

Preventing  
**CHRONIC DISEASES**  
a vital investment

DR.RUPNATHJI( DR.RUPAK NATH )

# ANNEXES

DR.RUPNATHJI ( DR.RUPAKNATH )

# 1 Methods for projections of mortality and burden of disease to 2015

WHO has prepared updated projections of trends for mortality and burden of disease between 2002 and 2015 using methods similar to those used in the original Global Burden of Disease (GBD) study (1). A set of relatively simple models was used to project future health trends under various scenarios, based largely on projections of economic and social development, and using the historically observed relationships of these to cause-specific mortality rates. The data inputs for the projection models have been updated to take account of the greater number of countries reporting death registration data to WHO, particularly developing countries, and to take into account other recently developed projection models on HIV/AIDS and other conditions where appropriate, as well as tobacco epidemics.

## A BRIEF OVERVIEW OF THE METHODS AND ASSUMPTIONS

Rather than attempt to model the effects of the many separate direct determinants or risk factors for disease from the limited data that are available, the GBD methodology considered a limited number of socioeconomic variables: average income per capita, measured as gross domestic product (GDP) per capita; average number of years of schooling in adults, referred to as “human capital”; and time, a proxy measure for the impact of technological change on health status. This latter variable captures the effects of accumulating knowledge and technological development, allowing the implementation

of more cost-effective health interventions, both preventive and curative – at constant levels of income and human capital (2).

These socioeconomic variables show clear historical relationships with mortality rates, and may be regarded as indirect, or distal, determinants of health. In addition, a fourth variable, tobacco use, was included in the projections for cancers, cardiovascular diseases and chronic respiratory diseases, because of its overwhelming importance in determining trends for these causes. Tobacco use was measured in terms of “smoking intensity” – that component of observed lung cancer mortality that is attributable to tobacco smoking (3).

For the projections reported here, death rates for all major causes excluding HIV/AIDS were related to these four variables using historical death registration data for 107 countries between 1950 and 2002 (4). Death rates were then projected using World Bank projections of GDP per capita, WHO projections of human capital, and smoking intensity projections based on historical patterns of tobacco use and further adjusted for recent regional trends in tobacco consumption where appropriate.

Separate projections for HIV/AIDS mortality were prepared by UNAIDS and WHO, under a scenario in which coverage with antiretroviral drugs reaches 80% by 2012, remaining constant beyond that year, and in which there are no changes to current transmission rates due to increased prevention efforts. Projected tuberculosis mortality rates were modified in regions with high HIV prevalence, owing

to the expected interaction of tuberculosis and HIV. Because a substantial proportion of diabetes mortality is attributable to overweight and obesity (5), a separate projection model for diabetes mortality was developed using WHO projection of trends in body mass index distributions from 2000 to 2010. Similarly, projections of mortality for chronic respiratory diseases were adjusted for projected changes in smoking intensity.

The original GBD projections assumed that the changes in death rates associated with income growth and time in countries with death registration data, mostly medium and high income countries, would also apply in low income countries. The new projections for low income countries were based on the observed relationships for a data set consisting of 3468 country-years of observation where income per capita was less than \$10 000 per year. Additionally, observed regional trends in child mortality from 1990 to 2002 were compared with those predicted by the projection model for low income countries. As a result, the regression coefficient for time was set to zero for sub-Saharan Africa, and to 25% of its original value for other low income countries.

The WHO projections of mortality rates to 2015, together with UN medium variant assumptions for fertility rates and migration rates (6), were also used to prepare consistent population projections for all regions. The projected global population in 2015 was 7.1 billion compared to the UN medium variant projection of 7.2 billion, reflecting somewhat higher adult death rates in the WHO mortality projections.

## PROJECTIONS FOR COUNTRIES

Projections were carried out at country level, but aggregated into regional or income groups for presentation of results, apart from the projections for nine selected countries included in this report. Baseline estimates at country level for 2002 were derived from the GBD analyses published in *The World Health Report 2004* (7). Mortality estimates were based on analysis of latest available national information on levels of mortality and cause distributions as at late 2003. Incidence, prevalence, duration and severity estimates for conditions were based on the GBD analyses for the relevant epidemiological subregion, together with national and sub-national level information available to WHO. These baseline estimates represent the best estimates of WHO,

based on the evidence available in mid-2004, rather than the official estimates of Member States, and have been computed using standard categories and methods to maximize cross-national comparability.

Initial WHO estimates and technical explanations were sent to Member States for comment in 2003, and comments or additional information incorporated where possible. Country-specific projections were shared with relevant WHO country offices and Member States in advance of publication.

## LIMITATIONS

By their very nature, projections of the future are highly uncertain and need to be interpreted with caution. Three limitations are briefly discussed: uncertainties in the baseline data on levels and trends in cause-specific mortality, the “business as usual” assumptions, and the use of a relatively simple model based largely on projections of economic and social development.

For regions with limited death registration data, such as the Eastern Mediterranean Region, sub-Saharan Africa and parts of Asia and the Pacific, there is considerable uncertainty in estimates of deaths by cause associated with the use of partial information on levels of mortality from sources such as the Demographic and Health Surveys, and from the use of cause-specific mortality estimates for causes such as HIV/AIDS, malaria, tuberculosis and vaccine-preventable diseases (8). The GBD analyses have attempted to use all available sources of information, together with an explicit emphasis on internal consistency, to develop consistent and comprehensive estimates of deaths and disease burden by cause, age, sex and region.

The projections of burden are not intended as forecasts of what will happen in the future but as projections of current and past trends, based on certain explicit assumptions and on observed historical relationships between development and mortality levels and patterns. The methods used base the disease burden projections largely on broad mortality projections driven to a large extent by World Bank projections of future growth in income per capita in different regions of the world. As a result, it is important to interpret the projections with a degree of caution commensurate with their uncertainty, and to remember that they represent a view of the future explicitly resulting from the baseline data, choice of models, and the assumptions made. Uncertainty in

projections has been addressed not through an attempt to estimate uncertainty ranges, but through preparation of pessimistic and optimistic projections under alternate sets of input assumptions.

The results depend strongly on the assumption that future mortality trends in poor countries will have the same relationship to economic and social development as has occurred in higher income countries in the recent past. If this assumption is not correct, then the projections for low income countries will be over-optimistic in the rate of decline of communicable and noncommunicable diseases. The projections have also not taken explicit account of trends in major risk factors apart from tobacco smoking and, to a limited extent, overweight and obesity. If broad trends in risk factors are for worsening of risk exposures with development, rather than the improvements observed in recent decades in many high income countries, then again the projections for low and middle income countries presented here will be too optimistic.

## THE GLOBAL GOAL

The global goal for chronic diseases, proposed in this report, was modelled in terms of an additional 2% annual decline in chronic disease death rates from 2006 to 2015. Annual rates of change in age and sex specific death rates for all chronic disease causes were calculated for the mortality projections from 2005 to 2015 and then adjusted by subtraction of an additional 2% per annum. Death rates for the years 2006 to 2015 were then recomputed using the adjusted annual trends for age/sex-specific rates. Note that the final death rates for chronic diseases in 2015 under the bold goal scenario will be substantially lower than the base projections, since the additional 2% annual declines are cumulative.

## FURTHER INFORMATION

Interested readers can visit the WHO web site at <http://www.who.int/evidence/bod>, where the following information is available:

- » mortality and burden of disease estimates for 2002 for WHO regions and for countries grouped by income level;
- » downloadable working papers on the data sources, methodology and tools used in assessment of mortality and burden of disease for 2002;
- » a downloadable technical paper giving a detailed description of the data inputs, methods and results for the projections of mortality and burden of disease;
- » links to other publications and results relating to the WHO projections.

## REFERENCES

1. Murray CJL, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. *Lancet*, 1997, 349:1498-1504.
2. Murray C JL, Lopez AD. Alternative visions of the future: projecting mortality and disability, 1990-2020. In: Murray CJL, Lopez AD, eds. *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Global Burden of Disease and Injury Series, Vol. I).
3. Peto R, Lopez AD, Boreham J, Thun M, Heath C. Mortality from tobacco in developed countries: indirect estimation from national vital statistics. *Lancet*, 1992, 339:1268-1278.
4. Mathers CD, Ma Fat D, Inoue M, Rao C, Lopez AD. Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bulletin of the World Health Organization*, 2005, 83:171-177.
5. James WPT, Jackson-Leach R, Ni Mhurchu C, Kalamara E, Shayeghi M, Higby NJ et al. Overweight and obesity (high body mass index). In: Ezzati M, Lopez AD, Rodgers A, Murray CJL, eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors*. Geneva, World Health Organization, 2004 (<http://www.who.int/publications/cra>, accessed 27 July 2005).
6. *World population prospects – the 2002 revision*. New York, NY, United Nations Population Division, 2003.
7. *The world health report 2004 – Changing history*. Geneva, World Health Organization, 2004 (<http://www.who.int/whr>, accessed 27 July 2005).
8. Mathers CD, Bernard C, Iburg KM, Inoue M, Ma Fat D, Shibuya K et al. *Global burden of disease in 2002: data sources, methods and results*. Geneva, World Health Organization, 2003 (GPE Discussion Paper No. 54).

# 2

## WHO regions

AFRICA	AMERICAS	SOUTH-EAST ASIA
Algeria	Antigua and Barbuda	Bangladesh
Angola	Argentina	Bhutan
Benin	Bahamas	Democratic People's Republic of Korea
Botswana	Barbados	India
Burkina Faso	Belize	Indonesia
Burundi	Bolivia	Maldives
Cameroon	Brazil	Myanmar
Cape Verde	Canada	Nepal
Central African Republic	Chile	Sri Lanka
Chad	Colombia	Thailand
Comoros	Costa Rica	Timor-Leste
Congo	Cuba	
Côte d'Ivoire	Dominica	
Democratic Republic of the Congo	Dominican Republic	
Equatorial Guinea	Ecuador	
Eritrea	El Salvador	
Ethiopia	Grenada	
Gabon	Guatemala	
Gambia	Guyana	
Ghana	Haiti	
Guinea	Honduras	
Guinea-Bissau	Jamaica	
Kenya	Mexico	
Lesotho	Nicaragua	
Liberia	Panama	
Madagascar	Paraguay	
Malawi	Peru	
Maldives	Saint Kitts and Nevis	
Mauritania	Saint Lucia	
Mauritius	Saint Vincent and the Grenadines	
Mozambique	Suriname	
Namibia	Trinidad and Tobago	
Niger	United States of America	
Nigeria	Uruguay	
Rwanda	Venezuela (Bolivarian Republic of)	
Sao Tome and Principe		
Senegal		
Seychelles		
Sierra Leone		
South Africa		
Swaziland		
Togo		
Uganda		
United Republic of Tanzania		
Zambia		
Zimbabwe		

EUROPE	EASTERN MEDITERRANEAN	WESTERN PACIFIC
Albania	Afghanistan	Australia
Andorra	Bahrain	Brunei Darussalam
Armenia	Djibouti	Cambodia
Austria	Egypt	China
Azerbaijan	Iran (Islamic Republic of)	Cook Islands
Belarus	Iraq	Fiji
Belgium	Jordan	Japan
Bosnia and Herzegovina	Kuwait	Kiribati
Bulgaria	Lebanon	Lao People's Democratic Republic
Croatia	Libyan Arab Jamahiriya	Malaysia
Cyprus	Morocco	Marshall Islands
Czech Republic	Oman	Micronesia (Federated States of)
Denmark	Pakistan	Mongolia
Estonia	Qatar	Nauru
Finland	Saudi Arabia	New Zealand
France	Somalia	Niue
Georgia	Sudan	Palau
Germany	Syrian Arab Republic	Papua New Guinea
Greece	Tunisia	Philippines
Hungary	United Arab Emirates	Republic of Korea
Iceland	Yemen	Samoa
Ireland		Singapore
Israel		Solomon Islands
Italy		Tonga
Kazakhstan		Tuvalu
Kyrgyzstan		Vanuatu
Latvia		Viet Nam
Lithuania		
Luxembourg		
Malta		
Monaco		
Netherlands		
Norway		
Poland		
Portugal		
Republic of Moldova		
Romania		
Russian Federation		
San Marino		
Serbia and Montenegro		
Slovakia		
Slovenia		
Spain		
Sweden		
Switzerland		
Tajikistan		
The former Yugoslav Republic of Macedonia		
Turkey		
Turkmenistan		
Ukraine		
United Kingdom		
Uzbekistan		

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## 3

# World Bank income groupings

For operational and analytical purposes, the World Bank's main criterion for classifying economies is gross national income (GNI) per capita. Based on its GNI per capita, every economy is classified as low income, middle income (subdivided into lower middle and upper middle), or high income.

Categories for this report were based on the income categories published in *World development indicators 2003*, Washington, DC, World Bank, 2003. Economies were divided according to 2001 GNI per capita, calculated using the World Bank Atlas method. The groups are: low income, US\$ 745 or less; lower middle income, US\$ 746–2975; upper middle income, US\$ 2976–9205; and high income, US\$ 9206 or more.

## COUNTRIES, AREAS AND TERRITORIES

HIGH INCOME	UPPER MIDDLE INCOME
Andorra	American Samoa
Aruba	Antigua and Barbuda
Australia	Argentina
Austria	Barbados
Bahamas	Botswana
Bahrain	Brazil
Belgium	Chile
Bermuda	Costa Rica
Brunei Darussalam	Croatia
Canada	Czech Republic
Cayman Islands	Dominica
Channel Islands	Estonia
Cyprus	Gabon
Denmark	Grenada
Faroe Islands	Hungary
Finland	Isle of Man
France	Latvia
French Polynesia	Lebanon
Germany	Libyan Arab Jamahiriya
Greece	Lithuania
Greenland	Malaysia
Guam	Malta
Iceland	Mauritius
Ireland	Mexico
Israel	Oman
Italy	Palau
Japan	Panama
Kuwait	Poland
Liechtenstein	Puerto Rico
Luxembourg	Saint Kitts and Nevis
Monaco	Saint Lucia
Netherlands	Saudi Arabia
Netherlands Antilles	Seychelles
New Caledonia	Slovakia
New Zealand	Trinidad and Tobago
Northern Mariana Islands	Uruguay
Norway	Venezuela (Bolivarian Republic of)
Portugal	
Qatar	
Republic of Korea	
San Marino	
Singapore	
Slovenia	
Spain	
Sweden	
Switzerland	
United Arab Emirates	
United Kingdom	
United States of America	
United States Virgin Islands	



LOWER MIDDLE INCOME	LOW INCOME	
Albania	Afghanistan	Liberia
Algeria	Angola	Madagascar
Belarus	Armenia	Malawi
Belize	Azerbaijan	Mali
Bolivia	Bangladesh	Mauritania
Bosnia and Herzegovina	Benin	Mongolia
Bulgaria	Bhutan	Mozambique
Cape Verde	Burkina Faso	Myanmar
China	Burundi	Nepal
Colombia	Cambodia	Nicaragua
Cuba	Cameroon	Niger
Djibouti	Central African Republic	Nigeria
Dominican Republic	Chad	Pakistan
Ecuador	Comoros	Papua New Guinea
Egypt	Congo	Republic of Moldova
El Salvador	Côte d'Ivoire	Rwanda
Fiji	Democratic People's Republic of Korea	Sao Tome and Principe
Guatemala	Democratic Republic of the Congo	Senegal
Guyana	Equatorial Guinea	Sierra Leone
Honduras	Eritrea	Solomon Islands
Iran (Islamic Republic of)	Ethiopia	Somalia
Iraq	Gambia	Sudan
Jamaica	Georgia	Tajikistan
Jordan	Ghana	Timor-Leste
Kazakhstan	Guinea	Togo
Kiribati	Guinea-Bissau	Uganda
Maldives	Haiti	Ukraine
Marshall Islands	India	United Republic of Tanzania
Micronesia (Federated States of)	Indonesia	Uzbekistan
Morocco	Kenya	Viet Nam
Namibia	Kyrgyzstan	Yemen
Paraguay	Lao People's Democratic Republic	Zambia
Peru	Lesotho	Zimbabwe
Philippines		
Romania		
Russian Federation		
Saint Vincent and the Grenadines		
Samoa		
Serbia and Montenegro		
South Africa		
Sri Lanka		
Suriname		
Swaziland		
Syrian Arab Republic		
Thailand		
The former Yugoslav Republic of Macedonia		
Tonga		
Tunisia		
Turkey		
Turkmenistan		
Vanuatu		
West Bank and Gaza		

# 4 Economic analysis methods

For the economic analyses of this report, three approaches were adopted:

1. systematic review on chronic disease costs of illness;
2. elucidation of the human capital impact of chronic diseases through their impact on labour supply – the Solow growth model using the Cobb-Douglas function;
3. elucidation of the impact of chronic diseases on and growth in economic welfare – the full-income approach.

Estimation of the economic impact was based on projections to 2015 for nine countries: Brazil, Canada, China, India, Nigeria, Pakistan, the Russian Federation, the United Kingdom and the United Republic of Tanzania. The focus was on heart disease, stroke and diabetes.

## THE GROWTH (COBB-DOUGLAS) MODEL

The Cobb-Douglas function (equation 1) was combined with the capital accumulation function (equation 2) to estimate the long-run impact of chronic diseases on economic growth for these countries.

$$Y_{it} = r A_{it} K_{it}^{\alpha} L_{it}^{1-\alpha} \quad (1)$$

### Where:

Y = national (production) income – GDP pc

K = capital accumulation

L = labour inputs

$\alpha$  = Elasticity of Y with respect to K

$1 - \alpha$  = elasticity of Y with respect to L

i = countries

t = time period

r = adjustment factor (Cuddington et al., 1992)

Note that  $\alpha + (1 - \alpha) = \text{unity}$ , i.e. constant returns to scale.

$$K_{it} = sY_{it} - xC_{it} + (1 - \delta)K_{i(t-1)} \quad (2)$$

### Where:

Y, K, i and t are as defined in above

s = savings rate

C = cost of treating illness

x = proportion of C funded from savings

$\delta$  = depreciation

## APPROACH TO ELUCIDATION

Three main approaches were initially considered: (1) econometric estimation and projections; (2) econometric estimation and calibration; and (3) straightforward calibration using information on variables from various sources. The third approach was adopted for this phase of work because of data availability issues and time constraints. However, options 1 and 2 will be pursued as part of the ongoing work in this area, and as a follow-up to the report.

## DATA AND DATA SOURCES

Projected gross domestic product (GDP) data were obtained from the World Bank and converted to GDP per worker as all other variable input. Capital per worker was obtained from Easterly & Levine (1). Information on the impact of chronic diseases on labour supply was obtained from the population and mortality projections of the Global Burden of Disease Unit of WHO. Costs of treating chronic diseases were obtained from WHO sources. Historical savings rates, depreciation, were obtained from the World Bank Development Index database.

For the base case estimated, proportion of cost of treating illness funded from savings was set at 10%. Region-specific elasticities of Y with respect to K were obtained from Senhadji (2). There was difficulty in obtaining data for capital accumulation in the Russian Federation; this was then set to the average of countries. All these variables were then subjected to sensitivity analysis.

## THE FULL-INCOME MODEL

The full-income (FI) approach captures the value of changes in population health in the assessment of “economic welfare” (3, 4). The welfare value of deaths or changes in life expectancy from disease, estimated through the Value of Statistical Life (VSL) (Value of a Life Year (VLY)) nexus is added to changes in annual GDP per capita. For example, if  $\Delta p$  = change in the probability of dying within a given period say 2005–2015, and  $VSL = 100$  times GDP per capita the welfare loss from mortality =  $(\Delta p \times 100) \times \text{GDP per capita} \times (\text{proportion of adults in the population})$ . Suppose  $\Delta p = 0.4\%$  and proportion of adults in pop = 50%, then welfare loss =  $0.4 \times \text{GDP} \times 0.5 = 20\%$  of GDP per capita. That is, GDP per capita would have been 20% of the actual GDP per capita. This would correspond to a rate of decrease in economic welfare due to mortality increase of 2% per annum. This approach, which may seem more complete than the previous approaches, does not account for the total value of the changes in health. It is, however, useful in that it demonstrates fuller returns to investment in health compared to the above approaches. Estimation should be of interest to country development strategists and policy-makers in the health and finance sectors, and also useful for international comparison.

## MODEL PROGRAMMING AND ELUCIDATION

Microsoft Excel was used to programme the relationships in the equations from 2002 to 2015. The model was programmed to compute output if there were no deaths due to chronic disease (the counterfactual) against output given the projected deaths from chronic disease on an annual basis. This procedure was then repeated for estimating the global goal of an additional 2% annual reduction in chronic disease death rates over and above baseline projections, over 10 years from 2006 to 2015.

All the variables in the Cobb-Douglas model were subjected to univariate and multivariate analysis (Monte Carlo) using Crystal Ball software.

1. Easterly W, Levine R. What have we learned from a decade of empirical research on growth? It's not factor accumulation: stylized facts and growth models. *World Bank Economic Review*, 2001, 15:177–219.
2. Senhadji A. Sources of economic growth: an extensive accounting exercise. IMF Institute, *IMF Staff Papers*, 2000, 47:129–158 (<http://www.imf.org/external/Pubs/FT/staffp/2000/00-01/pdf/senhadj.pdf>, accessed 2 August 2005).
3. Nordhaus WD. *The health of nations: the contribution of improved health to living standards*. New Haven, CT, Yale University, 2002 (Cowles Foundation Discussion Paper, No. 1355).
4. Usher D. An imputation to the measure of economic growth for changes in life expectancy. In: Moss M, ed. *The measurement of economic and social performance*. New York, NY, Columbia University Press, 1973:193–226.

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# 5 The WHO-CHOICE method

The CHOICE (**CHO**osing Interventions that are **Cost-Effective**) project was developed by WHO in 1998. The objective is to provide policy-makers with evidence on which to base decisions regarding interventions and programmes, given the need to provide the best health gains possible with available resources. WHO-CHOICE reports the costs and effects of a wide range of health interventions in 14 epidemiological sub-regions (world divisions made based on geographical location and epidemiological profiles). The results of these cost-effectiveness analyses are assembled in regional databases, which policy-makers can adapt to their specific country setting.

According to the cost-effectiveness results, interventions can be grouped into three categories:

COST-EFFECTIVENESS CATEGORY		DEFINITION
<b>Very cost-effective</b>		Interventions that avert each DALY at a cost less than gross domestic product per head.
<b>Cost-effective</b>		Interventions that avert each DALY at a cost between one and three times gross domestic product per head.
<b>Not cost-effective</b>		Interventions that avert each DALY at a cost higher than three times gross domestic product per head.

Interested readers can visit the WHO CHOICE web site at <http://www.who.int/choice> where the following information is available:

- » cost-effectiveness results of the interventions evaluated for the 14 world sub-regions;
- » a list of countries in the 14 sub-regions used for the WHO-CHOICE analysis;
- » downloadable background papers on the methodology and tools used in conducting the WHO-CHOICE cost-effectiveness analyses;
- » detailed region-specific demographic data and list of input variables, including prices and quantities, exchange rates, price multipliers and other key reference material for conducting cost-effectiveness analyses;
- » a brief description on the WHO guide to cost-effectiveness analysis (1), the theoretical and practical compendium on CHOICE methodology.

1. Tan Torres T, Baltussen RM, Adam T, Hutubessy RC, Acharya A, Evans DB et al. *Making choices in health: WHO guide to cost-effectiveness analysis*. Geneva, World Health Organization, 2003.

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Over 40 people with, or affected by, chronic disease were photographed and interviewed by a photojournalist in early 2005. Overall, this set of photographs and stories from five diverse countries demonstrates that chronic diseases are widespread in low and middle income countries and are an underappreciated source of poverty, requiring comprehensive and coordinated responses.

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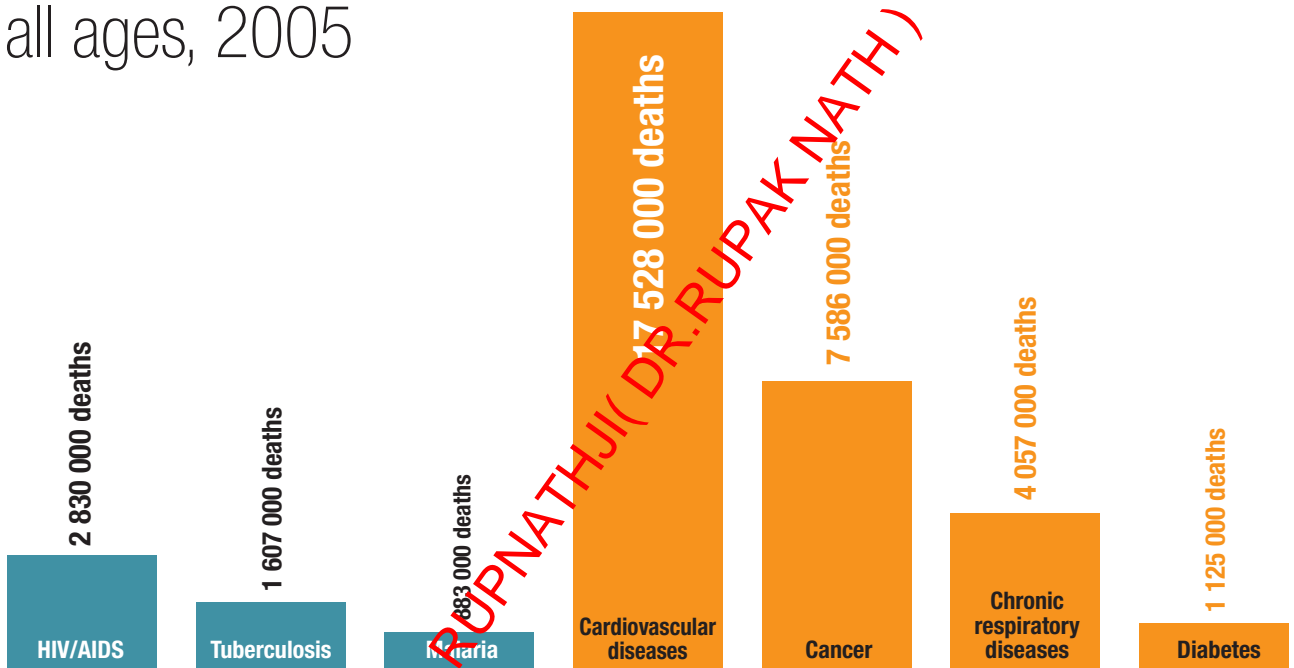
DR.RUPNATHJI( DR.RUPAK NATH )

Preventing  
**CHRONIC DISEASES**  
a vital investment



World Health  
Organization

**Projected global deaths by cause,**  
all ages, 2005



**35 000 000 people will die**  
**from chronic diseases in 2005**

**80%**

**of chronic disease deaths**  
**occur in low and middle**  
**income countries**