

Cardiovascular Disease Prevention

Summaries of Ten Seminal Papers

Kornelia Kotseva, MD, PhD, FESC

Cardiovascular Medicine - National Heart and Lung Institute (NHLI) - Imperial College London
London - UK (e-mail: k.kotseva@imperial.ac.uk)

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WHO. *WHO Library*. 2007

Selection of seminal papers by **David A. Wood, MSc, FRCPE, FFPHM, FESC; Kornelia Kotseva, MD, PhD, FESC,** Cardiovascular Medicine National Heart and Lung Institute (NHLI) - Imperial College London Charing Cross Campus - Fulham Palace Road, London W6 8RF - UK

Highlights of the years by **Ian Mudway, MD** Lung Biology - Division of Life Sciences Franklin Williams Building 150 Stamford Street - London SE1 9NN - UK

The strategy of prevention: lessons from cardiovascular disease

G. Rose

Br Med J (Clin Res Ed). 1981;282:1847-1851

Rose coins the term “the prevention paradox” in this paper based on his Adolf Streicher memorial lecture in 1980; defined as “a measure that brings large benefits to the community offers little to each participating individual.”

He juxtaposes the “mass” and “high-risk” strategies for cardiovascular prevention. The mass approach is based on the principle of shifting the whole distribution of a risk factor in the population, eg, reducing blood pressure by reducing population salt consumption, as compared with a “high-risk” strategy that identifies those individuals with very high blood pressure and advises them individually to reduce their salt intake and take drug therapies. Although these individuals are at very high risk of cardiovascular disease (CVD), there are relatively few of them at the top end of the distribution of blood pressure. So however successful this individualized strategy may be for those being targeted, it cannot impact on the larger proportion of deaths occurring among the many people with slightly raised blood pressure. Although their CVD risk is only modestly increased, there are many more of them and so their relative contribution to the total burden of CVD is much greater. So hypertension clinics only offer a limited answer to the wider population who will develop CVD. Therefore, Rose argues that a mass strategy is inherently the only answer to the problem of a mass disease. In this case: reduce the exposure of the whole population to the determinants of raised blood pressure rather than targeting only those individuals who have very high blood pressure. However, from the individual’s perspective the mass strategy offers little: some more than others and some not at all, whereas the high-risk strategy will definitely benefit those specific individuals to the extent that they comply with the advice and treatment. This is the medical approach—doctors identifying individuals at high risk and managing them accordingly. The mass approach is political.

1981

The Centers for Disease Control and Prevention report that 5 homosexual men from Los Angeles have a rare form of pneumonia associated with a weakened immune system: the first recognized cases of AIDS; the Israeli Air Force destroys Iraq’s Osirak nuclear reactor; and 800 passengers are killed when seven coaches of an overcrowded train fall off the tracks into the River Kosi in Bihar, India



Sick individuals and sick populations

G. Rose

Int J Epidemiol. 1985;14:32-38

In this classic paper, Rose reflects on the etiology and prevention of disease as a clinician concerned with sick individuals, and as an epidemiologist concerned with sick populations. He was throughout his professional life both a physician and an epidemiologist. Here Rose compares two approaches to prevention of cardiovascular disease: the “high-risk” strategy, which seeks to identify high-risk individuals and offer them individual protection; and the “population strategy,” which seeks to control the determinants of disease incidence in the whole population.

The high-risk strategy is the traditional medical approach to prevention and has several advantages. The intervention is appropriate to the individual. Individuals will be motivated to do something about their increased risk and so will physicians. It is a cost-effective use of resources, and the benefit-to-risk ratio is favorable. However, this approach has a number of disadvantages. It involves screening to identify those at high risk. It does not address the underlying causes of the disease in the population, but only identifies those individuals who are susceptible to such causes, and, however effective our individual care is, they will always be replaced by more and more of the same. The potential for this approach is limited because predicting those individuals who are going to develop the disease is very uncertain, at least in the short term. It is also limited because a large number of people at a small risk may give rise to more cases of disease than the small number who are at high risk. Finally, it requires an individual to change their behavior (eg, to give up smoking), which may run counter to the behavioral norms for that population, and thus more difficult for the individual to achieve.

The population strategy, in attempting to control the determinants of disease incidence, has several powerful advantages. First, it is radical because it aims to remove the underlying causes that make the disease common. It also has a much larger potential, compared with the high-risk strategy, to prevent disease in the population as a whole. Finally, it shapes the norms of behavior for the population (eg, a smoking ban in all public places) and so it is much

easier for the smoking individual to quit. However, this approach also has its disadvantages of which the most important is that a preventive measure that brings much benefit to the population offers little to each participating individual—which Rose termed the “prevention paradox.”

Although these two approaches are complementary, the population strategy is paramount. Managing high-risk individuals is a temporary expedient.

1985

British telecom announces it is phasing out its emblematic red telephone booths;
Coca-Cola releases “New Coke”: the new drink is a failure and the original formula is back on the market after only 3 months;
and US Route 66, established on November 11, 1926, dubbed “Main Street of America,” is decommissioned

An updated coronary risk profile. A statement for health professionals

K. Anderson, P. W. Wilson, P. M. Odell, W. B. Kannel

Circulation. 1991;83:356-362

The Framingham epidemiological study, which started in 1948, followed up a cohort of healthy white Americans who were free of cardiovascular disease (CVD), and related their lifestyles, physiology, and biochemistry to subsequent development of CVD. These pioneering investigators coined the term “risk factor” to describe those personal characteristics—smoking habits, blood pressure, cholesterol, diabetes—that were shown in this prospective cohort study to be independently related to the risk of developing CVD.

Twenty-nine years later, Truett published a coronary heart disease (CHD) risk equation for use by clinicians based on a multivariate analysis of CHD. In addition to age and sex, risk factors included systolic blood pressure, serum cholesterol, cigarette smoking, glucose intolerance, and left ventricular hypertrophy on the electrocardiogram. CHD risk tables in the form of a handbook, based on Framingham equations, were published in 1973, and this was followed by an even simpler version of the equations on a pocket-sized card. Yet, although the Framingham study became famous for being the first to define the causes of CVD, which led to risk factor intervention trials to reduce risk, the CHD risk tables did not engage the interest of physicians. Blood pressure was assessed and treated by physicians in isolation as a disease called “hypertension” rather than seen as one component of the total CVD risk of an individual.

This seminal paper by Anderson provided an update on the equations, which informed the development of the CHD risk chart in the Joint European Societies recommendations on prevention of CHD published in 1994, as well as many other versions of risk estimation around the world. What distinguished Anderson’s updated coronary risk profile from previous versions? First, the baseline examination was a larger and more recent examination from this study (1968-75) and included members of the original Framingham cohort who were free of CVD and the second-generation study population, the Framingham Offspring Cohort. Second, the contribution of high-density lipoprotein (HDL) cholesterol, which was measured for the first time in the Framingham study in 1968, was included. The new equations

were used to derive a worksheet for clinicians to estimate CHD risk of patients by assigning a point score to each risk factor, eg, cigarette smoking scored 4 points, diabetes in women 6 points, and left ventricular hypertrophy on the ECG 9 points. By adding up these points you could relate this score to the probability (%) of developing CHD over 5 or 10 years. The authors also provided a table to compare the estimated risk for a given patient’s age and sex to the average 10-year risk for the Framingham population. Anderson et al suggested that estimating CHD risk could be useful in projecting patient progress in clinic at which preventive cardiology is the goal, such as managing blood pressure and lipids.

Risk scores can provide a framework for intervention. They did so for the first time in an official guideline in 1993 when Jackson recommended managing blood pressure in the context of absolute CVD risk.

1991

Edith Cresson is appointed France’s first female prime minister by President François Mitterrand, but her unpopularity compels her to leave office after less than one year;
Queen Elizabeth II addresses the US Congress, the first British monarch to do so;
and Prince Norodom Sihanouk returns to Phnom Penh, Cambodia, after 13 years of exile, becoming king two years later. The *Guinness Book of World Records* identifies him as the politician having served the world’s greatest variety of political offices since 1941



Management of raised blood pressure in New Zealand: a discussion document

R. Jackson, P. Barham, J. Bills, T. Birch, L. McLennan, S. MacMahon, T. Maling

BMJ. 1993;307:107-111

Jackson and colleagues' seminal paper on the management of raised blood pressure represented a paradigm shift in thinking about the concept of "hypertension" and its treatment. In the 1950s, the first drugs for lowering blood pressure were used to treat malignant hypertension, often symptomatic, with very high blood pressure levels, and usually fatal if left untreated. Subsequently, randomized controlled trials showed that treating less extreme cases of raised blood pressure reduced the risk of cardiovascular disease (CVD)—initially stroke and then coronary disease and renal disease. As a consequence, the level for initiating antihypertensive drug treatment was progressively lowered. However, blood pressure is a risk factor for CVD, not a disease in itself. As the blood pressure rises, so does risk of CVD, and so the definition of high blood pressure is arbitrary. Yet, in the early 1990s, guidelines for the management of blood pressure based all decisions to treat on the blood pressure level alone.

Jackson et al asked the question, when is the risk of CVD sufficiently high, in someone with raised blood pressure, to justify drug treatment? In other words, they put the management of blood pressure in the context of total CVD risk. He illustrated this principal with a simple clinical example. A 60-year-old woman with a diastolic pressure of 100 mm Hg, but no other risk factors, has an absolute risk of developing CVD of about 10% over 10 years, but would be eligible for antihypertensive drug therapy. In contrast, a man of 70 years with multiple risk factors for CVD, but a diastolic blood pressure of 95 mm Hg, which would give him an absolute risk of say 50% over 10 years, may not receive drug therapy. So he proposed that estimation of absolute risk of developing CVD, based on an assessment of all risk factors, is a prerequisite to a decision about treating blood pressure with drugs.

Jackson et al recommended that people with an absolute risk of 20% or more in 10 years, and a sustained blood pressure of greater than 150 mm Hg systolic or 90 mm Hg diastolic (phase 5), should be considered for treatment to lower blood pressure. To calculate absolute CVD risk, they used data from the Framingham epidemiological study and ex-

pressed this as a figure relating different levels of blood pressure to numbers of risk factors (one, two, three, or major) for men and women at different ages from 40 to 70 years. He defined risk factors as cigarette smoking, diabetes, a ratio of cholesterol to high-density lipoprotein of >6:1, a body mass index of >30 kg/m², and a family history of premature CVD (in a parent or sibling before the age of 55 years). A major risk factor was principally defined as the diagnosis of symptomatic CVD. The authors qualified this recommendation on absolute risk by acknowledging that younger people in their 20s or 30s with blood pressures greater than 150 mm Hg systolic or 90 mm Hg diastolic may require blood pressure treatment even though they are at low absolute risk. Similarly, people between the ages of 40 and 60 years with blood pressure levels above 170 mm Hg systolic or 100 mm Hg diastolic may also benefit from blood pressure-lowering even when their absolute risk of CVD is less than 20%.

This recommendation to view blood pressure management in the context of absolute CVD risk challenged the traditional view of "hypertension" and its management and was followed by a succession of risk charts starting with the Joint European Societies' CHD Risk Chart in 1994 and then the New Zealand Cardiovascular Risk Chart the following year. The principle of total CVD risk being the overriding determinant of whether or not to treat blood pressure in the context of primary prevention is now universally accepted by all international guidelines on CVD prevention.

1993

Poet and playwright, and former dissident Václav Havel is elected President of the Czech Republic;
 Spanish road racing cyclist Miguel Indurain wins his third Tour de France, which he was to win five times, five years in a row;
 and the public is allowed inside the State Rooms of Buckingham Palace for the first time

Prevention of coronary heart disease in clinical practice. Recommendations of the Task Force of the European Society of Cardiology, European Atherosclerosis Society and European Society of Hypertension

K. Pyörälä, G. De Backer, I. Graham, P. A. Poole-Wilson, D. Wood

Eur Heart J. 1994;15:1300-1331

In 1992, Kalevi Pyörälä, Professor of Medicine at the University of Kuopio, brought together the European Society of Cardiology, European Atherosclerosis Society, and European Society of Hypertension in a unique partnership to create a common European agenda for prevention of coronary heart disease (CHD). The recommendations of these three Societies for clinical practice were announced at the World Congress of Cardiology in Berlin in 1994. Central to this guidance was the concept of risk: "For a proper assessment of CHD risk in an individual, the presence or absence and the degree of severity of each individual risk factor has to be considered." Up to this point, risk factor guidelines addressed single risk factors, eg, management of "hypertension" or "hyperlipidemia," resulting in undue emphasis being placed on individual risk factors rather than total CHD risk. A new Coronary Risk Chart was the centerpiece of these recommendations, based on a risk function derived from Framingham. Using this chart, clinicians could estimate the probability of their patients developing CHD over 10 years, based on age, sex, smoking habit, systolic blood pressure, and total cholesterol. A CHD risk of 20% or higher was a signal for intensive risk factor modification, including the use of drugs, if appropriate. The chart was published in black and white to facilitate dissemination throughout Europe, and a full color version was distributed at the World Congress. This European risk chart was the first of its kind and was followed by the New Zealand Cardiovascular Risk Chart, and other variations on the central theme of targeting those patients at highest multifactorial risk; the higher the total risk the more intensive the intervention. This unique European partnership between these three major Societies broke the silo mentality of treating single risk factors in isolation. This first Task Force laid the foundations on which three subsequent Task Forces on cardiovascular disease prevention in 1998, 2003, and 2007 were able to enlarge this European collaboration of professional Societies and produce updated guidelines for evidence-based preventive cardiology practice founded on the central principal of total risk assessment and management.

1994

The Zapatista Army of National Liberation begins its war in Chiapas, Mexico; the Church of England ordains its first female priests; and *Nature* reports the finding of the first complete *Australopithecus afarensis* skull in Ethiopia



Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project

R. M. Conroy, K. Pyörälä, A. P. Fitzgerald, S. Sans, A. Menotti, G. De Backer, D. De Backer, P. Ducimetière, P. Jousilahti, U. Keil, et al; SCORE Project Group

Eur Heart J. 2003;24:987-1003

The Joint European Societies' recommendations on coronary heart disease (CHD) prevention in 1994 broke the mould of single risk factor management by advocating total CHD risk estimation as the prerequisite to deciding to treat blood pressure or lipids. The CHD risk charts were based on the Anderson Framingham equation, with the caveat that this epidemiological study may underestimate CHD risk in very-high-risk European populations, such as countries in Eastern Europe, and underestimate risk in low-risk populations of southern Europe.

A European epidemiological database was needed and this was the birth of the SCORE (Systematic COronary Risk Evaluation) project. Graham and colleagues pooled datasets from 12 European prospective cohort studies—205 178 persons (117 098 men and 88 080 women) with 2.7 million years of follow-up and 7934 cardiovascular deaths, of which 5652 were deaths due to coronary heart disease—compared with just [...] individuals in the Framingham study. Ten-year risk of fatal cardiovascular disease was calculated using a Weibull model in which age was used as a measure of exposure to risk (time) rather than as a risk factor. Equations were calculated for high-risk and low-risk regions of Europe, and for each of these regions you can either calculate cardiovascular disease (CVD) risk using total cholesterol or the ratio of total cholesterol/high-density lipoprotein (HDL) cholesterol. The risk threshold for intervention was defined as a total CVD risk of 5% or higher for fatal cardiovascular disease over 10 years.

2003

The final signal is received from NASA's Pioneer 10 space probe 7.5 billion miles from Earth;
an American businessman is admitted to the Vietnam France Hospital in Hanoi with
the first diagnosed case of SARS;
and the Human Genome Project is completed,
with 99% of the genome sequenced

Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials

R. S. Taylor, A. Brown, S. Ebrahim, J. Jolliffe, H. Noorani, K. Rees, B. Skidmore, J. A. Stone, D. R. Thompson, N. Oldridge

Am J Med. 2004;116:682-692

Evidence for cardiac rehabilitation was first summarized by Oldridge who reported in 1988 that patients receiving exercise therapy had fewer cardiac deaths and longer survival compared with those with usual medical care. Subsequent updates of this original meta-analysis, three in total, and further trials, found the same result: reductions in total and coronary mortality ranging from 20% to 32%, but no reduction in the risk of recurrent myocardial infarction or revascularization.

Taylor and colleagues' paper updated the systematic review of exercise-based cardiac rehabilitation and meta-analysis and addressed previous concerns regarding applicability of this evidence to routine clinical practice. Previous meta-analyses had not reported outcomes of secondary prevention through risk factor modification and the impact of modern cardioprotective drug therapies on the magnitude of benefit of exercise-based cardiac rehabilitation. A total of 48 randomized controlled trials were included with a total of 8940 patients with coronary artery disease. Of these, 19 trials were exercise only, 30 were comprehensive cardiac rehabilitation (in combination with psychosocial or educational interventions), and 1 trial directly compared exercise with a comprehensive approach. Overall cardiac rehabilitation was associated with a significant reduction in all-cause mortality (odds ratio [OR], 0.80; 95% confidence interval [CI], 0.68 to 0.93), and total cardiac mortality (OR, 0.74; 95% CI, 0.61 to 0.96), and trials conducted in the last decade (with increasing use of revascularization and cardioprotective drug therapies) continued to show benefits of cardiac rehabilitation. However, there were no differences in rates of nonfatal myocardial infarction, coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI) with cardiac rehabilitation.

For risk factor management, the proportion of patients who were smoking was reduced significantly with cardiac rehabilitation (OR, 0.64; 95% CI, 0.50 to 0.83). However, other risk factor changes were more modest. Systolic blood pressure was significantly reduced, but only by 3.2 mm Hg (95% CI, -5.4 to -0.9 mm Hg), and there was no reduction

in diastolic pressure. Total cholesterol was only reduced by -0.37 mmol/L (95% CI, -0.63 to -0.11 mmol/L) with no significant difference in low-density lipoprotein (LDL) levels. These modest reductions suggest that drug treatments were not being effectively used in these programs. So, apart from smoking, these cardiac rehabilitation programs did not impact on risk factor management to the extent now possible with a combination of a lifestyle intervention, focusing on both diet and physical activity, and using modern drug therapies to lower blood pressure and modify blood lipids. Diabetes, which is an important risk factor for coronary artery disease, was not addressed in this meta-analysis.

Interestingly, Taylor et al tested several a priori hypotheses on the effect of cardiac rehabilitation on total mortality across particular subgroups: type of cardiac rehabilitation (exercise only versus comprehensive cardiac rehabilitation); dose of exercise intervention (based on a composite measure of duration of exercise, plus intensity, frequency, and length of exercise sessions); and program duration. There was no difference in outcome, expressed as total mortality, between exercise-only versus comprehensive cardiac rehabilitation. Nor was there any difference by exercise dose (which is surprising) or duration of the programs. The latter finding is in contrast to the first review by Oldridge who reported a greater reduction in all-cause death, with rehabilitation trials with follow-up lasting more than 36 months.

So, do we only need to offer our coronary patients an exercise program of light intensity and short duration? The answer is unequivocally no. These results are hypothesis-generating and need to be rigorously evaluated in randomized controlled trials assessing clinical and cost-effectiveness.

2004

Arsenal FC remains undefeated for a whole season to win the Premiership title; the last Oldsmobile rolls off the assembly line; and Canada wins the World Ice Hockey Championship in Prague



Meta-analysis: secondary prevention programs for patients with coronary artery disease

A. M. Clark, L. Hartling, B. Vandermeer, F. A. McAlister

Ann Intern Med. 2005;143:659-672

Clark et al, in this meta-analysis, aimed to determine the effectiveness of secondary prevention programs, with and without exercise, in patients with coronary artery disease. Sixty-three randomized controlled trials were identified, including 26 trials that were not included in a systematic review of cardiac rehabilitation (see Taylor RS et al, *Am J Med.* 2004;116:682-692), and this meta-analysis is based on 21 295 patients. The risk ratio for all 40 trials reporting all-cause mortality was 0.85 (95% confidence interval [CI], 0.77 to 0.94), and this result differed over time: 0.97 (95% CI, 0.82 to 1.14) at 12 months and 0.53 (95% CI, 0.35 to 0.81) at 24 months. In those trials reporting follow-up at least 5 years after initiation of the program the benefit was clearly sustained with a risk ratio of 0.77 (95% CI 0.63 to 0.93). There was no heterogeneity in treatment effect between the three types of secondary prevention programs included, namely, programs without exercise, programs with exercise, and exercise-only programs. The risk ratio for all-cause mortality in all exercise-based programs (27 trials and 6940 patients) was 0.83 (95% CI, 0.72 to 0.96) compared with a risk ratio of 0.87 (95% CI, 0.76 to 0.99) for the nonexercise-based programs (14 trials and 9202 patients). The risk ratio for recurrent myocardial infarction was 0.83 (95% CI, 0.74 to 0.94) over a median follow-up of 12 months, and this outcome did not differ between the three types of programs. These beneficial results should not be viewed as “best case scenario,” as trial participants assigned to control groups also received better than usual care, and therefore the impact on all-cause mortality and recurrent myocardial infarction is likely to be even greater in everyday clinical practice.

Despite these impressive benefits, other studies consistently demonstrate that fewer than 50% of patients with coronary artery disease access prevention and rehabilitation programs. In addition, those groups less likely to be referred, to attend, and to complete such programs are often those in greatest need, such as women, the elderly, low-income groups, and ethnic minorities. The clinical challenge is to increase access to, and participation in, comprehensive prevention and rehabilitation programs for all patients with atherosclerotic disease.

2005

In Bucharest, Romania, Adriana Iliescu gives birth at 66, becoming the oldest woman in the world to do so;
 Prince Charles weds Camilla Parker Bowles, who assumes the titles of Her Royal Highness and Duchess of Cornwall;
 and on December 31st, another second is added, 23:59:60, called a leap second, to end the year 2005: the last time this occurred was on June 30, 1998

Multiple risk factor interventions for primary prevention of coronary heart disease

S. Ebrahim, A. Beswick, M. Burke, G. Davey Smith

Cochrane Database of Systematic Reviews. 2006, Issue 4. Art. No.: CD001561. DOI: 10.1002/14651858.CD001561.pub2.

Evidence from single risk factor interventions such as lowering blood pressure, or lowering cholesterol, is impressive. So when you intervene on all cardiovascular risk factors at the same time—stopping smoking and reducing blood pressure and cholesterol—you would expect the combined effect to be impressive. In this systematic review from the Cochrane Collaboration the evidence from randomized controlled trials of multiple risk factor interventions in primary prevention of cardiovascular disease (CVD) is summarized with surprising results.

Interventions used counseling and/or educational approaches with or without pharmacological interventions in relation to smoking cessation, reducing blood pressure, and cholesterol. Thirty-nine trials meeting the selection criteria were analyzed and 10 of these reported clinical events. The pooled odds ratios for total and coronary heart disease (CHD) mortality were 0.96 (95% confidence interval [CI], 0.89 to 1.04) and 0.96 (95% CI, 0.92 to 1.01), respectively. So multiple risk factor interventions have very limited, if any, impact on mortality. However, the authors qualify this statement by pointing out that a small (about a 10% reduction in coronary mortality), but potentially important benefit of treatment may have been missed. Importantly, in the 38 trials reporting risk factor changes, the odds of a reduction in risk factor prevalence were 20% (95% CI, 8% to 31%), which is an important health benefit. In contrast, the mean difference in systolic blood pressure between intervention and control was only -3.6 mm Hg, and the reduction in cholesterol only -0.07 mmol/L, which, although statistically significant, is very modest. Indeed these differences may be overestimates of the treatment effect, because they are based on those who stayed in the trials. More intensive lifestyle intervention, and the appropriate use of drug therapies, would produce larger differences in risk factor control, which would be expected to further reduce CVD.

What this review highlights is the apparent discrepancy between the unequivocal benefit of single risk factor trials, eg, to lower blood pressure, and those observed in multiple risk factor trials.

2006

Grigori Perelman is awarded the Fields Medal for proving the Poincaré conjecture, one of seven Millennium Prize Problems; Slobodan Milošević is found dead in his cell at the UN war crimes tribunal's detention center; and Basque terrorist organization ETA declares a permanent cease-fire in their campaign for Basque independence from Spain



Prevention of cardiovascular disease. Guidelines for assessment and management of cardiovascular risk

World Health Organization

WHO Library: Geneva, Switzerland. 2007

Noncommunicable diseases, of which half are due to cardiovascular disease (CVD), are predicted to increase substantially over the coming years, and much of this disease burden will fall on low- and middle-income countries. This World Health Organization (WHO) report departed from the traditional view of CVD prevention by this organization in moving the focus from single risk factors to total risk assessment and management. In contrast to the 2003 WHO/International Society of Hypertension (ISH) statement on management of "hypertension" (the single risk factor approach), this document provides guidance to policymakers and health care workers on how to target individuals at high risk of developing CVD, at all levels of the health system and in different resource settings, using evidence-based and cost-effective preventive approaches. This guide to CVD prevention was based on the total risk approach to prevention of CVD elaborated in the World Health Report of 2002. The centerpiece is the new WHO/ISH cardiovascular risk prediction charts that were developed for each of the 14 WHO subregions.

The charts only provide approximate estimates of CVD risk in people who have not already developed cardiovascular disease. These risk estimates represent the average for the subregion and do not capture the variation in CVD risk within subregions or countries. They are a useful tool for health care workers to identify those at high CVD risk, and to motivate patients, particularly to change behavior and, when appropriate, to take antihypertensive and lipid-lowering drugs and aspirin. The charts are available for people with and without diabetes. In settings where facilities for measuring cholesterol are not available, versions of the prediction charts that do not use cholesterol are available. The risk factors included in the charts—age, sex, smoking habit, systolic blood pressure, cholesterol, and diabetes—do not encompass all factors that contribute to the development of CVD. Health care worker must therefore take into account obesity (and especially central obesity), family history of CVD, a sedentary lifestyle, low high-density lipoprotein (HDL) cholesterol, raised triglycerides, dysglycemia (impaired fasting glucose and glucose intolerance),

and other factors such as ethnicity and socioeconomic status. The CVD risk thresholds for intervention are stratified according to resource setting: high-resource, 20%; medium-resource, 30%; and low-resource, 40% risk of developing CVD over 10 years. There are huge differences in the prevalence of high-risk individuals between WHO regions. For example, in European region C, about 40% of men have a CVD risk of 30% or higher, compared with only 4% in African region E.

The objective of this report is to reduce the incidence of heart attacks, strokes, renal failure associated with hypertension and diabetes, as well as the need for amputation of limbs because of ischemia, by reducing total CVD risk. It is an evidence-based framework for CVD prevention that can be adapted to suit different political, social, cultural and medial circumstances.

2007

Ban Ki-moon becomes the new United Nations Secretary-General; former chess world champion

Garry Kasparov is arrested in Moscow for participating in a banned march; and Gordon Brown is elected Leader of the UK Labour Party and Prime Minister of the United Kingdom

