Assessment of coronary heart disease risk in populations with different levels of risk

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Since coronary heart disease is multifactorial in its origins, estimation of the risk of developing the disease for an individual should take into account all relevant risk factors, because otherwise undue emphasis will be placed on individual high risk factors rather than on the overall level of risk based on a combination of risk factors. Therefore recent recommendations on the primary prevention of coronary heart disease in clinical practice have emphasized a multifactorial approach in the assessment and management of risk[1–5]. Absolute risk rather than the relative risk of an individual to develop a serious coronary heart disease event has been recommended as the basis of clinical decision making concerning the need for and intensity of preventive measures.

The concepts of absolute and relative risk are derived from epidemiology. Absolute risk of coronary heart disease represents the probability of an individual to develop the disease within a defined time period, e.g. within the next 5 or 10 years. The relative risk is the ratio of coronary heart disease risk for an individual with defined risk factors to that for an individual at a reference level of risk. Two different ways of defining the reference level of risk have been used. The first is the risk for a person at low risk, i.e. a person of the same age and sex but without any major risk factors, and the other is the risk for a person of the same age and sex and with average risk in the population. The disadvantage in the practical use of relative risk in clinical decision making is that this concept is not easy to understand and tends to lead to overestimation of the real risk. Absolute risk of coronary heart disease within the next 5 or 10 years is easier to comprehend and the assessment of multifactorial absolute risk helps target intensive preventive measures, particularly expensive drug therapies, such as use of lipid-lowering drugs, to individuals at highest risk who are most likely to benefit.

Practical methods — tables, charts and computer programmes — have been developed for the multifactorial assessment of an individual’s absolute risk of developing coronary heart disease on the basis of risk functions derived from prospective epidemiological studies[1–11]. The majority of these methods have been based on risk functions derived from the Framingham Study, but other prospective studies have also been used to produce risk prediction programmes[4,11].

For the 1994 joint recommendations of the European Society of Cardiology (ESC), European Atherosclerosis Society (EAS) and European Society of Hypertension (ESH)[1] a simplified tool for the multifactorial assessment of absolute coronary heart disease risk over the next 10 years was developed using the Framingham risk function. In the 1998 revision of the European recommendations[3] the same coronary risk chart was offered as a tool for...
the assessment of absolute risk, with an expansion of the cholesterol scale at its lower end. The joint ESC/EAS/ESH Task Force, in preparing the 1994 European recommendations, considered using risk functions derived from European prospective studies for the preparation of the coronary risk chart or charts, because that would have been the ideal solution. However, it became clear that much more work was needed before that would be possible. Therefore, planning for a special research project to compare European risk functions was started. This research project, Systematic Coronary Risk Evaluation (SCORE), funded by the European Union Biomed 2 programme, was started in 1997. However, by 1998, when the European recommendations were revised, the project was not sufficiently advanced to provide a solid basis for the creation of a European risk chart. Thus, although the use of the Framingham risk function was an embarrassment for the European Societies, it was chosen because of its availability.

The coronary risk chart assesses the 10-year risk of coronary heart disease in a healthy individual on the basis of the following risk characteristics: sex, age (30, 40, 50, 60 and 70 years), smoking status (smokers, non-smokers), systolic blood pressure (120, 140, 160 and 180 mmHg), total cholesterol (4, 5, 6, 7 and 8 mmol l\(^{-1}\)). The chart is a visual display comprising 20 cells for each sex, age and smoking status group and allows the identification, for each person, of a cell relevant to his or her characteristics. The approximate 10-year absolute risk of coronary heart disease can be read by comparing the shading in the cell of the black and white version and the colour in the cell of the coloured version with the scale subdividing the risk into five levels: low (under 5%), mild (5 to 10%), moderate (10 to 20%), high (20 to 40%) and very high (over 40%).

The number of risk factors included in the chart had to be kept to a minimum to keep the visual display as easily readable as possible and therefore several other factors known to influence risk could not be included. The instructions in the use of the chart, however, emphasize that the risk will be higher than indicated in the chart for those with familial hyperlipidaemia, diabetes, family history of premature cardiovascular disease, low HDL cholesterol or raised triglycerides.

The European recommendations arbitrarily define a 10-year coronary heart disease risk \(\geq 20\%\) (or in young persons a risk exceeding 20% if projected to age 60) as a risk sufficiently high to recommend intensive risk factor modification in healthy individuals including, where appropriate, a selective use of proven drug therapies. Because cost/benefit and health economic issues are involved and because these may vary in different countries, the definition of high risk status with regard to need of intensive and often expensive action may, however, be different in different countries.

The European Task Forces have been aware of the limitations of the Framingham risk function-based coronary risk chart and have emphasized these limitations in their recommendations. The greatest problem is the application of risk function, based on a north American high-risk population, to European populations with a wide range of coronary heart disease risk. Some applications of the Framingham risk function to central and western European populations have shown that it predicts coronary heart disease risk reasonably well in these populations\(^{[12,13]}\). Keys\(^{[14]}\) has demonstrated, using data from the Seven Countries Study, that a risk function derived from a prospective study in a northern American male population, is a good predictor of coronary heart disease risk in northern and central European male populations, but overestimates it in southern European male populations. Similarly, the ERICA project\(^{[15]}\), comparing risk functions from several European prospective studies, has shown that risk functions derived from northern European populations overestimate the risk in southern European populations.

In this issue Menotti and colleagues\(^{[16]}\) report a formal comparison of the risk probabilities based on risk function derived from an Italian prospective study with the risk probabilities obtained from the Framingham risk function-based coronary risk chart of the 1998 European recommendations. The Italian prospective study comprised representative samples, 1656 men altogether, aged 40 to 59 years, from two Italian rural communities, Crevalcore in northern Italy and Montegiorgio in southern Italy, examined for the first time in 1960, as part of the Seven Countries Study. The same risk factors (age, systolic blood pressure, total cholesterol, smoking status) and coronary end-points (all coronary events, including coronary death, myocardial infarction and angina pectoris) were used as in the Framingham Study. Comparisons were made computing the mean coronary heart disease risk for each cell of the coronary risk chart for men aged 40, 50 and 60 years using the Italian risk function. The discrepancy between the risk estimates obtained from the coronary risk chart and those obtained using the Italian risk function was striking. The number of cells with a 10-year coronary heart disease risk \(\geq 20\%\) was 44 out of a total of 120 cells using the coronary risk chart, whereas using the Italian risk function the 10-year risk was \(\geq 20\%\) in only four cells. In the remaining 40 cells with a risk \(\geq 20\%\) according to the coronary risk chart, the risk
was reduced to a 10–20% category using the Italian risk function.

These results clearly indicate that the Framingham risk function-based coronary risk chart markedly overestimates absolute coronary heart disease risk in the Italian population. Menotti and colleagues[16] have considered the possibility that as a consequence of changes in population mean risk factor levels the coefficients for different risk factors might have changed in Italy over time. The baseline measurements for the Italian male cohorts of the Seven Countries Study were done in 1960, but comparisons with the coefficients obtained from a more recent Italian prospective study[17] do not support that possibility. Evidently the Italian population, and probably other Mediterranean populations, have protective factors which, at each risk factor level or with each combination of risk factors, reduce their coronary heart disease risk to levels lower than those observed in more northern European populations[18]. Mediterranean dietary habits and other lifestyle factors may be those protective factors.

The findings reported by Menotti and colleagues emphasize the importance of the ongoing SCORE project, already mentioned above, which aims to develop and compare risk functions derived from prospective population-based studies carried out in different parts of Europe. Ideally each country should have its own risk functions, but due to lack of databases from prospective studies in every European country, a more practical approach may be to develop a more general European risk function and adapt it by the use of correction factors to different countries or areas having approximately similar coronary heart disease incidence rates.

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References
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