Comparison of methods to identify individuals at increased risk of coronary disease from the general population

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Abstract

Objectives To evaluate the guidelines on measurement of cholesterol in the national service framework for coronary heart disease and to compare alternative strategies for identifying people at high risk of coronary disease in the general population.
Design Comparison of methods (national service framework criteria, Sheffield tables, age threshold of 50 years, estimated risk assessment using fixed cholesterol values) for identifying people with a 10 year coronary event risk of 15% or greater.
Setting Health survey for England 1998.
Subjects 6307 people aged between 30 and 74 years with no history of myocardial infarction, stroke, or angina.
Main outcome measures Proportion of the total population selected for measurement of cholesterol and proportion of people at 15% or greater risk identified.
Results The national service framework guidelines selected 43.4% (95% confidence interval 42.2% to 44.6%) of the study population for cholesterol measurement and identified 81.2% (80.2% to 82.2%) of those at 15% or greater risk. The Sheffield tables selected 73.1% (72.0% to 74.2%) for cholesterol measurement and identified 99.91% (99.83% to 99.99%) of those at 15% or greater risk. An age threshold of 50 years selected 46.3% (45.1% to 47.5%) for cholesterol measurement and identified 92.8% (92.1% to 93.4%) of those at 15% or greater risk. Estimated risk assessments using fixed cholesterol values selected 17.8% (16.8% to 18.7%) for cholesterol measurement and identified 75.9% (74.8% to 76.9%) of those at 15% or greater risk.
Conclusion Measuring the cholesterol concentration of everyone aged 50 years and over is a simple and efficient method of identifying people at high risk of coronary disease in the general population.

Introduction

One of the major barriers to routine assessment of coronary risk is that its accurate assessment requires knowledge of both total cholesterol and high density lipoprotein cholesterol.[1 2] Although most people referred to outpatients for cardiovascular problems will have their serum lipids measured, extending cholesterol screening to the entire population is not generally considered to be cost effective.[3] This has led to the development of different methods to select people at high risk from the general population for measurement of cholesterol and hence accurate risk assessment.

Four screening methods are commonly used in the United Kingdom. Firstly, in the section on primary prevention, the national service framework for coronary heart disease recommends measurement of cholesterol for people with hypertension, diabetes, or a family history of hyperlipidaemia or premature ischaemic heart disease.[4] Secondly, the Sheffield tables tailor cholesterol measurement to those people who are most likely to be at 15% or greater risk on the basis of knowledge of their other cardiovascular risk factors, including age, sex, smoking status, and presence or absence of hypertension, diabetes, and left ventricular hypertrophy.[5] Thirdly, people can be selected for cholesterol measurement on the basis of their age. Many screening and primary prevention programmes in the United Kingdom, including breast screening and flu vaccination, use age thresholds to identify people at high risk from the general population.[6] Fourthly, risk assessments can be estimated on the basis of fixed cholesterol values (see bmj.com for more detail).[7] We compared four approaches for selecting people at high risk from the general population against one criterion or "gold standard," the Framingham 10 year coronary heart disease risk equation.

Methods

Data

The health survey for England 1998 was a cross sectional survey of a stratified random sample of the English population aged between 2 and 98 years.[8 9] Of the 19 654 people surveyed, 6307 people were aged between 30 and 74 years and had complete data on risk factors available.[8]

Criterion standard

We calculated 10 year coronary heart disease risks of the sample population by using the Framingham equation.[1] We used this as the accepted criterion standard against which to compare the alternative methods

Comparison of the current national service framework for coronary heart disease cholesterol screening criteria, the Sheffield tables, age thresholds, and estimated risk assessments. Values are percentages (95% confidence intervals) unless stated otherwise

Strategy to identify people for cholesterol measurement	Adults (aged 30-74 years with no previous history of MI, stroke, angina) identified for cholesterol measurement	People at ≥15% risk identified	No of cholesterol measurements needed to identify one person at ≥15% risk (yield)
National service framework criteria	43.4 (42.2 to 44.6)	81.2 (80.2 to 82.2)	3.2
Sheffield tables	73.1 (72.0 to 74.2)	99.91 (99.83 to 99.99)	4.4
All people aged ≥50 years	46.3 (45.1 to 47.5)	92.8 (92.1 to 93.4)	2.9
All people whose estimated risk calculated by using fixed TC:HDL (5.3 in men and 4.6 in women) is ≥15%	17.8 (16.8 to 18.7)	75.9 (74.8 to 76.9)	1.4
National service framework criteria plus Sheffield tables	78.4 (77.4 to 79.4)	99.91 (99.83 to 99.99)	4.7
National service framework criteria plus all those ≥50 years	60.9 (59.8 to 62.2)	97.5 (97.2 to 97.9)	3.7
National service framework criteria plus all those whose estimated risk calculated by using fixed TC:HDL is ≥15%	46.8 (45.5 to 48.0)	93.4 (92.7 to 93.9)	3.0

MI=myocardial infarction; TC:HDL=ratio of total cholesterol to high density lipoprotein cholesterol.

to select people at high risk from the general population.

Comparison of methods of selection

We were blinded to actual cholesterol values recorded in the database. Firstly, we applied the national service framework criteria alone to the blinded data and recorded the number of people selected for cholesterol measurement. We compared the people who had been selected for cholesterol measurement with the criterion standard to determine the number of people at 15% or greater risk who had been identified. We calculated the sensitivity and specificity of the national service framework criteria in identifying people at 15% or greater risk.[10]

We repeated the analyses for the Sheffield tables, an age threshold of 50 years, and an estimated risk assessment using a fixed total cholesterol to high density lipoprotein cholesterol ratio of 5.3 in men and 4.6 in women. We recommended actual cholesterol measurements if the estimated risk was 15% or greater. We used the same analyses to evaluate the added value of incorporating each of these selection criteria into the current national service framework guidelines.

Results

In this population of 6307 people aged between 30 and 74 years with no previous history of myocardial infarction, angina, or stroke, the Framingham equation classified 1053 people (16.7%, 95% confidence interval 15.8% to 17.6%) at 15% or greater 10 year coronary risk. The current national service framework for coronary heart disease guidelines alone selected 43.4% of the population aged between 30 and 74 years for cholesterol measurement. Compared with the criterion standard this method identified 81.2% of those at 15% or greater risk (table).

The Sheffield tables selected 73.1% of the population aged between 30 and 74 years for cholesterol measurement. Compared with the criterion standard this method identified 99.9% of those at 15% or greater risk (table). An age threshold of 50 years selected 46.3% of the population aged between 30 and 74 years for cholesterol measurement. Compared with the criterion standard this method identified 92.8% of those at 15% or greater risk (table).

An estimated risk assessment using fixed total cholesterol to high density lipoprotein cholesterol ratios of 5.3 in men and 4.6 in women selected 17.8% of the population aged between 30 and 74 years for cholesterol measurement. Compared with the criterion standard this method identified 75.9% of those at 15% or greater risk (table). The table also summarises the impact of adding the Sheffield tables, an age threshold of 50 years, or an estimated risk assessment to the current national service framework criteria on cholesterol measurement.

Discussion

The effectiveness of a screening programme can be improved in two ways. The intervention can be made more effective or the population can be targeted more efficiently.[7] In this study we compared alternative methods for selecting people at high risk from a sample of the English population aged between 30 and 74 years against one criterion standard, the Framingham coronary risk equation with data on all covariates. We have presented the results to enable comparisons to be made between the proportion of the population who were selected for cholesterol measurement and the proportion of people at 15% or greater risk who were identified. This is important because general practitioners need to know whose cholesterol to measure based on a rational justification of any approach suggested. This study contributes to the debate on how limited resources are targeted to those people who, according to current guidelines, are most likely to benefit from treatment to reduce their risk of heart disease.

The Sheffield tables identified almost all people at 15% or greater risk. However, the "cost" of such a high sensitivity is a false positive rate of 67.7% and a requirement to measure the cholesterol in 73.1% of people aged between 30 and 74 years.

The transparency of a screening method based on age may have advantages over other more complex strategies. In this study we used an age threshold of 50 years to select people for cholesterol measurement and hence accurate risk assessment. This strategy required measurement of cholesterol in 46.3% of the population and led to 92.8% of those at 15% or greater risk being identified. Adding this age threshold to the current national service framework criteria resulted in

60.9% of the study population being selected for cholesterol measurement and identified 97.5% of those at 15% or greater risk. Compared with the results with the Sheffield tables this is a big reduction in the number of cholesterol measurements needed. Age is a strong predictor of cardiovascular risk and has the advantage of being readily identifiable by both doctor and patient. The simplicity of this criterion may help to increase the uptake in screening and outweigh the extra cholesterol measurements needed. In addition, this approach may help to identify people with other modifiable risk factors (such as hypertension, diabetes, and smoking) and thus lead to an integrated screening programme for coronary heart disease.

We made estimated risk assessments by using average ratios of total cholesterol to high density lipoprotein cholesterol from a population survey of adults aged between 50 and 64 years.[11] We chose these values as they have been built into the Framingham risk function in clinical information systems that are widely used in British general practice. This method required the fewest cholesterol measurements (17.8% of the population aged between 30 and 74 years) and identified 75.9% of people at 15% or greater risk. Adding this method to the current national service framework criteria resulted in 46.8% of the study population being selected for cholesterol measurement (a small increase of 3.4% on the national service framework criteria alone) and identified 93.4% of those at 15% or greater risk. We believe that given the small increase in workload and large increase in the number of people at high risk identified it may be of value to investigate further the fixed cholesterol values used in the equation to improve the proportion of people at 15% or greater risk identified. An additional advantage of this method is that estimating the coronary risk by using fixed total cholesterol to high density lipoprotein cholesterol ratios puts actual cholesterol measurement firmly in the context of risk assessment and thus focuses clinicians' attention on the purpose of the cholesterol measurement.

Conclusion

The current national service framework criteria on cholesterol measurement when strictly applied to a sample of the general population aged between 30 and 74 years identified 81.2% of those at 15% or greater 10 year coronary risk. Thus additional methods are needed to identify people at risk of coronary heart disease from the general population. Of the alternative screening tests evaluated in this study, targeting people aged 50 years and over for cholesterol measurement, and hence accurate risk assessment, is a simple and efficient method of identifying those at 15% or greater 10 year coronary risk from the general population.

What is already known on this topic

National guidelines for the prevention of coronary heart disease recommend the use of absolute risk profiles to guide decisions on treatment

Various methods are used to select people for measurement of cholesterol and hence accurate risk assessment

What this study adds

The current national service framework criteria identified 81% of people at 15% or greater 10 year coronary risk

Targeting people aged 50 years and over is a simple and efficient method of identifying people for accurate risk assessment

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Balloney

Some years ago I was making medical examinations on students wanting to join the university army training corps. Many had never experienced a physical examination before; so explanation and reassurance was required, and I took a conversational approach.

During the assessments I used to ask the men if they knew about testicular self examination. Unfortunately many did not, and I suspect that a good many of the others were bluffing. I asked one such eye-avoider how often he checked himself.

"Four times a day, sir."

He observed my eyebrows rising. "I mean six times, sir."

"What subject are you studying?"

"Politics, sir."

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