Estimating the high risk group for cardiovascular disease in the Norwegian HUNT 2 population according to the 2003 European guidelines: modelling study

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Abstract

Objective To estimate the high risk group for cardiovascular disease in a well defined Norwegian population according to European guidelines and the systematic coronary risk evaluation system.
Design Modelling study.
Setting Nord-Tröndelag health study 1995-7 (HUNT 2), Norway.
Participants 5548 participants of the Nord-Tröndelag health study 1995-7, aged 40, 50, 55, 60, and 65.
Main outcome measures Distribution of risk categories for cardiovascular disease, with emphasis on the high risk group.
Main results At age 40, 22.5% (95% confidence interval 19.3% to 25.7%) of women and 85.9% (83.2% to 88.6%) of men were at high risk of cardiovascular disease. Corresponding numbers at age 50 were 39.5% (35.9% to 43.1%) and 88.7% (86.3% to 91.0%) and at age 65 were 84.0% (80.6% to 87.4%) and 91.6% (88.6% to 94.1%). At age 40, one out of 10 women and no men would be classified at low risk for cardiovascular disease.
Conclusion Implementation of the 2003 European guidelines on prevention of cardiovascular disease in clinical practice would classify most adult Norwegians at high risk for fatal cardiovascular disease.

Introduction

Until recently most risk equations for cardiovascular disease have been derived from the US Framingham study, but these tended to overestimate risk in the European context.[1] A new European risk scoring system for cardiovascular disease, based on the first phase of the systematic coronary risk evaluation (SCORE) project, was presented in 2003.[2] The system is based on a pooled dataset of cohort studies from 12 European countries, among these Norway, and offers a format for estimating fatal cardiovascular disease risk that is suitable for clinical practice.[2] The system is embedded in the current version of the European guidelines on prevention of cardiovascular disease, issued by the Third Joint Task Force of European and other Societies on Cardiovascular Disease Prevention in Clinical Practice in 2003.[3]

Several studies have shown clinicians' limited adherence to medical guidelines for asymptomatic conditions, and even in relation to patients with high risk conditions such as angina pectoris.[3–5] This phenomenon has been termed "clinical inertia."[4]

Population based data on risk factors for cardiovascular disease are available for many European regions.[6] The 2003 European guidelines, however, provide no estimates of the aggregated workload associated with implementation of the recommendations.

We estimated the high risk group in the Norwegian population participating in the Nord-Tröndelag health study 1995-7 (HUNT 2),[7] according to the 2003 European guidelines on prevention of cardiovascular disease.

Materials and methods

In the European guidelines risk is defined in terms of the absolute probability of developing a fatal cardiovascular event within 10 years, and the threshold for high risk is ≥5%.[3] The systematic coronary risk evaluation system specifies a list of biomedical conditions that automatically classify people at high risk (see box). These people require maximal attention, with no further estimation of risk.[3] In remaining asymptomatic, apparently healthy people, risk estimation and counselling should be guided by the total risk level, as estimated from a chart produced by the systematic coronary risk evaluation project.

The chart comprises a table of several parameters. Risk is estimated by rounding a person's age to the nearest one shown on the chart, their cholesterol level to the nearest whole unit, and their blood pressure to the nearest multiple of 20 mm Hg.[2] The guidelines specifically recommend extrapolation of the risk estimate to 60 years when counselling younger age groups. We calculated risk distribution both with and without extrapolation to evaluate its effect on the high risk group.

The chart is designed in two versions for use in high or low risk populations. As the guidelines state

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The European guidelines' clinical priority list

The clinical priority list in the European guidelines on cardiovascular disease prevention in clinical practice (pocket version). Individuals who fulfill criteria 1 or 2, or both are defined as at high risk

Priorities of cardiovascular disease prevention in clinical practice
1) Patients with established coronary heart disease, peripheral artery disease and cerebrovascular atherosclerotic disease
2) Asymptomatic individuals who are at high risk of developing atherosclerotic cardiovascular disease because of:
 a) Multiple risk factors resulting in a 10 year risk of ≥5% now (or if extrapolated to age 60) for developing a fatal cardiovascular event
 b) Markedly raised levels of single risk factors: cholesterol ≥8 mmol/l (320 mg/dl), LDL cholesterol ≥6 mmol/l (240 mg/dl), blood pressure ≥180/110 mmHg
 c) Diabetes Type 2 and diabetes Type 1 with microalbuminuria
3) Close relatives (first degree relatives) of:
 a) Patients with early-onset atherosclerotic cardiovascular disease
 b) Asymptomatic individuals at particularly high risk
4) Other individuals met in connection with ordinary clinical practice

Source: De Backer et al [3]

that Norway is a high risk region, we analysed data using the high risk chart.

To facilitate communication of risk, a person's combined risk estimate is visualised by "traffic light" colours. High risk is illustrated by increasingly dark shades of red. Intermediate risk (2%-4% risk of a fatal event within 10 years) is illustrated by yellow-orange, and low risk (≤ 1%) by green.

Our population data were derived from the Nord-Tröndelag health study 1995-97, a large Norwegian population study.[7] To apply the guideline's recommendations as precisely as possible, the present analysis is based only on people of the ages shown in the chart. We thereby included participants from the Nord-Tröndelag health study aged 40, 50, 55, 60, and 65 years, totalling 5548 people (2841 women). These participants answered two questionnaires covering a range of health topics. Of relevance to our study were questions about cardiovascular disease, diabetes mellitus, and smoking habits. For our analysis we define smoking as daily consumption of cigarettes, cigars, or a pipe.

In the Nord-Tröndelag health study, blood pressure was measured in seated participants. In our analysis we record blood pressure as the mean values of the second and third of three measurements carried out consecutively at the same visit. Blood sampling was carried out whenever the participants attended—that is, in the non-fasting state. Height was measured to the nearest 1.0 cm and weight to the nearest 0.5 kg. Body mass index was calculated.

We established the proportion of participants at high risk of cardiovascular disease in a stepwise manner, in accordance with the guidelines. We calculated the age and sex specific proportions that should be assigned to the high risk category on the basis of criteria 1 and 2b-c of the priority list (see box). We used the chart to estimate risk in the remaining participants. The chart does not give exact cut-off points for systolic blood pressure and total cholesterol. See bmj.com for an outline of the applied limits.

Overall, 283 women (10% of the total) and 186 men (6.9%) were unclassifiable according to the chart owing to missing data, mostly on smoking. We included all participants in the denominator when we determined the distribution of risk categories.

We adapted the priority list on the basis of the data from the Nord-Tröndelag health study. Under criterion 1 we included only participants with a history of myocardial infarction or stroke. We did not calculate low density lipoprotein, as the Friedewald formula is unreliable in non-fasting people. We included participants who reported receiving treatment for hypertension and all people with diabetes mellitus in the high risk category.

We display the risk distribution for cardiovascular disease among the Nord-Tröndelag population in two versions; one based on extrapolation to age 60, the other based on the participants' age. In doing so we applied the colour system, without differentiating between shades of a colour. Shaded red indicates people who are at high risk on the basis of criteria 1 and 2b-c. Unshaded red indicates high risk according to criterion 2a.

Results

See table 1 on bmj.com for an overview of participants from the Nord-Tröndelag health study included in the present analysis. The participation rate varied from 70% to 89%. See table 2 on bmj.com for the proportion of people categorised as at high risk on the basis of noticeably raised levels of single risk factors (see box) and the distribution of the combined risk categories, according to the chart of the systematic coronary risk evaluation system.

If all recommendations including extrapolation to age 60 years are applied, 22.5% (95% confidence interval 19.3% to 25.7%) of women and 85.9% (83.2% to 88.6%) of men aged 40 are classified as at high risk for fatal cardiovascular disease (see table 2 on bmj.com and fig 1). Only 8.5% (6.5% to 10.9%) of women and no men aged 40 are classified as at low risk. By age 50, the high risk group includes 39.5% (35.9% to 43.1%) of women and 88.7% (86.3% to 91.0%) of men and by age 65, 84.0% (80.6% to 87.4%) of women and 91.6% (88.6% to 94.1%) of men.

Figure 2 shows the distribution of risk categories without extrapolation to age 60. Extrapolation explains 86.0% of the high risk group after evaluation using the chart among women aged 55. The values for men are 64.4% at age 50 and 18.7% at age 55.

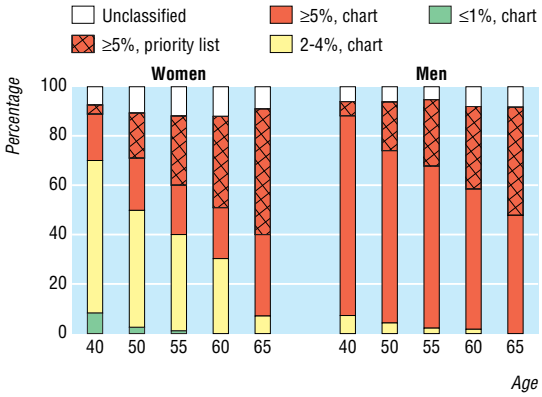

Fig 1 Distribution of risk categories for cardiovascular disease when risk is extrapolated to 60 years, as recommended by the 2003 European guidelines

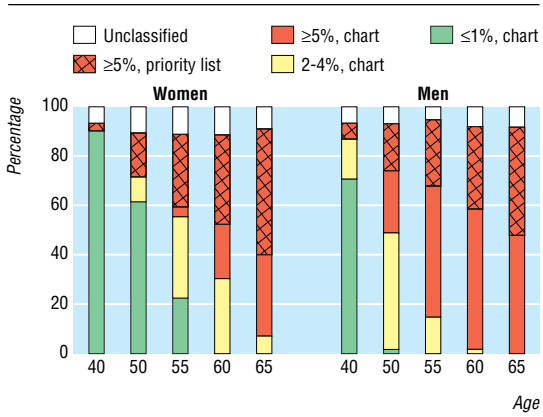

Fig 2 Distribution of risk categories for cardiovascular disease with reference to person's age (not extrapolated)

Discussion

Implementation of the 2003 European guidelines on prevention of cardiovascular disease in a well defined Norwegian population would class four out of 10 women and nine out of 10 men aged 50 as at high risk for fatal disease. No men aged 40 or older would be classified as at low risk.

Strengths and limitations of the study

The population of the Nord-Tröndelag health study 1995-7 (HUNT 2) is well defined and considered fairly representative of Norway, a country which contributed substantial amounts of data to the systematic coronary risk evaluation project.[2] Compared with other European high risk regions included in the systematic coronary risk evaluation project or the monitoring trends and determinants in cardiovascular disease project,[6] the population did not differ significantly for cholesterol levels and smoking. Blood pressure levels were somewhat higher in the Nord-Tröndelag population than in most comparable countries.

Our adaptations of the data from the Nord-Tröndelag health study to the priority list of the European guidelines, should not significantly affect our results. People with self reported angina, peripheral artery disease, and high levels of low density lipoprotein cholesterol were not automatically assigned to the high risk group. This contributes to a conservative estimate of the group before evaluation using the chart. Patients with diabetes type 1 without microalbuminuria, however, were included, as were patients receiving treatment for hypertension, irrespective of blood pressure levels. However, all patients with diabetes type 1 and people receiving antihypertensive treatment require a level of attention similar to that of people diagnosed as at high risk.

Applicability of 2003 European guidelines

A paramount aim of the systematic coronary risk evaluation project was to encourage development of national guidelines on prevention of cardiovascular disease.[2 3] Applying the Framingham risk equation to European countries overestimated the risk of cardiovascular disease.[1 2] This highlights the importance of evaluating risk scoring systems against epidemiological data from the population to be screened before implementation in clinical practice.[8] In addition, a country can show regional differences in morbidity and mortality.[1] A dichotomisation of Europe into high risk and low risk regions may maintain the earlier introduced imprecision of the risk assessment.

The 2003 European guidelines seem to be intended as a tool to define the priorities to be set, given limited resources. We found that the guidelines are unlikely to serve as an effective tool for prioritising Norwegians, as they classify an unreasonable number of people as at high risk. Extrapolation of risk to 60 years contributes strongly to this and implies that no men aged 40 or older and only a few women can be considered as at low risk for cardiovascular disease. Absence of extrapolation, however, makes it theoretically impossible for someone aged 40 to be classified as at high risk on the basis of the systematic coronary risk evaluation chart. So whereas extrapolation of risk leads to an overwhelmingly large high risk group, lack of extrapolation may lead to down prioritising of younger people who might benefit from early intervention.

The vision of the Third Joint Task Force was to make the guidelines part of standard daily clinical practice throughout Europe.[3] The European Society of Cardiology encourages visitors to its website (www.escardio.org) to include these guidelines in their handheld digital systems. The guidelines are therefore clearly recommended for direct use in counselling in clinical practice. Several ethical dilemmas may be linked to implementation of the guidelines in clinical practice. These arise from the likelihood of overestimating true risk for cardiovascular disease. People who contributed data to the systematic coronary risk evaluation project were mostly recruited in the 1970s and 80s (Norway, 1974-8). Since the early 1970s mortality from cardiovascular disease has decreased by 30%-50% in western Europe.[9] Lifestyle and body composition in the Norwegian population has also undergone important changes.[10] A given combination of the relevant risk factors for cardiovascular disease is likely to predict a lower mortality risk today than 25 years ago. The systematic coronary risk evaluation project[2] does not discuss the problem of retrospective risk bias.[1 8] A Norwegian expert group has suggested that a 5% risk for mortality in 1985 may correspond to a 2.5% risk in 2003.[11]

Any overestimation of a person's risk for cardiovascular disease can have important implications. Apart from causing unnecessary concern, it undermines the patient's informed choice for intervention. It is also likely to increase prescribing costs and affect life insurance premiums.[1 12]

Process for development of guidelines

When guidelines class most adults in one of the world's longest living and healthiest populations[13] as at high risk and in need of maximal clinical attention, it raises several scientific and ethical questions.[14] The finding predicts major dilemmas related to workload and resource allocation,[15] even in Norway where the political, economic, social, and medical circumstances[3] reflect excellent access to health care by international comparison,[13] and the per capita expenditure on health is among the highest in the world.[13]

Despite the contribution of numerous experts and professional societies, it seems that authoritative clinical guidelines on the basis of the systematic

What is already known on this topic

Clinicians are urged to implement clinical guidelines in everyday practice

Clinicians show limited adherence to medical guidelines that target asymptomatic conditions

What this study adds

Implementation of European guidelines to prevent cardiovascular disease would label most people in an unselected Norwegian population at high risk of fatal disease from age 40

The validity of the evidence base of the guidelines is questionable and predicts practical and ethical dilemmas related to resource allocation and clinical counselling

The size of the population at risk should be estimated before clinical guidelines are issued

coronary risk evaluation project may be an example of premature application of medical technology in routine clinical practice.

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One hundred years ago

Disease and fashion

Fashions in dress often have their origin in the wish to hide disfigurement caused by disease. The voluminous trunk hose worn by English gallants at the beginning of the seventeenth century were introduced by James I as a means of concealing an unsightly malformation. Slaves of fashion to whom Nature had refused an adequate curve of the hip had to supply the deficiency by art. Readers will remember the story told by Carlyle of the discomfiture of the unlucky courtier who sat down on a nail, and on rising to receive His Majesty instantaneously emitted several pecks of bran, and stood a pitiable figure with his breeches hanging in folds about his shrunken person. The introduction of the crinoline is often attributed to the Empress Eugénie before the birth of the Prince Imperial; as a matter of fact, a similar apparatus had, under the name of farthingales, *vertugadins*, and what not, been used by ladies in the sixteenth and seventeenth centuries. The patches which added so piquant an effect to the faces of the beauties of the eighteenth century were first used by officers to disguise the scars of wounds received in battle. If the late Sir Robert Peel had been a royal personage his manner of wearing his hat at an angle that seemed intended to express defiance of public opinion would have become fashionable among young "bloods," as they are beginning once more to be called; yet we believe it was really intended to conceal a scar. In a second series of his *Indiscrétions de l'Histoire*, recently published, Dr. Cabanès cites several other instances in point. In the fifteenth century Philippe le Bon, having fallen ill, had his head shaved. Like the fox in the fable that had lost his tail, he tried to persuade the nobles of Burgundy that the human head looked much handsomer when its shape was not hidden by a mass of hair. They did not see the thing in the same light, but, unlike the fox, Philippe had the power to compel people to be of his opinion, and, shaven heads perforce became fashionable. The daughters of Louis XI had feet of a size which made it necessary for them to hide them; hence the society dames of the day thought it due to themselves to wear trailing gowns. The wife of Philip III disguised an abnormally long neck with a high wimple, and was imitated by all ladies who wished to be considered fashionable. Henry Plantagenet, anxious to hide the deformity caused by an outgrowth on the foot, had boots made with extravagantly curved toes, which straightway became the only wear for courtiers. Louis XIV wore a wig to hide unsightly wens on his head; the fashion of wearing wigs has also been attributed to the havoc played by syphilis among the "love locks" of the seventeenth century. Many other instances could be given, but these will suffice to show that there is a closer connexion between fashion and deformity than might at first sight be suspected. This may serve to explain how a thing ugly in itself may come to be accepted as the stamp of social. (*BMJ* 1905;ii:88)