Addressing modifiable risk factors for coronary heart disease in primary care: an evidence-base lost in translation

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Background. Risk factors for cardiovascular disease can be modified in primary care. Electronic patient record (EPR) systems include embedded cardiovascular risk factor calculators and should facilitate this process.

Objective. To observe how the evidence base for assessing and managing cardiovascular risk is implemented in practice.

Method. We compared the different risk calculators promoted for calculating cardiovascular risk in primary care using four test cases. We looked to see how these calculators were implemented in primary care EPR systems. We explored through a workshop which risk factors GPs thought were important and felt motivated to address as part of clinical care.

Results. The risk calculators reviewed use different sets of risk factors and the levels of risk calculated for the same test patient profiles vary by up to 100%. The risk factor calculators embedded within UK computer systems all include the Framingham equation though there is variation in interface, default values and patient groups included. GPs showed consensus around the importance of managing smoking, blood pressure, obesity (body mass index), diabetes and cholesterol but also stressed the importance of providing personalized care and exercising professional judgement.

Conclusions. There appears to be an evidence-base lost in translation. Different guidelines calculate risk differently, and even when the same guideline is used, variation in implementation leads to further variation. Education and development of improved risk calculators should enable the most appropriate calculator to be used for an individual patient; accreditation of implementation could be achieved through the use of a standard set of test cases.

Keywords. Computerized, guidelines, heart disease, medical record systems, preventive health practice, public health practice, quality of health care, risk, vascular disease.

Introduction

Cardiovascular disease remains a major cause of mortality and morbidity, and risk can be measured and managed in primary care. Although the rate of cardiovascular disease is falling in the UK, it remains one of the highest in Europe.1 The British Heart Foundation (BHF) lists nine key modifiable risk factors for cardiovascular disease,2 which account for most risk of myocardial infarction worldwide in both sexes and all ages (Box 1).3 UK primary care is computerized and general practice electronic patient record (EPR) systems include records of most of these risk factors and also have cardiovascular risk calculators embedded within them, which facilitate the identification of people at increased risk and their modifiable risk factors.4

There have been a number of initiatives to improve the management of cardiovascular (CVS) risk in primary care. One of these was the creation of national guidance: the Coronary Heart Disease National Service Framework. Subsequently, it was produced for the management of important co-morbidities, initially diabetes and more recently for chronic kidney disease (CKD).5 A financially incentivized chronic disease management programme [The Quality and Outcomes
Framework (QOF) was introduced in 2004, which largely focussed on the management of the secondary prevention of cardiovascular disease. The latest initiative is the introduction of cardiovascular risk checks for the entire adult population aged 40–74 years. However, despite the quality of the evidence-base and the universal use of practice-based EPR systems, there remains a gap in the primary care management of cardiovascular disease. We consider the extent to which known cardiovascular risk factors are included in risk calculators, how these are implemented in primary care computer systems and then used in routine clinical care.

Method

The investigation was carried out in four parts: (i) A literature review of the risk factors for coronary heart disease (CHD) capable of being modified in primary care; (ii) Exploration of which cardiovascular risk factors were carried forward into risk calculators, designed for use in primary care; (iii) How these are implemented in commonly used brands of GP computer system and (iv) Which of these primary care professionals thought were important to prioritize in the 10-minute consultation.

We carried out a literature review to identify secondary research, largely systematic reviews and national or international guidance that identifies modifiable risk factors, which could be managed in primary care. We restricted our search to guidance relevant to UK practice as our objective was to identify gaps between evidence base and clinical practice. We searched Medline and supplemented this with a review of national guidelines used by the Department of Health, the National Institute for Health and Clinical Excellence (NICE), the Scottish Intercollegiate Guidelines Network (SIGN) and the Handbook for vascular risk assessment, risk reduction and risk management. We next identified and compared cardiovascular risk calculators designed to be used in primary care. We contacted the manufacturers and user groups of the principal GP computer systems used in England. We visited four practices to identify the ways that cardiovascular risk calculators were implemented within their EPR systems. Four EPR systems: EMIS-LV, EMIS-PCS, INPS-Vision and iSoft Synergy were in use at these practices. Analysis focussed on identifying the different variables each cardiovascular risk calculator took into account.

We developed four pilot cases (Table 1) and used them to test whether there were any differences between the main risk assessment tools in use (Table 2). These are based on general practice cases and attempted to draw out differences between cases. We used a pre-arranged primary care educational workshop on assessing global cardiovascular risk held as part of an international cardiovascular meeting, as a convenience sample to explore which risk factors were thought important. Participants consented for the meeting to be recorded and all material to be available online as part of an educational initiative. The workshop was video recorded and its audio-track transcribed verbatim, annotated and then thematically analysed. The workshop was attended by 56 delegates, mainly GPs but also included other members of the primary health care team. The first round response rate was 67% (38/56) and 18 delegates agreed to participate in Rounds 2 and 3. The Round 2 response rate was 83% (15/18). We carried out a thematic analysis of the transcript using NVIVO.

### Box 1  BHF list of modifiable cardiovascular risk factors

- Smoking
- Diet
- Physical activity
- Overweight and obesity
- Alcohol
- Psychosocial well-being
- Blood pressure
- Blood cholesterol
- Diabetes

### Table 1  Pilot cases developed to represent common general practice scenarios

<table>
<thead>
<tr>
<th>Cases</th>
<th>Description</th>
<th>Additional risk factors included in this case</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A 45-year-old unemployed Indian man with a positive FH of IHD. Smokes 3 cigarettes/day, BMI 28 kg/m² and BP 138/88. Fasting TC 5.3 mmol/l, HDL 1.1 mmol/l, LDL 3.3 mmol/l and glucose 5.5 mmol/l.</td>
<td>Ethnicity, social deprivation and FH</td>
</tr>
<tr>
<td>2</td>
<td>55-year-old Caucasian type 2 diabetes. Non-smoker, BMI 30 kg/m² and BP 130/78. TC 5.4 mmol/l, TG 2.8 mmol/l, HDL 0.9 mmol/l, LDL 3.2 mmol/l and TC:HDL 6 mmol/l.</td>
<td>Obesity</td>
</tr>
<tr>
<td>3</td>
<td>60-year-old judge. BMI 23 kg/m². BP 144/86, TC 5.6 mmol/l, TG 2.9 mmol/l, HDL 1.2 mmol/l, LDL 3.1 mmol/l and TC:HDL 4.7 mmol/l.</td>
<td>No additional risk factors</td>
</tr>
<tr>
<td>4</td>
<td>70-year-old woman. BMI 22, stable eGFR 40 (Stage 3b), BP 135/86, ACR &lt;2.0 mg/mmol, TC 5.0 mmol/l, HDL 1.2 mmol/l and TC:HDL 4.2 mmol/l.</td>
<td>CKD</td>
</tr>
</tbody>
</table>

BMI, body mass index; eGFR, estimated glomerular filtration rate; FH, family history; HDL, high-density lipoproteins; IHD, ischaemic heart disease; TG, triglycerides.
We used a consensus building exercise, as part of the workshop, to explore which cardiovascular risk factors primary care professionals thought should form an essential part of the context of the 10-minute consultation. We used a two-stage modified RAND/UCLA modification of the DELPHI consensus building process. In Round 1, on arrival before the workshop, delegates indicated via questionnaire which factors form an essential part of CVS risk assessment. They completed a second and third round 1 and 3 weeks, respectively, after the workshop. We incorporated 21 cardiovascular risk factors taken from the BHF and the main current risk assessment tools: Framingham, QRISK2, and ASSessing cardiovascular risk using SIGN (ASSIGN). This list includes all risk factors covered by the main risk assessment tools. After Round 1, the meeting organizers included additional key risk factors, which emerged in the meeting.

We used a rating scale for each risk factor that had a nine-point scale. A risk factor rated 1 had the delegate’s lowest rating of necessity for inclusion in a 10-minute cardiovascular risk assessment; a rating of 9 meant he/she thought it essential to be included. We scored the questionnaire by calculating the median score for each risk factor and adding the letter A (agreement: >75% raters in the same three-point range), E (equivocal: absence of A or D) or D (disagreement: >33% in range 1–3 and 6–9). We repeated this process for Rounds 2 and 3. We mapped which of the originally identified risk factors were likely to be implemented within routine clinical practice.

Results

Risk calculators used in current practice
Framingham risk score is the primary tool recommended for assessing cardiovascular risk, though other methods are emerging as possible contenders or being used in a more limited way. The Joint British Society (JBS2) and NICE guidance is to use a modified Framingham algorithm, which is used by the British National Formulary. Others include the ASSIGN tool, which is advocated by SIGN, the New Zealand risk calculator, the Heart score, the Sheffield risk table, ETHRISK (a modified Framingham CHD and cardiovascular disease risk calculator for British black and minority ethnic groups) and most recently the QRISK tool.

Risk calculators vary in how they predict risk
The five different risk calculators we identified as suitable for use in the UK produce results, which vary by up to 100% (Table 2). Although Case 2 is automatically at high risk due to diabetes, we have still used the risk calculators to quantify this risk; something commonly carried out as part of routine practice to illustrate the potential impact of lifestyle change of therapy.

Primary care EPR systems have very different data entry screens
The four most commonly used primary care EPR systems: EMIS-LV (Fig. 1), EMIS-PCS (Fig. 2), INPS-Vision (Fig. 3) and iSoft Synergy (Fig. 4) all include the Framingham equation but collect different data to calculate risk (Table 3). The systems have migrated from just offering Framingham to including other risk calculators: iSoft Synergy and INPS-Vision now offer the choice of using JBS2 and the EMIS systems QRisk2. Two types of risk calculator were embedded in the EPR system: data entry forms and automated risk calculators. Most used a Framingham-based equation. All four EPR systems collected data about smoking, diabetes, left ventricular hypertrophy and cholesterol. Age and gender were incorporated into the calculators from demographic data already recorded. Some systems did not include ethnicity data.

<table>
<thead>
<tr>
<th>Risk calculator</th>
<th>ASSIGN (%)</th>
<th>BNF (%)</th>
<th>ETHRISK (%)</th>
<th>Framingham (%)</th>
<th>QRISK (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>9.7</td>
<td>13.6</td>
<td>14</td>
<td>17.1</td>
<td>19</td>
</tr>
<tr>
<td>Case 2</td>
<td>20.9</td>
<td>10.9</td>
<td>11</td>
<td>23.7</td>
<td>14</td>
</tr>
<tr>
<td>Case 3</td>
<td>17.4</td>
<td>19.2</td>
<td>19</td>
<td>22.8</td>
<td>13</td>
</tr>
<tr>
<td>Case 4</td>
<td>19.8</td>
<td>11.9</td>
<td>12</td>
<td>16.4</td>
<td>26</td>
</tr>
</tbody>
</table>

BMI, body mass index; BNF, British National Formulary; CVD, cardiovascular disease; HDL, high-density lipoproteins.

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TABLE 2 Cases to demonstrate the differences between risk calculators

Note: The above table shows the differences between five risk calculators: ASSIGN, BNF, ETHRISK, Framingham, and QRISK, using four cases to compare their results for the risk of developing cardiovascular disease (CVD) within 10 years and the predictive factors for each calculator.
and none included CKD or atrial fibrillation (AF) in their risk calculation. The systems varied in how they calculated risk using the Framingham equation, through differing default values and the age-range and co-morbid groups for which they calculated risk.

Workshop qualitative analysis
Various cardiovascular risk factors, the assessment of risk, the evidence supporting a consensus and the practical implications of such checks were explored during the workshop and discussion. There is a general consensus and agreement among both primary and secondary care about what should be included in the 10-minute assessment of cardiovascular risk. Vascular checks are generally seen in a positive light. Some of the main messages are presented.

There is increased recognition among the delegates that ethnicity is a major cardiovascular risk factor. There was debate about whether different cut-offs for lipid measurements and waist circumference should be in use.

... the South Asian men and women have the highest mortality from cardiovascular, coronary deaths than any other population. 51% higher than white British population ... Cardiologist 1

QOF is viewed as not effective in smoking cessation. There was initially some discussion about the role of the GP in smoking cessation from the public health perspective. The GP should offer a very rapid intervention and refer to the smoking cessation clinic: this is accepted as one of the GP’s most cost effective interventions.

QOF ... is absolutely hopeless from the point of view of smoking cessation. It’s very costly ... but it’s been shown not to make any difference

if we can get our smokers to the Stop Smoking Service, they will achieve at one year a doubling of the 10% to 15% with the treatments, they’ll get a 20% to 30% cessation rate. GP 1

Lipids. The National Institute of Clinical Excellence guidelines are felt to be useful and clear in assessing level of risk. There is a need for a shift in mindset from thinking about drugs to thinking about regimens. Cost is still an important issue to consider and an area where primary and secondary care occasionally differ; in essence, low cost statins are generally first line except in some patients.

the most dangerous cholesterol is a normal cholesterol ... we need to move away from just looking at individual risk factors and talk about global risk ... There’s no magical plateau, no magical target below which risks or benefits suddenly stops Cardiologist 2

Like birth weight, South Asian babies are smaller. Why do we use the weight birth charts of European babies? We should have had different cut-offs. Cardiologist 1
Assessment of risk. Risk assessment strategies were either described as needing to be personalized or as exercises in modifying a small number of key risk factors. There was dichotomy between careful personalized approach and just focussing on a few major risk factors.

there's a huge amount of interest in predicting risk, because you can save money by taking people who you think are at high risk but actually aren't, probably are intermediate or low, and not treating them, and those people that are intermediate or low risk that you should be treating. Cardiologist 3

is a heart attack in Baghdad the same as in Chennai, the same as in Johannesburg and the same as in Manchester? Yes. 80% of the world's heart attacks are explained by four risk factors: your cigarettes, your diabetes, your cholesterol, and your blood pressure (BP). Cardiologist 1

The consensus workshop—essential elements of primary care CVS risk assessment

Delegates (n = 56) reported pre-workshop that smoking, physical activity, blood pressure, body mass index, total cholesterol (TC), TC:high-density lipoproteins ratio, diabetes, family history and ethnicity formed the essential elements of the primary care assessment of global cardiovascular risk (Table 4). There was consistent support for smoking as the top modifiable risk factor. However, delegates were equivocal about weight, low density lipoproteins (LDL), left ventricular hypertrophy on electrocardiogram (ECG), hypertension treatment, diet, stress, alcohol, social deprivation, AF, CKD and rheumatoid arthritis.

Post-workshop delegated added two other risk factors to the essential list: LDL and hypertension treatment. Additionally, the faculty felt that a measure of central obesity and albumin–creatinine ratio (ACR—a measure of renal damage) should be added.

In the final round of the consensus building exercise, five extra risk factors were listed as essential parts of the assessment of global CVS risk: weight, alcohol intake, a measure of central obesity, AF and CKD. However, ACR was listed as ‘equivocal’ and there was disagreement on whether left ventricular hypertrophy (LVH) on ECG should be included. Of the nine modifiable risk factors identified by the BHF, three are included in all risk calculators and one in three and a fifth in one. Four of the modifiable risk
factors do not appear at all (exercise, stress, alcohol and diet.) However, some of the risk calculators included risk factors not listed by BHF.

The primary care EPR systems omit the same four risk factors (Table 3) and all remain missing from the consensus building exercise except alcohol (Table 4). However, GPs also thought that CKD and AF should also be included.
Heterogeneity exists at each stage of the cardiovascular risk assessment process, and a significant proportion of the evidence base has been lost in translation. A varying number of the nine BHF modifiable cardiovascular risk factors are represented in the cardiovascular risk calculators and EPR systems (Table 5). It is well established that a gap exists between clinical evidence and its implementation into practice and calculating CVS risk appears to be no exception. Type 2 translation involves successful implementation of guidelines in clinical practice and this study highlights the extent of this gap.

**Table 4** Risk factors pre- and post-workshop and after 2 weeks delegates agreed (A) were an essential component of calculating CVS risk in primary care. At each stage, additional risk factors are added

| Risk factors thought to be essential to included in cardiovascular risk assessment |
| Rating: median + agreement (in same three-point range) |
| Round 1 | Round 2 | Round 3 |
| Smoking 9A | Smoking 9A | Smoking 9A |
| BP 9A | BP 9A | BP 9A |
| BMI 9A | BMI 9A | BMI 9A |
| Diabetes 9A | Diabetes 9A | Diabetes 9A |
| Cholesterol 9A | Cholesterol 9A | Cholesterol 9A |
| Ethnicity 9A | Ethnicity 8A | Ethnicity 9A |
| FH 7A | FH 8A | FH 9A |
| Exercise 7A | LDL 8A | LDL 9A |
| | HT Rx 8A | | |

LDL, weight and LVH on ECG 9E | Weight and LVH on ECG 8E | Central obesity 8A |
Hypertension treatment (HT Rx) 8E | Central obesity, alcohol, AF, CKD, exercise, social deprivation, ACR and RA 7E | Alcohol 7A |
Alcohol, AF, diet, social deprivation and stress 7E | Diet and stress 6E | AF 7A |
CKD and RA 6E | CKD 7A | CKD 7A |

| Extra RF included |
| Family history, ethnic category, LDL, triglycerides (all on PCS template) |

BMI, body mass index; FH, family history.

**Table 5** How the evidence base is lost in, and added to, translation

| BHF modifiable RF | CVS risk assessment tools (risk calculators) | Primary care EPR systems | Consensus |
| Smoking | Included in all | Included in all | Yes—9A |
| BP | Included in all | Included in all | Yes—9A |
| Diabetes | Assign, Framingham and QRISK | Included in all (PCS uses plasma glucose) | Yes—9A |
| Cholesterol | Included in all | Included in all | Yes—9A |
| Exercise | None | None | No |
| Stress | None | None | No |
| Alcohol | None | None | Yes, 7A |
| Obesity | QRISK | BMI and waist circumference included on PCS template | Yes: BMI—9A and central obesity—8A |
| Diet | None | BMI, body mass index | No |
| Extra RF included | Social deprivation (ETHRISK, QRISK), CKD, BP Rx and AF (QRISK), LVH on ECG (Framingham) | Family history, ethnic category | Yes: ethnicity—9A, CKD—7A and AF—7A |

BMI, body mass index.
There are two dilemmas for practitioners: which algorithm to use\textsuperscript{27} and recognizing that there may be differences in how it is implemented in practice. QRISK may be a better risk score calculator but licensing issues may restrict the availability of the QRISK calculator to EMIS brand practices,\textsuperscript{27} and others argue that ASSIGN may be superior.\textsuperscript{28} Inconsistency in the technical implementation of risk calculation could lead to variation in treatment, when the risk calculator produces different results from the same input variables. There are differences in their implementation of the Framingham risk calculator, which could lead to potential confusion. This problem could be addressed by creating a series of reference cases, which could be run against each calculator.

Although risk calculators are a useful guide, they do not replace using clinical judgement to ensure personalized care. There are challenges in calculating CVS risk, though there appears to be consensus from frontline GPs who see this as a complex process requiring personalized assessment and the application of professional judgement.

The main limitation of this study is the sampling bias. Delegates were a small self-selected group, who volunteered to attend the workshop and were representative of South West London general practices. The workshop addressed some of the main issues around assessing cardiovascular risk, but not all potential modifiable risk factors were discussed by the speakers. In addition, although all GP EPR systems were included, a small number of practices were involved and their systems were taken to be representative.

Most of the known modifiable risk factors map through to what practitioners think is feasible to implement in routine practice, while others do not. Further research is needed to explore whether it is possible to develop brief interventions to address the ‘softer risk factors’: stress, alcohol consumption, exercise and diet. In addition, further investigation into how this variation in risk assessment affects patient outcomes is needed. This is especially relevant as the National Health Service is aiming to implement a uniform and universal vascular risk assessment and management programme.\textsuperscript{7}

**Conclusion**

There is a gap between the known risk factors and their technical implementation in the consultation room. The heterogeneity in each step of the risk assessment process may lead to inconsistencies in the systematic assessment of cardiovascular risk, which may have an impact on patient management. Practitioners should not have blind faith in the technological calculation of cardiovascular risk and must take into account the modifiable risk factors that have been lost in translation and use a rating scale most appropriate to the patient sitting with them.

**Declaration**

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Ethical approval: none.

Conflicts of interest: Dr SdeL has given two lectures at meetings sponsored by Pfizer in the last 2 years.

**References**


17. British Cardiac Society; British Hypertension Society; Diabetes UK; HEART UK; Primary Care Cardiovascular Society; Stroke...


