ORIGINAL ARTICLE

Cost-effectiveness of cardiovascular magnetic resonance in the diagnosis of coronary heart disease: an economic evaluation using data from the CE-MARC study

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ABSTRACT

Objective To evaluate the cost-effectiveness of diagnostic strategies for coronary heart disease (CHD) derived from the CE-MARC study.

Design Cost-effectiveness analysis using a decision analytic model to compare eight strategies for the diagnosis of CHD.

Setting Secondary care out-patients (Cardiology Department).

Patients Patients referred to cardiologists for the further evaluation of symptoms thought to be angina pectoris.

Interventions Eight different strategies were considered, including different combinations of exercise treadmill testing (ETT), single-photon emission CT (SPECT), cardiovascular magnetic resonance (CMR) and coronary angiography (CA).

Main outcome measures Costs expressed as UK sterling in 2010–2011 prices and health outcomes in quality-adjusted life-years (QALYs). The time horizon was 50 years.

Results Based on the characteristics of patients in the CE-MARC study, only two strategies appear potentially cost-effective for diagnosis of CHD, both including CMR. The choice is between two strategies: one in which CMR follows a positive or inconclusive ETT, followed by CA if CMR is positive or inconclusive (Strategy 3 in the model); and the other where CMR is followed by CA if CMR is positive or inconclusive (Strategy 5 in the model). The more cost-effective of these two rests on the threshold cost per QALY gained below which health systems define an intervention as cost-effective. Strategy 3 appears cost-effective at the lower end of the threshold range used in the UK (£20 000 per QALY gained), while Strategy 5 appears cost-effective at the higher end of the threshold range (£30 000 per QALY). The results are robust to various sources of uncertainty although prior likelihood of CHD requiring revascularisation and the rate at which false negative patients are eventually appropriately identified do impact upon the results.

Conclusions The CE-MARC study showed that CMR had superior diagnostic accuracy to SPECT and concluded that CMR should be more widely used in the investigation of patients with CHD. The economic evaluation results show that using CMR is also a cost-effective strategy and supports the wider adoption of this modality.

INTRODUCTION

Coronary heart disease (CHD) is a leading cause of death and disability worldwide. In the UK, over 2 million people are living with CHD and, in 2007, it was estimated to account for over 94 000 deaths, of which over 31 000 were considered premature.¹

A variety of investigations may be used to diagnose CHD and identify patients who require coronary revascularisation; all these tests, however, have their limitations. Increasingly, non-invasive imaging has replaced exercise treadmill testing (ETT), with single-photon emission CT (SPECT) being the most commonly used test for myocardial ischaemia worldwide.² Cardiovascular magnetic resonance (CMR) imaging is increasingly used for the diagnosis of CHD as a result of its safety (no ionising radiation), high spatial resolution and ability to assess multiple aspects of CHD pathology in both the stable and unstable clinical settings.^{3–8}

The diagnosis of CHD has no direct health benefit in itself; instead, any improved accuracy in diagnosis should result in more appropriate treatment which can confer health benefits on patients. The optimal management of patients with CHD continues to be debated, but options include medical therapy, percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). Many patients with CHD, however, do not have significant coronary artery stenosis and so do not require revascularisation. In the absence of detectable ischaemia, current guidelines recommend risk factor modification and optimal medical therapy as first line therapy for angina symptom control.⁹

Establishing the best diagnostic strategy for patients with suspected CHD is central to providing appropriate therapeutic interventions. To inform this decision, Clinical evaluation of magnetic resonance imaging in coronary heart disease study (CE-MARC) was the largest prospective evaluation to date of the diagnostic accuracy of CMR compared with the reference standard of coronary angiography (CA) for patients referred to cardiologists for the further investigation of symptoms thought to be angina pectoris.¹⁰ ¹¹ All patients underwent ETT if physically able, and were scheduled for SPECT and CMR (in random order) followed by CA irrespective of clinical intention. This evaluation considers the cost-effectiveness of different diagnostic strategies for CHD based on the

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METHODS Overview

The aim of the analysis was to determine the cost-effectiveness of alternative diagnostic strategies derived from the CE-MARC study for patients referred to cardiologists with suspected angina. The methods employed are consistent with those detailed by the National Institute for Health and Clinical Excellence (NICE).¹² Costs falling on the NHS and Personal Social Services are considered and outcomes are measured in terms of quality-adjusted life-years (QALYs). The time horizon is 50 years and future costs and QALYs are discounted at 3.5% per annum. All costs are calculated in UK sterling in 2010-2011 prices. For the base case analysis, the case of a 60-year-old male with grade 2 symptoms on the Canadian Cardiovascular Society (CCS) angina grading scale¹³ and prior likelihood of significant stenosis requiring revascularisation of 39.5% is used; 15.9% of patients are considered to have CHD but not significant coronary artery stenosis (based on CE-MARC data).¹¹ It is assumed the patients are fit enough to undergo ETT. The choice of the base case characteristics are based on patients' characteristics from the CE-MARC study and clinical opinion. Alternative scenarios for age, gender, CCS grade, prior likelihood of disease and costs of the diagnostic tests are also considered.

Diagnostic pathways

The aim of diagnostic testing is to identify patients with significant coronary artery stenosis who require revascularisation (either PCI or CABG). It is assumed all patients who are suspected of having significant coronary stenosis must undergo a CA as a definitive test before revascularisation. As the CA is regarded as the 'gold standard' test (ie, it is assumed to have sensitivity and specificity of 100%), it is assumed that there can be no false positives, so no patients will receive an inappropriate revascularisation procedure. However, as most of the non-invasive diagnostic tests (ETT, SPECT and CMR) are not sufficiently accurate (ie, sensitivities and specificities below 100%), some patients with clinically significant stenosis requiring revascularisation will not progress across the diagnostic pathways to CA, as a consequence of a false negative (FN) test. Similarly, some patients without clinically significant stenosis will progress to CA, as a consequence of a false positive test, with its associated cost and morbidity/mortality risk. Patients incorrectly identified as not having significant stenosis will not receive an appropriate revascularisation procedure and, as a result, may experience less relief from their angina symptoms until their disease is subsequently correctly managed. It is assumed, however, that these 'false negative' cases in terms of selection for revascularisation will have their ischaemia treated by optimal medical therapy. Equally, there will be patients without clinically significant stenosis and hence who do not require revascularisation, but who do suffer from angina; these patients are assumed to receive risk factor modification and optimal medical management.

Identification strategies

Eight possible diagnostic strategies are derived from the CE-MARC study and compared in the analysis based upon consideration of how the tests are likely to be sequentially used in clinical practice:

- 1. CA only
- 2. ETT, followed by CA if ETT is positive or inconclusive

- 4. ETT, followed by SPECT if ETT is positive or inconclusive, followed by CA if the SPECT is positive or inconclusive
- 5. CMR, followed by CA if CMR is positive or inconclusive
- 6. SPECT, followed by CA if SPECT is positive or inconclusive
- 7. ETT, followed by CA if positive, or followed by CMR if ETT is inconclusive, followed by CA if CMR is positive or inconclusive
- 8. ETT, followed by CA if positive, or followed by SPECT if ETT is inconclusive, followed by CA if SPECT is positive or inconclusive.

Model structure

To conduct the economic evaluation a decision analytic model was developed. For the initial diagnosis a decision tree allocates patients to the appropriate diagnostic group. The prognostic implications of being in one of these groups are then quantified using three distinct Markov models. An example of the decision tree for Strategy 2 (ETT, followed by CA if ETT is positive or inconclusive) is shown in figure 1.

Patients with significant stenosis requiring revascularisation are allocated to one of three states as a result of the diagnostic strategy: true positive who are correctly identified and revascularised; FN who are misidentified and not revascularised; or dead as a result of the mortality risks associated with CA, PCI and CABG. Patients without significant stenosis can be separated into those with and without CHD, and allocated to the states true negative (TN) with angina, TN without angina and dead. The proportion of patients in each state is dependent upon the sensitivities and specificities of the various tests in a diagnostic strategy.

The prognostic Markov model is based on a previously published model for angina based on the EUROPA trial and captures future cardiovascular events and mortality.¹⁴ Submodels relate to patients with significant stenosis (see figure 2) and to patients without significant stenosis but with angina (see figure 3). For patients without significant stenosis or angina, a simple Markov model was developed incorporating only two states, alive and dead. Full descriptions of the models can be found in online supplementary appendix 1. Improved identification of patients with significant stenosis will result in more patients receiving appropriate revascularisation, and therefore receiving greater symptom relief and higher health related quality of life (HRQoL). The model allows for FN patients to be subsequently identified and revascularised.

Parameter estimates

Parameter estimates are derived from the CE-MARC study,¹⁰ ¹¹ the EUROPA study¹⁴ and from reviews of the published literature.^{15–17}

Patient characteristics, effectiveness and natural history data

In the base case, the prior likelihood of significant stenosis requiring revascularisation and the proportion of patients without a significant stenosis but with CHD (based on patients with between 10% and 69% coronary luminal stenosis) is taken from CE-MARC. An alternative scenario was considered where up to 20% of patients with significant stenosis would not be scheduled for revascularisation, for example, due to patient preference or comorbidity. Following a positive test, these patients were assumed to receive optimal medical therapy instead (based on CE-MARC data).



Figure 1 Structure of decision tree using Strategy 2 as an example. CA, coronary angiography; CABG, coronary artery bypass grafting; CHD, coronary heart disease; ETT, exercise treadmill testing; PCI, percutaneous coronary intervention.

The CE-MARC study also provides estimates of test accuracy.¹¹ To account for correlations between tests within diagnostic strategies, the sensitivities and specificities of tests are calculated conditional on positive/uncertain results in earlier tests in the strategy. The proportions of patients with severe stenosis suitable for PCI and CABG are based on estimates from UK practice.⁵⁻¹⁶ Mortality rates for the procedures are based on UK estimates.^{15 16} The parameter estimates for the diagnostic strategies are shown in table 1.

The risks of cardiovascular events for true positive, FN and TN patients with angina are based on the equations from a previously published model and patient covariates, which allow risk to be conditioned on factors such as age and gender.¹⁴ The equations also allow for the capture of increased risk following a non-fatal cardiovascular event. The non-cardiovascular mortality risk was derived from UK life tables.¹⁸

To capture the increased risk of cancer mortality as a result of ionising radiation from certain diagnostic tests and revascularisation procedures (CA, SPECT and PCI), evidence on radiation dose and the consequential lifetime risk of cancer mortality is incorporated into the model (for more details see online supplementary appendix 2).^{19–21}

No evidence was identified on the time it would take to correctly diagnose FN patients. Therefore, an exercise was







conducted with a sample of consultant cardiologists (n=9) to elicit estimates of the proportion of FN patients who would be expected to be correctly diagnosed within a year based on a patient's CCS grade (full details of the exercise can be found in online supplementary appendix 3).

For TN patients without angina, the risk of mortality from all causes was taken from UK life tables.¹⁸ The parameter estimates for the Markov models are shown in table 2.

Resource use and costs

Costs for the diagnostic tests and revascularisation procedures are taken from UK sources and based on 2010–2011 prices.^{22 23} However, costs may vary as there are presently no national tariffs for cardiac imaging. Therefore, a scenario analysis considers the cost differential between SPECT and CMR imaging. These costs are presented in table 1.

For patients with significant stenosis and those with angina but without significant stenosis, the costs of the following were included: general treatment, fatal and non-fatal cardiovascular events, and fatal non-cardiovascular events. These costs were derived from the EUROPA trial and inflated to 2010–2011 prices.¹⁴ ²⁴ No costs other than those of the initial diagnostic tests were considered for patients who did not have significant stenosis or angina. These costs are shown in table 2.

Health related quality of life

HRQoL is incorporated in terms of weights on a scale from 0 (death) to 1 (good health). Evidence was sought based on the EQ-5D instrument²⁵ which is the preferred measure of NICE.¹² Estimates are based on the combination of several sources and assumptions^{26–28} to give HRQoL weights by age, gender, initial CCS grade and treatment status (whether the patient had received a revascularisation procedure or medical management). It is assumed that HRQoL reductions for patients experiencing angina were a fixed proportion of the HRQoL of the general population by age; however, this assumption is tested in a scenario analysis using fixed absolute HRQoL decrement from angina symptoms. Full details of the sources and methods used are provided in online supplementary appendix 4.

Analysis

Standard decision rules are used to identify the most costeffective diagnostic strategy for CHD based on a given set of patient characteristics.²⁹ This involves ranking strategies in terms of their expected costs or effectiveness, removing strategies which are subject to dominance (less effective and more costly than one or more other strategies), then removing strategies subject to extended dominance (where a linear combination of other strategies dominates them). Incremental cost-effectiveness ratios (ICERs) are calculated for all remaining options: the additional cost per QALY gained of a strategy compared with the next most effective. To assess which option is potentially cost-effective, the range of cost-effectiveness thresholds used by NICE in the UK (£20 000–£30 000 per QALY) is used,¹² such that the most effective option with an ICER below the threshold is considered the cost-effective strategy.

To reflect the uncertainty in the evidence used in the model, input parameters are entered as probability distributions. Probabilistic sensitivity analysis is then used to calculate the mean costs and QALYs for each strategy and the probability that a strategy is cost-effective for a given cost-effectiveness threshold (in this case for $\pounds 20\ 000\ \text{per}\ \text{QALY}$ and $\pounds 30\ 000\ \text{per}\ \text{QALY}$).²⁹

A range of alternative scenarios is also considered in the model including varying CCS grade, gender, age, prior likelihood of CHD requiring revascularisation, the impact of ionising radiation on cancer, risk of cardiovascular events following revascularisation, HRQoL decrements and the cost of diagnostic tests.

RESULTS

Base case

Cost-effectiveness results for the base case and scenario analyses are presented in table 3 with dominated and extendedly dominated strategies excluded. In the base case (60-year-old male with suspected CCS grade 2 and a prior likelihood of significant stenosis of 39.5%), four of the diagnostic strategies are not dominated or extendedly dominated. The least costly and least effective of these strategies is Strategy 6, where patients are first tested with SPECT and those identified as positive or inconclusive then receive a CA to confirm the diagnosis. When the next

Parameter	Mean value (95% CI)	Source	Comments/distribution
Accuracy of diagnostic devices			
Primary analysis			
CA—sensitivity	1	Assumed	
CA—specificity	1	Assumed	
Probability ETT inconclusive given CHD	0.215686 (0.163 to 0.270)	CE-MARC ¹¹	Non-parametric bootstrap
Probability ETT inconclusive given no CHD	0.40694 (0.352 to 0.460)	CE-MARC ¹¹	Non-parametric bootstrap
ETT—sensitivity (inconclusive treated as positive)	0.9755 (0.953 to 0.995)	CE-MARC ¹¹	Non-parametric bootstrap
ETT—specificity (inconclusive treated as positive)	0.1924 (0.152 to 0.239)	CE-MARC ¹¹	Non-parametric bootstrap
ETT—sensitivity (excluding inconclusive)	0.9688 (0.941 to 0.994)	CE-MARC ¹¹	Non-parametric bootstrap
ETT—specificity (excluding inconclusive)	0.3245 (0.260 to 0.396)	CE-MARC ¹¹	Non-parametric bootstrap
CMR—sensitivity	0.8627 (0.821 to 0.903)	CE-MARC ¹¹	Non-parametric bootstrap
CMR—specificity	0.8312 (0.792 to 0.868)	CE-MARC ¹¹	Non-parametric bootstrap
CMR—sensitivity given ETT positive/uncertain	0.8643 (0.817 to 0.907)	CE-MARC ¹¹	Non-parametric bootstrap
CMR—specificity given ETT positive/uncertain	0.8633 (0.817 to 0.903)	CE-MARC ¹¹	Non-parametric bootstrap
SPECT—sensitivity (inconclusive treated as positive)	0.6784 (0.623 to 0.736)	CE-MARC ¹¹	Non-parametric bootstrap
SPECT—specificity (inconclusive treated as positive)	0.7980 (0.760 to 0.836)	CE-MARC ¹¹	Non-parametric bootstrap
SPECT—sensitivity given ETT positive/uncertain (inconclusive treated as positive)	0.6784 (0.613 to 0.743)	CE-MARC ¹¹	Non-parametric bootstrap
SPECT—specificity given ETT positive/uncertain (inconclusive treated as positive)	0.7969 (0.750 to 0.847)	CE-MARC ¹¹	Non-parametric bootstrap
Mortality rates			
CA mortality	0.0007	West 2006 ¹⁷	Fixed
PCI mortality	0.001281 (0.0009 to 0.0017)	BCIS ¹⁶	β-Distribution
CABG mortality	0.007914 (0.0066 to 0.0094)	SCS ¹⁵	β-Distribution
Procedure costs			
ETT cost—base case	£75	NHS reference costs ²²	Fixed value
CMR cost—base case	£313	NICE costing document ²³	Fixed value
SPECT cost—base case	£293	NICE costing document ²³	Fixed value
CA cost	£1052	NHS reference costs ²²	Fixed value
PCI cost	£2657	NHS reference costs ²²	Fixed value
CABG cost	£8635	NHS reference costs ²²	Fixed value
Other			
Proportion of patients with severe stenosis eligible for PCI	0.6276 (0.623 to 0.632)	BCIS and SCS ^{15 16}	β-Distribution
Proportion of patients with severe stenosis	0.3947 (0.360 to 0.434)	CE-MARC ¹¹	β-Distribution
Proportion of patients without severe stenosis but with angina	0.159	CE-MARC ¹¹	Fixed value

BCIS, British Cardiovascular Intervention Society; CA, coronary angiography; CABG, coronary artery bypass grafting; CHD, coronary heart disease; CMR, cardiovascular magnetic resonance; ETT, exercise treadmill testing; NHS, National Health Service; NICE, National Institute for Health and Clinical Excellence; PCI, percutaneous coronary intervention; SCS, The Society for Cardiothoracic Surgery in Great Britain & Ireland; SPECT, single-photon emission CT.

more effective strategy, Strategy 3 (ETT, followed by CMR if ETT is positive, followed by CA if CMR is positive or inconclusive), is compared with Strategy 6 an ICER of £7779 per QALY is generated. When the next more effective strategy, Strategy 5 (CMR followed by CA if CMR is positive or inconclusive), is compared with Strategy 3, an ICER of £26 858 per QALY is generated. When the most expensive strategy, Strategy 7 (ETT, followed by CA if positive, or followed by CMR if ETT is inconclusive, followed by CA if CMR is positive), is compared with Strategy 5, an ICER of £113 401 per QALY is generated.

Therefore, below the lower limit of cost-effectiveness threshold range of NICE (£20 000per QALY), Strategy 3 appears to be the cost-effective option. However, if the upper limit of the cost-effective threshold range of NICE is used (£30 000per QALY), Strategy 5 appears to be the cost-effective strategy. The probabilities of Strategy 3 and Strategy 5 being cost-effective at a cost-effectiveness threshold of £20 000 per QALY are 0.5534 and 0.4482. At a threshold of £30 000 per QALY, the probabilities are 0.4708 and 0.5082, respectively.

Scenario analyses

Alternative scenarios relating to gender, increasing the base case age to 70-years-old, assuming the cancer risk from ionising radiation is zero and altering the impact of revascularisation on the risk of subsequent cardiovascular events have minimal impact on the results (table 3). Reducing the base case age to 50-years-old, making HRQoL decrements absolute rather than relative or allowing for patients with significant stenosis, which is not scheduled for revascularisation, results in Strategy 3 appearing cost-effective at both threshold levels.

Increasing the severity of symptoms from CCS grade 2 to grade 4 results in Strategy 5 appearing to be the cost-effective strategy at the lower as well as the higher thresholds. Altering the prior likelihood of CHD requiring revascularisation does appear to have a marked impact on cost-effectiveness. Reducing the prior likelihood to 20% (compared with 39.5% in the base-case) led to Strategy 3 dominating all other strategies (ie, it has lower cost and higher outcomes). If the prior likelihood is increased to 80% then Strategy 2 (ETT followed by CA if ETT is positive or

Table 2 Parameters for Markov models

Parameter	Value (95% CI)	Source	Comments/ distribution
Transition probabilities			
Patients with CHD			
Probability of 1st cardiovascular event (TP)	Risk equation 1	EUROPA ¹⁴	Multivariate normal
Probability of 1st cardiovascular event (FN)	Risk equation 1	EUROPA ¹⁴	Multivariate normal
Probability cardiovascular event is fatal	Risk equation 2	EUROPA ¹⁴	Multivariate normal
Probability of another cardiovascular event within 12 months of previous event	Risk equation 3	EUROPA ¹⁴	Multivariate normal
Probability of another cardiovascular event at least 12 months postprevious event	Risk equation 4	EUROPA ¹⁴	Multivariate normal
Proportion of FN patients identified within 12 months with CCS grade 2 (base case)	0.5759 (0.436 to 0.704)	Expert clinical experts	β-Distribution
Proportion of FN patients identified within 12 months with CCS grade 4	0.7392 (0.626 to 0.829)	Expert clinical experts	β-Distribution
Probability of non-cardiovascular death	UK life tables	UK life tables ¹⁸	Fixed value
Patients without CHD			
Probability of death	UK life tables	UK life tables ¹⁸	Fixed value
Costs			
Patients with CHD			
Background costs per quarter (for base case patient)	£401	EUROPA ¹⁴ and PSSRU ²⁴	Multivariate normal
Additional background cost per quarter following previous non-fatal cardiovascular event	£251	EUROPA ¹⁴ and PSSRU ²⁴	Multivariate normal
Cost of non-fatal cardiovascular event	£12 001	EUROPA ¹⁴ and PSSRU ²⁴	Multivariate normal
Cost of fatal cardiovascular event	£3701	EUROPA ¹⁴ and PSSRU ²⁴	Multivariate normal
Cost of fatal non-cardiovascular event	£12 627	EUROPA ¹⁴ and PSSRU ²⁴	Multivariate normal

CCS, Canadian Cardiovascular Society; CHD, coronary heart disease; FN, false negative; TP, true positive.

inconclusive) is the cost-effective strategy with an ICER of £8034 per QALY, as well as being the most effective strategy.

Altering the reidentification rate of FN patients also impacted upon the cost-effective strategy. When the rate is halved, Strategy 5 is the cost-effective option at the lower threshold, while Strategy 7 is the cost-effective option at the higher threshold. However, when the rate of reidentification of FN is increased, Strategy 6 (SPECT followed by CA if SPECT is positive or inconclusive), the least costly and effective strategy, appeared cost-effective across the range of NICE threshold.

Given the lack of a national price tariff for the diagnostic tests, the cost increment of CMR compared with SPECT was varied to assess the impact on cost-effectiveness (in the base case the cost increment was £20). When the cost increment was reduced to £0, Strategy 5 appears cost-effective even at the lower threshold of £20 000 per QALY. However, when the cost increment is increased to £75, Strategy 5 no longer appears among the non-dominated strategies, with Strategy 3 appearing cost-effective at both threshold levels. When the cost increment is increased to £100, Strategy 6 appears to be the cost-effective option at the lower threshold, while Strategy 3 still appears to be the cost-effective option at the higher threshold.

DISCUSSION

Principal findings

Based on the characteristics of the patients recruited to, and the results of, the CE-MARC study and the other evidence and assumptions, two strategies appear cost-effective at UK NICE accepted cost-effectiveness thresholds. The choice between Strategy 3 (ETT, followed by CMR if ETT is positive or inconclusive, followed by CA if CMR is positive or inconclusive) and Strategy 5 (CMR followed by CA if CMR is positive or inconclusive) rests upon whether the lower or higher limit of the NICE cost-effectiveness threshold range is used. The results are robust under various alternative scenarios. The fact that both strategies contain CMR supports the results of the CE-MARC

study: that CMR's high diagnostic accuracy in CHD and superiority over SPECT indicates it should be more widely used in the investigation of CHD.¹¹

The secondary analysis considering the incremental cost of CMR to SPECT showed that CMR was likely to remain part of a cost-effective strategy as long as its incremental cost is not too large (a threshold analysis showed that the incremental cost needed to be less than £90 at a threshold of £20 000 per QALY, and less than £115 at the threshold of £30 000 per QALY). As it stands, no national tariff for cardiac imaging exists in the UK; the development of national reference costs for CMR, and cardiac imaging more generally, would be of great value in ensuring that incremental cost of CMR does not exceed this value so that CMR remains cost-effective.

Our results also demonstrated that the prior likelihood of CHD is an important determinant of which strategy is costeffective. There is little contemporary evidence to predict the prior likelihood of CHD on the basis of a patient's presenting characteristics. Recent guidelines from NICE refer to published data from the 1970s.^{1 30} Our results suggest that examining predictors of this prior likelihood would be a valuable area of further research. In principle, this could facilitate the appropriate stratification of patients on the basis of their prior likelihood, and this is likely to lead to an individualised choice of diagnostic strategies being cost-effective compared with using a single strategy for all patients.

Other studies

No other studies were identified which compared SPECT and CMR for identification of CHD using methods for the economic evaluation recommended by NICE, that is, which reported a cost per QALY outcome.¹² Dewey and Hamm³¹ found that CMR was not cost-effective for any pretest likelihood of CHD but this was based upon the use of cost per correct diagnosis, which is a limited outcome measure for economic evaluation. Other published studies and meta-analyses of the diagnostic accuracy of SPECT and

Table 3 Cost-effectiveness results

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UP in the late of C 4 MARCStratey G - SPECTCA118 240.21153864175780.0120.006Stratey G - MCKCA118 246.611538641758.80.4820.582Stratey G - MCKCA118 246.611538641758.80.4820.582Stratey G - MCKCA118 245.211538670.0270.0260.126Stratey G - SPECTCA116 52.212.005930.5060.4750.566Stratey G - SPECTCA118 65.1012.100512.063.30.0220.566Stratey G - SPECTCA118 65.1012.100512.063.30.0220.566Stratey G - SPECTCA118 65.1012.00510.518.60.0220.566Stratey G - SPECTCA118 74.312.405501.586.70.567.00.566Stratey G - SPECTCA119 134.512.405501.586.70.592.00.518Stratey G - SPECTCA119 134.512.4265301.586.70.592.00.518Stratey G - SPECTCA119 134.512.4265301.640.040.5720.598Stratey G - SPECTCA119 134.512.4265301.640.040.5720.598Stratey G - SPECTCA119 134.512.4265100.0190.019Stratey G - SPECTCA119 134.514.265910.1920.1920.108Stratey G - SPECTCA119 134.512.4265100.0160.0160.016Stratey G - SPECTCA119 240.512.4265100.0180.018Stratey G - SPECTCA119 240.5 <t< td=""><td>Base case</td><td></td><td></td><td></td><td></td><td></td></t<>	Base case					
strangy ==-PET-CA [18 241, 2 11 S3843 VT78, B1 0.032 0.006 Strangy 3=-CMR-CA [18 27, 46, 6] 1.53843 2778, B1 0.032 0.032 Strangy 3=-CMR-CA [18 360, 9] 1.539337 [13 401, 9] 0.002 0.019 Strangy 3=-FET-CA [18 63, 92, 9] 1.20939 0.02 0 0 Strangy 3=-CHCA [18 67, 92] 1.20939 0.02 0 0 Strangy 3=-CHCA [18 67, 10] 1.210039 0.012 0.012 0.308 Strangy 3=-CHCA [18 67, 10] 1.210101 [20 913, 9] 0.472 0.308 Strangy 3=-CHCA [18 10, 11, 124550 1.201570 0.012 0.308 0.318 Strangy 3=-CHCA [19 10, 11, 124550 1.201570 0.023 0.308 0.318 Strangy 3=-CHCA [19 10, 11, 124559 1.0400, 0.657 0.399 0.306 Strangy 3=-CHCA [19 10, 11, 24559 1.0400, 0.657 0.399 0.306 Strangy 3=-CHCA [19 10, 31, 12, 2456 0.039	60-year-old male with suspected CCS2	2, prior likelihood of di	sease based on CE-MARC			
Stratey 3—HTCAUR-CA[18 22.6611.5383327.780.53940.4420.502Stratey 3—MC-CA[18 26.6411.53937E1 3.01.090.4020.502Stratey 3—MC-CA[18 60.9411.53937E1 3.01.090.4020.502Stratey 3—MC-CA[18 60.7212.109579505.010.5160.446Stratey 3—MC-CA[18 65.1012.1010720.93.930.47520.504Stratey 3—MC-CA[18 15.2412.101671[11 3.67.390.1220.5045Stratey 3—TC-CARCA[18 15.2411.24052518.790.45720.506Stratey 3—TC-CARCA[18 15.2411.24052518.790.45720.506Stratey 3—TC-CARCA[18 18.7411.24052518.790.45720.506Stratey 3—TC-CARCA[18 18.7411.24052518.790.45720.506Stratey 3—TC-CARCA[19 18.7311.2405811.52450.5020.508Stratey 3—TC-CARCA[19 28.7114.2605711.52450.0040.577Stratey 3—TC-CARCA[19 28.7114.265711.641750.0040.577Stratey 3—TC-CARCA[19 13.5714.26570.01560.004Stratey 3—TC-CARCA[16 47.568.613470.378.10.5760.566Stratey 3—TC-CARCA[16 47.568.613470.378.10.5760.566Stratey 3—TC-CARCA[16 47.568.613470.378.10.5760.566Stratey 3—TC-CARCA[16 47.568.613470.378.10.5	Strategy 6—SPECT-CA	£18 241.22	11.533647		0.0132	0.0006
Stratey >CMR-CA Stratey >-EMP-CACMBCA112 8604 113 53937113 4010 113 539370.00260.0026Stratey S-SPECTCA Stratey S-SPECTCA118 6521 12 10020 12 101021210 013 	Strategy 3—ETT-CMR-CA	£18 278.46	11.538433	£7778.81	0.5334	0.4708
StrategyCH12 A00.09(113 30.09(113 40.09)(0.020(0.019)PR-pare old famale with suppertal CS2, prior likelihood of discuesU.2095930.0200.0400.446StrategyCHC4AAC(18 66 1.0)12.101031E350 1.00.0120.4456StrategyCHC4AAC(18 72.81)12.101031E30 91.380.47520.4555StrategyCHC4AAC(18 72.81)12.40532518.870.45720.4555StrategyCHC4AAC(18 18.4411.2455315.8670.45720.5666StrategyCHC4AAC(18 18.4411.2455815.8670.45720.5666StrategyCHC4AAC(18 18.4411.2455815.8670.45720.5666StrategyCHC4AAC(18 18.4311.2468915.667.600.55680.5188StrategyCHC4AC(19 28.5714.2669316.148.650.00400.038StrategyCHC4AC(19 28.5714.2669316.148.650.00400.037StrategyCHC4AC(19 19.87)14.2669316.148.650.00400.004StrategyCHC4AC(16 47.588.613472.2721530.44260.516StrategyCHC4ACAAC(16 47.588.613472.2721530.42620.516StrategyCHC4ACAAC(16 47.588.613472.2721530.42620.516StrategyCHC4ACAAC(16 47.588.613472.2721530.42620.516StrategyCHC4ACAAC(16 4	Strategy 5—CMR-CA	£18 284.66	11.538664	£26 858.45	0.4482	0.5082
Bidgep G=SPECT CARE18 657212.100839E350.000.01060.406Strategy S=CPT CARCAE18 657.0112.10081E20 912.980.475.20.9046Strategy S=CPT CACACIARE18 728.1512.10181E10 567.300.012.00.016Strategy S=CPT CACACIARE18 18.4311.246520.0260.00610.0061Strategy S=CPT CACCACIARE18 18.4311.246520.05680.0210.022Strategy S=CPT CACACIARE18 18.4311.24689E15 667.300.06610.038Strategy S=CPT CACCACIARE18 18.4311.246189E19 667.300.06610.0161Strategy S=CPT CACACIARE19 81.7311.246189E19 667.300.06620.018Strategy S=CPT CACACIARE19 92.85.7311.246189E19 647.700.1720.023Strategy S=CPT CACACIARE19 91.7914.26663E19 41.700.1720.588Strategy S=CPT CACACIARE19 41.838.69470.0740.0740.072Strategy S=CPT CACACIARE16 425.848.613947E23 721.500.40250.016Strategy S=CPT CACACIARE16 425.848.613947E23 721.500.40250.016Strategy S=CPT CACACIARE16 425.848.613947E23 721.500.40250.016Strategy S=CPT CACACIARE16 425.648.613947E23 721.500.40250.0060.016Strategy S=CPT CACACIARE16 425.648.613947E2	Strategy 7—ETT-CA/CMR-CA	£18 360.94	11.539337	£113 401.09	0.0026	0.0196
64) sprand tends with supperted CCS2, prior likelihood of disease based on CE-MARC 0.002 0.002 0.4466 Strategy S—EFT-CA E18 65/21 12.100879 E050.01 0.016 0.4496 Strategy S—EFT-CA E18 728.15 12.101611 E0 913.80 0.4752 0.0456 G6-yaarold male with supperted CCS4, prior likelihood of disease based on CE-MARC Strategy S—SPECT-CA E18 183.46 11.246552 0.0562 0.0562 0.3566 Strategy S—SPECT-CA E18 183.74 11.246552 10.358.75 0.3568 0.358 Strategy S—SPECT-CA E18 183.74 11.246559 E15 657.60 0.566 0.568 Strategy S—SPECT-CA E19 82.73 14.26593 E10 440.0 0.377 0.3372 Strategy S—SPECT-CA E19 42.73 14.26593 E10 415.66 0.004 0.037 Strategy S—SPECT-CA E19 412.73 14.26593 E10 415.56 0.0016 0.0018 Strategy S—CMARCA E19 412.73 14.26593 E10 415.56 0.0016 0.012 Strategy S—CMARCA E16 447.58 8.640415	Scenario analyses					
StrateySPECT-CA E18 6529 12.100839 63500 0.5106 0.4106 Stratey 3CMR-CA E18 661.01 12.100121 £0.913.86 0.4752 0.5046 60-par-oid male with suppected CCA, prior likelihood of discue based or (E-MARC 5 0.0052 0.0016 0.0016 Stratey 3ETC-CACR E18 18.4.3 11.246552 566.760 0.5668 0.5118 Stratey 3ETC-CACR E19 18.9.3 11.246518 E59 17.02 0.3670 0.5688 Stratey 3ETC-CACR E19 18.9.3 11.246188 E59 10.3.2 0.022 0.232 Stratey 3ETC-CACRE E19 328.251 1.426693 E10 440.04 0.637 0.5988 Stratey 3ETC-CACRE E19 33.251 1.426693 E16 445.66 0.004 0.098 Stratey 3ETC-CACRE E19 413.97 1.426693 E16 445.66 0.004 0.018 Stratey 3ETC-CACRE E19 413.91 1.426693 E16 445.66 0.004 0.029 Stratey 3ETC-CACRE E16 440.36 8.68647 1237.215 0.426 0.51 </td <td>60-year-old female with suspected CC</td> <td>S2, prior likelihood of</td> <td>disease based on CE-MA</td> <td>RC</td> <td></td> <td></td>	60-year-old female with suspected CC	S2, prior likelihood of	disease based on CE-MA	RC		
Stategy 3—ETCARCA E18 65/21 12.10021 E050.01 0.5106 0.4465 Strategy 5—CRCA E18 661.01 12.101021 E013 360 0.472 0.0456 Geyeraldmane with suspected CCS, prior likelihood of disave hards on CE-MARC 0.0062 0.001 3.516 Strategy 5—DFET-CAC E18 183.46 11.240580 E18 6.70 0.506 0.518 Strategy 7—ETCARCAC E18 183.73 11.240580 E18 6.70 0.506 0.518 Strategy 7—ETCARCAC E18 183.73 11.240589 E15 6.67.00 0.009 0.0038 Strategy 5—CRCAC E19 325.10 14.260593 E10 4997.17 0.1712 0.372 Strategy 5—CRCAC E19 325.10 14.260593 E10 4155.66 0.0014 0.033 Strategy 5—CRCAC E16 440.38 8.68107 E732.88 0.5326 0.4456 Strategy 5—CRCAC E16 455.86 6.0014 0.024 0.024 Strategy 5—CRCAC E16 455.86 6.0014 0.014 0.024 Strategy 5—CRCAC E16 455.86 6.01046	Strategy 6—SPECT-CA	£18 639.29	12.095929		0.002	0
Stratey 5—CMR CA E18 60.01 12.101021 E20 913.98 0.4752 0.5648 66 yaves old male with suppected CSA, price Wileblood of disease based on CE-MARC 0.0067 0.0067 0.0366 67 yaves old male with suppected CSA, price Wileblood of disease based on CE-MARC 5188.79 0.572 0.3666 51 stratey 3—CTI-CAC(MR-CA E18 18.91.4 11.24689 E15 667.60 0.5068 0.5188 50 stratey 3—CTI-CAC(MR-CA E19 28.03 11.248188 E59 10.32.0 0.023 0.0337 51 stratey 3—CTI-CAC(MR-CA E19 28.03 14.26693 0.0038 0.0038 51 stratey 3—CTI-CAC(MR-CA E19 28.03 14.26693 E16 485.66 0.0004 0.0038 51 stratey 3—CTI-CAC(MR-CA E19 49.79 14.26693 E16 485.66 0.0004 0.0098 70 yave-old male with suppected CS2, prior Wileblood of disease do CK-MARC E16 480.56 8.600471 E137250 44.266 0.0156 0.0018 51 stratey 3—CTI-CAC (MR-CA E16 480.56 8.600471 E137250 44.266 0.0166 0.0156 51 stratey 3—CTI-CAC (MR-CA E16	Strategy 3—ETT-CMR-CA	£18 657.21	12.100839	£3650.01	0.5106	0.4496
Strategy 7—ETT-CACKINCA [13 [13 617.98 0.0122 0.0456 Gryseroid make with suppect CCS, prior likelihood of disesse hased on CE-MARC 0.0052 0.0051 Strategy 5—ETT-CMM-CA [13 13.445530 E5 (87.07) 0.4572 0.3606 Strategy 5—MM-CA [13 13.445530 E5 (87.07) 0.052 0.152 Strategy 5—MM-CA [13 12.44138 E5 (91.03.2) 0.0232 0.152 Strategy 5—MM-CA [13 253.33 11.246593 E1 (40.0 0.039 0.0038 Strategy 5—TT-CMM-CA [13 253.35 11.2466933 E1 (41.05.66 0.004 0.039 Strategy 5—CMR [15 243.35 14.266933 E1 (41.05.66 0.004 0.039 Strategy 5—CMR [15 40.33 8.61307 [23 23.725 0.0165 0.0198 Strategy 5—CMR [16 40.53 8.61307 [23 23.725 0.0426 0.518 Strategy 5—TCMR [16 45.83 8.61307 [23 23	Strategy 5—CMR-CA	£18 661.01	12.101021	£20 913.98	0.4752	0.5048
F6P-year-old male with suppected CS2, prior likelihood of disease based on CE-MARC 0.0508 0.001 Stratey 3—ETT-CMR-CA E18 183.4 11.246550 E188.79 0.4572 0.3606 Stratey 3—ETT-CMR-CA E18 189.74 11.246580 E15 667.60 0.5068 0.5118 Stratey 7—ETT-CA/CMR-CA E19 28.73 11.246830 E39 103.22 0.023 0.033 Stratey 7—ETT-CA/CMR-CA E19 28.73 14.26693 E10 440.04 0.637 0.5382 Stratey 7—ETT-CA/CMR-CA E19 19.79 14.266693 E164 185.66 0.0004 0.003 Stratey 7—ETT-CA/CMR-CA E19 419.79 14.266673 E164 185.66 0.0015 0.0015 Stratey 7—ETT-CA/CMR-CA E16 440.38 8.60477 E23 721.50 0.426 0.51 Stratey 7—ETT-CA/CMR-CA E16 480.58 8.61305 F18.816.16 0.0074 0.028 Stratey 7—ETT-CA/CMR-CA E16 480.58 8.613126 F28 141.61 0.0074 0.026 Stratey 7—ETT-CA/CMR-CA E16 480.58 8.613126 F28 141.61 0.0074 0.026 </td <td>Strategy 7—ETT-CA/CMR-CA</td> <td>£18 728.15</td> <td>12.101611</td> <td>£113 667.98</td> <td>0.0122</td> <td>0.0456</td>	Strategy 7—ETT-CA/CMR-CA	£18 728.15	12.101611	£113 667.98	0.0122	0.0456
Stratey 5—SPECT-CA F18 13.46 11.246550 F18 0.47 0.0062 0.001 Stratey 5—CMR-CA F18 18/3.4 11.246859 F15 667.60 0.5068 0.5118 Stratey 5—CMR-CA F18 18/3.5 11.248138 E59 103.32 0.0292 0.1262 Stratey 5—CMR-CA F19 28.73 14.26593 E10 440.04 0.637 0.5588 Stratey 5—CMR-CA F19 32.51 14.26593 E10 440.04 0.637 0.5588 Stratey 5—CMR-CA F19 33.35 14.266170 E49 667.17 0.3172 0.3872 Stratey 5—CMR-CA F19 419.31 14.266893 E61 44185.66 0.004 0.098 Stratey 5—CMR-CA F16 440.38 8.69137 F23 271.50 0.4426 0.518 Stratey 5—CMR-CA F16 485.8 8.61337 F23 721.50 0.4426 0.518 Stratey 5—CMR-CA F16 583.84 8.614315 F23 721.50 0.4426 0.518 Stratey 5—FCT-CAC F26 598.39 11.272855 E322.96 0.1066 0.0016 Stratey 5—FCT-CAC </td <td>60-year-old male with suspected CCS4</td> <td>4, prior likelihood of di</td> <td>sease based on CE-MARC</td> <td></td> <td></td> <td></td>	60-year-old male with suspected CCS4	4, prior likelihood of di	sease based on CE-MARC			
Stratey 3—ETT-CMR-CA E18 18/4.3 11.246550 E518.79 0.4572 0.3066 Stratey 7—ETT-CACMR-CA E18 263.53 11.248138 E59 103.32 0.0292 0.1262 50-year-old male with suspected CC2, prior likelihood of disease based on CE-MARC E19 28.73 14.265993 E10 440.04 0.637 0.9988 Stratey 3—ETT-CMR-CA E19 28.73 14.266993 E164 185.66 0.0004 0.0098 70-year-old male with suspected CC2, prior likelihood of disease based on CE-MARC E164 185.66 0.0014 0.0018 Stratey 3—ETT-CMR-CA E16 440.58 8.613066 E782.28 0.532.28 0.4436 Stratey 3—ETT-CMR-CA E16 440.54 8.613045 £782.88 0.532.28 0.4426 Stratey 3—ETT-CMR-CA E16 455.68 8.613045 £782.88 0.532.80 0.042 60-year-old male with suspected CC2, prior likelihood of disease of 00% Etratey 3—ETT-CMR-CA E16 452.68 1.820481 0.067 0.042 60-year-old male with suspected CC2, prior likelihood of disease of 80% Etratey 3—ETT-CMR-CA E465.93 1.820481 0.099 0.0016	Strategy 6—SPECT-CA	£18 153.46	11.240582		0.0062	0.001
Stratery S—CMR-CA E18 18/74 11.246889 E15 667.60 0.5068 0.118 Stratery S—STL-CA/CMR-CA E19 263.51 11.24188 E59 103.32 0.0292 0.0238 Stratery S—STL-CA/CMR-CA E19 268.73 14.260393 E10 440.04 0.637 0.038 Stratery S—STL-CM/CA E19 333.55 14.260170 E49 967.17 0.3172 0.3372 Stratery S—STL-CM/CAR E19 333.55 14.260170 E49 967.17 0.3172 0.3372 Stratery S—STL-CM/CAR E19 440.38 8.064174 0.0156 0.0018 Stratery S—STL-CM/CAR E16 47.58 8.613947 E23 271.50 0.4426 0.51 Stratery S—CTL-CA/CMR-CA E16 47.58 8.613947 E23 271.50 0.4426 0.51 Stratery S—STL-CM/CAR E16 585.84 8.614315 E78 81.61 0.0074 0.0418 Stratery S—STL-CM/CAR E16 585.84 8.614315 E78 81.61 0.0074 0.0016 Stratery S—STL-CM/CAR E16 585.84 8.613347 E32 230 0.0426 0.0016	Strategy 3—ETT-CMR-CA	£18 184.43	11.246550	£5188.79	0.4572	0.3606
Strategy 7—ETT-CAURACA £18 263.53 11.248138 £99 103.22 0.0292 0.0292 Synaer.off maker with suspect CCS, prof rikelihood of disease based on CE-MARC 0.039 0.0038 Strategy 7—ETT-CMCA £19 268.73 14.265931 £10 440.04 0.637 0.5988 Strategy 7—CTT-CAURACA £19 137.9 14.266693 £16 4185.56 0.0004 0.008 D'ayaer.off maker with suspect CCS, prof rikelihood of disease based on CE-MARC £16 440.38 £608474 0.0156 0.0018 Strategy 7—ETT-CAURACA £16 440.38 £608474 2.0155 0.0074 0.4458 Strategy 7—CTT-CAURACA £16 462.54 & 6.613076 £7332.88 0.5328 0.4456 Strategy 7—ETT-CAURACA £16 462.54 & 6.613076 £7832.88 0.5328 0.4458 Strategy 7—ETT-CAURACA £16 462.54 & 6.61307 £7832.88 0.5328 0.4456 G-ayaer.off maker with suspect CCS2, prof rikelihood of disease of 20% 578788 0.0076 0.0016 Strategy 6—STTC-CA £27 476.61 12.42717 £872.30 0.0476 0.0016 Strategy 6—STTC-CA £27 476.61 11.242177	Strategy 5—CMR-CA	£18 189.74	11.246889	£15 667.60	0.5068	0.5118
50-year-old male with suspected CCS2, prior likelihood of disease 0.039 0.039 0.039 Strategy S—CMR-CA E19 325.10 14 265993 E10 440.04 0.637 0.5988 Strategy S—CMR-CA E19 333.95 14 266793 E10 440.04 0.637 0.5988 70-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC 0.0156 0.0018 Strategy S—CMR-CA E16 440.24 8.60304 F7832.88 0.5328 0.4458 Strategy S—TET-CA/LMR-CA E16 440.254 8.613307 E23 721.50 0.4426 0.014 Strategy S—TET-CA/LMR-CA E16 482.54 8.613317 E73 284.61 0.0074 0.042 60-year-old male with suspected CCS2, prior likelihood of disease of 60% 5 5 5 0.009 0.016 Strategy S—TET-CA/LMR-CA E27 476.66 11.247217 E827.23 0.9476 0.009 Strategy C—TET-CA/LMR-CA E27 476.66 11.247217 E827.23 0.9476 0.0016 Strategy C—SPECT-CA E23 303.01 10.944551 0 0 0 <t< td=""><td>Strategy 7—ETT-CA/CMR-CA</td><td>£18 263.53</td><td>11.248138</td><td>£59 103.32</td><td>0.0292</td><td>0.1262</td></t<>	Strategy 7—ETT-CA/CMR-CA	£18 263.53	11.248138	£59 103.32	0.0292	0.1262
Strategy S=-ETF-CA £19 28.7.3 1.4260593 £10 440.04 0.637 0.098 Strategy S=-ETF-CA/R-CA £19 333.95 1.4266170 £49 967.17 0.3172 0.3872 Strategy T=ETF-CA/RR-CA £19 419.79 1.4266693 £164 185.66 0.0004 0.098 Oryaer-oft make with suspected CS2, profit Mellhood of disease based on CE-MARC 1.5372.88 0.5328 0.0018 Strategy S=-ETF-CMR-CA £16 407.58 8.613347 £23 271.50 0.4426 0.51 Strategy S=-ETF-CMR-CA £16 558.84 8.614315 £78 841.61 0.007 0.0426 Oryaer-oft make with suspected CS2, prote likelihood of disease of 20% 5 11.820481 Dominant 0.96 0.0016 Strategy T=-ETF-CA/RR-CA £27 333.93 11.237285 0.009 0.0016 0 Strategy T=-ETF-CA/RR-CA £27 357.40 11.247317 £817.823 0.9476 0.98966 Strategy T=-ETF-CA/RR-CA £27 357.40 11.247317 £817.823 0.9476 0.98956 Strategy T=-ETF-CA/RR-CA £27 557.40 11.247217 £8222	50-year-old male with suspected CCS2	2, prior likelihood of di	sease based on CE-MARC	2		
Strategy S—ETT-CMR-CA £19 325.10 14.265993 £10 440.04 0.637 0.5988 Strategy T—ETT-CMR-CA £19 419.79 14.266693 £164 185.66 0.0004 0.0098 70-year-old male with suspected CS2, prior likelihood of disease based on CE-MARC 0.0156 0.0018 Strategy S—SPET-CA £16 407.58 8.61306 £783.28 0.5328 0.4426 0.515 Strategy S—CIR-CA £16 407.58 8.613047 £23 721.50 0.4426 0.515 Strategy S—CIR-CA £16 4402.54 8.613347 £23 721.50 0.4426 0.515 Strategy S—ETT-CARCA £16 482.54 8.61315 £784.16 0.0074 0.422 60-year-old male with suspected CS2, prior likelihood of disease of 60% 5 5 0.096 0.0016 Strategy S—ETT-CARCA £27 393.89 1.237285 0.009 0.0016 Strategy S—ETT-CAR CA £27 393.89 1.23728 0.9466 0.0016 Strategy S—ETT-CAR CA £27 393.89 1.237217 £887.23 0.9476 0.0016 Strategy S—ETT-CAR CA	Strategy 6—SPECT-CA	£19 268.73	14.260593		0.039	0.0038
Strategy 7—ETT-CA/CMR-CA £19 333.95 14.266170 £49 96.717 0.3172 0.3872 Strategy 7—ETT-CA/CMR-CA £19 419.79 14.266693 £164 185.66 0.0004 0.0098 70-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC 0.156 0.0118 Strategy 3—ETT-CMR-CA £16 440.38 8.608474 £23 721.50 0.4426 0.51 Strategy 3—ETT-CMR-CA £16 553.8.8 8.613347 £23 721.50 0.4426 0.51 O-year-old male with suspected CCS2, prior likelihood of disease of 20% USA 0.009 0.0016 Strategy 3—ETT-CMR-CA £27 393.89 11.237285 0.009 0.0016 Strategy 6—SPECT-CA £27 393.89 11.237285 0.109 0 Strategy 7—ETT-CA/CMR-CA £27 393.89 11.237285 0.9476 0.9886 Strategy 6—SPECT-CA £27 393.89 11.237285 0.1049 0 0 Strategy 7—ETT-CA/CMR-CA £27 393.70 11.247217 £887.23 0.9476 0.9386 Strategy 7—ETT-CA/CMR-CA £27 37.40 11.247217	Strategy 3—ETT-CMR-CA	£19 325.10	14.265993	£10 440.04	0.637	0.5988
Strategy A CPT-CACMR-CA E19 419:79 14.266033 E164 185.66 0.0004 0.0098 70-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC 6.154 76.58 8.61306 F783 28.8 0.528 0.4426 0.015 Strategy 5 CARR-CA E16 492.58 8.61315 F78 841.61 0.0074 0.042 60-year-old male with suspected CCS2, prior likelihood of disease of 20% T 578 841.61 0.009 0.0016 0.0016 50-year-old male with suspected CCS2, prior likelihood of disease of 60% T 0.009 0.0016 0.0016 50-year-old male with suspected CCS2, prior likelihood of disease of 80% T 878/82.23 0.9476 0.9856 50-year-old male with suspected CCS2, prior likelihood of disease of 80% T 0 0 0 51 51 1.927 357.40 1.926 303.1 10.944361 0 0.0016 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer U 0.0124 0.0028 51 51 53.59 10.959506 £303.42 0.1020 0.0124	Strategy 5—CMR-CA	£19 333.95	14.266170	£49 967.17	0.3172	0.3872
To-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, or Canadian and the suspected CCS2 prior likelihood of disease of 20%. 0.0156 0.0166 Strategy 3—ETT-CMR-CA E16 482.54 8.613947 £721.50 0.4426 0.512 Go-year-old male with suspected CCS2, prior likelihood of disease of 20%. 0.0074 0.0074 0.0042 Go-year-old male with suspected CCS2, prior likelihood of disease of 60%. 0.0016 0.0016 0.0016 Strategy 3—ETT-CMR-CA E27 393.89 11.237285 0.009 0.0016 Strategy 3—ETT-CACRECA E27 461.91 11.245557 £822.296 0.0016 0.0016 Strategy 4—ETT-CACRECA E27 787.40 11.247217 £878.23 0.9476 0.0016 Strategy 5—SPECT-CA E27 393.81 11.247217 £878.23 0.9476 0.0016 Strategy 5—SPECT-CA E27 537.40 11.247217 £878.23 0.9476 0.0016 Strategy 5—SPECT-CA E36 330.31 10.944361 0 0 0 Strategy 5—SPECT-CA E36 357.00 10.95520 £224.74 0.1012 0.0008 Strategy 5—SPECT-CA E18 20.970 11.52087 T7813	Strategy 7—ETT-CA/CMR-CA	£19 419.79	14.266693	£164 185.66	0.0004	0.0098
Strategy 3—ETF-CA E16 440.38 8.60847 0.0156 0.0018 Strategy 3—ETT-CMR-CA E16 476.58 8.61336 F7832.88 0.5328 0.4426 Strategy 5—CMR-CA E16 482.54 8.61337 F23 721.50 0.4426 0.51 Gotyear-old male with suspected CCS2, prior likelihood of disease F23 721.80 0.0074 0.9646 Strategy 5—FPET-CA E73 738.9 11.820481 Dominant 0.96 0.9646 Strategy 6—FPET-CA E27 393.89 11.227275 f8222.96 0.0166 0.0016 Strategy 6—FPET-CA E27 373.0 11.247317 f887.23 0.9476 0.9956 Strategy 6—SPET-CA E27 373.0 11.247317 f887.23 0.9476 0.9556 Strategy 6—SPET-CA E27 373.0 10.944361 0.124 0.0008 0.9518 Strategy 6—SPET-CA E36 33.59 10.959560 £204.74 0.0124 0.0008 Strategy 6—SPET-CA E36 38.59 10.959560 £204.74 0.0124 0.0008 Strategy 6—SPET-CA E18 20.71	70-year-old male with suspected CCS2	2, prior likelihood of di	sease based on CE-MARC			
Strategy 3—CTR-CA E16 476.58 8.61394 £783 2.83 0.5328 0.4458 Strategy 7—CTR-CA E16 582.4 8.613347 £73 21.50 0.0074 0.042 60-year-old male with suspected CCS2, prior likelihood of disease of 20% 578 841.61 0.0074 0.042 60-year-old male with suspected CCS2, prior likelihood of disease of 60% 578 841.61 0.0016 0.0016 Strategy 7—ETT-CARCM E27 461.91 11.245557 f.822.296 0.0016 0.0016 Strategy 7—ETT-CARC E27 461.91 11.247217 f.887 8.23 0.9476 0.98956 Strategy 7—ETT-CARCM E27 461.91 11.247217 f.887 8.23 0.9476 0.0016 Strategy 7—ETT-CARCM E27 53.740 11.247217 f.887 8.23 0.9476 0.98956 Strategy 7—ETT-CARCM E36 35.700 10.956250 f.2244.74 0.0122 0.0008 Strategy 8—ETT-CASPECT-CA E36 35.700 10.956250 f.2244.74 0.0124 0.0008 Strategy 6—SPECT-CA E18 20.971 11.528218 0.0124 0.0026 Strategy 6—SPECT-CA E18 20.971 11.528278 f.781 3.29 0.	Strategy 6—SPECT-CA	£16 440.38	8.608474		0.0156	0.0018
Strategy 5—CMR-CA E16 482.54 8.61331 £27 27.150 0.4426 0.074 0.042 Strategy 7—ETT-CA/CMR-CA £16 558.84 8.614315 £70 841.61 0.074 0.074 60 year-old male with suspected CS2, prior likelihood of disease of 20% 5 5 0.096 0.0966 60 year-old male with suspected CS2, prior likelihood of disease of 60% 0.0074 0.0016 0.0016 Strategy 6—ETT-CA/SPECT-CA £27 393.9 11.247357 £8222.96 0.0166 0.0016 Strategy 7—ETT-CA/SPECT-CA £27 475.60 11.247317 £8178.23 0.9476 0.98956 Strategy 6—SPECT-CA £27 475.60 11.247317 £8178.23 0.9476 0.98956 Strategy 6—SPECT-CA £36 330.31 10.944361 0 0 0 Strategy 2—ETT-CA £36 337.01 10.944361 0 0 0 Strategy 6—SPECT-CA £36 337.01 10.944361 0 0 0 Strategy 3—ETT-CA/SPECT-CA £36 337.01 10.944361 0 0 0 Strategy	Strategy 3—ETT-CMR-CA	£16 476.58	8.613096	£7832.88	0.5328	0.4458
Strategy 7—ETT-CAVCMR-CA E16 558.84 8.614315 F78 841.61 0.0074 0.042 60-year-old male with suspected CCS. prior likelihood of disease of 0 0.016 0.966 60-year-old male with suspected CCS. prior likelihood of disease of 0.009 0.0016 60-year-old male with suspected CCS. prior likelihood of disease of 0.006 0.0016 Strategy 6—SPECT-CA £27 476.66 11.247217 £8878.23 0.9476 0.9856 Strategy 6—SPECT-CA £27 476.66 11.247317 £8878.23 0.9476 0.9856 Obyear-old male with suspected CCS. £27 476.66 11.247317 £8878.23 0.9476 0.9856 Strategy 6—SPECT-CA £26 353.03 10.944361 0 0 0.95578 Strategy 6—SPECT-CA £36 353.70 10.955550 £204.74 0.0124 0.0008 Strategy 6—SPECT-CA £18 30.90 11.532281 0.0124 0.0026 0.95518 Strategy 6—SPECT-CA £18 316.01 11.53228 £25 557.83 0.4644 0.5256 Strategy 6—SPECT-CA £18 316.01 11.53229 £11 643.25 0.0046	Strategy 5—CMR-CA	£16 482.54	8.613347	£23 721.50	0.4426	0.51
60-year-old male with suspected CCS2, prior likelihood of disease 60% 0.96 0.966 60-year-old male with suspected CCS2, prior likelihood of disease 60% 0.009 0.0016 Strategy 6—SPECT-CA E27 393.89 11.237285 0.009 0.0016 Strategy 8—ETT-CMSPECT-CA E27 461.91 11.245557 f.8222.96 0.0166 0.0016 Strategy 7—ETT-CA E27 537.40 11.247317 f.611.88.29 0 0 60-year-old male with suspected CCS2, prior likelihood of disease 80% 0 0 Strategy 6—SPECT-CA E36 335.01 10.944361 0 0 0 Strategy 6—SPECT-CA E36 335.01 10.955250 f.2244.74 0.10122 0.0008 Strategy 5—SPECT-CA E36 335.01 10.955250 f.2244.74 0.1124 0.0008 Strategy 5—SPECT-CA E36 335.01 11.53221 f.7813.29 0.519 0.4526 Strategy 5—SPECT-CA E18 309.97 11.53287 f.7813.29 0.519 0.4526 Strategy 5—CMR-CA E18 309.97 11.532917 f.7813.29 0.6046 0.0024 Strategy 5—CMR-CA	Strategy 7—ETT-CA/CMR-CA	£16 558.84	8.614315	£78 841.61	0.0074	0.042
Strategy 3—ETT-CMR-CA 69463.05 11.820481 Dominant 0.96 0.966 60-year-old male with suspected CCS2, prior likelihood of disease 600 0.0016 0.0016 Strategy 6—SPECT-CA E27 393.89 11.237285 0.0166 0.0016 Strategy 7—ETT-CA/CMR-CA E27 476.66 11.247217 E8872.23 0.9476 0.9856 Strategy 7—ETT-CA/CMR-CA E27 37.40 11.247317 E817 82.23 0.9476 0.9008 60-year-old male with suspected CCS2, prior likelihood of disease 5800 E2244.74 0.012 0.0008 Strategy 6—SPECT-CA E36 383.51 10.959560 £034.32 0.906 0.9008 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer V V 0.0124 0.0008 5trategy 5—CTA-CA E18 316.01 11.53323 £25 557.83 0.4644 0.5256 5trategy 5—CTA-CA E18 316.01 11.53324 £21 37.60 0.499 0.3374 5trategy 5—CTA-CA E18 216.40 11.55510 0.4046 0.5256 0.0004 0.0004<	60-year-old male with suspected CCS2	2, prior likelihood of di	sease of 20%			
60-year-old male with suspected CCS2, prior likelihood of disease of 60% Strategy 8ETT-CA £27 393.89 11.237285 0.009 0.0166 Strategy 8ETT-CA £27 476.66 11.247217 £8878.23 0.9476 0.9856 Strategy 7ETT-CA/CMR-CA £27 476.66 11.247217 £8878.23 0.9476 0.9856 60-year-old male with suspected CCS2, prior likelihood of disease of 80% 5 5 5 0 0 50-year-old male with suspected CCS2, prior likelihood of disease of 80% 5 0 0 0 5trategy 6-SPECT-CA £36 330.31 10.944361 0.0122 0.0008 5trategy 6-SPECT-CA £18 309.37 11.532987 £7813.29 0.519 0.4526 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer 5 5 5 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer 5 5 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer 5 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, ne vascularisation	Strategy 3—ETT-CMR-CA	£9463.05	11.820481	Dominant	0.96	0.9646
Strategy 6—SPECT-CA £27 393.89 11.237285 0.009 0.0016 Strategy 8—ETT-CA/SPECT-CA £27 461.91 11.245557 £8222.96 0.0166 0.0016 Strategy 7—ETT-CA/CMR-CA £27 466.66 11.247317 £8878.23 0.9476 0.9856 60-year-old male with suspected CCS2, prior likelihood of disease of 80% 0 0 60-year-old male with suspected CCS2, prior likelihood of disease of 80% 0.0122 0.0008 Strategy 7—ETT-CA £36 330.31 10.95625 £2244.74 0.0122 0.0008 Strategy 7—ETT-CA £16 383.59 10.959560 £8034.32 0.906 0.9518 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer 0.0124 0.0028 Strategy 3—ETT-CMR-CA £18 316.01 11.533223 £25 57.83 0.4644 0.5256 Strategy 7—ETT-CA/CMR-CA £18 392.91 11.533912 £110 833.85 0.0008 0.0021 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revacularistion based on the EUROPA study 5.574 0.0046 0.0024 <tr< td=""><td>60-year-old male with suspected CCS2</td><td>2, prior likelihood of di</td><td>sease of 60%</td><td></td><td></td><td></td></tr<>	60-year-old male with suspected CCS2	2, prior likelihood of di	sease of 60%			
Strategy 8—ETT-CA/SPECT-CA E27 461.91 11.245557 E8222.96 0.0166 0.0916 Strategy 7—ETT-CA/CMR-CA E27 476.66 11.247217 F8878.23 0.9476 0.9956 60-year-old male with suspected CCS2, prior likelihood of disease F8078.23 0.9476 0 60-year-old male with suspected CCS2, prior likelihood of disease F8078.23 0.9016 0.0008 Strategy 6—SPECT-CA E36 330.31 10.944361 0 0 0 Strategy 7—ETT-CA E36 383.59 10.959506 E204.74 0.0122 0.0008 Strategy 6—SPECT-CA E18 27.71 11.528218 0.0124 0.0008 Strategy 5—CMR-CA E18 30.97 11.53297 F7813.29 0.519 0.4526 Strategy 5—CMR-CA E18 30.97 11.53297 F7813.29 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revascularisation bernet bused on the EUROPA study 0.526 Strategy 5—CMR-CA E18 216.40 11.53012 E10 633.85 0.0006 0.0004 Strategy 5—CMR-CA E18 216.40 </td <td>Strategy 6—SPECT-CA</td> <td>£27 393.89</td> <td>11.237285</td> <td></td> <td>0.009</td> <td>0.0016</td>	Strategy 6—SPECT-CA	£27 393.89	11.237285		0.009	0.0016
Strategy 7—ETT-CA/CMR-CA £27 476.66 11.247217 £8878.23 0.9476 0.9856 Strategy 2—ETT-CA £27 537.40 11.247317 fc11 188.29 0 0 60-year-old male with suspected CCS2, prior likelihood of disease fc11 188.29 0 0 0 Strategy 6—SPECT-CA £36 330.31 10.94361 0 0.0122 0.0008 Strategy 3—ETT-CA £36 335.90 10.959500 £803.43.20 0.906 0.0208 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no carcer 5 0.0124 0.0008 Strategy 5—SPECT-CA £18 202.71 11.528218 0.0124 0.0008 Strategy 5—CMR-CA £18 309.97 11.53223 £25 557.83 0.4644 0.5256 Strategy 5—CMR-CA £18 392.39 11.53322 £10 833.59 0.0008 0.0020 GO-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revascularisation set on the EUROPA study 5.255 0.4644 0.5256 Strategy 5—CMR-CA £18 216.40 11.555109 0.0046 0.0020	Strategy 8—ETT-CA/SPECT-CA	£27 461.91	11.245557	£8222.96	0.0166	0.0016
Strategy 2—ETT-CA £27 537.40 11.247317 £611 188.29 0 0 60-year-old male with suspected CCS2, prior likelihood of disease 60 0 0 Strategy 6—SFECT-CA £36 330.31 10.944361 0.0122 0.0008 Strategy 2—ETT-CA/SFECT-CA £36 385.59 10.956250 £224.74 0.0124 0.0008 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer 0.0008 0.0008 Strategy 6—SFECT-CA £18 20.71 11.528218 0.0124 0.0208 Strategy 5—CMR-CA £18 309.97 11.532923 £25 557.83 0.4644 0.5256 Strategy 5—CMR-CA £18 309.91 11.533212 £110 833.85 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revascularisation benetisc based on the EUROPA study 0.519 0.3024 Strategy 6—SPECT-CA £18 216.61 11.560534 £20 134.76 0.489 0.4044 Strategy 5—CMR-CA £18 213.61 11.560534 £20 134.76 0.489 0.517 Strategy 5—CMR-CA £18 213.01 11.560534 £20 134.76 0.489 0.527	Strategy 7—ETT-CA/CMR-CA	£27 476.66	11.247217	£8878.23	0.9476	0.9856
60-year-old male with suspected CCS2, prior likelihood of disease of 80% 0 0 Strategy 6—SPECT-CA £36 330.31 10.944361 0 0 Strategy 6—SPECT-CA £36 337.00 10.956250 £2244.74 0.0122 0.0008 Strategy 2—ETT-CA £36 337.59 10.959560 £8034.32 0.906 0.9518 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no carcer 0.0124 0.0008 Strategy 3—ETT-CMR-CA £18 316.01 11.532987 £7813.29 0.519 0.4526 Strategy 3—ETT-CA/CMR-CA £18 316.01 11.533212 £10 833.85 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revascularisation berretts based on the EUROPA study 0.5374 Strategy 6—SPECT-CA £18 216.40 11.555109 0.0066 0.0472 Strategy 5—CMR-CA £18 23.82 11.56136 £30 29.10 0.0066 0.5374 Strategy 7—ETT-CA/CMR-CA £18 23.51 11.56034 £20 134.76 0.499 0.517 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, basolute EQ-SD 0.0132 0.0016	Strategy 2—ETT-CA	£27 537.40	11.247317	£611 188.29	0	0
Strategy 6—SPECT-CA £36 330.31 10.944361 0 0 0 Strategy 8—ETT-CA/SPECT-CA £36 387.00 10.956250 £2244.74 0.0122 0.006 0.058 Got-year-old male with suspected CCS2, prior likelihood of disese beed on CE-MARC, no cance 0.0124 0.0008 Strategy 6—SPECT-CA £18 309.97 11.532987 £7813.29 0.519 0.4526 Strategy 5—CMR-CA £18 309.97 11.533912 £10 833.85 0.0008 0.0008 Strategy 5—CMR-CA £18 309.97 11.533912 £10 833.85 0.0008 0.002 Got-year-old male with suspected CCS2, prior likelihood of diseuse based on CE-MARC, revascularisation be-true based on the EUROPA study 0.0004 0.0004 Strategy 7—ETT-CA/CMR-CA £18 216.01 11.555109 0.0046 0.0004 Strategy 3—ETT-CMR-CA £18 251.61 11.560534 £20 134.76 0.4899 0.5374 Strategy 3—ETT-CMR-CA £18 213.01 11.560534 £20 134.76 0.499 0.5374 Strategy 5—CMR-CA £18 213.01 11.560534 £20 134.76 0.499 0.527 Strategy 5—SPECT-CA £18 213.01 11.561396	60-year-old male with suspected CCS2	2, prior likelihood of di	sease of 80%			
Strategy 8—ETT-CA/SPECT-CA £36 357.00 10.956250 £2244.74 0.0122 0.0008 Strategy 2—ETT-CA £36 333.9 10.959560 £8034.32 0.006 0.9518 60-year-old male with suspected CCS2, prior likelihood of disesse based on CE-MARC, no carcer 0.0124 0.0008 Strategy 6—SPECT-CA £18 309.97 11.522918 0.0124 0.0008 Strategy 5—CMR-CA £18 316.01 11.532937 £7813.29 0.519 0.4526 Strategy 7—ETT-CA/CMR-CA £18 392.39 11.532917 £10 833.85 0.0008 0.2020 60-year-old male with suspected CCS2, prior likelihood of disesse based on CE-MARC revescularisation betwerse subsed on the EUROPA studt 0.0004 Strategy 7—ETT-CA/CMR-CA £18 21.61 11.560259 £578.65 0.489 0.4142 Strategy 5—CMR-CA £18 21.61 11.560254 £20 134.76 0.499 0.5374 Strategy 5—CMR-CA £18 21.61 11.560254 £83 829.10 0.0066 0.0047 Strategy 5—CMR-CA £18 21.31 11.54120 £60 40.392 0.512 0.012 0.012 <	Strategy 6—SPECT-CA	£36 330.31	10.944361		0	0
Strategy 2—ETT-CA £6 3 83.59 10.959560 £8034.32 0.906 0.9518 60-year-old male with suspected CCS2, pror likelihood of disease based on CE-MARC, recurred 0.0124 0.008 Strategy 6—SPECT-CA £18 30.97 11.53228 £7813.29 0.519 0.4526 Strategy 5—CMR-CA £18 30.97 11.53223 £25 557.83 0.4644 0.5256 Strategy 7—ETT-CA/CMR-CA £18 392.39 11.533912 £110 833.85 0.0008 0.0020 60-year-old male with suspected CCS2, pror likelihood of disease based on CE-MARC, revascularistation revascu	Strategy 8—ETT-CA/SPECT-CA	£36 357.00	10.956250	£2244.74	0.0122	0.0008
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer 0.0124 0.0008 Strategy 3—ETT-CMR-CA E18 309.97 11.528218 0.1724 0.4526 Strategy 3—ETT-CMR-CA E18 309.97 11.532287 £7813.29 0.4644 0.5256 Strategy 5—CMR-CA E18 316.01 11.533223 £25 557.83 0.4644 0.2020 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revacularisation benefits based on the EUROPA stuty 0.0004 0.0004 Strategy 6—SPECT-CA E18 246.26 11.560269 £5788.65 0.489 0.4142 Strategy 3—ETT-CMR-CA E18 251.61 11.560534 £20 134.76 0.499 0.5374 Strategy 7—ETT-CA/CMR-CA E18 251.61 11.560534 £20 134.76 0.499 0.0016 Strategy 7—ETT-CA/CMR-CA E18 251.61 11.560534 £20 134.76 0.499 0.374 Strategy 7—ETT-CA/CMR-CA E18 251.31 11.561396 £83 829.10 0.0066 0.0016 Strategy 7—ETT-CMR-CA E18 251.31 11.541305 £34 029.55 0.395 0.52 Strategy 5—CMR-CA E18 257.60 11.541305 <td>Strategy 2—ETT-CA</td> <td>£36 383.59</td> <td>10.959560</td> <td>£8034.32</td> <td>0.906</td> <td>0.9518</td>	Strategy 2—ETT-CA	£36 383.59	10.959560	£8034.32	0.906	0.9518
Strategy 6—SPECT-CA £18 272.71 11.528218 0.0124 0.0008 Strategy 3—ETT-CMR-CA £18 309.97 11.532287 £7813.29 0.519 0.4526 Strategy 5—CMR-CA £18 316.01 11.533223 £25 557.83 0.4644 0.5256 Govear-old male with suspected CCS2, prior likelihood of isezese based on CE-MARC, revascularisation be=tris based on the EUROPA situation 0.0004 0.0004 Strategy 6—SPECT-CA £18 216.40 11.555109 0.0046 0.0004 Strategy 3—ETT-CMR-CA £18 26.26 11.56059 £578.65 0.489 0.4142 Strategy 7—ETT-CA/CMR-CA £18 251.61 11.560534 £20 134.76 0.499 0.5374 Go-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, absolute EQ-5D decr== 0.0132 0.0016 Strategy 3—ETT-CA/CMR-CA £18 213.1 11.541120 £7654.60 0.5882 0.526 Govear-old male with suspected CCS2, prior likelihood of lisease based on CE-MARC, reidentification rate = 0.0012 0.0028 0.526 Strategy 3—ETT-CA/CMR-CA £18 213.9 11.54120 £7654.60 0.5882 0.526 Strategy 5—CMR-CA £18 325.1 11.5	60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, no cancer					
Strategy 3—ETT-CMR-CA f18 309.97 11.532987 f7813.29 0.519 0.4526 Strategy 5—CMR-CA f18 316.01 11.533223 f25 57.83 0.4644 0.5256 Strategy 7—ETT-CA/CMR-CA f18 392.39 11.533912 f110 833.85 0.0008 0.0202 60-year-old male with suspected CCS2, pror likelihood of disexe based on CE-MARC, revascularisation berts based on the EUROPA study 0.0004 Strategy 6—SPECT-CA f18 216.40 11.555109 0.0046 0.0004 Strategy 5—CMR-CA f18 246.26 11.560534 f20 134.76 0.489 0.5374 Strategy 7—ETT-CA/CMR-CA f18 233.82 11.561396 f83 829.10 0.0066 0.0072 60-year-old male with suspected CCS2, pror likelihood of disexer based on CE-MARC, base as a strategy 6—SPECT-CA f18 21.31 11.561396 f83 829.10 0.0066 0.0016 Strategy 6—SPECT-CA f18 21.31 11.561396 f83 829.10 0.0026 0.0016 Strategy 3—ETT-CMR-CA f18 21.31 11.51302 f7654.60 0.582 0.52 Strategy 5—CMR-CA f18 257.60 11.541305 f34 029.55 0.395 0.456 St	Strategy 6—SPECT-CA	£18 272.71	11.528218		0.0124	0.0008
Strategy 5—CMR-CA £18 316.01 11.533223 £25 57.83 0.4644 0.5256 Strategy 7—ETT-CA/CMR-CA £18 392.39 11.533912 £110 833.85 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revacularisation betwerts based on the EUROPA study 0.0046 0.0004 Strategy 6—SPECT-CA £18 216.40 11.555109 0.489 0.4142 Strategy 3—ETT-CMR-CA £18 246.26 11.560269 £788.65 0.499 0.5374 Strategy 7—ETT-CA/CMR-CA £18 23.82 11.561396 £3 829.10 0.0066 0.0047 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, absolve EV-SD exterment £18 21.31 11.561396 £3 829.10 0.0066 0.0016 Strategy 6—SPECT-CA £18 21.39 11.5120 £7654.60 0.582 0.0016 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.0022 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strat	Strategy 3—ETT-CMR-CA	£18 309.97	11.532987	£7813.29	0.519	0.4526
Strategy 7—ETT-CA/CMR-CA £18 392.39 11.533912 £110 833.85 0.0008 0.0202 60-year-old male with suspected CCS2, prior likelihood of diseaue based on CE-MARC, revascularisation bertis based on the EUROPA study 0.004 0.0004 Strategy 6—SPECT-CA £18 216.40 11.555109 0.0046 0.0040 Strategy 3—ETT-CMR-CA £18 246.26 11.560269 £5788.65 0.489 0.4142 Strategy 5—CMR-CA £18 251.61 11.560534 £20 134.76 0.499 0.5374 Strategy 7—ETT-CA/CMR-CA £18 32.82 11.561396 £83 829.10 0.0066 0.0472 60-year-old male with suspected CCS2, prior likelihood of diseaue based on CE-MARC, absolute EQ-5D decrement 0.0132 0.0016 Strategy 6—SPECT-CA £18 21.39 11.54120 £7654.60 0.5882 0.52 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strategy 7—ETT-CA/CMR-CA £18 33.451 11.541980 £113 840.17 0.0028 0.0222 60-year-old male with suspected CCS2, prior likelihood of diseaue based on CE-MARC, reidentification rate ruce by 50% 0.001 0.0022 Strategy 6—SPECT-CA £18 33.451	Strategy 5—CMR-CA	£18 316.01	11.533223	£25 557.83	0.4644	0.5256
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Strategy 6—SPECT-CA £18 216.40 11.555109 0.0046 0.0004 Strategy 3—ETT-CMR-CA £18 246.26 11.560269 £5788.65 0.489 0.4142 Strategy 5—CMR-CA £18 251.61 11.560534 £20 134.76 0.499 0.5374 Strategy 7—ETT-CA/CMR-CA £18 323.82 11.561396 £83 829.10 0.0066 0.0472 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, absolute EQ-5D decrement 0.0016 0.0016 Strategy 6—SPECT-CA £18 21.31 11.541120 £7654.60 0.5882 0.52 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strategy 7—ETT-CA/CMR-CA £18 334.51 11.541980 £113 840.17 0.0028 0.022 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate: were diseased by the suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate: were diseased by the suspect disease based on CE-MARC, reidentification rate: were diseased by the suspect disease diseased by the suspect disease	60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, revascularisation benefits based on the EUROPA study					
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Strategy 5—CMR-CA £18 251.61 11.560534 £20 134.76 0.499 0.5374 Strategy 7—ETT-CA/CMR-CA £18 323.82 11.561396 £83 829.10 0.0066 0.0472 60-year-old male with suspected CCS2, prior likelihood of disexe based on CE-MARC, absolute EQ-5D decrement 0.01132 0.0016 Strategy 6—SPECT-CA £18 251.31 11.541120 £7654.60 0.5882 0.52 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strategy 7—ETT-CA/CMR-CA £18 334.51 11.541980 £113 840.17 0.0028 0.0222 60-year-old male with suspected CCS2, prior likelihood of disexe based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of CE-MARC, reidentification rate with suspected CCS2, prior likelihood of LS 200 0.0016 0.0022 60-year-old male with suspected CCS2, prior likelihood of LS 200 11.519688 0.001 0.0002 Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 5—CMR-CA £18 28.70 11.535112 £24 335.95 0.2902 0.604<	Strategy 3—ETT-CMR-CA	£18 246.26	11.560269	£5788.65	0.489	0.4142
Strategy 7—ETT-CA/CMR-CA £18 323.82 11.561396 £83 829.10 0.0066 0.0472 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, absolute EQ-5D december 0.0132 0.0016 Strategy 6—SPECT-CA £18 213.99 11.536243 0.0132 0.0016 Strategy 3—ETT-CMR-CA £18 257.60 11.541120 £7654.60 0.5882 0.52 Strategy 5—CMR-CA £18 334.51 11.541980 £113 840.17 0.0028 0.0222 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with cuspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with cuspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with cuspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate with cuspect disease d	Strategy 5—CMR-CA	£18 251.61	11.560534	£20 134.76	0.499	0.5374
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Strategy 6—SPECT-CA £18 213.99 11.536243 0.0132 0.0016 Strategy 3—ETT-CMR-CA £18 251.31 11.541120 £7654.60 0.5882 0.52 Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strategy 7—ETT-CA/CMR-CA £18 334.51 11.541980 £113 840.17 0.0028 0.0222 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate reident by 50% 0.0002 0.0002 Strategy 6—SPECT-CA £18 122.30 11.519688 0.001 0.0002 Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 28.70 11.535112 £24 335.95 0.2902 0.604	60-year-old male with suspected CCS2	2, prior likelihood of di	sease based on CE-MARC	, absolute EQ-5D de	ecrement	
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Strategy 5—CMR-CA £18 257.60 11.541305 £34 029.55 0.395 0.456 Strategy 7—ETT-CA/CMR-CA £18 334.51 11.541980 £113 840.17 0.0028 0.0222 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate educed by 50% 0.001 0.0002 Strategy 6—SPECT-CA £18 122.30 11.519688 0.001 0.0002 Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 28.70 11.535112 £24 335.95 0.2902 0.604	Strategy 3—ETT-CMR-CA	£18 251.31	11.541120	£7654.60	0.5882	0.52
Strategy 7—ETT-CA/CMR-CA £18 334.51 11.541980 £113 840.17 0.0028 0.0222 60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate reduced by 50% 0.001 0.0002 Strategy 6—SPECT-CA £18 122.30 11.519688 0.001 0.0002 Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 28.70 11.535112 £24 335.95 0.2902 0.604	Strategy 5—CMR-CA	£18 257.60	11.541305	£34 029.55	0.395	0.456
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate reduced by 50% Strategy 6—SPECT-CA £18 122.30 11.519688 0.001 0.0002 Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 283.70 11.535112 £24 335.95 0.2902 0.604	Strategy 7—ETT-CA/CMR-CA	£18 334.51	11.541980	£113 840.17	0.0028	0.0222
Strategy 6—SPECT-CA £18 122.30 11.519688 0.001 0.0002 Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 283.70 11.535112 £24 335.95 0.2902 0.604	60-year-old male with suspected CCS2	2, prior likelihood of di	sease based on CE-MARC	, reidentification rat	te reduced by 50%	
Strategy 3—ETT-CMR-CA £18 185.04 11.530546 £5778.22 0.245 0.1068 Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 283.70 11.535112 £24 335.95 0.2902 0.604	Strategy 6—SPECT-CA	£18 122.30	11.519688		0.001	0.0002
Strategy 5—CMR-CA £18 193.98 11.531425 £10 164.82 0.4634 0.289 Strategy 7—ETT-CA/CMR-CA £18 283.70 11.535112 £24 335.95 0.2902 0.604	Strategy 3—ETT-CMR-CA	£18 185.04	11.530546	£5778.22	0.245	0.1068
Strategy 7—ETT-CA/CMR-CA £18 283.70 11.535112 £24 335.95 0.2902 0.604	Strategy 5—CMR-CA	£18 193.98	11.531425	£10 164.82	0.4634	0.289
	Strategy 7—ETT-CA/CMR-CA	£18 283.70	11.535112	£24 335.95	0.2902	0.604

Table 3 Continued

Strategy	Expected costs	Expected QALYs	ICER	Probability cost-effective at £20 000 per QALY	Probability cost-effective at £30 000 per QALY
Strategy 2—ETT-CA	£18 407.24	11.535246	£922 885.87	0	0
60-year-old male with suspected CCS2,	60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, reidentification rate increased by 50%				
Strategy 6—SPECT-CA	£18 209.45	11.541417		0.1512	0.0366
Strategy 4—ETT-SPECT-CA	£18 221.04	11.541438	£558 877.72	0.0226	0.0062
Strategy 3—ETT-CMR-CA	£18 236.15	11.543805	£6382.18	0.5892	0.6964
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, £0 cost increment of CMR compared with SPECT					
Strategy 6—SPECT-CA	£18 233.24	11.538210		0.0034	0
Strategy 3—ETT-CMR-CA	£18 252.93	11.543031	£4084.38	0.4432	0.3964
Strategy 5—CMR-CA	£18 256.36	11.543263	£14 767.81	0.5522	0.594
Strategy 7—ETT-CA/CMR-CA	£18 346.28	11.543933	£134 122.19	0.001	0.0096
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, £50 cost increment of CMR compared with SPECT					
Strategy 6—SPECT-CA	£18 220.92	11.534299		0.1196	0.0122
Strategy 3—ETT-CMR-CA	£18 284.77	11.539085	£13 341.26	0.556	0.5314
Strategy 5—CMR-CA	£18 294.70	11.539318	£42 421.27	0.2906	0.3858
Strategy 7—ETT-CA/CMR-CA	£18 350.65	11.539985	£83 991.25	0.0136	0.0644
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, £75 cost increment of CMR compared with SPECT					
Strategy 6—SPECT-CA	£18 204.59	11.534179		0.309	0.052
Strategy 3—ETT-CMR-CA	£18 290.04	11.538979	£17 801.45	0.4222	0.5128
Strategy 7—ETT-CA/CMR-CA	£18 342.53	11.539887	£57 789.58	0.029	0.129
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, £100 cost increment of CMR compared with SPECT					
Strategy 6—SPECT-CA	£18 267.50	11.532462		0.5154	0.1302
Strategy 3—ETT-CMR-CA	£18 375.08	11.537255	£22 441.83	0.1926	0.3788
Strategy 7—ETT-CA/CMR-CA	£18 413.91	11.538184	£41 832.10	0.0234	0.176
60-year-old male with suspected CCS2, prior likelihood of disease based on CE-MARC, 20% of TP patients do not undergo revascularisation					
Strategy 6—SPECT-CA	£17 917.91	11.45855		0.0212	0.0014
Strategy 3—ETT-CMR-CA	£17 947.35	11.46251	£7440.79	0.5554	0.5222
Strategy 5—CMR-CA	£17 952.48	11.46264	£39 398.46	0.4196	0.473
Strategy 7—ETT-CA/CMR-CA	£18 024.81	11.46289	£290 686.98	0	0.003

CA, coronary angiography; CCS, Canadian Cardiovascular Society; CMR, cardiovascular magnetic resonance; ETT, exercise treadmill testing; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; SPECT, single-photon emission CT.

CMR have shown comparable results. For example, the sensitivity of CMR in CE-MARC was similar to that in a recent CMR meta-analysis³² (86% vs 89%) and to a prospective study of women (84%).³³ Previous studies of SPECT have shown a wide range in sensitivity (63%–93%) and specificity (10%–90%) compared with x-ray angiography.^{34–36} This may be due to the fact that published SPECT data are heterogeneous for population, radioisotope tracer, mode of stress and protocol; notably, before CE-MARC, SPECT had never been tested prospectively against CA in such large numbers and in an unselected patient population of this kind.

Strengths and limitations

This study provides the first assessment of the cost-effectiveness of various strategies containing SPECT and CMR for the diagnosis of CHD which meet UK guidelines for cost-effectiveness analyses.³¹ The CE-MARC study is the largest prospective evaluation of CMR to date and allowed for robust estimates of diagnostic accuracy for the different tests, resulting in high internal validity for the analysis. Access to data from the CE-MARC study also allowed for correlation in diagnostic accuracies along strategies, removing the need for assumptions about independence in diagnostic accuracy between tests. The use of one diagnostic study which allows the estimation of correlations may be preferable to a synthesis of summary data from multiple studies, particularly given that the methods for meta-analysis of diagnostic accuracy are not well established or validated.³⁷

A possible weakness of the analysis is the exclusion of other technologies not included in the CE-MARC study which may prove to be constituents of a cost-effective diagnostic strategy. For example, CT coronary angiography (CTCA) is becoming more widely available for the diagnosis of CHD.^{1 38} However, as there is a paucity of CTCA data in unselected patient populations and which are comparable with the CE-MARC study, and also a dearth of methods for the synthesis of diagnostic data, we did not want to compromise the high internal validity of the CE-MARC study by including data on diagnostic accuracy from other modalities not included in CE-MARC. Further to this, the use of CTCA in a population with medium to high pretest likelihood of CHD, such as that in CE-MARC, is not currently recommended in UK NICE guidelines (CG95), in part due to the issue of potential high false positive rates in those with coronary artery calcification.¹

This study has not explicitly considered patients who were unfit to undergo ETT. In the CE-MARC study, around 20% of patients were unfit for ETT. However, as no difference was observed in the sensitivities of subsequent tests between the fit and unfit populations, the use of CE-MARC data for all patients for the accuracy of SPECT and CMR will not impact upon the results. In those patients unfit for ETT, only those strategies excluding ETT should be considered.

This analysis has only considered mortality as a result of cancers caused by radiation and not the morbidity or costs associated with such cancers, which may bias the results in favour of those strategies which result in patients receiving a greater radiation dose. However, this effect is likely to be negligible given the low risk of radiation induced cancer. This focus in the modelling on mortality risks rather than morbidity impacts is also true for other tests considered but, again, the impact on costeffectiveness results is likely to be minimal.

Another possible limitation is that the model assumes that all diagnostic strategies take the same time from start to finish. However, this may not be the case, as more tests are likely to increase the length of the strategy and, therefore, the time until the patient receives the benefits of revascularisation.

The study is focused on the costs and effects of alternative diagnostic tests in a UK NHS context. The focus on a single healthcare system is an inevitable feature of all economic evaluations given that much evidence is country specific, particularly costs. The extent to which this analysis generalises to other settings needs careful consideration. However, the developed model can be readily adapted to assess the cost-effectiveness in other jurisdictions.

CONCLUSIONS

The results from this economic evaluation suggest that CMR should be considered as part of a diagnostic strategy for the identification of patients with CHD suitable for revascularisation. The exact strategy will depend on the cost-effectiveness threshold used as well as several other factors, most notably the prior likelihood of CHD in the population. However, between the thresholds of $\pounds 20\ 000\ and\ \pounds 30\ 000\ per\ QALY$ (lower and upper limits considered cost-effective by NICE), CMR forms part of the optimum investigation strategy for the investigation of patients with CHD.

Contributors All authors contributed to the interpretation of the data and to several drafts of the paper. SW, FG, CM and MS developed the model used to evaluate the diagnostic strategies. JPG, SGB and SP provided advice throughout the model development process. JPG planned the CE-MARC study, led the clinical trial, analysed the data and interpreted the results. SGB, SP and JN planned the study, analysed the data and interpreted the results.

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