Cardiovascular disease prevention and control

Translating evidence into action

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"The key to WHO's work in the coming years will be a new commitment to results at country level. Five years from now, our operations will be significantly more focused in countries. We will be "closer to the ground," working more intensively with national health authorities to respond to their priority health goals. We will focus on achievable objectives in areas where WHO can provide skills and resources."

Dr LEE Jong-wook, Director-General
Speech to the Fifty-sixth World Health Assembly

Contents

Foreword

More people suffer from heart attacks and strokes today than at any other time in the history of mankind. Three fourths of these events now occur in the poorer regions of the world which are still experiencing a major burden of communicable diseases.

Heart attacks and strokes are preventable. We have witnessed tremendous strides in their prevention and management due to public health programmes, and medical advances in drug treatment, technology and techniques. But by no means has everyone benefited from this cutting edge medical science.

There is a huge gap that excludes large sections of humanity, even from inexpensive medications that can prevent life threatening heart attacks and strokes. Further, not only does medical information tend to be scarcer in low-resource settings, but local systems for efficient use of scarce information and limited resources are often not in place in such settings.

The WHO-PREMISE (Prevention of REcurrences of Myocardial Infarction and StrokE) project was initiated two years ago to address these issues and scale-up prevention of recurrent heart attacks and strokes in people with established cardiovascular disease. Demonstration projects have been established in 12 countries, and the health care provided to patients who have survived heart attacks and strokes has been assessed.

Over the next few years, in close collaboration with country teams, we will focus our efforts on the development and implementation of context-specific and sustainable strategies at local and national levels to narrow the treatment gaps that have been identified.

Dr Robert Beaglehole
Director, Department of Chronic Diseases and Health Promotion

Dr Catherine Le Galès-Camus
Assistant Director-General
Noncommunicable Diseases and Mental Health

Summary

Every year, an estimated 17 million people die of cardiovascular disease (CVD) (1). Three fourths of these deaths occur in low- and middle-income countries. In addition, at least one third of the world population is currently at high risk of developing major cardiovascular events; an estimated 1.3 billion due to tobacco use, 1 billion due to overweight and at least another billion due to elevated blood pressure, blood cholesterol and/or diabetes (1).

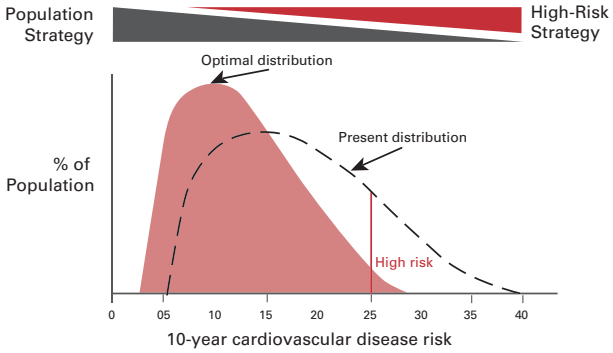


Figure 1. Population-wise and high-risk strategies are complementary and synergistic (2)

The risks associated with blood pressure, cholesterol, smoking and body mass index do not occur across arbitrary thresholds, but rather as a continuum extending across almost all levels seen in different populations. A modest reduction in these risk factors, achieved through an appropriate combination of population-wide and high-risk strategies, has the potential to halve cardiovascular events within a relatively short period of five years (1). While high-risk strategies will not prevent cardiovascular events in individuals with modest elevations of several risk factors, population-based strategies by themselves will not be able to prevent cardiovascular events in those at high risk. The two approaches are complementary and synergistic (Figure 1). The challenge is to balance the mix of population-wide and high-risk strategies to match available resources.

The World Health Organization (WHO) has recently stepped up its activities for the prevention and control of CVD and other major noncommunicable diseases (NCDs) (3). A global strategy for the prevention and control of noncommunicable diseases was endorsed by the Fifty-third World Health Assembly in 2000 (4). The main risk factors of noncommunicable diseases are being targeted through global action, including such initiatives as the WHO Framework Convention on Tobacco Control (5) and the Global Strategy on Diet, Physical Activity and Health (6). In addition, national surveillance systems for key risk factors are being strengthened through the WHO STEPwise approach (7), and regional networks are being established to strengthen capacity and advocacy for prevention and control of noncommunicable diseases at the country level (8).

The following areas have been specifically identified as priority areas for the provision of technical assistance to countries in relation to CVD:

i) secondary prevention of heart attacks and strokes (9);

ii) integrated approach to cost-effective reduction of cardiovascular risk (10);

iii) secondary prevention of rheumatic heart disease (11).

This document outlines the main activities carried out in these three priority areas in collaboration with WHO regional and country offices, from 2001-2004, with a special focus on country-based activities.

Shanthi Mendis
Coordinator, Cardiovascular Diseases

1. Scaling-up secondary prevention of cardiovascular disease

Secondary prevention of major cardiovascular events (fatal and non-fatal myocardial infarction, fatal and non-fatal stroke, sudden cardiac death and revascularization procedures) is a key component of the public health strategy to reduce the rising burden of CVD. Individuals with established CVD, particularly those who have survived a myocardial infarction or stroke, have high rates of recurrent vascular events and are much more likely to die in a recurrent event.

Cost-effective interventions are available for secondary prevention, and the potential gains associated with the consistent use of such interventions are very large. Aspirin, beta blockers, angiotensin converting enzyme (ACE) inhibitors and lipid-lowering therapies lower the risk of future vascular events in high-risk patients by about a quarter each. The benefits of these interventions appear to be largely independent, so that when used together it is expected that two thirds to three quarters of future vascular events could be prevented. When, in addition to these drug therapies, smoking cessation and aggressive blood pressure lowering are attained, it may be possible to lower the risk of future vascular events by about four fifths in high-risk people (12, 13). Given the tremendous potential gains, making these interventions affordable and accessible to all patients with CVD could lead to substantial individual and public health benefits.

In August 2001, WHO convened an expert consultation in collaboration with the Wellcome Trust to discuss ways of assisting Member States in strengthening health care for those with established CVD (9). One of the recommendations of the expert committee was the establishment of model projects in selected countries to generate important information of broad relevance to low- and middle-income countries, and thus promote evidence-based approaches to secondary prevention. In pursuance of this recommendation, the WHO-PREMISE (Prevention of REcurrences of Myocardial Infarction and StrokE) project was developed.

1.1 The WHO-PREMISE (Prevention of Recurrences of Myocardial Infarction and Stroke) project

The WHO-PREMISE project was initiated in 2003. Phase I of the project, a situation analysis of current practice patterns related to secondary prevention of CVD, has now been completed in the demonstration areas of 10 countries: Brazil, Egypt, India, Indonesia, the Islamic Republic of Iran, Pakistan, the Russian Federation, Sri Lanka, Tunisia and Turkey. In addition, Georgia and Uruguay began implementing the situation analysis (Phase I) in defined areas in 2004.

In Phase II, technical assistance will be provided to country teams to develop and implement context-specific, resource-sensitive, sustainable strategies to narrow the gaps identified in the situation analyses. The long-term objective is to replicate these measures on a national scale and to extend the program to other low- and middle-income countries.

1.2 Countries and institutions collaborating in the WHO-PREMISE project

	1.2.1 Brazil	1.2.2 Egypt
		
Demonstration project	Phase I of the project was conducted in Porto Alegre, the capital of Rio Grande do Sul State. Porto Alegre has a population of 1.4 million. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary and tertiary settings and interviewed with standard questionnaires. Phase II will be initiated in 2005.	The situation analysis (Phase I) was conducted in Assiut (Asyout) region. Assiut is the largest town in Upper Egypt. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary and tertiary care settings and interviewed with standard questionnaires.
Investigators	J. G. Fernandes, E. Moriguchi, I. Cruz, J. Siviero.	N.M. Salim, S.S. Abdel-kader, M.A. Ahmad, A.F. Osman, M.A. Adam, D.Y. Abdel-Hamid.
Participating institutions	Hospital São Lucas — Pontifical Catholic University of Rio Grande do Sul, Grupo Hospitalar Conceição, Porto Alegre.	Assiut University Hospital, Assiut Health Insurance Hospital, Primary Health Care Center of Assiut University Hospital, Primary Health Center of Assiut Friends Society for rehabilitation of cardiac patients.
WHO Regional Adviser	S. Robles	O. Khatib
WHO Representative	A.H. Toro Ocampo	Z.S. Hallaj

1.2.3 India

1.2.4 Indonesia

Demonstration project	Phase I was conducted in Bangalore, a city in Karnataka State with a population of 6.5 million. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary and tertiary care settings and interviewed with standard questionnaires. Results of Phase I were discussed at a multidisciplinary workshop in Bangalore in November 2003.	Phase I was conducted in Jakarta, the capital of Indonesia, which has a population of 8 million. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary and tertiary care settings and interviewed with standard questionnaires. Phase II was initiated in 2004.
Investigators	P. Pais, D. Misquith, D. Xavier.	J. Kisjanto, B. Sutrisna, S.M.L. Tobing, Y. Misbach, S.F. Supari, Samino, M. Suryapradja.
Participating institutions	St. John's Medical College, Bangalore.	Division of Cardiology, Department of Medicine, University of Indonesia, Jakarta.
WHO Regional Adviser	J. Leowski	J. Leowski
WHO Representative	S.J. Habayeb	G. Petersen

1.2.5 Islamic Republic of Iran

1.2.6 Pakistan

Demonstration project

Phase I was conducted in Isfahan (Esfahan), an industrial city with a population of 1.5 million. Representative samples of 1200 patients and 300 physicians were selected from primary and secondary care settings and interviewed with standard questionnaires. Results of Phase I were discussed at a workshop held in Isfahan in June 2003 in which policy makers, health care providers, and representatives of professional associations and NGOs, participated. Phase II was initiated in 2004.

The situation analysis was conducted in Islamabad, the capital of Pakistan. Representative samples of 1200 patients and 300 physicians from primary, secondary and tertiary care settings were drawn and interviewed with standard questionnaires. Phase II was initiated in 2004.

Investigators

N. Sarraf-Zadegan, M.R. Omrani, M. Fatemi, H.R. Tolouei, R. Pyman, A.R. Mazroie, A. Akhavan.

S. Nishtar, A. Badar, H.Z. Abbasi, H. Ali, M.A. Mattu, N. Ara, Habibullah, S. Memon, J. Iqbal, A. Shakoor.

Participating institutions

Isfahan Cardiovascular Research Center (WHO Collaborating Center), Isfahan Provincial Health Center and Ministry of Health, NCD Department, Isfahan.

Heartfile; Pakistan Institute of Medical Sciences, Islamabad; Rawalpindi General Hospital, Rawalpindi.

WHO Regional Adviser

O. Khatib

O. Khatib

WHO Representative

El Fatih El-Samani

Z.K.M. Bile

1.2.7 Russian Federation

Demonstration project

Phase I was conducted in Chelyabinsk, a city with a population of 1.1 million. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary and tertiary care settings and interviewed with standard questionnaires.

Investigators

E. Volkova, S. Levashov, T. Karasikova, A. Startseva, I. Gabrin, V. Gabrin, V. Levit, V. Lasoreva, O. Mirgorodskaya, T. Zhurkina, E. Belinskaya.

Participating institutions

Ural State Medical Academy for Additional Education, Chelyabinsk; Administration of Public Heath Service of Chelyabinsk.

WHO Regional Adviser

A. Shatchkute

WHO Representative

M. Vienonen

1.2.8 Sri Lanka

The situation analysis was conducted in the North Central and Wyamba Provinces of Sri Lanka. Representative samples of 1200 patients and 300 physicians were recruited from primary, secondary and tertiary health care centres and interviewed with standard questionnaires. In March 2003 a workshop was held in collaboration with the Ministry of Health during the Annual Academic Sessions of the Sri Lanka Medical Association to discuss the results of the situation analysis. Phase II was initiated in 2004.

W.P. Dissanayake, S. Dharmaratne, B. Subasinghe, S. Wijesundara, C. Subasinghe, M Marasinghe, A. Karunaratne, M. Weerakoon, P. Bandara.

General Hospital, Anuradhapura; Faculty of Medicine, University of Peradeniya, Peradeniya; Provincial Council Ministry of Health, North Central Province.

J. Leowski

Kan Tun

1.2.9 Tunisia

1.2.10 Turkey

Demonstration project

Phase I was conducted in the region of Sousse. Sousse is the third largest town in Tunisia with a population of approximately 400 000. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary, and tertiary care settings and interviewed with standard questionnaires. A workshop was conducted in April 2004 to discuss the results of the situation analysis and to plan Phase II, which was initiated later that year.

The situation analysis was conducted in Eskisehir, a city located in central Turkey with a population of 600 000. Representative samples of 1200 patients and 300 physicians were drawn from primary, secondary and tertiary settings and interviewed with standard structured questionnaires. A multi-stakeholder workshop was held in Ankara to discuss results of Phase I, in which representatives from the Ministry of Health, professional associations and NGOs participated. Phase II was initiated in Eskisehir in 2004.

Investigators

H. Ghannem, E. Boughzala, G. Jeridi, S. Ben Ammou, A. Ben Abdelaziz.

B. Gorenek, T. Ozkan, S. Bakar, D. Gucuyener, B. Timuralp, A. Unsal, S. Metintas.

Participating institutions

Services of Cardiology and Neurology, University Hospital Sahloul; Services of Cardiology and Epidemiology, University Hospital Farhat Hached.

Osmangazi University, Ministry of Health, Eskisehir.

WHO Regional Adviser

O. Khatib

A. Shatchkute

1.3 Phase I of the WHO-PREMISE project in 10 countries

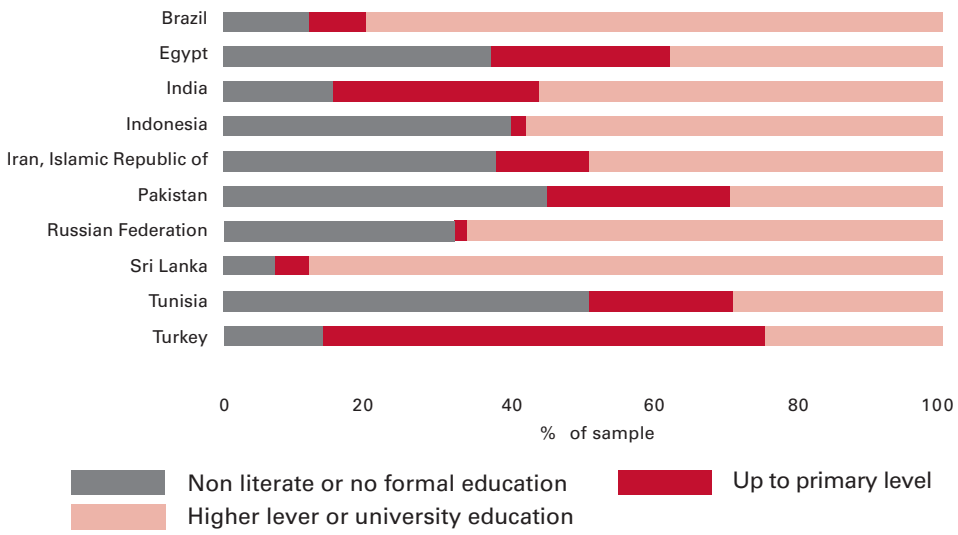
The following results are based on some of the data from the situation analyses conducted in defined areas of 10 countries as part of Phase I of the WHO-PREMISE project.

Education levels of patients with cardiovascular disease
Data show that a significant proportion of patients with established CVD have had either no formal education or education up to primary level only (Figure 2).

If education level is considered a proxy for socioeconomic status, our data indicate that a significant proportion of patients with CVD are from the lower socioeconomic strata of society.

Measures need to be taken, therefore, to make services for secondary prevention of CVD accessible to all socioeconomic groups. Furthermore, health education messages need to be tailored to cater to the less literate.

Figure 2. Education level of patients

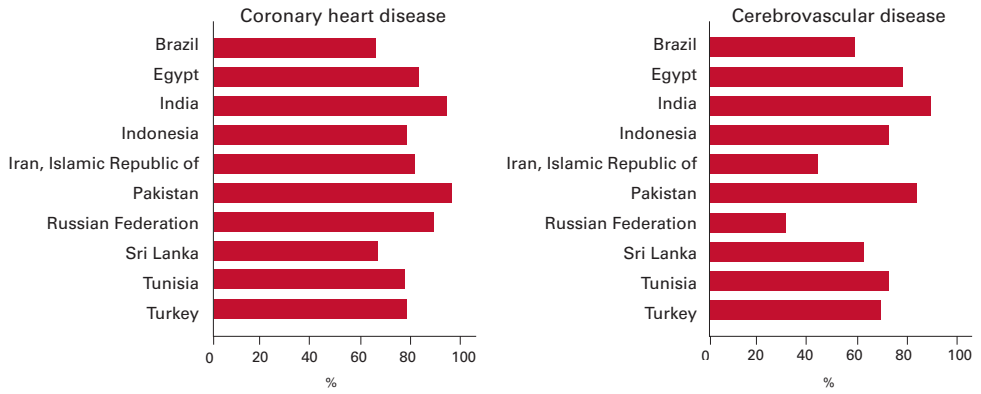


Data from WHO-PREMISE indicate that a significant proportion of patients with CVD are from the lower socioeconomic strata of society. Measures need to be taken to make services for secondary prevention of CVD accessible to all socioeconomic groups.

Aspirin

A significant proportion of eligible patients were not prescribed aspirin (Figure 3).

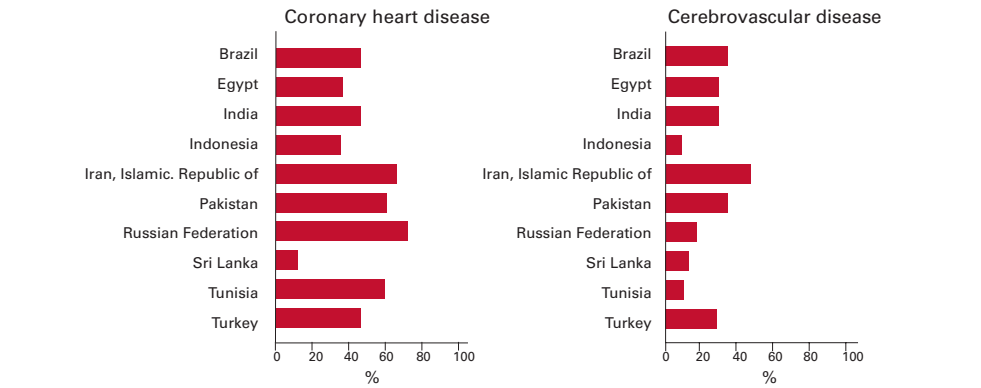
Figure 3. Proportion of patients using aspirin



Beta blockers

Beta blockers were not being prescribed to many patients who could benefit from them (Figure 4).

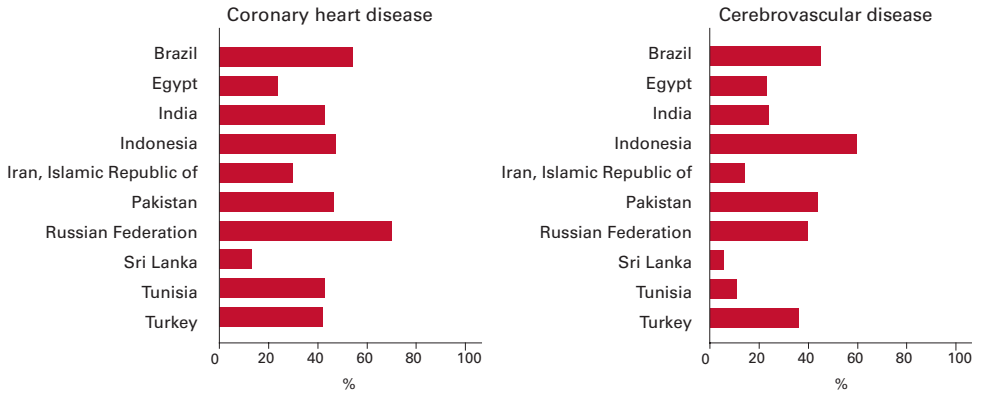
Figure 4. Proportion of patients using beta blockers



ACE inhibitors

ACE inhibitors were under-utilized for the prevention of recurrences of CVD (Figure 5).

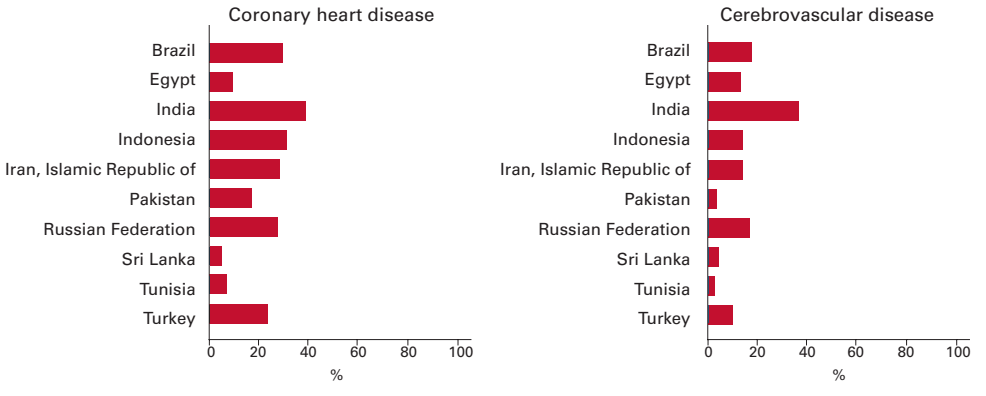
Figure 5. Proportion of patients using ACE inhibitors



Statins

In all 10 countries, the majority of eligible patients were not prescribed statins (Figure 6).

Figure 6. Proportion of patients using statins



Many patients are not receiving cost-effective medications that have the potential to prevent recurrent cardiovascular events.

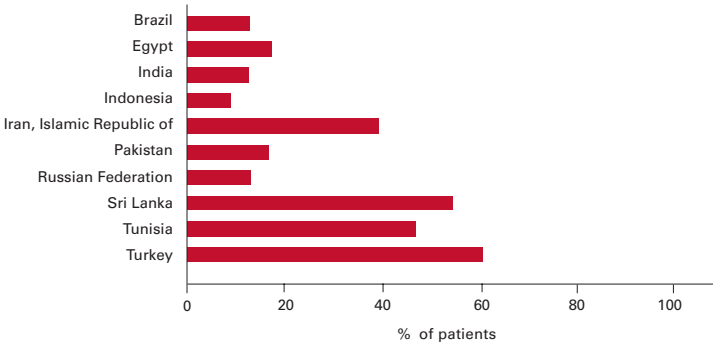
Healthy lifestyle practices/advice in patients with cardiovascular disease

Results show that overall, 12.5% of patients with previous vascular events still continued to smoke, about one third (34.8%) had difficulties in complying with dietary advice, and more than half (52.5%) were not engaged in regular moderate physical activity.

Advice on heart-healthy diet

In all countries, a significant proportion of patients had not been counselled on a heart-healthy diet (Figure 7).

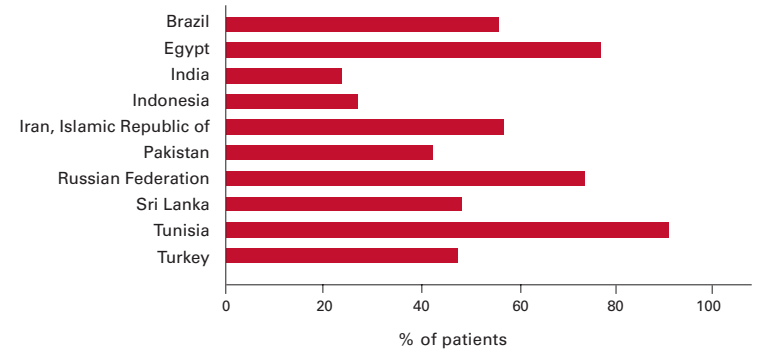
Figure 7. Proportion of patients who have NOT been counselled on heart-healthy diet



Physical activity

The majority of patients were not engaged in regular physical activity (Figure 8).

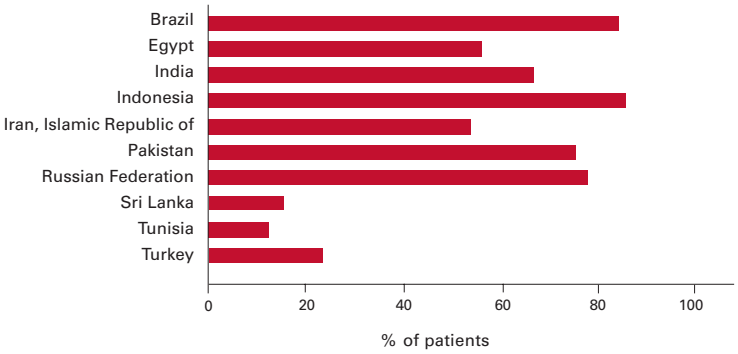
Figure 8. Proportion of patients NOT engaging in at least 30 min. physical activity on a regular basis



Advice on physical activity

The majority of physically inactive patients had not receiving appropriate counselling (Figure 9).

Figure 9. Proportion of patients NOT engaging in at least 30 min. regular physical activity and have NOT been counselled on active lifestyle



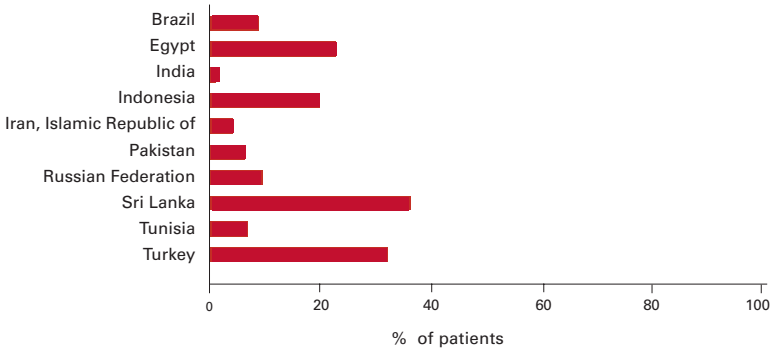
Measurement of blood sugar and blood cholesterol in patients with cardiovascular disease

The quality of basic follow-up care provided to the majority of high-risk patients appears to be suboptimal in most settings.

Blood sugar

A significant proportion of patients had not had their blood sugar checked within a year (Figure 10).

Figure 10. Proportion of patients who have NOT had blood sugar checked in the past year

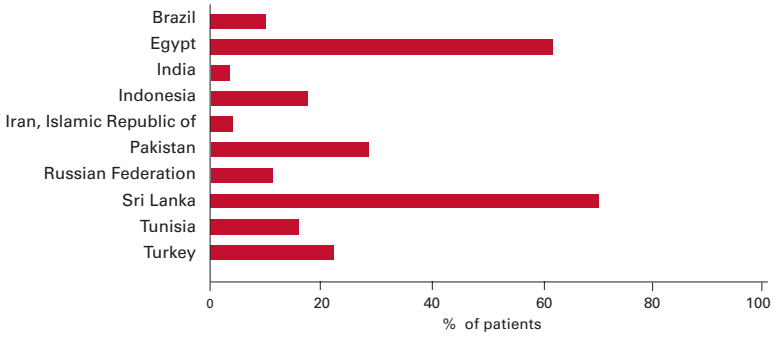


A significant number of patients have not adopted a healthy lifestyle, even after major cardiovascular events. Major gaps are evident in health care providers' counselling practices in relation to healthy lifestyles.

Blood cholesterol

A significant proportion of patients had not had their blood cholesterol checked within a year (Figure 11).

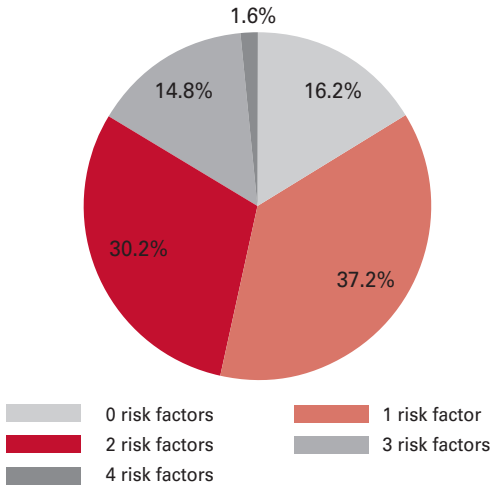
Figure 11. Proportion of patients who have NOT had blood cholesterol checked in the past year



Clustering of major risk factors

On average, only 16.2% of patients had no major coronary risk factors. Nearly half (46.6%) had at least two risk factors, and 16.4% had at least three risk factors (Figure 12).

Figure 12. Clustering of major risk factors, all countries (smoking, high blood pressure, high blood sugar and high blood cholesterol)



The quality of basic follow-up care provided to the majority of high-risk patients appears to be suboptimal in most settings.

1.3.1 Gaps in secondary prevention of CVD

Data from local situation analyses conducted in Phase I of WHO-PREMISE was discussed at multi-stakeholder workshops held in India, the Islamic Republic of Iran, Sri Lanka, Tunisia and Turkey in 2003. In addition to the team of investigators, representatives from the Ministry of Health and a wide range of professional organizations and academic institutions have participated in the workshops (12). Workshop participants identified multidimensional factors responsible for high rates of recurrent vascular events, some of which are listed below:

- lack of evidence-based clinical practices;
- unavailability and lack of affordability of essential drugs;
- missed opportunities for patient counselling;
- under-utilization of primary health care facilities for the secondary prevention of CVD;
- suboptimal monitoring and fragmented follow-up of patients due to weak infrastructure;
- inequalities in the provision of secondary prevention services to economically disadvantaged groups;
- poor knowledge and skills of health care providers in CVD management due to the inadequacy of undergraduate medical curricula and organized accreditation programs;
- insufficient patient awareness of the importance of healthy behaviours and regular use of medications for the prevention of vascular events;
- inadequate media participation in the dissemination of risk-modifying information and health promotion.

1.3.2 Strategies for bridging gaps

Strategic options for bridging the above gaps, as proposed at the workshops, include:

1. strengthening the capacity of primary and secondary health care centres to deliver cardiovascular care;

2. ensuring the supply of good quality drugs at affordable prices through a national drug policy;

3. introducing modifications to social insurance schemes to ensure free access to generic drugs recommended for the secondary prevention of CVD;

4. providing training and incentives to health care providers for patient counselling;

5. developing evidence-based guidelines for the secondary prevention of CVD;

6. appropriate revision of undergraduate medical and nursing curricula;

7. developing systematic programmes for the continuing medical education of health care providers through national professional associations;

8. ensuring the effective flow of patient information from tertiary to primary and secondary health care centres;

9. strengthening the stewardship of the Ministry of Health for improving quality of cardiovascular care at all health care levels;

10. government action to set aside a minimum amount of broadcasting time to public health education programming.

1.4 Phase II of the WHO-PREMISE project

1.4.1 Implementation and evaluation of interventions to scale-up secondary prevention

Many of the gaps identified during Phase I of the WHO-PREMISE project are amenable to cost-effective interventions that can be implemented at local or national levels with a modest amount of resources. In six of the countries where Phase I of WHO-PREMISE was conducted (Indonesia, the Islamic Republic of Iran, Pakistan, Sri Lanka, Tunisia and Turkey), Phase II is being implemented to evaluate the feasibility of narrowing the identified gaps with simple, flexible, context-specific interventions. Specifically, Phase II of the WHO-PREMISE project focuses on the following issues: lack of organized programmes for continuing medical education of health care providers, lack of evidence-based clinical practices, insufficient counselling of patients on lifestyle factors, and inadequate patient education. To address these gaps, a set of three interventions is being implemented in demonstration areas:

- continuing medical education programmes for professional development of health care providers;
- user-friendly practice guidelines (13) and checklists for improving practice patterns;
- patient education programmes to improve the knowledge and behaviour of patients.

These interventions will be evaluated for effectiveness, sustainability and feasibility for national extension.

1.4.2 Evidence-based guidelines for secondary prevention of heart attacks and strokes

In 2003, WHO published guidelines which summarize the evidence regarding effectiveness of interventions for the secondary prevention of cardiovascular disease and cerebrovascular disease. The two conditions were analyzed separately, as the evidence for the effectiveness of particular interventions differs between them. The guidelines also contain a commentary on the evidence for cardiovascular prevention in peripheral vascular disease and diabetes. Each review of evidence is followed by a short summary of clinical recommendations for secondary prevention. The guidelines also review other considerations influencing policy-makers in the implementation of secondary prevention strategies, including health economics, and identify areas in which research is needed to improve secondary prevention of CVD in low- and middle-income populations.

1.4.3 Cost-effectiveness of secondary prevention interventions

Despite the clear efficacy of available interventions for secondary prevention of CVD, only very limited information is available on their cost-effectiveness, particularly for low- and middle-income country settings. To gain widespread support from ministries of health, who will determine whether or not to implement these interventions, consideration has to be given to their affordability and cost-effectiveness. In collaboration with Dr Shah Ebrahim and his team from the Department of Social Medicine, University of Bristol, preliminary work has been

conducted in country settings in India, Pakistan and Tunisia to examine the cost-effectiveness of secondary prevention interventions, individually and in various combinations (Tables 1-4).

The most important findings relate to the cost-effectiveness of smoking cessation and exercise promotion following myocardial infarction. These two simple interventions are affordable, even to low-income countries. If widely available and used, they would result in the saving of large numbers of lives at a relatively low cost. Of the pharmacological treatments, aspirin is the clear front runner. The cost of aspirin treatment is low; in low-income countries such as India it is equivalent to about 15% of the annual per capita household expenditure on health care, making it an affordable medication. Other drug treatments are also clearly cost-effective.

Combinations of treatments offer considerably better cost-effectiveness, attributable to their greater efficacy. Lifestyle modification by means of exercise and smoking cessation, together with aspirin treatment, would be within the resources of most low-resource settings and, in the developing countries studied here, would be cost-saving in net terms.

1.4.4 Strengthening capacity for development of evidence-based policies for CVD prevention and control

The success of integrating the above interventions into health system infrastructures at a national level depends on the existence of a receptive national health policy framework. During Phase II of WHO-PREMISE, health system stewards in countries will be sensitized to the need for including chronic diseases as a priority on the national health agenda. Further steps will also be taken to strengthen national capacity for policy analysis and development with regard to chronic disease prevention and control. To bridge gaps in treatment, a global initiative will be launched to scale-up treatment of major chronic diseases, including cardiovascular disease.

1.5 Some comments from countries regarding the WHO-PREMISE project

"The WHO-PREMISE project enabled a critical assessment of the secondary prevention practices relating to cardiovascular diseases in Pakistan – lessons learnt will enable us to devise evidence-based strategies to bridge these gaps as part of the National Action Plan on NCDs, which is a tripartite collaborative initiative involving the Ministry of Health, WHO and Heartfile."

Maj Gen (Rtd) Mohammad Aslam, Minister of Health, Pakistan

"Following the PREMISE project, a regional committee has been set up to develop strategies that combine population and high-risk approaches for prevention of NCDs. This committee is also charged with implementing pragmatic and sustainable interventions to address the gaps in secondary prevention in Sousse, Tunisia."

Dr. Ayoub Mustaf, Regional Director of Health, Sousse, Tunisia

"The WHO-PREMISE project provided an opportunity for assessment and upgrading of quality of secondary prevention of coronary heart disease and cerebrovascular diseases in a defined area in Sri Lanka. This experience will also contribute to scaling-up of secondary prevention on a national scale."

Dr Athula Kahandaliyanage Director General of Health, Sri Lanka

"The WHO-PREMISE project in Turkey has made a major contribution to raising awareness of heart attacks and strokes among the public in Eskisehir, and has paved the way to according cardiovascular diseases and noncommunicable diseases an important place in the national health agenda."

Prof. Dr. Recep Akdag, Minister of Health, Turkey

2. Integrated approach to primary prevention of cardiovascular disease in high-risk populations

A substantial proportion of the world population is currently at high-risk of developing major cardiovascular events, due to tobacco use (1.3 billion), overweight (1 billion), elevated blood pressure, elevated blood cholesterol and diabetes (1 billion) (1). These cardiovascular risk factors often cluster together. An individual's absolute risk of a major cardiovascular event (stroke or heart attack) is determined by his/her overall risk profile.

In most populations, the majority of cardiovascular events occur in individuals with modest elevations of several risk factors, rather than in individuals with marked elevation of a single risk factor. Thus, focusing on cholesterol or blood pressure levels separately to identify high-risk individuals is of limited value. An alternative, more cost-effective approach is to base treatment decisions on each individual's overall risk of a cardiovascular event in the next 10 years, determined by the individual's comprehensive cardiovascular risk profile. This **absolute risk approach** enables the selection of individuals most likely to benefit from treatment through risk stratification, improves health outcomes, and is of particular importance to settings with scarce resources.

2.1 Implementing the absolute risk approach

In most developing countries, resources for cardiovascular disease are currently being allocated to vertical programs targeting individual risk factors. For example, most countries have programs focussing on blood pressure control in which treatment decisions are based on blood pressure levels alone. Risk stratification can help identify subsets of patients most in need of treatment, thereby increasing the efficiency of limited resources. However, health systems in low-income countries do not have the infrastructure to support resource-intensive risk stratification systems. The WHO has therefore developed a feasible risk assessment system using simple indicators that are measurable in low-resource settings. These include age, sex, tobacco use, history of premature cardiovascular disease in the family, presence or absence of diabetes, and presence or absence of hypertension (10, 14). This pragmatic risk stratification system may not be optimal in terms of accuracy, but it is the only feasible method of ranking people into low- and high-risk groups in order to make affordable treatment decisions in low-resource settings.

2.2 The WHO CVD-Risk Management Package

The WHO CVD-Risk Management Package has been designed for the assessment and management of cardiovascular risk, primarily in individuals detected to have elevated blood pressure through opportunistic screening (14). However, it can be easily adapted to be applied with diabetes or smoking as entry points. The Package also seeks to inform health care decision-makers of the need and feasibility of managing cardiovascular risk in settings with limited resources. It targets health care providers serving in outpatient facilities, particularly at primary and secondary health care levels. These include non-physician health workers, practitioners of traditional medicine, and physicians. A training manual has been developed to provide appropriate instruction in the use of the Package where necessary.

2.2.1 Validation of protocols for very low-resource settings (Scenario 1)

Two studies were conducted in primary health care settings in Bangalore, India and Islamabad, Pakistan to validate Scenario I of the WHO CVD-Risk Management Package, meant for very low-resource settings. Matched observations of patients between a non-physician health care worker and an expert physician were employed. The studies were based on an a priori assumption that the non-physician health care workers' application of Scenario I must agree to at least 80% of that of expert physicians, for the scenario to be considered valid and acceptable for wider use.

Result of the pair wise (bivariate) comparison showed 80% correlation in the estimated age of patients between the non-physician health care worker and the expert physician. Correlations of over 80% were obtained for blood pressure and body weight measurements in Pakistan, compared to India where correlation of blood pressure estimates was 73%. Much lower correlations were obtained for body mass index in both countries, and for body weight and waist circumference in India. In the patient history section of the package, agreement between the non-physician health care worker and the expert physician was over 80%. There were also strong agreements (80–100%) with respect to the choice of treatment tracts, which was to be informed by the outcomes of the previous observations/measurements. However, the results showed poor agreement (less than 80%) on the decision to refer.

Overall, in applying Scenario I of the WHO CVD-Risk Management Package, the non-physician health care workers performed to as much as 80% of the level of the expert physician in both sites.

2.2.2 Implementation of the WHO CVD-Risk Management Package in demonstration sites

The WHO CVD-Risk Management Package offers a pragmatic risk stratification approach that can serve as a starting point for health systems in low-resource scenarios. The countries in Figure 13 are translating this approach into practice in demonstration sites in the primary health care setting. A basic health care infrastructure is necessary for applying the CVD-Risk Management Package in order to identify people at varying risk levels, and to ensure appropriate treatment of those who are identified as being at increased risk. It is important that facilities are available for opportunistic screening of blood pressure, that personnel are trained to measure blood pressure appropriately, that reliable blood pressure measuring devices are available, and that ongoing quality control is built into the system of implementation. It is also critical that basic treatment and referral pathways are available for those who are diagnosed as having hypertension and/or diabetes. This again requires adequately trained personnel, as well as a regular supply of appropriate drugs.

Figure 13. Demonstration sites implementing the WHO CVD - Risk Management Package in primary care.

Country	Lead Investigator	Regional Adviser	WHO Representative
Bangladesh	M.Rahman	J. Leowski	S. Acharya
Chile	C. Escobar	S. Robles	H. Jouval
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India	V. Pandurangi	J. Leowski	S.J. Habayeb
Indonesia	D. Kusmana	J. Leowski	G. Petersen
Kenya	E.N. Ogolla	A. Filipe Junior	P. Eriki
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Mozambique	A. Damasceno	A. Filipe Junior	B. Touré
Nigeria	O. Oladapo	A. Filipe Junior	M. Belhocine
Pakistan	S. Nishtar	O. Khatib	K.B. Mohamud
Sri Lanka	L. Somatunga	J. Leowski	K. Tun
Tunisia	H. Ghannem	O. Khatib	---

All of these requirements may not be entirely fulfilled in all settings, and in such situations a concerted effort has to be made to upgrade the existing facilities so that the Package can have a maximal impact where applied.

2.2.3 Improving the accuracy and affordability of blood pressure measurement in low-resource settings

The availability of a reliable blood pressure measurement device is considered to be a prerequisite for implementation of the WHO CVD-Risk Management Package under all levels of resource availability. Several barriers limit access to appropriate blood pressure measurement in developing countries. These include the unavailability of accurate and affordable blood pressure measuring devices, infrequent validation of devices, limited awareness of the problems associated with conventional blood pressure measurement techniques, and a general lack of trained manpower and limited training of personnel.

To fulfil requirements related to blood pressure measurement in low-resource settings, blood pressure measuring devices should therefore be affordable and extremely simple to use, but at the same time be accurate and robust so that they can be easily used for repeated blood pressure measurements.

On December 3rd, 2003, WHO held a Meeting of Experts in Geneva, Switzerland, to develop technical specifications for an accurate and affordable blood pressure measuring device for use in low-resource settings. The technical specifications and recommendations of this expert committee were published in the report *Affordable technology: blood pressure measuring devices for low resource settings* in February 2005.

References

1. *The world health report 2002-Reducing risks, promoting healthy life.* Geneva, World Health Organization, 2002.

2. Mendis S. Cardiovascular risk assessment and management. *Journal of Vascular Health and Risk Management,* 2005, 1(1):15-18.

3. *The world health report 2003-Shaping the future.* Geneva, World Health Organization, 2003.

4. Resolution WHA53.17. Prevention and control of noncommunicable diseases. In: *Fifty-third World Health Assembly, Geneva, 15-20 May 2000. Volume 1. Resolutions and decisions, annex.* Geneva, World Health Organization, 2000:22-24 (document WHA53/2000/REC/1).

5. Resolution WHA56.1. WHO Framework Convention on Tobacco Control. In: *Fifty-sixth World Health Assembly, 19-28 May 2003. Geneva, World Health Organization, 2003.*

6. Resolution WHA57.17. Global strategy on diet, physical activity and health. In: *Fifty-seventh World Health Assembly, 17-22 May 2004.* Geneva, World Health Organization, 2004.

7. Bonita R et al. *Surveillance of risk factors for non-communicable diseases: The WHO STEPwise approach.* Summary. Geneva, World Health Organization, 2001.

8. *Report of the second meeting of the Global Forum on non-communicable disease prevention and control.* Shanghai, China, November 2002. Geneva, World Health Organization, 2002.

9. *Secondary prevention of noncommunicable diseases in low- and middle-income countries through community-based and health service interventions.* World Health Organization – Wellcome Trust meeting report, 1–3 August 2001. Geneva, World Health Organization, 2002.

10. *Integrated management of cardiovascular risk:.* Report of a WHO meeting; Geneva, 9–12 July 2002. Geneva, World Health Organization, 2002.

11. *Rheumatic fever and rheumatic heart disease.* Report of a WHO Expert Consultation. Geneva, 29 October - 1 November 2001. WHO Technical Report Series, No. 923. Geneva, World Health Organization, 2004.

12. Mendis S. Workshop on secondary prevention of myocardial infarction and stroke and management of cardiovascular risk. *Anadolu Kardiyoloji Dergisi,* 2003 Dec, 3(4):366-367.

13. *Prevention of recurrent heart attacks and strokes in low and middle income populations. Evidence-based recommendations for policy makers and health professionals.* Geneva, World Health Organization, 2003.

14. *WHO CVD-risk management package for low- and medium-resource settings.* Geneva, World Health Organization, 2002.

Tables

Table 1: Annual treatment costs in $US used to calculate cost of treatments

Drug and dose used in analysis	India	Pakistan	Tunisia	United Kingdom
Aspirin 300mg	2.42	3.62	3.79	6.68
Dipyridamole 400mg / aspirin 75mg	12.08	12.08	29.44	201.30
Atenolol 50mg	17.26	10.32	125.36	18.65
Bendrofluzide 2.5mg	24.16	24.16	70.26	16.09
Enalapril 20mg	52.34	16.51	21.28	128.60
Simvastatin 27.2mg	115.00	247.04	598.30	643.88
Atorvastatin 10mg	64.42	64.42	434.09	391.01
Antihypertensive low-cost regimen - assuming 100% bendrofluazide 2.5, 50% atenolol 100mg, 20% enalapril 20mg	51.88	37.78	199.88	52.76
Polypill estimated using above costs for aspirin, enalapril, bendrofluazide, atenolol (50%) + atorvastatin. Costs of folic acid not included.	151.97	113.88	592.10	511.11
Exercise based cardiac rehabilitation This service is proxied by 1 hour of nurse supervised group exercise conducted twice weekly for 7 weeks. Assume 10 people per group.	3.49	2.33	3.49	290
Smoking cessation 60 minutes nurse counselling proxied by cost of additional outpatient appointment. Five subsequent nurse phone calls in total (assuming 15 mins per call). Cost of cigarettes avoided not included. One year max.	3.74	2.48	3.74	206

(1 US$ = 45.3 Indian Rupees, = 57.5 Pakistan Rupees, = 1.25 Tunisian Dinar, = 0.60 £GB)
Staff costs: Indian and Tunisian costs: US$1.66 / hour for nurse time, US$0.83 / hour for administration. Pakistan costs: US$1.10 / hour for nurse time + US$0.55 / hour for administration
Source: Shah Ebrahim and Fiona Sampson 2004

Table 2: Costs of events avoided in US$ used in calculation of possible savings assuming midpoint of estimates provided

Procedure	India	Pakistan*	Tunisia	United Kingdom
CABG/PTCA combined	3227	3227	2396	7245
Acute MI admission	1076	1076	1725	2783
Stroke admission	772	772	1725†	15004

** No data available for Pakistan so Indian costs used*
† No data available so assumed to be same as cost of acute MI admission.
Source: Shah Ebrahim and Fiona Sampson 2004

Table 3: Gross costs $US per life year gained for different secondary prevention treatments, discounting at 6%

Treatment†	Cost $US per life year gained (95% CI)			
	India	Pakistan	Tunisia	United Kingdom
Aspirin (300mg)	42 (20, 260)	66 (35, 400)	70 (40, 420)	133 (72, 804)
Dipyridamole 400mg / aspirin 75mg	211 (110, 1280)	219 (120, 1325)	541 (290, 3270)	3999 (2157, 24228)
Bendrofluazide: middle-age (56)	776 (480, 1560)	804 (501, 1625)	2382 (1480, 4810)	564 (352, 1140)
Bendrofluazide: 2.5mg old-age (69)	503 (300, 2030)	510 (300, 2060)	1530 (910, 6210)	369 (218, 1493)
Antihypertensive: low cost regimen‡	1630 (1020, 3290)	1233 (770, 2490)	6615 (4130, 13360)	2054 (1281, 4150)
Beta-blockers	146 (110, 260)	88 (65, 157)	1076 (790, 1920)	171 (126, 305)
Simvastatin	1664 (1260, 2270)	3706 (2810, 5070)	9062 (6860, 12390)	9953 (7530, 13608)
"Polypill"	771 (590, 1180)	593 (449, 912)	3096 (2340, 4765)	2661 (2010, 4094)
Exercise rehabilitation	7 (4, 91)	4 (2, 60)	6 (3, 91)	527 (286, 7530)
Smoking cessation	3 (2, 4)	2 (1, 3)	3 (2, 4)	188 (156, 223)

† dose and regimen as specified in Table 1
‡Low-cost regimen: 100% bendrofluazide 2.5mg, 50% atenolol 100mg, 20% enalapril 20mg
Source: Shah Ebrahim and Fiona Sampson 2004

Table 4: Net costs $US per life year gained for different secondary prevention treatments, discounting at 6%
(Note – net costs make allowance for cost savings from events avoided)

Treatment †	Cost $US per life year gained (95% CI)			
	India	Pakistan	Tunisia	United Kingdom
Aspirin	186 (-150, -550)	-172 (-150, -440)	-343 (-280, -1010)	-1296 (-1081, -3567)
Aspirin & dipyridamole	-13 (-44, 335)	-18 (-60, 490)	129 (-25, 1845)	2570 (1005, 19,857)
Bendrofluazide: middle-age (56)	705 (480, 1560)	730 (440, 1540)	1243 (750, 2590)	-489 (-470, -390)
Bendrofluazide: old-age (69)	397 (210, 1830)	402 (210, 1870)	1308 (720, 5750)	-1175 (-992, -2514)
Antihypertensive: low cost regimen‡	1556 (950, 3200)	1155 (700, 2400)	6457 (3990, 13165)	955 (424, 2555)
Beta-blockers	40 (5, 140)	-19 (-38, -32)	903 (627, 1716)	-127 (-161, -42)
Simvastatin	940 (650, 1660)	2956 (2170, 4430)	8072 (5960, 11550)	4057 (1953, 8813)
"Polypill"	534 (381, 936)	350 (237, 661)	1737 (1222, 3062)	1737 (1222, 3062)
Exercise rehabilitation	-10 (-47, 1588)	-11 (-45, 1513) -57 (N.E.)	-7 (-39, 1377)	493 (183, 10,769)
Smoking cessation	-55 (N.E.)		-94 (N.E.)	29 (1 , 66)

† dose and regimen as specified in Table 1; N.E. 95% CIs not estimatable.
‡Low-cost regimen: 100% bendrofluazide 2.5mg, 50% atenolol 100mg, 20% enalapril 20mg
Source: Shah Ebrahim and Fiona Sampson 2004

Publications of the WHO cardiovascular diseases programme, 2002 - 2005

2005

1. *Affordable technology: blood pressure measuring devices for low resource settings.* Geneva, World Health Organization, 2005.

2. Cardiovascular risk assessment and management. *Journal of Vascular Health and Risk Management*, 2005, 1(1):15-18.

3. *Avoiding heart attacks and strokes. Don't be a victim: protect yourself.* Geneva, World Healthe Organization. 2005.

4. Recommendations for blood pressure measuring devices for office/clinic use in low ressource settings. *Blood Pressure Monitoring,* 2005, 10(1): 3-10.

2004

5. Barriers to management of cardiovascular risk in a low-resource setting using hypertension as an entry point. *Journal of Hypertension*, 2004 Jan, 22(1):59-64.

6. *Cardiovascular survey methods*. Third edition. Geneva, World Health Organization, 2004.

7. *Rheumatic fever and rheumatic heart disease*. Report of a WHO Expert Consultation. WHO Technical Report Series, No. 923. Geneva, World Health Organization, 2004.

8. *The atlas of heart disease and stroke.* Geneva, World Health Organization, 2004.

9. The global stroke initiative. *Lancet Neurology*, 2004 July, 3(7):391-393.

2003

10. Case definitions for acute coronary heart disease in epidemiology and clinical research studies: a statement from the AHA Council on Epidemiology and Prevention; AHA Statistics Committee; World Heart Federation Council on Epidemiology and Prevention; European Society of Cardiology Working Group on Epidemiology and Prevention; Centers for Disease Control and Prevention; and National Heart, Lung, and Blood Institute. *Circulation*, 2003 Nov 18, 108(20):2543-9.

11. Hypertension. In: *Adherence to long-term therapies. Evidence for action.* Geneva, World Health Organization, 2003: 107-114.

12. Challenges for the management of hypertension in low-resource settings. *Ethnicity and Disease,* 2003, 13(2 Suppl. 2):S67-70.

13. *MONICA monograph and multimedia sourcebook. World's largest project of heart disease, stroke, risk factors and population trends. 1979-2002.* Geneva, World Health Organization, 2003.

14. *Prevention of recurrent heart attacks and strokes in low and middle income populations. Evidence-based recommendations for policy makers and health professionals.* Geneva, World Health Organization, 2003.

15. Reducing the risk of cardiovascular disease worldwide; the untapped potential. *Heart Matters* (Bulletin of European Heart Network), 2003, 7:3-6.

16. Research gap in cardiovascular disease in developing countries. *Lancet*, 2003 Jun 28, 361(9376):2246-2247.

17. The burgeoning cardiovascular disease epidemic in low- and middle-income countries. Urgent need to implement what is known. *CV Network,* 2003, 2(2):13-24.

18. Workshop on secondary prevention of myocardial infarction and stroke and management of cardiovascular risk. *Anadolu Kardiyoloji Dergisi*, 2003 Dec, 3(4):366-7.

19. 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. *Journal of Hypertension,* 2003 Nov, 21(11):1983-1992.

2002

20. Air travel and venous thromboembolism. *Bulletin of the World Health Organization* 2002; 80(5):403-6.

21. *Integrated management of cardiovascular risk.* Report of a WHO meeting, Geneva, 9-12 July 2002. Geneva, World Health Organization, 2002.

22. S*econdary prevention of noncommunicable diseases in low- and middle-income countries through community-based and health service interventions.* World Health Organization – Wellcome Trust meeting report, 1-3 August 2001. Geneva, World Health Organization, 2002.

23. *WHO CVD-risk management package for low- and medium-resource settings.* Geneva, World Health Organization, 2002.

Forthcoming publications

24. Air travel and deep vein thrombosis: WRIGHT project report.

25. Atherosclerosis in children and young adults; an overview of the World Health Organization and International Society and Federation of Cardiology Study on Pathobiological Determinants of Atherosclerosis in Youth study 1985-1995. *Prevention and Control.* In Press 2005.

26. Gaps in secondary prevention of myocardial infarction and stroke in low- and middle-income countries: World Health Organization project on Prevention of REcurrences of Myocardial Infarction and StrokE (WHO-PREMISE). *Bulletin of the World Health Organization*, 2005, 83(11):820-828.

Available in English. Arabic, Chinese, French, Portuguese, Russian and Spanish forthcoming.

Available in English.

Available in English. Arabic, Chinese, French, Russian and Spanish forthcoming.

Available in English.

Available in English and Italian.

Available in English.

Available in English. Chinese, Italian and Spanish forthcoming.

Available in English.

Available in English and Turkish.

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World Health Assembly resolutions related to cardiovascular disease include:

WHA9.31	Cardiovascular diseases and hypertension	9th WHA, May 1956
WHA19.38	Research in cardiovascular diseases	19th WHA, May 1966
WHA25.44	Cardiovascular diseases	25th WHA, May 1972
WHA29.49	Cardiovascular disease	29th WHA, May 1976
WHA36.32	Prevention and control of cardiovascular diseases	36th WHA, May 1983
WHA38.30	Prevention and control of chronic noncommunicable diseases	38th WHA, May 1985
WHA42.35	Prevention and control of cardiovascular diseases and other chronic noncommunicable diseases	42nd WHA, May 1989
WHA51.18	Noncommunicable disease prevention and control	51st WHA, May 1998
WHA53.16	Framework convention on tobacco control	53rd WHA, May 2000
WHA53.17	Prevention and control of noncommunicable diseases	53rd WHA, May 2000
WHA55.23	Diet, physical activity and health	55th WHA, May 2002
WHA56.1	WHO Framework convention on tobacco control	56th WHA, May 2003
WHA57.16	Health promotion and healthy lifestyles	57th WHA, May 2004
WHA57.17	Global strategy on diet, physical activity and health	57th WHA, May 2004