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The SuRF Report 2

Surveillance of chronic disease Risk Factors:

Country-level data and comparable estimates

World Health Organization

WORLD HEART FEDERATION®

SuRF

Surveillance of Risk Factors

The SuRF Report 2

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Risk
Factors:

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comparable estimates

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The SuRF Report 2

Surveillance of chronic disease Risk Factors:

Country-level data and comparable estimates

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WORLD HEART FEDERATION®

Contributors

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Contents

Figures

Tables

Preface

This report is the second in the Surveillance of Risk Factors Report Series (SuRF). It builds on the innovative display of country-level risk factor data in SuRF1 (published in May 2003). This report provides a much needed update for the eight major risk factors that cause diseases such as cardiovascular disease, cancers, diabetes and chronic respiratory diseases. In addition, it describes the methods used to calculate comparable, country-level estimates for two risk factors, overweight/obesity and systolic blood pressure. These estimates are used as inputs for calculating the disease burden at the country level. This document sets the standard for future work in this area.

SuRF1 introduced the WHO Global InfoBase, which assembles, with complete source and survey information, chronic disease risk factor data collected from WHO Member States. The production of SuRF2 is made possible by this growing data warehouse. In addition, the WHO Global InfoBase is being integrated at the regional level in the South-East Asia Region (SEAR) and is now being piloted at the country level in this same region. It is also expanding to include disease-specific modules, for example, stroke, diabetes, preventable blindness, asthma and allergies, and thalassemia. An on-line version of the Global InfoBase is now available. This website includes Country Profile pages which provide country specific information from the InfoBase and information on premature mortality and burden (as DALYs) caused by chronic disease in a user friendly format.

We know that the information presented here will be of use to all who are working to prevent and control the rising burden of chronic diseases worldwide.

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Noncommunicable Diseases and Mental Health

Summary

High quality health statistics are essential for planning and implementing health policy in all countries. This technical report, the Surveillance of Risk Factors Report 2 (SuRF2), describes the status of country-level, chronic, noncommunicable, disease risk factors and their contribution to the burden of chronic disease in populations. It presents for the first time:

– comparable country-level estimates for overweight/obesity, and systolic blood pressure;
– attributable mortality and burden from all causes of disease due to overweight/obesity and raised blood pressure for the 11 most populated countries;
– an introduction to the InfoBase on-line Country Profile pages found at http://infobase.who.int.

The methods used to produce the comparable estimates and attributable mortality and burden are also described in detail.

SuRF2 improves upon SuRF1's presentation of country-level chronic disease risk factor information in updated Country Profiles. The focus of the Country Profiles included in the report is on recent, nationally representative data.

– The risk factors included in this report are those that make the greatest contribution to mortality and morbidity from chronic disease, can be changed through primary interventions, and are easily measured in populations.
– Eight risk factors that relate mainly to cardiovascular disease and cancers fit this criteria: tobacco and alcohol use, patterns of physical inactivity, low fruit/vegetable intake, obesity (as measured by BMI), blood pressure, cholesterol and diabetes (as measured by blood glucose).
– Of principal importance to the data collection is the need to display prevalence data and (where possible) mean values for these eight risk factors by age group(s) and sex and with some measure of the uncertainty of the estimates for each Member country so that the data can be used for further analysis.

Chronic disease risk factor information included in the SuRF Report Series comes from a variety of sources, ranging from peer-reviewed journal articles to reports and unpublished data from Ministries of Health. All of this information is held in the WHO Global InfoBase which is designed as a single source for data needs. The Global InfoBase is a tool for collecting and displaying current country-level chronic disease risk factor data and is the source of the Country Profiles of risk factor data displayed in this report.

Introduction

Over 33 million people a year die from chronic (noncommunicable) diseases, including cardiovascular disease, cancers, diabetes and chronic respiratory diseases.

Furthermore, the demand placed by chronic diseases on national health systems is significant and increasing. Much of this burden can be averted by focusing prevention efforts on the key, causal risk factors of chronic disease. These are:
– tobacco use
– excessive alcohol consumption
– low fruit and vegetable intake
– obesity
– raised blood pressure
– raised cholesterol
– physical inactivity
– diabetes.

Preventing future disease and premature death requires a comprehensive response from governments and the health sector.

However, preventing future disease and premature death requires a comprehensive response from governments and the health sector combining surveillance, prevention, and management. To respond effectively, governments need good quality information from a reliable source about the status of chronic diseases and their associated risk factors at the country-level. The Surveillance of Risk Factors Report Series (SuRF) fills this gap by providing biennial, technical reports on country-level data for these eight risk factors. The first of these, SuRF1, produced in 2003, assembled country-level chronic disease risk factor data with complete source and survey information for the first time for WHO Member countries.

The SuRF Series is an on-going surveillance activity for the Department of Chronic Diseases and Health Promotion. The Series aims to:
– provide regularly updated Country Profiles on chronic disease risk factors
– use the collated data to produce comparable estimates for all eight risk factors
– report on the burden of disease attributed to these major chronic disease risk factors.

The country-level information presented in the SuRF Series comes from a larger data source, the WHO Global InfoBase, which collates and stores chronic disease data from WHO Member States in a single source for immediate use or further analysis.

SuRF2 – What's new?

SuRF2 – the second in this series of technical reports –updates the Country Profiles first presented in SuRF1 in 2003. While the Country Profiles presented in SuRF1 were informative, SuRF2 improves the usefulness of risk factor data for health policy action with the following additional features:
– comparable country-level estimates for overweight/obesity (as measured by body mass index, BMI), and systolic blood pressure (SBP);
– a brief description of the global burden of disease attributable to seven of the eight major chronic disease risk factors;
– attributable mortality and burden from all causes of disease due to overweight/obesity and raised blood pressure for the 11 most populated countries;
– an introduction to the InfoBase on-line Country Profile pages that make the data accessible via the internet.

The methods used to produce the comparable estimates and attributable mortality and burden are also described in detail.

The text of SuRF2 follows a format similar to that of SuRF1, presenting the user with an overview of the:
– data sources
– methods used to produce comparable estimates
– results of trend analysis for overweight/obesity and systolic blood pressure
– results of the attributable mortality and burden for 11 countries
– a vision for the future
– country risk factor profiles.

The Country Profiles are a major feature of SuRF2. The amount of information displayed in these profiles for each Member State necessitates the production of this report on CD-ROM. The CD-ROM format enables direct access to the data on a computer instead of an unwieldy paper copy. An added advantage of the CD-ROM presentation is that it makes the data more accessible, especially in countries where internet connectivity is limited. Each Country Profile displays the following information for the data (where available) of each Member State:
– all available recent risk factor data
– age-specific prevalence rates or mean values survey sample sizes
– 95% confidence intervals for total age groups (for each sex)
– risk factor definitions
– complete source information.

In many cases, study authors or Ministries of Health have been contacted for additional, unpublished information about their risk factor surveys. Notes attached to the source reference indicate where additional information has been provided and identifies the provider. Figure 1.1 shows the format of the Country Profiles with some basic explanatory text.

SuRF2 provides supporting information to further illustrate and explain the results of our analysis of the country-level data. These supporting documents are listed in the following appendices:
– a list of abbreviations used in the Country Profiles and throughout the text (Appendix 1);
– a glossary to explain frequently used terms (Appendix 2);
– tables showing status of current data for each Member country by WHO region (Appendix 3);
– maps of comparable data (overweight/obesity and systolic blood pressure) (Appendix 4);
– annex tables containing estimates and predictions from 2002 to 2010 for mean BMI, prevalence of overweight/obesity, and mean SBP (Appendix 4);
– additional information on statistical methods and calculations (Appendix 5).

The country level attributable mortality and burden estimates presented here for the first time are a significant addition to the regional estimates produced by WHO in the Comparative Risk Assessment project *(2)*. Future reports will focus on burden of disease estimates for the remaining six risk factors.

Producing the attributable mortality and burden estimates at the country-level provides policy makers with much-needed evidence on which to base advocacy for public health and disease prevention. The Country Profile pages provided by our on-line tool make important chronic disease and risk factor evidence easily available to all. In this way, the SuRF Series contributes to the impetus for governments to intervene early to curb the rising tide of preventable chronic diseases.

Figure 1.1

How to read the Country Profile reports

mean systolic blood pressure [1]

Survey Year(s): 2000 [2]

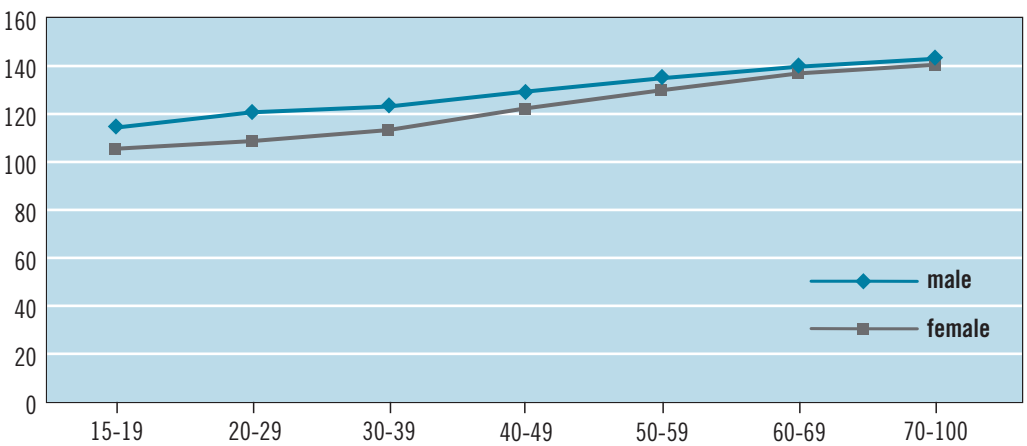
Survey Population: national, both urban and rural populations. [3]

Source: Ministry of Health et al. Kokumin-eiyou no Genjo: Heisei 12-nen Kokumin-eiyou chosa kekka (Results of National Nutrition Survey, 2000). 2002. [4]

Notes: [5]

	Age Groups [6]	n [7]	Mean [8]	±SD [9]
Definition: average of 2 measurements mmHg [10]				
Males	15-19	120	114.3	12.6
	20-29	235	120.7	11.8
	30-39	309	123.1	12.5
	40-49	357	129.3	15.3
	50-59	432	134.9	19.5
	60-69	443	139.7	18.3
	70+	268	143	19.7
	15+	2,164	131.6	18.7

Age specific rates [11]



How to read the tables

1. Risk factor name
2. Year(s) in which survey was conducted
3. Details of population surveyed
4. Complete source reference, including any personal communication
5. Additional survey information that helps to interpret data
6. Age groups as provided by survey
7. Survey sample sizes by specified age group
8. Prevalence/Mean values
9. 95%CI – (if not published, calculated by InfoBase team assuming a binomial distribution) or standard deviation provided for mean value
10. Exact definition of risk factor as presented in survey source
11. Associated graph, if available

Data Sources

Chronic disease-related information comes from many different sources depending on the structure of a country's health information system. As a result, finding this type of data can be difficult, time consuming and confusing. Furthermore, once data are identified, it is often difficult to determine their quality, especially if the source and survey methodology are unknown. There is a clear need for a comprehensive resource for country-level risk factor data. The SuRF Series provides this resource in a structured format.

The information reported in the Country Profiles and used in further analysis comes from the published literature, published or unpublished reports from Ministries of Health and National Statistical Agencies, and contacts with survey initiators. Most information is collected through WHO regional offices. Regional advisers check each Country Profile to ensure that the most recent information has been displayed. An overview of the sources of information provided by this technical report follows.

Chronic disease-related information comes from many different sources depending on the structure of a country's health information system.

Population data and average life expectancy

Each Country Profile is identified by the WHO official name of the Member State, the WHO region to which it belongs and general information about its population size and average life expectancy (Figure 2.1). Estimates of 2002 population size and age structure are based on the 2002 revision of the demographic assessments prepared by the United Nations Population Division *(3)*.

These estimates are for the de facto population (e.g. including guest workers and refugees) rather than the de jure population (e.g. citizens and, in some Member States, permanent residents). As a result, these estimates may differ from official country statistics. WHO uses a standard method to estimate and project life tables for all Member States *(1)*. This may lead to minor differences when compared to official life tables prepared by Member States. A 95% uncertainty interval is included for the average life expectancy estimates. These intervals take into account the uncertainty in the estimates due to sampling.

Figure 2.1

Population data and average life expectancy

	Male	Females
2002 Total Population	4,498,305	5,259,387
2020 Projected Population	4,836,000	5,121,000
2001 Average Life Expectancy (years) Uncertainty Interval	71.9 71.5 – 72.2	78.8 78.5 – 79.1

Figure 2.2

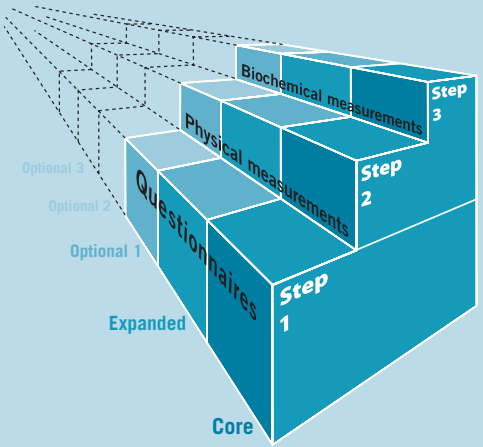
The WHO STEPwise approach to chronic disease surveillance

The conceptual framework offers a distinction between different levels of risk-factor assessment information by:

– questionnaire
– physical measurements
– blood samples.

and three modules offering different quantity of detail on each risk factor:

– core
– expanded core
– optional.



Statistical methods

Population prevalence or exposures to risk factors are displayed as age-specific rates in the SuRF Report. These were calculated by dividing the number of people exhibiting the risk factor of interest in each specified age group by the corresponding survey sample in the same age group. This rate was multiplied by 100 to give the per cent prevalence for particular age and sex groupings.

The age-specific prevalence rates presented in this report also show 95% confidence intervals. Some surveys and study authors provided the InfoBase team with these values from their own calculations. Where this was not possible, the InfoBase team estimated the confidence intervals, assuming a binomial distribution for the risk factor of interest in the specified age range. These estimations were done for the total age range in each sex provided by the study.

For some countries with national risk factor surveys, the age-specific prevalence rates from the survey are weighted to the estimates of the national population, either from a recent population census or from demographic models. If the national survey used a sampling frame with no systematic biases and good population coverage, these weighted prevalence values provide a reasonable estimate of national risk factor prevalence. In these cases, the SuRF Report provides the weighted national prevalence estimate along with the actual survey sample size in the Country Profiles. This presentation is noted in the accompanying text.

Risk factors

Risk factors are displayed following the order as outlined in the STEPwise approach to Surveillance of chronic disease risk factors *(4)*. STEPS is a sequential programme that focuses on building and strengthening country capacity for middle and low income countries to collect, on a periodic basis, small amounts of high quality risk factor data *(4)* (Figure 2.2). Step 1 is the collection of self-reported information about health behaviours, including tobacco use, alcohol consumption (heavy drinkers and abstainers), diet and

physical inactivity. Step 2 focuses on objective standardized physical measurements to collect data on blood pressure, height and weight. Finally, Step 3 collects blood samples to measure lipids (cholesterol) and glucose status (for diabetes).

The SuRF Report presents risk factors in accordance with the STEPwise approach to Surveillance of chronic disease risk factors (STEPS) protocol *(4)*. Key health behaviours collected in Step 1 are reported first, followed by obesity/BMI and raised blood pressure from Step 2, and finally, raised blood lipids and diabetes from Step 3. The order in each specific Country Profile depends on data availability. Many countries have limited data which may not cover all of the chronic disease risk factors included in this report. As a result, their risk factor profiles may be incomplete. However, countries with incomplete data have the opportunity to begin collecting standardized data using STEPS.

The Global InfoBase collates risk factor data coming from many disparate sources and in many different forms.

A database for SuRF Series information

WHO Global InfoBase

The risk factor data displayed by the SuRF Report Series come from the WHO Global InfoBase. The WHO Global InfoBase is a data framework that provides transparent, accessible and traceable information on chronic disease risk factors and that adheres to minimum quality standards for provision of source and survey methodology information. The InfoBase collects all current country-level data on important chronic disease risk factors for all WHO Member countries. There are many different survey instruments available for collecting data on health behaviours and physical measurements of risk exposure. Each instrument has advantages and limitations. The Global InfoBase collates risk factor data coming from many disparate sources and in many different forms. A unique feature of the InfoBase is that each record can be linked back to its source, a necessity when the collection of such data involves so many different protocols and definitions. The current version of the Global InfoBase contains over 150,000 data points from more than 5,000 sources and 9,500 surveys.

Regional InfoBases

All of the data presented in this report are a product of open collaboration with our counterparts in all of the WHO regional offices. The wide range of information collected could not have been realized at the global level without continuous feedback from regional offices and countries. Supporting Regional InfoBases ensures that we have the most up-to-date information on country-level chronic disease risk factors available. This structure is in place in the South-East Asia Region and may be implemented to support other regional offices, where necessary.

The SEAR InfoBase is now functioning out of the WHO Regional Office for South-East Asia (SEARO) and can be accessed on-line at http://w3.whosea.org/ncd/index1.asp. The SEAR InfoBase team is working closely with the health information systems of its 11 Member countries to build the best possible database of chronic disease risk factors in the region. The Global InfoBase team provides support to the SEAR InfoBase in the form of platform improvements, data transfer routines, quality assurance protocols and training. Nine countries in the South-East Asia Region have expressed an interest in the InfoBase and have developed proposals for hosting their own national InfoBases.

Modular design

The InfoBase has a modular design which allows it to collect a range of different data on chronic diseases, their risk factors and all the associated metadata while maintaining the basic InfoBase principles of "transparency, accessibility, and traceability". The current modules contain information on: stroke, oral health, tobacco and alcohol consumption, diabetes, nutrition, physical inactivity, blood pressure, cholesterol levels, and body mass index. These modules adhere to the same principles of data quality. This refers to a minimum set of both qualitative and quantitative factors that need to be captured for a specific data point to be useful. Qualitative factors relate to the methods by which the data were collected. Quantitative factors, if included, relate to statistical values associated with a data point. By including these fields, a user of the system can make a subjective judgment on the information within the system. This in effect allows users to impose a personal "quality filter" on the information they use in their health related interpretations or for further analysis.

The InfoBase promotes " transparency, accessibility, and traceability" of health information.

The InfoBase promotes "transparency, accessibility, and traceability" of health information. "Transparency" refers to the ability to easily access and work with data that are held within the InfoBase. "Accessibility" refers to the ability of all interested parties to easily contribute to, access and act on the information within the InfoBase. "Traceability" refers to the availability of an "audit trail" for all data entered into the InfoBase. The audit trail provides a resource with which a user can trace each data point within the system to the original source from which it came and also know the methods used to collect the data. The purpose of the audit trail is to allow a user to make expert judgments on the information they are accessing. Without an audit trail it would be impossible to know where a particular dataset came from or how it was collected and therefore to judge the merit of the collection for further analysis.

In order to achieve these objectives the InfoBase provides three basic services. These services are: data entry, data verification, and data analysis. The first step for the InfoBase is collating as much of the existing information that is currently available in various formats (published sources, electronic sources, personal communication, etc.) The second step is the verification process. Quality assurance protocols have been established to ensure that all data is entered correctly and completely. These protocols include second party data review to catch data entry and interpretation mistakes. Contact with original authors is made where clarification regarding collection of data or consistency of numbers is needed. The data analysis performed by the InfoBase team is detailed in the methods and results sections.

The Global InfoBase also has an on-line tool called the Chronic Disease Country Profile pages. The figures on the next pages (Figures 2.3 and 2.4) show the structure of the Country Profile pages and what you can expect to find if you access this information from our web site at http://infobase.who.int.

Figure 2.3

Entry point into the Country Profile pages

Why surveillance of chronic disease risk factors?

Surveillance is the cornerstone of disease control and prevention. It is defined as the ongoing (continuous or periodic) collection, analysis and interpretation of population health data and the timely dissemination of this data to users. Chronic disease risk factors are the focus of our surveillance activities because they are:

– among the leading causes of disease burden
– causally linked to disease outcomes
– modifiable
– relatively easy to measure in populations.

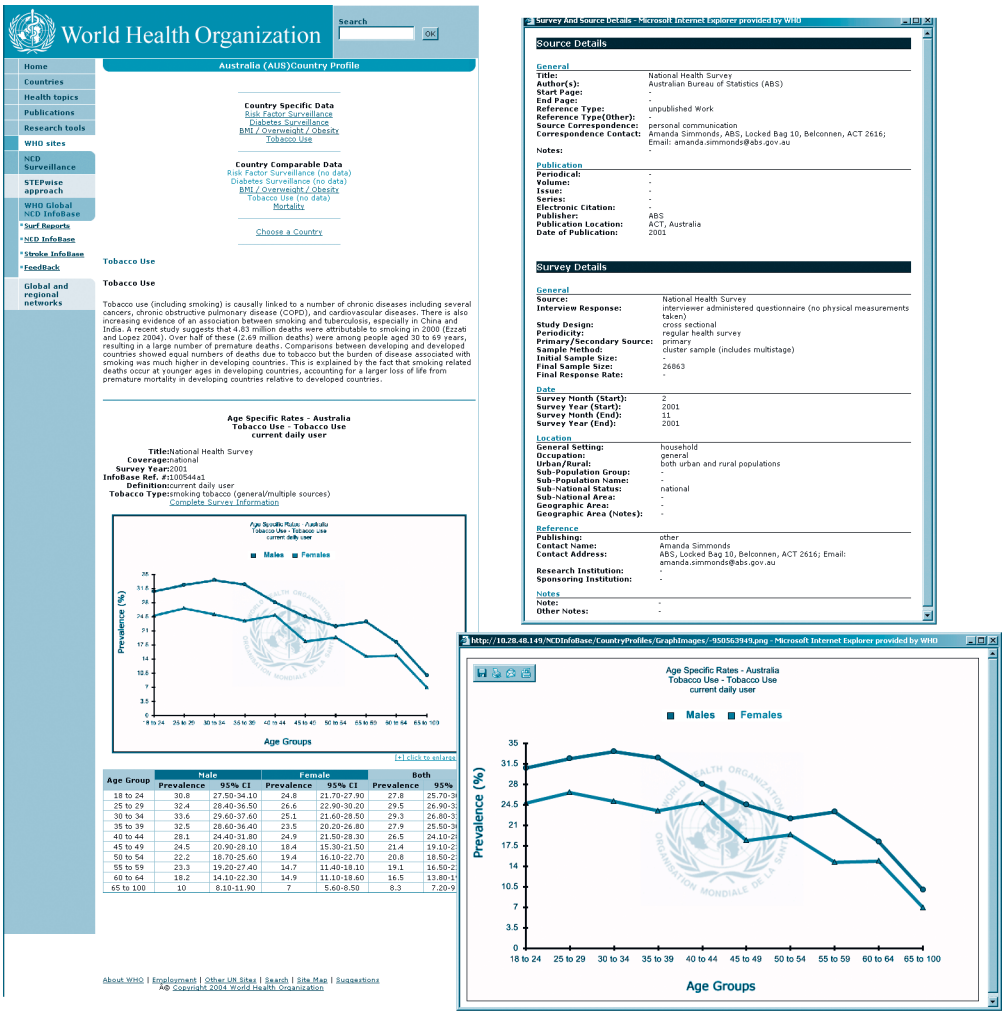
Because of the relatively long time frame between exposure to a causal agent and disease, monitoring and surveillance of specific chronic diseases such as heart disease, stroke, and cancer can be a costly exercise involving disease registries and legislation to ensure disease reporting. It also requires a greater understanding of population coverage, or population rates, than with communicable disease where emphasis is, of necessity, on cases. For this reason, most of the focus for surveillance of chronic disease involves the modifiable risk factors that predict disease.

Surveillance data need to be translated into prevention and control action. Information on the population distribution of risk for the major common risk factors is the key required by countries for planning primary prevention programmes and for the evaluation of their success. To make the data useful for action, it is helpful if the standardized collection methods allow for data to be compared, not only through time but across countries. For this to be done, it is essential that the sources of and methods for collecting data be well documented.

The focus for surveillance of chronic disease involves the modifiable risk factors that predict disease.

Figure 2.4

Preview of country specific information available on the Country Profile pages



WHO's response to addressing the gaps in risk factor data

The need for comparable data is being followed up at WHO with four main survey instruments for chronic disease risk factors. These are the STEPwise approach to chronic disease risk factor Surveillance (STEPS), the Global Youth Tobacco Survey (GYTS), the Global School-Based Student Health Survey (GSHS), and the World Health Survey (WHS). The World Health Survey risk factor module and the STEPS survey instrument share a common set of indicators at Step 1 (health behaviours) as well as standardized measurement methods for those indicators. Valid data are produced by using validated and standard measurements methods, the best possible sampling strategies and common training of field staff.

The use of these survey tools allows for surveillance in a greater number of country settings over a short period of time while still producing data using the same definitions and in standard age groups to enhance comparability.

Methods

The major limitation of the data presented in SuRF Series Country Profiles is that they are often not comparable across surveys. This is generally the case for survey data from different countries. However, even within a country, when trend data are available, the data may not be comparable. Part of the problem is the use of different survey instruments, different measurement methods and different criteria for a clinical outcome (i.e. diabetic or hypertensive). An additional problem occurs with variables that change in a consistent way with some other covariate, such as age. For example, systolic blood pressure increases with age in most populations *(1)*. As a result, prevalence values for raised blood pressure can be over or under-reported, depending on the survey start and end ages.

This section explains how SuRF2 has dealt with these problems in producing comparable country-level data for overweight/obesity and systolic blood pressure. The comparable estimates for these risk factors are further used as inputs for the calculation of attributable mortality and burden caused by overweight/obesity and raised blood pressure. The reasons for the data adjustments used to produce the estimates are outlined below. Further information on calculation methods can be found in Appendix 5.

The major limitation of the data presented in SuRF Series Country Profiles is that they are often not comparable across surveys.

Measuring risk in populations

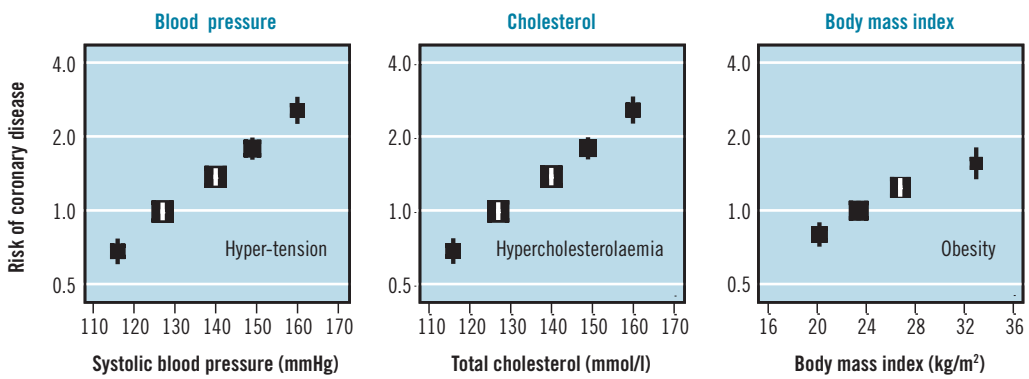
Preventing disease and injury requires systematic assessment and reduction of their causes – the health risks which underlie them. Good quality health risk factor data are essential to improving the evidence-base for allocation of resources to address the rising burden of chronic diseases. There are two broad approaches to reducing risk:

– to focus an intervention on the people most likely to benefit from it;
– to seek to reduce risks in the entire population, regardless of each individual's risk and potential benefit.

In reality, for most diseases, the minority of people at high risk are not a distinct group but part of a continuum in the population across which risk increases. Therefore a large number of people exposed to a small risk may generate many more cases than a small number exposed to a high risk. For example, people with slightly raised blood pressure suffer more cardiovascular events in total than the few with hypertension (Figure 3.1).

Figure 3.1

Risk of coronary heart disease increasing with exposure to risk factors



Focusing on high-risk individuals will deal only with the margin of the problem and make no impact on the high proportion of the disease occurring in the large proportion of the population at moderate risk *(5)*. In general, population-wide interventions have the greatest potential for prevention, though this is yet to be fully realized: the high-risk approach may instinctively appear more appropriate to the individuals concerned and their physicians, but it does not alter the underlying causes of the illness and requires continuous and expensive screening *(6)*. Preventive strategies, targeting the whole population, aim to encourage healthier behaviours and thus reduce exposure to risk.

Preventive strategies, targeting the whole population, aim to encourage healthier behaviours and thus reduce exposure to risk.

WHO uses a population-based approach to risk and prevention *(1)*. For this reason, the SuRF Series includes, whenever possible, data on the population distribution of risk factors which are continuous rather than categorical. These are systolic blood pressure, BMI, total blood cholesterol and blood glucose. These distributions are presented here in terms of mean values and standard deviations (SD).

Comparable country-level estimates of risk factor levels

Identifying country-level data and assessing its validity is the first step in developing better quality chronic disease data collections. Country-level risk factor prevalence profiles help to identify a country's strengths in risk factor data collection and also its gaps and deficiencies *(7)*. Our objective is to use the available country-level chronic disease risk factor data in a transparent way to produce comparable, country-level estimates. These are then further used as one set of inputs (the others being cause-specific mortality, DALYs, and relative risk of disease with risk factor exposure) into calculating the mortality and burden of disease attributable to these risk factors (see Attributable mortality and burden section on page 26 and Appendix 5).

Risk factor data can be compared across time periods within a country as well as between countries. By making these comparisons information users can:
– assess the current situation
– see what is working in chronic disease and risk factor prevention
– identify priorities for policy interventions to address situations that show rising levels of risk.

Adjustments made for comparable estimates

In order to make the data comparable they need to be adjusted for the following factors:
– risk factor definition
– a standard set of age groups for reporting
– a standard reporting year
– nationally representative population.

Only when all adjustments are made will the country-level data be considered comparable, as detailed in the following sections.

Standardizing survey definitions

One of the most important steps in adjusting survey data for comparability is to decide on a standard definition or measurement type that should be used consistently for collecting this information. Ideally this would be done prior to data collection. However, this is not always possible as our understanding of measurement issues is constantly changing with new evidence and survey experience, and new survey methods will always be developed. Using a preferred definition and mapping algorithms for other useable definitions, existing

surveys can be combined in a logical and consistent way. Subsequently, the data are able to be displayed in a standard way.

Questions on tobacco use are one of the most discussed topics when it comes to producing survey instruments to measure chronic disease risk factors. There are many different definitions used by many different survey instruments. All ask a relatively straightforward question about tobacco use but in slightly different ways. The most common designations include:

– current daily smoker (including definitions of "at least one cigarette per day")
– smoker
– regular smoker
– user of some form of tobacco (including multiple sources).

Most surveys specify the meaning of "smoker" and "regular smoker" but often this is not reported. One of the ways in which we have dealt with this problem is to decide from the start what the quantity of interest will be for the analysis. Two broad choices are available:

– smoker (of cigarettes and other tobacco related products)
– tobacco user (including chewers, smokers and snuff users).

Obviously, the prevalence values for these categories will be different with the tobacco users having a higher prevalence than smokers, worldwide (and in certain regions). As long as we are specific about what we are reporting, we can produce good estimates of the quantity of interest.

Setting standards for data definitions: The example of overweight and obesity

The global epidemic of overweight and obesity is a major public health problem prevalent in both high and low income countries affecting children and adults alike.

In recent years, there has been a growing debate on whether there is a need for recommending different BMI cut-off points for different ethnic groups due to the increasing evidence that the associations between BMI, percentage of body fat, and body fat distribution differ across populations and therefore, the health risks increase below the cut-off point of 25 kg/m^2 that currently defines overweight in the current WHO BMI classification (Table 3.1) *(9, 25)*.

The evidence was reviewed at a WHO Expert Consultation, Singapore, 8-11 July 2002 *(26)*. The Consultation concluded that the proportion of Asian people with a high risk of type 2 diabetes and cardiovascular disease is substantial at BMI's lower than the existing WHO cut-off point for overweight (≥25 kg/m^2). However, the cut-off point for observed risk varies from 22 kg/m^2 to 25 kg/m^2 in different Asian populations and for high risk, it varies from 26 kg/m^2 to 31 kg/m^2. The Consultation, therefore, recommended that the current WHO BMI cut-off points (Table 3.1) be retained as the principal classification system *(27)*. It was further recommended that an additional four BMI cut-off points (23, 27.5, 32.5 and 37.5 kg/m^2) be included for public health action as well as for reporting purposes to facilitate international comparisons *(27)*. A further review and assessment of available data on the relationships between waist circumference and morbidity and the interaction between BMI, waist circumference, and health risk are currently being undertaken by a WHO expert working group in the Department of Nutrition for Health and Development.

Table 3.1

WHO classification of adult underweight, overweight, and obesity according to BMI including additional cut-off points recommended by the WHO Expert Consultation

Classification	BMI (kg/m^2) Principal cut-off points	BMI (kg/m^2) Additional cut-off points
Underweight	**<18.50**	**<18.50**
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 – 16.99	16.00 – 16.99
Mild thinness	17.00 – 18.49	17.00 – 18.49
Normal range	**18.50 – 24.99**	18.50 – 22.99 23.00 – 24.99
Overweight	**≥25.00**	**≥25.00**
Pre-obese	25.00 – 29.99	25.00 – 27.49 27.50 – 29.99
Obese	**≥30.00**	**≥30.00**
Obese class I	30.00 – 34-99	30.00 – 32.49 32.50 – 34.99
Obese class II	35.00 – 39.99	35.00 – 37.49 37.50 – 39.99
Obese class III	≥40.00	≥40.00

Source: Adapted from WHO, 1995, WHO, 2000 and WHO, 2004

WHO advocates that countries report available national and sub-national adult BMI data providing, where feasible and when sample sizes allow, the 12 cut-off point BMI classification system (as outlined in table 3.1). This will enable enhanced global monitoring and prediction of the magnitude of the overweight and obesity epidemic. It will also assist in undertaking more effective situational analysis of national nutrition problems through providing supportive evidence that can be used to inform and trigger policy action, for targeting prevention programs, and to measure the effectiveness of specific interventions.

The start and end age of each survey instrument affects the prevalence or mean value that is reported.

Standardizing age groupings

All eight of the risk factors in this report show very strong associations with age. Mostly, the age-specific rates show similar patterns for each set of country-level data. This is very positive because it means that there is a consistent pattern between the risk factor variable and age, within and between countries. However, it also means that the start and end age of each survey instrument affects the prevalence or mean value that is reported. We can see this clearly using tobacco use as an example. Tobacco use increases dramatically from teens to early 20's, but then declines with age in most populations. Including younger ages and excluding older ages in a population survey will produce a higher prevalence of tobacco use compared with a value obtained from a survey of only those aged over 30 years. Thus the prevalence of tobacco use is dependent on the ages included in the survey.

Therefore, if we are to compare two surveys of tobacco use, we must adjust for this difference by creating a standard set of age categories for reporting the data. We can estimate age categories missing from current surveys by using a least-squares weighted regression technique. In some cases, regional age-specific patterns can be used to fill out age groups.

The values in each of the estimated age categories are based upon the empirical data collected by the study as well as the age-specific patterns for the country or region.

Standardizing survey year

Different Member countries collect chronic disease risk factor data at different times. As a result, data are available from many different survey years, often spanning several decades. We know from good quality empirical studies *(8)* that the eight risk factors are changing at different rates over different decades, making it difficult to compare surveys, even using the same survey instrument at different points in time. Ideally, we would have comparable data from all countries for the most recent year but when we do not, we must project our most current information to a standard year. We make these projections using country-level trend data, where available. Where information about changes over time is unavailable, we apply a regional average trend, based on the 17 epidemiological subregions used for the global burden of disease analysis *(1,9)*.

Working with non-nationally representative data

Some surveys are conducted so that the data obtained from a random sample reflects the entire country's population. Such nationally representative data provide an excellent basis for monitoring and evaluation of the population risk factor status over time. However, data come from many different types of surveys, and often only from specific populations of interest (i.e. urban or a specific ethnic group) sampled for research purposes. In addition, for some countries with very large geographically disparate populations, such as China, India and Brazil, having a truly national survey of chronic disease risk factors is logistically difficult.

Since not much data on chronic disease risk factors exists, especially from low and middle income countries, all the available data should be used. Every piece of information is used to develop a national picture of a country's risk factor status. Combining the UN Population Division's country-level demographic data with age-specific population distributions in rural and urban designations is one way to use existing data to produce a national estimate for a chronic disease risk factor. The most important analysis issue for making these adjustments is to be consistent across countries in the way in which the population data (or other covariates, where appropriate) are applied to the sub-national data.

Every piece of information is used to develop a national picture of a country's risk factor status.

Levels of evidence

Conceptually (and analytically), making the abovementioned four data adjustments is not a complicated process, but a time consuming one. The outcome relative to existing country-level data depends on the amount of information available at the country level. Countries that routinely collect data on chronic disease risk factors with nationally representative health surveys are well on their way to having useable risk factor information with adjustments making very little difference to their country-estimated value. However, countries with "one-off" surveys of non-nationally representative sub-populations need more adjustment and a nationally representative estimate made in these situations is associated with much greater uncertainty.

The best possible estimate of chronic disease risk factors and chronic disease levels is dependent on the quality of data available for any given country. When we access the available country-level data, we by necessity make decisions about the "quality" of a given

dataset. This assessment is based on what we know about the design and implementation of the survey, which is why we include this type of metadata in the WHO Global InfoBase.

When talking about "quality" of data, in this publication we refer to how much we know about the biases inherent in the collected survey data. All health statistics have some level of bias associated with them and though we try to minimize bias as much as possible, it is unrealistic and unnecessary to expect that we can create an estimate that is unbiased and has no uncertainty for any given population.

The classification of levels of evidence detailed in table 3.2 *(10)* is a helpful starting point for describing the types of data that we find on chronic disease risk factors, whether from published or unpublished sources. We can use the eight categories separated in the table by levels of evidence and dimension in time to develop a standard and consistent way of estimating risk factor prevalence or mean values from country-level data.

Table 3.2

A hierarchy of evidence related to population health *(10)*.

	Dimension in time		
		Data available for time period of interest	Data available for earlier time period
Level of evidence		a	b
1	Direct, unbiased estimates available for population of interest	Evidence based on synthesis of available measurements	Evidence for earlier time period projected forward in time using trend information
2	Direct, biased estimates available for population of interest	Evidence based on synthesis of measurements adjusted for bias	Evidence for earlier time period (adjusted for bias) projected forward in time using trend information
3	Partial, direct data available for population of interest	Partial data corrected for known biases and supplemented by evidence available for other similar populations	Partial and other evidence used together with model to project forward to period of interest
4	Direct data not available for population of interest but information on covariates and evidence of their association is available	Evidence based on observed relationship between measured covariates and quantity of interest	Evidence based on observed relationship between measured covariates and quantity of interest and projected forward to time period of interest

Level 1 (a and b)

Level 1 data represent measured risk factor data collected through nationally representative population-based surveys. Countries which carry out regular health surveys which measure height, weight, blood pressure, and total cholesterol have data that approximate this highest level of evidence.

To satisfy our need for a standard set of survey years for country-comparable data, most of the level 1 information reported in this report falls into category b. We have used unbiased (measured) population data from national health surveys and projected this forward for the years 2005 and 2010 using a model of time trends developed from country-level or regional-level risk factor specific trend data.

Level 2 (a and b)

Self-report (unmeasured) risk factor data are an example of level 2 evidence. These data are often from national health surveys where the extra expense of collecting measurements has not been made.

For body mass index, there is an extensive literature on the association between measured and self-report height and weight and the bias inherent in using self-report to estimate population level mean BMI or overweight/obesity prevalence *(48-62)*. In this case, the difference between measured and self-report data differ from one country/region to the next. Where these differences are well documented, an adjustment factor can be calculated to allow the use of self-reported BMI data in the estimation of a comparable, national mean BMI. This is useful because it allows more data to be included in the estimation process.

For other traditionally measured risk factor variables, such as systolic blood pressure, total cholesterol or blood glucose levels, self-report of raised levels of these risk factors is a poor substitute for the measured variable. This type of data, difficult to obtain at the best of times, cannot be used unless measurements are made. For countries where no measured data exist for these risk factors, comparable estimates were not made.

Level 3 (a and b)

Direct data from sub-population samples are examples of level 3 evidence. A good example of this type of information comes from Demographic and Health Surveys (run by Macro International in conjunction with Ministries of Health). These are samples of women of reproductive years (aged 15 to 49), often with children under the age of 5 years. Measured height and weight data exist for these (often nationally representative for the age class) samples and some surveys also ask about tobacco use. This partial data can be adjusted for known biases and supplemented by additional country-level or regional-level data to produce a comparable estimate of a risk factor for females and males.

Level 4 (a and b)

Obviously, not having direct data is a serious limitation to the production of comparable estimates. The opportunities to collect relevant data need to be explored in this case. Nonetheless, if good information on covariates and their association with the risk factor of interest exist, these can be used to create a reasonable but uncertain estimate, pending the availability of better national data. A good example of this level of evidence is the use of the covariate gross domestic product (GDP) to estimate mean BMI. GDP is closely associated with BMI; a country with high GDP has a higher population mean BMI and a country with low GDP has a lower mean BMI. This association is stable across regions and can be used to grossly estimate mean BMI where no or little data exist. Of course, such estimates will have greater uncertainty than for the other levels of evidence.

Attributable mortality and burden

WHO has recently published the methods and results for a comprehensive assessment of the global and regional mortality and burden of disease attributable to 26 risk factors, including seven of the eight addressed by this report *(2)*. This study, known as the Comparative Risk Assessment (CRA) project, used mortality and other inputs for the year 2000.

One of the long term goals of the Surveillance and Information for Policy Unit is to provide a set of consistent and transparent inputs into the development of the attributable and avoidable burden calculations for eight chronic disease risk factors at the country-level. SuRF2 presents country-level estimates for two risk factors, overweight/obesity and systolic blood pressure and these estimates are used to calculate the deaths and disease burden attributable to these two risk factors in the year 2002. Results for 11 of the world's most populated countries are presented in this report (Appendix 5 and Tables 4.1-4.4).

Why use a summary measure of population health?

Policy makers face the challenge of responding to current disease prevention and control priorities while also facing the responsibility of predicting future priorities. These decisions should be based on good evidence. An important part of such evidence is information on the loss of health at the population level which is attributable to diseases and risk factors *(12)*. Ideally, a summary measure for quantifying the loss of health at the population level would have the following attributes:

– combine health loss due to mortality and non-fatal health outcomes
– include all disease and injury outcomes in an internally consistent way
– use a common unit of measurement for all diseases, injuries, and risk factors.

This type of summary measure serves as a common currency for reporting on the burden of disease in populations. It facilitates monitoring and evaluation of population health so that appropriate prevention and control actions can be identified and put into place.

The most widely used summary measure with these properties is the Disability Adjusted Life Year (or DALY). The DALY combines the number of years of healthy life lost to premature mortality and to time spent in less than full health. DALYs have been used to guide World Bank investment policies for health and to inform global priority setting for health research and international health programmes *(11)*. Over the last few years, WHO has published global and regional estimates of the global burden of disease (GBD) measured in DALYs for the years 2000-2002.

Disability Adjusted Life Years (DALYs)

The Disability Adjusted Life Year or DALY is a health gap measure that extends the concept of potential years of life lost due to premature death (PYLL) to include equivalent years of 'healthy' life lost by virtue of being in states of poor health or disability *(13)*. The DALY combines in one measure the time lived with disability and the time lost due to premature mortality. One DALY can be thought of as one lost year of 'healthy' life and the burden of disease as a measurement of the gap between current health status and an ideal situation where everyone lives into old age free of disease and disability.

DALYs for a disease or health condition are calculated as the sum of the years of life lost due to premature mortality (YLL) in the population and the years lost due to disability (YLD) for incident cases of the health condition. YLL are calculated from the number of deaths at each age multiplied by a global standard life expectancy for the age at which death occurs. To estimate YLD for a particular cause in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead). The weights used in the GBD 2000 are listed in detail elsewhere *(14)*.

Additionally, 3% time discounting and non-uniform age weights which give less weight to years lived at young and older ages are used in calculating standard DALYs as reported in recent World Health Reports *(15)*. With age weights and discounting, a death in infancy corresponds to 33 DALYs, and deaths at ages 5 to 20 to around 36 DALYs. Thus a disease burden of 3,300 DALYs in a population would be the equivalent of 100 infant deaths or to approximately 5,500 persons aged 50 years living one year with blindness (disability weight 0.6).

Estimating attributable mortality and burden

The burden of disease attributable to a health risk can be estimated if the prevalence of exposure to the risk factor in the community and the relative risk of each causally associated disease for those exposed to the risk factor is known. The proportions of current disease burden attributable to current and past exposure to a risk factor is referred to as the population attributable fraction (PAF). Alternatively, one could estimate the proportion of the current disease burden that could be prevented in the future if exposure to a risk factor was eliminated. This avoidable burden is most relevant to the analysis of potential public health interventions but it requires a projection model that predicts the future disease burden under the current projected risk exposures and under an alternative hypothetical or "counterfactual" scenario of reduced risk exposure (Figure 3.2). In this report, we focus on the attributable mortality and disease burden in 2002 due to past and current exposure to risk factors. These estimates provide an indication of the overall potential for improving health through reducing risk exposures.

The attributable mortality (or burden) associated with exposure to a risk factor can only be calculated by comparing the current mortality with that which would have occurred under a counterfactual scenario in which current and past exposure to the risk factor had been reduced to a theoretical minimum. That minimum may be "zero" (i.e. no tobacco use) for risk factors such as smoking, but for continuously distributed risk factors such as blood pressure and body mass index where zero exposure is not possible, a theoretical minimum exposure distribution was defined in terms of the levels associated with lowest risk that have been observed in some population or epidemiological studies *(2, 83)*. Use of the theoretical minimum exposure distribution as the counterfactual has the advantage of providing some idea of the maximum possible potential gains in population health by reducing all

levels of sub-optimal exposure to risks. In practice, available cost-effective interventions and other societal constraints may only allow partial achievement of this potential.

Whereas it is possible for some risk factors such as occupational injuries or motor vehicle deaths due to alcohol to categorically assign specific deaths to specific risk exposures, this is not generally possible for diseases where there are generally multiple causes, some risk factors act through others, or interact to increase risk, and some disease occurs even in non-exposed population groups. Thus, for most risk exposures, and particularly for the chronic disease risk factors considered in this report, it is only possible to attribute a proportion of deaths or burden to a risk factor through the comparison with a counterfactual scenario described above. However, this means that population attributable fractions for multiple risk factors for the same disease can add to more than 100%. Thus some cardiovascular disease deaths may be due to a combination of smoking and physical inactivity, the latter also acting partly through obesity, cholesterol and blood pressure. Some deaths may thus be correctly attributed to more than one of these risk factors.

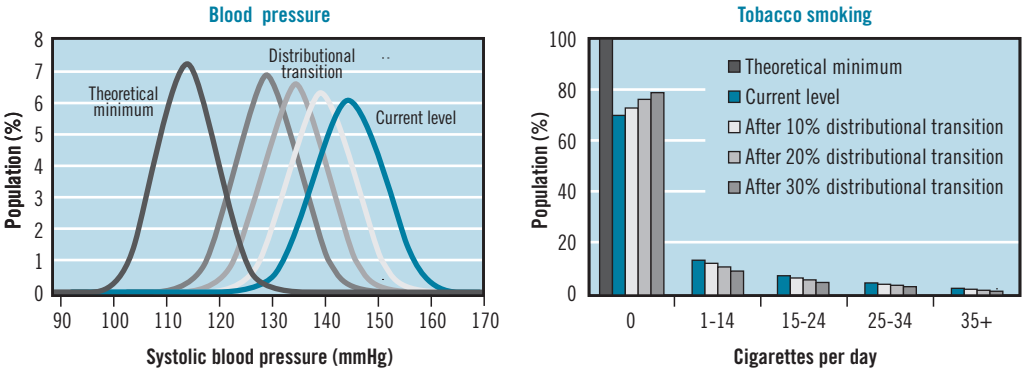
The Comparative Risk Assessment project carried out an analysis of the joint effects of cardiovascular risk factors and estimated that the risk factors considered in this report, together accounted for around 70 to 80% of ischaemic heart disease and stroke *(82)*. The CRA study estimated that globally almost 50% of premature deaths and 40% of disease burden were attributable to the joint effects of 20 leading risk factors, including chronic disease risk factors and other risk factors such as unsafe sex, malnutrition and poor water and sanitation.

Whenever possible, the relative risks used in the CRA analyses were derived from studies which control for the effect of other confounding risk factors, so they capture the causal contribution of the risk factor. However, it is unlikely that these studies can control for all of the complexities of the interaction between risk factors. Nonetheless, despite these limitations the attributable DALY estimates represent a useful measure of the size of the health problem presented by these risk factors, and of the potential for health gain through modification of risk exposures.

Comparable country-level risk factor data for overweight/obesity and mean systolic blood pressure were used in conjunction with previously reported relative risk data *(1)* and mortality data estimated to 2002. We calculated the attributable mortality and burden associated

Figure 3.2

Examples of distributional transition towards a counterfactual (alternative) exposure used to measure the burden of diseases caused by raised blood pressure or tobacco use



Source: The world health report, 2002. Geneva, Switzerland.

with raised blood pressure and raised BMI using the counterfactual exposures at the theoretical minimum of 115 mmHg (SD 6) for systolic blood pressure and a BMI of 21 kg/m^2 (SD 1). Standard WHO global burden of disease age groups were chosen (15-24, 25-44, 45-59, 60-69, 70-79, and 80+ years) for consistency with other global and regional estimates. The methodology involved calculating population attributable risk. These measures estimate the proportional reduction in disease burden resulting from a specific change in the distribution of a risk factor. The inputs required are:

– population distribution of risk factor of interest
– counterfactual distribution of risk factor of interest
– risk factor disease association (relative risk)
– disease burden.

See Appendix 5 for more information on calculations and statistical methods.

Results

This section focuses on describing what is known about the relationship between our risk factors and disease outcomes. First, we present a summary of the patterns, including trends, in our comparable country-level estimates for BMI and systolic blood pressure. Next, we present attributable mortality and burden (in DALYs) due to our selected risk factors at the global level as estimated using the methods developed by the Comparative Risk Assessment project led by WHO in 2001-2002 *(2)*. These results were reported in the World Health Report 2002 at the regional level. Next, we show the results obtained when these methods were applied at the country-level using updated information on risk factor exposure at the country-level, together with revised country-level estimates of the burden of disease for the year 2002.

We present, for the first time, our estimates for BMI and systolic blood pressure.

Producing comparable country-level estimates for 192 Member States is a tremendous effort, especially because risk factor data are not available for all countries and where they do exist, they are often of uncertain quality. After one and a half years of this effort, we present, for the first time, our estimates for BMI and systolic blood pressure. Calculations are currently being finalised for the remaining six risk factors and comparable estimates are being generated for all countries. The results of this on-going analysis will be published in future SuRF Report Series.

Reliable, country-level information on the prevalence of risk factors for chronic disease can help countries avoid the predicted high burden of these diseases through timely population-level interventions. Unfortunately, country-level data on common, measurable chronic disease risk factors are not always readily available in a user-friendly format. This deficit, now addressed by the SuRF Report Series, has hindered efforts to combat the emerging epidemics of chronic diseases in low and middle income countries. Prevention and control of these diseases requires knowledge about trends in the population distribution of major risk factors (e.g. tobacco use, physical inactivity, obesity) to promote and evaluate the desired changes and risk reductions. Surveillance can also provide useful information to identify populations at greatest risk where prompt interventions may help most. SuRF2 takes the first steps towards increasing awareness of trends in population distributions of overweight/obesity and systolic blood pressure by using the data collated in the WHO Global InfoBase to produce comparable, country-level estimates. These estimates highlight the current and future prevention and control needs of low and middle income countries in combating chronic disease.

Country-level comparable estimates of risk factors

The data presented in this section represent the first attempt to produce comparable country-level estimates of BMI and systolic blood pressure and to examine the country-level trends for these risk factors. In addition, estimates of the burden of disease attributable to these risk factors at the country-level were made. This work is an extension of the CRA project which focused on global and regional estimates of mortality and burden associated with disease risk factors.

Appendix 4 presents the results of our analysis by total age group, sex and country for the years 2002, 2005 and 2010. The following sections describe what is currently known about country-level and regional trends in BMI and mean systolic blood pressure. This trend information was used to produce comparable country-level estimates of BMI and systolic blood pressure for 2002 and to project them to 2005 and 2010.

Trends in body mass index (BMI) by WHO region

Region of the Americas

Where trend data are available for the region of the Americas, they show an increasing rate of obesity (Figure 4.1). Our analysis of obesity patterns in this region contained data from 75 surveys and 21 countries. We have relied on Demographic and Health Survey (DHS; Macro International) data from all regions of the world to do our analysis. Even though BMI data from the DHS source are limited to women of reproductive age (15-49 years), and often to mothers of children under the age of 5, it remains the most consistent source of data on temporal changes in obesity rates in developing countries.

The obesity epidemic in the United States of America is well documented *(34-36)* and the pattern of increasing obesity rates extends to its North American neighbour, Canada *(37-39)*. Intriguingly, Central and Latin America follow a similar pattern of rising obesity rates as demonstrated by Monteiro for Brazil *(40)* over the last two decades. In addition, Martorell has demonstrated a similar trend for women in several Latin American countries using data from DHS as well as other reproductive health surveys covering similar populations *(41)*.

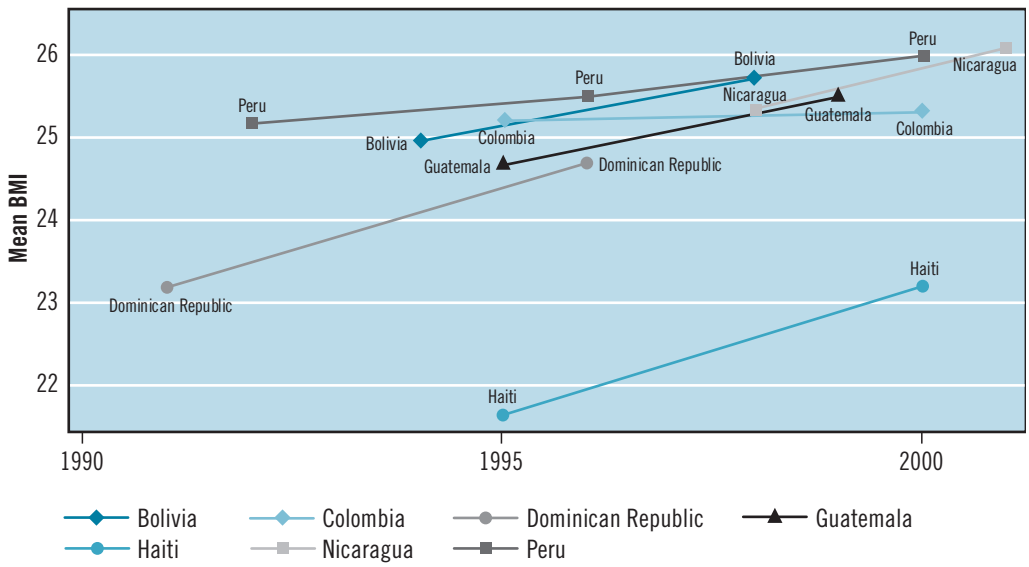
African Region

No substantial source has been published to date that describes trend patterns for overweight and obesity in the African region. DHS data were again a major source of information on height and weight for this region. Other than DHS, the Seychelles is the only country in the region that has survey-based trend information for overweight/obesity *(42)*. Unfortunately, this is the only country with data for males.

Out of 14 countries with available trend information (13 of which is DHS), three countries (Burkina Faso, Kenya and Zambia) have shown decreasing mean BMI scores. Eight countries (Eritrea, Côte d'Ivoire, Ghana, Niger, Malawi, the United Republic of Tanzania, Uganda and Zimbabwe) show a slight increase in mean BMI over time. Benin, Mali and Seychelles show an increase that matches that of North America.

Figure 4.1

Graph of DHS, AMRO female BMI trends



The African continent is large and culturally diverse. With 46 countries in the WHO African Region and BMI trend information on only 14, we do not have enough information to make definitive predictions about the status of this risk factor in all populations. Moreover existing trend information is concentrated in Western and Eastern Africa. There is a lack of trend information for many areas in Central Africa. The predictions shown in Appendix 4 are associated with great uncertainty and await new data for further development.

Currently the African region shows a low prevalence of obesity. However, rapid urbanization on this continent paints an alarming picture for the future. As illustrated in some published literature *(43, 44)* as well as the results of DHS, urban areas have higher mean BMI (and therefore higher prevalence of obesity) compared to rural areas. As more people move from rural areas into urban areas, it is possible for obesity rates to increase within a short period of time, leading potentially to a higher prevalence of heart disease and diabetes in this region.

Currently the African region shows a low prevalence of obesity.

Eastern Mediterranean Region

The data on BMI for males in this region are inconclusive, although there is some literature describing the nutrition transition in Egypt *(45)*, Morocco *(46)*, and the Islamic Republic of Iran *(47)*. For males we are unable to draw any conclusion for overall regional trend from what is available in the InfoBase. Data from the Islamic Republic of Iran and Kuwait show no change over time. For Saudi Arabia BMI is increasing over time.

Females in this region already have a high prevalence of obesity and this seems to be increasing for Kuwait, Egypt, the Islamic Republic of Iran and the United Arab Emirates. Jordan shows trend towards a lower prevalence of obesity, and a new DHS from Egypt shows the rate of increase of obesity in this country is slowing down.

European Region

Many national governments regularly collect data on height and weight through national health interview or examination surveys. Data from these survey instruments represent good quality information on overweight and obesity, including good trend analyses for countries in the European Region.

Health interview surveys provide self-reported data for height and weight that have known biases *(48-62)*. The extent of this bias differs from country to country, so it is not possible to create a regional correction factor. Published literature was used to make some adjustment to self-reported data for use in the analysis; however this increases the uncertainty of our estimates for some countries in this region.

In addition to the existing health interview surveys, the WHO MONICA project *(63)*, conducted in the 1980s and early 1990s provides regional trends for many European countries, including some countries in Eastern Europe. Sweden and the Czech Republic continued the survey regime long after the MONICA project officially ended. These additional surveys allow for two decades' worth of measured data on overweight and obesity rates in these countries.

In general Western European countries show a pattern of increasing obesity. Several Southern European countries with quite a high prevalence of overweight and obesity are not showing increasing trends and appear to have stabilized.

Eastern European countries show a different picture. There are only a few countries with significant and positive upward trends in obesity. These are:
– males from Lithuania and Serbia and Montenegro
– females from Turkey and Uzbekistan.

These increasing trends are not consistent across the region. Many other countries show either no increase or a decrease in obesity.

South-East Asia Region

Bangladesh has one of the lowest population level mean BMI in the world. Projections show that mean BMI here is increasing, an encouraging sign of better nutrition in this extreme case where malnutrition, not obesity, brings more death and disease. India shows large regional differences in all risk factors, including BMI. The regional nature of the surveys conducted in this country makes it difficult to assess what the overall patterns are nationally.

Bangladesh has one of the lowest population level mean BMI in the world.

Thailand is the only country for which we have good trend information for overweight and obesity. The published literature on the nutrition transition in Thailand *(64)* describes an increase of almost double the prevalence rates of overweight for both males and females from two National Health Examination Surveys, one from 1991 and the other from 1996. However, this comparison did not adjust the data to a standard set of age groups for the purpose of the comparison. Thus, the 1991 survey covers adults ages 20 and over, whereas the 1996 survey covers only those aged 13 to 59 years of age. As mentioned in the methods section of this report, the prevalence of overweight and obesity has a strong relationship with age in most human populations. Prevalence increases steadily from adolescence until around the age of 60 years, when it declines. We would expect the sample containing those aged 13 to 59 years to have higher prevalence of overweight than a sample containing all those over 20 by virtue of the ages sampled, not necessarily due to an increase in the number of overweight people in the population with time. To further examine this interesting result, we used data from the InterASIA study *(65)* conducted in 2001. By adjusting to the same age groups *(35-64)* between 1996 and 2001, we found there was no change in the prevalence of overweight for males but reasonable increase for females. It is expected that the trend towards increasing urbanization in Thailand and many other countries may result in an increase in the prevalence of overweight and obesity over time.

Western Pacific Region

Some Western Pacific Region countries have good trend information. Notable examples are:
– Japan, with an annual National Nutrition Survey;
– Australia, with a 5-yearly National Health Survey and separate National Nutrition Surveys;
– China, with MONICA-Beijing project and After-MONICA, which continued after the completion of MONICA project.

However, given the ethnic and cultural diversity of this region, it is difficult to present a cohesive picture of BMI trends, especially in the absence of trend data from every country in the region. Australia published a report *(66)* showing an increase in the prevalence of obesity for its overall population. While the pattern of increase in Australia is quite similar to Western Europe and North America, Japan stands out in showing a very different pattern for BMI from other developed countries. Male rates are increasing regardless of age. On the other hand, the rates for young females have decreased, whereas those for older females

have increased slightly. This pattern is shared by China, as is evident from the Beijing MONICA data *(63, 67)*. Additional trend information can be found from Western Pacific Region countries, such as the Philippines, the Republic of Korea, and Singapore. All show unique, country specific trend patterns.

Many Pacific Island countries have a high prevalence of obesity, and substantial increases have been occurring since the late 1970's *(68)*. There is much uncertainty in predicting whether or not these trends will increase because individual countries do not have good data for tracking trends over time. Nonetheless, the quantitative trend information that does exist from Fiji suggests that obesity is increasing quickly and may continue to increase at these rates into the future. However, applying such levels of increase to our estimates will push the boundaries of what has been reported in the peer-reviewed literature for population mean BMI. Therefore, we have decided to apply very conservative estimates for this region. The rate of increase is still astonishing compared with many other regions in the world.

Many Pacific Island countries have a high prevalence of obesity, and substantial increases have been occurring since the late 1970's.

Trends in systolic blood pressure (SBP) by WHO region

Available measured data for blood pressure, especially comparisons across different points in time, are incomplete. When data are available, they show inconsistent patterns within a country or across a region, making it difficult to decide how blood pressure varies across populations. Three factors contribute to the confusion:

– difficulty in measuring blood pressure in individuals *(69)*
– unreliable self-reported high blood pressure data *(70, 71)*
– cost of measuring blood pressure in a regular health survey.

Age-specific rates for systolic blood pressure are similar across all populations. Similar age-specific patterns are observed for males and females (Figure 4.2).

Most population surveys show that mean SBP goes up with age. This relationship has been reported many times *(31, 72)* and is clear from examining the age-specific rates for blood pressure in the SuRF2 Country Profiles. However, there is also evidence that a few isolated populations do exist in which this age-related increase in blood pressure does not

Figure 4.2

Graph showing standard pattern of age-specific rates for systolic blood pressure in males and females

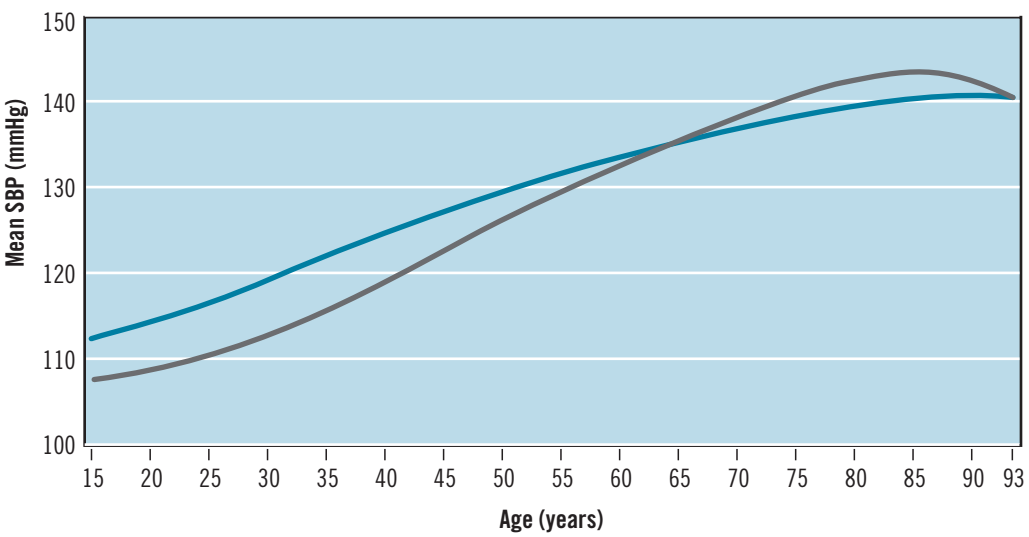
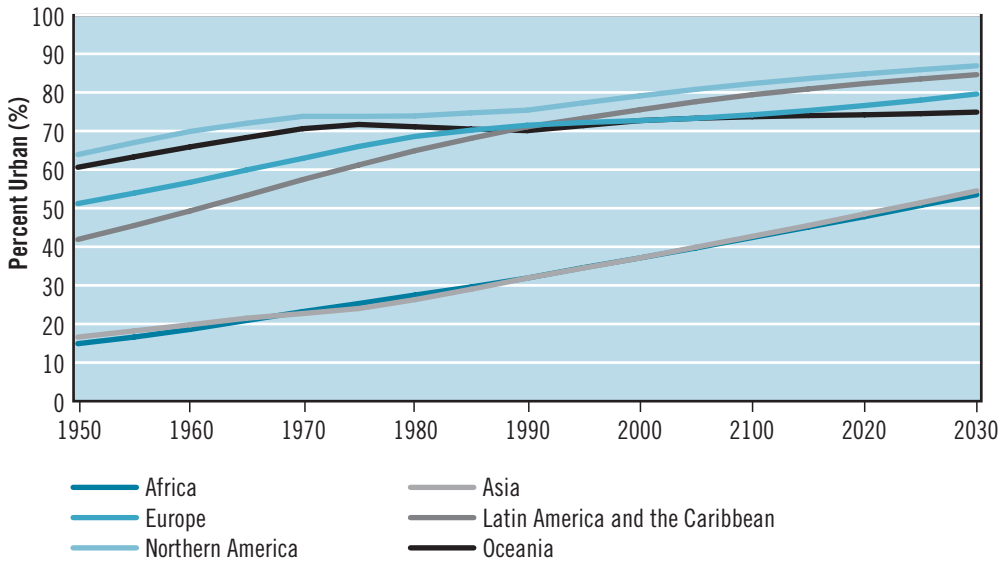


Figure 4.3

World urbanization by region from 1950 to 2030 by the UN Population Division



Source: Adopted from World Urbanization Prospects, the 2003 Revision. New York, United Nations, 2004.

In general, mean SBP is going down in most high income countries, except North America.

occur *(31)*. These populations show that the age-related blood pressure increase is not a physiological phenomenon but is related to life-style changes increasingly associated with ageing in urban populations, such as weight gain and lower levels of physical activity.

Temporal trends in systolic blood pressure

In general, mean SBP is going down in most high income countries *(31, 73-80)*, except North America. The reasons for this general decline in population levels of blood pressure are currently unknown, despite much research on the subject. Anti-hypertensive medication is one possible reason for the declining rates. However, since medication is only recommended for the high risk portion of the population, then one would not expect to see a downward shift in the entire population as is observed *(77, 78, 81)*.

Eastern European countries demonstrate inconsistent patterns for raised blood pressure. The only trend information available is from the MONICA Study *(73-76)*. Often several sites from within a country show changes in opposite directions, making it difficult to determine a national pattern for blood pressure. After examining the different trend patterns within the region, it was assumed that blood pressure was remaining constant over time. Therefore, these predictions are uncertain but are conservative estimates of blood pressure levels in the future.

For many other countries, particularly in the African region, reliable trend information for blood pressure is not available. However, it is worth noting that the difference between urban and rural blood pressure rates in developing countries, especially in Africa, is quite large. Urban populations in Africa show significantly higher mean systolic blood pressures than their rural counterparts. These patterns, combined with indications of increasing urbanization within Africa (Figure 4.3), suggest that raised blood pressure is becoming a health problem that urgently needs to be addressed by policy makers in this region.

Conclusions

Currently, European countries have the highest population mean systolic blood pressures. However, this may change as most Western European countries show that population mean SBP is decreasing over time. The already high SBP in urban populations of Africa may mean that Africa will replace Europe as the region with the highest blood pressure levels in the world (Figures 4.4 and 4.5).

Global perspective

The abovementioned trend information was combined with the available country-level data from the WHO Global InfoBase. The data were adjusted for the following factors which are described in more detail in the method section. The adjustments were made for:

- risk factor definition
- a standard set of age groups for reporting
- a standard reporting year
- nationally representative population.

The results of these analyses are presented in Appendix 4 in the form of data tables and global maps.

Global burden due to chronic disease risk factors in 2000

The results of the CRA project for seven of our risk factors are briefly presented below. Refer to the methods section of this report for further information about the methods used in the CRA project.

The Comparative Risk Assessment project 2000-2001

The Comparative Risk Assessment project (CRA) aimed to systematically estimate and compare the current burden of disease and injury in the world's population resulting from previous exposure to risks – known as the "attributable" burden.

The burden of disease is a measurement of the gap between a population's current health and an ideal situation where everyone lives to old age in full health *(16)*.

To make these estimates and comparisons, risks have to be assessed using a "common currency", the Disability Adjusted Life Year (DALY). The DALY takes into account the loss of full health as well as the loss of life years. One DALY can be thought of as one lost year of "healthy" life. DALYs are calculated as the sum of the years of life lost due to premature death and the years lost due to disability *(16)*. Attributable burden is presented in terms both of attributable deaths and attributable DALYs.

For all risk factors, some data had to be extrapolated where direct information was unavailable: it is often absent or scanty in developing countries, where many risks are highest. Perfect data on a health hazard's potential impact will never exist, so using such projections is justified, but it is important to treat estimates of numerical risk and its consequences with care.

26 risk factors were chosen with these considerations in mind:

– potential global impact
– high likelihood of causality
– potential to be modified
– neither too specific nor too broad
– availability of reasonably complete data.

For more information on analysis methods used for the CRA, see: Ezzati M, Lopez A, Rodgers A, Murray CJL. *Comparative quantification of health risks: global and regional burden of disease attributable to several major risk factors.* Geneva: WHO, 2004.

Figure 4.4

Males 15+ estimates and predictions for mean SBP from 2002 to 2010

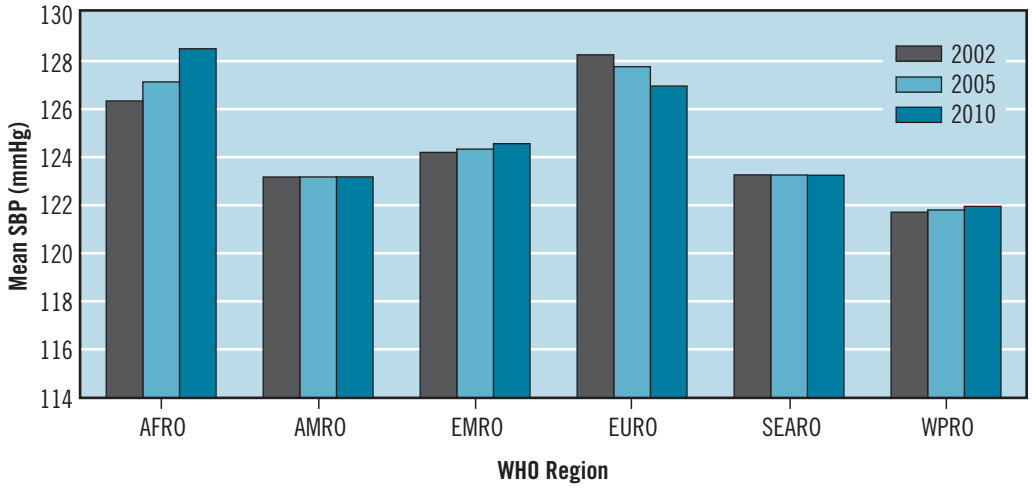
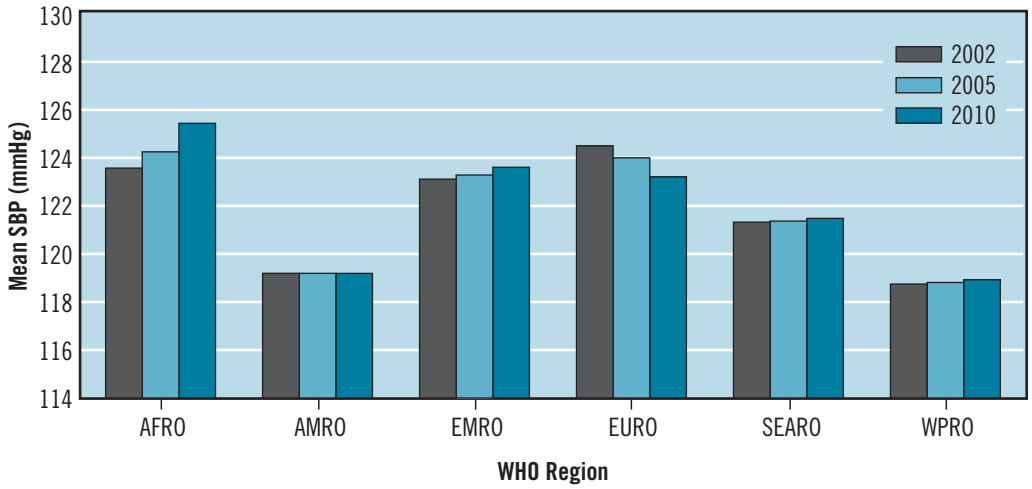


Figure 4.5

Females 15+ estimates and predictions for mean SBP from 2002 to 2010



The highlights from the CRA project are presented here for seven of the major chronic disease risk factors. Although this information has been published elsewhere *(2,83)*, the information presented here sets the context for our published country-level results and also shows the urgent need for further work at the country-level on these important causes of preventable disease.

Tobacco use

Tobacco use (including smoking) is causally linked to a number of chronic diseases including several cancers, chronic obstructive pulmonary disease (COPD), and cardiovascular diseases. The CRA project (see Attributable mortality and burden section on page 25) calculated the attributable mortality and burden due to tobacco use using the theoretical minimum risk distribution that would occur in a population in which no one had ever smoked. Although this scenario may not be feasible for a population, there are no physical constraints on the reduction of smoking to this level. The study estimated that in 2000, 4.8 million deaths were caused by smoking *(17)*. The leading causes of death due to smoking were:

– cardiovascular disease (1.69 million deaths)
– chronic obstructive pulmonary disease (COPD) (0.97 million deaths)
– lung cancer (0.85 million deaths).

Smoking accounted for 4.1% of the healthy life years lost in 2000. The burden of smoking-related deaths is higher in developing countries than developed countries because people are dying at younger ages from CVD, COPD, and lung cancer in these countries.

High alcohol consumption caused considerable disease burden, resulting in 3.2% of global mortality and 4.0% of global burden as measured in DALYs.

High alcohol consumption

Excessive alcohol consumption has long been associated with disease outcomes. Direct health consequences range from automobile accidents and domestic violence to chronic health and social problems *(18)*. However, there are also reported beneficial relationships between low to moderate drinking in a non-binge pattern and coronary heart disease, stroke and diabetes mellitus *(19)*. The main predictors of alcohol use and disease outcomes are:

– average volume of alcohol consumed
– pattern of drinking.

The CRA project *(20)* found that high alcohol consumption caused considerable disease burden, resulting in 3.2% of global mortality and 4.0% of global burden as measured in DALYs. Approximately half of the attributable mortality was due to unintentional and intentional injuries. Cancers, cardiovascular disease and liver cirrhosis were the other high causes of deaths due to excessive alcohol consumption.

Low fruit and vegetable intake

Increasing epidemiological evidence suggests that increasing the amount of fruits and vegetables in the diet can reduce the risks of certain cancers and cardiovascular disease *(21)*. Not having a diet sufficient in fruits and vegetables is an independent risk factor for cardiovascular disease, and cancers (including lung, stomach, colorectal and oesophageal).

The CRA project analysis of levels of fruit and vegetable in the diet was assessed using mean dietary intakes of fruit and vegetable (excluding potatoes) measured in grams per day *(22)*. The theoretical minimum risk distributions were estimated to be 600 grams/day for adults and 480 grams/day for children aged 5 to 14 and 330 grams per day for children 0 to 4 years. One serving of fruit and vegetables was set at 80 grams/day *(22)*.

The total worldwide attributable mortality due to insufficient fruit and vegetable intake was estimated to be 2.7 million deaths. This translates into 26.6 million disability adjusted life years per year.

Physical inactivity

Regular physical activity has health benefits including regulation of body weight and strengthening of the cardiovascular system *(23)*. Measuring the levels of activity or inactivity in a population has proved difficult. There is no internationally agreed definition or measure of physical activity. Nevertheless, the CRA project made an attempt at calculating attributable mortality and burden due to levels of physical inactivity in populations *(24)*. The CRA project found that overall physical inactivity accounted for:

- 21.5% of ischaemic heart disease
- 11% of stroke
- 14% of diabetes
- 16% of colon cancers
- 10% of breast cancers.

Overweight/obesity

The estimates of attributable mortality and burden due to being overweight and obese have been made by the CRA project for 2000 using a measure of high body mass index (BMI) calculated as weight (kg) divided by height squared (m^2). BMI was chosen as a simple measurement of body weight in relation to height because it is in principle easier to measure at the population level than body fat *(28)*.

Analysis of the relationship between BMI and mortality and morbidity suggests that the theoretical optimum mean population BMI is around 21 kg/m^2. Analysis based on BMI as a continuous variable replaced the usual BMI cut points for pre-obese and obese (pre-obese = BMI 25.0-29.9 and obese = BMI≥30).

The disease outcomes considered for pre-obese and obesity in the 2000 estimates were:

- diabetes type 2
- ischaemic heart disease
- stroke
- hypertensive disease
- osteoarthritis
- cancers (colon, kidney, endometrial, and postmenopausal breast cancer).

The results indicate that there are currently over 300 million obese people and over 750 million overweight people in the world. The burden attributable to excess BMI amounted to 30 million DALYs with most resulting from ischaemic heart disease and diabetes type 2. Overall about 2.5 million deaths are attributed to obesity worldwide.

Raised blood pressure

Raised blood pressure is almost always without symptoms but the result is structural damage to the arteries that supply blood to the major organs of the body. This damage eventually results in stroke, ischaemic heart disease, renal failure, and other diseases. It is becoming increasingly clear that the risk of these conditions is not limited to those with particularly high levels of blood pressure, but also for those with average or even below average levels of blood pressure *(29,30)*.

The results indicate that there are currently over 300 million obese people and over 750 million overweight people in the world.

Raised systolic blood pressure is most consistently associated with disease outcomes in both males and females and has therefore been used by the CRA project for the attributable burden analysis. Recent studies suggest that a substantial proportion of diseases attributable to non-optimal blood pressure are related to systolic blood pressure greater than 115 mmHg with a standard deviation of 6 mmHg *(31)*.

The CRA project considered the following disease outcomes associated with systolic blood pressure greater than 115 mmHg (SD 6):
– stroke
– ischaemic heart disease
– renal disease
– hypertensive disease.

Globally 7.1 million deaths and 64.3 million DALYs (4.4% of the total) were found to be attributable to non-optimal blood pressure.

Globally 7.1 million deaths and 64.3 million DALYs (4.4% of the total) were found to be attributable to non-optimal blood pressure. This represents two thirds of all stroke, one half of all ischaemic heart disease and three quarters of all hypertensive disease *(31)*.

Raised cholesterol

High levels of cholesterol are associated with heredity, diabetes mellitus and a diet high in saturated fats. The result is an increased risk of stroke, ischaemic heart disease and other vascular diseases. As with raised blood pressure, the risks of cholesterol are continuous *(32)*.

The CRA project defined raised cholesterol levels as those relative to the theoretical minimum of total cholesterol of 3.8 mmol/l with a standard deviation of 0.6 mmol/l for all ages, both sexes and regions *(33)*.

Disease outcomes considered for raised cholesterol include:
– ischaemic heart disease
– non-fatal stroke.

Globally 4.4 million deaths and 40.4 million DALYs were estimated to be due to non-optimal cholesterol levels. The distribution of attributable burden due to raised cholesterol was:
– 40% for developed countries
– 20% for low mortality developing countries
– 40% for high mortality developing countries.

The burden attributable to non-optimal cholesterol level occurs in all countries of the world, regardless of economic development *(33)*.

Attributable mortality and burden assessment for selected countries

Using the results of our comparable country-level estimates for BMI and systolic blood pressure, attributable mortality and burden (in DALYs) were calculated (Tables 4.1-4.4) for the 11 most populated countries. This is the first time that this type of analysis has been done for risk factors at the country-level. These estimates were calculated using a revision of the burden of disease estimates to 2002 *(15)*. Our results are consistent with the CRA regional analysis, which used the 14 WHO epidemiological sub-regions for their analyses *(1)*. The countries that we have chosen dominate the analysis within their respective regions and this is reflected in the similar values between the two levels of analysis for all causes of disease and deaths. The differences in the values between our analysis and

the CRA also reflect the use of updated burden of disease estimates for 2002 (CRA used 2000) as inputs into our calculations.

In general, the population attributable fractions for raised blood pressure and BMI are lower for DALYs than deaths for two reasons:

– DALYs measure lost years and therefore give relatively less weight to deaths at older ages (where many raised blood pressure and raised BMI deaths occur) than a straight count of deaths;
– DALYs include lost healthy years due to disability, of which a substantial amount is due to mental health problems, and not much if any of these are attributable to our two risk factors.

However, the attributable DALYs give a more complete picture of the contribution of these risk factors to total loss of health, since most people would agree that simple counts of attributable deaths, giving equal weight to a death at age 40 and age 80 do not give a full picture of the comparative loss of health associated with raised systolic blood pressure and raised BMI.

Raised blood pressure

The results for raised blood pressure are presented in tables 4.1 and 4.2. The per cent of deaths from all causes of disease attributable to sub-optimal blood pressures (where sub-optimal is defined in relation to the theoretical minimum, 115 mmHg, SD 6) is highest for males in the Russian Federation, followed by males in the United States of America, China, Japan, Brazil and Indonesia (Table 4.1). For females, a similar pattern is observed with 44% of all deaths attributable to sub-optimal blood pressure in the Russian Federation, followed by 18% in the United States of America and 16% in China. For the

Table 4.1

% deaths from all causes attributed to raised blood pressure for 11 of the world's most populated countries – 2002.

Country	% deaths from raised blood pressure by country - 2002		
	males	females	total
Nigeria	4.5	5.6	5.0
United States of America	13.5	18.1	15.8
Brazil	11.7	14.0	12.7
Mexico	7.6	10.5	8.9
Pakistan	7.0	8.1	7.5
Russian Federation	27.9	44.3	35.5
Indonesia	11.2	14.5	12.8
India	10.2	9.7	10.0
Bangladesh	5.6	7.0	6.3
Japan	12.5	13.8	13.1
China	13.0	15.8	14.3

Table 4.2

% DALYs from all causes attributed to raised blood pressure for 11 of the world's most populated countries – 2002.

Country	% DALYs from raised blood pressure – 2002		
	males	females	total
Nigeria	1.3	1.5	1.4
United States of America	5.2	5.4	5.3
Brazil	4.0	3.7	3.9
Mexico	2.0	2.1	2.0
Pakistan	2.3	2.2	2.2
Russian Federation	14.1	19.6	16.3
Indonesia	4.0	4.5	4.2
India	1.7	1.8	1.8
Bangladesh	3.6	2.9	3.2
Japan	8.6	5.4	7.1
China	4.8	4.8	4.8

Table 4.3

% deaths from all causes attributed to raised BMI for 11 of the world's most populated countries – 2002.

Country	% deaths from raised BMI – 2002		
	males	females	total
Nigeria	1.0	1.7	1.3
United States of America	11.6	11.5	11.5
Brazil	6.2	11.1	8.3
Mexico	11.8	17.7	14.4
Pakistan	1.9	2.2	2.0
Russian Federation	12.5	17.0	14.6
Indonesia	1.3	2.9	2.0
India	2.2	2.6	2.3
Bangladesh	0.4	0.1	0.2
Japan	2.8	2.9	2.9
China	3.1	3.7	3.4

Russian Federation, this represents a total of over 5 million years of life lost (YLLs) as a result of sub-optimal blood pressure for males and females combined. These years of life lost represent the maximum deaths from cardiovascular disease that are potentially preventable through cost effective interventions preventing raised blood pressure or for lowering blood pressure in people already suffering from high blood pressure.

The proportion of DALYs from all causes attributable to sub-optimal blood pressure are highest for the Russian Federation, followed by Japan and the United States of America (Table 4.2). The important point about these DALYs is that they show that sub-optimal blood pressure is causing significant chronic disease and disability, resulting from cardiovascular disease in a range of countries, regardless of economic standing.

Body mass index

The results for BMI (raised BMI as defined against the theoretical minimum of BMI 21 with SD 1) are presented in tables 4.3 and 4.4. The per cent of deaths attributed to raised BMI for all causes are highest in females from Mexico, followed closely by females from the Russian Federation, the United States of America and Brazil. For males, the highest per cent of deaths attributable to raised BMI is in the Russian Federation, followed by Mexico and the United States of America (Table 4.3). For Mexico, this represents 639,400 years of life lost for males and females combined. Again, these are premature deaths, mainly from cardiovascular disease and cancers, and if effective interventions were implemented, some of these deaths could be prevented or postponed.

The per cent of DALYs due to raised BMI are highest for the Russian Federation and the United States of America but still significant for Brazil, Japan and Mexico (Table 4.4).

See Appendix 5 for further explanation of how these calculations were made.

Table 4.4

% DALYs from all causes attributed to raised BMI for 11 of the world's most populated countries – 2002

Country	% DALYs from raised BMI – 2002		
	males	females	total
Nigeria	0.4	0.6	0.5
United States of America	8.2	8.7	8.5
Brazil	3.0	5.2	4.0
Mexico	4.3	6.3	5.2
Pakistan	0.8	1.0	0.9
Russian Federation	7.8	12.0	9.5
Indonesia	1.0	2.0	1.5
India	1.2	1.1	1.2
Bangladesh	0.1	0.1	0.1
Japan	3.9	3.3	3.6
China	1.9	2.1	2.0

Conclusions: the rising burden of chronic disease

Our results support the main messages of this technical report:

– chronic disease risk factors such as raised blood pressure, obesity, cholesterol, tobacco use, excessive alcohol consumption, and the diseases linked to them, are now becoming prevalent in low and middle income countries *(1)*;

– Low and middle income countries suffer from a double burden of disease, the combination of long-established infectious diseases and the rapidly growing epidemic of chronic diseases.

For Mexico, this represents 639,400 years of life lost for males and females combined.

Ageing societies and increasingly urbanized populations with more sedentary patterns of behaviour are key reasons why conditions like cardiovascular disease, cancers and diabetes are increasingly contributing to untimely deaths and chronic disability worldwide. The surveillance of chronic diseases has been neglected in modern public health but the growing burden of these diseases in both developed and developing countries adds to the urgency of chronic disease surveillance activities.

Vision for the future

This section sets out our plans for future collection, analysis and display of chronic disease risk factor data. The Surveillance of Risk Factors Report Series is a product of the WHO Global InfoBase. The Global InfoBase was developed to make health information transparent and accessible for all interested users and there are many ways of displaying the information that we produce. Some of these are outlined here.

The Surveillance of Risk Factors Report Series

We plan to produce regular updates of the Country Profiles provided with this report. These are especially useful for people working at the country level who need to know what information has been collected as they plan for the future. The SuRF Report Series also provides an update on the types of data analysis currently being done in the Surveillance and Information for Policy Unit.

Development of the WHO Global InfoBase 2005-2006

The WHO Global InfoBase is not only the source of the SuRF Series Country Profiles and data analysis but has also been used by others to produce presentations and publications on chronic disease risk factors. Two notable examples include *The atlas of heart disease and stroke* *(84)* and the Aichi Expo 2005 exhibit on the ageing society and cardiovascular disease. The demonstrated success of the WHO Global InfoBase warrants continuing support for maintenance and evolution of this platform. The future vision for the Global InfoBase is to provide the data and analysis required by the Noncommunicable Diseases and Mental Health Cluster, WHO regional and country offices to ensure that policy makers can act on evidence. Supporting valid and reliable chronic disease information and making it accessible to all potential users will require significant effort over 2005 to 2006 time period. The essential activities are:

- maintenance and development of the WHO Global InfoBase platform;
- development of good quality data analysis and interpretation of chronic disease and risk factor information;
- strengthening regional InfoBases to meet the chronic disease information needs of Member countries;
- building a comprehensive communication strategy to disseminate chronic disease and risk factor information in an easy-to-understand format.

Maintaining the InfoBase

Maintaining and updating such a large amount of risk factor information is an on-going process, involving data entry personnel and quality assurance protocols, not only at WHO HQ but also in our regional offices where much of the data originates. Additionally, the technological improvements in the structure of the InfoBase are constantly being updated. These changes are aimed at improving the speed, accuracy and accessibility of chronic disease information to the public.

Evolving the InfoBase

While chronic disease risk factor information is needed to predict future trends in chronic disease burden, a country-level source of chronic disease prevalence and incidence data is also needed. Much of the data collected for diseases are not population-based, but come from hospital records or disease registries. The addition of disease-specific domains, including stroke, asthma and allergies, thalassemia, preventable blindness and deafness, will expose the need for population-based disease-specific collections. Such information will serve as a resource for Member countries as they strive to monitor and evaluate their own disease prevention programs.

The disease-specific modular development of the InfoBase has just begun.

The disease-specific modular development of the InfoBase has just begun. It is expected that the development of further modules will continue. Different units and teams within CHP and NMH are at different stages in the development of their data management systems and will come on-line at different times in the 2005-2006 time period. It is expected that partnerships with many different chronic disease-related technical groups will continue over the next two years and will lead to development of different methods for dissemination of existing data.

Improving information dissemination

Improving our display of information is a key activity for 2005-2006. Our new on-line reporting tool, the Country Profile pages, was developed through consultations with small focus groups composed of various known data users. The Country Profile pages provide improved graphics, maps of countries, a section including comparable country-level data on demographic projections, cause-specific mortality, summary measures of population health (disability-adjusted life years, DALYs), and selected risk factors related to chronic disease. To judge the usefulness and usability of the Country Profile pages, an on-line monitoring tool is being developed by the InfoBase team. This tool will track the number of times the site is used both internally and externally. In addition, the InfoBase team is investigating the possibility of having external users log in to the site so that we can develop user profiles that will help us keep up-to-date on what needs to be improved on the Country Profiles pages. We plan to have this tool available by August 2005. Broader focus groups, consisting of users in a range of countries, will be developed to determine the needs and expectations of all InfoBase users. Additional information about these activities and the availability of our Country Profile tool can be found on the web site of the Department of Chronic Diseases and Health Promotion at: http://www.who.int/chp/en/ or contact infobase@who.int.

References

1. *The world health report 2002 – Reducing risks to health, promoting healthy life.* Geneva, World Health Organization, 2002 (http://whqlibdoc.who.int/hq/2002/WHO_WHR_02.1.pdf, accessed 28 February 2005).

2. Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors.* Geneva, World Health Organization, 2004.

3. *World population prospects: the 2002 revision.* New York, United Nations, 2003.

4. Bonita R et al. *Summary. Surveillance of risk factors for noncommunicable diseases: the WHO STEPwise approach.* Geneva, World Health Organization, , 2003 (WHO/NMH/CCS/01.01 Rev. 1; (http://whqlibdoc.who.int/hq/2003/WHO_NMH_CCS_01.01_Rev.1.pdf, accessed 25 February 2005).

5. Rose G, Day S. The population mean predicts the number of deviant individuals. *British Medical Journal*, 1990, 301:1031-1034.

6. Rose G. *The strategy of preventive medicine.* Oxford, Oxford University Press, 1992.

7. Strong K, Bonita R. *The SuRF Report 1. Surveillance of risk factors related to noncommunicable diseases: current status of global data.* Geneva, World Health Organization, 2003 (http://whqlibdoc.who.int/publications/2003/9241580305.pdf, accessed 25 February 2005).

8. Monteiro CA et al. The nutrition transition in Brazil. *European Journal of Clinical Nutrition, 1995, 49:105-113.*

9. *The world health report 2000 – Health systems: improving performance.* Geneva, World Health Organization, 2000 (http://www.who.int/whr/2000/en/whr00_en.pdf, accessed 25 February 2005).

10. Murray, CJL et al. Towards evidence-based public policy. In: Murray CJ, Evans DB, eds. *Health systems performance assessment: debates, methods, and empiricism.* Geneva, World Health Organization, 2003 (http://whqlibdoc.who.int/publications/2003/9241562455.pdf, accessed 25 February 2005).

11. *World development report 1993: investing in health.* Washington, DC, World Bank, 1993 (http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/1993/06/01/000009265_3970716142319/Rendered/PDF/multi0page.pdf, accessed 25 February 2005).

12. van der Maas PJ. Applications of summary measures of population health. In: Murray CJ et al., eds. *Summary measures of population health: concepts, ethics, measurement and applications.* Geneva, World Health Organization, 2002:53-60 (http://whqlibdoc.who.int/publications/2002/9241545518.pdf, accessed 25 February 2005).

13. 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,* 1 edn. Cambridge, MA, Harvard University Press, 1996.

14. Mathers CD et al. *The global burden of disease in 2002: data sources, methods and results.* Geneva, World Health Organization, 2003 (GPE Discussion Paper no. 54).

15. *The world health report 2004 – changing history.* Geneva, World Health Organization, 2004 (http://whqlibdoc.who.int/whr/2004/924156265X.pdf, accessed 28 February 2005).

16. 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 University Press, 1996.

17. Ezzati M, Lopez AD, eds. Smoking and oral tobacco use. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol. 1.* Geneva, World Health Organization, 2004:883-957.

18. *The world health report 1999 – Making a difference.* Geneva, World Health Organization, 1999 (http://whqlibdoc.who.int/hq/1999/WHO_WHR_99.1.pdf, accessed 28 February 2005).

19. Rehm J, Gutjahr E, Gmel G. Alcohol and all-cause mortality: a pooled analysis. In: *Contemporary drug problems.* 2001, 28:337-61.

20. Rehm J et al. Alcohol use. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1.* Geneva, World Health Organization, 2004:960-1108.

21. Klerk M, Veer P, Kok FJ. *Vegetables and fruits in chronic disease prevention.* Wageningen, The Netherlands, Wageningen University, 1998.

22. Lock K et al. Low fruit and vegetable consumption. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1.* Geneva, World Health Organization, 2004:597-728.

23. *Physical activity and health. A report of the Surgeon General: executive summary.* Atlanta, GA, US Department of Health and Human Services, Centers for Disease Control and Prevention, 1996 (http://www.cdc.gov/nccdphp/sgr/pdf/execsumm.pdf, accessed 28 February 2005).

24. Bull F et al. Physical activity. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1.* Geneva, World Health Organization, 2004:729-881.

25. *The world health report 1995 – bridging the gaps.* Geneva, World Health Organization, 1995 (http://whqlibdoc.who.int/whr/1995/WHR_1995.pdf, accessed 28 February 2005).

26. WHO expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*, 2004, 363:157-163.

27. *The world health report 2004 – changing history.* Geneva, World Health Organization, 2004 (http://whqlibdoc.who.int/whr/2004/924156265X.pdf, accessed 28 February 2005).

28. Philip W et al. Overweight and obesity (high body mass index). In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1.* Geneva, World Health Organization, 2004:497-596.

29. Law MR, Wald NJ. Risk factor thresholds: their existence under scrutiny. *BMJ,* 2002, 324:1570-1576 (http://bmj.bmjjournals.com/cgi/reprint/324/7353/1570, accessed 28 February 2005).

30. Eastern Stroke and Coronary Heart Disease Collaborative Research Group. Blood pressure, cholesterol, and stroke in eastern Asia. *Lancet,* 1998, 352:1801-1807.

31. Lawes CMM et al. High blood pressure. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1.* Geneva, World Health Organization, 2004:281-389.

32. Prospective Studies Collaboration. Cholesterol, diastolic blood pressure, and stroke: 13,000 strokes in 450,000 people in 45 prospective cohorts. *Lancet*, 1995, 346:1647-1653.

33. Lawes CMM et al. High cholesterol. In: Ezzati M et al., eds. *Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1.* Geneva, World Health Organization, 2004:391-496.

34. *Overweight and obesity: obesity trends. U.S. obesity trends 1985-2003.* National Center for Chronic Disease Prevention and Health Promotion, Nutrition & Physical Activity. Atlanta, GA, Centers for Disease Control and Prevention, 2004 (http://www.cdc.gov/nccdphp/dnpa/obesity/trend/maps/, accessed 17 February 2005).

35. Flegal KM et al. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA*, 2002, 288:1723-1727.

36. Mokdad AH et al. The spread of the obesity epidemic in the United States, 1991-1998. *JAMA*, 1999, 282:1519-1522.

37. Katzmarzyk PT, Ardern CI. Overweight and obesity mortality trends in Canada, 1985-2000. *Canadian Journal of Public Health*, 2004, 95:16-20.

38. Bruce MJ, Katzmarzyk PT. Canadian population trends in leisure-time physical activity levels, 1981-1998. *Canadian Journal of Applied Physiology*, 2002, 27(6):681-690.

39. Wong J, Wong S. Trends in lifestyle cardiovascular risk factors in women: analysis from the Canadian National Population Health Survey. *International Journal of Nursing Studies*, 2002, 39(2):229-242.

40. Monteiro CA et al. Shifting obesity trends in Brazil. *European Journal of Clinical Nutrition*, 2000, 54:342-346.

41. Martorell R et al. Obesity in Latin American women and children. *Journal of Nutrition*, 1998. 128(9):1464-1473 (http://www.nutrition.org/cgi/reprint/128/9/1464, accessed 28 February 2005)

42. Bovet P et al. The Seychelles Heart Study II: methods and basic findings. *Seychelles Medical & Dental Journal*, 1997, 5:8-24 (http://www.seychelles.net/smdj/97issue/orig2.htm#Heart%20Study%20II, accessed 28 February 2005).

43. Cooper R et al. The prevalence of hypertension in seven populations of West African origin. *American Journal of Public Health*, 1997, 87(2): 160-168.

44. Akinkugbe OO, ed. Non-Communicable Diseases in Nigeria, Series 4. Final Report of a National Survey. Lagos, Federal Ministry of Health and Social Services, 1997.

45. Galal OM. The nutrition transition in Egypt: obesity, undernutrition and the food consumption context. *Public Health Nutrition*, 2002, 5(1A):141-148 (http://www.cpc.unc.edu/nutrition_transition/private/papers/PHNEgypt-Galal.pdf, accessed 28 February 2005).

46. Benjelloun S. Nutrition transition in Morocco. *Public Health Nutrition,* 2002, 5(1A):135-140 (http://www.cpc.unc.edu/nutrition_transition/private/papers/PHNMorocco-Sabah.pdf, accessed 28 February 2005).

47. Ghassemi H, Harrison G, Mohammad K. An accelerated nutrition transition in Iran. *Public Health Nutrition*, 2002, 5(1A):149-155 (http://www.cpc.unc.edu/nutrition_transition/private/papers/PHNIran-Ghassemi.pdf, accessed 28 February 2005).

48. Plankey MW et al. Prediction equations do not eliminate systematic error in self-reported body mass index. *Obesity Research*, 1997, 5:308-314.

49. Villanueva EV. The validity of self-reported weight in US adults: a population based cross-sectional study. *BMC Public Health*, 2001, 1 (http://www.biomedcentral.com/1471-2458/1/11).

50. Roberts RJ. Can self-reported data accurately describe the prevalence of overweight? *Public Health*, 1995, 109:275-284.

51. Bostrom G, Diderichsen F. Socioeconomic differentials in misclassification of height, weight and body mass index based on questionnaire data. *International Journal of Epidemiology*, 1997, 26:860-866.

52. Spencer EA et al. Validity of self-reported height and weight in 4808 EPIC-Oxford participants. *Public Health Nutrition*, 2001, 5:561-565.

53. Bolton-Smith C et al. Accuracy of the estimated prevalence of obesity from self-reported height and weight in an adult Scottish population. *Journal of Epidemiology and Community Health*, 2000, 54:143-148.

54. Jalkanen L et al. Accuracy of self-reported body weight compared to measured body weight. *Scandinavian Journal of Social Medicine*, 1987, 15:191-198.

55. Kuskowska-Wolk A et al. The predictive validity of body mass index based on self-reported weight and height. *International Journal of Obesity*, 1989, 13:441-453.

56. Palta M. Comparison of self-reported and measured height and weight. *American Journal of Epidemiology*, 1982, 115: 223-230.

57. Jeffery RW. Bias in reported body weight as a function of education, occupation, health and weight concern. *Addictive Behavior*, 1996, 21:217-222.

58. Stunkard AJ, Albaum JM. The accuracy of self-reported weights. *The American Journal of Clinical Nutrition*, 1981, 34:1593-1599.

59. Black DR, Tyalor AM, Coster DC. Accuracy of self-reported body weight: stepped approach model component assessment. *Health Education Research*, 1998, 13:301-307.

60. Nawaz H et al. Self-reported weight and height: implications for obesity research. *American Journal of Preventative Medicine*, 2001, 20: 294-298.

61. Paccaud F, Wietlisback V, Rickenbach M. Body mass index: comparing mean values and prevalence rates from telephone and examination surveys. *Epidemiology and Public Health*, 2001, 49:33-40.

62. Stewart AW et al. Underestimation of relative weight by use of self-ported height and weight. *American Journal of Epidemiology*, 1987, 125:122-126.

63. Tunstall-Pedoe H, ed. MONICA monograph and multimedia sourcebook : world's largest study of heart disease, stroke, risk factors, and population trends 1979-2002. Geneva, World Health Organization, 2003 (http://whqlibdoc.who.int/publications/2003/9241562234.pdf, accessed 2 March 2005).

64. Kosulwat V. The nutrition and health transition in Thailand. *Public Health Nutrition*, 2002, 5:183-189.

65. InterASIA Collaborative Group. Cardiovascular risk factors in urban and rural Thailand – the international collaborative study of cardiovascular disease in Asia (InterASIA). *European Journal of Cardiovascular Prevention and Rehabilitation*, 2003, 10:249-57.

66. de Looper M, Bahtia K. *Australian health trends 2001*. AIHW Cat. No. PHE 24. Canberra, Australian Institute of Health and Welfare, 2001 (http://www.aihw.gov.au/publications/phe/aht01/aht01.pdf, accessed 1 March 2005).

67. Dong Z, Liu J. After-MONICA, unpublished data. Beijing, 1999.

68. Hodge AM et al. Dramatic increase in the prevalence of obesity in Western Samoa over the 13 year period 1978-1991. *International Journal of Obesity*, 1994, 18:419-428.

69. Bovet P et al. Assessing the prevalence of hypertension in populations: are we doing it right? Journal of Hypertension, 2003, (21(3):509-517.

70. Vargas CM et al. Validity of self-reported hypertension in the National Health and Nutrition Examination Survey III, 1988-1991. *Preventive Medicine*, 1997, 26:678-685.

71. Martin LM et al. Validation of self-reported chronic conditions and health services in a managed care population. American Journal of Preventatives Medicine, 2000, 18: 215-218.

72. Whelton PK. Epidemiology of hypertension. *Lancet*, 1994, 344:101-106.

73. Evans A et al. Trends in coronary risk factors in the WHO MONICA Project. *International Journal of Epidemiology*, 2001, 30:S35-40 (http://saturn.bids.ac.uk/cgi-bin/ds_deliver/1/u/d/ISIS/16300684.1/oup/ije/2001/00000030/000000s1/art00035/935160B33A92BA3E110967258247E60BD4F801B537.pdf?link=http://www.ingentaconnect.com/error/delivery&format=pdf, accessed 1 March 2005).

74. Kuulasmaa K et al. Estimation of contribution of changes in classic risk factors to trends in coronary-event rates across the WHO MONICA Project populations. *Lancet*, 2000, 355:675-687.

75. Merlo J et al. Population effects on individual systolic blood pressure: a multilevel analysis of the World Health Organization MONICA Project. *American Journal of Epidemiology*, 2004, 159:1168-1179 (http://www.nepi.net/jm.pdf#search='american%20journal%20of%20epidemiology,%202004,%20159:11681179', accessed 1 March 2005).

76. Tolonen H et al. Do trends in population levels of blood pressure and other cardiovascular risk factors explain trends in stroke event rates? Comparisons of 15 populations in 9 countries within the WHO MONICA Stroke Project. *Stroke*, 2002, 33:2367-2375 (http://stroke.ahajournals.org/cgi/reprint/33/10/2367?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=1&andorexacttitle=and&andorexacttitleabs=and&andorexactfulltext=and&searchid=1109674420844_622&stored_search=&FIRSTINDEX=0&sortspec=relevance&volume=33&firstpage=2367&search_url=http%3A%2F%2Fstroke.ahajournals.org%2Fcgi%2Fsearch&journalcode=strokeaha, accessed 1 March 2005).

77. Cifkova R et al. Trends in blood pressure levels, prevalence, awareness, treatment, and control of hypertension in the Czech population from 1985 to 2000/01. *Journal of Hypertension*, 2004, 22(8):1479-1485.

78. Vartiainen E et al. Cardiovascular risk factor changes in Finland, 1972-1997. *International Journal of Epidemiology*, 2000, 29:49-56 (http://ije.oupjournals.org/cgi/reprint/29/1/49?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=1&author1=vartiainen&andorexacttitle=and&andorexacttitleabs=and&andorexactfulltext=and&searchid=1109675407545_188&stored_search=&FIRSTINDEX=0&sortspec=relevance&journalcode=intjepid, accessed 1 March 2005).

79. Galobardes B, et al. Trends in risk factors for the major "lifestyle-related diseases" in Geneva, Switzerland, 1993-2000. *Annals of Epidemiology*, 2003, 13:537-540 (http://www.sciencedirect.com/science?_ob=MImg&_imagekey=B6T44-48SPB6K-6-5&_cdi=4964&_user=606406&_orig=browse&_coverDate=08%2F31%2F2003&_sk=999869992&view=c&wchp=dGLbVtz-zSkzV&md5=0656ae79a3a8a5ead09e29cbf7d9a99e&ie=/sdarticle.pdf, accessed 1 March 2005).

80. *Health Survey for England 2002*. London, Department of Health, 2003 (http://www.dh.gov.uk/PublicationsAndStatistics/PublishedSurvey/HealthSurveyForEngland/HealthSurveyResults/fs/en, accessed 23 Feb, 2005).

81. Wietlisbach V et al. Trends in cardiovascular risk factors (1984-1993) in a Swiss region: results of three population surveys. *Preventive Medicine*, 1997, 26(4):523-533.

82. Ezzati M et al. Estimates of global and regional potential health gains from reducing multiple major risk factors. *Lancet*, 2003, 362:271-280.

83. Ezzati M et al. Selected major risk factors and global and regional burden of disease. *Lancet*, 2002, 360:1347-1360.

84. Mackay, J and G. Mensah. *The atlas of heart disease and stroke*. World Health Organization 2004.

Appendices

Appendix 1: Acronyms and abbreviations

AFRO	World Health Organization Regional Office for Africa
AIHW	Australian Institute of Health Welfare
AMRO	World Health Organization Regional Office for the Americas
AUDIT	Alcohol Use Disorders Identification Test
BMI	body mass index (kg/m^2)
CAGE	questionnaire developed by Dr John Ewing for detecting alcohol dependence
CARMEN	Conjuntos de Accionnes para la Reduccion Multifactorial de Enfermadades No transmisibles (Region of the Americas)
CDC	Centers for Disease Control and Prevention (USA)
CHP	Department of Chronic Diseases and Health Promotion
CI	confidence interval
CINDI	Countrywide Integrated Noncommunicable Diseases Intervention Programme (European Region)
COPD	chronic obstructive pulmonary disease
CRA	comparative risk assessment project
CVD	cardiovascular disease
DALY	disability adjusted life year
DBP	diastolic blood pressure
DHS	Demographic and Health Survey
DIS/DSM-III	diagnostic and statistical manual of mental health disorders, third edition (DSM-III) American Psychiatric Association
EMRO	World Health Organization Regional Office for the Eastern Mediterranean
EURO	World Health Organization Regional Office for Europe
EUROHIS	European Health Interview Survey
GBD	Global Burden of Disease
GDP	Gross Domestic Product
GSHS	Global School-Based Student Health Survey
GYTS	Global Youth Tobacco Survey
HMP	Health Monitoring Programme
ICD	International classification of diseases
INCLEN	International Clinical Epidemiology Network
kCal	Kilo-calories
MET	metabolic equivalent
mg/dl	milligrams per decilitre
mM	millimolar
mmHg	millimetres of mercury
mmol/l	millimoles per litre
MOH	Ministry of Health
MONICA	WHO Multinational Monitoring of Trends and Determinants in Cardiovascular Disease project
NCD	noncommunicable disease
NIDDM	non-insulin dependent diabetes mellitus
NMH	Noncommunicable Diseases and Mental Health Cluster
OECD	Organization for Economic Co-operation and Development
OGTT	oral glucose tolerance test
PAHO/AMRO	Pan American Health Organization/ Regional Office for the Americas
SBP	systolic blood pressure
SD	standard deviation
SE	standard error
SEARO	World Health Organization Regional Office for South-East Asia
SIP	Surveillance and Information for Policy Unit
SIR	smoking impact ratio
STEPS	STEPwise approach to Surveillance of chronic disease risk factors
SuRF	Surveillance of Risk Factors Report Series
UN	United Nations
WHO / WHO HQ	World Health Organization/ World Health Organization Headquarters
WHR	World Health Report
WHS	World Health Survey
WPRO	World Health Organization Regional Office for the Western Pacific

Appendix 2: Glossary

Age-specific rate: A rate for a specified age group. The numerator and denominator refer to the same age group.

Attributable burden: The proportion of current disease or injury burden that results from past exposure.

Attributable mortality: The proportion of current deaths from disease or injury that result from past exposure.

Avoidable burden: The proportion of future disease or injury burden that is avoidable if current and future exposure levels are reduced to those specified by some alternative distribution.

Blood pressure: A measure of the force that circulating blood exerts on the walls of the arteries.

Body mass index (BMI): A measure of a person's weight in relation to their height calculated as weight in kilograms divided by height in metres squared (synonym: Quetelet's index).

Burden of disease: A systematic and comprehensive assessment of the health consequences of diseases and injuries in a population using a single summary measure of population health for each cause.

Cholesterol: A fat-like substance found in the bloodstream, in various bodily organs and nerve fibres. Most cholesterol is made in the liver from a variety of foods but particularly from saturated fats. Cholesterol is a key component in the development of artherosclerosis, the accumulation of fatty deposits on the inner lining of the arteries, and as such is a determinant for increased risk of stroke and heart disease.

Comparative risk assessment (CRA) project: This project was coordinated by WHO in 2000-2001 and the results were published in the World Health Report 2002. It involved a systematic evaluation of potential changes in population health from altering the distribution of exposure to a risk factor or a group of risk factors, relative to other risk factors. Twenty-six risks to health were evaluated by the project.

Confidence interval (CI): The computed interval with a given probability, i.e., 95%, that the true value of a variable such as a mean, proportion or rate is contained within the interval.

Covariate: A variable that is possibly predictive of the outcome under study. A covariate may be of direct interest to the study or may be a confounding variable or effect modifier.

Death rate: An estimate of the portion of a population that dies during a specified period. The numerator is the number of persons dying during the period; the denominator is the number in the population, usually estimated as mid-year population.

Diabetes mellitus: A group of heterogenous disorders with the common elements of hyperglycaemia and glucose intolerance, resulting from insulin deficiency, impaired effectiveness of insulin action or both.

Diastolic blood pressure (DBP): The blood pressure created when the heart fills with blood.

Disability adjusted life year (DALY): The DALY is a health gap measure that extends the concept of potential years of life lost due to premature death (PYLL) to include equivalent years of "healthy" life lost by virtue of being in states of poor health or disability. The DALY combines in one measure the time lived with disability and the time lost due to premature mortality. One DALY can be thought of as one lost year of "healthy" life and the burden of disease as a measurement of the gap between current health status and an ideal situation where everyone lives into old age free of disease and disability.

Distribution: The complete summary of the frequencies of the values or categories of a measurement made on a group of persons. The distribution tells either how many or what proportion of the group was found to have each value (or range of values) out of all the possible values that the quantitative measure can have.

Exposure (to risk): The amount of a factor to which a group or individual is exposed.

Global burden of disease subregions: To help with the cause of death analysis, burden of disease analysis and comparative risk assessment analysis, the 192 WHO Member countries have been divided into 5 mortality strata on the basis of their levels of child mortality under five years of age and 15-59-year-old male mortality. When these mortality strata are applied to the six WHO regions, they produce 14 epidemiological subregions. This classification has no official status and is for analytical purposes only. The mortality strata are as follows: A. very low child, very low adult; B. low child, low adult; C. low child, high adult; D. high child, high adult; and E. high child, very high adult.

Health behaviour: The combination of knowledge, practices, and attitudes that together contribute to motivate the actions that we take regarding health. These behaviours may promote good health or if harmful, be a determinant of disease.

Incidence: The number of new events (i.e. new cases of disease) in a defined population, within a specified period of time.

Least-Square: A mathematical technique that attempts to find a "best fit" to a set of data by minimizing the sum of squared differences between the observed values and the values predicted by the model.

Life Table: A summarizing technique used to describe the pattern of mortality and survival in populations.

Mortality (see death rate): Deaths from disease or injury.

Obesity: A measure of how overweight an individual is defined using WHO criteria to be those individuals having a BMI equal to or greater than 30.

Population attributable fraction (PAF): The proportion of current disease burden attributable to current and past exposure to a risk factor.

Prevalence: The number of events (disease or other condition), in a given population at a specific time.

Prevalence of risk: The proportion of a population who are exposed to a particular risk.

Prevention: Actions aimed at eradicating, eliminating or minimizing the impact of disease and disability.

Relative risk: The ratio of the risk of disease or death among the exposed to the risk among the unexposed.

Reliability: The degree of stability exhibited when a measurement is repeated under identical conditions.

Risk: A probability of an adverse outcome, or a factor that raises this probability.

Risk Factor: Any attribute, characteristic or exposure of an individual which increases the likelihood of developing a disease or injury.

Standard deviation (SD): A measure of dispersion or variation. The mean tells where the values for a group are centred and the standard deviation is a summary of how widely dispersed the values are around this centre.

Standard error (SE): The standard deviation of an estimate. It is used to calculate confidence intervals for the estimate.

Surveillance: Systematic, ongoing collection, collation, and analysis of data and the timely dissemination of information to those who need to know so that action can be taken.

Survey: An investigation in which information is systematically collected not using experimental method but by using a questionnaire or medical examination.

Systolic blood pressure (SBP): The blood pressure that is created by the heart contracting.

Theoretical minimum risk distribution (theoretical minimum): The distribution of exposure which would yield the lowest population risk (for example, zero tobacco use). This risk distribution is more complicated for risk factors for which zero is not possible (such as cholesterol), in which case a distribution or level will have to be estimated that has lowest overall risk using empirical evidence.

Validity: An expression of the degree to which a measurement measures what it purports to measure.

Weighted sample: A sample that is not strictly proportional to the distribution of classes in the total population. A weighted sample has been adjusted to include larger proportions of some other parts of the total population, because those parts accorded greater "weight" would otherwise not have the sufficient numbers in the sample to lead to generalisable conclusions.

Years of life lost (YLL): Part of the calculation of the DALY, this measure is the sum of the years of life lost due to premature mortality (YLL) in the population. YLL are calculated from the number of deaths at each age multiplied by a global standard life expectancy for the age at which death occurs.

Years of life lived with disability (YLD): The other part of the calculation of the DALY, this measure is the years lost due to disability for incident cases of the health condition. YLD for a particular cause in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead).

Appendix 3: Regional tables of available country-level data presented in Country Profiles

Quick reference check list of selected risk factor data

African Region

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Algeria	✓✓	✓	✓	✓	✓	✓	✓	✓✓
Angola								
Benin	✓✓				✓			
Botswana	✓✓							
Burkina Faso	✓				✓	✓		
Burundi	✓							
Cameroon	✓	✓✓		✓	✓	✓	✓	✓
Cape Verde								
Central African Republic					✓✓			
Chad	✓				✓			
Comoros					✓			
Congo	✓	✓	✓	✓	✓✓	✓		✓
Côte d'Ivoire	✓				✓			
Democratic Republic of the Congo								
Equatorial Guinea								
Eritrea					✓			
Ethiopia	✓✓	✓✓		✓	✓✓	✓✓	✓	
Gabon					✓			
Gambia	✓			✓	✓	✓	✓	✓
Ghana	✓	✓			✓✓	✓✓		✓
Guinea	✓✓				✓			
Guinea-Bissau								
Kenya	✓	✓	✓	✓	✓✓	✓✓		
Lesotho	✓✓	✓			✓	✓		
Liberia						✓		
Madagascar					✓	✓		

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Malawi	✓✓				✓✓	✓		
Mali	✓				✓✓			✓
Mauritania	✓				✓			
Mauritius	✓	✓		✓	✓✓	✓	✓	✓
Mozambique	✓				✓			
Namibia	✓	✓			✓			
Niger	✓				✓			
Nigeria	✓✓	✓✓		✓✓	✓✓	✓✓	✓✓	✓✓
Rwanda	✓				✓			
Sao Tome and Principe	✓							
Senegal	✓✓				✓✓	✓		
Seychelles	✓✓	✓		✓	✓	✓	✓	✓
Sierra Leone	✓	✓			✓✓	✓		✓
South Africa	✓✓	✓		✓✓	✓	✓	✓✓	✓
Swaziland	✓	✓	✓		✓			
Togo	✓				✓			
Uganda	✓✓	✓			✓			✓
United Republic of Tanzania	✓	✓		✓✓	✓✓	✓✓	✓✓	✓
Zambia	✓✓				✓	✓		
Zimbabwe	✓✓	✓✓		✓	✓✓	✓		

Note:
As of 3 March 2005
Empty box correspond to missing (or no available data)

* prevalence and/or mean value
** high alcohol consumer and/or abstainer
✓ signifies data available in SuRF1 Country Profiles
✓ signifies new data in SuRF2 Country Profiles that were not available in SuRF1

Eastern Mediterranean Region

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Afghanistan	✓				✓		✓	
Bahrain	✓✓		✓	✓	✓	✓		✓
Djibouti	✓							
Egypt	✓✓	✓		✓	✓✓	✓	✓	✓
Iran (Islamic Republic of)	✓✓		✓	✓	✓✓	✓✓	✓✓	✓
Iraq	✓							✓
Jordan	✓✓		✓	✓✓	✓✓	✓	✓	✓✓
Kuwait	✓				✓	✓	✓	✓
Lebanon	✓✓	✓		✓	✓✓	✓	✓	✓
Libyan Arab Jamahiriya	✓✓				✓	✓	✓	✓
Morocco	✓✓				✓✓	✓✓	✓✓	✓✓
Oman	✓✓			✓	✓✓	✓✓		✓✓
Pakistan	✓		✓		✓	✓	✓	✓
Qatar	✓							
Saudi Arabia	✓✓		✓✓	✓	✓✓	✓✓	✓✓	✓✓
Somalia								
Sudan	✓							✓
Syrian Arab Republic	✓✓							
Tunisia	✓✓			✓	✓	✓	✓	✓
United Arab Emirates	✓✓		✓	✓	✓	✓	✓	✓
Yemen	✓✓				✓	✓	✓	✓

Note:
As of 3 March 2005
Empty box correspond to missing (or no available data)
* prevalence and/or mean value
** high alcohol consumer and/or abstainer
✓ signifies data available in SuRF1 Country Profiles
✓ signifies new data in SuRF2 Country Profiles that were not available in SuRF1

European Region

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Albania	✓✓	✓			✓	✓✓	✓	✓✓
Andorra	✓							
Armenia	✓✓				✓			
Austria	✓	✓	✓	✓	✓	✓	✓	✓
Azerbaijan	✓✓				✓	✓		
Belarus	✓✓							
Belgium	✓	✓	✓	✓	✓	✓	✓	✓
Bosnia and Herzegovina	✓✓	✓✓		✓	✓✓	✓✓		✓✓
Bulgaria	✓✓	✓	✓	✓	✓✓	✓✓	✓	
Croatia	✓✓		✓✓	✓✓	✓✓	✓	✓✓	
Cyprus	✓				✓	✓	✓	
Czech Republic	✓✓	✓✓	✓	✓	✓✓	✓	✓	
Denmark	✓	✓	✓	✓	✓✓	✓	✓	✓
Estonia	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓	✓
Finland	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓	
France	✓✓	✓✓	✓✓	✓✓	✓✓	✓	✓	✓
Georgia	✓✓	✓✓			✓	✓	✓	✓
Germany	✓✓	✓✓	✓	✓	✓	✓	✓	✓
Greece	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Hungary	✓✓	✓		✓✓	✓✓	✓	✓	✓✓
Iceland	✓	✓		✓	✓	✓	✓	✓
Ireland	✓✓	✓✓	✓✓	✓✓	✓✓	✓		✓
Israel	✓✓	✓	✓	✓✓	✓✓	✓✓	✓✓	✓✓
Italy	✓			✓	✓	✓	✓	✓
Kazakhstan	✓				✓			
Kyrgyzstan	✓✓			✓	✓✓	✓	✓	
Latvia	✓✓	✓✓	✓✓	✓✓	✓✓			
Lithuania	✓✓	✓✓	✓✓	✓✓	✓	✓	✓	
Luxembourg	✓			✓	✓	✓	✓	

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
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	✓	✓		✓	✓✓	✓✓		✓✓

Note:
As of 3 March 2005
Empty box correspond to missing (or no available data)
* prevalence and/or mean value
** high alcohol consumer and/or abstainer
✓ signifies data available in SuRF1 Country Profiles
✓ signifies new data in SuRF2 Country Profiles that were not available in SuRF1

Region of the Americas

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Antigua and Barbuda	✓							
Argentina	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓	✓✓
Bahamas	✓	✓				✓		
Barbados	✓	✓			✓✓	✓		✓
Belize	✓✓	✓						
Bolivia	✓	✓		✓	✓	✓✓		✓
Brazil	✓✓	✓✓	✓	✓✓	✓✓	✓	✓✓	✓
Canada	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Chile	✓✓	✓✓	✓	✓	✓	✓	✓	✓
Colombia	✓	✓			✓✓	✓	✓	✓
Costa Rica	✓✓	✓	✓	✓	✓	✓	✓	✓
Cuba	✓	✓		✓	✓	✓	✓	✓
Dominica	✓				✓	✓		✓
Dominican Republic	✓				✓✓	✓	✓	✓
Ecuador	✓✓	✓				✓		
El Salvador	✓✓							
Grenada	✓							
Guatemala	✓✓	✓		✓	✓	✓	✓	✓
Guyana	✓	✓	✓	✓	✓			
Haiti	✓✓	✓			✓✓	✓		
Honduras	✓✓							
Jamaica	✓	✓			✓	✓		✓
Mexico	✓✓	✓		✓✓	✓	✓	✓	✓
Nicaragua	✓✓				✓✓			
Panama	✓	✓			✓			
Paraguay	✓✓	✓				✓		✓
Peru	✓✓	✓✓			✓✓	✓		✓
Saint Kitts and Nevis	✓							
Saint Lucia	✓	✓			✓	✓✓		

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Saint Vincent and the Grenadines	✓							
Suriname	✓							
Trinidad and Tobago	✓	✓✓		✓	✓	✓✓	✓	✓
United States	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Uruguay	✓	✓✓	✓	✓	✓	✓	✓	✓✓
Venezuela	✓✓	✓		✓	✓	✓✓	✓✓	✓

Note:
As of 3 March 2005
Empty box correspond to missing (or no available data)

* prevalence and/or mean value

** high alcohol consumer and/or abstainer

✓ signifies data available in SuRF1 Country Profiles

✓ signifies new data in SuRF2 Country Profiles that were not available in SuRF1

South-East Asia Region

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Bangladesh	✓✓		✓	✓	✓	✓	✓	✓
Bhutan								
Democratic People's Republic of Korea								
Timor-Leste								
India	✓✓	✓✓	✓	✓	✓	✓	✓	✓
Indonesia	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓
Maldives	✓				✓	✓		
Myanmar	✓✓				✓	✓		✓
Nepal	✓	✓			✓			✓
Sri Lanka	✓				✓	✓	✓	✓
Thailand	✓	✓	✓		✓	✓	✓	✓

Note:
As of 3 March 2005
Empty box correspond to missing (or no available data)
* prevalence and/or mean value
** high alcohol consumer and/or abstainer
✓ signifies data available in SuRF1 Country Profiles
✓ signifies new data in SuRF2 Country Profiles that were not available in SuRF1

Western Pacific Region

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Australia	✓✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓	✓
Brunei Darussalam	✓							
Cambodia	✓✓				✓			
China	✓✓	✓✓	✓	✓✓	✓	✓	✓	✓
Cook Islands	✓				✓✓	✓	✓	✓✓
Fiji	✓	✓	✓	✓✓	✓✓	✓		✓
Japan	✓	✓	✓	✓	✓	✓	✓	✓
Kiribati	✓	✓		✓	✓	✓		✓✓

WHO Member State	Tobacco	Alcohol**	Diet	Physical Inactivity	Obesity*	Blood Pressure*	Cholesterol*	Diabetes*
Lao People's Democratic Republic	✓				✓			
Malaysia	✓				✓	✓	✓	✓✓
Marshall Islands								
Micronesia (Federated States of)	✓					✓		✓
Mongolia	✓✓	✓	✓	✓	✓	✓		✓
Nauru	✓	✓✓		✓	✓	✓	✓	✓
New Zealand	✓	✓✓		✓✓	✓✓	✓✓	✓✓	✓
Niue					✓	✓		✓
Palau	✓	✓			✓	✓		
Papua New Guinea	✓✓	✓			✓	✓	✓	✓
Philippines	✓	✓		✓	✓	✓	✓	✓
Republic of Korea	✓✓	✓		✓	✓✓	✓✓	✓✓	✓✓
Samoa	✓				✓	✓✓	✓	✓
Singapore	✓	✓	✓	✓	✓	✓	✓	✓
Solomon Islands			✓		✓	✓		✓
Tonga	✓							
Tuvalu	✓							✓✓
Vanuatu	✓✓	✓	✓	✓	✓✓	✓✓	✓	✓✓
Viet Nam	✓	✓			✓✓	✓	✓	✓✓

Note:
As of 3 March 2005
Empty box correspond to missing (or no available data)

* prevalence and/or mean value
** high alcohol consumer and/or abstainer
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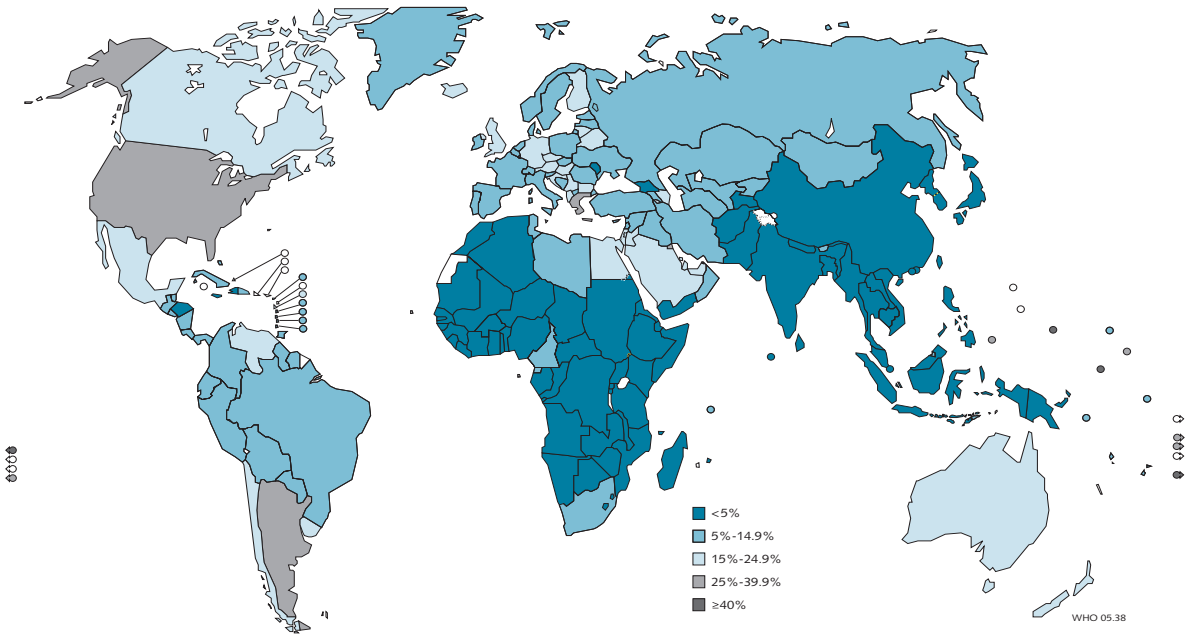
Appendix 4: Comparable estimates for BMI and SBP distributions 2002-2010

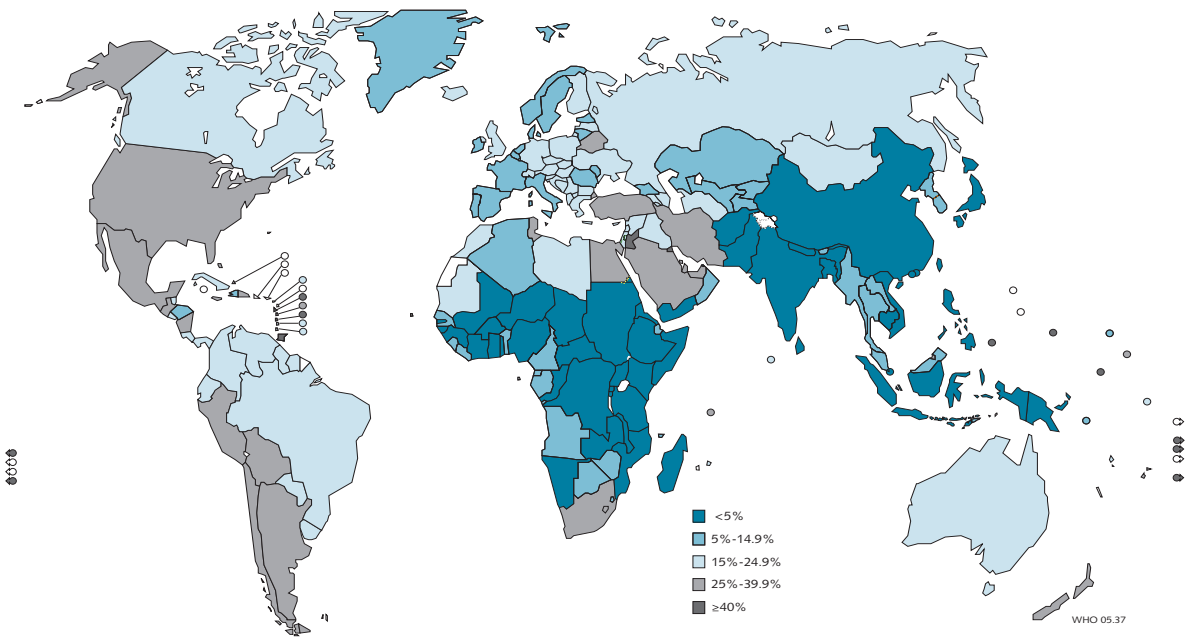
Map 1

Estimated prevalence of obesity (≥30kg/m^2), %, males aged 15 and above, 2002



Map 2

Estimated prevalence of obesity (≥30kg/m^2), %, females aged 15 and above, 2002



Source: WHO Global InfoBase

Age-standardized to WHO Standard Population

The designations employed and the presentation of material on the above maps do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concering the delimitation of its frontiers or boundaries. Dashed lines represent approximate border lines for which there may not yet be full agreement.

Table 1

Males aged 15 years and above mean BMI, prevalence of overweight, and prevalence of obesity estimates and projections for 2002 to 2010

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Afghanistan	21.0	21.2	21.6	11.2	12.7	15.6	0.3	0.5	0.7
Albania	26.0	26.0	26.0	57.2	57.2	57.2	18.6	18.6	18.6
Algeria	23.3	23.5	23.8	32.1	34.1	37.4	4.5	5.2	6.4
Andorra	26.0	26.2	26.3	59.8	60.9	62.5	14.9	15.8	17.1
Angola	21.9	22.1	22.4	19.9	21.3	23.8	1.6	1.9	2.4
Antigua and Barbuda	25.1	25.2	25.4	50.0	51.2	53.2	10.4	11.2	12.4
Argentina	27.5	27.9	28.7	70.1	73.1	77.7	28.0	31.4	37.4
Armenia	25.5	25.5	25.5	53.9	53.9	53.9	12.1	12.1	12.1
Australia	27.0	27.3	27.8	69.7	72.1	75.7	21.2	23.8	28.4
Austria	26.2	26.5	26.7	59.0	61.0	62.9	19.5	21.3	23.1
Azerbaijan	25.9	25.9	25.9	57.4	57.4	57.4	15.4	15.4	15.4
Bahamas	25.7	25.8	26.0	55.9	57.0	58.7	13.9	14.7	16.0
Bahrain	26.4	26.4	26.4	60.9	60.9	60.9	21.2	21.2	21.2
Bangladesh	20.1	20.2	20.5	5.9	6.7	8.4	0.1	0.1	0.2
Barbados	25.7	26.1	26.8	55.5	59.2	65.1	14.1	16.8	22.0
Belarus	26.3	26.3	26.3	63.7	63.7	63.7	16.2	16.2	16.2
Belgium	25.1	25.4	25.6	49.0	51.9	54.1	11.4	13.3	14.8
Belize	24.5	24.6	24.8	43.3	44.7	47.0	7.3	7.9	9.0
Benin	21.6	21.9	22.3	15.8	17.9	21.9	0.7	1.0	1.5
Bhutan	23.4	23.6	23.8	34.0	35.3	37.7	5.3	5.8	6.7
Bolivia	25.4	25.8	26.4	52.5	56.3	62.4	12.2	14.7	19.4
Bosnia and Herzegovina	25.8	25.8	25.8	56.6	56.6	56.6	13.8	13.8	13.8
Botswana	23.7	23.9	24.3	35.5	37.8	41.6	4.6	5.4	6.9
Brazil	24.5	24.8	25.5	43.4	47.4	54.0	6.9	8.7	12.4
Brunei Darussalam	25.6	25.8	26.0	55.3	56.4	58.1	14.4	15.2	16.6
Bulgaria	26.3	26.3	26.3	62.8	62.8	62.8	17.0	17.0	17.0
Burkina Faso	21.0	21.2	21.6	10.6	12.1	15.1	0.3	0.4	0.6
Burundi	20.4	20.5	20.7	7.0	7.8	9.1	0.1	0.1	0.2

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Cambodia	21.7	22.1	22.8	9.6	13.3	21.4	0.1	0.2	0.5
Cameroon	23.7	24.0	24.5	35.7	38.7	43.9	6.3	7.5	10.1
Canada	26.7	26.8	27.0	64.5	65.1	66.9	23.1	23.7	25.5
Cape Verde	23.1	23.3	23.6	30.5	32.4	35.6	4.0	4.6	5.8
Central African Republic	20.8	20.9	21.0	6.7	7.2	8.0	0.1	0.1	0.1
Chad	21.0	21.2	21.6	10.4	12.0	15.0	0.3	0.4	0.6
Chile	26.0	26.4	27.1	58.9	62.6	68.4	16.1	19.0	24.3
China	23.3	23.7	24.6	27.5	33.1	45.0	1.0	1.6	4.1
Colombia	25.4	25.8	26.5	52.7	56.5	62.6	12.4	14.9	19.6
Comoros	21.9	22.1	22.6	17.7	20.0	24.3	0.9	1.2	1.9
Congo	21.3	21.4	21.5	12.0	12.7	13.8	0.4	0.4	0.5
Cook Islands	32.5	32.8	33.2	92.0	92.6	93.4	67.9	69.5	72.1
Costa Rica	25.1	25.5	26.2	49.8	53.9	60.1	10.6	13.0	17.5
Croatia	26.2	26.3	26.6	60.0	61.3	63.5	17.1	18.2	20.1
Cuba	25.6	26.0	26.6	55.2	59.2	65.4	12.3	14.9	20.1
Cyprus	25.2	25.3	25.5	50.4	51.7	53.9	9.4	10.1	11.4
Czech Republic	26.0	26.1	26.4	56.7	58.1	60.1	17.4	18.5	20.2
Côte d'Ivoire	21.4	21.5	21.6	10.9	11.6	12.7	0.2	0.2	0.3
Democratic People's Republic of Korea	23.5	23.6	23.9	31.0	32.7	35.5	2.4	2.7	3.4
Democratic Republic of Timor-Leste	23.6	23.8	24.0	35.9	37.2	39.5	6.0	6.5	7.5
Democratic Republic of the Congo	19.8	19.9	20.1	4.3	4.8	5.7	0.0	0.0	0.1
Denmark	25.2	25.3	25.6	50.7	52.5	55.0	9.6	10.6	12.0
Djibouti	21.7	21.8	22.1	17.6	18.9	21.2	1.2	1.4	1.8
Dominica	26.2	26.6	27.3	61.5	65.1	70.8	16.9	20.0	25.8
Dominican Republic	24.4	24.8	25.4	42.5	46.6	53.4	6.0	7.7	11.2

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Ecuador	24.2	24.3	24.5	40.2	41.7	44.0	6.1	6.7	7.7
Egypt	26.7	26.7	26.7	64.5	64.5	64.5	22.0	22.0	22.0
El Salvador	24.4	24.5	24.7	42.1	43.5	45.8	6.8	7.4	8.5
Equatorial Guinea	23.6	23.8	24.2	35.4	37.5	41.0	5.6	6.4	7.9
Eritrea	20.0	20.0	20.1	2.9	3.1	3.5	0.0	0.0	0.0
Estonia	25.1	25.1	25.1	50.7	50.7	50.7	8.6	8.6	8.6
Ethiopia	20.6	20.6	20.7	7.4	7.8	8.6	0.1	0.2	0.2
Fiji	24.4	24.5	24.9	42.7	43.9	47.5	7.8	8.7	10.7
Finland	26.5	26.6	26.8	63.8	64.9	67.1	18.0	18.9	20.9
France	24.6	24.7	25.0	44.1	45.6	48.0	7.2	7.8	9.0
Gabon	22.4	22.6	23.1	22.7	25.4	30.2	1.8	2.3	3.4
Gambia	20.6	20.8	21.2	9.0	10.3	12.8	0.2	0.3	0.5
Georgia	24.0	24.1	24.3	37.4	38.9	41.5	4.7	5.2	6.1
Germany	26.6	26.7	27.0	63.7	65.1	67.2	19.7	20.9	22.9
Ghana	22.9	23.1	23.6	27.3	30.3	35.6	2.6	3.3	4.8
Greece	27.6	27.7	28.0	74.6	75.7	77.5	26.2	27.7	30.3
Grenada	24.9	25.0	25.2	47.4	48.7	50.8	9.1	9.8	11.0
Guatemala	25.5	25.9	26.5	53.2	56.9	62.9	13.1	15.7	20.5
Guinea	21.5	21.7	22.1	14.5	16.5	20.3	0.6	0.8	1.3
Guinea-Bissau	20.7	20.8	21.0	10.5	11.4	12.9	0.4	0.5	0.6
Guyana	24.2	24.4	24.6	40.6	42.1	44.4	6.3	6.8	7.9
Haiti	21.3	21.6	22.0	13.0	15.1	19.0	0.5	0.7	1.3
Honduras	23.8	23.9	24.2	36.2	37.6	40.1	4.7	5.2	6.2
Hungary	25.8	25.8	25.8	55.9	55.9	55.9	15.8	15.8	15.8
Iceland	25.9	26.1	26.3	57.7	59.0	61.2	15.7	16.7	18.5
India	21.4	21.6	22.0	15.0	16.8	20.1	0.9	1.1	1.7
Indonesia	21.0	21.0	21.0	9.6	9.7	9.9	0.2	0.2	0.2
Iran (Islamic Republic of)	24.8	24.9	24.9	47.3	48.5	48.5	9.4	10.0	10.0
Iraq	24.0	24.1	24.3	38.7	40.1	42.4	6.6	7.2	8.3
Ireland	25.1	25.3	25.5	50.0	51.5	53.9	9.5	10.3	11.7
Israel	25.8	25.9	26.2	55.9	57.2	59.4	15.2	16.2	17.9

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Italy	25.4	25.5	25.7	51.9	52.7	55.0	12.2	12.9	14.4
Jamaica	23.8	24.2	24.8	36.0	40.0	46.8	3.8	5.1	7.7
Japan	23.0	23.1	23.3	25.3	27.0	29.8	1.5	1.8	2.3
Jordan	26.1	26.1	26.1	57.5	57.5	57.5	19.6	19.6	19.6
Kazakhstan	24.6	24.6	24.6	43.9	43.9	43.9	7.9	7.9	7.9
Kenya	20.5	20.6	20.7	6.5	6.9	7.7	0.1	0.1	0.1
Kiribati	27.5	27.8	28.2	71.4	73.2	76.1	27.6	29.8	33.6
Kuwait	27.5	27.5	27.5	69.5	69.5	69.5	29.6	29.6	29.6
Kyrgyzstan	23.6	23.6	23.6	34.5	34.5	34.5	5.0	5.0	5.0
Lao People's Democratic Republic	23.4	23.6	23.8	30.4	32.1	34.9	2.3	2.6	3.3
Latvia	25.1	25.1	25.1	49.9	49.9	49.9	9.7	9.7	9.7
Lebanon	25.3	25.3	25.3	51.7	51.7	51.7	14.9	14.9	14.9
Lesotho	23.0	23.1	23.3	26.3	27.5	29.5	1.7	1.9	2.3
Liberia	22.8	23.0	23.3	27.8	29.6	32.7	3.3	3.8	4.8
Libyan Arab Jamahiriya	24.9	25.0	25.2	47.6	48.8	50.8	10.7	11.4	12.7
Lithuania	26.3	26.3	26.3	62.3	62.3	62.3	16.8	16.8	16.8
Luxembourg	25.4	25.6	25.8	53.0	54.4	56.9	11.2	12.1	13.6
Madagascar	20.9	21.1	21.5	12.9	14.5	17.5	0.7	1.0	1.5
Malawi	21.6	21.7	21.8	14.3	15.1	16.4	0.6	0.7	0.8
Malaysia	22.5	22.5	22.5	22.5	22.7	23.0	1.6	1.6	1.7
Maldives	22.9	23.2	23.7	29.7	32.3	36.6	4.7	5.7	7.7
Mali	21.3	21.5	21.9	12.8	14.6	18.1	0.4	0.6	1.0
Malta	27.2	27.4	27.7	70.2	71.4	73.3	24.6	25.9	28.1
Marshall Islands	24.1	24.2	24.4	39.1	40.6	43.0	5.7	6.3	7.3
Mauritania	22.8	23.1	23.6	27.5	30.4	35.4	2.9	3.7	5.3
Mauritius	23.6	24.0	24.5	35.6	39.0	44.8	4.5	5.6	8.0
Mexico	26.6	27.1	27.8	64.6	68.4	73.6	20.3	24.0	30.1
Micronesia (Federated States of)	31.9	32.2	32.7	91.5	92.1	93.1	64.3	66.2	69.1
Monaco	25.9	26.0	26.2	58.0	59.1	60.9	13.7	14.5	15.9

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Mongolia	24.7	25.3	26.3	46.0	53.0	64.1	5.2	7.9	14.5
Morocco	23.2	23.2	23.2	31.1	31.1	31.1	3.7	3.7	3.7
Mozambique	21.1	21.1	21.3	8.7	9.3	10.3	0.1	0.2	0.2
Myanmar	23.2	23.3	23.6	27.8	29.4	32.3	1.8	2.1	2.7
Namibia	21.4	21.5	21.7	11.6	12.3	13.5	0.2	0.3	0.4
Nauru	35.6	35.8	36.2	96.3	96.5	96.9	82.3	83.2	84.6
Nepal	20.5	20.7	21.0	7.7	8.8	11.0	0.1	0.2	0.3
Netherlands	24.8	25.0	25.2	46.7	48.0	50.2	9.6	10.4	11.7
New Zealand	26.6	27.1	27.7	65.2	68.7	73.9	19.7	23.0	28.9
Nicaragua	25.0	25.4	26.0	48.9	52.9	59.4	9.3	11.5	15.9
Niger	21.2	21.4	21.8	12.1	13.9	17.2	0.4	0.6	0.9
Nigeria	21.9	22.2	22.6	19.6	21.9	26.0	1.6	2.0	3.0
Niue	28.3	28.6	29.0	76.9	78.5	80.9	34.4	36.8	40.7
Norway	25.4	25.5	25.8	53.3	54.8	57.2	10.4	11.3	12.8
Oman	24.4	24.4	24.4	43.4	43.4	43.4	7.7	7.7	7.7
Pakistan	21.7	22.0	22.4	16.7	18.8	22.8	0.8	1.0	1.6
Palau	27.7	28.0	28.4	72.7	74.5	77.2	29.0	31.2	35.0
Panama	24.7	24.8	25.0	45.2	46.5	48.7	8.1	8.8	9.9
Papua New Guinea	23.2	23.4	23.7	29.2	31.5	35.3	2.0	2.5	3.4
Paraguay	24.3	24.4	24.6	40.9	42.3	44.7	6.4	7.0	8.0
Peru	25.2	25.6	26.2	50.8	54.6	60.9	10.8	13.2	17.7
Philippines	22.5	22.5	22.5	21.7	21.9	22.2	1.1	1.1	1.1
Poland	25.3	25.3	25.3	50.7	50.7	50.7	12.9	12.9	12.9
Portugal	25.7	25.9	26.1	55.5	58.5	60.9	13.1	13.7	15.5
Qatar	25.8	26.0	26.1	56.9	57.9	59.5	16.6	17.4	18.7
Republic of Korea	23.7	24.3	25.2	32.8	40.2	51.5	2.3	4.1	8.3
Republic of Moldova	23.6	23.7	24.0	33.3	34.8	37.5	3.5	4.0	4.8
Romania	23.9	23.9	23.9	37.7	37.7	37.7	5.5	5.5	5.5
Russian Federation	24.9	24.9	24.9	46.5	46.5	46.5	9.6	9.6	9.6
Rwanda	20.8	20.9	21.0	6.8	7.3	8.1	0.1	0.1	0.1

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Saint Kitts and Nevis	25.2	25.3	25.5	50.7	52.0	53.9	10.8	11.6	12.8
Saint Lucia	24.3	24.6	25.3	41.3	45.5	52.5	5.0	6.6	9.8
Saint Vincent and the Grenadines	24.6	24.7	24.9	44.3	45.6	47.9	7.7	8.4	9.5
Samoa	28.5	28.8	29.2	77.2	78.7	81.1	36.2	38.4	42.2
San Marino	25.8	25.9	26.1	57.6	58.8	60.5	13.5	14.3	15.7
Sao Tome and Principe	21.2	21.4	21.6	14.4	15.5	17.5	0.8	0.9	1.2
Saudi Arabia	26.6	26.6	26.6	62.4	63.1	63.1	22.3	23.0	23.0
Senegal	21.0	21.2	21.5	14.4	16.1	19.2	1.0	1.3	2.0
Serbia and Montenegro	26.3	26.3	26.3	61.2	61.2	61.2	17.7	17.7	17.7
Seychelles	25.6	25.9	26.6	55.1	58.5	63.8	14.2	16.7	21.3
Sierra Leone	21.9	22.1	22.6	20.2	22.4	26.3	1.9	2.4	3.5
Singapore	22.7	22.7	22.7	23.6	23.8	24.1	1.3	1.3	1.4
Slovakia	25.2	25.3	25.5	50.7	52.0	54.0	10.1	10.8	12.0
Slovenia	25.6	25.7	25.9	54.8	56.0	57.9	11.8	12.5	13.9
Solomon Islands	23.9	24.0	24.2	36.8	38.2	40.7	4.9	5.4	6.4
Somalia	20.5	20.7	20.9	9.8	10.6	12.1	0.3	0.4	0.6
South Africa	23.9	24.1	24.3	38.2	39.3	41.3	6.2	6.7	7.6
Spain	25.8	25.8	26.0	55.7	55.8	57.9	15.6	15.6	17.3
Sri Lanka	20.9	20.9	20.9	8.8	8.9	9.1	0.2	0.2	0.2
Sudan	21.5	21.6	21.9	16.0	17.2	19.3	1.0	1.2	1.5
Suriname	24.3	24.4	24.6	41.0	42.4	44.8	6.4	7.0	8.1
Swaziland	23.6	23.8	24.1	33.6	35.8	39.5	4.0	4.7	6.1
Sweden	25.3	25.5	25.8	51.7	54.5	57.0	10.1	11.8	13.3
Switzerland	25.4	25.6	25.8	52.4	54.1	56.5	11.4	12.4	13.9
Syrian Arab Republic	24.8	24.9	25.1	47.2	48.4	50.4	10.5	11.2	12.4
Tajikistan	23.2	23.4	23.6	29.2	30.8	33.5	2.5	2.9	3.6
Thailand	23.0	23.0	23.1	27.7	27.9	28.3	2.5	2.5	2.6
The former Yugoslav Republic of Macedonia	23.9	23.9	23.9	37.1	37.1	37.1	5.9	5.9	5.9

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Togo	21.6	21.8	22.2	15.0	17.1	20.9	0.6	0.9	1.4
Tonga	31.1	31.4	31.9	89.5	90.3	91.4	58.7	60.7	64.0
Trinidad and Tobago	25.5	25.9	26.6	54.8	58.9	65.2	11.3	14.0	19.1
Tunisia	24.4	24.4	24.4	42.8	42.8	42.8	7.7	7.7	7.7
Turkey	25.0	25.0	25.0	47.9	47.9	47.9	10.8	10.8	10.8
Turkmenistan	25.0	25.0	25.0	48.1	48.1	48.1	9.3	9.3	9.3
Tuvalu	25.2	25.3	25.5	51.2	52.5	54.4	11.1	11.9	13.1
Uganda	20.9	20.9	21.1	6.9	7.4	8.2	0.1	0.1	0.1
Ukraine	24.3	24.3	24.3	41.2	41.2	41.2	7.4	7.4	7.4
United Arab Emirates	27.0	27.0	27.0	66.9	66.9	66.9	24.5	24.5	24.5
United Kingdom	26.4	26.8	27.0	62.5	65.7	67.8	18.7	21.6	23.7
United Republic of Tanzania	21.7	21.8	21.9	14.7	15.4	16.8	0.6	0.7	0.8
United States of America	27.8	28.4	29.3	72.2	75.6	80.5	32.0	36.5	44.2
Uruguay	26.1	26.6	27.3	60.0	63.6	69.3	17.1	20.1	25.7
Uzbekistan	24.4	24.4	24.4	42.0	42.0	42.0	7.1	7.1	7.1
Vanuatu	25.5	25.7	26.1	54.0	56.3	60.2	11.9	13.4	16.2
Venezuela	26.6	27.0	27.8	65.6	69.1	74.4	19.7	23.2	29.5
Viet Nam	20.4	20.8	21.3	2.7	4.1	7.5	0.0	0.0	0.0
Yemen	22.6	22.6	22.6	24.6	24.6	24.6	2.0	2.0	2.0
Zambia	20.8	20.9	21.0	7.0	7.5	8.3	0.1	0.1	0.1
Zimbabwe	21.7	21.8	22.0	14.5	15.3	16.7	0.5	0.6	0.8

Notes:

1. Data source: WHO Global InfoBase (http://infobase.who.int)
2. Values age-adjusted to the WHO Standard Population
3. Mean BMI is measured in kg/m^2
4. Overweight is defined as $\geq 25 kg/m^2$, the value is expressed as a percentage
5. Obese is defined as $\geq 30 kg/m^2$, the value is expressed as a percentage
6. Standard deviation available upon request, contact infobase@who.int

Table 2

Females aged 15 years and above mean BMI, prevalence of overweight, and prevalence of obesity estimates and projections for 2002 to 2010

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Afghanistan	21.2	21.5	21.8	15.6	17.4	20.8	1.1	1.4	2.1
Albania	25.8	25.8	25.8	52.5	52.5	52.5	23.8	23.8	23.8
Algeria	24.3	24.6	25.1	43.2	45.6	49.4	11.9	13.4	16.2
Andorra	27.1	27.3	27.6	65.5	66.8	68.7	27.3	28.8	31.2
Angola	23.0	23.2	23.6	31.4	33.6	37.2	5.9	6.9	8.7
Antigua and Barbuda	26.2	26.4	26.7	58.3	59.8	62.1	21.5	22.9	25.3
Argentina	26.9	27.5	28.5	62.1	65.7	71.2	27.1	31.0	37.8
Armenia	25.7	25.7	25.7	52.8	52.8	52.8	19.8	19.8	19.8
Australia	26.4	26.8	27.3	60.2	62.7	66.5	22.5	24.9	29.1
Austria	25.9	25.9	26.1	53.4	53.2	55.2	20.4	20.3	21.8
Azerbaijan	26.4	26.4	26.4	56.8	56.8	56.8	24.9	24.9	24.9
Bahamas	26.7	26.9	27.2	62.5	63.8	65.9	25.6	27.1	29.5
Bahrain	27.7	27.9	28.4	66.0	67.3	69.5	33.5	35.2	37.9
Bangladesh	19.4	19.6	19.8	4.3	5.4	6.7	0.1	0.2	0.2
Barbados	29.6	30.3	31.3	77.8	80.1	83.3	46.7	50.8	57.2
Belarus	27.7	27.7	27.7	69.9	69.9	69.9	32.2	32.2	32.2
Belgium	24.2	24.2	24.5	40.7	40.7	42.9	9.5	9.5	10.7
Belize	25.5	25.7	26.1	53.3	54.9	57.6	17.2	18.6	21.0
Benin	23.1	23.8	24.4	32.8	39.1	43.8	6.2	9.3	12.1
Bhutan	24.5	24.7	25.1	44.7	46.5	49.6	13.1	14.3	16.5
Bolivia	27.1	27.7	28.7	64.4	68.0	73.2	28.8	33.1	40.2
Bosnia and Herzegovina	25.7	25.7	25.7	51.0	51.0	51.0	21.5	21.5	21.5
Botswana	24.8	25.1	25.6	46.9	49.4	53.5	12.9	14.6	17.7
Brazil	25.1	25.6	26.5	49.2	53.5	60.3	15.0	18.3	24.5
Brunei Darussalam	26.7	26.9	27.2	61.9	63.2	65.2	25.9	27.4	29.7
Bulgaria	25.0	25.0	25.0	45.5	45.5	45.5	19.0	19.0	19.0
Burkina Faso	21.3	21.3	21.7	15.8	16.0	19.4	1.1	1.1	1.7

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Burundi	21.5	21.7	22.0	16.3	18.1	21.1	1.2	1.5	2.2
Cambodia	20.9	21.2	21.7	7.1	9.3	13.8	0.1	0.1	0.4
Cameroon	23.8	24.1	24.6	38.3	41.1	45.8	9.2	10.8	13.8
Canada	25.9	26.1	26.5	55.9	57.1	59.5	22.2	23.2	25.7
Cape Verde	24.2	24.4	24.9	41.8	44.1	48.0	11.0	12.5	15.1
Central African Republic	21.8	21.9	22.0	17.7	18.5	20.0	1.1	1.3	1.5
Chad	21.5	21.7	22.1	17.1	19.2	22.9	1.3	1.7	2.6
Chile	27.0	27.6	28.5	64.4	68.0	73.3	27.2	31.6	39.1
China	22.6	22.8	23.4	22.7	24.7	32.0	1.5	1.9	3.6
Colombia	25.9	25.8	26.7	55.1	54.6	61.1	20.3	19.9	26.1
Comoros	23.2	23.5	24.0	33.1	35.9	40.7	5.8	7.1	9.6
Congo	22.4	22.5	22.7	24.2	25.2	26.8	2.7	3.0	3.5
Cook Islands	33.6	34.0	34.7	88.5	89.2	90.3	69.0	70.8	73.4
Costa Rica	26.1	26.4	27.3	56.2	57.8	63.8	22.7	24.2	30.5
Croatia	24.9	25.0	25.3	45.3	46.4	48.3	15.4	16.2	17.6
Cuba	26.0	26.6	27.5	57.0	61.1	67.2	20.7	24.6	31.5
Cyprus	26.2	26.4	26.7	59.0	60.6	63.0	20.7	22.2	24.7
Czech Republic	25.2	25.3	25.6	47.0	47.8	49.3	20.0	20.7	22.1
Côte d'Ivoire	23.3	23.4	23.6	32.5	34.2	36.0	4.8	5.4	6.2
Democratic People's Republic of Korea	24.5	24.8	25.1	44.0	46.2	49.7	9.5	10.7	12.9
Democratic Republic of Timor-Leste	24.7	24.9	25.3	46.4	48.2	51.1	14.2	15.4	17.7
Democratic Republic of the Congo	20.9	21.1	21.4	11.9	13.3	15.8	0.6	0.8	1.1
Denmark	23.9	24.0	24.2	37.5	39.1	41.4	6.4	7.1	8.3
Djibouti	22.7	22.9	23.3	28.8	31.0	34.5	5.0	5.8	7.4
Dominica	29.0	29.6	30.6	74.4	77.1	80.8	41.8	46.0	52.6
Dominican Republic	26.9	27.5	28.5	62.8	66.4	71.7	27.8	31.8	38.7

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Ecuador	25.2	25.4	25.8	50.9	52.6	55.5	15.4	16.7	19.1
Egypt	28.6	29.6	30.0	69.7	74.2	76.0	39.3	45.5	48.0
El Salvador	25.4	25.6	26.0	52.3	54.0	56.8	16.5	17.8	20.2
Equatorial Guinea	24.7	24.9	25.4	46.1	48.5	52.3	13.8	15.4	18.4
Eritrea	20.3	20.2	20.3	5.9	5.7	6.3	0.1	0.1	0.1
Estonia	23.5	23.5	23.5	33.8	33.8	33.8	8.4	8.4	8.4
Ethiopia	19.7	19.8	19.9	3.1	3.3	3.7	0.0	0.0	0.0
Fiji	27.2	27.6	28.3	63.4	65.6	69.5	29.8	32.5	37.1
Finland	25.6	25.6	25.9	52.0	52.4	54.5	17.5	17.8	19.4
France	23.5	23.7	23.9	33.4	34.7	36.9	6.1	6.6	7.6
Gabon	24.5	24.9	25.5	45.0	47.7	52.2	13.5	15.5	19.2
Gambia	21.9	22.1	22.5	20.5	22.8	27.0	1.9	2.5	3.6
Georgia	25.0	25.2	25.6	48.9	50.8	53.8	13.4	14.7	17.1
Germany	25.8	26.0	26.2	53.6	55.1	57.1	19.2	20.4	22.1
Ghana	22.4	22.6	23.1	26.2	28.1	32.5	3.5	4.2	5.9
Greece	26.5	26.7	27.0	60.1	61.3	63.2	23.4	24.5	26.4
Grenada	25.9	26.1	26.5	56.4	58.0	60.4	19.8	21.2	23.6
Guatemala	26.6	27.3	28.2	61.1	65.4	70.9	25.0	29.7	36.8
Guinea	22.6	22.9	23.4	27.8	30.4	34.9	4.2	5.2	7.1
Guinea-Bissau	21.7	21.9	22.3	20.3	22.1	25.1	2.4	2.8	3.7
Guyana	25.3	25.5	25.8	51.2	52.9	55.8	15.6	17.0	19.4
Haiti	24.0	25.2	26.1	39.8	50.6	57.7	8.2	15.0	21.1
Honduras	24.9	25.1	25.4	47.5	49.4	52.5	13.1	14.4	16.7
Hungary	25.1	25.1	25.1	47.4	47.4	47.4	16.1	16.1	16.1
Iceland	26.4	26.6	26.8	60.5	61.7	63.7	22.0	23.2	25.3
India	20.9	21.1	21.4	13.7	15.2	18.1	1.1	1.4	2.0
Indonesia	21.9	22.2	22.7	20.3	22.7	27.1	2.0	2.6	3.9
Iran (Islamic Republic of)	26.2	26.5	26.9	55.7	57.8	60.2	25.0	27.0	29.5
Iraq	25.0	25.2	25.6	49.0	50.8	53.6	15.5	16.8	19.1
Ireland	24.2	24.3	24.5	40.3	41.7	43.9	8.4	9.1	10.4
Israel	26.3	26.5	26.7	56.3	57.5	59.3	23.3	24.3	25.9

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Italy	24.1	24.2	24.4	37.8	38.3	40.0	12.2	12.6	13.7
Jamaica	28.2	28.8	29.8	71.8	74.7	79.0	36.4	41.0	48.3
Japan	21.9	21.9	21.7	18.6	18.1	16.2	1.5	1.5	1.1
Jordan	28.7	27.9	28.3	67.3	63.4	65.4	40.2	35.6	37.9
Kazakhstan	24.4	24.0	24.0	41.9	38.9	38.9	13.1	11.0	11.0
Kenya	22.1	22.2	22.4	21.3	21.7	23.3	1.8	1.9	2.2
Kiribati	28.4	28.8	29.5	71.9	73.9	77.1	37.9	41.0	46.1
Kuwait	30.4	31.0	31.4	76.6	79.0	80.4	49.2	52.9	55.2
Kyrgyzstan	24.7	24.7	24.7	43.9	43.9	43.9	14.2	14.2	14.2
Lao People's Democratic Republic	24.5	24.7	25.1	43.5	45.6	49.2	9.2	10.4	12.6
Latvia	24.8	24.8	24.8	44.7	44.7	44.7	15.0	15.0	15.0
Lebanon	26.0	26.2	26.6	52.9	54.3	56.7	23.9	25.2	27.4
Lesotho	27.8	27.9	28.2	68.7	69.5	70.8	33.2	34.3	36.1
Liberia	23.9	24.1	24.6	39.2	41.6	45.4	9.6	11.0	13.4
Libyan Arab Jamahiriya	25.9	26.1	26.4	56.0	57.5	59.8	21.1	22.5	24.9
Lithuania	24.7	24.7	24.7	43.9	43.9	43.9	13.9	13.9	13.9
Luxembourg	25.4	25.6	25.8	52.6	54.0	56.2	15.0	16.0	17.8
Madagascar	21.6	21.8	22.2	18.1	20.2	24.1	1.5	1.9	2.9
Malawi	22.2	22.4	22.6	21.6	23.5	25.2	1.6	2.0	2.4
Malaysia	23.4	23.7	24.3	34.2	37.2	42.2	6.8	8.2	11.0
Maldives	24.9	25.3	25.8	45.7	47.6	50.8	20.2	22.0	25.0
Mali	22.4	23.2	23.7	26.1	33.6	38.4	3.4	6.2	8.4
Malta	27.9	28.1	28.3	65.1	66.1	67.6	33.8	34.8	36.5
Marshall Islands	25.1	25.3	25.7	50.0	51.8	54.7	14.8	16.1	18.5
Mauritania	25.6	25.9	26.5	52.2	54.6	58.6	20.6	22.9	26.9
Mauritius	25.1	25.4	26.0	49.5	52.3	56.8	16.1	18.3	22.3
Mexico	27.5	27.9	28.9	65.6	67.9	73.0	31.6	34.3	41.0
Micronesia (Federated States of)	34.3	34.7	35.4	89.5	90.1	91.1	71.3	72.9	75.3

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Monaco	26.9	27.1	27.4	64.3	65.6	67.6	26.0	27.5	29.9
Mongolia	26.9	27.4	28.3	65.8	69.3	74.4	24.6	29.0	36.6
Morocco	25.6	25.8	26.2	53.0	54.7	57.5	19.0	20.5	23.1
Mozambique	22.4	22.5	22.7	24.3	25.3	26.9	2.7	3.0	3.4
Myanmar	24.3	24.5	24.9	41.1	43.3	47.0	8.0	9.1	11.3
Namibia	23.1	23.2	23.4	31.5	32.6	34.4	4.9	5.3	6.1
Nauru	36.1	36.5	37.1	92.0	92.4	93.0	77.7	78.8	80.5
Nepal	20.3	20.3	20.6	8.0	8.0	9.9	0.2	0.2	0.3
Netherlands	24.4	24.6	24.8	42.6	44.0	46.1	10.7	11.5	12.9
New Zealand	27.0	27.6	28.7	64.0	68.2	74.2	26.7	31.5	39.9
Nicaragua	27.0	27.9	28.9	62.9	68.1	73.1	28.3	34.3	41.1
Niger	21.7	21.9	22.3	19.6	21.3	25.1	1.9	2.3	3.4
Nigeria	22.8	23.1	23.6	29.6	32.2	36.8	4.9	6.0	8.1
Niue	31.6	32.1	32.8	83.8	85.0	86.7	58.6	61.0	64.7
Norway	24.3	24.4	24.7	42.0	43.4	45.8	8.6	9.3	10.7
Oman	24.7	24.9	25.3	46.0	47.8	50.8	13.5	14.8	17.0
Pakistan	22.1	22.3	22.8	23.2	25.5	29.5	2.9	3.6	5.0
Palau	30.4	30.9	31.6	81.0	82.4	84.5	52.2	55.0	59.4
Panama	25.7	25.9	26.2	54.7	56.3	58.9	18.3	19.8	22.2
Papua New Guinea	22.6	22.9	23.4	26.1	29.0	34.0	3.2	4.2	6.1
Paraguay	25.3	25.5	25.9	51.4	53.2	56.0	15.8	17.2	19.6
Peru	27.1	27.4	28.4	62.7	64.7	70.1	28.9	31.1	37.7
Philippines	22.5	22.8	23.3	25.4	28.5	33.6	2.8	3.7	5.5
Poland	24.8	24.8	24.8	44.3	44.3	44.3	18.0	18.0	18.0
Portugal	25.0	25.2	25.5	47.6	49.2	51.2	14.6	16.1	17.7
Qatar	26.9	27.1	27.4	62.9	64.1	65.9	27.9	29.3	31.6
Republic of Korea	24.0	24.6	25.3	38.2	43.8	51.0	7.2	10.1	14.6
Republic of Moldova	24.6	24.9	25.2	45.4	47.4	50.7	11.2	12.5	14.8
Romania	24.2	24.2	24.2	40.6	40.6	40.6	12.0	12.0	12.0
Russian Federation	25.9	25.9	25.9	51.7	51.7	51.7	23.6	23.6	23.6

Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
Rwanda	22.0	22.1	22.2	19.2	20.1	21.7	1.2	1.3	1.6
Saint Kitts and Nevis	26.2	26.4	26.8	58.9	60.3	62.6	22.0	23.4	25.8
Saint Lucia	27.4	27.9	28.9	65.7	69.1	74.1	30.5	34.7	41.7
Saint Vincent and the Grenadines	25.6	25.8	26.2	54.0	55.7	58.3	17.8	19.2	21.6
Samoa	31.4	31.8	32.5	80.7	82.1	84.1	55.0	57.3	60.9
San Marino	26.9	27.1	27.4	64.1	65.4	67.4	25.7	27.2	29.7
Sao Tome and Principe	22.3	22.5	22.9	25.2	27.2	30.5	3.7	4.4	5.7
Saudi Arabia	27.4	27.6	28.0	63.0	63.8	65.9	32.8	33.8	36.4
Senegal	23.3	23.6	24.1	34.1	36.7	41.0	7.8	9.2	11.8
Serbia and Montenegro	25.4	25.4	25.4	48.5	48.5	48.5	20.6	20.6	20.6
Seychelles	28.0	28.4	29.1	68.6	70.7	73.8	35.8	38.6	43.2
Sierra Leone	24.1	24.5	25.0	41.6	44.5	49.1	10.9	12.7	16.0
Singapore	22.0	22.2	22.7	20.7	22.0	26.7	1.6	1.8	2.9
Slovakia	26.2	26.4	26.8	59.1	60.6	62.9	21.3	22.8	25.3
Slovenia	26.6	26.8	27.1	62.1	63.5	65.7	23.7	25.2	27.6
Solomon Islands	24.9	25.1	25.5	48.0	49.9	52.9	13.4	14.7	17.1
Somalia	21.6	21.8	22.1	19.3	21.1	24.0	2.1	2.6	3.4
South Africa	27.8	27.9	28.2	66.4	67.2	68.5	34.3	35.2	36.8
Spain	24.9	25.2	25.4	45.7	47.7	49.8	14.5	15.8	17.3
Sri Lanka	20.0	20.2	20.5	5.0	5.9	7.9	0.1	0.1	0.2
Sudan	22.5	22.7	23.1	27.0	29.1	32.5	4.3	5.1	6.5
Suriname	25.3	25.5	25.9	51.5	53.2	56.1	15.8	17.2	19.6
Swaziland	24.6	24.9	25.4	45.2	47.8	51.9	11.8	13.5	16.5
Sweden	24.5	24.6	24.9	43.3	44.9	47.2	10.0	10.9	12.4
Switzerland	25.6	25.9	26.2	53.8	56.7	58.9	16.4	18.7	20.6
Syrian Arab Republic	25.9	26.1	26.4	55.7	57.2	59.6	20.8	22.2	24.6
Tajikistan	24.3	24.5	24.9	41.8	43.9	47.4	9.2	10.4	12.6
Thailand	23.2	23.5	24.1	32.5	35.2	39.9	7.0	8.4	11.1

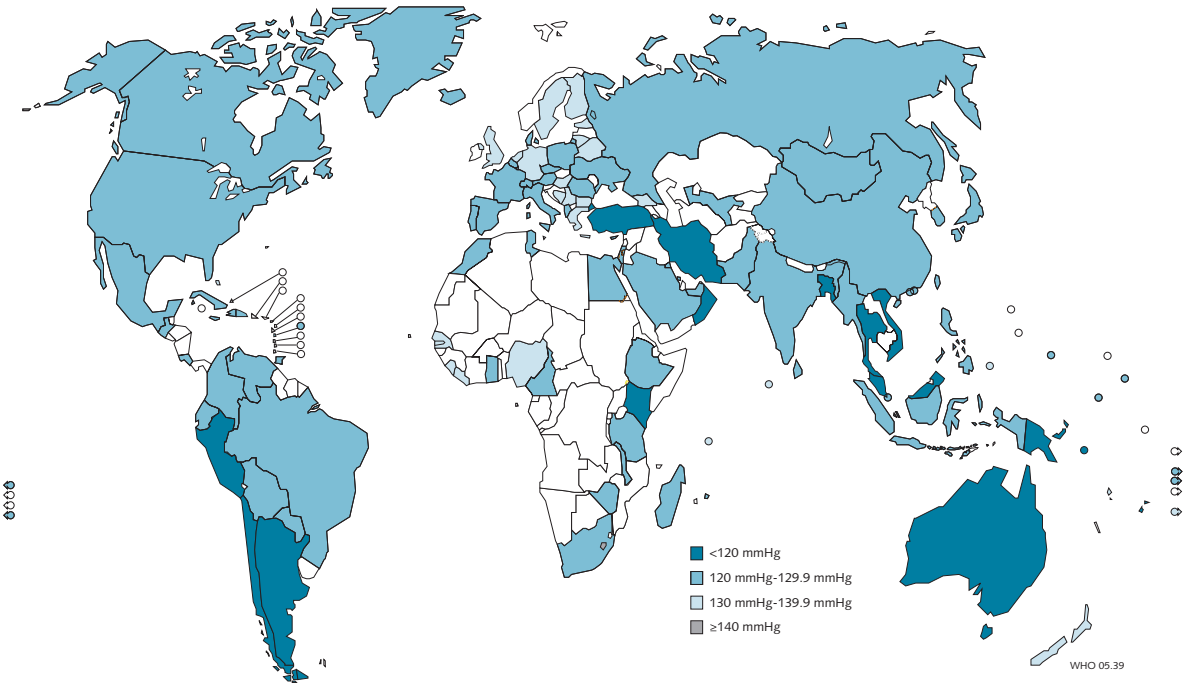
Country	Mean BMI			Overweight (%)			Obesity (%)		
	2002	2005	2010	2002	2005	2010	2002	2005	2010
The former Yugoslav Republic of Macedonia	26.4	26.4	26.4	57.4	57.4	57.4	24.3	24.3	24.3
Togo	22.7	23.0	23.4	28.3	30.9	35.5	4.3	5.3	7.3
Tonga	35.3	35.7	36.3	90.9	91.4	92.1	74.8	76.1	78.1
Trinidad and Tobago	29.0	29.6	30.6	74.4	77.0	80.8	41.9	46.1	52.7
Tunisia	26.7	26.9	27.3	57.9	59.2	61.4	28.8	30.2	32.6
Turkey	27.6	27.6	27.6	65.4	65.7	65.7	32.1	32.5	32.5
Turkmenistan	24.9	24.9	24.9	45.5	45.5	45.5	15.0	15.0	15.0
Tuvalu	26.3	26.5	26.8	59.2	60.7	62.9	22.3	23.8	26.2
Uganda	22.1	22.3	22.4	20.1	22.2	23.9	1.3	1.6	1.9
Ukraine	25.4	25.4	25.4	48.5	48.5	48.5	19.4	19.4	19.4
United Arab Emirates	28.3	28.6	29.0	68.4	69.6	71.6	37.9	39.4	42.0
United Kingdom	26.2	26.7	26.9	58.8	61.9	63.8	21.3	24.2	26.3
United Republic of Tanzania	22.6	22.7	22.9	26.0	27.0	28.7	2.8	3.1	3.6
United States of America	28.2	28.8	29.9	69.8	72.6	76.7	37.8	41.8	48.3
Uruguay	25.7	26.3	27.2	54.1	58.1	64.4	19.6	23.3	29.8
Uzbekistan	24.7	25.4	25.4	44.3	49.9	49.9	13.5	17.6	17.6
Vanuatu	26.4	26.8	27.5	60.1	62.9	67.2	23.4	26.3	31.4
Venezuela	26.2	26.7	27.7	57.5	61.4	67.3	22.4	26.2	33.0
Viet Nam	20.3	20.6	21.0	7.0	8.7	12.2	0.2	0.3	0.7
Yemen	22.6	22.8	23.1	27.8	29.4	32.2	4.4	5.1	6.2
Zambia	22.0	21.9	22.0	20.2	18.6	20.0	1.6	1.3	1.5
Zimbabwe	24.9	25.1	25.3	47.2	48.9	50.6	14.1	15.3	16.7

Notes:

1. Data source: WHO Global InfoBase (http://infobase.who.int)
2. Values age-adjusted to the WHO Standard Population
3. Mean BMI is measured in kg/m^2
4. Overweight is defined as $\geq 25kg/m^2$, the value is expressed as a percentage
5. Obese is defined as $\geq 30kg/m^2$, the value is expressed as a percentage
6. Standard deviation available upon request, contact infobase@who.int

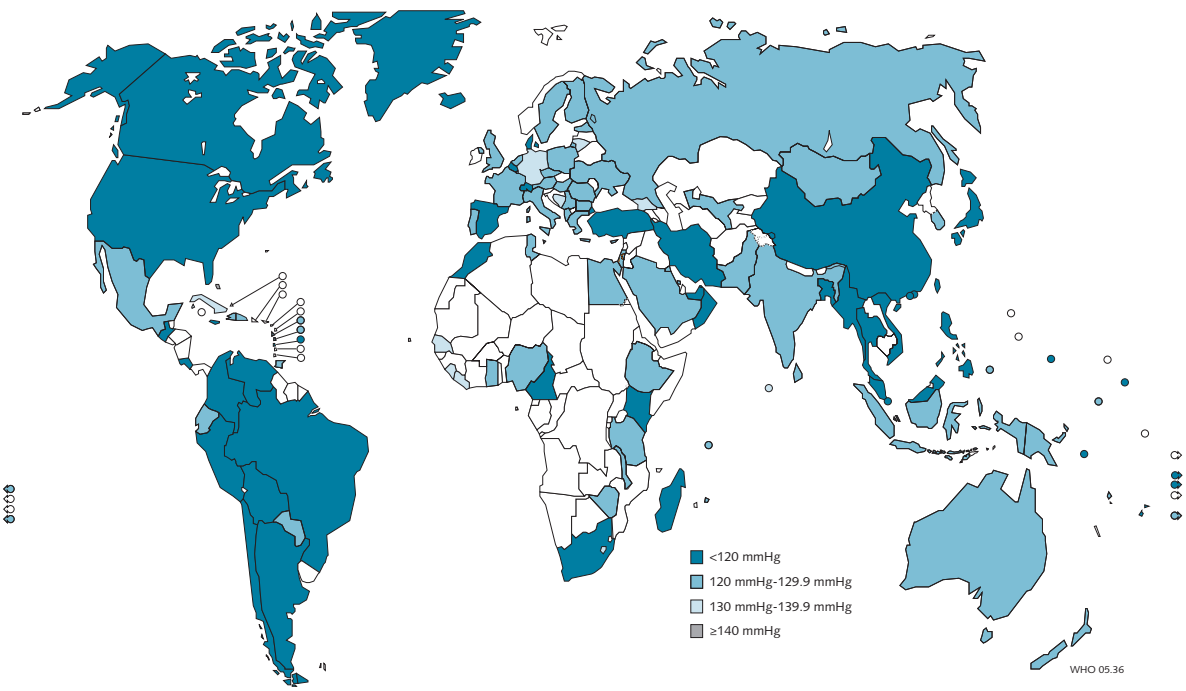
Map 3

Estimated mean systolic blood pressure (mmHg), males aged 15 and above, 2002



Map 4

Estimated mean systolic blood pressure (mmHg), females aged 15 and above, 2002



Source: WHO Global InfoBase

Age-standardized to WHO Standard Population

The designations employed and the presentation of material on the above maps do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dashed lines represent approximate border lines for which there may not yet be full agreement.

Table 3

Males aged 15 years and above mean SBP estimates and projections for 2002 to 2010

Country	2002	2005	2010
Albania	128.8	128.8	128.8
Argentina	119.9	119.9	119.9
Australia	118.2	118.2	118.2
Austria	128.6	127.9	126.8
Bahamas	139.2	139.2	139.2
Bahrain	125.3	125.3	125.3
Bangladesh	116.9	116.9	116.9
Barbados	123.6	123.6	123.6
Belarus	134.2	134.2	134.2
Belgium	127.2	127.2	127.2
Bolivia	124.0	124.0	124.1
Bosnia and Herzegovina	130.1	130.1	130.1
Brazil	123.7	123.7	123.7
Bulgaria	132.4	132.4	132.4
Cameroon	124.8	125.5	126.8
Canada	125.9	125.9	125.9
Chile	118.5	118.5	118.5
China	121.3	121.5	121.8
Colombia	122.0	122.0	122.0
Cook Islands	129.2	129.2	129.2
Costa Rica	121.6	121.6	121.6
Cuba	126.8	126.8	126.8
Cyprus	127.7	127.7	127.7
Czech Republic	129.8	129.1	128.0
Denmark	122.2	121.6	120.6
Dominican Republic	126.0	126.0	126.0
Ecuador	124.4	124.5	124.6
Egypt	124.2	124.2	124.3
Estonia	131.4	131.4	131.4

Country	2002	2005	2010
Ethiopia	123.7	124.2	125.4
Fiji	116.8	116.8	116.8
Finland	131.4	130.3	128.5
France	129.3	127.2	123.9
Gambia	131.0	131.0	131.4
Georgia	139.7	139.7	139.7
Germany	134.4	134.4	134.4
Ghana	124.4	124.9	125.8
Greece	130.5	129.8	128.6
Guatemala	128.1	128.2	128.4
Haiti	125.5	125.6	125.9
Hungary	133.7	133.7	133.7
Iceland	124.9	124.9	124.9
India	124.4	124.4	124.4
Indonesia	123.3	123.3	123.3
Iran (Islamic Republic of)	118.1	118.1	118.1
Israel	127.5	126.8	125.7
Italy	128.8	127.4	125.0
Jamaica	120.6	120.6	120.6
Japan	126.6	126.0	125.0
Kenya	118.2	118.7	119.6
Kiribati	127.0	127.0	127.0
Kuwait	129.4	129.4	129.4
Lesotho	141.6	142.2	144.1
Liberia	131.3	132.2	133.8
Lithuania	136.7	136.7	136.7
Luxembourg	125.8	125.1	124.0
Madagascar	124.3	124.7	125.6
Malawi	127.1	128.1	130.0
Malaysia	118.1	118.1	118.1

Country	2002	2005	2010
Maldives	137.9	137.9	137.9
Malta	132.3	131.6	130.4
Mauritius	127.0	127.3	128.0
Mexico	124.7	124.7	124.7
Micronesia (Federated States of)	124.3	124.3	124.3
Mongolia	129.0	129.0	129.0
Morocco	129.7	129.9	130.2
Myanmar	120.6	120.6	120.6
Nauru	128.8	128.8	128.8
Netherlands	130.5	129.8	128.7
New Zealand	133.8	132.5	130.3
Nigeria	131.6	132.8	134.6
Niue	125.1	125.1	125.1
Oman	116.5	116.5	116.5
Pakistan	125.5	125.5	125.5
Palau	134.9	134.9	134.9
Papua New Guinea	117.5	117.5	117.5
Paraguay	121.8	121.8	121.8
Peru	113.9	113.9	113.9
Philippines	121.9	121.9	121.9
Poland	128.6	128.6	128.6
Portugal	126.7	126.1	125.1
Republic of Korea	126.1	126.1	126.1
Romania	126.8	126.8	126.8
Russian Federation	129.4	129.4	129.4
Saint Lucia	126.8	126.8	126.8
Samoa	124.7	124.7	124.7
Saudi Arabia	123.5	123.5	123.5
Senegal	133.8	134.8	136.5
Serbia and Montenegro	132.7	132.7	132.7
Seychelles	134.7	134.9	135.6
Sierra Leone	133.3	134.5	136.5
Singapore	124.3	124.3	124.3
Solomon Islands	116.6	116.6	116.6
South Africa	124.8	125.2	125.7
Spain	123.1	122.5	121.6
Sri Lanka	123.3	123.3	123.3
Sweden	130.8	130.8	130.8
Switzerland	126.2	125.4	124.0
Thailand	119.3	119.3	119.3
Tonga	133.2	133.2	133.2
Trinidad and Tobago	128.4	128.4	128.4
Tunisia	124.4	124.4	124.4
Turkey	117.6	117.6	117.6
Ukraine	127.2	127.2	127.2
United Arab Emirates	123.9	123.9	123.9
United Kingdom	132.2	130.9	128.7
United Republic of Tanzania	123.4	124.2	125.4
United States of America	123.3	123.3	123.3
Uzbekistan	121.4	121.4	121.4
Vanuatu	130.9	130.9	130.9
Venezuela	120.2	120.2	120.2
Viet Nam	119.6	119.6	119.6
Zimbabwe	123.9	124.3	125.2

Notes:

1. Data source: WHO Global InfoBase (http://infobase.who.int)
2. Values age-adjusted to the WHO Standard Population
3. Mean SBP is measured in mmHg
4. Standard deviation available upon request, contact infobase@who.int

Table 4

Females aged 15 years and above mean SBP estimates and projections for 2002 to 2010

Country	2002	2005	2010
Albania	125.1	125.1	125.1
Argentina	119.2	119.2	119.2
Australia	124.7	124.7	124.7
Austria	122.4	121.6	120.2
Bahamas	142.4	142.4	142.4
Bahrain	128.2	128.2	128.2
Bangladesh	117.3	117.3	117.5
Barbados	118.8	118.8	118.8
Belgium	118.9	118.9	118.9
Bolivia	119.4	119.4	119.5
Bosnia and Herzegovina	130.7	130.7	130.7
Brazil	119.1	119.1	119.1
Bulgaria	125.2	125.2	125.2
Cameroon	116.5	116.9	117.6
Canada	118.4	118.4	118.4
Chile	115.6	115.6	115.6
China	118.9	119.1	119.5
Colombia	119.1	119.1	119.1
Cook Islands	127.6	127.6	127.6
Costa Rica	117.2	117.2	117.2
Cuba	135.2	135.2	135.2
Cyprus	123.4	123.4	123.4
Czech Republic	123.1	122.2	120.6
Denmark	114.8	114.1	113.1
Dominican Republic	121.2	121.2	121.2
Ecuador	121.6	121.7	121.8
Egypt	125.1	125.1	125.2
Estonia	121.7	121.7	121.7
Ethiopia	122.8	123.3	124.3

Country	2002	2005	2010
Fiji	111.8	111.8	111.8
Finland	124.6	123.2	121.0
France	124.6	122.5	119.2
Gambia	128.3	128.3	128.6
Georgia	134.6	134.6	134.6
Germany	130.0	130.0	130.0
Ghana	123.4	123.9	124.8
Greece	124.1	123.2	121.7
Guatemala	112.9	112.9	112.9
Haiti	126.9	127.2	127.7
Hungary	126.1	126.1	126.1
Iceland	117.9	117.9	117.9
India	122.1	122.1	122.3
Indonesia	123.3	123.3	123.3
Iran (Islamic Republic of)	118.6	118.6	118.6
Israel	121.1	120.2	118.8
Italy	121.8	120.3	118.0
Jamaica	119.1	119.1	119.1
Japan	118.6	117.6	116.1
Kenya	107.7	107.8	107.9
Kiribati	118.3	118.3	118.3
Kuwait	127.3	127.3	127.3
Lesotho	136.5	137.0	138.5
Liberia	134.2	135.2	136.9
Lithuania	133.8	133.8	133.8
Luxembourg	120.8	120.0	118.7
Madagascar	118.8	119.0	119.7
Malawi	123.2	124.0	125.3
Malaysia	117.0	117.0	117.0

Country	2002	2005	2010
Maldives	139.6	140.4	141.8
Malta	128.1	127.2	125.8
Mauritius	123.7	124.0	124.5
Mexico	121.3	121.3	121.3
Micronesia (Federated States of)	118.7	118.7	118.7
Mongolia	125.5	125.5	125.5
Morocco	119.7	119.7	119.7
Myanmar	114.3	114.3	114.3
Nauru	121.5	121.5	121.5
Netherlands	121.6	120.8	119.5
New Zealand	122.8	121.6	119.6
Nigeria	128.4	129.4	131.0
Niue	122.4	122.4	122.4
Oman	114.4	114.4	114.4
Pakistan	125.0	125.2	125.4
Palau	128.6	128.6	128.6
Papua New Guinea	121.4	121.4	121.4
Paraguay	128.0	128.0	128.0
Peru	110.0	110.0	110.1
Philippines	116.8	116.8	116.8
Poland	123.3	123.3	123.3
Portugal	124.4	123.6	122.3
Republic of Korea	120.8	120.8	120.8
Romania	122.0	122.0	122.0
Russian Federation	127.4	127.4	127.4
Saint Lucia	122.2	122.2	122.2
Samoa	116.2	116.2	116.2
Saudi Arabia	120.6	120.6	120.6
Senegal	133.7	134.7	136.3
Serbia and Montenegro	129.9	129.9	129.9
Seychelles	127.7	127.9	128.4
Sierra Leone	133.8	134.9	136.9
Singapore	119.1	119.1	119.1
Solomon Islands	112.7	112.7	112.7
South Africa	119.4	119.6	120.0
Spain	117.6	117.0	115.9
Sri Lanka	121.9	121.9	121.9
Sweden	125.0	125.0	125.0
Switzerland	115.4	114.0	111.9
Thailand	117.3	117.3	117.3
Tonga	126.8	126.8	126.8
Trinidad and Tobago	123.2	123.2	123.2
Tunisia	122.8	122.8	122.8
Turkey	118.8	118.8	118.8
Ukraine	125.3	125.3	125.3
United Arab Emirates	117.6	117.6	117.6
United Kingdom	126.6	125.3	123.1
United Republic of Tanzania	121.8	122.4	123.4
United States of America	118.6	118.6	118.6
Uzbekistan	121.2	121.2	121.2
Vanuatu	127.3	127.3	127.3
Venezuela	116.7	116.7	116.7
Viet Nam	116.7	116.7	116.7
Zimbabwe	128.2	128.9	130.0

Notes:

1. Data source: WHO Global InfoBase (http://infobase.who.int)
2. Values age-adjusted to the WHO Standard Population
3. Mean SBP is measured in mmHg
4. Standard deviation available upon request, contact infobase@who.int

Appendix 5: Statistical methods and calculations

Estimating the attributable fractions and the disease burden

The overall aim of the analyses reported in the results section of this report was to obtain reliable and comparable estimates of the attributable mortality and burden of disease for two risk factors, non-optimal systolic blood pressure and overweight/obesity for 11 countries.

The standard approach in epidemiology for estimating the health effects of a risk factor is to calculate the attributable fraction of a disease or injury due to the risk factor as a function of the prevalence of exposure (P) and the relative risk (RR) of the disease or injury outcome in the exposed group compared to the non-exposed group. The basic statistic in such an "exposure-based" assessment is the population attributable fraction (PAF), defined as the percentage reduction in disease or death that would occur if exposure to the risk factor was reduced to zero and is calculated as follows by equation 1:

$$PAF = \frac{P(RR-1)}{P(RR-1)+1} \qquad (1)$$

Alternatively, the contribution of a risk factor to disease burden can be estimated by comparing the burden due to the observed exposure distribution in a population with that due to an alternative ideal (or minimum risk) exposure distribution *(1)*. This is more appropriate for systolic blood pressure and BMI which have known (or estimated) distributions in a population. For these cases, the burden due to the observed exposure distribution (the first term in the numerator of equation 2) is compared with that from a hypothetical distribution defined according to some scenario or scenarios (the second term in the numerator of equation 2). This hypothetical distribution of exposure to risk is called a counterfactual distribution.

The PAF of a disease due to exposure to the risk factor is then defined by equation 2:

$$PAF = \frac{\sum_{i=1}^{n} P_i RR_i - \sum_{i=1}^{n} P'_i RR_i}{\sum_{i=1}^{n} P_i RR_i} \qquad (2)$$

where n is the number of exposure categories or levels, Pi is the fraction of population in exposure category i, RRi is the relative risk for exposure category i, and P'i the fraction of population in exposure category i in the counterfactual distribution. Because our risk factors BMI and systolic blood pressure are expressed in a continuous manner, the PAF is given by equation 3:

$$PAF = \frac{\int_{x=0}^{m} RR(x)\,P(x) - \int_{x=0}^{m} RR(x)\,P'(x)}{\int_{x=0}^{m} RR(x)\,P(x)} \qquad (3)$$

where RR(x) is the relative risk of death or disease for exposure level x, P(x) is the distribution of the population by exposure level, P'(x) is the counterfactual distribution of exposure for the population, and m is the maximum exposure level.

The fraction of burden from a cause (disease or injury) that is attributed to a risk factor (PAF) can be multiplied by the total burden (B) due to that cause to obtain the attributable burden (AB), i.e. AB = PAF x B for the end cause associated with the risk factor. The same type of calculation can be done for attributable mortality where the fraction of mortality attributed to a risk factor (PAF) can be multiplied by the total mortality (M) due to that cause to obtain the attributable mortality (AM), i.e. AM= PAF x M.

What are the stages in this type of risk assessment?

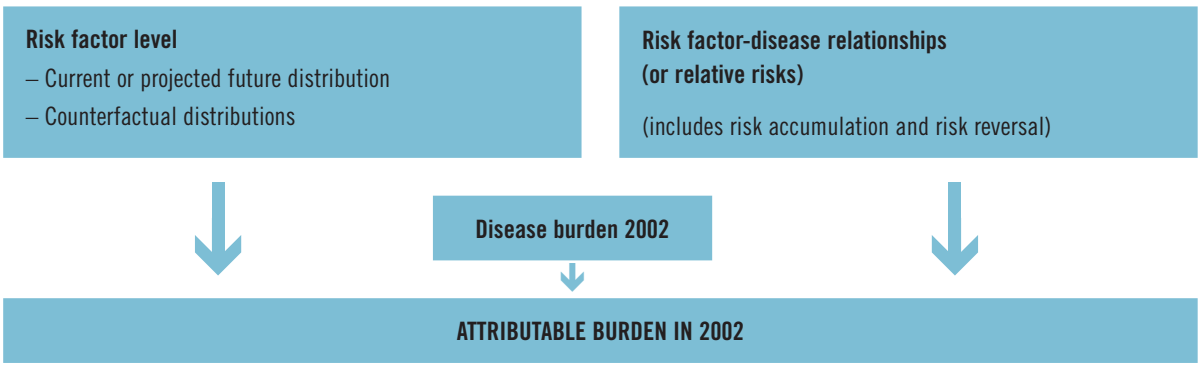
The stages of a comparative risk assessment exercise, such as those done in this report for BMI and systolic blood pressure, are as follows:
- Identify risk factor(s) of interest
- Choose relevant diseases and injuries caused by the risk factor
- Choose appropriate exposure variable
- Collect data on population distribution of exposure for the risk factor (from the WHO Global InfoBase).

Specify the risk factor – disease relationship for each disease and injury (step 2) due to exposure to the risk factor. To do this, you will need to systematically review the epidemiological literature and estimate relative risks by exposure level, age, and sex;
- Choose a counterfactual distribution of exposure;
- Calculate the burden of disease or injury due to each cause identified in step 2;
- Calculate PAFs for each risk factor-cause combination and add them to obtain the total attributable burden;
- Calculate uncertainty around the estimates.

Stages 1 – 6, together with equation 2, will allow you to calculate the PAF. This result together with stage 7 gives the attributable burden. This process is shown in figure 1 (below). An additional feature of figure 1 is the distinction between current burden of premature death and disability due to past or current exposure and future burden due to current and future exposure. To make this distinction explicit, attributable burden is defined as the reduction in current burden that would have been observed if current and past levels of exposure had been equal to some counterfactual distribution of exposure (Figure 2).

Figure 1

Key data inputs and outputs in Comparative Risk Assessment



How to calculate population attributable fractions

Quantitative risk assessment will always involve assumptions and uncertainty. It is essential to document such assumptions and sources of uncertainty so that users of assessment information can be aware of these in interpreting the results. For this analysis, two risk factors were chosen, non-optimal systolic blood pressure and BMI, because these risk factors are causally linked to disease (cardiovascular disease, diabetes and cancers), can be changed through effective primary prevention and comparable estimates are available for most countries. Meaningful data on population distribution of exposure and relative risks is available for systolic blood pressure and BMI. An added advantage of these risk factors is that they can be described by a mean, standard deviation and continuous relative risks. Theoretical minimum distributions for systolic blood pressure and BMI were the same as those used in the CRA project *(2)*. For systolic blood pressure, this is a population mean value of 115mmHg (standard deviation 6) and for BMI, a mean value of 21 (standard deviation 1). An example of the application of equation 3 to the mean systolic blood pressure data is provided below.

Application of the PAF formula for continuous risk factors, the example of systolic blood pressure (SBP)

The theoretical minimum for continuous risk factors is often a distribution of exposure levels. Figure 2, for example, illustrates a scenario for usual systolic blood pressure (SBP) with typical exposure levels in an older population (mean: 150 mmHg; SD: 9 mmHg) compared with the theoretical minimum distribution (mean: 115 mmHg; SD: 6 mmHg). The non-zero standard deviation of the theoretical minimum distribution reflects the reality that there will always be some inter-person variability within any given population even after hypothetical reductions such as that shown in figure 2.

The optimal exposure distribution for a population would overlap precisely with the theoretical minimum distribution. By definition of theoretical minimum, individuals within such a population would be considered collectively to be within a "neutral zone" without any increased risk and therefore with zero attributable burden due to the risk factor of interest. Any population containing individuals at increased risk outside this neutral zone will then have attributable burden greater than zero and exposure distributions converging on the theoretical minimum will have attributable burden tending towards zero.

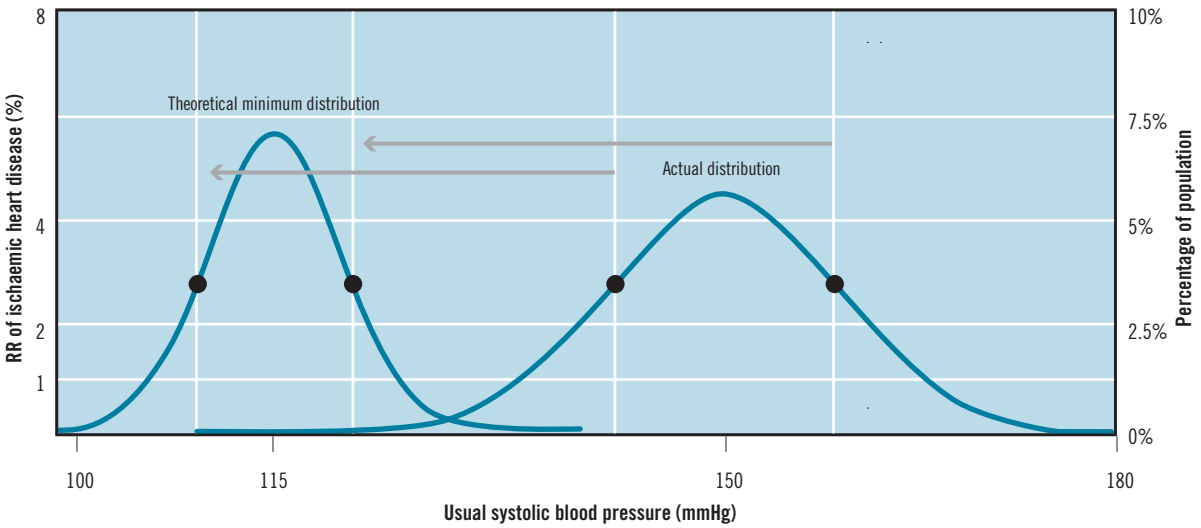
The risk for any individual in the population would be determined by the difference between their current exposure (SBP level) and the SBP level that (s)he would have when the population distribution overlaps with the theoretical minimum distribution. Equation 3 is used in the case of continuous risk factors by assuming that the ordering of individuals in the exposure distribution remains unchanged (i.e. the rank-order correlation of individual exposures before and after a shift to the theoretical minimum equals 1) in the transition to theoretical minimum distribution in estimating the PAF. For example, those with higher/lower exposures levels of a particular risk factor are expected to have higher/lower exposure levels within the theoretical minimum distribution (see the hypothetical individuals in figure 2). Further details regarding the application of equation 3 in the case of continuous risk factors with a non-zero theoretical minimum are described within the CRA project publications *(3-4)*.

Country-level templates for risk assessment

A set of templates for carrying out country-level risk assessment analyses has been constructed using spreadsheet software to facilitate the attributable burden calculations at the national level. These templates use the methodology described above, in the World Health Report 2002 and in more detail in the Comparative Risk Assessment project *(2)*. Additional notes regarding risk factor specific calculations are noted throughout the spreadsheet systems and several exceptions to the previous CRA work are detailed below. WHO country-specific mortality and burden of disease estimates from 2002 were used in the calculations of attributable mortality and disease burden for non-optimal systolic blood pressure and BMI.

Figure 2

Attributable fraction formula when risk factor is continuous



There are two small differences between the implementation of the attributable fraction calculations for systolic blood pressure and BMI within the spreadsheet system and the methodology underlying the analyses presented in recent published results *(2)*. These deviations did not result in major differences from that of the CRA project but for completeness they are detailed as follows:

– The source of hazard estimates for blood pressure and cardiovascular disease has been updated based on a recently published meta analysis involving a much larger database *(5)*;
– A minor change in how the calculations for continuous risk factors have been implemented in that the exposure levels near the theoretical minimum are handled differently. Again, the exact details of how these analyses are carried out is discussed in greater depth elsewhere *(6)*.

Estimates of exposure distributions for a particular country were extracted from the WHO Global InfoBase. Estimates of mortality and burden of disease by cause, age and sex were obtained from the WHO Mortality and Burden of Disease databases *(7)* and entered into a standard set of templates to create a country level analysis. These estimates are considered as the best WHO prior estimates for a given country given the data available to WHO but can potentially be improved with more accurate, country specific data. The template system provides calculations of population attributable fractions and attributable mortality estimates for the country of interest.

Explanation for data on diabetes

Many changes have occurred in the way diabetes is detected and diagnosed, both at a population level and also at a clinical level. A brief description of some of these changes is provided here to facilitate the interpretation of the Country Profile section of this report.

The SuRF2 report includes data on the prevalence of diabetes which is presented with well-defined detection methods and diagnostic criteria. The detection methods of choice are a fasting blood glucose measure and/or an oral glucose tolerance test (using a 75 gram glucose load). The preferred diagnostic criteria are those of WHO from one of the following three time periods, 1980, 1985 and 1999 (Table 1). Most good quality studies use the WHO criteria that correspond to the period in which the survey was performed.

Table 1

Diagnostic values for the oral glucose tolerance test for diabetes mellitus: WHO definitions for 1980, 1985 and 1999 compared.

Diagnostic criteria for diabetes mellitus compared	Glucose concentration mmol/litre (mg/dl)			
	Whole blood		Plasma	
	venous	capillary	venous	capillary
Fasting value				
1980	>=7.0	>=7.0	>=8.0	---
1985	>= 6.7 (>=120)	>= 6.7 (>=120)	>=7.8 (>=140)	>=7.8 (>=140)
1999	>=6.1 (>=110)	>=6.1 (>=110)	>=7.0 (>=126)	>=7.0 (>=126)
OGTT: 2 hours post glucose load of 75 grams				
1980	>=10.0	>=11.0	>=11.0	---
1985	>=10.0 (>=180)	>=11.1 (>=200)	>=11.1 (>=200)	>=12.2 (>=200)
1999	>=10.0 (>=180)	>=11.1 (>=200)	>=11.1 (>=200)	>=12.2 (>=200)

The apparent change in the number of people with diabetes is probably due to the cut-off point for fasting blood glucose concentration being lowered, meaning that the number of people considered to be diabetic now is different than in the past, based on this screening test. For the oral glucose tolerance test (OGTT), the diagnostic blood glucose concentration has remained the same. The OGTT is the preferred measure of diabetes in the population because it also detects impaired glucose tolerance and it provides a consistent measure of the prevalence of diabetes in populations over time. However, the OGTT requires a level of resources which is beyond the capacity of most countries for surveillance purposes and is not recommended in the WHO STEPwise approach to surveillance of chronic disease risk factors.

Exact definitions, as reported by survey sources, have been provided in the Country Profile definitions. Where WHO criteria are used as definitions, this is recorded with the designation “WHO, year”. Many national health surveys collect self-reported information on diabetes status by using a questionnaire that asks whether or not the participants have been diagnosed with diabetes by a medical professional. While measured, population-level data are more accurate, self-reported information does provide base line data where none would otherwise be collected.

References

1. 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, 1 edn. Cambridge, MA, Harvard University Press, 1996.

2. Ezzati M et al., eds. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva, World Health Organization, 2004.

3. Lawes CMM et al. High blood pressure. In: Ezzati M et al., eds. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1. Geneva, World Health Organization, 2004:281-389.

4. Philip W et al. Overweight and obesity (high body mass index). In: Ezzati M et al., eds. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 1. Geneva, World Health Organization, 2004:497-596.

5. Vander Hoorn S et al. Estimating attributable burden of disease from exposure and hazard data. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Vol 2. Geneva, World Health Organization, 2004:2129-2140.

6. Prospective studies collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. Lancet, 2002, 360:1903-1913 (http://pdf.thelancet.com/pdfdownload?uid=llan.360.9349.original_research.23620.1&x=x.pdf, accessed 8 April 2005).

7. Mathers CD et al. The global burden of disease in 2002: data sources, methods and results. Geneva, World Health Organization, 2003 (GPE Discussion Paper no. 54).

Appendix 6: Errata

The known errors concerned with the SuRF2 country data are listed below. If you discover another error, please contact us at infobase@who.int, so that it can be rectified. Note that country data are available from the SuRF2 CD-Rom.

World Health Survey

The definition used for physical inactivity is incorrect. The correct definition is «during the last week subjects undertook either < 30 minutes per day on < 5 days of moderate activity or walking or < 20 minutes per day on < 3 days of vigorous activity or achieving < 10 MET hours per week on < 5 days of any combination of activity».

Global School-Based Student Health Survey

The citation for Zambia was incorrect. The correct citation should be:

Zambia Global School-Based Student Health Survey (GSHS): 2004

Germany

For the country data for Germany, the nouns were not correctly capitalized.

More recent data for Germany are available on the website http://infobase.who.int

China

Wrong definitions were presented for the data provided in the China National Nutrition Survey 2002. The correct defintions are: overweight ≥ 24 and obesity ≥ 28. The standard cut-off points of overweight ≥ 25 and obesity ≥ 30 are available on our website:
http://infobase.who.int

SuRF

Surveillance of Risk Factors

The SuRF Report 2

This report is the second in the Surveillance of Risk Factors Report Series (SuRF). SuRF2 provides a much needed update for the eight major risk factors that cause diseases such as cardiovascular disease, cancer, diabetes and chronic respiratory diseases. It focuses on recent, nationally representative data on tobacco and alcohol use, patterns of physical inactivity, low fruit/vegetable intake, obesity, raised blood pressure, raised cholesterol and diabetes.

For the first time, comparable country-level estimates for two of the abovementioned risk factors, namely overweight/obesity and systolic blood pressure, are presented together with a brief description of the methodology used.

The information presented here comes from a larger data source, the WHO Global InfoBase, which assembles chronic disease data in a single source for immediate use or further analysis. An on-line version of the Global InfoBase is now available at http://infobase.who.int.

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