The rising burden of cancer in the developing world. *Annals of Oncology* 2006;17 (Suppl 8): viii15–viii23.

Cancer remains one of the leading causes of morbidity and mortality worldwide. It is predicted that by 2020, the number of new cases of cancer in the world will increase to more than 15 million, with deaths increasing to 12 million. Much of the burden of cancer incidence, morbidity, and mortality will occur in the developing world. This forms part of a larger epidemiological transition in which the burden of chronic, noncommunicable disease—once limited to industrialized nations—is now increasing in less developed countries. In addition to the accumulating risks associated with diet, tobacco, alcohol, lack of exercise, and industrial exposures, the developing world is already burdened by cancers some of which are attributable to infectious diseases. These disparities in cancer risk combined with poor access to epidemiological data, research, treatment, and cancer control and prevention combine to result in significantly poorer survival rates in developing countries for a range of specific malignancies. This paper summarizes the recent trends in the epidemiology and survival of cancers in the developing and developed world, and explores potential causes and policy responses to the

disproportionate and growing cancer burden in less developed countries. Such responses may include raising awareness as well as education and training to foster better informed decision-making, together with improved cancer surveillance, early detection and emphasis on prevention. Improved health care financing and international initiatives and/or partnerships could also provide additional impetus in targeting resources where needed urgently.

81. Wilson CM, Tobin S, Young RC. The exploding worldwide cancer burden: the impact of cancer on women. *International Journal of Gynecological Cancer* 2004; 14(1): 1–11.

Although age-adjusted cancer death rates have started to decline in the United States and other developed nations - thanks in large part to widespread screening programs that detect cancers at early, treatable stages - cancer in developing countries is on the rise. Ironically, rising life expectancy in those nations along with the adoption of 'Western' lifestyles will leave many more people vulnerable to cancer. Unfortunately, the early detection tools and treatment technology that have helped control cancer in wealthier lands are often not readily available in many other countries. Much of this increased cancer burden will take the form of cancers that affect women - not only breast, cervical, and other gynecologic cancers but colorectal cancer, lung cancer, and other malignancies related to tobacco. Physicians specializing in cancer care for women need to be alert to every opportunity to improve cancer screening and prevention among the growing, aging populations of less-developed countries. Less precise but less costly and more widely available screening techniques may save thousands more lives than the most sophisticated technology because low-cost programs can be applied widely instead of being reserved for a fortunate few. In addition, education and prevention efforts directed toward tobacco use need to be put in place to help stem an epidemic of tobacco-related cancers that has largely peaked in developed countries but looms ominously in the future of developing nations.

82. Bosetti C, Malvezzi M, Chatenoud L et al. Trends in cancer mortality in the Americas, 1970-2000. *Annals of Oncology* 2005; 16(3): 489–511.

Data and statistics on cancer mortality over the last decades are available for most developed countries, while they are more difficult to obtain, in a standardized and comparable format, for countries of Latin America. Methods: Age standardized (world population) mortality rates around the year 2000, derived from the WHO database, are presented for 14 selected cancers and total cancer in 10 countries of Latin America, plus, for comparative purposes, Canada and the USA. Trends in mortality are also given over the period 1970-2000. Results: In 2000, the highest total cancer mortality for males was observed in Argentina and Chile, with rates comparable to those of Canada and the USA, i.e. about 155/100,000. For women, Chile and Cuba had the highest rates in Latin America (114 and 103/100,000, respectively), again comparable to those of North America (around 105/100,000). These reflect the comparatively high mortality from cancer of the stomach (for Chile), lung and intestines (for Argentina) in men, and of stomach and uterus (for Chile), intestines and lung (for Cuba) in women. Colombia,

Ecuador and Mexico had the lowest total cancer mortality for men, due to low mortality from stomach, colorectal and lung cancer. For women, the lowest rates were in Brazil and Puerto Rico, reflecting their low stomach and cervical cancer rates. In Argentina, Chile, Colombia, Costa Rica and Venezuela cancer mortality rates tended to decline, particularly in men. Rates were stable in Ecuador and Puerto Rico, and were increasing in Mexico and Cuba. Conclusions: Mortality from some common cancers (including colorectal and lung) is still low in Latin America compared with Canada and the USA, and decreasing trends have been observed in the last decades for some cancer sites (including stomach, uterus, lung and other tobacco-related cancers) in several countries. However, mortality from female lung and breast cancers has been increasing in most countries of Latin America, and several countries still show an extremely elevated mortality from cancer of the cervix. Selected neoplasms amenable to treatment, including testis and leukemias, also show unsatisfactory trends in Latin America.

83. Althuis MD, Dozier JM, Anderson WF et al. Global trends in breast cancer incidence and mortality 1973-1997. *International Journal of Epidemiology* 2005; 34(2): 405–12.

Worldwide, breast cancer is the most common cancer and is the leading cause of cancer death among women. Methods: To describe global trends, we compared age-adjusted incidence and mortality rates over three decades (from 1973-77 to 1993-97) and across several continents. Results: Both breast cancer incidence and mortality rates varied 4-fold by geographic location between countries with the highest and lowest rates. Recent (1993-1997) incidence rates ranged from 27/100,000 in Asian countries to 97/100,000 among US white women. Overall, North American and northern European countries had the highest incidence rates of breast cancer; intermediate levels were reported in Western Europe, Oceania, Scandinavia, and Israel; and Eastern Europe, South and Latin America, and Asia had the lowest levels. Breast cancer incidence rose 30-40% from the 1970s to the 1990s in most countries, with the most marked increases among women aged > or =50 years. Mortality from breast cancer paralleled incidence: it was highest in the countries with the highest incidence rates (between 17/100,000 and 27/100,000), lowest in Latin America and Asia (7-14/100,000), and rose most rapidly in countries with the lowest rates. Conclusion: Breast cancer incidence and mortality rates remain highest in developed countries compared with developing countries, as a result of differential use of screening mammograms and disparities in lifestyle and hereditary factors. Future studies assessing the combined contributions of both environmental and hereditary factors may provide explanations for worldwide differences in incidence and mortality rates.

84. Igene H. Global health inequalities and breast cancer: an impending public health problem for developing countries. *Breast Journal* 2008; 14(5): 428–34.

The aim of the study was to provide information on the global health inequality pattern produced by the increasing incidence of breast cancer and its relationship with the health expenditure of developing countries with emphasis on sub-Saharan Africa. It examines the difference between the health expenditure of developed and developing countries, and how this affects breast cancer incidence and mortality. The data collected from the World Health Organization and World Bank were examined, using bivariate analysis, through

scatter-plots and Pearson's product moment correlation coefficient. Multivariate analysis was carried out by multiple regression analysis. National income, health expenditure affects breast cancer incidence, particularly between the developed and developing countries. However, these factors do not adequately explain variations in mortality rates. The study reveals the risk posed to developing countries to solving the present and predicted burden of breast cancer, currently characterized by late presentation, inadequate health care systems, and high mortality. Findings from this study contribute to the knowledge of the burden of disease in developing countries, especially sub-Saharan Africa, and how that is related to globalization and health inequalities.

85. Ribeiro RC, Steliarova-Foucher E, Magrath I et al. Baseline status of pediatric oncology care in ten low-income or mid-income countries receiving My Child Matters support: a descriptive study. *The Lancet Oncology* 2008; 9(8): 721–729.

Background: Childhood-cancer survival is dismal in most low-income countries, but initiatives for treating pediatric cancer have substantially improved care in some of these countries. The My Child Matters program was launched to fund projects aimed at controlling pediatric cancer in low-income and mid-income countries. We aimed to assess baseline status of pediatric cancer care in ten countries that were receiving support (Bangladesh, Egypt, Honduras, Morocco, the Philippines, Senegal, Tanzania, Ukraine, Venezuela, and Vietnam). Methods: Between Sept 5, 2005, and May 26, 2006, qualitative face-to-face interviews with clinicians, hospital managers, health officials, and other health-care professionals were done by a multidisciplinary public-health research company as a field survey. Estimates of expected numbers of patients with pediatric cancer from population-based data were used to project the number of current and future patients for comparison with survey-based data. 5-year survival was postulated on the basis of the findings of the interviews. Data from the field survey were statistically compared with demographic, health, and socioeconomic data from global health organizations. The main outcomes were to assess baseline status of paediatric cancer care in the countries and postulated 5-year survival. Findings: The baseline status of pediatric oncology care varied substantially between the surveyed countries. The number of patients reportedly receiving medical care (obtained from survey data) differed markedly from that predicted by population-based incidence data. Management of paediatric cancer and access to care were poor or deficient (ie, nonexistent, unavailable, or inconsistent access for most children with cancer) in seven of the ten countries surveyed, and accurate baseline data on incidence and outcome were very sparse. Postulated 5-year survival were: 5—10% in Bangladesh, the Philippines, Senegal, Tanzania, and Vietnam; 30% in Morocco; and 40—60% in Egypt, Honduras, Ukraine, and Venezuela. Postulated 5-year survival was directly proportional to several health indicators (per capita annual total health-care expenditure [Pearson's $r^2=0.760$, $p=0.001$], per capita gross domestic product [$r^2=0.603$, $p=0.008$], per capita gross national income [$r^2=0.572$, $p=0.011$], number of physicians [$r^2=0.560$, $p=0.013$] and nurses [$r^2=0.506$, $p=0.032$] per 1000 population, and most significantly, annual government health-care expenditure per capita [$r^2=0.882$, $p<0.0001$]). Interpretation: Detailed surveys can provide useful data for baseline assessment of the status of paediatric oncology, but cannot substitute for national cancer

registration. Alliances between public, private, and international agencies might rapidly improve the outcome of children with cancer in these countries.

Argentina

86. Jimenez F, Ahumada CA. Colonic cancer: an enemy in retreat? *Acta Gastroenterologica Latinoamericana* 2001; 31(2): 65–9.

Argentina and Uruguay are countries with high mortality rates for colorectal cancer. In the Province of Santa Fe, colorectal cancer ranks as third when considering cancer as the cause of death. The aim in this study was to compare the mortality rates for colorectal cancer in the Province for a 10 year period. The mortality rates for 1985-1987 and 1995-1997 were 17.2% and 19.1% respectively. There was no significant difference with the mortality rates during that decade our study encompasses.

87. Munoz SE, Chatenoud L, La Vecchia C et al. Trends in cancer mortality in Argentina, 1966–91. *European Journal of Cancer Prevention* 1998; 7(1): 37–44.

Trends in death certification rates for 12 major cancer sites and total cancer mortality in Argentina were analyzed for the period 1966-91 on the basis of the World Health Organization database. In the late 1960s, total cancer mortality rates in Argentina (184/100,000 men, 117/100,000 women, world standard) were among the highest in the world. Over the 25-year period considered, however, cancer mortality in Argentina declined by 15% in both sexes, to reach 157/100,000 in men and 99/100,000 in women, for 1990-91. These rates were somewhat lower than those of North America and, particularly for women, relatively low on a worldwide scale. The favorable trends, observed mostly between the 1960s and the 1980s, reflect the steady decline in gastric cancer rates in both sexes, together with some decline in oesophageal, lung and other tobacco-related neoplasms, mostly in men, following some decline in tobacco consumption over the last two decades. The fall in oesophageal cancer may be related to decreased consumption of hot mate, too. Colorectal cancer rates were high in the 1960s, but declined by 17% in men and 35% in women. An approximately 50% decline was observed for skin cancer mortality, which was among the lowest in the world in the early 1990s, and some decline was observed also for leukemias and uterine cancer, while breast and prostate neoplasms showed a general stability. The two major unfavorable features of cancer mortality in Argentina were the persistently high rates for oesophageal in men, and for uterine cancer mortality in women. These are likely a result of hot mate drinking for oesophageal cancer and inadequate screening for cervical cancer.

Brazil

88. Algranti AU, Menezes E, Achutti AM. Lung cancer in Brazil. *Seminars in Oncology* 2001; 28(2): 143–52.

Lung cancer is the second leading cause of death in Brazil, after exclusion of external causes. Registries in the country are not reliable because of under-registration and limited

coverage. Incidence rates for Brazil are less than half those for selected areas with good registries. Crude and adjusted incidence and mortality rates for lung cancer are rising, particularly among women. The main reason is the acceleration in tobacco consumption and the spread of smoking among women. At present, approximately 40% of men and 25% of women, 15 years of age or older, are current smokers. In the state of Rio Grande do Sul, where registries are reliable, incidence and mortality for males are similar to US data and the figures for women are rapidly approaching those for men. Occupations associated with risks of exposure to respiratory carcinogens show a rise in the incidence of lung cancer in the industrialized area of Sao Paulo. The main occupational risk in Brazil is exposure to mineral dusts, silica, or asbestos. Although about 15 million Brazilians are exposed to pesticides, agricultural workers were not a risk group for lung cancer in a case-control study. Pesticides containing arsenic and dichlorodiphenyltrichloroethane (DDT) are banned. In recent years, a trend towards a decrease in male smoking has been noted, but there is still a high tobacco exposure burden in both males and females, with a forecast of a further increase in rates of lung cancer incidence and deaths. Control of respiratory carcinogens at work continues to be a problem, particularly in the present scenario of economic and political pressures on Brazil and other developing nations.

89. de Moura Alda AG, de Carvalho EF, da Silva Neiton JC. Impacts of non-transmissible chronic diseases on social security benefits. *Cien Saude Colet* 2007; 12(6): 1661–72.

This paper strives to identify the current impact of Non-Transmissible Chronic Diseases (NTCDs) on sickness and disability benefits paid out by Brazil's National Social Security Institute (INSS) between 2000 and 2002. A total of 17,970 new cases were studied, registered at the two local agencies in Recife, Pernambuco State, Northeast Brazil. Initially the cases were divided up according to major diseases groups, following the CID-10 classification. Osteomuscular diseases (OMDs) and cardiovascular diseases (CVDs) were among the main reasons for granting sickness benefits. Among the disability benefits, CVDs, mental disorders (MDs), and OMDs, were the main reasons. In terms of specific diseases within the major DCNT groups, the main reasons for granting sickness benefits were high blood pressure, diabetes mellitus, arthrosis, breast and intestinal cancer, mood disorders and schizophrenia. For disability benefits, the main causes were cerebrovascular diseases, diabetes mellitus, cancer of the gastro-intestinal tract and schizophrenia. Most (66%) of the recipients were men between 39 and 58 years of age, and the initial value of the benefit was of up to three minimum wages per month.

90. Oliveira AF, Valente JG, Leite Iuri C. The disease burden attributable to smoking in the state of Rio de Janeiro, Brazil in 2000. *Clinics* 2008; 63(2): 215–22.

Smoking is one of the main risk factors for morbidity and mortality. An estimated 59 million (4.4%) disability-adjusted life years were lost due to smoking throughout the world in 2000. Objective: To estimate the disease burden attributable to smoking in the State of Rio de Janeiro, Brazil, for the year 2000. Methods: Based on estimates of smoking prevalence and relative death risks, the smoking-attributable fraction was

calculated for each selected cause, by age and gender. The disease burden attributable to smoking was estimated by multiplying the fractions by the corresponding disability-adjusted life years. Results: In the State of Rio de Janeiro, 7% of all disability-adjusted life years were due to smoking. For individuals 30 or more years old, the fraction increased to 10.6% (13.6% in males and 7.5% in females). Chronic obstructive pulmonary disease, ischemic heart disease, cerebrovascular disease, and tracheal, bronchial, and lung cancer accounted for 32.2%, 15.7%, 13.2%, and 11.1% of the estimated total DALYs, respectively, amounting to 72.2% of the smoking-attributable disease burden. Discussion: Limitations related to parameter estimates were not unique to this study, and therefore should not compromise the comparability of our results. Outcomes were similar to those obtained in other countries, despite methodological differences. Conclusion: Smoking is an important risk factor and places a significant disease burden on Rio de Janeiro, Brazil, showing a pattern similar to that observed in high income countries.

91. Boing AF, Rossi TF. Temporal trend in and spatial distribution of lung cancer mortality in Brazil between 1979 and 2004: magnitude, regional patterns, and gender-related differences. *Brazilian Journal of Pulmonology* 2007; 33(5): 544–51.

Objective: To describe the temporal trend in and spatial distribution of mortality from tracheal, bronchial, and lung cancer in Brazil from 1979 to 2004. Methods: Mortality data by gender and geographic region were obtained from the Mortality Database created by the Ministry of Health in 1975. Demographic data were collected from the national censuses, from population counts, and from population estimates made in non-census years. Mortality rates were standardized according to the direct method, and the trends were analyzed by gender and geographic region using the Prais-Winsten method for generalized linear regression. Results: Lung cancer mortality accounted for approximately 12% of the overall neoplasia-related mortality during the period. There was a trend toward an increase for both genders and in all regions, except for the male population in the southeast region, whose rates remained steady between 1979 and 2004. The highest rates were observed in the south and southeast regions. However, the northeast region was the one that presented the greatest increase, followed by the central-west and north regions. In all regions, the increase in mortality rates was higher in women. Conclusion: The increase in lung cancer mortality in Brazil between 1979 and 2004 requires public measures that can minimize exposition to risk factors, mainly tobacco, and allow greater access to health care facilities for diagnosis and treatment.

92. Malta DC, Moura L, Souza M et al. Lung cancer, cancer of the trachea, and bronchial cancer: mortality trends in Brazil, 1980-2003. *Brazilian Journal of Pulmonology* 2007; 33(5): 536–43.

Objective: To describe the mortality trends for lung cancer, cancer of the trachea, and bronchial cancer in relation to gender and age brackets in Brazil. Methods: Data related to mortality between 1980 and 2003 were collected from the Brazilian Mortality Database. A trend analysis of mortality was carried out, nationwide and in selected states, using the LOWESS technique for rate smoothing and model adjustments. Results: In

Brazil, the standardized mortality rate for lung cancer, cancer of the trachea, and bronchial cancer increased from 7.21/100,000 inhabitants in 1980 to 9.36/100,000 inhabitants in 2003. Specific mortality rates decreased in males in the 30-49 and 50-59 age brackets. In the 60-69 age bracket, the rates for males increased from 1980 to 1995 and declined thereafter. There was a trend toward higher mortality rates in males over 70, as well as in females over 30, throughout the period evaluated. Conclusion: The decrease in the mortality rates in younger males might have resulted from recent national interventions aimed at reducing the prevalence of smoking and reducing exposure in younger cohorts. High mortality rates in older populations remained constant due to prior tobacco use. Increased mortality rates in females are a worldwide trend and are attributable to the recent increase in smoking prevalence in females.

93. Cadaval GA, Costa JP, Vanacor R et al. Increase in breast cancer mortality in Southern Brazil from 1980 to 2002. *Cadernos de Saúde Pública* 2007; 23(8): 1785–90.

Breast cancer is the most prevalent form of cancer in the world. Breast cancer mortality rates are high in Brazil and show striking variations between geographic regions. A time-trend ecological study was performed in Southern Brazil from 1980 to 2002. Data were collected from the Mortality Information System (Ministry of Health) to assess age-standardized mortality rates. Linear regression for mortality time-trend analysis and multiple regression for mortality differences among three States were calculated. The highest mean mortality rate (14.45) was observed in Rio Grande do Sul, significantly greater ($p < 0.001$) than in Santa Catarina (8.93) and Parana (9.95). An annual increase of 0.47 in the mortality rate was observed in the three States of Southern Brazil. According to these results, the South of Brazil and especially the State of Rio Grande do Sul showed a significant upward trend in breast cancer mortality. Continued efforts are needed to help explain these numbers and reverse the present situation.

94. das Neves FJ, Mattos IE, Koifman RJ. Colon and rectal cancer mortality in Brazilian capitals, 1980-1997. *Arquivos de Gastroenterologia* 2005; 42(1): 63–70.

Background: In Brazil, colorectal tumors are among the five more important sites of neoplasms, for both sexes, in terms of mortality. The etiology of colon and rectal cancer is complex and some of the factors involved in its genesis are related to diet. Brazilian geographic regions present heterogeneous alimentary profiles, that could be influencing the distribution of the mortality rates for these tumors. Objective: To describe the patterns of mortality from cancers of the colon and the rectum in Brazilian State capitals in the period 1980-1997. Methods: Mortality data for individuals of both sexes, residents in Brazilian State capitals (except Palmas, Tocantins) was obtained from the Ministry of Health Mortality System (SIM/MS). We considered as death from colon and rectum cancers those whose underlying cause of death was coded as 153.0 to 153.9, 154.0 and 154.1, according to ICD 9, in the period 1980-95; C18.0 to C18.9, C19 and C20, according to ICD 10, in the period 1996-97. The trends of the standardized mortality rates from colon and rectum cancer were analyzed through linear regression models. Results: The highest standardized mortality rates for colorectal cancer were observed in

the South and Southeastern regions and varied between 8,0 and 10,7/100000 inhabitants. Porto Alegre (11,9), Sao Paulo (10,8) and Rio de Janeiro (9,6) presented the greatest rates among the State capitals in the study period. In the South region, rates of mortality for Porto Alegre and Florianopolis presented an increasing trend in the study period and the same behavior was observed for Sao Paulo and Vitoria in the Southeastern region. Brasilia and the other capitals of the Midwest, with the exception of Goiania, showed a tendency of increment of the mortality rates. Among the capitals of the North and Northeast regions, an increasing trend of mortality was observed in Rio Branco and Fortaleza. The separate analysis of the mortality rates for tumors of the colon and for tumors of the rectum showed a similar pattern, with higher values being observed for colon neoplasia. Discussion: Regional differences in the mortality rates for colon and rectum neoplasias have been discussed for different authors, who point to the contribution of cultural and alimentary habits, and differences of life style and socioeconomic status to this heterogeneity, besides other aspects related to access to health services and quality of hospital care and preventive services. These factors must be considered in the evaluation of the differences observed in Brazilian capitals. Although the State capitals situated in South and Southeastern regions presented higher rates than the others, mortality rates of Porto Alegre (9,8/100.000) and Rio de Janeiro (9,0/100.000), in period 1983- 85, were about three times lower than those observed in the United States, Canada and France, in 1985. The sex distribution pattern of the mortality rates in Brazilian capitals was not uniform, with higher rates in men. We observed a trend of increment of the mortality rates of colorectal cancer in all Brazilian regions, similar to that was observed in some countries of the world, although with different gradients. Conclusion: The standardized mortality rates for colon and rectum neoplasias presented important regional differences among Brazilian State capitals. The highest rates were observed in the South and Southeastern regions. A trend of increment of the standardized mortality rates for cancers of the colon and the rectum was observed in all Brazilian regions in the period 1980-1997.

95. Wunsch FV, Moncau JE. Cancer mortality in Brazil 1980-1995: regional patterns and time trends. *Revista da Associação Médica Brasileira* 2002; 48(3): 250–7.

Purpose: To analyze the distribution and time-series trends of cancer mortality in the Northern, Northeastern, Central Western, Southern and Southeastern Brazilian geographic regions from 1980 to 1995. Methods: Deaths according to year, age, gender and municipality of residence, were ascertained from the Ministry of Health. Age-adjusted rates were calculated for specific cancer sites by gender in the five Brazilian geographic regions. Results: Lung and breast cancers were, respectively in males and females, the main causes of cancer deaths in the Brazilian population. Overall cancer mortality rates for whole country declined among males (-0.3%) and females (-4.8%). But, rates were on increase for cancers of prostate (38.3%), lung (10.5%) and, more recently, colorectal (14.5% from 1989 to 1995) in males, and for lung (26.7%), breast (9.9%) and colorectal (10.2% from 1989 to 1995) in females. Mortality rates by lung and other tobacco related cancers were higher in the Southern and Southeastern. Females in the Northern and Northeastern had more expressive mortality rates by cervical cancer than other regions, and an inverse trend was observed for breast cancer. Conclusion:

Mortality rates by all cancers were heterogeneous in Brazil. The risk of death by cancer was higher in the Southern and Southeastern regions, but was decreasing in these regions, the more developed in the country. The other regions, less developed, had lower mortality rates by cancer, but the rates were on increase. From 1991 to 1995, it was observed the stability of mortality rates from tobacco related cancers, fact less perceived among females.

96. Lessa I, Mendonca GA, Teixeira MT. Noncommunicable chronic diseases in Brazil: from risk factors to social impact. *Bulletin of Pan American Health Organization* 1996; 120(5): 389–413.

The current epidemiologic profile of Brazil includes both the diseases of underdevelopment and those associated with modern life. Consequently, the country faces the difficult task of carrying out health promotion and protection activities aimed at controlling communicable diseases as well as noncommunicable chronic diseases (NCDs). This study sought to describe the epidemiologic situation of Brazilian adults with regard to NCDs and to present available data on the quality of care provided for these diseases and their social impact. To these ends, a literature review was conducted for the period 1964-1995--that is, since the beginning of the production and dissemination of data on cardiovascular diseases, cancer, and diabetes. Of the 153 bibliographic references that were discovered, 97 were used. The social, political, economic, and health inequities that exist among Brazil's geographic regions are reflected in the national scientific production, which is concentrated in the Southeast and South. Most of the studies based on primary data come from those regions. Information is scarce from the North-east, except the city of Salvador. Therefore, the health profile of adults--including risk factors and morbidity and mortality--can be better delineated for residents of the South and Southeast of the country, whereas for the other regions the necessary information is practically nonexistent. Risk factors linked to life-style are as widespread and important in Brazil as they are in industrialized countries. Prevalence and mortality rates among persons with or without certain socio-environmental risks (such as low level of schooling or unskilled occupations) indicate that NCDs predominate in the lowest social strata. Inter-regional differences in the prevalence of arterial hypertension and diabetes mellitus, the most common fatal cardiovascular causes, and the predominant cancers, as well as morbidity and mortality in both sexes, illustrate the political, social, and economic inequities of development in each region. Comparisons with other countries of the incidence of cardiovascular diseases in a capital in the Northeast or mortality from cardiovascular diseases in the capitals in the South and Southeast show, in the first case, that Salvador has the highest incidence among the Western countries analyzed and, in the second case, that the mortality data rank among the top seven. Cardiovascular diseases and diabetes show increasing trends, with the exception of a small decline for ischemic heart disease and cerebrovascular disease in the municipality of Sao Paulo. Deaths rates in hospitals from specific cardiovascular diseases and avoidable complications of diabetes are high, especially among indigent patients as opposed to private patients. Premature mortality, as measured by productive years of life lost, reflects the poor quality of medical care and the absence of targeted control programs. These data, combined with other sources of information, such as consents for

treatment and pensions paid for illness, give some idea of the impact of NCDs on the society. The authors point to the basic research that could be done in all the country's regions to serve as a basis for planning and implementing populational strategies to reduce risk factors and to treat and control chronic noncommunicable diseases in Brazil.

97. Boing AF, Vargas SA, Boing AC. The burden of neoplasm in Brazil: mortality and hospital morbidity from 2002 to 2004. *Revista da Associação Médica Brasileira* 2007; 53(4): 317–22.

Objective: To describe mortality and the hospital morbidity by neoplasias in Brazil and regions according to gender. Methods: Data of deaths were obtained from the Mortality Information System and of hospital morbidity from the Hospital Information System. Deaths were categorized according to primary tumor sites, selected in accordance with the tenth revision of the International Classification of Diseases. The population data were drawn from the inter census estimates of the IBGE (Brazilian Institute of Geography and Statistics). The period of analysis was the triennial 2002-2004, with the most recent mortality data in Brazil. The average of this period was calculated to ensure greater stability of the rates. Results: Between 2002 and 2004, 405,415 deaths from neoplasias occurred in Brazil. The highest rates of mortality were identified in the South and South-East regions. For men, cancer of the trachea, bronchi and lungs were the malignant neoplasias with the highest mortality rate while for women breast cancer was highest. Breast cancer and cancer of the uterine cervix are those requiring the largest number of in-hospital admissions. In internments, leukemia presented the highest average cost and total cost. Conclusion: The burden of neoplasms is extremely high in Brazil and public policies focused on the population must be given priority for an effective control of mortality and morbidity.

Chile

98. Solimano CG; Mazzei PM. Which are the causes of death among Chileans today? Long-term perspectives. *La Revista Médica de Chile* 2007; 135(7): 932–8.

During the last decades, Chile experienced substantial socioeconomic, epidemiological and demographic changes. These resulted, among other consequences, in a deceleration of population growth, a notorious decrease in fertility rates, and one of the most rapid and deepest drop in general and infant mortality rates in the Latin American region. These changes resulted in a sustained increase of life expectancy and a substantial ageing of the Chilean population. This process is also changing the disease burden of the population. Infectious and perinatal diseases lost relevance as major causes of mortality, and have been replaced by chronic non transmissible diseases, specifically cardiovascular conditions and cancer, that are becoming the main causes of death. High blood pressure, cardiovascular risk, hypercholesterolemia, diabetes, overweight and obesity, smoking, sedentary lifestyle and depression will have a great impact on health conditions during the XXI century. These factors and a persistent social inequity will hinder the efforts to reduce the impact and consequences of chronic non transmissible, diseases in the Chilean population.

99. Icaza NM, Nunez FM, Torres A et al. Geographical distribution of mortality caused by stomach, trachea, bronchi and lung malignant tumors in Chile. *La Revista Médica de Chile* 2007; (11): 1397–405.

Maps have played a critical role in public health since 1855, when John Snow associated a cholera outbreak with contaminated water source in London. After cardiovascular diseases, cancer is the second leading cause of death in Chile. Cancer was responsible for 22.7% of all deaths in 1997-2004 period. Aim: To describe the geographical distribution of stomach, trachea, bronchi and lung cancer mortality. Methods: Mortality statistics for the years 1997-2004, published by the National Statistics Institute and Chilean Ministry of Health, were used. The standardized mortality ratio (SMR) for sex and age quinquennium was calculated for 341 counties in the country. A hierarchical Bayesian analysis of Poisson regression models for SMR was performed. The maps were developed using adjusted SMR (or smoothed) by the Poisson model. Results: There is an excess mortality caused by stomach cancer in south central Chile, from Teno to Valdivia. There is an excess mortality caused by trachea, bronchi and lung cancer in northern Chile, from Copiapo to Iquique. Conclusion: The geographical analysis of mortality caused by cancer shows cluster of counties with an excess risk. These areas should be considered for health care decision making and resource allocation.

100. Medina LE, Kaempffer RA. Trends and main features of Chilean mortality. *La Revista Médica de Chile* 2007; 135(2): 240–50.

Mortality data of a community allow to identify its severest diseases and health problems. AIM: To report epidemiologic data on Chilean mortality. Methods: Information about mortality was obtained from the World Health Organization, Pan American Health Organization, the Chilean Institute of Statistics and Ministry of Health. Results: A continuously declining trend in the risk of dying during the last 30 years was observed. Chile has the best situation among South American countries. Infant and general mortality rates fell in 89 and 39%, respectively, during the period 1970-2003. This reduction is observed in all Chilean geographical regions. At the county level, there are 11 counties that duplicate the figure of mortality of the 337 other counties. In the case of infant mortality, there are 91 counties that duplicate the national figure, indicating an important inequity. Mortality is significantly associated with population aging, availability and use of hospital beds. There is a lower level of association with the proportion of population living in urban areas and poverty levels. A projection until 2010 shows an increasing mortality caused by malignant tumors and diabetes and a declining trend for circulatory, respiratory and digestive diseases and accidental deaths. Conclusion: Mortality has been managed efficiently in Chile but future trends underscore the need for cancer and diabetes prevention and management programs.

101. Donoso A, Villarroel L, Pinedo G. Increase in colon cancer mortality rates in Chile, during the period 1990-2003. *La Revista Médica de Chile* 2006; 134(2): 152–8.

In Chile, colorectal cancer is the third cause of mortality due to digestive cancer. AIM: To assess the evolution of colon cancer mortality rates in the period 1990-2003. Methods:

Information was obtained from demography and vital statistics yearbooks, published by the Chilean National Statistics Institute. Mortality tendencies and slopes, were calculated using Pearson correlation analysis and linear regression. Proportions were compared using Chi square. Results: There was a significantly rising tendency in mortality for colon cancer in the general population ($r= 0.964$, $p <0.001$), in men ($r=0.926$, $p <0.001$) and in women ($r=0.943$, $p <0.001$). This tendency was not modified if rates were corrected by age. Mortality among women was significantly higher in all study years. The increase in mortality rates in the period was 0.175/100,000 inhabitants per year. The higher mortality rates were observed during 2003, reaching 6.2/100,000 inhabitants. Conclusion: There was a steady increase in colon cancer mortality during the studied period.

102. Medina E, Kaempffer AM. Cancer mortality in Chile: epidemiological considerations. *La Revista Médica de Chile* 2001; 129(10): 1195–202.

Malignancies are the second most important cause of mortality in Chile, accounting for 21.8% of total deaths. In comparison with other causes, cancer mortality shows an upward trend with increasing mortality rates from 99 to 118 per 100.000 population in the period 1980-1998. The most important cancer locations are stomach, lung and prostate among men and gallbladder, stomach, breast and uterine cervix in women. According to present risks, the mean probability for a Chilean to die from cancer is 3.0% for stomach, 2.3% for prostate, 2.0% for lung, 1.7% for gallbladder, 1.6% for breast and 1.2% for uterine cervix cancer. Recent trends of cancer crude death rates are a matter of concern. During the period 1990-1998 a significant decrease of death rates was only noticed for uterine cervix cancers. On the other hand, important increases were observed for prostate, lung, gallbladder, colon and kidney cancers. If death rates are adjusted by age, an increased risk, not due to the population aging process, is noticed for prostate and to less extent for kidney, colon, skin and myeloma. The adjusted rates show a downward trend for uterine cervix, stomach, breast and esophagus cancer. Increasing cancer mortality is associated with diagnostic and therapeutic delays. Possible actions in screening programs are discussed.

China

103. You WC, Jin F, Devesa S et al. Rapid increase in colorectal cancer rates in urban Shanghai, 1972-97, in relation to dietary changes. *Journal of Cancer Epidemiology and Prevention* 2002; 7(3): 143–6.

In urban Shanghai, the largest industrial and commercial city in China, the age-adjusted (to world standard) incidence rates for colorectal cancer increased from 14.8 to 24.1 per 10(5) man-years and from 11.7 to 20.7 per 10(5) woman-years between 1972-73 and 1996-97. These changes were even more pronounced for colon cancer. The reasons for the rapid increases in cancer rates are not fully understood, but may involve dietary habits that have changed substantially over the past two decades. Methods: Based on incidence data on 37000 colorectal cancers from 1972-1997 and dietary information during the past 20 years, an ecologic correlation analysis was performed. Results: Available data indicate that per capita food consumption in Shanghai of vegetable oil, poultry, eggs, and pork

rose rapidly during the period 1978-97, whereas consumption of seafood, grain, and fresh vegetables changed little or showed little consistent trends. Statistically significant positive associations were observed between colon cancer rates and per capita consumption of vegetable oil, poultry, fresh eggs and pork. Discussion: These findings suggest that increases in dietary fat and certain protein consumption may play a role in the rising colon cancer rates in Shanghai.

104. Lin S, Song G, Zhou F. Mortality study of major noncommunicable diseases in Shanghai, from 1951 to 1998. *Zhonghua Liu Xing Bing Xue Za Zhi* 2001; 22(4): 265–8.

To study the transition of major noncommunicable diseases (NCDs) in Shanghai. Methods: Demographic and mortality data since early 1950s in Shanghai was used. Linear regression model was employed to evaluate the mortality trends of diseases. Results: During the past five decades, age-adjusted mortality had been gradually decreasing, with leading cause of deaths shifting from infectious diseases to NCDs. In 1998, the average life expectancy reached 77.03, and the three leading causes of deaths, i.e. tumor, cardio-vascular diseases and respiratory diseases, accounted for 75% of all deaths. The crude mortality of major NCDs increased consistently. However, the age-adjusted mortality trends of major NCDs decreased during the past two decades after a 30-year's increase. Turnover took place in the late 1970s for tumors, for coronary heart in late 1980s diseases and in the early 1990s for strokes. For malignant tumors, the age-adjusted mortality of breast cancer, cancer of colon and rectum did not significantly decrease in the past two decades. Conclusion: The increase of crude mortality of major NCDs was mainly due to the trend of aging in Shanghai. It is suggested that the risk factors of major NCDs had decreased to some extent but the behavior and dietary related risk factors remained serious.

105. Chie WC, Chen SY, Chang KJ. Disability-adjusted Life Years of Breast Cancer in Taiwan. *Journal of Formosan Medical Association* 2001; 100: 20–5.

The incidence and mortality of breast cancer in Taiwan have increased rapidly in the past several decades, but the societal impact of deaths and disabilities due to breast cancer has not been assessed. This study estimated the disability-adjusted life years (DALYs) for breast cancer patients during 1994, and compared the results with similar data from other areas of the world. Methods: DALYs for breast cancer patients in Taiwan were calculated using the equation developed by Murray and Lopez. The incidence and mortality of breast cancer and the population structure were obtained from national statistics maintained by the Department of Health and the Ministry of the Interior. The age-specific mean survival time for breast cancer patients was estimated using the exponential distribution from incidence-mortality linkage of the incidence file at National Taiwan University Hospital and the National Mortality File maintained by the Department of Health. Results: There were 11,963 years of life lost (YLL) due to breast cancer during 1994, 2677 years lived with disability (YLD), and 14,640 DALYs. The YLL and DALYs per 1000 population (1.17 and 1.44) were in the middle of the world spectrum, while the YLD value per 1000 population (0.26) was closer to those of developed countries. The

proportion of DALYs contributed by younger patients (< 45 years) was higher than in developed countries and similar to those in developing countries other than Sub-Saharan Africa. The DALYs per 1000 population of women younger than 45 years of age in Taiwan were also higher than those in India, China, other regions of Asia and Islands, Sub-Saharan Africa, and the Middle Eastern Crescent. Conclusion: The disability portion (YLD) of the DALYs for breast cancer patients in Taiwan was higher than in other regions of the world. Moreover, patients younger than 45 years contributed a higher proportion of DALYs than in developed countries. The DALY value per 1000 population younger than 45 years of age was also higher than in developing countries. These results suggest that health professionals should focus more attention on programs for education, screening, and treatment of younger women.

106. Linos E, Spanos D, Rosner BA et al. Effects of reproductive and demographic changes on breast cancer incidence in China: a modeling analysis. *Journal of the National Cancer Institute* 2008; 100(19): 1352–60.

Breast cancer incidence is currently low in China. However, the distribution of reproductive and lifestyle risk factors for breast cancer among Chinese women is changing rapidly. We quantified the expected effect of changes in breast cancer risk factors on future rates of breast cancer in China. Methods: We first validated and calibrated the Rosner-Colditz log-incidence breast cancer model in Chinese women who participated in the Shanghai Women's Health Study cohort (N = 74,942). We then applied the calibrated model to a representative sample of Chinese women who were aged 35-49 years in 2001 using data from the Chinese National Family Planning and Reproductive Health Survey (NFPRHS, N = 17,078) to predict the age-specific and cumulative breast cancer incidence among all Chinese women of this age group. We evaluated the relative impact of changes in modifiable risk factors, including alcohol intake, parity, postmenopausal hormone use, and adult weight gain, on cumulative incidence of breast cancer. Results: Breast cancer incidence in China is expected to increase substantially from current rates, estimated at 10-60 cases per 100,000 women, to more than 100 new cases per 100,000 women aged 55-69 years by 2021. We predicted 2.5 million cases of breast cancer by 2021 among Chinese women who were 35-49 years old in 2001. Modest reductions in hormone and alcohol use, and weight maintenance could prevent 270,000 of these cases. Conclusions: China is on the cusp of a breast cancer epidemic. Although some risk factors associated with economic development are largely unavoidable, the substantial predicted increase in new cases of breast cancer calls for urgent incorporation of this disease in future health care infrastructure planning.

107. Cai L, Chongsuvivatwong V, Geater A. Changing pattern of premature mortality burden over 6 years of rapid growth of the economy in suburban south-west China: 1998-2003. *Public Health* 2008; 122(5): 478–86.

This study was conducted in Kunming, the capital of Yunnan, a poor province in south-west China experiencing rapid economic growth. The study examined the short-term trend in premature mortality burden from common causes of death in a suburban region between 1998 and 2003. Methods: Years of life lost (YLL) per 1000 population and

mortality rate per 100,000 population were calculated from medical death certificates, and broken down by cause of death, sex and year without age weighting but with a discounting rate of 3%. Results: Noncommunicable diseases contributed over 80% of all causes of YLL, with a slightly increasing trend. The combined rate for communicable, maternal, prenatal and nutritional deficiencies declined from 4.7 to 2.4 per 1000 population. Remarkably, declining trends in YLL were also seen for chronic obstructive pulmonary disease, drug use and road traffic accidents, whereas increasing trends were seen for ischaemic heart disease (IHD) and liver cancer (males). The YLL rate for stroke, self-inflicted injuries, lung cancer and stomach cancer fluctuated over time. Conclusion: The region should focus on further control of IHD and liver cancer.

108. Gan Q, Smith KR, Hammond S et al. Disease burden of adult lung cancer and ischaemic heart disease from passive tobacco smoking in China. *Tobacco Control* 2007; 16(6): 417–22.

To address the health hazards tobacco smoking imposes upon non-smokers in China, this paper estimates the burden of diseases in adults from passive tobacco smoking for two major diseases--lung cancer and ischaemic heart disease (IHD). Methods: The disease burden was estimated in terms of both premature mortality and disability adjusted life years (DALYs), a measure that accounts for both the age at death and the severity of the morbidity. Results: Passive smoking caused more than 22,000 lung cancer deaths in 2002 according to these estimates. When the toll of disability is added to that of mortality, passive smoking was responsible for the loss of nearly 230,000 years of healthy life from lung cancer. Using the evidence from other countries that links IHD to passive smoking, we estimated that approximately 33,800 IHD deaths could be attributable to passive smoking in China in 2002. Passive smoking is also responsible for the loss of more than one quarter of a million years of healthy life from IHD. Although most of the disease burden caused by active smoking occurs among men, women bear nearly 80% of the total burden from passive smoking. The number of deaths among women caused by passive smoking is about two-thirds of that caused by smoking for the two diseases we examined. Conclusion: Even without considering the passive smoking risks for other diseases and among children that have been documented in other countries, passive smoking poses serious health hazards for non-smokers, especially for adult female non-smokers in China, adding more urgency to the need for measures to be taken immediately to protect the health of non-smokers and curb the nation's tobacco epidemic.

109. Cui YL, Fu L, Geng ZX. The trend of cancer mortality from 1988 to 2005 in Kaifeng county, China. *Zhonghua Yu Fang Yi Xue Za Zhi* 2007; 41(Suppl PS): 62–5.

Objective: To investigate the time trends of cancer mortality among residents in Kaifeng county, Henan province. Methods: Data on cancer mortality from the vital registration system in Kaifeng county from 1988 to 2005 was analyzed. A total of 9543 death records (5974 males and 3567 females) due to malignant tumors were studied. A two-year-period age-specified standardized mortality rates were directly adjusted by the world standard population, and the annual percentage change (APC) of mortality were estimated by a linear logarithm regression. Results: The crude cancer death rate for male was

95.09/100,000 and its age-standardized death rate was 117.41/100,000. While, the crude cancer death rate for female was 59.13/100,000 and the age-standardized death rate was 57.15/100,000. There was a significant growth trend for lung cancer (APC: 6.54%), liver cancer (5.07%) in males and breast cancer (7.04%) in females in the groups aged over 18. On the contrary, the decreasing trends for esophageal cancer in both of sexes (-7.09%, -13.53%) were also observed in this study. Meanwhile, there was no other significant changes in the trend, either in the tumor sites or mortality, was observed. Conclusion: In the past two decades, there has been a significant increasing trend for cancer mortality in Kaifeng county, of Henan Province. Hence, it is necessary to enhance epidemiological survey to identify risk factors at the earlier stages.

110. Ma JL, Liu WD, Zang Lian. Analysis of mortality trend of cancer from 1980 to 2002 in Linqu County Shandong Province. *Zhonghua Yu Fang Yi Xue Za Zhi* 2006; 40(6) 405–8.

Objective: To investigate the trend of total cancer mortality in Linqu County Shandong Province from 1980 to 2002. Methods: A retrospective survey on all causes of death in 1980–1982, 1990–1992 and 2000–2002 was conducted in Linqu County, a high risk area of gastric cancer in Northeast of China, respectively. Results: The cancer death, was found the third leading cause of death in 1980–1982 in Linqu County, and the second to that of vascular disease in 2000–2002. The cancer mortality (standardized mortality) was 108.97/100,000 (111.48/100,000), 132.38/100,000 (127.94/100,000) and 148.48/100,000 (105.53/100,000) in 1980–1982, 1990–1992 and 2000–2002, respectively. The trend of cancer mortality was significantly increased ($Z = 13.42$, $P < 0.0001$). The added cancer-eliminated life expectancy in three periods was 2.46 years, 3.29 years and 3.76 years in male ($F = 13.99$, $P < 0.0001$), and 1.67 years, 2.30 and 2.33 years in female ($F = 13.61$, $P < 0.0001$), respectively. The standardized mortality of gastric cancer (percentage in all cancer death) was 44.93/100,000 (40.29%), 41.37/100,000 (32.34%) and 27.73/100,000 (26.90%) in 1980-1982, 1990-1992 and 2000-2002, respectively. The trend of gastric cancer standardized mortality was significantly reduced ($Z = 6.35$, $P < 0.01$). Conclusion: The mortality of cancer in Linqu County has been increased from 1980 to 2002, but no such trend was found after adjusting ages. However, there was a decreased trend on standardized mortality of gastric cancer in the past 20 years.

111. Yang L, Li LD, Chen YD et al. Time trends, estimates and projects for breast cancer incidence and mortality in China. *Zhonghua Zhong Liu Za Zhi* 2006 28(6): 438–40.

Objective: Using comprehensive available data on women breast cancer in China, to describe the mortality trends from late 1970s, estimate and project the profile in 2000 and 2005, and to aim to provide a reference for clinic, basic research and prevention and control strategy making for breast cancer in China. Methods: Using Joinpoint model, the mortality trends were analyzed on the basis of routine surveillance data. Combining with the data from the second national mortality survey and several cancer registries, using the log-linear model (based on Poisson distribution), the breast cancer profile in 2000 and 2005 were estimated and projected. Results: Although there was a slight decline in mortality between early 1970s and 1990s, the age-specific mortality rates among young

and middle age women increased dramatically which followed a continuing increase trend on both rates and absolute numbers, in both urban and rural areas in recent 15 years. Compared with 2000, there are 470 thousands more new breast cancer cases and 130 thousands more deaths from breast cancer in 2005. Conclusion: Due to the double effects of both increasing risk factors and population growth and ageing, breast cancer will be one of the most extensively increasing cancers in Chinese women. The prevention and control of breast cancer will be of great emphasis for future cancer control strategy in China.

112. Wang QJ, Zhu W, Xing X. Analysis of the incidence and survival of female breast cancer in Beijing during the last 20 years. *Zhonghua Zhong Liu Za Zhi* 2006; 28(3): 208–10.

Objective: To provide scientific evidence for breast cancer prevention and control through epidemiological analysis of the incidence, mortality and survival rate of female breast cancer in Beijing. Methods: The registration data of females in Beijing urban area from 1982 to 2001 were retrospectively reviewed. The incidence, mortality and survival rate of female breast cancer were analyzed using routine and life table statistical methods. Results: There was a trend of annual increase by an average of 4.6% and 4.9% in the Beijing urban incidence and world population standardized incidence of female breast cancer during the period of 1982 to 2001. The epidemiological features of Beijing urban female breast cancer showed: (1) The incidence curve of different age groups from 25 to 80 years elevated with two peaks at age of ≥ 45 and ≥ 70 years; (2) There was an elevation in each age group during the last 20 years; (3) The interception rate at age of 35 to 64 reached 95.3/100,000 population, which made the breast cancer become the number one cancer in female. The changes of survival rate showed: the 5-year observed survival rate (OSR) increased from 62.0% in 1982 - 1983 to 68.7% in 1987 - 1988, the relative survival rate (RSR) increased from 66.3% to 74.2%. The OSR and RSR in 1987 - 1988 were 60.3% and 65.1% at 10 years, and 57.7% and 61.3% 15 years, respectively. The mortality rate of breast cancer fluctuated at 8 to 10 per 10(5) population during the last 20 years. Conclusion: There is a trend of an annual increase in female breast cancer in Beijing. The 5-year survival is being improved gradually while the mortality rate remains stable. The results demonstrate that the "early prevention, early diagnosis and early treatment" principles for breast cancer is effective in Beijing.

113. He J, Gu D, Wu X, Major causes of death among men and women in China. *New England Journal of Medicine* 2005; 353(11): 1124–34.

With China's rapid economic development, the disease burden may have changed in the country. We studied the major causes of death and modifiable risk factors in a nationally representative cohort of 169,871 men and women 40 years of age and older in China. Methods: Baseline data on the participants' demographic characteristics, medical history, lifestyle-related risk factors, blood pressure, and body weight were obtained in 1991 with the use of a standard protocol. The follow-up evaluation was conducted in 1999 and 2000, with a follow-up rate of 93.4 percent. Results: We documented 20,033 deaths in 1,239,191 person-years of follow-up. The mortality from all causes was 1480.1 per

100,000 person-years among men and 1190.2 per 100,000 person-years among women. The five leading causes of death were malignant neoplasms (mortality, 374.1 per 100,000 person-years), diseases of the heart (319.1), cerebrovascular disease (310.5), accidents (54.0), and infectious diseases (50.5) among men and diseases of the heart (268.5), cerebrovascular disease (242.3), malignant neoplasms (214.1), pneumonia and influenza (45.9), and infectious diseases (35.3) among women. The multivariate-adjusted relative risk of death and the population attributable risk for preventable risk factors were as follows: hypertension, 1.48 (95 percent confidence interval, 1.44 to 1.53) and 11.7 percent, respectively; cigarette smoking, 1.23 (95 percent confidence interval, 1.18 to 1.27) and 7.9 percent; physical inactivity, 1.20 (95 percent confidence interval, 1.16 to 1.24) and 6.8 percent; and underweight (body-mass index [the weight in kilograms divided by the square of the height in meters] below 18.5), 1.47 (95 percent confidence interval, 1.42 to 1.53) and 5.2 percent. Conclusions: Vascular disease and cancer have become the leading causes of death among Chinese adults. Our findings suggest that control of hypertension, smoking cessation, increased physical activity, and improved nutrition should be important strategies for reducing the burden of premature death among adults in China.

114. Wang YG, Chen KX, Wu GL. An analysis: colon cancer mortality in Tianjin, China, from 1981 to 2000. *World Journal of Gastroenterology* 2005; 11(6): 895–8.

Aim: To analyze the data from Tianjin Cancer Registry of mortality due to colon cancer from 1981 to 2000 in Tianjin, China. Methods: Tumors diagnosed in this study were coded according to ICD-9. Mortality rates were calculated by sex and calendar year of diagnosis. Results: Seventy point four percent of colon cancer deaths occurred in the age group of 55-79 years and the mortality rate reached its peak in the age group of 75-80 years. The average age at death was 64.10 years. An ascending trend was observed in the mean age of death due to colon cancer from 1981 through 2000. However, as for the sex ratio, there was no clear trend exhibited. During 1981-2000, the total number of deaths was 2147, 1041 males and 1106 females. The mean mortality rate of colon cancer was 3.04/100,000. The mortality caused by colon cancer ascended from 1981 to 2000. Conclusion: The epidemic trend of colon cancer in Tianjin and its risk factors and prevention should be studied further.

115. Yang L, Parkin DM, Li LD et al. Estimation and projection of the national profile of cancer mortality in China: 1991-2005. *British Journal of Cancer* 2004; 90(11): 2157–66.

There are no national-level data on cancer mortality in China since two surveys in 1973-1975 and 1990-1992 (a 10% sample), but ongoing surveillance systems, based on nonrandom selected populations, give an indication as to the trends for major cancers. Based on a log-linear regression model with Poisson errors, the annual rates of change for 10 cancers and all other cancers combined, by age, sex and urban/rural residence were estimated from the data of the surveillance system of the Center for Health Information and Statistics, covering about 10% of the national population. These rates of change were applied to the survey data of 1990-1992 to estimate national mortality in the year 2000,

and to make projections for 2005. Mortality rates for all cancers combined, adjusted for age, are predicted to change little between 1991 and 2005 (-0.8% in men and +2.5% in women), but population growth and ageing will result in an increasing number of deaths, from 1.2 to 1.8 million. The largest predicted increases are for the numbers of female breast (+155.4%) and lung cancers (+112.1% in men, +153.5% in women). For these two sites, mortality rates will almost double. Cancer will make an increasing contribution to the burden of diseases in China in the 21st century. The marked increases in risk of cancers of the lung, female breast and large bowel indicate priorities for prevention and control. The increasing trends in young age groups for cancers of the cervix, lung and female breast suggest that their predicted increases may be underestimated, and that more attention should be paid to strategies for their prevention and control.

116. Yang L, Parkin DM, Li L, Time trends in cancer mortality in China: 1987-1999. *International Journal of Cancer*; 106(5): 771-83.

A first analysis of time trends in cancer mortality in China at the national level is presented. Using a joinpoint regression model, based on data from a national mortality routine reporting system in China (CHIS), time trends in mortality for 9 major cancers are analyzed. Between 1987 and 1999, the age-standardized mortality rates for all cancers combined declined slightly in rural areas but have increased since 1996 in urban areas. The mortality rates for cancers in oesophagus, stomach, cervix uteri, leukemia (except for urban males after 1996) and nasopharynx declined, while lung cancer and female breast cancer showed significant increasing trends in both urban and rural areas and for both sexes. Cancers of the colon-rectum and liver had different trends in mortality in urban and rural populations. The trends in age-specific mortality rates suggest some different trends in the younger population, which may presage future overall trends, for example, increasing mortality from cancer of the cervix. The observed trends primarily reflect the dramatic changes in socioeconomic circumstances and lifestyles in China in the last 2 decades. Tobacco smoking remains a major problem, with increases in mortality from lung cancer. The improvements in socioeconomic status, diet and nutrition may be responsible for the declining risk of some cancers (oesophagus, stomach and nasopharynx), while increasing the risk for others (breast and colon-rectum). Screening programs (especially for cervix cancer), and more available and better facilities for cancer therapy, may have helped to reduce mortality for several cancers. The large increases in the absolute number of deaths that resulted from the increasing and aging population are much more important in determining the future cancer burden than any changes due to change in risk, emphasizing the increasing importance of cancer as a health problem in the 21st century in China.

Ghana

117. Wiredu EK, Armah HB. Cancer mortality patterns in Ghana: a 10-year review of autopsies and hospital mortality. *BMC Public Health* 2006; 6: 159.

Cancer mortality pattern in Ghana has not been reviewed since 1953, and there are no population-based data available for cancer morbidity and mortality patterns in Ghana due

to the absence of a population-based cancer registry anywhere in the country. Methods: A retrospective review of autopsy records of Department of Pathology, and medical certificate of cause of death books from all the wards of the Korle-Bu Teaching Hospital (KBTH), Accra, Ghana during the 10-year period 1991-2000 was done. RESULTS: The present study reviews 3659 cancer deaths at the KBTH over the 10-year period. The male-to-female ratio was 1.2:1. The mean age for females was 46.5 [Standard Deviation (SD), 20.8] years, whilst that of males was 47.8 (SD, 22.2) years. The median age was 48 years for females and 50 years for males. Both sexes showed a first peak in childhood, a drop in adolescence and young adulthood, and a second peak in the middle ages followed by a fall in the elderly, with the second peak occurring a decade earlier in females than in males. The commonest cause of cancer death in females was malignancies of the breast [Age-Standardized Cancer Ratio (ASCAR), 17.24%], followed closely by hematopoietic organs (14.69%), liver (10.97%) and cervix (8.47%). Whilst in males, the highest mortality was from the liver (21.15%), followed by prostate (17.35%), hematopoietic organs (15.57%), and stomach (7.26%). Conclusion: Considering the little information available on cancer patterns in Ghana, this combined autopsy and death certification data from the largest tertiary hospital is of considerable value in providing reliable information on the cancer patterns in Ghana.

Israel

118. Barchana M, Liphshitz I, Rozen P. Trends in colorectal cancer incidence and mortality in the Israeli Jewish ethnic populations. *Familial Cancer* 2004; 3(3-4): 207-14 .

Ashkenazi Jews, as compared to non-European Jews and non-Jews, are at increased risk for colorectal cancer (CRC), this is attributed to genetic susceptibility and/or lifestyle. Aims: To follow Israeli long-term trends in CRC incidence and mortality and their associations with ethnicity. Methods: All Israeli CRC data accumulated 1970-2001 was used, age standardized rates (adjusted to world standard population) was computed by cancer site, US Surveillance, Epidemiology and End Results Program (SEER) Stage and ethnic group (continent of birth: Europe-America, Asia, Africa, Israel). Results: From 1970, CRC incidence increased 190% in males and 140% in females; mainly colon cancer (270% and 185% respectively) ($P < 0.01$), while rectal cancer incidence decreased and is now stable. Stage 3 CRC increased while stage 4 decreased significantly ($P < 0.01$ for both). In 2001, CRC incidence per 100,000 in European-American-born males was 48.3, Asian and African born 35.5 and Israeli born 32.7 (relative risk (RR) 1.36, $P = 0.03$), while European-American female rates were 35 and all the others 26 (RR 1.35, $P < 0.01$). Overall survival increased 9% over 30 years ($P < 0.01$), 5 years survival since 1988-1996 for European-American born was 43.1%, Asian 46.7%, African 47.5% and Israeli 55.8%. Stage-2 CRC 5 years survivals for 1970-1996 (most had no post surgical treatment) for European-American born were 41.7%, Asian and African 44.8% and Israeli 53.4% ($P < 0.05$). Stage-3 CRC survivals (most received adjuvant therapy in addition to surgery) for European-American born was 38.8%, Asian and African 43.3% and Israeli 45.1% ($P < 0.01$). Conclusions: Colon cancer has increased in Israel, mainly in males and European-American born. Israeli-born Jews (of 20 to 60% mixed ethnicity and

lifestyle habits) have the lowest incidence and best survival data for stages-2 and -3 CRC. There is evidence of ethnic survival advantage and possibly in response to adjuvant oncological therapy.

India

119. Yeole BB, Sunny L, Swaminathan R et al. Population-based survival from colorectal cancer in Mumbai, (Bombay) India. *European Journal of Cancer* 2001; 37(11): 1402–8.

Survival estimates of patients registered by population-based cancer registries reflect the average prognosis from a given cancer as they are based on unselected patients with a wide range of natural histories and treatment patterns. In this paper, we report the survival experience of colorectal cancer patients in Mumbai (Bombay), India. Follow-up information on 1642 colorectal cancer patients registered by the Bombay Population-based Cancer Registry for the period 1987-1991 was obtained by matching with death certificates from the Bombay vital statistics registration system, postal/telephone enquiries, home visits and scrutiny of medical records. Cumulative observed and relative survival proportions were calculated by Hakulinen's method. For comparison of results with other populations, age-standardized relative survival (ASRS) was calculated by directly standardizing age-specific relative survival to the specific age distributions of the world standard cancer patient population in 1985. The log-rank test was used to identify the potential prognostic variables which were introduced step-wise into a Cox regression model to identify the independent predictors of survival. The 5-year relative survival was 36.6% for colon and 42.2% for rectal cancer. Age, site of cancer and clinical stage of disease emerged as independent predictors of survival. Age-specific 5-year relative survival declined with advancing age. Survival at 5 years was 61.2% for localized colon cancer; 31.9% for regional and 9.0% for distant metastatic disease. These were 65.7, 25.6 and 4.3%, respectively for rectal cancers. Comparison of the results with other populations revealed significant variations, which seem to be related to differences in detection and treatment. The prognosis from colorectal cancer in Mumbai and developing countries, may be further improved through early detection linked with treatment.

120. Gajalakshmi CK, Shanta V, Swaminathan R et al. A population-based survival study on female breast cancer in Madras, India. *British Journal of Cancer* 1997;75(5): 771–5.

Breast cancer is the second most common cancer among women in Madras and southern India after cervix cancer. The Madras Metropolitan Tumor Registry (MMTR), a population-based cancer registry, collects data on the outcome of cancer diagnosis by both active and passive methods. A total of 2080 cases of invasive female breast cancer were registered in MMTR during 1982-89. Of these, 98 (4.7%) cases were registered on the basis of death certificate information only (DCO), and there was no follow-up information for 235 (11.3%). These were excluded, leaving 1747 (84%) for survival analysis. The mean follow-up time was 43 months. The overall Kaplan-Meier observed survival rates at 1, 3 and 5 years were 80%, 58% and 48% respectively; the

corresponding figures for relative survival were 81%, 61% and 51%. A multifactorial analysis of prognostic factors using a proportional hazards model showed statistically significant differences in survival for subjects in different categories of age at diagnosis, marital status, educational level and clinical extent of disease. Increasing age at diagnosis was associated with decreased survival. Single women displayed poorer survival (37.4%) at 5 years than those married and living with spouses (50.0%). The survival rate among those who had more than 12 years of education was higher (70%) at 5 years than that of illiterate subjects (47%). An inverse relationship was seen between survival rates and clinical extent of disease. The need for research to determine feasible public health approaches, allied to coordinated treatment facilities to control breast cancer in India, is emphasized.

121. Nandakumar A, Anantha N, Venugopal TC et al. Survival in breast cancer: a population-based study in Bangalore, India. *International Journal of Cancer* 1995; 60(5): 593–6.

Survival from cancer reflects the aggressiveness of the disease, the effectiveness of treatment and host factors such as age. While hospital-based survival rates are typically used to evaluate the care provided in a particular hospital, population-based survival reflects the effectiveness of the overall cancer control strategy in the region. Here, we report the survival experience of 1514 breast cancer patients registered by the Bangalore population-based registry during 1982-1989. There have been very few reports on survival from cancer in India, mainly because of poor patient follow-up and inadequate system of registration of death. This has been largely overcome in this study by means of active follow-up through visits of homes of patients. Scrutiny of medical records and matching with death certificates, was also carried out in a small proportion (12%) of cases. Thus, information on vital status (whether dead or alive) as on January 1, 1993 was available for 1334 (88%) subjects and partial follow up data were available for a further 34 (2%). The observed 5 year survival was 42.3% and the corresponding relative survival was 46.8%. The observed survival was 57.4% for localized disease, 45.8% for direct extension, 37% for those with regional node involvement, 14.2% for distant metastasis and 38.3% for those with unstaged disease. The clinical extent of disease and the educational status were independent predictors of survival.

122. Srinath RK, Shah B, Varghese C et al. Responding to the threat of chronic diseases in India. *The Lancet* 2005; 366(9498): 1744–9.

At the present stage of India's health transition, chronic diseases contribute to an estimated 53% of deaths and 44% of disability-adjusted life-years lost. Cardiovascular diseases and diabetes are highly prevalent in urban areas. Tobacco-related cancers account for a large proportion of all cancers. Tobacco consumption, in diverse smoked and smokeless forms, is common, especially among the poor and rural population segments. Hypertension and dyslipidemia, although common, are inadequately detected and treated. Demographic and socioeconomic factors are hastening the health transition, with sharp escalation of chronic disease burdens expected over the next 20 years. A national cancer control program, initiated in 1975, has established 13 registries and

increased the capacity for treatment. A comprehensive law for tobacco control was enacted in 2003. An integrated national program for the prevention and control of cardiovascular diseases and diabetes is under development. There is a need to increase resource allocation, coordinate multisectoral policy interventions, and enhance the engagement of the health system in activities related to chronic disease prevention and control.

123. Behera D, Balamugesh T. Lung cancer in India. *Indian Journal of Chest Disease* 2004; 46(4): 269–81.

Lung cancer is one of the commonest malignant neoplasms all over the world. It accounts for more cancer deaths than any other cancer. It is increasingly being recognized in India. Methods: We did a systematic review of the published studies on epidemiology, diagnosis and treatment of lung cancer in India. Literature from other countries was also reviewed. Results: With increasing prevalence of smoking, lung cancer has reached epidemic proportions in India. It has surpassed the earlier commonest form of cancer, that of oropharynx, and now is the commonest malignancy in males in many hospitals. In addition to smoking, occupational exposure to carcinogens, indoor air pollution and dietary factors have recently been implicated in the causation of lung cancer. Squamous cell carcinoma is still the commonest histological type in India in contrast to the Western countries, although adenocarcinoma is becoming more common. Molecular genetics of lung cancer has opened up new vistas of research in carcinogenesis. Various modalities for early detection through screening are being investigated. Majority of the patients have locally advanced or disseminated disease at presentation and are not candidates for surgery. Chemotherapy applied as an adjunct with radiation improves survival and the quality of life. New anticancer drugs, which have emerged during the last decade, have shown an improved efficacy-toxicity ratio. Conclusions: In view of our large population, the burden of lung cancer will be quite enormous in India. Drastic measures aimed at discouraging people from smoking must be taken to reduce the morbidity and mortality due to lung cancer.

Jordan

124. Centers for Disease Control and Prevention. Assessing risk factors for chronic disease--Jordan, 2004. *Morbidity and Mortality Weekly Report* 2006; 55(23): 653–5.

In 2003, chronic diseases were the leading cause of mortality in Jordan; 38.2% of deaths were attributed to cardiovascular disease and 14.3% to cancer (Jordan Ministry of Health [MOH], unpublished data, 2004). In 2002, MOH, with assistance from CDC and the World Health Organization (WHO), established a behavioral risk factor surveillance program to monitor risk factors associated with chronic diseases. This report summarizes the findings of the second Behavioral Risk Factor Survey, which was conducted in Jordan in 2004. The findings indicated that the prevalence of obesity had increased by 52.3% in Jordan since 2002. In addition, cancer screening rates among women and seatbelt use rates overall were low compared with U.S. rates. Development and implementation of a national plan to prevent and control chronic diseases is needed.

Mexico

125. Zambrana M, Zurita B, Ramirez TJ et al. Hospital expenditures for five diseases of high economic impact. *Revista médica del Instituto Mexicano del Seguro Social* 2008; 46(1): 43–50.

Objective: to identify by gender and age group, the hospital expenditures of the diseases that have the major economic impact at Instituto Mexicano del Seguro Social through using the diagnosis related groups (DRG) classification system and by estimating their associated costs. Methods: DRG system served to estimate hospital expenditures for five diseases: hypertension, type 2 diabetes, chronic renal failure, cervical cancer and HIV/AIDS. DRG allow for better estimation given that consider cost adjustment based on the amount of resources employed in the treatment of different episodes. Results: in the year 2002, 6.7 % of the hospital budget was assigned to the care of these five diseases. 42.6 % of the expenditures were allocated to patients aged 60 years and older and 22.3 % to patients from 50 to 59 years of age. Regarding diabetes mellitus and hypertension, care to patients over the age of 60 reached values of 55 % and 57 % of hospital expenditures respectively. Chronic renal failure and cervical cancer reached 60.5 % and 72.8 % of the expenditures, which were concentrated in patients aged 59 years or less; HIV/AIDS expenditures were distributed among patients from 20 to 50 years of age, the highest percentage (41.7 %) was in the group of 30 to 39 years of age. Conclusions: It is relevant to develop classification and information tools that consider the type of patients receiving hospital care, that are able to monitor changes due to the demographic and epidemiologic transition processes, and that allow for sensitive outcomes measurement. These tools will help in achieving an adequate financing and planning of health expenditures.

126. Ruiz-Godoy L, Rizo RP, Sanchez CF et al. Mortality due to lung cancer in Mexico. *Lung Cancer* 2007; 58(2): 184–90.

The highest mortality due to cancer worldwide for both genders corresponds to lung cancer (1,179,000 deaths). In Mexico, the crude mortality rate due to lung cancer was of 5.01 per 10(5) inhabitants in 1979. The most important risk factor is smoking. The present study was aimed at analyzing the mortality due to lung cancer in Mexico, assessing data from each of the states constituting the Mexican Republic during the 1998-2004 period. Data were obtained from the National Institute of Statistics, Geography and Informatics (INEGI, for its initials in Spanish) corresponding to deaths due to lung cancer (1998-2004). We estimated the mean annual mortality rate (MAMR) for each of the 32 states of Mexico. We used the "World Population Standard". The MAMR was standardized according to age (ARS) direct method, and the standard error was determined by Poisson's approximation at a 95% confidence interval. To know the excess risk due to mortality, we calculated the standardized mortality ratios (SMRs) of ARS for each federal state, using the national rate as reference. In this period, 397,400 deaths due to malignant neoplasms were recorded, corresponding 45,578 (11.5%) to lung cancer; for men, 31,025 (68.1%) with MAMR of 8.9 and the respective ARS of 13.2 both x10(5) inhabitants. For women, results were 4553 (31.9%) deaths with MAMR of 4.1 and ARS of 5.4 both x10(5) inhabitants. The highest mortality rates due to lung cancer in both

genders were observed in the north of Mexico, whereas for women this was observed in the central states. Although smoking is the main risk for lung cancer, there are other factors such as environmental pollution or exposure to toxicants that could be associated to this cancer. The years potentially lost due to lung cancer were 258,550 for men and 133,315 for women, with a total of 391,865 according to histopathology registry neoplasm malignant RHNM (1985-1995). Studies focused on the characterization and measurement of polluting agents would be a good start to determine the level of participation of air pollution in the development of lung cancer.

127. Arredondo A, Carrillo C, Zuniga A. Economic burden of expected epidemiological changes in diseases related to tobacco, Mexico. *Revista de Saúde Pública* 2007; 41(4): 523–9.

Objective: To determine health care costs and economic burden of epidemiological changes in diseases related to tobacco consumption. Methods: A time-series analysis in Mexico (1994-2005) was carried out on seven health interventions: chronic obstructive pulmonary diseases, lung cancer with and without surgical intervention, asthma in smokers and non-smokers, full treatment course with nicotine gum, and full treatment course with nicotine patch. According with Box-Jenkins methodology, probabilistic models were developed to forecast the expected changes in the epidemiologic profile and the expected changes in health care services required for selected interventions. Health care costs were estimated following the instrumentation methods and validated with consensus technique. Results: A comparison of the economic impact in 2006 vs. 2008 showed 20-90% increase in expected cases depending on the disease ($p < 0.05$), and 25-93% increase in financial requirements ($p < 0.01$). The study data suggest that changes in the demand for health services for patients with respiratory diseases related to tobacco consumption will continue showing an increasing trend. Conclusions: In economic terms, the growing number of cases expected during the study period indicates a process of internal competition and adds an element of intrinsic competition in the management of preventive and curative interventions. The study results support the assumption that if preventive programs remain unchanged, the increasing demands for curative health care may cause great financial and management challenges to the health care system of middle-income countries like Mexico.

128. Malvezzi M, Bosetti C, Chatenoud L et al. Trends in cancer mortality in Mexico, 1970-1999. *Annals of Oncology* 2004; 15(11): 1712–8.

Few data on cancer mortality have been published for Mexico over the last few decades. It is therefore of interest to conduct a systematic and updated analysis of cancer mortality in this country. Methods: Age-standardized (world population) mortality rates, at all ages and truncated at age 35-64 years, from major cancers and all cancers combined were computed on the basis of certified deaths derived from the World Health Organization database for the period 1970-99. Results: Mortality rates for all neoplasms showed an upward trend in men of all ages (from 58.2/100,000 in 1970-74 to 87.1/100,000 in 1995-99) and in middle-aged men (from 76.1 to 93.7/100,000, respectively). This reflects the rise until the early 1990s in lung cancer mortality (from 8.1/100,000 in 1970-74 to

15.6/100,000 in 1995-99) and prostate cancer (from 5.5 to 12.2/100,000, respectively). In women, overall mortality rates showed an increase between the early 1970s (75.4/100,000) and the late 1990s (82.3/100,000). Total cancer mortality rates remained low, however, compared with other American countries (e.g. 153.3/100,000 men and 108.6/100,000 women in 1999 in the United States). Truncated rates were stable (126.5/100,000 in 1970-74 and 125.8/100,000 in 1995-99), although they were much higher than overall rates, reflecting exceedingly high rates for uterine (mostly cervical) cancer mortality in middle-aged women (29.5/100,000 in 1995-99). Conclusions: Total cancer mortality in Mexico has remained comparably low on a worldwide scale, and the upward trends in mortality rates for lung and other tobacco-related neoplasms have tended to level off over the last decade. However, steady rises have been observed for other major cancers, including prostate and breast. Cervical cancer remains a major health problem in women.

129. Tovar-Guzman VJ, Barquera S, Lopez-Antunano FJ. Mortality trends in cancer attributable to tobacco in Mexico. *Revista de Saúde Pública* 2002; 44 (Suppl 1): S20-8.

Objective: To describe the mortality trends of cancer attributable to tobacco smoking, particularly lung cancer, for the 1980-1997 period in Mexico. Methods: Mortality trends were analyzed for each type of cancer associated to tobacco smoking, according to the International Classification of Diseases (ICD). Crude and adjusted mortality rates were estimated for the period between 1980 and 1997, by age, gender, basic death cause, and year of death. The gender ratio and the relative proportion were estimated for cases in the 35-64 age group and for the entire study population. Age population projections by Consejo Nacional de Poblacion (National Population Council), were used as denominators (1970-2010). Results: The gender ratio for mortality rates for lung, esophageal, oral cavity and pharyngeal cancer was 2.10:1.00 (male:female). The gender ratio for laryngeal cancer was striking: 4.21:1.00, probably due to the higher prevalence of male tobacco smokers. The estimated relative proportion, using the total mortality due to malignant cancers between 1980-1997, was 12.31% for lung cancer, 1.71% for larynx cancer, 1.55% for esophageal cancer, and 1.49% for oral cavity/pharyngeal cancer. Previous tobacco smoking was correlated with the mortality rate trends for lung cancer (beta: 0.910, IC 95%: 1.097-1.797, R2 0.827). For the poorest social groups by federal entity, the correlation was inverted (beta: -0.510, IC 95% -0.170, -0.039, R2: 0.260). CONCLUSIONS: In Mexico, increased tobacco smoking, improved cancer diagnosis, and the demographic transition, are probably the main factors determining cancer mortality rates. However, other lifestyle associated variables, such as urbanization, physical activity, carotenoid intake, and other dietary and toxic substances like alcohol, may also influence the morbidity and mortality rates. Although tobacco-related cancer is a fast-growing public health problem having a poor prognosis, tobacco smoking, the main risk factor, could be eliminated by health education and promotion, together with publicity regulation and healthy taxation policies.

Nigeria

130. Adebamowo CA, Ajayi OO. Breast cancer in Nigeria. *West African Journal of Medicine* 2000; 19(3): 179–91.

Breast cancer is now the commonest malignancy affecting women in Nigeria. It is likely to become an important public health issue in the next millennium. Recent years have witnessed an explosion in knowledge about the basic sciences of the disease, including the genetic basis and the pathology. These changes are leading to revisions in the management of the disease with a positive impact on prognosis. In this review, the recent developments in the various aspects of breast cancer are reviewed with reference to how they affect the disease in this environment.

Russia

131. Davydov MI, Aksel' EM. The incidence of malignant tumors and mortality caused by them in Commonwealth of Independent States in 2005. *Vestn Ross Akad Med Nauk* 2007; 11: 45–9.

The world's incidence of cancer is 10.9 million new cases each year. In developed countries cancer is the second cause of death after cardiovascular diseases. In Russia, the number of patients with a newly established diagnosis of a malignant tumor increased by 4.6% in 2000–2005 reaching 469.2 thousands. Standardized indices of cancer incidence in Commonwealth of Independent States (CIS) were the highest in Belarus (312.5 per tens of thousand in men and 217.6 per tens of thousand in women), Russia (270.8 per tens of thousand and 196.8 per tens of thousand), and Kazakhstan (234.0 per tens of thousand and 171.4 per tens of thousand), lower in Armenia (201.3 per tens of thousand and 143.2 per tens of thousand) and Moldova (185 per tens of thousand and 162.2 per tens of thousand), and minimal in Azerbaydzhan (85.6 per tens of thousand and 73.5 per tens of thousand) and Kyrgyzstan (104.8 per tens of thousand and 115.3 per tens of thousand). The number of deaths caused by cancer is 6.7 million per year. In CIS, cancer-related mortality fell in Belarus (by 6.7% and 4.7% among men and women, respectively) and Kazakhstan (by 9.3% and 7.7%), while in Armenia it grew significantly (by 37.5% and 24.7%). In Russia, cancer-related mortality in 2000–2005 decreased by 2.6% in men and 0.8% in women. In Russia, Kazakhstan, and Armenia, the incidence of cancer of prostate grew more intensively than that of other localizations. Mortality caused by colon cancer grew in Russia and Armenia (both genders) and Belarus (women); skin cancer mortality grew in Belarus and Kazakhstan (men); breast cancer mortality grew in Armenia.

132. Hirte L, Nolte E, Bain C et al. Breast cancer mortality in Russia and Ukraine 1963–2002: an age-period-cohort analysis. *International Journal of Epidemiology* 2007; 36(4): 900–6.

Objective: To determine the reasons for the steady increase in breast cancer mortality in Russia and Ukraine. Methods: Age-period-cohort analysis, supplemented by analysis of historical fertility trends. Results: Mortality from breast cancer has risen steadily in both countries over the past 40 years, although faster in Russia than in Ukraine. There are strong birth cohort effects, which are consistent with known changes in fertility. Death

rates were highest among those born in the first half of the 20th century, declining among those born after the 1950s. There has been a decline in mortality among younger women since the mid 1990s, which may reflect improvements in treatment. Conclusion: The increase in breast cancer mortality in Russia and Ukraine can largely be explained by known changes in fertility, while recent changes may reflect changes in treatment. Observed trends suggest that death rates from female breast cancer in the two countries are likely to stabilize or even decline in the future.

Singapore

133. Wong M, Eu KW. Rise of colorectal cancer in Singapore: an epidemiological review. *Journal of Surgery* 2007; 77(6): 446–9.

Over the past three decades, Singapore has seen a dramatic increase in the incidence of colorectal cancer and this is now the most frequent cancer when both genders are combined. Methods: In light of this alarming trend, a review of colorectal cancer in Singapore was conducted, using data from the Singapore Cancer Registry from 1968 to 2002. Our research has shown that among Southeast Asian countries, Singapore has the highest age-standardized incidence rates, 35.1% in men and 29.9% in women, more than twice that of the next country; these rates have been increasing at a startling average annual rate of approximately 2.6 and 2.35%, for men and women, respectively. Results: Between 1998 and 2002, deaths from colorectal cancer constituted 19% of all cancer mortalities in men and 14% in women, accounting for the second highest cause of cancer mortality in both genders. In the same period, more than three quarters (75.6%) of colorectal cancers occurred in the distal colon (including splenic flexure, descending, sigmoid colon and rectum), with the predominant histological subtype being adenocarcinoma (approximately 90%). The age-specific rates for colorectal cancer begin to increase sharply in the 40- to 45-year age group. It remains the most common primary site of cancer in men aged between 35 and 64 years but lies a distant second after breast cancer in women. In individuals aged 65 years and above, colorectal cancer remains prominent in both genders. Conclusion: Despite the dramatic increase in incidence of colorectal cancer in Singapore, there has also been significant progress in survival of colorectal cancer patients with localized disease (limited to large bowel), with 5-year, age-standardized relative survival improving from 36 to 66% in men and 32 to 71% in women; in rectal cancer, improvements from 25 to 66% in men and 23 to 66% in women were also observed. Similar improvements were noted in patients with regional disease (lymph node involvement) but not with distant metastases. This has paralleled the dramatic national development in socioeconomic and health-care services.

134. Du WB, Chia KS, Sankaranarayanan R et al. Population-based survival analysis of colorectal cancer patients in Singapore, 1968-1992. *International Journal of Cancer* 2002; 99(3): 460–5.

Since the 1980s, colorectal cancer incidence in Singapore has ranked second to lung in males and females. We describe a population-based analysis of survival of colorectal cancer patients diagnosed from 1968 to 1992 in Singapore. Data of colorectal cancer

patients diagnosed during 1968-1992 were retrieved from the Singapore Cancer Registry. Patients were passively followed up for death to the end of 1997. The final dataset consisted of 10,114 subjects. Observed and relative survival rates were calculated by stage (localized, regional metastases and distant metastases), age, ethnicity and calendar period for both genders. Over the study period, a significant progress in survival of colorectal cancer patients was observed. For localized cancer of the colon, the 5-year age-standardized relative survival (ASRS) increased from 36% in 1968-1972 to 66% in 1988-1992 for males and from 32 to 71% for females. For localized rectal cancer, the 5-year ASRS improved from 25 to 66% for males and from 23 to 66% in females. Similarly, improvement was observed in colorectal cancer patients with regional metastases, but not in those with distant metastases. Calendar year period and clinical stage of disease were identified as major significant prognostic factors of survival for colorectal cancer. The substantially improved colorectal cancer survival rates reflected the interplay of cancer control activities in various areas, such as health promotion, early diagnosis and treatment. Our study shows a unique changing pattern of survival experience for colorectal patients from a country undergoing rapid economic development.

South Africa

135. Norman R, Cairncross E, Witi J et al. Estimating the burden of disease attributable to urban outdoor air pollution in South Africa in 2000. *South African Medical Journal* 2007; 97(8): 782–90.

Objectives: To quantify the mortality burden attributed to urban outdoor air pollution in South Africa in 2000. Design: The study followed comparative risk assessment (CRA) methodology developed by the World Health Organization (WHO). In most urban areas, annual mean concentrations of particulate matter (PM) with diameters less than 10 microm (PM₁₀) from monitoring network data and PM with diameters less than 2.5 microm (PM_{2.5}) derived using a ratio method were weighted according to population size. PM₁₀ and PM_{2.5} data from air-quality assessment studies in areas not covered by the network were also included. Population-attributable fractions calculated using risk coefficients presented in the WHO study were weighted by the proportion of the total population (33%) in urban environments, and applied to revised estimates of deaths and years of life lost (YLLs) for South Africa in 2000. Subjects: Children under 5 years and adults 30 years and older. Outcome measures: Mortality and YLLs from lung cancer and cardiopulmonary disease in adults (30 years and older), and from acute respiratory infections (ARIs) in children aged 0 - 4 years. Results: Outdoor air pollution in urban areas in South Africa was estimated to cause 3.7% of the national mortality from cardiopulmonary disease and 5.1% of mortality attributable to cancers of the trachea, bronchus and lung in adults aged 30 years and older, and 1.1% of mortality from ARIs in children under 5 years of age. This amounts to 4,637 or 0.9% (95% uncertainty interval 0.3 - 1.5%) of all deaths and about 42,000 YLLs, or 0.4% (95% uncertainty interval 0.1 - 0.7%) of all YLLs in persons in South Africa in 2000. Conclusion: Urban air pollution has under-recognized public health impacts in South Africa. Fossil fuel combustion emissions and traffic-related air pollution remain key targets for public health in South Africa.

136. Joubert J, Norman R, Bradshaw D et al. Estimating the burden of disease attributable to excess body weight in South Africa in 2000. *South African Medical Journal* 2007; 97(8) : 683–90.

Objectives: To quantify the burden of disease attributable to smoking in South Africa for 2000. Design: The absolute difference between observed lung cancer death rate and the level in non-smokers, adjusted for occupational and indoor exposure to lung carcinogens, was used to estimate the proportion of lung cancer deaths attributable to smoking and the smoking impact ratio (SIR). The SIR was substituted for smoking prevalence in the attributable fraction formula for chronic obstructive pulmonary disease (COPD) and cancers to allow for the long lag between exposure and outcome. Assuming a shorter lag between exposure and disease, the current prevalence of smoking was used to estimate the population-attributable fractions (PAF) for the other outcomes. Relative risks (RR) from the American Cancer Society cancer prevention study (CPS-II) were used to calculate PAF. Outcome measures: Deaths and disability-adjusted life years (DALYs) due to lung and other cancers, COPD, cardiovascular conditions, respiratory tuberculosis, and other respiratory and medical conditions. Results: Smoking caused between 41,632 and 46,656 deaths in South Africa, accounting for 8.0 - 9.0% of deaths and 3.7 - 4.3% of DALYs in 2000. Smoking ranked third (after unsafe sex/ sexually transmitted disease and high blood pressure) in terms of mortality among 17 risk factors evaluated. Three times as many males as females died from smoking. Lung cancer had the largest attributable fraction due to smoking. However, cardiovascular diseases accounted for the largest proportion of deaths attributed to smoking. Conclusion: Cigarette smoking accounts for a large burden of preventable disease in South Africa. While the government has taken bold legislative action to discourage tobacco use since 1994, it still remains a major public health priority.

South Korea

137. Jung KW, Yim SH, Kong HJ et al. Cancer Survival in Korea 1993-2002: A Population Based Study. *Journal of Korean Medical Science* 2007; 22(Suppl) :S5–S10.

Population-based survival reflect the average prognosis of unselected patients with a variety of natural histories as well as treatment patterns and are also useful for evaluating effectiveness and efficiency of cancer-directed health services in a given region. Although survival data have been reported based on hospital data, the survival data from population-based registry have been rarely reported in Korea. Based on the Korea National Cancer Incidence Database, we report the results from survival analysis for cancer patients diagnosed during 1993-2002 and followed up until 31 December 2005 at primary cancer sites. The five-year relative survival rates (RSR) were calculated using the Ederer II method. The Kaplan-Meier method was used to estimate median survival and the 95% confidence intervals. In males, the five-year RSR for all cancers was 32.5% during 1993-1997 and was 37.8% during 1998-2002. In females, the five-year RSR for all cancers was 53.7% during 1993-1997 and was 57.0% during 1998-2002. The largest

improvement in survival was shown in prostate cancer in males and breast and stomach cancer in females. The median survival durations were 16.3 months in males and 81.6

138. Lee JH, Yim SH, Won YJ et al.. Population-based Breast Cancer Statistics in Korea during 1993-2002; incidence, mortality, and survival. *Journal of Korean Medical Science* 2007; 22(Suppl): S11–6.

In 2002, breast became the most common cancer site in Korean women. Using national breast cancer incidence data during 1993-2002, crude, age-standardized, and age-specific rates for incidence and mortality were calculated. Survival was examined for cases diagnosed during 1993-2002 and followed up to 2004. Observed survival was calculated using the life table method and relative survival using the Ederer II method. Age-standardized incidence rates in female increased from 14.5 in 1993 to 26.2 per 100,000 in 2002. Age-specific incidences showed peaks in women in their forties. Mortality rates increased from 3.7 in 1993 to 4.6 per 100,000 in 2002 and showed peaks in women in their fifties. Five-year relative survival for female breast cancer diagnosed during 1993-2002 was 82.2%. When we examined the secular trends using cases diagnosed 1993-1999 for complete 5-yr follow-up, the 5-yr relative survival increased from 75.2% in 1993 to 83.5% in 1999. The data from this study will provide valuable information to plan and evaluate actions against breast cancer including national breast cancer screening.

139. Kim SG, Hahm MI, Choi K,S et al. The economic burden of cancer in Korea in 2002. *European Journal of Cancer Care* 2008; 17(2): 136–44.

Cancer is the leading cause of death and one of the most significant healthcare expenses in Korea. The purpose of this study was to estimate the economic burden of cancer on Korean society. We studied the medical, non-medical, morbidity and mortality costs related to cancer treatment, lost productivity and premature death. Healthcare claims for 2002 obtained from the Health Insurance Review Agency were used to estimate medical expenditures; these were linked with the Korean Central Cancer Registry database to identify cancer patients. The number of deaths used to estimate mortality costs was obtained from the Annual Report of Mortality from the National Statistics Office of Korea. Moreover, data from the Korean National Statistics Office and Ministry of Labor were used to calculate life expectancy at the age of death, labor force participation, and average age- and gender-specific earnings. In 2002, the estimated total economic cost of cancer amounted to \$9.4 billion (1.72% of GDP) at a 3% discount rate. Medical care costs amounted to 13.7% of total costs, non-medical costs 6.5%, morbidity costs 14.5%, and mortality costs accounted for 65.3%. Increased prevention, earlier diagnosis, new therapies and effective cancer control policies are needed to reduce the economic burden of cancer in Korea.

140. Yoon SJ, Bae SC, Lee SI et al. Measuring the burden of disease in Korea. *Journal of Korean Medical Science* 2007; 22(3): 518–23.

This paper provides an overview of the Korean Burden of Disease (KBoD) study, which was the first such study to assess the national burden of disease using disability-adjusted

life years (DALYs) in an advanced Asian country. The KBoD study generally followed the approach utilized in the original Global Burden of Disease study (GBD), with the exception of the disease classification and epidemiological data estimation methods used, and the relative weightings of disabilities. The results of the present study reveal that the burden of disease per 100,000 of the Korean population originates primarily from; cancer (1,525 Person Years, PYs), cardiovascular disease (1,492 PYs), digestive disease (1,140 PYs), diabetes mellitus (990 PYs), and certain neuro-psychiatric conditions (883 PYs). These results are largely consistent with those of developed countries, but also represent uniquely Korean characteristics.

141. Yoon SJ, Lee H, Shin Y et al. Estimation of the burden of major cancers in Korea. *Journal of Korean Medical Science* 2002; 17(5): 604–10.

We estimated the burden of diseases in Korea especially caused by major cancers using DALY (disability adjusted life year) measurement. Firstly, the burden of disease due to premature death was estimated by using YLLs (years life lost due to premature death) measurement developed by the global burden of disease study group. Secondly, for the calculation of the YLD (years lived with disability), the following parameters were estimated in the formula; incidence rate, case fatality rate and disability weight of major cancers. Thirdly, we estimated DALY of major cancers by adding YLLs and YLDs. The burden of major cancers for male per 100,000 population was attributed mainly to liver cancer (528.8 person-year), stomach cancer (451.4 person-year), and lung cancer (374.9 person-year). The burden of major cancers for female per 100,000 population was attributed mainly to liver cancer (140.0 person-year), stomach cancer (259.7 person-year), and lung cancer (125.2 person-year). Each of these cancers was responsible for the loss of over 100 person-year per 100,000 population based on our DALY measurement. We found the DALY method employed was appropriate to quantify the burden of disease. Thereby, it would provide a rational bases to plan a national health policy regarding the burden of disease caused by major cancers in Korea.

142. Park JH, Park EC, Park JH, et al. Job loss and re-employment of cancer patients in Korean employees: A nationwide retrospective cohort study. *Journal of Clinical Oncology* 2008; 26(8): 1302–1309.

The aim of this study was to investigate whether a diagnosis of cancer has an impact on the cancer patients' job loss and re-employment and to identify the factors affecting job loss and re-employment during 6 years of follow-up of Korean employees with cancer. Methods: All employees except for the self-employed in Korea who were diagnosed with cancer during the 2001 calendar year (n = 5,396) were identified as the first baseline patients and were followed every 3 months over 6 years to estimate the time taken to job loss. Patients who lost their job within the first year after a diagnosis of cancer (n = 1,398) were identified as the second baseline patients and were followed up over 5 years to estimate the time taken to re-employment using the National Health Insurance claims data. Patient demographic, socioeconomic, and clinical variables were investigated as factors that affected job loss and re-employment. Results: Among the first baseline cancer patients, 47.0% lost their job, and among the second baseline patients, 30.5% were

re-employed over 69 to 72 months of follow-up. Female sex, younger age and older age, company employee, lower income, blood cancer, and brain and CNS, lung, and liver cancer were significant predictors of early job loss or delayed re-employment. Conclusion: The diagnosis of cancer affects cancer patients' employment status differently according to different factors: sex, age, type of job, income, and cancer site. Efforts should be made to support re-employment and reduce unnecessary work cessation and disparity between different demographic and socioeconomic groups of cancer survivors.

Turkey

143. Cakir EE, Karlikaya C. The cost of lung cancer in Turkey. *Tuberk Toraks* 2007; 55(1): 51–8.

The aim of this study was to evaluate the individual and societal burden of lung cancer in Turkey. A total of 103 cases with lung cancer attended our department between January 2002 and February 2003 were included in our study prospectively. The primary outcome measure was the cost of disease until death of the patients or the end of study. All the costs were expressed as United States dollars (USD) and were estimated regarding the effective exchange rate at the time of recording. Descriptive statistics, chi-square, Fisher's exact test, Kaplan-Meier analysis and non-parametric "Bootsraping" tests were performed to evaluate the data. The average survival was 6.8 months. The estimated total direct cost for the entire group was 564.490 USD, and the direct cost per patient was 5.480 +/- 4.088 USD. The total cost of lung cancer in the study group was 1.473.530 USD, with a per-patient cost of 14.306 +/- 17.705 USD. The average direct cost per life year was 18.058 +/- 25.775 USD. Age, gender and histopathology did not affect the cost, whereas direct medical costs were increased with increasing stage. With the low life expectancy and cure rates, lung cancer has been alerting for the cost minimization and disease control measures.

Viet Nam

144. Ngoan LT. Cancer mortality in a Hanoi population, Viet Nam, 1996-2005. *Asian Pacific Journal of Cancer Prevention* 2006; 7(1): 127–30.

Hitherto, cancer mortality data have not been available in Viet Nam, so that the real public health problem with this disease has yet to be addressed and recognized in the country with a population of over 80 million in South East Asia. The aim of the present pilot study was to examine cancer mortality in a commune population of Hanoi city, 1996-2005. Methods: Cancer data was accessed from the database of the population-routine-based death registration performed by medical workers at commune health stations based on the guidelines of the Ministry of Health at Hanoi city. All deaths occurring in the community were registered. This registration process was monthly reviewed for each fatal case regarding the name, age, sex, address, occupation, date-place-cause of death, and information concerning to pre-death medical care during the study period from Jan. 1996 to Dec. 2005. The list of death and residents of the study

population was carefully cross-checked with other information sources to avoid under- or over-registration. The world population structure was used to estimate age-standardized cancer mortality rates per 100,000, (ASR). Results: During 60,770 person-years estimated from Jan. 1996 to Dec. 2005, 320 deaths and their causes were registered. Among them, 100 cancer cases of all sites (66 males and 34 females) were included. Cancer mortality rates were 222 and 109 (Crude), 353 and 115 (ASR), for males and females, respectively. For both genders combined, lung cancer was the most common, 27 cases, followed by liver, 26 cases and stomach, with 19. Proportion of death from cancer was about 31% of all causes. Conclusions: The present findings suggest that in Viet Nam, a developing country, cancer is indeed an important public health problem.

Cancer costs—US and miscellaneous

145. Kessler RC, Greenberg PE, Mickelson KD et al. The effects of chronic medical conditions on work loss and work cutback. *Journal of Occupational and Environmental Medicine* 2001; 43(3): 218–25.

Although work performance has become an important outcome in cost-of-illness studies, little is known about the comparative effects of different commonly occurring chronic conditions on work impairment in general population samples. Such data are presented here from a large-scale nationally representative general population survey. The data are from the MacArthur Foundation Midlife Development in the United States (MIDUS) survey, a nationally representative telephone-mail survey of 3032 respondents in the age range of 25 to 74 years. The 2074 survey respondents in the age range of 25 to 54 years are the focus of the current report. The data collection included a chronic-conditions checklist and questions about how many days out of the past 30 each respondent was either totally unable to work or perform normal activities because of health problems (work-loss days) or had to cut back on these activities because of health problems (work-cutback days). Regression analysis was used to estimate the effects of conditions on work impairments, controlling for sociodemographics. At least one illness-related work-loss or work-cutback day in the past 30 days was reported by 22.4% of respondents, with a monthly average of 6.7 such days among those with any work impairment. This is equivalent to an annualized national estimate of over 2.5 billion work-impairment days in the age range of the sample. Cancer is associated with by far the highest reported prevalence of any impairment (66.2%) and the highest conditional number of impairment days in the past 30 (16.4 days). Other conditions associated with high odds of any impairment include ulcers, major depression, and panic disorder, whereas other conditions associated with a large conditional number of impairment days include heart disease and high blood pressure. Comorbidities involving combinations of arthritis, ulcers, mental disorders, and substance dependence are associated with higher impairments than expected on the basis of an additive model. The effects of conditions do not differ systematically across subsamples defined on the basis of age, sex, education, or employment status. The enormous magnitude of the work impairment associated with chronic conditions and the economic advantages of interventions for ill workers that reduce work impairments should be factored into employer cost-benefit calculations of expanding health insurance coverage. Given the enormous work impairment associated

with cancer and the fact that the vast majority of employed people who are diagnosed with cancer stay in the workforce through at least part of their course of treatment, interventions aimed at reducing the workplace costs of this illness should be a priority.

146. Brown ML, Lipscomb J, Snyder C. The burden of illness of cancer: economic cost and quality of life. *Annual Review of Public Health* 2001; 22: 91–113.

Cancer is a major public health issue and represents a significant burden of disease. In this chapter, we analyze the main measures of burden of disease as relate to cancer. Specifically, we review incidence and mortality, years of life lost from cancer, and cancer prevalence. We also discuss the economic burden of cancer, including cost of illness, phase-specific and long-term costs, and indirect costs. We then examine the impact of cancer on health-related quality of life as measured in global terms (disability-adjusted life years and quality-adjusted life years) and using evaluation-oriented applications of health-related quality of life scales. Throughout, we note the relative strengths and weaknesses of the various approaches to measuring the burden of cancer as well as the methodologic challenges that persist in burden-of-illness research. We conclude with a discussion of the research agenda to improve our understanding of the burden of cancer and of illness more generally

147. Brown ML, Fintor L. The Economic Burden of Cancer. In *Cancer Prevention and Control*, Greenwald P, Kramer BS and Weed DL (eds.). New York: Marcel-Dekker Publisher, 1995.

Review of concepts, definitions and data on the economics burden of cancer. Provides estimates, for 1990, on the national economic cost of cancer by direct medical, morbidity and mortality cost for all cancer. For mortality cost and direct cost, provides cost breakdown by type of medical expenditures, and cancer organ site (e.g. breast cancer, lung cancer, etc.).

148. Brown ML, Lipscomb J, Snyder C. The burden of illness of cancer: economic cost and quality of life. *Annual Review of Public Health* 2001; 22: 91–113.

Cancer is a major public health issue and represents a significant burden of disease. In this chapter, we analyze the main measures of burden of disease as relate to cancer. Specifically, we review incidence and mortality, years of life lost from cancer, and cancer prevalence. We also discuss the economic burden of cancer, including cost of illness, phase-specific and long-term costs, and indirect costs. We then examine the impact of cancer on health-related quality of life as measured in global terms (disability-adjusted life years and quality-adjusted life years) and using evaluation-oriented applications of health-related quality of life scales. Throughout, we note the relative strengths and weaknesses of the various approaches to measuring the burden of cancer as well as the methodologic challenges that persist in burden-of-illness research. We conclude with a discussion of the research agenda to improve our understanding of the burden of cancer and of illness more generally.

149. Bradley CJ, Neumark D, Luo Z et al. Employment and cancer: findings from a longitudinal study of breast and prostate cancer survivors. *Cancer Investigation* 2007; 25(1): 47–54.

We discuss how cancer affected the employment of almost 800 employed patients who participated in a longitudinal study. The greatest reduction in patients' labor supply (defined as employment and weekly hours worked) was observed 6 months following diagnosis. At 12 and 18 months following diagnosis, many patients returned to work. Based on these and other findings related to patients' employment situations, we suggest 4 areas for future research: 1) collection of employment information in cancer studies; 2) research into racial and ethnic minority patients and employment outcomes; 3) interventions to reduce the effects of cancer and its treatment on employment; and 4) investigations into the influence of employment-contingent health insurance on cancer treatment and recovery.

150. Sasser AC, Rousculp MD, Birnbaum HG et al. Economic burden of osteoporosis, breast cancer, and cardiovascular disease among postmenopausal women in an employed population. *Women's Health Issues* 2005; 15(3): 97–108.

Postmenopausal women have a significant risk of developing a number of chronic conditions including osteoporosis (OP), breast cancer (BrCa), and cardiovascular disease (CVD). These diseases can result in significant direct (medical treatment) and indirect (workplace) costs. The objective of this study is to assess these costs among an employed population. Methods: Deidentified medical and disability claims data from seven large employers (n = 585,441) were analyzed from 1998 through 2000 for female employees, age 50-64 years. Medical claim ICD-9CM codes were used to identify patients treated for: OP (n = 2,314), BrCa (n = 555), and CVD (n = 1,710). Each disease cohort was compared to a random sample of 50- to 64-year-old female employees (n = 7,575). Descriptive and multivariate techniques were used to characterize direct and indirect costs attributable to each condition. Results: Average annual direct costs were higher (p < .001) for female employees treated for OP (6,259 dollars), BrCa (13,925 dollars), or CVD (12,055 dollars) when compared with the random sample (2,951 dollars). In addition, average annual indirect costs associated with OP (4,039 dollars), BrCa (8,236 dollars), and CVD (4,990 dollars) were higher (p < .001) than indirect costs for the random sample (2,292 dollars). Even when controlling for each disease-state cohort's demographics and disease-specific comorbidities, patients treated for OP, BrCa, and CVD continued to have significantly greater direct and indirect costs (p < .001) than the random sample. Conclusions: Chronic conditions such as OP, BrCa, and CVD, which occur more frequently in women after menopause, impose a significant financial burden. Greater health care utilization and work-loss prevalence among women treated for these conditions contribute to these additional costs.

151. Chang S, Long SR, Kutikova L et al. Estimating the cost of cancer: results on the basis of claims data analyses for cancer patients diagnosed with seven types of cancer during 1999 to 2000. *Journal of Clinical Oncology* 2004; 22(17): 3524–30.

Cancer accounts for 60.9 billion dollars in direct medical costs and 15.5 billion dollars for indirect morbidity costs. These estimates are derived primarily from national surveys or Federal databases. We derive estimates of the costs of cancer using administrative databases, which include claims and employment-related information on individuals insured by private or Medicare supplemental health plans. Methods: A retrospective matched-cohort control analysis was performed using 1998 to 2000 databases with information on insurance claims, benefits, and health productivity for 3 million privately insured employees, their dependents, and early retirees. Study patients had new diagnoses of one of seven types of cancer (n = 12,709). Controls without cancer were matched at a 3:1 ratio by demographics. A variable follow-up length was used (maximum of 2 years). Direct costs included health care costs for patients and deductibles and copayments for caregivers. Indirect costs of work absence and short-term disability (STD) were calculated for a subgroup of cancer patients and caregivers. Results: Mean monthly health care costs ranged from 2,187 dollars for prostate cancer to 7,616 dollars for pancreatic cancer, most often driven by hospitalization. Costs for controls were 329 dollars per month. Indirect morbidity costs to employees with cancer averaged 945 dollars, a result of a mean monthly loss of 2.0 workdays and 5.0 STD days. Conclusion: The economic burden of cancer is substantial. It is feasible to derive tumor-specific estimates of direct and indirect costs for large numbers of cancer patients using administrative databases. Policy makers charged with providing annual cost-of-cancer estimates should incorporate data obtained from a broad range of sources.

152. Chirikos TN, Russell-Jacobs A, Cantor AB. Indirect economic effects of long-term breast cancer survival. *Cancer Practice* 2002; 10(5): 248–55.

The indirect morbidity/disability costs of breast cancer may be rising as a consequence of the growth in the population of long-term survivors. This study was conducted to test whether women who have survived breast cancer for at least 5 years experience long-lasting or continuing economic consequences that are attributable to their disease. Method: A group of 105 women who initially had been treated for breast cancer approximately 5 years before were interviewed to obtain data on economic, demographic, and health changes in the period since diagnosis. An age-matched and work-matched group of 105 women without cancer also was interviewed to obtain the same data for the same time period. Key changes in the economic position of subjects and their families were measured, including changes in work effort, pay rates, and annual earnings of working women and changes in household earnings, income, and assets of all women. Results: These preliminary empirical findings suggest that breast cancer exacts an economic toll from long-term survivors. In particular, survivors who were working at the time of their diagnosis experienced significantly larger reductions in annual market earnings over the 5-year study period than did working control subjects. These losses appear to arise mostly from reduced work effort, not changes in pay rates. Also, changes in total household earnings were lower for survivors, suggesting the presence of family adjustments to the disease. However, no significant differences were detected between the groups in changes in total income or assets over the study period. Clinical implications: Clinicians and policy makers must seek ways to minimize the indirect economic losses that are attributable to breast cancer.

153. Gordon L, Scuffham P, Hayes S et al. Exploring the economic impact of breast cancers during the 18 months following diagnosis. *Psychooncology* 2007; 16(12): 1130–9.

The economic impact on individuals with breast cancer is not well understood. We sought to identify and describe the direct and indirect economic losses to breast cancer survivors in Australia. A longitudinal, population-based study of 287 women was used to explore economic outcomes (costs and lost income) for women with breast cancer 0-18 months post-diagnosis. Survey methods collected data on out-of-pocket costs, care-giving support, paid and unpaid work reductions, and perceptions from participants on these financial impacts. Bootstrapping was used to estimate 95% confidence intervals around means. Data were sub-grouped by cost type, age category and disease severity. Lost income, health service expenditures and lost unpaid work were the greatest sources of economic burden. Women with positive lymph nodes reported significantly higher costs than those with negative lymph nodes (US\$6674 versus US\$3533, $p < 0.001$), and younger women ($< \text{or} = 50$ years) with positive lymph nodes experienced costs 80% greater than older women (US\$8880 versus US\$4937, $p < 0.001$). Economic costs related to breast cancer may continue to affect women 18 months post-diagnosis. Economic research adds an important dimension for understanding the impact of breast cancer, and findings may be used to help improve supportive care services for women and families confronted by this disease.

154. Bradley CJ, Neumark D, Bednarek HL et al. Short-term effects of breast cancer on labor market attachment: results from a longitudinal study. *Journal of Health Economics* 2005; 24(1): 137–60.

In this longitudinal study, we examine the consequences of breast cancer for women's labor market attachment for the 6-month period following diagnosis. Women with breast cancer, with the exception of those having in situ cancer, were less likely to work 6 months following diagnosis relative to a control sample of women drawn from the Current Population Survey. Breast cancer's non-employment effect appears to be twice as large for African-American women. Women with breast cancer who remained working worked fewer hours than women in the control group.

155. Bradley CJ, Neumark D, Oberst K et al. Combining registry, primary, and secondary data sources to identify the impact of cancer on labor market outcomes. *Medical Decision Making* 2005; 25(5): 534–47.

Some cancers are rapidly becoming chronic conditions that are more and more often diagnosed in working-age individuals. The authors developed a research agenda to study the labor market outcomes attributable to detection and treatment for cancer, and research design and data collection strategies to improve upon other research on these questions. In this article, they describe their approach to combining secondary data sources, primary data collection, and cancer registry data to evaluate the impact cancer has on labor market outcomes such as employment, hours worked, wages, and health insurance. They then critically assess how well their study design and data collection strategy accomplished its

objectives. The intention is to offer guidance on how researchers, who are interested in the economic consequences of cancer, as well as of other chronic conditions, might develop and execute studies that examine labor market outcomes. As more attention is placed on the economic aspects of disease, the methods used to estimate productivity loss and other economic outcomes attributable to these conditions require careful scrutiny so that reliable findings can be used to shape health care decisions and policy.

156. Bradley CJ, Bednarek HL, Neumark D. Breast cancer survival, work, and earnings. *Journal of Health Economics* 2002; 21(5): 757–79.

Relying on data from the Health and Retirement Study (HRS) linked to longitudinal social security earnings data, we examine differences between breast cancer survivors and a non-cancer control group in employment, hours worked, wages, and earnings. Overall, breast cancer has a negative impact on employment. However, among survivors who work, hours of work, wages, and earnings are higher compared to women in the control group. We explore possible biases underlying these estimates, focusing on selection, but cannot rule out a causal interpretation. Our research points to heterogeneous labor market responses to breast cancer, and shows that breast cancer does not appear to be debilitating for women who remain in the work force.

157. Lidgren M, Wilking N, Jonsson B. Cost of Breast Cancer in Sweden in 2002. *European Journal of Health Economics* 2007; 8(1): 5–15.

Breast cancer is the most common cancer among Swedish women and an important cause of illness and death. The aim of this study was to estimate the total cost of breast cancer in Sweden in 2002, using a top-down prevalence-based cost-of-illness approach. The total cost of breast cancer in Sweden in 2002 was estimated at 3.0 billion SEK (1 euro = 9.4 SEK, 1 \$309 million*). The direct costs were estimated at 895 million SEK and constituted 30% of the total cost. Indirect costs were estimated at 2.1 billion SEK (\$216 million) and constituted 70% of the total cost. The main cost driver was production losses caused by premature mortality, amounting to 52% of the indirect costs. The reason that indirect costs were the dominant cost is because most newly detected breast cancers occur in patients aged below 65, thus causing significant production losses due to sick leave, early retirement, and premature mortality.

* SEK=.1033US\$

Cardiovascular Disease

Global/Regional

158. Leeder S, Raymond S and Greenberg H. *A race against time. The challenge of cardiovascular diseases in developing economies*. Earth Institute, Columbia University, 2004.

This report examines the social and economic impact of cardiovascular disease (CVD) in one low-income and four middle-income countries, now and for the next forty years. It also reviews strategies for the prevention of CVD in terms of their costs and benefits, where such data exist. CVD is a major cause of morbidity and mortality in the world today and will become the leading cause of death and disability worldwide by 2020. (1) The diseases constituting its range of fatal expression (end organ CVD) include heart attack, myocardial infarction, acute coronary syndrome, congestive heart failure, strokes, kidney disease, and peripheral vascular disease.

159. Bertrand E. *Cardiovascular Disease in Developing Countries*. New York, NY: McGraw-Hill, 1999.
160. Kearney M, Whelton K, Reynolds P. Global burden of hypertension: analysis of worldwide data. *The Lancet* 2005; 365(9455): 217– 223.

Reliable information about the prevalence of hypertension in different world regions is essential to the development of national and international health policies for prevention and control of this condition. We aimed to pool data from different regions of the world to estimate the overall prevalence and absolute burden of hypertension in 2000, and to estimate the global burden in 2025. Methods: We searched the published literature from Jan 1, 1980, to Dec 31, 2002, using MEDLINE, supplemented by a manual search of bibliographies of retrieved articles. We included studies that reported sex-specific and age-specific prevalence of hypertension in representative population samples. All data were obtained independently by two investigators with a standardized protocol and data-collection form. Results: Overall, 26.4% (95% CI 26.0-26.8%) of the adult population in 2000 had hypertension (26.6% of men [26.0-27.2%] and 26.1% of women [25.5-26.6%]), and 29.2% (28.8-29.7%) were projected to have this condition by 2025 (29.0% of men [28.6-29.4%] and 29.5% of women [29.1-29.9%]). The estimated total number of adults with hypertension in 2000 was 972 million (957-987 million); 333 million (329-336 million) in economically developed countries and 639 million (625-654 million) in economically developing countries. The number of adults with hypertension in 2025 was predicted to increase by about 60% to a total of 1.56 billion (1.54-1.58 billion). Interpretation: Hypertension is an important public-health challenge worldwide. Prevention, detection, treatment, and control of this condition should receive high priority.

161. Yusuf S, Reddy S, Ounpuu S, Anand S. Global Burden of Cardiovascular Diseases: Part I: General considerations, the epidemiologic transition, risk factors, and impact

of urbanization. *Circulation* 2001; 104: 2746–2753.

162. Yusuf S, Reddy S, Ôunpuu S. Global Burden of Cardiovascular Diseases: Part II: Variations in Cardiovascular Disease by Specific Ethnic Groups and Geographic Regions and Prevention Strategies. *Circulation* 2001; 104: 2855–2864.

This two-part article provides an overview of the global burden of atherothrombotic cardiovascular disease. Part I initially discusses the epidemiological transition which has resulted in a decrease in deaths in childhood due to infections, with a concomitant increase in cardiovascular and other chronic diseases; and then provides estimates of the burden of cardiovascular (CV) diseases with specific focus on the developing countries. Next, we summarize key information on risk factors for cardiovascular disease (CVD) and indicate that their importance may have been underestimated. Then, we describe overarching factors influencing variations in CVD by ethnicity and region and the influence of urbanization. Part II of this article describes the burden of CV disease by specific region or ethnic group, the risk factors of importance, and possible strategies for prevention.

163. Lawes CM, Vander Hoorn S, Rodgers A. Global burden of blood-pressure-related disease, 2001. *The Lancet* 2008; 371(9623): 1513–8.

Few studies have assessed the extent and distribution of the blood-pressure burden worldwide. The aim of this study was to quantify the global burden of disease related to high blood pressure. Methods: Worldwide burden of disease attributable to high blood pressure ($>$ or $=$ 115 mm Hg systolic) was estimated for groups according to age ($>$ or $=$ 30 years), sex, and World Bank region in the year 2001. Population impact fractions were calculated with data for mean systolic blood pressure, burden of deaths and disability-adjusted life years (DALYs), and relative risk corrected for regression dilution bias. Findings: Worldwide, 7.6 million premature deaths (about 13.5% of the global total) and 92 million DALYs (6.0% of the global total) were attributed to high blood pressure. About 54% of stroke and 47% of ischaemic heart disease worldwide were attributable to high blood pressure. About half this burden was in people with hypertension; the remainder was in those with lesser degrees of high blood pressure. Overall, about 80% of the attributable burden occurred in low-income and middle-income economies, and over half occurred in people aged 45-69 years. Interpretation: Most of the disease burden caused by high blood pressure is borne by low-income and middle-income countries, by people in middle age, and by people with prehypertension. Prevention and treatment strategies restricted to individuals with hypertension will miss much blood-pressure-related disease.

164. Lim SS, Gaziano TA, Gakidou E et al. Prevention of cardiovascular disease in high-risk individuals in low-income and middle-income countries: health effects and costs. *The Lancet* 2007; 370(9604): 2054–62.

In 2005, a global goal of reducing chronic disease death rates by an additional 2% per year was established. Scaling up coverage of evidence-based interventions to prevent

cardiovascular disease in high-risk individuals in low-income and middle-income countries could play a major part in reaching this goal. We aimed to estimate the number of deaths that could be averted and the financial cost of scaling up, above current coverage levels, a multidrug regimen for prevention of cardiovascular disease (a statin, aspirin, and two blood-pressure-lowering medicines) in 23 such countries. Identification of individuals was limited to those already accessing health services, and treatment eligibility was based on the presence of existing cardiovascular disease or absolute risk of cardiovascular disease by use of easily measurable risk factors. Over a 10-year period, scaling up this multidrug regimen could avert 17.9 million deaths from cardiovascular disease (95% uncertainty interval 7.4 million-25.7 million). 56% of deaths averted would be in those younger than 70 years, with more deaths averted in women than in men owing to larger absolute numbers of women at older ages. The 10-year financial cost would be US\$47 billion (\$33 billion-\$61 billion) or an average yearly cost per head of \$1.08 (\$0.75-1.40), ranging from \$0.43 to \$0.90 across low-income countries and from \$0.54 to \$2.93 across middle-income countries. This package could effectively meet three-quarters of the proposed global goal with a moderate increase in health expenditure.

165. Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. *Circulation* 1998; 97: 596–601.

As the twentieth century draws to a close, it is clear that cardiovascular disease (CVD) has become a ubiquitous cause of morbidity and a leading contributor to mortality in most countries. The rise and recent decline of the CVD epidemic in the developed countries have been well documented. The identification of major risk factors through population-based studies and effective control strategies combining community education and targeted management of high risk individuals have contributed to the fall in CVD mortality rates (inclusive of coronary and stroke deaths) that has been observed in almost all industrialized countries. It has been estimated that during the period 1965 to 1990, CVD related mortality fell by ~50% in Australia, Canada, France, and the United States and by 60% in Japan. Other parts of Western Europe reported more modest declines (20% to 25%). The decline in stroke mortality has been more marked compared with the decline in coronary mortality. In the United States, the decline in stroke mortality commenced nearly two decades earlier than the decline in coronary mortality and maintained a sharper rate of decline. During the period 1979 to 1989, the age-adjusted mortality from stroke declined, in that country, by about one third, whereas the corresponding decline in coronary mortality was 22%. In Japan, where stroke mortality outweighs coronary mortality, the impressive overall decline in CVD mortality is principally contributed by the former. The discordant trend of rising CVD mortality rates in Eastern Europe, however, is in sharp contrast to the decline in Western Europe.

166. Thomas A. Gaziano. Reducing The Growing Burden Of Cardiovascular Disease in the Developing World. *Health Affairs* 2007; 26(1): 13–24.

Cardiovascular disease (CVD) has become the number-one cause of death in the developing world. This epidemic has the potential to place a large social and economic burden on developing countries, where CVD tends to strike those in their prime working

years. Since resources for managing CVD are limited, it is important that interventions be guided by cost-effectiveness results for low- and middle-income countries. Despite the burden, cost-effective strategies exist at the population and individual levels for reducing CVD. Integral to all personal intervention strategies is an adequate assessment of the underlying risk of disease.

167. Levensoon JW, Skerrett PJ, Gaziano JM. Reducing the global burden of cardiovascular disease: the role of risk factors. *Preventive Cardiology* 2002; 5:188–199.

During the last century, cardiovascular disease (CVD) has burgeoned from a relatively minor disease worldwide to a leading cause of morbidity and mortality. By 2020 it is projected that CVD will surpass infectious disease as the world's leading cause of death and disability. Some of this increase in the relative importance of CVD is due to improved public health measures and medical care leading to longer life spans and reduced mortality from other causes. However, a substantial portion of the increasing global impact of CVD is attributable to economic, social, and cultural changes that have led to increases in risk factors for CVD. These changes are most pronounced in the countries comprising the developing world. Because the majority of the world's population lives in the developing world, the increasing rate of CVD in these countries is the driving force behind the continuing dramatic worldwide increase in CVD. In order to blunt the impact of the global explosion in CVD, it will be crucial to attempt to understand and reduce the global increase in CVD risk factors. In this review, the authors describe the changes responsible for the global epidemic of CVD, with particular attention to the contributions of established risk factors and their impact on the growth of CVD among the world's various economic sectors. The authors outline the major challenges facing countries in different economic sectors, and discuss ways to address these challenges with the goal of reducing the global burden of CVD.

168. INCLIN Multicentre Collaborative Group. Risk factors for cardiovascular disease in the developing world. A multicentre collaborative study in the International Clinical Epidemiology Network. *Journal of Clinical Epidemiology* 1992; 45(8):841–7.

Twelve centers in 7 countries in the Developing World (China, Thailand, the Philippines, Indonesia, Chile, Colombia and Brazil) connected with the International Clinical Epidemiology Network (INCLIN) each measured cardiovascular disease (CVD) risk factors in random samples of approx. 200 men aged between 35 and 65 years. Samples of men aimed to be representative of the population from which they were drawn, but the population in each centre was not designed to be representative of the whole country. Cigarette smoking rates varied from 16 to 78% and mean cholesterol levels varied from 3.8 to 6.4 mmol/l. In Bogota, Colombia, 46% of the men had a cholesterol level greater than 6.5 mmol/l and in another 5 communities 19% or more of the population had these levels. A body mass index (BMI) of greater than 25 was seen in more than 50% of 4 communities and a blood pressure greater than or equal to 160 mmHg systolic and/or 95 mmHg diastolic was found in more than 20% of 6 countries. BMI was strongly correlated with blood cholesterol and blood pressure levels in almost all population groups. It would

appear that many communities in the Developing World have high levels of risk factors for CVD and that steps could well start to be taken now to prevent the emergence of CVD epidemics in the future.

169. Palmira P, Carlos M, Alberto B et al. Cardiovascular diseases in Latin America and the Caribbean: The present situation. *Prevention and Control* 2006; 2(3): 149–157.

In Latin America and the Caribbean, cardiovascular diseases (CVD) are already the leading cause of death and disability. Predictions for the next two decades include a near tripling of ischemic heart disease and stroke mortality in Latin American countries (LAC). The present review has compiled information from the Pan American Health Organization and taking into consideration relevant information on risk factors and has gleaned from recognized studies, published in peer reviewed journals. In general, epidemiological data are scarce and have been collected without standardized methodologies, especially on cardiovascular risk factors. The largest and most populated LAC have more complete mortality data and epidemiological studies have been performed by scientific societies and by health authorities. An analysis of mortality indicates that the recent declines in CVD seen in developed countries are not as favorable in LAC, nonetheless, there is considerable variability between countries and by age group. Some of the countries of the region are still in the epidemiological transition where both chronic and infectious diseases have a high prevalence. As the countries of the Region continue their rapid economic and demographic transition, CVD continue to grow in importance. Several cardiovascular risk factors have a great health impact in the region. Tobacco, hypertension, diabetes, obesity and physical inactivity rank among the five most important causes of ill health and premature death in the Americas. The resources available to implement prevention and control programs, in most countries, are still very limited. Reversing current trends will require a wide range of strategies, some beyond the traditional realm of public health. Sustainable programs targeting both individuals at high risk and entire communities are needed in combination with effective policies to support the adoption of healthy lifestyles.

170. Nicholls ES, Peruga A, Restrepo HE. Cardiovascular disease mortality in the Americas. *World Health Statistics Quarterly* 1993; 46(2):134–150.

Despite subregional differences, mortality profiles have undergone major changes in most countries of the Americas. While the proportion of deaths caused by noncommunicable diseases, particularly cardiovascular diseases, has increased, overall age-adjusted mortality rates attributable to all cardiovascular disease are declining in 13 of the 15 countries selected for the present study. About half the countries showed decreasing mortality rates for ischaemic heart disease; the other half had increasing rates. The mortality rates for cerebrovascular disease and hypertensive disease declined in all but four countries. The ischaemic heart disease/cerebrovascular disease mortality ratio increased as a consequence of a greater decline in deaths due to cerebrovascular disease, except in two countries that exhibited a greater decline for ischaemic heart disease. With few exceptions the male-to-female mortality ratios increased for all cardiovascular disease, ischaemic heart disease and cerebrovascular disease, reflecting a greater decline

in female mortality. In general there was a decline in all cardiovascular disease mortality for almost every age group in the North American, Southern Cone, English-speaking Caribbean, and Andean subregions, while there were increases in the Central American and Latin Caribbean subregions. The magnitude of the changes was related to the initial level of mortality and the date of onset of the decline. Change began earlier and the declines were largest in the countries with the highest initial mortality levels, whereas in the countries that initially had comparatively low values the mortality rates are still increasing. Insufficient information is available to permit elucidation of the determinants of the changes reported. There has been speculation about the possible role of factors such as demographic and sociocultural changes, changes in lifestyle and subsequently in the prevalence of risk factors for cardiovascular disease, and the increased utilization of advanced diagnostic and therapeutic technologies.

171. Schargrotsky H, Hernández-Hernández R, Champagne BM et al. CARMELA: assessment of cardiovascular risk in seven Latin American cities. *American Journal of Medicine* 2008; 121(1): 58–65.

This cross-sectional, population-based observational study using stratified multistage sampling assessed the prevalence of cardiovascular risk factors and carotid plaques and measured carotid intima-media thickness in individuals living in major cities in 7 Latin American countries. Methods: The study comprised individuals (n=11,550) aged 25 to 64 years, living in Barquisimeto, Bogota, Buenos Aires, Lima, Mexico City, Quito, and Santiago. Data on anthropometric parameters, blood pressure, fasting glucose, total and high-density lipoprotein cholesterol, triglycerides, carotid intima-media thickness, carotid plaque, and smoking status were collected through household interviews and clinical, biochemical, and sonographic measurements. Results: The overall prevalence rates (ranges across cities) were as follows: hypertension (> or = 140/90 mm Hg or pharmacologic treatment), 18% (9%-29%); hypercholesterolemia (total cholesterol > or = 240 mg/dL), 14% (6%-20%); diabetes (glycemia > or = 126 mg/dL or self-reported diabetes), 7% (4%-9%); metabolic syndrome, 20% (14%-27%); obesity (body mass index > or = 30 kg/m²), 23% (18%-27%); smoking, 30% (22%-45%); and plaque, 8% (5%-14%). The mean intima-media thickness was 0.65 mm (0.60-0.74 mm). Conclusion: The prevalence of hypertension mirrored the world average in 3 cities but was lower in the rest. Hypercholesterolemia was highly prevalent even in countries of different socioeconomic levels. The prevalence of diabetes was similar to that in the developed countries. Tobacco use in women living in Santiago and Buenos Aires was among the world's highest. Intima-media thickness and carotid plaque prevalences varied widely.

172. Lanús F, Avezum A, Bautista LE et al. Risk factors for acute myocardial infarction in Latin America: the INTERHEART Latin American study. *Circulation* 2007; 115(9): 1067–74.

Current knowledge of the impact of cardiovascular risk factors in Latin America is limited. Methods and results: As part of the INTERHEART study, 1237 cases of first acute myocardial infarction and 1888 age-, sex-, and center-matched controls were enrolled from Argentina, Brazil, Colombia, Chile, Guatemala, and Mexico. History of

smoking, hypertension, diabetes mellitus, diet, physical activity, alcohol consumption, psychosocial factors, anthropometry, and blood pressure were recorded. Nonfasting blood samples were analyzed for apolipoproteins A-1 and B-100. Logistic regression was used to estimate multivariate adjusted odds ratios (ORs) and their 95% confidence intervals (CIs). Persistent psychosocial stress (OR, 2.81; 95% CI, 2.07 to 3.82), history of hypertension (OR, 2.81; 95% CI, 2.39 to 3.31), diabetes mellitus (OR, 2.59; 95% CI, 2.09 to 3.22), current smoking (OR, 2.31; 95% CI, 1.97 to 2.71), increased waist-to-hip ratio (OR for first versus third tertile, 2.49; 95% CI, 1.97 to 3.14), and increased ratio of apolipoprotein B to A-1 (OR for first versus third tertile, 2.31; 95% CI, 1.83 to 2.94) were associated with higher risk of acute myocardial infarction. Daily consumption of fruits or vegetables (OR, 0.63; 95% CI, 0.51 to 0.78) and regular exercise (OR, 0.67; 95% CI, 0.55 to 0.82) reduced the risk of acute myocardial infarction. Abdominal obesity, abnormal lipids, and smoking were associated with high population-attributable risks of 48.5%, 40.8%, and 38.4%, respectively. Collectively, these risk factors accounted for 88% of the population-attributable risk. Conclusions: Interventions aimed at decreasing behavioral risk factors, lowering blood pressure, and modifying lipids could have a large impact on the risk of acute myocardial infarction among Latin Americans.

173. Martiniuk A, Lee C, Lawes CM et al. Hypertension: its prevalence and population-attributable fraction for mortality from cardiovascular disease in the Asia-Pacific region. *Journal of Hypertension* 2007; 25: 73–79.

About half of the world's burden of cardiovascular disease is carried by countries in the Asia-Pacific region. This study aimed to quantify the contribution of hypertension to cardiovascular diseases (CVD) at the country level, by calculating the sex-specific, population-attributable fractions (PAFs) for fatal ischaemic heart disease (IHD) and stroke (hemorrhagic and ischaemic) for the World Health Organization Western Pacific and South-east Asian regions. Methods: The most recent sex-specific prevalence data on hypertension were sought. Age-adjusted hazard ratio (HR) estimates for fatal IHD and stroke associated with hypertension were obtained using Cox analyses of individual participant cohort data from 600,000 adult participants in the Asia-Pacific Cohort Studies Collaboration. HR estimates and prevalence were then used to calculate sex-specific PAFs for fatal IHD and stroke, by country. Results: In 15 countries with available data, the prevalence of hypertension ranged from 5-47% in men and from 7-38% in women. Overall, the fraction of IHD attributable to hypertension ranged from 4-28% in men and from 8-39% in women. Corresponding ranges for hemorrhagic stroke were 18-66% and 15-49%, and for ischaemic stroke were 8-44% and 12-45%. Conclusions: In the Asia-Pacific region, up to 66% of some subtypes of CVD can be attributed to hypertension, underscoring the immense impact that blood pressure-lowering strategies could have in this populous region.

174. Asia Pacific Cohort Studies Collaboration. The burden of overweight and obesity in the Asia-Pacific region. *Obesity Review* 2007; 8(3): 191–6.

The rise in the prevalence of overweight and obesity (body mass index ≥ 25 kg m⁻²) is, in part, a negative consequence of the increasing economic developments of many

lower- and middle-income countries in the Asia-Pacific region. To date, there has been no systematic quantification of the scale of the problem in countries of this region. From the most recent nationally representative estimates for the prevalence of overweight and obesity in 14 countries of the region, it is apparent that overweight and obesity is endemic in much of the region, prevalence ranging from less than 5% in India to 60% in Australia. Moreover, although the prevalence in China is a third of that in Australia, the increase in prevalence in China over the last 20 years was 400% compared with 20% in Australia. In addition, across various countries in the region, the population attributable fractions because of overweight and obesity ranged from 0.8% to 9.2% for coronary heart disease mortality, 0.2% to 2.9% for haemorrhagic stroke mortality, and 0.9% to 10.2% for ischaemic stroke mortality. These results indicate that consequences of overweight and obesity for health and the economy of many of these countries are likely to increase in coming years.

175. Gaziano TA. Economic burden and the cost-effectiveness of treatment of cardiovascular diseases in Africa. *Heart* 2008; 94(2): 140–4.

Cardiovascular disease is the leading cause of death in those over the age of 45 in Africa. The economic toll from cardiovascular diseases is equally devastating, leading to billions of dollars lost due to healthcare costs and reduced productivity from the disabling and fatal outcomes related to diabetes, hypertension, stroke, valvular heart disease, and heart failure. Much of it is preventable. With reasonable screening programs and judicious use of scarce resources much of the suffering can be alleviated. This article reviews the economic burden attributable to cardiovascular disease in Africa and many of the potential cost-effective solutions to the large burden. It further outlines many of the areas where we know less and must focus our future research in trying to outline cost-effective solutions.

176. Reddy KS. *Research for Prevention and Control of High Blood Pressure and Associated Cardiovascular Risk Factors in the Developing Countries*. Summary report of an IC Health Workshop, October 9-12, 2001, Geneva.
177. AP Kengne, A Patel, F Barzi et al. Systolic blood pressure, diabetes and the risk of cardiovascular diseases in the Asia Pacific region. *Journal of Hypertension*. In press.

Algeria

178. Temmar M, Labat C, Benkhedda S et al. Prevalence and determinants of hypertension in the Algerian Sahara. *Journal of Hypertension* 2007; 25(11): 2218–26.

Background In-Salah is a city-oasis located in the middle of the Algerian Sahara, a desert area whose drinking water has a high sodium content. No cardiovascular epidemiological studies have ever been conducted in this region. Methods A randomized sample of 635 men and 711 women, aged 40-99 years, was studied. Blood pressure measurements, combined with a clinical questionnaire that included educational and socio-economic data, and standard blood samples for the detection of dyslipidemia and diabetes mellitus, were collected. Results The mean age was 55 ± 12 years. The prevalence of hypertension was

44% and was highly influenced by age, sex, skin color, educational status, obesity and metabolic parameters. The higher prevalence of hypertension among black individuals was independent of socio-economic and educational levels, and of metabolic parameters. The presence of antihypertensive treatment was three times more frequent in women than in men, and there was no difference according to skin color. Among treated subjects, 25% were well controlled, and this percentage was similar among both black and white individuals. Conclusion Epidemiological studies in such an emergent population indicate that hypertension is a major public health problem. The high sodium content in drinking water in this region could play a major role in the development of hypertension.

Argentina

179. Hauger-Klevene JH, Balossi EC. Coronary heart disease mortality and coronary risk factors in Argentina. *Cardiology* 1987;74(2):133–40.

A marked increase in the coronary heart disease (CHD) mortality of working-age (35-64 years) men and women occurred in Argentina in the 1960s and 1970s. CHD is the leading cause of death in men. In 1978, Argentine men had also one of the highest CHD mortality rates (603.9/100,000) in international mortality statistics and Argentine women (155.2/100,000) were also at the top of these statistics. Stroke mortality has also increased in the younger age-group of men and women over the last decade. The high CHD and stroke mortality rates are compatible with a high prevalence of cardiovascular risk factors. Several surveys have demonstrated that mean serum total cholesterol levels are high, the prevalence of smokers is increasing and the proportion of adequately treated hypertensive patients is low. These results suggest that measures should be introduced to change the Argentine way of life to try to initiate a decline in cardiovascular mortality.

Brazil

180. Reinert Azambuja MI, Foppa M. Economic burden of severe cardiovascular diseases in Brazil: An estimate based on secondary data. *Arquivos Brasileiros de Cardiologia* 2008; 91(3): 148.

In recent years, several authors and institutions involved in health promotion and disease prevention have recommended less developed nations to be more prepared to deal with chronic diseases, which are expected to significantly increase their burden in the next decades. The present study was conducted to estimate the economic burden of cardiovascular diseases based on Brazilian data. With the purpose of obtaining a (conservative) preliminary estimate of cardiovascular disease economic burden in the country, a group of severe CVD cases was designed. The present study aims at estimating the costs of severe CVD cases in Brazil. Study design: A stepwise approach was developed to estimate socioeconomic impact. Cases of severe CVD were estimated based on hospitalized cases lethality and total CVD mortality rates. National data bases and sample studies were used to estimate costs of hospitalization, outpatient care, and social security benefits. Loss of income was estimated from the Burden of Disease in Brazil data. Results: Approximately two million cases of severe CVD were reported in 2004 in

Brazil, which accounts for 5.2% of the population over age 35 years. The resulting annual cost was at least US\$10.5 billion (36.4% for health care, 8.4% for social security and employers' reimbursements, and 55.2% due to loss in productivity). That corresponded to US\$170.60 per capita (considering population age 35 and older) and US\$3208 per patient. Direct costs with health care from severe CVD cases accounted for 8% of total national expenditure on health and 0.52% of 2004 GNP (US\$602 billion). That corresponded to a yearly average direct cost of US\$62 per capita (US\$30 from public resources) and of US\$1199 per case. Comments: Even after choosing conservative strategies to estimate costs - which included focusing this analysis on severe cases only - this study showed that total annual costs per severe CVD case are significant, even at still low rates of severe disease. The aging of the Brazilian population must be expected to significantly increase the burden of CVD and related disabilities and deaths in the next decades. Through the estimates presented, the authors of the study do expect to have provided more intelligible arguments for political decisions encompassing CVD prevention not only by the health sector but by the society as a whole. According to the authors, the translation of the epidemiologic data into economic information is an interesting exercise because it helps to cross-check validity data across both fields. In addition, this type of economical information might be one of the most powerful arguments to convince governments from developing countries to take immediate action against CVD and other chronic non-communicable diseases.

181. Ribeiro RA, Mello R, Melchior R et al. Annual cost of ischemic heart disease in Brazil. Public and private perspective. *Arquivos Brasileiros de Cardiologia* 2005; 85(1): 3–8.

Objective: To estimate the annual cost of coronary artery disease (CAD) management in Public Health Care System (SUS) and HMOs values in Brazil. Methods: Cohort study, including ambulatory patients with proven CAD. Clinic visits, exams, procedures, hospitalizations and medications were considered to estimate direct costs. Values of appointments and exams were obtained from the SUS and the Medical Procedure List (LPM 1999) reimbursement tables. Costs of cardiovascular events were obtained from admissions in public and private hospitals with similar diagnoses-related group classifications in 2002. The price of medications used was the lowest found in the market. Results: The 147 patients (65 +/- 12 years old, 63% men, 69% hypertensive, 35% diabetic and 59% with previous AMI) had an average follow-up of 24 +/- 8 months. The average estimated annual cost per patient was R\$ 2,733.00, for the public sector, and R\$ 6,788.00, for private and fee-for-service plans. Expenses with medications (R\$ 1,154.00) represented 80% and 55% of outpatient costs, and 41% and 17% of total expenses, in public and non-public sectors, respectively. The occurrence of cardiovascular event had a great impact (R\$ 4,626.00 vs. R\$ 1,312.00, in SUS, and R\$ 13,453.00 vs. R\$ 1,789.00, for HMOs, $p < 0.01$) on the results. Conclusion: The average annual cost of CAD management was high, being the pharmacological treatment the main determinant of public costs. Such estimates may subsidize economical analyses in this area, and foster related healthcare policies.

182. Marins MR, Almeida MVR, Pereira RA. The association between socioeconomic indicators and cardiovascular disease risk factors in Rio de Janeiro, Brazil. *Journal of Biosocial Science* 2007; 39(2): 221–229.

The objective of this study was to analyze the association between socioeconomic indicators and cardiovascular disease risk factors in adult residents of Rio de Janeiro city, Brazil. Data were obtained by direct interview and physical examination in a population-based cross-sectional study in the city of Rio de Janeiro, 1995-96. Subjects were selected by two-stage random sampling and information was collected on socioeconomic, anthropometric and demographic characteristics, as well as on existing risk factors for cardiovascular disease. An index to express the risk of cardiovascular disease (CVD) was built, based on the presence of two or more of the following risk factors: overweight (measured by the body mass index, BMI), fat location (measured by the waist-hip ratio index, WHR), smoking, hypertension, sedentary lifestyle and alcohol consumption. The association between this risk index and the socioeconomic variables level of schooling, per capita income and residence location (slum vs non-slum) was evaluated through logistic regression models that controlled for the age of the subjects. Two separate models were built, according to the gender of the subjects. Complete data were collected for 1413 males and 1866 females over the age of 20 years (82% of the intended sample). In the studied population, a considerable prevalence of risk for CVD was found: 42-2% among males and 65-4% among females. For males, the socioeconomic and demographic indicators retained in the logistic model were age (OR 1-01, 95% CI 1-00-1-01), level of schooling (1-77, 95% CI 1-39-2-26) and per capita income (OR 0-77, 95% CI 0-61-0-97). For females, the indicators retained were age (OR 1-02, 95% CI 1-01-1-02) and level of schooling (OR 2-26, 95% CI 1-84-2-77). The findings indicate that cardiovascular disease risk is already an alarming problem in the urban populations of developing countries, and that educational level is the most important socioeconomic factor associated with its presence.

183. Lessa I. Productive years of life lost in Brazil because of cardiovascular mortality. *Boletín de la Oficina Sanitaria Panamericana* 1991; 110(2): 118–25.

Based on Brazilian Government official statistics for 1985, an estimate was made of the number of productive years of life lost due to cardiovascular premature mortality (ages 15 to 59). Data were corrected by the proportion of the population actually engaged in work activities during 1985. Crude results showed a loss of 481,052.0 years of productive life for men and 333,912.5 for women. The average years of productive life lost per person were 12.5 for males and 13.4 for females. The averages for women were higher in all regions. Averages were also higher for both men and women in underdeveloped regions (North, Northeast and Midwest) as compared with the South and Southeast. The two latter regions had the highest proportions of economically active years of life lost (80% and above). Data correction increased the average of years lost from 1.0 to 2.8 per woman and from 0.2 to 0.8 per man. This suggests that, in Brazil, death by cardiovascular diseases occurs earlier in people engaged in work activities than in the population outside the work force. Social costs of premature cardiovascular mortality and the need for a national program on education and control of high blood pressure are discussed.

184. Piegas LS, Avezum A, Pereira JC et al. AFIRMAR Study Investigators. Risk factors for myocardial infarction in Brazil. *American Heart Journal* 2003; 146: 331–338.

Approximately three-quarters of cardiovascular disease deaths in the world come from developing countries, and acute myocardial infarction (AMI) is an important cause of death. Brazil is one of the largest countries in Latin America and the contemporary evaluation of risk factors for AMI is crucial for a more efficacious disease management.

Methods The Acute Myocardial Infarction Risk Factor Assessment in Brazil (AFIRMAR) study is a case-control, hospital-based study involving 104 hospitals in 51 cities in Brazil, designed to evaluate risk factors for a first ST-segment elevation AMI. Results A total of 1279 pairs, matched by age (± 5 years) and sex, were enrolled. The conditional multivariable analysis of 33 variables showed the following independent risk factors for AMI: ≥ 5 cigarettes per day (odds ratio [OR] 4.90, $P < .00001$); glucose ≥ 126 mg/dL (OR 2.82, $P < .00001$); waist/hip ratio ≥ 0.94 (OR 2.45, $P < .00001$); family history of CAD (OR 2.29, $P < .00001$), low-density lipoprotein-cholesterol 100 to 120 mg/dL (OR 2.10, $P < .00001$); reported hypertension (OR 2.09, $P < .00001$); < 5 cigarettes per day (OR 2.07, $P = .0171$); low-density lipoprotein-cholesterol > 120 mg/dL (OR 1.75, $P < .00001$); reported diabetes mellitus (OR 1.70, $P = .0069$); waist/hip ratio 0.90 to 0.93 (OR 1.52, $P = .0212$); alcohol intake (up to 2 days/week) (OR 0.75, $P < .0309$); alcohol intake (3-7 days/week) (OR 0.60, $P = .0085$); family income R\$600 to R\$1200 and college education (OR 2.92, $P = .0499$); family income $> R\$1200$ and college education (OR 0.68, $P = 0.0239$)

Conclusions The independent risk factors for AMI in Brazil showed a conventional distribution pattern (smoking, diabetes mellitus and central obesity among others) with different strengths of association; most of them being preventable by implementation of adequate policies.

China

185. Zhang XH, Lu ZL, Liu L. Coronary heart disease in China. *Heart* 2008; 94(9): 1126–31.

Coronary heart disease (CHD) is the second leading cause of cardiovascular death in the Chinese population. It accounts for 22% of cardiovascular deaths in urban areas and 13% in rural areas. Although mortality from CHD in China is relatively low compared with Western levels, the burden of CHD has been increasing. This is partly because of a worsening profile of risk factors, such as an increased prevalence of hypertension, hyperlipidemia, overweight/obesity, diabetes, etc and partly because of an increase in the aged population. Large-scale, randomized controlled trials on thrombolytic, blood-pressure-lowering, antiplatelet and blood-cholesterol-lowering treatment as well as cardiac intervention have been conducted for Chinese patients with myocardial infarction. The studies provide important information for the prevention and management of chronic CHD and acute myocardial infarction in the Chinese population.

186. Yang, Li1; Wu, Ming; Cui, Bin et al. Economic burden of cardiovascular diseases in China. *Expert Review of Pharmacoeconomics and Outcomes Research* 2008; 8(4): 349–356.

Cardiovascular diseases (CVD) have become the principle cause of death and disability among the middle-aged and elderly both in urban and rural areas of China. The objective of this study is to estimate the direct costs of CVD in China. Direct costs were estimated for the Chinese population with CVD in 2003 by sex, age, geography, type of medical condition and medical insurance, and then calculated based on the 2003 National Health Services Survey. The annual average direct medical cost and direct nonmedical cost were 4238.3 Yuan (US\$529.8) and 153.9 Yuan (US\$19.2) in urban areas, 2302.5 Yuan (US\$278.1) and 416.4 Yuan (US\$50.3) in rural areas, respectively. On average, only 23.9% of outpatient costs and 35.2% in-patient costs could be paid by various kinds of medical insurance. This disease burden led to 209.0 billion Yuan (US\$26.1 billion) in direct costs in 2003. The strong positive association between CVD, and the economic burden to families and society, demonstrates the need for greater investment to prevent CVD in China.

187. Critchley J, Liu J, Zhao D et al. Explaining the Increase in Coronary Heart Disease Mortality in Beijing Between 1984 and 1999. *Circulation* 2004; 110: 1236–1244.

Coronary heart disease (CHD) mortality is rising in many developing countries. We examined how much of the increase in CHD mortality in Beijing, China, between 1984 and 1999 could be attributed to changes in major cardiovascular risk factors and assessed the impact of medical and surgical treatments. Methods and Results: A validated, cell-based mortality model synthesized data on (1) patient numbers, (2) uptake of specific medical and surgical treatments, (3) treatment effectiveness, and (4) population trends in major cardiovascular risk factors (smoking, total cholesterol, blood pressure, obesity, and diabetes). Main data sources were the WHO MONICA and Sino-MONICA studies, the Chinese Multi-provincial Cohort Study, routine hospital statistics, and published meta-analyses. Age-adjusted CHD mortality rates increased by 50% in men and 27% in women (1608 more deaths in 1999 than expected by application of 1984 rates). Most of this increase (77%, or 1397 additional deaths) was attributable to substantial rises in total cholesterol levels (more than 1 mmol/L), plus increases in diabetes and obesity. Blood pressure decreased slightly, whereas smoking prevalence increased in men but decreased substantially in women. In 1999, medical and surgical treatments in patients together prevented or postponed 642 deaths, mainly from initial treatments for acute myocardial infarction (41%), hypertension (24%), angina (15%), secondary prevention (11%), and heart failure (10%). Multiway sensitivity analyses did not greatly influence the results. Conclusions: Much of the dramatic CHD mortality increases in Beijing can be explained by rises in total cholesterol, reflecting an increasingly "Western" diet. Without cardiological treatments, increases would have been even greater.

188. Siegrist J, Bernhardt R, Feng Z. Socioeconomic Differences in Cardiovascular Risk Factors in China. *International Journal of Epidemiology* 1990; 19(4): 905–910.

Socioeconomic conditions are important in explaining variation in cardiovascular morbidity in advanced societies. To analyze whether cardiovascular risk factors vary according to socioeconomic status in a developing country, and more specifically, in an urban area of China, we compared data from structured interviews and cardiovascular screenings in a group of 1169 male workers (45–65 years). These men participated in the five-year follow-up of a prospective investigation started in 1982/83 in several plants in Wuhan. Unhealthy behaviors such as heavy cigarette smoking and alcohol consumption were significantly more prevalent among men with low educational attainment and with jobs characterized by heavy physical workload, noise and heat. Men paid according to a new, highly demanding salary system exhibited significant increases in total cholesterol and systolic blood pressure from first to second screening. In conclusion, our findings show significant socioeconomic variation in cardiovascular risk factors among middle-aged male workers in China.

189. Wang, YL, Wu D, Liao X. Burden of stroke in China. *International Journal of Stroke* 2007; 2(3): 211–213.

Stroke is second leading cause of death in China, however, there are very few data available in the English literature to reflect the burden. We summarize the current epidemiological trends and estimate of the burden of stroke in recent reports available in Chinese.

190. Jin SG, Lu BY, Yan DY. An evaluation on smoking-induced health costs in China (1988-1989). *Biomedical Environmental Science* 1995; 8(4): 342–9.

A study on smoking-attributable health economic costs in China was conducted from 1988-1992, in which three major categories of chronic diseases, diseases of cancer, diseases of circulatory system, and diseases of respiratory system were included. A prevalence-based method which estimated the cumulative effect of cigarette smoking during the past 20-30 years was used. The results show that in 1989, the total smoking-attributable economic costs to health sectors in China were about 27.1 billion of Chinese Yuan, including about 7 billion Yuan in direct medical costs and 20 billion Yuan in indirect costs, which include indirect morbidity costs and indirect mortality costs. The relatively low direct costs reflected the low medical costs at hospitals in China at that time. And the high proportion of indirect costs relative to the total costs shows the high potential years of life lost due to cigarette smoking. The results also show the heavier health burden in urban areas than in rural areas, reflecting the worse situation in urban China at nowadays. But if considering that almost 80% of the Chinese are rural farmers with the higher smoking prevalence and relatively shorter history of manufactured cigarette smoking than their urban counterparts, the very frightful situation due to cigarette smoking would be for China in the next century.

191. Wu, Z, Yao C, Zhao D. Cardiovascular disease risk factor levels and their relations to CVD rates in China - results of Sino-MONICA project. *European Journal of Cardiovascular Prevention & Rehabilitation* 2004; 11(4): 275–283.

The Sino-MONICA project is a 7-year study monitoring trends and determinants of cardiovascular disease (CVD) in geographically defined populations in different parts of China. This report focuses on risk factor levels and their relations to CVD rates. Design: Successive surveys on smoking habits, blood pressure (BP), serum total cholesterol (TC), weight and height were conducted in independent random samples of the same populations early (1987-1988) and late (1992-1993) in the study period, by the methodology and criteria of the WHO MONICA project. Associations between risk levels and CVD rates were also assessed by correlation analysis. Results: In general, the mean level of BP in the populations studied was high by international standards. Serum TC and body mass index (BMI) were low compared with the world average. There were significant geographic variations in CVD risk levels, being higher in the north and lower in the south, which correlated with the north-south difference of CVD event rates. Conclusions: The Sino-MONICA study has established the feasibility of long-term monitoring of CVD events and risk factors with international standardized methods in Chinese communities. The results will have significance in curbing the CVD epidemic not only in China, but also internationally.

192. Yu Z, Nissinen A, Vartiainen E et al. Associations between socioeconomic status and cardiovascular risk factors in an urban population in China. *Bulletin of the World Health Organization* 2000, 78: 1296–1305.

In developed countries socioeconomic status has been proven to be an important factor in the progression of cardiovascular disease. The present article reports the results of a cross-sectional assessment to investigate the association between socioeconomic status and cardiovascular risk factors in a Chinese urban population. Methods: In 1996, a behavioral risk factor survey was carried out in Tianjin, the third largest city in China. A sample of 4000 people aged 15–69 years, stratified by sex and 10-year age groups, was drawn randomly from urban areas of the city. The present study covers respondents aged 25–69 years (1615 men and 1592 women). Four socioeconomic indicators (education, occupation, income, and marital status), blood pressure, body mass index, and cigarette smoking were determined in the survey. Results: Educational level seemed to be the most important measure of the four socioeconomic indicators in relation to the cardiovascular risk factors in the study population. People with lower socioeconomic status had higher levels of cardiovascular risk factors. The association between socioeconomic status and cardiovascular risk factors was more consistent among women than men. Discussion: Our findings do not seem to differ from those observed in developed countries.

Colombia

193. Bautista L, Orósteguib M, Verab Let al. Prevalence and impact of cardiovascular risk factors in Bucaramanga, Colombia: results from the Countrywide Integrated Noncommunicable Disease Intervention Programme (CINDI/CARMEN) baseline survey. *European Journal of Cardiovascular Prevention and Rehabilitation* 2006; 13(5): 769–75.

Although cardiovascular diseases are the main cause of death in the region, there are few data on the prevalence of cardiovascular risk factors in Latin American. We studied the distribution and impact of cardiovascular risk factors in Bucaramanga, Colombia. Methods: We conducted a cross-sectional study in a random sample of 2989 subjects 15-64 years old. Population attributable risks were estimated from Framingham risk scores. Results: Smoking prevalence was 16.2% (men 26.3%; women 10.5%). Hypertension prevalence was 9.9% in women and 8.8% in men, but reached 50% in those 60-64 years old. After adjustment for body mass index, men were more likely to be hypertensive, but only if under 40 years old. Obesity was more frequent in women (15.7%) than in men (8.7%), even after age-adjustment. About 46% of the participants were overweight or obese. Women also had higher prevalence of high total cholesterol (19.7 versus 15.7%) and high low-density lipoprotein-cholesterol (23.9 versus 19.5%), but lower prevalence of low high-density lipoprotein (HDL)-cholesterol (22.2 versus 37.6%). Only low-HDL prevalence was significantly different after body mass index and age-adjustment. The prevalence of diabetes was similar in men and women (4%), but age and body mass index-adjusted impaired fasting glucose prevalence was 60% higher in women. Population attributable risks were larger and similar for high total cholesterol, hypertension, and large waist-to-hip ratio (19%). Conclusions: Women had higher prevalence of all risk factors with the exception of smoking and low-HDL. Reduction in cholesterol levels, blood pressure and obesity is a priority to control the ongoing epidemic of cardiovascular diseases in this population.

Ghana

194. Addo J, Amoah AG, Koram KA. The changing patterns of hypertension in Ghana: a study of four rural communities in the Ga District. *Ethnicity and Disease* 2006; 16(4): 894-9.

Objective: To determine the prevalence, distribution and risk factors of hypertension among rural residents in Ghana. Design and setting: Cross sectional study in four rural communities in the Ga District of Ghana. Subjects and methods: All adults aged \geq 18 years in four rural communities were asked to participate. The average of two blood pressure readings taken with a mercury sphygmomanometer after 10 minutes of rest was used in the analysis. Hypertension was defined as blood pressure \geq 140/90 mm Hg. Results: 362 subjects with a mean age of 42.4 \pm 18.6 years participated in the study. The prevalence of hypertension was 25.4%. Of those with hypertension, only 32.3% (n=30) had prior knowledge of their condition, and less than half of these (n=12) were on treatment. Of those on treatment 16.7% were well controlled (blood pressure \leq 140/90 mm Hg). The adjusted odds ratios for developing hypertension for overweight or obesity were 5.8 (95% confidence interval 1.4-24.3) and 6.9 (95% confidence interval 1.7-28.2), respectively. The adjusted odds ratio for hypertension for age groups 45-54, 55-64, and \geq 65 years were 31.9 (95% confidence interval 1.88-539.11), 31.8 (95% confidence interval 1.6-624.2), and 58.8 (95% confidence interval 2.9-1168.7), respectively. The adjusted odds ratio for hypertension with respect to smoking, alcohol consumption, job-related physical activity, family history, education, occupation, and diabetes status did not attain statistical significance. Conclusion: Hypertension is now of

public health significance in rural Ga District of Ghana. The high rate of hypertension was associated with low levels of awareness, drug treatment, and blood pressure control. Overweight and obesity are modifiable risk factors for hypertension that can be addressed through lifestyle interventions. Additionally, integrating hypertension care into primary care in rural health facilities may prove beneficial.

195. Aikins A. Ghana's neglected chronic disease epidemic: a developmental challenge. *Ghana Medical Journal* 2007; 41(4): 154–159.

This paper charts a brief history of Ghana's chronic disease burden over the last fifty years, focusing on prevalence, risk and illness experiences. Two arguments are made. First, chronic diseases in Ghana constitute public health and developmental challenges, requiring the same intellectual and financial commitments afforded to communicable and infectious diseases such as malaria and HIV/AIDS. Second, to understand and respond to the multifaceted roots and consequences of chronic diseases, research, interventions and policies have to be informed by multidisciplinary biomedical and social science collaborations.

India

196. Sharma M, Ganguly NK. Premature coronary artery disease in Indians and its associated risk factors. *Vascular Health and Risk Management* 2005; 1(3): 217–225.

Of particular concern to India is not only the high burden of cardiovascular diseases (CVDs), but also the effects of these diseases on the productive workforce aged 35-65 years. Heart diseases are rising in Asian Indians 5-10 years earlier than in other populations around the world. The mean age for first presentation of acute myocardial infarction in Indians is 53 years. Coronary artery disease (CAD) that manifests at a younger age can have devastating consequences for an individual, the family, and society. Prevention of these deaths in young people is a nation's moral responsibility. A strategy involving prevention of CVDs long before their onset will be more cost-effective than providing interventions at a stage when the disease is well established. We review the rising trends in CAD with particular emphasis on prevalence of premature CAD and the associated risk factors in young Indian CAD patients. Action strategies to reduce the risk are suggested.

197. Goyal A, Yusuf S. The burden of cardiovascular disease in the Indian subcontinent. *Indian Journal of Medical Research* 2006; 124: 235–44.

Ischaemic heart disease and stroke are among the most common causes of death and disability in the world. The Indian subcontinent (including India, Pakistan, Bangladesh, Sri Lanka, and Nepal) has among the highest rates of cardiovascular disease (CVD) globally. Previous reports have highlighted the high CVD rates among South Asian immigrants living in Western countries, but the enormous CVD burden within the Indian subcontinent itself has been underemphasized. In this review, we discuss the existing data on the prevalence of CVD and its risk factors in the Indian subcontinent. We also review

recent evidence indicating that the burden of coronary heart disease in the Indian subcontinent is largely explained on the basis of traditional risk factors, which challenges the common thinking that South Asian ethnicity per se is a strong independent risk factor for coronary heart disease. Finally, we suggest measures to implement in policy, capacity building, and research to address the CVD epidemic in the Indian subcontinent.

198. Sugathan TN, Soman CR, Sankaranarayanan K. Behavioral risk factors for noncommunicable diseases among adults in Kerala, India. *Indian Journal of Medical Research* 2008; 127(6): 555–3.

Cardiovascular and other chronic diseases are becoming the major causes of morbidity and mortality in most of the third world countries including India, especially in the southern Indian States, like Kerala, where most of the health indicators match closely with those of any developed country. Various behavioral risk factors (BRF) namely smoking, unhealthy diet, stress at home and work place, consumption of alcohol, sedentary life style, etc., are known to be risk factors for many such diseases. The present study was carried out to estimate the prevalence of various behavioral risk factors for chronic diseases, and to identify their biosocial correlates. Methods: A cross-sectional study was done in which the data were collected from a sample of 6579 individuals of age 30 to 74 yr, randomly selected following a stratified multi-stage cluster sampling design covering Kerala State. The important factors investigated include various behavioral risk factors, presenting chronic diseases and family histories among close relatives. The data were analyzed using both univariate and multivariate analyses. Results: The two major risk factors observed among males were smoking and alcohol consumption. About two fifths (40%) of them were current smokers as well as current users of alcohol (41%). The median age at initiation was 21 yr for both smoking habits and for alcohol consumption. Nearly a quarter of the target population were inactive (23% males and 22% females) based on work and leisure time activities. More than one-fifth of them (23%) reported stress. Obesity was found more among females (33%) than males (17%). Low socio-economic background was found to be a high predictor (high risk group) for habit of smoking, alcohol consumption, stress and unhealthy diet. Conclusion: Substantially high levels of the various behavioral risk factors among adults in Kerala suggests an urgent need for adopting healthy life style modifications among the population in general. The increased risk observed among the younger generation for behavioral risk factors such as smoking and alcohol consumption calls for urgent corrective steps and measures for long-term monitoring of all major risk factors as well as the major chronic disease conditions.

199. Ramaraj R, Alpert JS. Indian poverty and cardiovascular disease. *American Journal of Cardiology* 2008; 102(1):102–6.

Cardiovascular disease is among the world's leading causes of death, and nearly 80% of deaths occur in developing countries. Cardiovascular disease is becoming a major health problem in India, where life expectancy has increased with decreases in infectious disease and childhood mortality. It is well established that this population experiences coronary artery disease at a younger age than other populations. With infectious diseases

still endemic, noncommunicable diseases are a lower priority for the governments of developing countries. There is a clear progression to degenerative and lifestyle-related diseases such as cardiovascular disease as a result of current social and economic change. The lack of a public response to the increasing risk for cardiovascular disease thus far is due mostly to a perception among policy makers and the public that cardiovascular disease is largely a problem of the urban rich. In conclusion, this review addresses the imminent threats and ways to tackle the epidemic in India.

200. Ramachandran A, Mary S, Yamuna A et al. High prevalence of diabetes and cardiovascular risk factors associated with urbanization in India. *Diabetes Care* 2008; 31(5): 893–8.

Objective: To compare prevalence of diabetes, impaired glucose tolerance (IGT), impaired fasting glucose (IFG), and cardiovascular risk factors between a city, a town, and periurban villages (PUVs) in southern India and to look for temporal changes in the city and PUVs. Methods: Subjects aged ≥ 20 years were studied in Tamilnadu, India, in Chennai (city, n = 2,192; 1,053 men and 1,138 women), Kanchipuram (town, n = 2,290; 988 men and 1,302 women), and Panruti (PUVs, n = 2,584; 1,280 men and 1,304 women) in 2006. Demographic, socioeconomic, and anthropometric details; blood pressure; physical activity; diet habits; and lipids were studied. Risk associations with diabetes were analyzed using multiple logistic regression analyses. Present and previous data in the city and the PUVs were compared. Results: Mean BMI, waist circumference, and family history of diabetes were significantly lower in the PUVs. The PUVs had a lower prevalence of diabetes (9.2 [95% CI 8.0-10.5], $P < 0.0001$) than the city (18.6 [16.6-20.5]) and town (16.4 [14.1-18.6]). Approximately 40% of subjects were newly diagnosed. Prevalence of impaired glucose tolerance (IGT) was higher ($P < 0.0001$) in the city (7.4 [6.2-8.5]) than in the town (4.3 [3.3-5.3]) and the PUVs (5.5 [4.6-6.5]). Prevalence of IFG was generally low. Age, family history, and waist circumference were significantly associated with diabetes, while physical activity was not. Overweight, elevated waist circumference, hypertension, and dyslipidemia were more prevalent in the city. Conclusions: In the city, diabetes increased from 13.9 to 18.6% in 6 years and IGT decreased significantly. The town and city had similar prevalences; the PUVs had lower diabetes prevalence, but prevalence had increased compared with that in a previous survey. Cardiometabolic abnormalities were more prevalent in urban populations.

201. Gupta R, Joshi P, Mohan V et al. Epidemiology and causation of coronary heart disease and stroke in India. *Heart* 2008; 94(1): 16–26.

Cardiovascular diseases are major causes of mortality and disease in the Indian subcontinent, causing more than 25% of deaths. It has been predicted that these diseases will increase rapidly in India and this country will be host to more than half the cases of heart disease in the world within the next 15 years. Coronary heart disease and stroke have increased in both urban and rural areas. Case-control studies indicate that tobacco use, obesity with high waist:hip ratio, high blood pressure, high LDL cholesterol, low HDL cholesterol, abnormal apolipoprotein A-1:B ratio, diabetes, low consumption of

fruits and vegetables, sedentary lifestyles and psychosocial stress are important determinants of cardiovascular diseases in India. These risk factors have increased substantially over the past 50 years and to control further escalation it is important to prevent them. National interventions such as increasing tobacco taxes, labeling unhealthy foods and trans fats, reduction of salt in processed foods and better urban design to promote physical activity may have a wide short-term impact.

202. Hypertension Study Group. Prevalence, awareness, treatment and control of hypertension among the elderly in Bangladesh and India: a multicentre study. *Bulletin of the World Health Organization* 2001; 79(6): 490–500.

Objective: To evaluate the prevalence, awareness, treatment and control of hypertension among elderly individuals in Bangladesh and India. Method: A community-based sample of 1203 elderly individuals (670 women; mean age, 70 years) was selected using a multistage cluster sampling technique from two sites in Bangladesh and three sites in India. Findings: The overall prevalence of hypertension (WHO-International Society for Hypertension criteria) was 65% (95% confidence interval = 62-67%). The prevalence was higher in urban than rural areas, but did not differ significantly between the sexes. Multiple logistic regression analyses identified a higher body mass index, higher education status and prevalent diabetes mellitus as important correlates of the prevalence of hypertension. Physical activity, rural residence, and current smoking were inversely related to the prevalence of hypertension. Among study subjects who had hypertension, 45% were aware of their condition, 40% were taking anti-hypertensive medications, but only 10% achieved the level established by the US Sixth Joint National Committee on Detection, Evaluation and Treatment of Hypertension (JNC VI)/WHO criteria. A visit to a physician in the previous year, higher educational attainment and being female emerged as important correlates of hypertension awareness. Conclusions: Our findings emphasize the need to implement effective and low cost management regimens based on absolute levels of cardiovascular risk appropriate for the economic context. From a public health perspective, the only sustainable approach to the high prevalence of hypertension in the Indian subcontinent is through a strategy to reduce the average blood pressure in the population.

Malaysia

203. Zambahari R. Trends in cardiovascular diseases and risk factors in Malaysia. *International Congress Series*, Vol. 1262, May 2004: 446–449.

Data from the Information and Documentation System Unit of the Ministry of Health of Malaysia showed that cardiovascular disease had been the principal cause of death in government hospitals over the years, accounting for 23% to 26% of deaths from 1994 to 2001. Heart disease accounted for 14% to 16.6%. Of cardiovascular disease admissions and deaths in government hospitals from 1985 to 2000, ischaemic heart disease accounted for 25% to 33% of admissions and 27% to 35% of deaths. A National Health and Morbidity Survey (NHMS) conducted in 1996 to evaluate health status, health-related behavior and health services utilization in 21,708 individuals aged 30 years or

older, of whom 17,390 (80%) agreed to participate, 39% had no risk factors, 34% had one risk factor, 19% had 2 risk factors, 7% had 3 risk factors and 1% had 4 risk factors. Conclusions: Cardiovascular disease is the major cause of hospital admissions and death in government hospitals in Malaysia. The National Health and Morbidity survey showed 61% of Malaysians had one risk factor or more.

Mexico

204. Stevens G, Dias RH, Thomas KJ. Characterizing the epidemiological transition in Mexico: national and subnational burden of diseases, injuries, and risk factors. *PLoS Medicine* 2008; 5(6): e125.

Rates of diseases and injuries and the effects of their risk factors can have substantial subnational heterogeneity, especially in middle-income countries like Mexico. Subnational analysis of the burden of diseases, injuries, and risk factors can improve characterization of the epidemiological transition and identify policy priorities. Methods and findings: We estimated deaths and loss of healthy life years (measured in disability-adjusted life years [DALYs]) in 2004 from a comprehensive list of diseases and injuries, and 16 major risk factors, by sex and age for Mexico and its states. Data sources included the vital statistics, national censuses, health examination surveys, and published epidemiological studies. Mortality statistics were adjusted for underreporting, misreporting of age at death, and for misclassification and incomparability of cause-of-death assignment. Nationally, noncommunicable diseases caused 75% of total deaths and 68% of total DALYs, with another 14% of deaths and 18% of DALYs caused by undernutrition and communicable, maternal, and perinatal diseases. The leading causes of death were ischemic heart disease, diabetes mellitus, cerebrovascular disease, liver cirrhosis, and road traffic injuries. High body mass index, high blood glucose, and alcohol use were the leading risk factors for disease burden, causing 5.1%, 5.0%, and 7.3% of total burden of disease, respectively. Mexico City had the lowest mortality rates (4.2 per 1,000) and the Southern region the highest (5.0 per 1,000); under-five mortality in the Southern region was nearly twice that of Mexico City. In the Southern region undernutrition and communicable, maternal, and perinatal diseases caused 23% of DALYs; in Chiapas, they caused 29% of DALYs. At the same time, the absolute rates of noncommunicable disease and injury burdens were highest in the Southern region (105 DALYs per 1,000 population versus 97 nationally for noncommunicable diseases; 22 versus 19 for injuries). Conclusions: Mexico is at an advanced stage in the epidemiologic transition, with the majority of the disease and injury burden from noncommunicable diseases. A unique characteristic of the epidemiological transition in Mexico is that overweight and obesity, high blood glucose, and alcohol use are responsible for larger burden of disease than other noncommunicable disease risks such as tobacco smoking. The Southern region is least advanced in the epidemiological transition and suffers from the largest burden of ill health in all disease and injury groups.

205. Reynales-Shigematsu LM, Rodriguez-Bolanos R, Jimenez JA et al. Health care costs attributable to tobacco consumption on a national level in the Mexican Social Security Institute. *Revista de Saúde Pública* 2006; 48(Suppl 1): S48–64.

Objective: To estimate the cost of medical care for the major diseases attributable to tobacco consumption at the IMSS. Methods: A cost of illness (COI) analysis was carried out from the perspective of the health provider. A random sample of clinical files (n= 1,596) was reviewed to estimate the human resources and medical supplies utilization according to the health care facilities. The smoking attributable fraction (SAF) by disease was used to derive costs attributable to tobacco consumption. The unitary cost was valued in 2004 Mexican pesos (MP). Results: The estimated annual total cost of medical care was 7114 million MP (\$643 million*) for acute myocardial infarction (AMI); 3424 million MP(\$315 million) for Cerebrovascular Disease, 1469 million MP for chronic obstructive pulmonary disease (COPD) and 102 million MP for lung cancer (LC). The annual total cost of medical care for IMSS was 12100 million MP (\$11115 million). The total annual cost of medical care attributable to tobacco consumption corresponds to 7100 million MP, which is equivalent to 4.3% of the annual expenditures of the IMSS during 2004. Conclusion: These results confirm the high medical costs associated with smoking. This information would be used to reinforce the tobacco control preventive actions at IMSS and support decision-makers in strengthening public policies to control tobacco use in Mexico.

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206. Arredondo A, Zúñiga A. Epidemiologic changes and economic burden of hypertension in Latin America: evidence from Mexico. *American Journal of Hypertension* 2006; 19(6): 553–9.

Costs of health services for hypertension and the financial consequences of epidemiologic changes in this disease are important concerns for health systems in Latin America. Methods: We conducted longitudinal analyses of the economic impact of the epidemiologic changes on health care services for hypertension in the Mexican health care system. The cost evaluation method used was based on costing technique by production function and consensus techniques. To estimate the epidemiologic changes and financial consequences for the period 2005 to 2007, three probabilistic models were constructed according to the Box-Jenkins technique. Results: If changes are not implemented in prevention programs to reduce the effects of current risk factors, there will be increases in the number of patients with hypertension as well as in the financial burden to treat the disease. The amount allocated for hypertension in 2007, which will be 6% to 8% of the total health budget, is US\$ 2,486,145,132. Of these, US\$ 1,178,725,132 will be direct costs and US\$ 1,307,420,000 will be indirect costs. Regarding epidemiologic changes for 2005 v 2007 ($P < .05$), an increase is expected, although results show a greater increase in insured populations. Conclusions: If the risk factors and different health programs remain as they currently are, the economic impact of expected epidemiologic changes on the social security system will be particularly strong. Another relevant financial factor is the appearance of internal competition in the allocation of financial resources among the main providers of health services for hypertension; this factor becomes even more complicated within each provider.

207. Garcia-Pena C, Thorogood M, Wonderling D et al. Economic analysis of a pragmatic randomized trial of home visits by a nurse to elderly people with hypertension in Mexico. *Salud pública Méx* 2002; 44(1): 14–20.

Objective. To analyze the costs and the effectiveness of an intervention of home visits made by nurses to elderly people versus usual care given by the family medicine units. **Material and Methods.** A sample of 4 777 subjects aged 60 years and over covered by the Mexican Institute of Social Security (Instituto Mexicano del Seguro Social, IMSS) were screened. Those with a systolic and/or diastolic blood pressure level higher or equal than 160/90 mm Hg were randomly allocated to the intervention or control groups. The intervention consisted of visits at home by nurses who gave health and lifestyle advice to the participants. The economic evaluation was considered from a health services and patient perspective. Direct and indirect costs were calculated as incremental. Effectiveness was measured in terms of cost per millimeter of mercury reduced. **Results.** Three hundred and forty five participants were allocated to the intervention group and compared with 338 controls. At the end of the intervention period the difference in the mean change in systolic blood pressure was 3.31 mm Hg (95% CI 6.32, 0.29; $p=0.03$) comparing with the control group. In diastolic blood pressure the difference was 3.67 (95% CI 5.22, 2.12; $p<0.001$). The total cost of the intervention was 101 901.66 pesos. The intervention cost per patient was 34.61 pesos (US\$3.78), (CI 95% 34.44, 35.46). The cost-effectiveness ratios was 10.46 pesos (US\$1.14) for systolic (CI 95% 129.31, 5.51) and 9.43 (US\$1.03) for diastolic (CI 95% 19.90, 2.49). **Conclusions.** The reduction in blood pressure obtained may well justify the small incremental cost of the intervention.

Morocco

208. Tazi MA, Abir-Khalil S, Chaouki N et al. Prevalence of the main cardiovascular risk factors in Morocco: results of a National Survey, 2000. *Journal of Hypertension* 2003; 21(5): 897–903.

The aim of this study was to determine the prevalence of the main cardiovascular risk factors in Morocco and their distribution according to age, sex and residential area. **Methods:** The study was conducted during the year 2000 on a Moroccan representative sample aged 20 years and over, considering the population distribution between urban and rural areas. The crude results were weighted according to the Moroccan population distribution by age and sex. In order to allow comparison with data from other countries, means and prevalence were standardized according to world population distribution by age. **Results:** The participation rate was 90.1%. The prevalence of hypertension was 33.6% (30.2% for men and 37.0% for women). The means of systolic and diastolic blood pressure were 129.8 and 76.0 mmHg, respectively. The prevalence of diabetes was 6.6% and was similar for males and females. The prevalence of hypercholesterolemia was 29.0%, and was higher in females. The means and prevalence of diabetes and hypercholesterolemia were higher in urban areas. The prevalence of hypertension, diabetes and hypercholesterolemia increased with age. The prevalence of obesity was markedly higher in females and in urban areas. The average body mass index was 23.8 and 25.6 kg/m² in males and females, respectively. Thirty-four per cent of men smoked

cigarettes, but women rarely smoked cigarettes (0.6%). Conclusions: The prevalence of cardiovascular risk factors was high in Morocco and it is necessary to increase action against the cardiovascular diseases and their risk factors.

Nigeria

209. Sani MU, Adamu B, Mijinyawa MS et al. Ischaemic heart disease in Aminu Kano Teaching Hospital, Kano, Nigeria: a 5 year review. *Nigerian Journal of Medicine* 2006; 15(2): 128–31.

Socioeconomic changes and rural urban migration have led to emergence of non-communicable disease including ischaemic heart disease (IHD) and many others. The actual prevalence of IHD in Nigeria is not known. The non communicable disease (NCD) survey sought to determine the prevalence of major risk factors, rather than the prevalence of the disease itself. The prevalence is generally considered low in Nigeria but the current impression about its importance stems mostly from anecdotal reports. We therefore set out to describe the prevalence as well as the spectrum of IHD at Aminu Kano Teaching Hospital, Kano. Method: Between July 2000 and June 2005, we reviewed the prevalence as well as the spectrum of presentation of IHD in Aminu Kano Teaching Hospital. Information was obtained from the medical records of patients in the medical unit of the hospital. Age, sex, diagnosis, risk factors for IHD, other relevant clinical and laboratory data and outcome of patients for myocardial infarction (MI) were extracted from the records. Data was analyzed using SPSS version 10.0 software. Results: There were 5124 medical patients admitted over the period under review, out of which 1347 had cardiovascular diseases. Forty six patients were diagnosed to have IHD giving it a prevalence of 0.9% of medical conditions and 3.4% of all cardiovascular cases. There were 33 males and 13 females (M : F = 2.5:1). Twenty two patients (47.8%) had myocardial infarction, 14 (30.4%) had ischemic cardiomyopathy and 10 (21.7%) had angina. The patients consist of 41 (89.1%) Nigerians, 3 (6.5%) Lebanese, 1 (2.2%) Indian and 1 (2.2%) Pakistani. The risk factors found were Hypertension in 37 (80.4%) of patients, diabetes in 16 (34.8%), and Dyslipidemia in 20 (43.5%). Others were cigarette smoking and obesity. Conclusion: IHD is an important cause of morbidity and mortality in our population. There is need for us to be on the alert and prepare ourselves to manage these cases. Focus should be on preventive cardiology.

Philippines

210. Reyes-Gibby C, Aday LA. Prevalence of and Risk Factors for Hypertension in a Rural Area of the Philippines. *Journal of Community Health* 2000; 25(5): 389–399.

This study reports on a community health survey conducted among 30 year old rural residents of San Antonio, Nueva Ecija, Philippines, to serve as a basis for tailoring health programs for hypertension in the community. The focus of the analyses is the assessment of the prevalence of and risk factors for hypertension. A cluster survey was conducted among 336 residents in May 1998. Sixty clusters were drawn from areas comprising the town using probability proportionate to size sampling technique. Seven households were

visited per cluster and one respondent was randomly chosen for interview and measurement of blood pressure, height and weight in each household. Eighty-four percent of eligible respondents participated. Hypertension prevalence was 23%. Only 42% had been diagnosed with hypertension (i.e., had been told and prescribed anti-hypertensive medication by their physician). Forty-seven percent reported taking anti-hypertensive medication (33 were prescribed by a physician while 4 were by self-medication) but only 17% of those identified as being hypertensive had it under control. Logistic regression showed that age ≥ 50 ($p = 0.000$), family history of hypertension ($p = 0.004$), and body mass index ≥ 25 ($p = 0.003$) were significantly associated with hypertension. This study documents the prevalence and predictors of hypertension in a previously understudied population. In the absence of fully implemented programs to prevent and control hypertension, the current prevalence is only expected to increase, leading to substantial increases in morbidity and mortality and health care cost.

211. Morales DD, Dans AL, Velandria FV et al. Metabolic syndrome in the Philippine general population: prevalence and risk for atherosclerotic cardiovascular disease and diabetes mellitus. *Diabetes and Vascular Disease Research* 2008; 5(1): 36–43.

The objectives of this study were to determine the prevalence of metabolic syndrome (MS) and its component risk factors among Filipinos using three sets of criteria and to evaluate the association between MS and atherosclerotic cardiovascular disease and diabetes mellitus. The study utilized a multi-staged cluster sampling design. The prevalence of MS was found to be 11.9% by National Cholesterol Education Program/Adult Treatment Panel (NCEP/ATP III) criteria, 14.5% by International Diabetes Federation (IDF) criteria and 18.6% by NCEP/ATP III criteria modified by the American Heart Association/National Heart, Lung and Blood Institute (NCEP/ATP III-AHA/NHLBI) criteria. Low levels of high-density lipoprotein cholesterol (HDL-C) occurred in 60.2% of men and 80.9% of women. Abdominal obesity was noted in 17.7% of men and 35.1% of women. Blood pressure (BP) $\geq 130/85$ mmHg was seen in 33.3%, hypertriglyceridemia in 20.6% and fasting blood sugar ≥ 100 mg/dL (5.55 mmol/L) in 7.1%. Age-adjusted odds ratios showed that MS, by all three definitions, predisposed an individual to diabetes mellitus (DM) and stroke while MS by the IDF definition predisposed an individual to myocardial infarction (MI). Individuals with MS did not have a significant predisposition to angina and peripheral artery disease (PAD). Thus, the metabolic syndrome is common in Filipinos, with low HDL-C as the most prevalent component. The metabolic syndrome predisposes to diabetes mellitus and stroke, with a tendency to MI using the IDF criteria.

Russia

212. Laatikainen T, Laura Delong L, Pokusajeva S. Changes in cardiovascular risk factors and health behaviors from 1992 to 1997 in the Republic of Karelia, Russia. *The European Journal of Public Health* 2002; 12(1): 37–43.

In Russia rapid changes have taken place both in total and chronic disease mortality during recent years. Little reliable information is available on the trends in conventional

risk factors in Russia. Methods: Chronic disease risk factors and health behaviors were studied in the Republic of Karelia, Russia in 1992 and 1997, in population surveys connected with the National FINRISK Study in Finland. Independent random population samples (n=1000) of people aged between 25 and 64 years were drawn in both survey years. Surveys included a self-administered questionnaire, physical measurements and laboratory analyses. Results: The levels of systolic blood pressure, total serum cholesterol, and high-density lipoprotein cholesterol decreased among both genders from 1992 to 1997, but the difference between the survey years was statistically significant only among women. Both self-reported alcohol consumption and serum gamma-glutamyl transferase levels increased significantly in both men and women. There was a significant shift in the type of fat used on bread and in cooking, from butter use to use of margarine and vegetable oil, among both genders. Conclusions: As a whole the risk factor levels in the Republic of Karelia are high. However, some slight improvement in risk profile was seen. Positive changes in dietary habits, such as change in the quality of fat and associated reduction in serum cholesterol levels may have contributed to the decline in cardiovascular disease mortality seen in Russia since 1995. However, since smoking and elevated blood pressure levels as well as alcohol consumption are still highly prevalent, there is a great need for effective interventions.

Singapore

213. Lee J, Ma S, Heng D. Hypertension, concurrent cardiovascular risk factors and mortality: the Singapore Cardiovascular Cohort Study. *Journal of Human Hypertension* 2008; 22(7): 468–74.

The current hypertension (HTN) guidelines recommend the assessment of other cardiovascular disease (CVD) risk factors in individuals with HTN for further management. Few studies in Asian populations have been published to identify the outcome of individuals with HTN and other CVD risk factors. This study aims to assess the effect of HTN alone, and in combination with other CVD risk factors on all-cause and CVD mortality. Three cross-sectional studies carried out in Singapore (baseline 1982--1995) consisting of 5830 persons were grouped by the absence or presence of HTN and CVD risk factors. They were followed-up (mean 14.1 years) by linkage with the National Death Register. Cox's proportional hazards model was used to obtain adjusted hazard ratios (HRs) for risk of mortality. HTN individuals with either <2 CVD risk factors (adjusted HR 1.4; 95% confidence interval (CI) 1.0-1.8) or ≥2 CVD risk factors (adjusted HR 2.3; 95% CI 1.9-3.0) were at increased risk of all-cause mortality compared to normotensive individuals. The findings were similar for CVD mortality. HTN individuals who also smoked or had diabetes were at highest risk of all-cause mortality, whereas those with elevated total cholesterol/high-density lipoprotein cholesterol, smoked or diabetes had the highest risk for CVD mortality. These findings show that in HTN individuals it is important to assess the presence of other CVD risk factors and manage accordingly.

South Africa

214. Pestana JA, Steyn K, Leiman A et al. The direct and indirect costs of cardiovascular disease in South Africa in 1991. *South African Medical Journal* 1996; 86(6): 679–84.

In South Africa, cardiovascular disease (CVD) is the leading cause of death among all population groups, other than blacks, among whom it ranks third. CVD therefore has a severe impact on the South African economy. Objectives: To ascertain the availability and quality of South African data on the cost of CVD and to estimate the impact of CVD on the South African economy during 1991. Methods: The direct health care costs and the indirect costs related to loss of productivity were estimated. Where no direct or complete detailed South African data were available, projections were made based on reasonable assumptions of data and models developed in other countries; these were applied to the limited available South African data. The major disease outcomes considered for this cost estimation were: expenditure on ischaemic heart disease, cerebrovascular disease (stroke), venous thrombosis and embolism, and peripheral vascular diseases and related conditions. These diseases are responsible for the majority of fatal cases of CVD reported in South Africa. Results: The estimated total cost of CVD in South Africa in 1991 was between R4.135 billion (\$1.50 billion*) and R5.035 billion (\$1.83 billion). This does not include the cost of rehabilitation and follow-up of CVD patients since the necessary data were not available to estimate it. About three-quarters of the direct health care costs were carried by the private sector. The direct health care costs were estimated to be approximately 42% of the total cost. The rest reflects the indirect cost of earnings foregone as a result of premature morbidity and mortality. Conclusion: To determine accurately the total economic burden of CVD on the South African economy, additional data will have to be collected. The estimated economic burden of CVD in South Africa clearly highlights the need for a broad-based population strategy, part of an overall national effort to prevent, diagnose and cost-effectively treat CVD.

*1SA Rand=.3627US\$

215. Norman R, Gaziano T, Laubscher R et al. Estimating the burden of disease attributable to high blood pressure in South Africa in 2000. *South African Medical Journal* 2007; 97(2): 692–698.

Objectives: To estimate the burden of disease attributable to high blood pressure (BP) in adults aged 30 years and older in South Africa in 2000. Design: World Health Organization comparative risk assessment (CRA) methodology was followed. Mean systolic BP (SBP) estimates by age and sex were obtained from the 1998 South African Demographic and Health Survey adult data. Population-attributable fractions were calculated and applied to revised burden of disease estimates for the relevant disease categories for South Africa in 2000. Monte Carlo simulation-modeling techniques were used for uncertainty analysis. Subjects: Adults aged 30 years and older. Outcome measures: Mortality and disability-adjusted life years (DALYs) from ischaemic heart disease (IHD), stroke, hypertensive disease and other cardiovascular disease (CVD). RESULTS: High BP was estimated to have caused 46,888 deaths (95% uncertainty interval 44,878 - 48,566) or 9% (95% uncertainty interval 8.6 - 9.3%) of all deaths in

South Africa in 2000, and 390,860 DALYs (95% uncertainty interval 377,955 - 402,256) or 2.4% of all DALYs (95% uncertainty interval 2.3 - 2.5%) in South Africa in 2000. Overall, 50% of stroke, 42% of IHD, 72% of hypertensive disease and 22% of other CVD burden in adult males and females (30+ years) were attributable to high BP (systolic BP \geq 115 mmHg). Conclusions: High BP contributes to a considerable burden of CVD in South Africa and results indicate that there is considerable potential for health gain from implementing BP-lowering interventions that are known to be highly cost effective.

216. Bradshaw D, Groenewald P, Laubscher R et al. Initial burden of disease estimates for South Africa, 2000. *Medical Research Council*, 2003. Cape Town: South Africa.

This paper describes the first national burden of disease study for South Africa. The main focus is the burden due to premature mortality, i.e. years of life lost (YLLs). In addition, estimates of the burden contributed by morbidity, i.e. the years lived with disability (YLDs), are obtained to calculate disability-adjusted life years (DALYs); and the impact of AIDS on premature mortality in the year 2010 is assessed. Method: Owing to the rapid mortality transition and the lack of timely data, a modeling approach has been adopted. The total mortality for the year 2000 is estimated using a demographic and AIDS model. The non-AIDS cause-of-death profile is estimated using three sources of data: Statistics South Africa, the National Department of Home Affairs, and the National Injury Mortality Surveillance System. A ratio method is used to estimate the YLDs from the YLL estimates. Results: The top single cause of mortality burden was HIV/AIDS followed by homicide, tuberculosis, road traffic accidents and diarrhea. HIV/AIDS accounted for 38% of total YLLs, which is proportionately higher for females (47%) than for males (33%). Pre-transitional diseases, usually associated with poverty and underdevelopment, accounted for 25%, non-communicable diseases 21% and injuries 16% of YLLs. The DALY estimates highlight the fact that mortality alone underestimates the burden of disease, especially with regard to unintentional injuries, respiratory disease, and nervous system, mental and sense organ disorders. The impact of HIV/AIDS is expected to more than double the burden of premature mortality by the year 2010. Conclusion: This study has drawn together data from a range of sources to develop coherent estimates of premature mortality by cause. South Africa is experiencing a quadruple burden of disease comprising the pre-transitional diseases, the emerging chronic diseases, injuries, and HIV/AIDS. Unless interventions that reduce morbidity and delay morbidity become widely available, the burden due to HIV/AIDS can be expected to grow very rapidly in the next few years. An improved base of information is needed to assess the morbidity impact more accurately.

217. Bradshaw D, Steyn K. *Poverty and chronic diseases in South Africa: Technical report 2001*. Cape Town: South African Research Council, 2001.

South Korea

218. Suh I. Cardiovascular mortality in Korea: a country experiencing epidemiologic transition. *Acta Cardiologica* 2001; 56(2): 75–81.

The pattern of morbidity and mortality of cardiovascular disease (CVD) changes with epidemiologic transition. An understanding of this pattern in rapidly developing countries might provide important clues for the understanding of the epidemiological trends in CVD mortality. The objective of this paper was to address the changing pattern of CVD mortality in Korea during the period 1984-1999, and to examine the significant changes in associated major risk factors for CVD over a similar period. Methods - For the purpose of this study, three main categories in CVD were reviewed: hypertensive heart disease, ischaemic heart disease, and cerebrovascular disease (stroke). The analyses of mortality were based on nationwide mortality data published by the National Statistical Office from 1984 to 1999. All the mortality rates were adjusted for age using the direct method. Changes in major CVD risk factors (blood pressure, cigarette smoking, serum total cholesterol and diet) were also reviewed during similar periods. Findings - During the 15-year period investigated, the age-adjusted mortality from CVD decreased markedly. It decreased by 57% in males (from 172.2 to 73.0/100,000) and 48% in females (from 135.5 to 70.2/100,000). The age-adjusted mortality from stroke decreased while the proportion of ischaemic strokes among total stroke deaths increased. The proportion increased about 5.2 times in men and 4.9 times in women. The age-adjusted mortality from hypertensive heart disease decreased markedly. It decreased by 92% in men (from 51.6 to 4.1/100,000) and 84% in women (from 34.1 to 5.3/100,000). Also the age-adjusted mortality from ischaemic heart disease increased significantly. In 1999, the rates for men and women were 11.9 and 7.5/100,000, respectively. These rates were 3.8 and 3.6 times higher than the rates in 1984 for men and women, respectively. The changes of CVD risk factors in Korea observed during a similar period were a decrease in hypertension prevalence, although still present at a high level, an increase in serum total cholesterol level and intake of total fat along with a high, although decreasing, prevalence of cigarette smoking. Interpretation-The mortality changes in Korea are consistent with the change that occurs during the transition from the age of receding pandemics to the age of degenerative and man-made diseases. This study has indicated that the change of CVD mortality was closely associated with the change in CVD risk factors. In order to avert the ongoing epidemic of CVD in developing countries, prevention and treatment of modifiable risk factors must become a high health priority.

219. Jung YH. The socioeconomic cost of diseases in Korea. *Journal of Preventive Medicine and Public Health* 2006; 39(6): 499–504.

Korea has been facing various public health problems such as increase in prevalence population ratio and rapid growth of health expenditures. The aim of the study is to estimate the annual socioeconomic cost of diseases in Korea. Methods: We estimate both direct and indirect costs of diseases in Korea in 2001 using a prevalence-based approach. Direct cost estimates include medical expenditures, traffic costs and caregiver's cost. Indirect costs representing the loss of production include lost workdays due to illness and lost earnings due to premature death and are estimated based on human capital theory. The cost estimates are reported in USA Purchasing Power Parity Dollars and calculated at three different discount rates (0%, 3% and 5%). The major data sources are National Health Insurance Statistical Yearbook, Annual Report on the Cause of Death Statistics, and Survey Report on Wage Structure. We also use other information such as the Korean

Statistical Information System. Results: The cost of diseases in Korea in 2001 is 50.0 billion US PPP\$(\$ hereafter) based on 0% discount rate. The estimate represents approximately 6.6% of GDP or 1,627\$ per person. Direct and indirect costs are estimated at 26.1 billion \$ (52.2% of total cost) and 23.9 billion \$ (47.8%), respectively. And it is found that the cost at aged 40~49 accounts for the largest proportion (22.2%) at age group and the cost of the male is 25.6% higher than that of the female. In the case of major diseases, the total cost of neoplasms is 8.2 billion \$; 7.4 billion \$ in diseases of digestive system; 6.5 billion \$ in diseases of respiratory system; and 5.9 billion \$ in diseases of circulatory system. Conclusions: This study can be expected to provide a valuable information for determining intervention and funding priorities, and planning for health policy.

220. Lee H, Yoon SJ, Bae SC et al. *Estimation of the Burden of Disease in Korea*. Abstract of Academy of Health Meeting 2005; Abstract no. 4005.

We estimated the burden of diseases in Korea using disability adjusted life year (DALY), a composite measure of premature mortality and disability that equates to years of healthy life lost. Study design: We calculated DALYs of 123 diseases for the year 2002. The burden of disease due to premature death was estimated by using years life lost due to premature death (YLLs) measurement developed by the global burden of disease study group. For the calculation of the years lived with disability (YLD), the following parameters were estimated in the formula; incidence rate, mortality, prevalence rate and disability weight of disease. Findings: By disease category, DALYs per 100,000 population were attributable mainly to cancer (1,525 person-year), cardiovascular disease (1,492 person-year), digestive disease (1,140 person-year), diabetic mellitus (970 person-year), respiratory disease (951 person-year). The leading five diseases of DALYs for males per 100,000 population in Korea were diabetic mellitus (1020 person-year), cerebrovascular accident (937 person-year), cirrhosis of the liver (671 person-year), asthma (663 person-year), ischemic heart disease (601 person-year). For females, the leading five diseases of DALYs per 100,000 population were diabetic mellitus (919 person-year), cerebrovascular accident (900 person-year), peptic ulcer disease (794 person-year), asthma (755 person-year), rheumatoid arthritis (531 person-year). Conclusions: These results presented a substantially different ranking of disease burden than did mortality rates alone. Also, we found differences in the rank order by gender and age group. Implications for policy: We found the DALY method employed was appropriate to quantify the burden of disease. Thereby, it would provide a rational bases to plan a national health policy regarding the burden of disease in Korea.

221. Lee SY, Jee SH, Yun JE. Medical Expenditure of National Health Insurance Attributable to Smoking among the Korean Population. *Journal of Preventive Medicine and Public Health* 2007; 40(3): 227–32.

The purpose of this study was to determine the population-attributable risk (PAR) and estimate the total medical expenditure of the Korean National Health Insurance (KNHI) due to smoking. Methods: We used data from the Korean Cancer Prevention Study of 1,178,138 Koreans aged 30 to 95. These data were available from 1992 to 2003 and

covered a long-term follow-up period among the Korean population. RESULTS: The total medical expenditure of KNHI related to smoking increased by 27% from \$324.9 million in 1999 to \$413.7 million in 2003. By specific diseases, smoking attributable KNHI medical expenditure was the highest for lung cancer (\$74.2 million), followed by stroke (\$65.3 million), COPD (\$50.1 million), CHD (\$49 million) and stomach cancer (\$30 million). A total of 1.3 million KNHI patients were suffering from smoking-related diseases in 2003. We predicted rises in total KNHI medical expenditure related to smoking to \$675.1 million (63% increase compared with that of 2003) and in the total number of KNHI patients suffering from smoking-related diseases to about 2.6million (an approximate 100% increase compared with those in 2003) in 2015. Conclusions: We found a substantial economic burden related to the high smoking prevalence in South Korea.

Tunisa

222. Ben Romdhane H, Haouala H, Belhani A et al. Epidemiological transition and health impact of cardiovascular disease in Tunisia. *La Tunisie Médicale* 2005; 83(Suppl 5): 1–7.

We aim at analyzing the increase of CVDs in the Tunisian hospitals in order to assess the burden of NCDs in the transitional context. Methods: Data are recorded through the Tunisian National Morbidity and Mortality Survey (TNMMS). In order to assess the CVDs (CHDs vs RHDs) trend, two representative samples of Cardiology Departments patients were compared one is selected from the TNMMS and the second from the hospitalizations recorded in 1992. Causes, stay duration, status at the end of the hospitalization, transfer to another hospital and patients socio-demographic characteristics are recorded and compared for the two periods. All the diagnosis are coded referring to the DMC 10. To analyze the determinant of the epidemiological transition, we have elaborated the CVD causal pattern and we have documented all their determinants. Results: CHD rate has dramatically increased, while RHD has decreased especially on men. In 1992, 39.2% of men and 11.8% of women were admitted for CHD. In 2002, these rate are respectively 58.8% and 38.2% while RHD rates were, in 1992, 11.8% on men and 25.3% on women vs 4.4% and 11.7% respectively. Conclusion: This study has confirmed that so far controlling transmitted diseases seems to be successful, Tunisian people are about to face a new problems as hypertension, obesity, diabetes and tobacco smoking. The new challenge with the burden of diseases requires the implementation of a national strategy relevant to the epidemiological, social and economical transition. Population needs and cost effectiveness of interventions assessment is crucial to set the national priorities.

223. Aounallah Skhiri H, Ben Abdelkrim I, Ouldezein H et al. The cost of acute myocardial infarction management: the Tunisian experience. *Tunis Medicine* 2005;83 (Suppl 5): 24–9.

Objective: To assess the medical direct cost of acute myocardial infarction. Method: Data are recorded through a prospective study in 7 wards of cardiology of the District of Tunis

during one year: from November 2001 to October 2002. Cost of hospital stay, biologic analyses, drugs, functional investigations and possible non surgical cardiologic intervention (IC) was calculated. Results: 632 AMI cases are recorded, the death rate is 7.8%. The average of hospital stay was 13.3 days. 49.1% of patients benefited from thrombolytic therapy, 55.5% benefited from a coronary angiography and 16.1% of an act of IC. The mean of direct cost (CGM) was 2171 Tunisian Dinars and the median was 1731 DT (\$1217*), of whom room costs 31.7%, 22.5% acts of IC, 7.2% drugs, 26.2% functional investigations and 12.4% biological analyses. The mean cost of IC was 3030 +/- 401 DT (\$2125 +/- \$281). Conclusion: The methodology of our study remains original in our country and can be used to assess the other aspects of AMI as other diseases cost management.

*1 DT=.7013US\$

Viet Nam

224. Hoang VM, Dao LH, Wall S et al. Cardiovascular disease mortality and its association with socioeconomic status: findings from a population-based cohort study in rural Vietnam, 1999-2003. *Preventing Chronic Disease* 2006; 3(3): A89.

Cardiovascular disease is an emerging epidemic in Vietnam, but because cause of death and other routine data are not widely available, it is difficult to characterize community-based disease patterns. Using 5-year data from an ongoing cause-specific mortality study conducted within a demographic surveillance system in Vietnam's Bavi district, this article estimates the rates of adult cardiovascular disease mortality in relation to the mortality rates of other noncommunicable diseases in rural northern Vietnam and examines the association of cardiovascular disease with certain demographic and socioeconomic factors. Methods: All causes of death of adults aged 20 and older occurring from 1999 through 2003 (n = 1067) were determined by using an established demographic surveillance system and data collected by trained interviewers who asked caretakers or relatives of the deceased individuals about signs and symptoms of disease during quarterly household visits. Deaths were classified as cardiovascular disease, cancer, or other noncommunicable diseases. These records were linked to demographic and socioeconomic data. Results: Of the 1067 adult deaths that were recorded, there was an overall noncommunicable disease mortality rate of 7.8 per 1000 person-years. Cardiovascular disease accounted for 33% of male and 31% of female deaths. Compared with cancer and other noncommunicable causes of death in a Cox proportional hazards model, higher cardiovascular disease mortality rates were observed among men, older age groups, and those without formal education. Conclusion: To date, cohort studies and population-based mortality data in Vietnam have been scarce; this study provides insights into the public health aspects of cardiovascular disease in transitional Vietnam. The rates of cardiovascular disease mortality in this rural Vietnamese community were high, suggesting the need for both primary prevention and secondary treatment initiatives. The demographic surveillance system is an important tool for characterizing such an epidemic.

Cardiovascular Disease Costs—US, Miscellaneous

225. Flack JM, Casciano R, Casciano J et al. Cardiovascular disease costs associated with uncontrolled hypertension. *Managed Care Interface* 2002 ; 15(11): 28–36.

This research evaluated the effect of inadequate blood pressure (BP) control on selected cardiovascular (CV) disease outcomes and costs for American patients with hypertension. The results of a hypertension outcomes trial, which provided incidence rates for CV disease morbidity and mortality at distinct systolic/diastolic BP ranges, were integrated with U.S. hypertension statistics from the Third National Health and Nutrition Examination Survey and cost estimates for stroke, congestive heart failure, and myocardial infarction. A model was developed to estimate the number of cases and costs of myocardial infarction, stroke, and congestive heart failure for patients achieving BP control versus those not achieving control. For the U.S. population with hypertension, inadequate BP control was estimated to result in 39,702 CV events, 8,374 CV disease deaths, and \$964 million in direct medical expenditures. Within the medicated population with CV disease, the incremental costs of failure to attain BP goals reached approximately \$467 million. These results reflect the importance of adequate BP control--in particular, systolic BP control--in reducing cardiovascular morbidity, mortality, and overall health care expenditures among patients with hypertension.

226. Miah MS, Wilcox-Gok V. Do the Sick Retire Early? Chronic Illness, Asset Accumulation and Early Retirement. *Applied Economics* 2007; 39 (3-15): 1921–36.

Our objective is to determine how chronic illness affects asset accumulation and retirement. Previous studies have found that poor health leads to early retirement, but those studies failed to look at the indirect impact of chronic illness on retirement. Using data from the Health and Retirement Study, we define an illness as chronic if the individual reports having asthma, cancer, heart disease, stroke or diabetes for four or more years. We first estimate how a chronic illness influences asset accumulation. We then estimate how asset accumulation and current poor health influence retirement. We observe that the vast majority of the chronically ill population do not report their general health to be poor nor do they report functional limitations in activities of daily living. Nevertheless, our results indicate that chronic illness leads these people to accumulate fewer assets during their working years and consequently retire later. Neither researchers nor policy-makers discussing the many critical issues surrounding illness and retirement have addressed this issue.

227. Sicras-Mainar A, Velasco-Velasco S, González-Rojas Guix N et al. Influence of morbidity, metabolic control, and use of resources in subjects with cardiovascular risk in the primary care setting. *Atención Primaria* 2008; 40(9): 447–54.

Objective: To determine the comorbidity, the therapeutic objectives, and economic impact in subjects with cardiovascular risk in primary care (PC). Design: Multicentre, cross-sectional study. Setting: Five urban PC centers, Spain. Participants: Patients over

55 years seen during the year 2006. Compared according to the presence/absence of a cardiovascular event (CVE). Measurements: Demographics, cardiovascular/general comorbidity (adjusted clinical groups), Charlson index, clinical parameters, multiple drugs and semi-fixed direct costs (operational) and variables (tests, referrals, drugs). A logistical regression and ANCOVA analysis was performed to correct the models. SPSSWIN Program ($P < .05$). Results: Of 24 410 patients, 15.4% (CI, 14.9-15.9) had a CVE. The subjects with a CVE showed a higher mortality (4.0% vs 1.8%) and general morbidity (8.1 vs 6.4 episodes) ($P < .001$). The CVE had an independent association in males (OR=2.7), Charlson index (OR=2.1), dyslipemia (OR=1.5), depression (OR=1.4), age (OR=1.3), arterial hypertension (OR=1.2) and diabetes (OR=1.1) ($P < .005$). In primary prevention worse average cholesterols were obtained (211.6 vs 192.4 mg/dL), while in secondary prevention blood glucose was worse (111.3 vs 104.2 mg/dL; $P < .001$). The average corrected direct costs were euro1543.55 versus euro1027.65, respectively ($P < .001$). These differences were maintained in all the cost components. Conclusions: The presence of a CVE is associated with higher comorbidity, causing an increase in costs. The achievement of therapeutic control objectives could be improved, in primary prevention as well as in secondary. Intervention strategies should be increased to modify life styles in these patients.

228. Oldridge NB. Economic burden of physical inactivity: healthcare costs associated with cardiovascular disease. *European Journal of Cardiovascular Prevention and Rehabilitation* 2008; 15(2): 130–9.

Increasingly important objectives for developed and especially for developing countries include increasing the numbers of individuals who do not smoke, who eat healthy diets and who are physically active at levels that are health enhancing. In developing countries, deaths from chronic disease are projected to increase from 56% of all deaths in 2005 to 65% by 2030 (driven largely driven by deaths due to cardiovascular and coronary heart disease); in developed countries, however, the increase is only from 87.5 to 88.5%. The data on physical inactivity presented in this review were derived primarily from World Health Organization (WHO) publications and data warehouses. The prevalence of physical inactivity at less than the levels recommended for enhancing health is high; from 17 to 91% in developing countries and from 4 to 84% in developed countries. In developed countries, physical inactivity is associated with considerable economic burden, with 1.5-3.0% of total direct healthcare costs being accounted for by physical inactivity. Other than on some exciting work in Brazil, there is little information on the effectiveness and cost-effectiveness of physical activity-enhancement strategies in developing countries. The WHO has signaled a shift from the treatment of illness to promotion of health, with an emphasis on changing modifiable health-risk factors, including smoking, unhealthy diets and physical inactivity: the real question, especially for developing countries, is “what is the future healthcare cost of not encouraging healthier lifestyles today”?

229. Sullivan PW, Ghushchyan V, Wyatt HR et al. The medical cost of cardiometabolic risk factor clusters in the United States. *Obesity* 2007; 15(12): 3150–8.

Objective: Diabetes, hypertension, hyperlipidemia, and overweight/obesity often cluster together. The prevalence of these cardiometabolic risk factor clusters (CMRFCs) is increasing significantly for all sociodemographic groups, but little is known about their economic impact. Methods: The nationally representative Medical Expenditure Panel Survey was used (2000 and 2002). The current study estimated the national cost of CMRFCs independent of the cost of cardiovascular disease in the U.S., as well as the cost for all major payers and the marginal cost per individual using a Heckman selection model with Smearing retransformation. CMRFCs included BMI ≥ 25 and two of the following three: diabetes, hyperlipidemia, and/or hypertension. All amounts are expressed in 2005 U.S. dollars. RESULTS: National medical expenditures attributable to CMRFCs in the U.S. totaled 80 billion dollars, of which 27 billion dollars was spent on prescription drugs. Private insurance paid the largest amount of the national bill (28 billion dollars), followed by Medicare (11 billion dollars), Medicaid (6 billion dollars), and the Veterans Administration (4 billion dollars), whereas individuals paid 28 billion dollars out-of-pocket. For each individual with CMRFCs, 5477 dollars in medical expenditures was attributable to CMRFCs, of which 1832 dollars was for prescription drugs. On average, individuals with CMRFCs spent 1668 dollars out-of-pocket, of which 830 dollars was for prescription drugs. Discussion: The results of this study show that CMRFCs result in significant medical cost in the U.S. independent of the cost of cardiovascular disease. Individuals, private insurers, Medicare, Medicaid, the Veterans Administration, and other payers all share this burden.

230. Sullivan PW, Ghushchyan V, Wyatt HR et al. Productivity costs associated with cardiometabolic risk factor clusters in the United States. *Value Health* 2007; 10(6): 443–50.

Objective: Cardiometabolic risk factors such as overweight/obesity, hyperlipidemia, diabetes, and hypertension are prone to cluster together in the same individual and result in an elevated risk of cardiovascular disease and mortality. The purpose of this study was to examine and quantify the impact of cardiometabolic risk factor clusters independent of heart disease on productivity in a nationally representative sample of US adults. Methods: The current study estimated the impact of cardiometabolic risk factor clusters on missed work days and bed days, controlling for sociodemographic characteristics, comorbidity, and smoking status in a nationally representative, pooled 2000 and 2002 Medical Expenditure Panel Survey sample. Cardiometabolic risk factor clusters included BMI ≥ 25 and two of the following three: diabetes, hyperlipidemia, and/or hypertension. All estimates were expressed in \$US 2005. Sensitivity analyses were conducted to examine the impact of varying assumptions on the results. RESULTS: After controlling for differences in sociodemographics, smoking and comorbidity, individuals with cardiometabolic risk factor clusters missed 179% more work days and spent 147% more days in bed (in addition to lost work days) than those without. Lost work days and bed days resulted in \$17.3 billion annually in lost productivity attributable to cardiometabolic risk factor clusters in the United States. Sensitivity analyses resulted in a range of annual lost productivity costs from \$3.2 to \$23.1 billion. Conclusions: Common cardiometabolic risk factor clusters have a significant deleterious impact on the US economy, resulting in \$17.3 billion in lost productivity.

231. Alley DE, Chang VW. The changing relationship of obesity and disability, 1988–2004. *Journal of the American Medical Association* 2007; 298(17): 2020–7.

Recent studies suggest that the obese population may have been growing healthier since the 1960s, as indicated by a decrease in mortality and cardiovascular risk factors. However, whether these improvements have conferred decreased risk for disability is unknown. The obese population may be living longer with better-controlled risk factors but paradoxically experiencing more disability. Objective: To determine whether the association between obesity and disability has changed over time. Design: Adults aged 60 years and older (N = 9928) with measured body mass index from 2 waves of the nationally representative National Health and Nutrition Examination Surveys (NHANES III [1988-1994] and NHANES 1999-2004). Outcome measures: Reports of much difficulty or inability to perform tasks in 2 disability domains: functional limitations (walking one-fourth mile, walking up 10 steps, stooping, lifting 10 lb, walking between rooms, and standing from an armless chair) and activities of daily living (ADL) limitations (transferring, eating, and dressing). Results: Among obese individuals, the prevalence of functional impairment increased 5.4% (from 36.8%-42.2%; P = .03) between the 2 surveys, and ADL impairment did not change. At time 1 (1988-1994), the odds of functional impairment for obese individuals were 1.78 times greater than for normal-weight individuals (95% confidence interval [CI], 1.47-2.16). At time 2 (1999-2004), this odds ratio increased to 2.75 (95% CI, 2.39-3.17), because the odds of functional impairment increased by 43% (OR 1.43; 95% CI, 1.18-1.75) among obese individuals during this period, but did not change among nonobese individuals. With respect to ADL impairment, odds for obese individuals were not significantly greater than for individuals with normal weight (OR, 1.31; 95% CI, 0.92-1.88) at time 1, but increased to 2.05 (95% CI, 1.45-2.88) at time 2. This was because the odds of ADL impairment did not change for obese individuals but decreased by 34% among nonobese individuals (OR, 0.66; 95% CI, 0.50-0.88). Conclusions: Recent cardiovascular improvements have not been accompanied by reduced disability within the obese older population. Rather, obese participants surveyed during 1999-2004 were more likely to report functional impairments than obese participants surveyed during 1988-1994, and reductions in ADL impairment observed for nonobese older individuals did not occur in those who were obese. Over time, declines in obesity-related mortality, along with a younger age at onset of obesity, could lead to an increased burden of disability within the obese older population.

232. Murray CJL, Lauer JA, Hutubessy RCW et al. Effectiveness and costs of interventions to lower systolic blood pressure and cholesterol: a global and regional analysis on reduction of cardiovascular-disease risk. *The Lancet* 2003, 361:717–725.

Cardiovascular disease accounts for much morbidity and mortality in developed countries and is becoming increasingly important in less developed regions. Systolic blood pressure above 115 mm Hg accounts for two-thirds of strokes and almost half of ischaemic heart disease cases, and cholesterol concentrations exceeding 3.8 mmol/L for 18% and 55%, respectively. We report estimates of the population health effects, and costs of selected interventions to reduce the risks associated with high cholesterol concentrations and

blood pressure in areas of the world with differing epidemiological profiles. Methods: Effect sizes were derived from systematic reviews or meta-analyses, and the effect on health outcomes projected over time for populations with differing age, sex, and epidemiological profiles. Incidence data from estimates of burden of disease were used in a four-state longitudinal population model to calculate disability-adjusted life years (DALYs) averted and patients treated. Costs were taken from previous publications, or estimated by local experts, in 14 regions. Findings: Non-personal health interventions, including government action to stimulate a reduction in the salt content of processed foods, are cost-effective ways to limit cardiovascular disease and could avert over 21 million DALYs per year worldwide. Combination treatment for people whose risk of a cardiovascular event over the next 10 years is above 35% is also cost effective leading to substantial additional health benefits by averting an additional 63 million DALYs per year worldwide. Interpretation: The combination of personal and non-personal health interventions evaluated here could lower the global incidence of cardiovascular events by as much as 50%.

233. World Bank. A Discussion Document, Counterfeit and Substandard Drugs, Public Health and Macro-economic Issues: A Blueprint for Action. Washington, DC: World Bank, June 2007.
234. Yabroff KR, Bradley CJ, Mariotto AB et al.. Estimates and Projections of Value of Life Lost From Cancer Deaths in the United States. *Journal of the National Cancer Institute* 2008; 100: 1755-1762.

Background: Value-of-life methods are increasingly used in policy analyses of the economic burden of disease. The purpose of this study was to estimate and project the value of life lost from cancer deaths in the United States. Methods: We estimated and projected US age-specific mortality rates for all cancers and for 16 types of cancer in men and 18 cancers in women in the years 2000–2020 and applied them to US population projections to estimate the number of deaths in each year. Cohort life tables were used to calculate the remaining life expectancy in the absence of cancer deaths—the person-years of life lost (PYLL). We used a willingness-to-pay approach in which the value of life lost due to cancer death was calculated by multiplying PYLL by an estimate of the value of 1 year of life (\$150 000). We performed sensitivity analyses for female breast, colorectal, lung, and prostate cancers using varying assumptions about future cancer mortality rates through the year 2020. Results: The value of life lost from all cancer deaths in the year 2000 was \$960.6 billion; lung cancer alone represented more than 25% of this value. Projections for the year 2020 with current cancer mortality rates showed a 53% increase in the total value of life lost (\$1472.5 billion). Projected annual decreases of cancer mortality rates of 2% reduced the expected value of life lost in the year 2020 from \$121.0 billion to \$80.7 billion for breast cancer, \$140.1 billion to \$93.5 billion for colorectal cancer, from \$433.4 billion to \$289.4 billion for lung cancer, and from \$58.4 billion to \$39.0 billion for prostate cancer. Conclusions: Estimated value of life lost due to cancer deaths in the United States is substantial and expected to increase dramatically, even if mortality rates remain constant, because of expected population changes. These estimates and projections may help target investments in cancer control strategies to tumor sites

that are likely to result in the greatest burden of disease and to interventions that are the most cost-effective.

235. Feachem, Richard, et al., *The Health of Adults in the Developing World*, The World Bank, Washington, D. C., 1992.

Although the control of infectious diseases during infancy and childhood is of undoubted importance, it will not, on its own, lead to a lifetime of good health. This volume draws attention to the causes and consequences of disease and ill health in adults within the developing world. By focusing more attention on this age group, especially those in the labor force, we can hope to improve health status and productivity and ultimately the quality of life of the entire population.