The impact of prevention on reducing the burden of cardiovascular disease
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study examined the potential cost-effectiveness of 11 interventions recommended to prevent cardiovascular disease (CVD) in the US population of eligible individuals aged 20 to 80 years. The authors concluded that these nationally recommended interventions prevented a high proportion of CVD, but most of them substantially increased the health care costs. The methodology was appropriate and the results were described comprehensively, although few details on the sources of data were reported. The authors’ conclusions appear to be valid.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to examine the potential cost-effectiveness of 11 interventions recommended for the prevention of cardiovascular disease (CVD) in the actual US population of eligible individuals aged between 20 and 80 years.

Interventions
Eleven intervention strategies and two combinations of these were compared with a baseline strategy of no prevention.

Strategy 1 was to provide aspirin if the 10-year myocardial infarction (MI) risk was 10% or more.
Strategy 2 was to lower the low-density lipoprotein (LDL) cholesterol to under 160mg/dL in low-risk individuals.
Strategy 3 was to lower the LDL cholesterol to under 130mg/dL in high-risk individuals.
Strategy 4 was to lower the LDL cholesterol to under 100mg/dL in people with coronary artery disease (CAD).
Strategy 5 was to lower the blood pressure to 140 over 90mmHg in people who did not have diabetes.
Strategy 6 was to lower the A1c to under 7.0% in people with diabetes.
Strategy 7 was to lower the blood pressure to 130 over 80mmHg in people with diabetes.
Strategy 8 was to lower the LDL cholesterol to under 100mg/dL in people with diabetes.
Strategy 9 was to reduce the fasting plasma glucose (FPG) to under 110mg/dL.
Strategy 10 was to cease smoking.
Strategy 11 was to reduce the weight to body mass index to under 30kg/m^2.

The two combination strategies were of all the 11 strategies above, with either 100% performance and success in reaching the treatment targets or more feasible levels. Each individual strategy was also tested under these two assumptions.

Location/setting
USA/primary and secondary care.

Methods
Analytical approach:
This economic evaluation was based on a published mathematical model, namely the Archimedes model, with a 30-year time horizon. The authors did not explicitly report the perspective.

Effectiveness data:
The clinical data came from the published report of the decision model and little information on the sources was provided. For example, the characteristics of the patient population came from real populations such as the National
Health and Nutrition Education Survey (NHANES) covering the period 1998-2004. The treatment effects for the medications were taken from several randomised controlled trials, but no details of these studies were given. The key clinical estimate was the efficacy of treatment.

Monetary benefit and utility valuations: 
The utility valuations were derived from published studies, the details of which were not given.

Measure of benefit: 
Quality-adjusted life-years (QALYs) were used as the summary benefit measure and were discounted at an annual rate of 3%. Life-years (LYs) and the number of MIs and strokes prevented were also reported, but were not combined with costs.

Cost data: 
The health service costs were physician visits, medications, laboratory tests, hospital admissions, and emergency visits. The costs were calculated using a micro-costing method. The drug costs were based on a large on-line seller and the costs of other health care services reflected the prices paid by Kaiser Permanente Southern California or came from the literature. The source for the resource use data was not reported. All costs were in US dollars ($) and the price year was not explicitly reported. Future costs were discounted at an annual rate of 3%.

Analysis of uncertainty: 
A series of univariate sensitivity analyses was carried out to investigate how robust the model findings were to changes in the assumptions for clinical and economic inputs, which were varied on the basis of the authors’ opinions.

Results 
Of the 200 million people in the US between the ages of 20 and 80 years, approximately 156 million (78%) met the criteria for at least one of the interventions.

The total cost of care in this hypothetical population of eligible individuals, with 100% compliance and success, over 30 years, in thousands, was $9,504,964,366 with no intervention, $50,699,597 with strategy 1, $682,796,396 with strategy 2, $1,531,310,449 with strategy 3, $390,465,478 with strategy 4, $1,788,939,554 with strategy 5, $1,548,262,083 with strategy 6, $723,892,917 with strategy 7, $1,053,107,096 with strategy 8, $587,945,671 with strategy 9, -$47,210,943 with strategy 10, $1,011,235,711 with strategy 11, $7,626,041,025 with all strategies, and $5,353,109,158 with all strategies assuming a feasible level of performance.

The corresponding QALYs were 4,459,603 no intervention, 17,005 strategy 1, 3,990 strategy 2, 21,222 strategy 3, 10,985 strategy 4, 38,737 strategy 5, 38,389 strategy 6, 32,626 strategy 7, 18,350 strategy 8, 42,617 strategy 9, 27,597 strategy 10, 65,779 strategy 11, 243,926 all strategies, and 147,161 all strategies assuming feasible performance.

The incremental cost per QALY gained ranged from $2,779 (strategy 1) to $272,061 (strategy 2) and only strategy 10, smoking cessation, was cost-saving. Strategy 1, aspirin for high-risk people, had a low cost per QALY of under $3,000. Strategy 11, weight control and strategy 9, control of pre-diabetes FPG, had costs per QALY of around $18,000. Strategies 4 to 7, blood pressure control in people with and without diabetes, cholesterol control in people with CAD, and A1c control in those with diabetes, and the combination strategies had costs per QALY between $25,000 and $55,000. Only strategies 8, 3 and 2, cholesterol control in people with diabetes and those at high risk and low risk of CAD, had a cost per QALY higher than $55,000.

The sensitivity analysis identified the cost of the preventive measures as the key model driver, but in general the results were robust to variations in the model parameters.

Authors’ conclusions 
The authors concluded that the application of nationally recommended prevention activities prevented a high proportion of CVD, but most of them substantially increased the health care costs.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear in that nationally recommended interventions were compared. The treatment patterns were based on published national guidelines.

Effectiveness/benefits:
The authors did not provide clear information on the sources used to derive the clinical data, which had already been incorporated in the published decision model. Thus, it is not possible to judge the validity of the clinical evidence. However, the data on treatment effect were taken from randomised controlled trials, which generally provide high internal validity. The benefit measure was appropriate, given that QALYs are a validated measure, which captures the impact of the disease on both life expectancy and quality of life. However, no description of the sources used to derive the utility values was provided.

Costs:
The economic viewpoint was not explicitly reported, although it appears, from the categories of costs and some of their sources, to have been that of the health care system. A breakdown of cost items was not given and no information on the unit costs, quantities of resources used, and price year was provided. This limits the transparency of the economic analysis. However, a large number of interventions were considered and it would have been difficult to report these details for all of them. The authors pointed out that the cost of screening individuals with abnormal values was not considered.

Analysis and results:
The use of an incremental approach to combine the costs and benefits of the alternative strategies was appropriate. The issue of uncertainty was partially addressed by means of a deterministic univariate analysis. The authors noted that their findings might not reflect the real-world setting over 30 years because the patterns of care may change over time, and the implementation of preventive programmes may vary, resulting in different benefits or costs.

Concluding remarks:
On the whole, the methodology was appropriate and the results were described comprehensively, although few details on the sources of data were reported. The authors’ conclusions appear to be valid.

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