Resource impact report: 
Recent-onset chest pain of suspected cardiac origin: assessment and diagnosis (CG95)

Published: November 2016
Summary

This report looks at the resource impact of implementing NICE’s updated guideline on chest pain of recent onset in England. The updated guideline includes new recommendations on which diagnostic tests adults with stable chest pain should be offered following an assessment of the type of chest pain and other risk factors.

This report focuses on the new recommendations that we consider to have the greatest resource impact nationally, and therefore need the most additional resources to implement or that can potentially generate the biggest savings. They are:

Offer 64-slice (or above) CT coronary angiography if:

- clinical assessment (see recommendation 1.3.3.1) indicates typical or atypical angina, or
- clinical assessment indicates non-anginal chest pain but 12-lead resting ECG has been done and indicates ST-T changes or Q waves. [recommendation 1.3.4.3, new 2016]

Offer non-invasive functional imaging (see section 1.3.6) for myocardial ischaemia if 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance or is non-diagnostic. [recommendation 1.3.5.1, 2016]

Offer invasive coronary angiography as a third-line investigation when the results of non-invasive functional imaging are inconclusive. [recommendation 1.3.5.2, 2016]

The estimated annual saving of implementing this guideline for the population of England based on the resource impact assumptions is shown in table 1.
### Table 1 Estimated annual saving of implementing the recommendations

<table>
<thead>
<tr>
<th></th>
<th>2016/17 (£000)</th>
<th>2017/18 (£000)</th>
<th>2018/19 (£000)</th>
<th>2019/20 (£000)</th>
<th>2020/21 (£000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savings</td>
<td>-1,132</td>
<td>-6,790</td>
<td>-10,184</td>
<td>-13,579</td>
<td>-16,974</td>
</tr>
</tbody>
</table>

Implementing NICE’s guideline may result in the following benefits and savings:

- more effective use of NHS resources
- improved prognosis for adults with chest pain because of prompt and accurate diagnosis
- more appropriate diagnostic investigations and reduced adverse events.

Implementing the guideline may result in the following additional costs:

- Increasing the number of CT coronary angiography scans performed may have resource implications because of the availability of suitable scanners and appropriately trained professionals. Any associated resource impact should be considered locally.

Stakeholder comments suggested that limited availability of suitable CT scanners and appropriately trained professionals may affect the speed of implementation.

The resource impact template for this guideline helps organisations in England, Wales and Northern Ireland to change variables and estimate the impact locally. A sample calculation using this template showed that additional savings of £31,500 are possible for a population of 100,000 from year 5 onwards.

Services for people with chest pain of recent onset are commissioned by clinical commissioning groups. Providers are NHS hospital trusts, primary care services and ambulance services.
1 Introduction

1.1 The guideline offers best practice advice on chest pain of recent onset.

1.2 This report discusses the resource impact of implementing the new recommendations from the updated guideline on chest pain of recent onset in England. It aims to help organisations plan for the financial implications of implementing this NICE guideline.

1.3 The updated guideline includes new recommendations on which diagnostic tests adults with stable chest pain should be offered following an assessment of the type of chest pain and other risk factors.

1.4 A resource impact template accompanies this report to help with assessing the resource impact at a local level in England, Wales or Northern Ireland.

1.5 Services for people with chest pain of recent onset are commissioned by clinical commissioning groups. Providers are NHS hospital trusts, primary care services and ambulance services.

2 Background

2.1 Chest pain is a symptom of coronary artery disease (CAD). It occurs when blood supply to heart muscles is restricted as a result of atherosclerosis in surrounding blood vessels. This type of chest pain, known as angina, can affect function and physical ability, as well as quality of life. If left untreated, it can lead to myocardial infarction (heart attack), which can be life threatening. In the UK, mortality from CAD accounts for 12.9% of all-cause mortality; the
prevalence of angina in England is 2.9% (British Heart Foundation, 2014).

2.2 The NICE guideline on chest pain of recent onset was checked in 2014 and new evidence was identified on the use of non-invasive tests to diagnose CAD in people with stable (non-acute) chest pain. New evidence was also identified on clinical prediction models that may lead to improved estimation of the pre-test likelihood of CAD.

2.3 This report focuses on the resource implications of the new recommendations in the guideline, which are expected to lead to a significant resource impact. The changes to the guideline recommendations are summarised in table 2.

Table 2 Summary of changes to the recommendations in the guideline on chest pain of recent onset (CG95)

<table>
<thead>
<tr>
<th>Recommendation in 2010 guideline</th>
<th>Change in the updated (2016) guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>If people have features of typical angina based on clinical assessment and their estimated likelihood of CAD is greater than 90%, further diagnostic investigation is unnecessary. Manage as angina. (1.3.3.5)</td>
<td>This recommendation has been deleted because diagnostic testing is no longer dependent on an estimation of likelihood of CAD for people assessed as having typical or atypical angina chest pain.</td>
</tr>
<tr>
<td>If the estimated likelihood of CAD is less than 10%, first consider causes of chest pain other than angina caused by CAD. (1.3.3.7)</td>
<td>This recommendation has been deleted because estimation of likelihood of CAD is no longer part of the guideline.</td>
</tr>
</tbody>
</table>
| In people without confirmed CAD, in whom stable angina cannot be diagnosed or excluded based on clinical assessment alone, estimate the likelihood of CAD. Take the clinical assessment and the resting 12-lead ECG into account when making the estimate. Arrange further diagnostic testing as follows:  
  - If the estimated likelihood of CAD is 61–90%, offer invasive coronary angiography as the first-line diagnostic investigation if appropriate (see recommendations 1.3.4.4 and 1.3.4.5).  
  - If the estimated likelihood of CAD is 30–60%, offer functional Replaced by: Offer 64-slice (or above) CT coronary angiography if:  
    - clinical assessment (see recommendation 1.3.3.1) indicates typical or atypical angina, or  
    - clinical assessment indicates non-anginal chest pain but 12-lead resting ECG has been done and indicates ST-T changes or Q waves. (1.3.4.3) |
imaging as the first-line diagnostic investigation (see recommendation 1.3.4.6).

- If the estimated likelihood of CAD is 10–29%, offer CT calcium scoring as the first-line diagnostic investigation (see recommendation 1.3.4.7). (1.3.3.16)

- If the estimated likelihood of CAD is 10–29%, offer CT calcium scoring as the first-line diagnostic investigation (see recommendation 1.3.4.7).

This recommendation has been deleted because CT coronary angiography is now the recommended first-line diagnostic test and is considered to pose minimal risk of radiation exposure relative to the yield of important diagnostic information. (1.3.3.16)

Take into account people’s risk from radiation exposure when considering which diagnostic test to use. (1.3.4.3)

Additional diagnostic investigations

Offer non-invasive functional imaging (see section 1.3.6) for myocardial ischaemia if invasive coronary angiography or 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance. (1.3.5.1)

Offer invasive coronary angiography as a third-line investigation when the results of non-invasive functional imaging are inconclusive. (1.3.5.2)

2.4 A resource impact is expected as a result of the replacement of (old) recommendation 1.3.3.16 by (new) recommendation 1.3.4.3 and the subsequent tests recommended in 1.3.5.1 and 1.3.5.2.

This is expected to lead to a change in the diagnostic tests carried out for people with stable chest pain.

3 Significant resource impact recommendations

3.1 Offer 64-slice (or above) CT coronary angiography if:

- clinical assessment (see recommendation 1.3.3.1) indicates typical or atypical angina, or

Replaced by:

Offer non-invasive functional imaging (see section 1.3.6) for myocardial ischaemia if 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance or is non-diagnostic. (1.3.5.1)

Offer invasive coronary angiography as a third-line investigation when the results of non-invasive functional imaging are inconclusive. (1.3.5.2)
• clinical assessment indicates non-anginal chest pain but 12-lead resting ECG has been done and indicates ST-T changes or Q waves. [recommendation 1.3.4.3, new 2016]

Offer non-invasive functional imaging (see section 1.3.6) for myocardial ischaemia if 64-slice (or above) CT coronary angiography has shown CAD of uncertain functional significance or is non-diagnostic. [recommendation 1.3.5.1, 2016]

Offer invasive coronary angiography as a third-line investigation when the results of non-invasive functional imaging are inconclusive. [recommendation 1.3.5.2, 2016]

Background

3.1.1 The guideline published in 2010 recommended different diagnostic testing strategies for adults without confirmed coronary artery disease (CAD), in whom stable angina cannot be diagnosed or excluded based on clinical assessment alone, depending on the estimated likelihood of CAD (see table 2, recommendation 1.3.3.16).

3.1.2 The updated guideline concluded that CT coronary angiography has the lowest cost per correct diagnosis for diagnosing CAD in adults with stable chest pain of suspected cardiac origin. Recommendation 1.3.4.3, which replaces recommendation 1.3.3.16 in the updated guideline, therefore recommends 64-slice (or above) CT coronary angiography if clinical assessment indicates typical or atypical angina.

3.1.3 Implementing the updated recommendation will result in a shift from the previously recommended testing strategies to CT coronary angiography.

Assumptions made

3.1.4 The most recent national data available in 2016 indicate that about 120,000 people attend a rapid access chest pain clinic in England
each year and may therefore undergo diagnostic testing for stable chest pain (Department of Health integrated performance measures monitoring, 2012). People may also present to services via other routes (for example, an emergency department). Therefore 120,000 is likely to be an underestimate of the number undergoing diagnostic testing for stable chest pain. The figure can be amended in the resource impact template that accompanies this report. The template assesses the impact of variations in this baseline assumption in the sensitivity analysis.

3.1.5 Pre-test probabilities of CAD for people attending rapid access chest pain clinics are derived from a 10-year prognostic model for people with suspected angina attending a chest pain clinic (Sekhri et al. 2016)\(^1\).

3.1.6 Current (2016) practice is generally assumed to be as modelled as ‘future practice’ in the costing report and template that was published with the NICE guideline on chest pain of recent onset in 2010. The proportions of functional tests (stress echocardiography, myocardial perfusion imaging, and stress magnetic resource imaging) and follow-up invasive coronary angiography have been amended slightly, based on expert clinical opinion, to be consistent with the proportions used for future practice (that is, following implementation of the recommendations in the updated 2016 guideline).

3.1.7 For future practice, the following assumptions have been made:

- People previously undergoing testing according to (old) recommendation 1.3.3.16 will now have testing in line with (new) recommendation 1.3.4.3 (that is, irrespective of their pre-test probability of CAD).

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• All these people will receive CT coronary angiography as the first-line diagnostic test.

• Based on expert clinical opinion, for people with a pre-test probability of CAD of 10–90% and previously undergoing testing according to (old) recommendation 1.3.3.16, following CT coronary angiography, 20% will go on to have a functional test (8.5% stress echocardiography, 8.5% myocardial perfusion imaging, 3% stress magnetic resource imaging), with a further 10% receiving invasive coronary angiography.

• Based on expert clinical opinion for people with a pre-test probability of CAD of 0–9% or over 90%, previously undergoing testing according to (old) recommendation 1.3.3.16, the clinical pathway will remain unchanged following CT coronary angiography.

3.1.8 Unit costs for diagnostic tests are taken from the NHS National Tariff Payment System 2016/17 or NHS reference costs 2014/15. Further detail can be found in the resource impact template that accompanies this report.

Savings

3.1.9 The estimated annual saving of implementing this guideline for the population of England based on the resource impact assumptions is shown in table 3, with further detail provided in table 4.

<table>
<thead>
<tr>
<th>Table 3 Estimated annual saving of implementing the recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Savings each year due to change in diagnostic tests performed</td>
</tr>
</tbody>
</table>
Table 4 Estimated annual savings from year 5 onwards

<table>
<thead>
<tr>
<th>Diagnostic test undertaken</th>
<th>Current</th>
<th>Proposed</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit cost (£)</td>
<td>Numbers of tests</td>
<td>Cost (£000)</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>67</td>
<td>2,750</td>
<td>184</td>
</tr>
<tr>
<td>Stress echocardiography</td>
<td>277</td>
<td>17,988</td>
<td>4,983</td>
</tr>
<tr>
<td>Myocardial perfusion imaging</td>
<td>367</td>
<td>17,988</td>
<td>6,602</td>
</tr>
<tr>
<td>Stress MRI</td>
<td>520</td>
<td>6,349</td>
<td>3,301</td>
</tr>
<tr>
<td>CT calcium scoring</td>
<td>98</td>
<td>37,651</td>
<td>3,690</td>
</tr>
<tr>
<td>CT angiography</td>
<td>157</td>
<td>22,214</td>
<td>3,488</td>
</tr>
<tr>
<td>Invasive coronary angiography</td>
<td>1,173</td>
<td>27,020</td>
<td>31,695</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>131,961</strong></td>
<td><strong>53,942</strong></td>
<td><strong>146,656</strong></td>
</tr>
</tbody>
</table>

Benefits and savings

Implementing NICE’s guideline may result in the following benefits and savings:

- more effective use of NHS resources
- improved prognosis for adults with chest pain because of prompt and accurate diagnosis
- more appropriate diagnostic investigations and reduced adverse events.
Other considerations

Increasing the number of CT coronary angiography scans performed may have resource implications because of the availability of suitable scanners and appropriately trained professionals. Any associated resource impact should be considered locally.

Stakeholder comments suggested that limited availability of suitable CT scanners and appropriately trained professionals may affect the speed of implementation of this guideline.

4 Sensitivity analysis

4.1 There are a number of assumptions in the model for which no empirical evidence exists; these are therefore subject to a degree of uncertainty. Appropriate minimum and maximum values of variables were used in the sensitivity analysis to assess which variables have the biggest impact on the net cost or saving. This enables users to identify the significant cost drivers.

4.2 Appendix A contains a table detailing all variables modified, and the key conclusions drawn are discussed below.

4.3 The resource impact is sensitive to rates of attendance at rapid access chest pain clinics. Increasing the baseline of 0.22% to 0.44% changes the baseline resource impact from a saving of £17 million to a saving of £34 million, a difference of around £17 million.

4.4 The resource impact is also sensitive to a change in the future proportion of people receiving invasive coronary angiography. Varying the baseline percentage of 10% to between 5% and 15% changes the baseline resource impact from a saving of £17 million
to a saving of between £22.8 million and £11.2 million, a difference of around £11.6 million.

4.5 The next most sensitive variable is the unit cost of invasive coronary angiography. Varying the baseline cost of £1,173, by around 20% each way, to between £938 and £1,408 changes the baseline resource impact from a saving £17 million to a saving of between £13 million and £21 million, a difference of around £8 million.

4.6 The resource impact is also sensitive to the unit cost of CT coronary angiography. Varying the baseline cost of £157, by around 20% each way, to between £126 and £188 changes the baseline resource impact from a saving £17 million to a saving of between £19.9 million and £14 million, a difference of around £5.9 million.

5 **Implications for commissioners**

5.1 Most diagnostic tests recommended in the NICE guideline will be covered by the [NHS National Tariff Payment System 2016/17](https://www.england.nhs.uk/nhsfunding/financedata/ntps/).  

5.2 Costs relating to this NICE guideline will fall under programme budgeting category 10; ‘Problems of circulation’.

5.3 The expected change in the numbers of each diagnostic test could require commissioners to redesign services.
### Individual variable sensitivity

<table>
<thead>
<tr>
<th></th>
<th>Baseline value</th>
<th>Minimum value</th>
<th>Maximum value</th>
<th>Baseline resource impact (£000s)</th>
<th>Minimum resource impact (£000s)</th>
<th>Maximum resource impact (£000s)</th>
<th>Change (£000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence of attendance at rapid access chest pain clinics</td>
<td>0.22%</td>
<td>0.22%</td>
<td>0.44%</td>
<td>-16,974</td>
<td>-16,974</td>
<td>-33,943</td>
<td>-16,974</td>
</tr>
<tr>
<td>Future proportion of people receiving stress echocardiography</td>
<td>8.5%</td>
<td>6.0%</td>
<td>11.0%</td>
<td>-16,974</td>
<td>-17,861</td>
<td>-16,287</td>
<td>1,374</td>
</tr>
<tr>
<td>Future proportion of people receiving myocardial perfusion imaging</td>
<td>6.5%</td>
<td>6.0%</td>
<td>11.0%</td>
<td>-16,974</td>
<td>-17,064</td>
<td>-16,064</td>
<td>1,020</td>
</tr>
<tr>
<td>Future proportion of people receiving stress MRI</td>
<td>3.0%</td>
<td>1.0%</td>
<td>5.0%</td>
<td>-16,974</td>
<td>-16,065</td>
<td>-15,942</td>
<td>2,064</td>
</tr>
<tr>
<td>Future proportion of people receiving CT calcium scoring</td>
<td>0%</td>
<td>0%</td>
<td>10%</td>
<td>-16,974</td>
<td>-16,974</td>
<td>-16,974</td>
<td>-16,974</td>
</tr>
<tr>
<td>Future proportion of people receiving CT coronary angiography</td>
<td>100%</td>
<td>90%</td>
<td>100%</td>
<td>-16,974</td>
<td>-18,532</td>
<td>-16,974</td>
<td>1,568</td>
</tr>
<tr>
<td>Future proportion of people receiving invasive coronary angiography</td>
<td>10%</td>
<td>5%</td>
<td>15%</td>
<td>-16,974</td>
<td>-22,793</td>
<td>-11,155</td>
<td>11,638</td>
</tr>
<tr>
<td>Unit cost of stress MRI test</td>
<td>£520</td>
<td>£416</td>
<td>£624</td>
<td>-16,974</td>
<td>-16,823</td>
<td>-17,325</td>
<td>-702</td>
</tr>
<tr>
<td>Unit cost of CT coronary angiography</td>
<td>£157</td>
<td>£126</td>
<td>£188</td>
<td>-16,974</td>
<td>-19,903</td>
<td>-14,039</td>
<td>5,870</td>
</tr>
<tr>
<td>Unit cost of invasive coronary angiography</td>
<td>£1,173</td>
<td>£938</td>
<td>£1,408</td>
<td>-16,974</td>
<td>-12,966</td>
<td>-20,992</td>
<td>-8,036</td>
</tr>
</tbody>
</table>
About this resource impact report

This resource impact report accompanies the NICE guideline on chest pain of recent onset and should be read in conjunction with it. See terms and conditions on the NICE website.

This report is written in the following context

This report represents the view of NICE, which was arrived at after careful consideration of the available data and through consulting healthcare professionals. The report is an implementation tool and focuses on the recommendations that were considered to have a significant impact on national resource use.

Assumptions used in the report are based on assessment of the national average. Local practice may be different from this, and the impact should be estimated locally.

Implementation of the guidance is the responsibility of local commissioners and providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations. Nothing in this resource impact product should be interpreted in a way that would be inconsistent with compliance with those duties.

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