

# Cost implications of implementing NICE guideline on chest pain in rapid access chest pain clinics: an audit and cost analysis

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## ABSTRACT

**Background** Implementing the recently published National Institute for Health and Clinical Excellence (NICE) clinical guideline on chest pain (CG95) in rapid access chest pain clinics (RACPCs) could significantly impact on overall cost, while introducing new technology like cardiac computed tomography (CT) scanning. With the National Health Service (NHS) under pressure to make £20 billion savings, applying CG95 in RACPCs could be challenging. An audit enabled us to assess the cost implications.

**Methods** A retrospective audit was performed of 204 consecutive cases attending Croydon RACPC from 13 July to 21 September 2010, on risk factors, demographics and planned first-line investigations. CG95 and three alternative strategies were mapped on the sample, and the estimated cost and volume of first-line investigations were compared with actual RACPC activities and costs.

**Results** Application of CG95 resulted in significant increases in cost and volume of functional testing, cardiac CT scan angiography and invasive coronary angiography, with 42–43% overall cost increases. The application of three alternative strategies resulted in annual cost increases ranging from 0.1 to 33%. An alternative cost analysis showed annual savings of up to 24%.

**Conclusions** Implementing NICE CG95 can significantly increase the cost of RACPCs but alternative strategies could enable the introduction of new technology without significant cost increases and even significant savings.

**Keywords** CG95, implementation, cost, audit, RACPC

## Introduction

NICE published clinical guidance in March 2010 (CG95)<sup>1</sup> on the management of chest pain of recent onset, the implementation of which could have implications on the cost and volume of planned first-line investigations in rapid access chest pain clinics (RACPCs). The new algorithm incorporates recent technological advances in first-line investigations such as 64-, 256-, 320- and 640-slice cardiac CT scan angiography (CCTA).<sup>2,3</sup> CG95 also excludes the use of a much utilized 'traditional' first-line investigation—exercise tolerance testing (ETT).

In recent months, the NHS is seeing large-scale changes in the way it is managed and funded.<sup>4,5</sup> It is under pressure to make £20 billion savings at a time of major structural changes.<sup>6</sup> In this backdrop, implementing a new NICE guideline in chest pain clinics which of necessity requires the

introduction of new technology, can be particularly challenging.

Croydon has the second highest levels of inequality in circulatory disease mortality of all London boroughs.<sup>7</sup> Cardiology services are being reviewed in Croydon using programme budgeting and marginal analysis (PBMA),<sup>8</sup> considering the most effective and efficient options for service provision, including implementing CG95. Croydon is an outer South West (SW) London borough and is the second

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largest borough by population size.<sup>9</sup> Over the next 10 years, significant increases in the 50–75-year-old population are projected.<sup>10</sup> We performed an audit of Croydon's RACPC from March to April 2011 to ascertain the current volume of activity and predict how implementing CG95 and alternative strategies would impact on cost and activity.

## Methods

### Audit design

The audit was a retrospective review of 204 consecutive case records from 13 July to 21 September 2010 (71 days). An audit protocol was developed and agreed between the Primary Care Trust (Public Health Directorate) and the Croydon University Hospital. The audit was registered with Croydon Health Services NHS Trust. Aggregate data were obtained for 2010 separately.

### Standards audited against

The standards audited against were the NICE Clinical Guideline 95: Chest Pain of Recent Onset and, in secondary analysis, the London Cardiac and Stroke Networks (LCSNs) RACPC and diagnostics survey.<sup>11</sup>

### Data collection

We collected data at Croydon RACPC using the hospital's electronic database PRISM. An audit template was developed in consultation with the cardiology team there, and data were collected on patients' demographic details (date of birth, gender, ethnicity and post code), chest pain descriptors, initial RACPC chest pain assessment (non-cardiac/atypical/typical chest pain), risk factors (previous cardiac history, hypertension, diabetes, smoking, alcohol, family

history of CAD, hypercholesterolemia and peripheral/cerebrovascular disease), planned first-line investigations (exercise tolerance test, stress echocardiography, invasive coronary angiography (ICA) and discharged to GP), angiography outcomes and clinical diagnosis. We also obtained aggregated annual 2010 data that included patients' date of birth, type of first-line investigation and whether angiography was done or not.

### NICE CG95 application

The CG95 algorithm for stable chest pain of recent onset was applied to the audit dataset. Based on clinical symptoms, age, sex, presence of diabetes, smoking and hypercholesterolemia (using the table published in the guideline<sup>12</sup>), it was possible to estimate the likelihood of coronary artery disease (CAD) for all the patients, placing each of them in one of the CAD likelihood groups: <10, 10–29, 30–60 and 61–100%. Depending on the CAD likelihood group assigned, each patients' first-line investigation was predicted using the NICE algorithm (Fig. 1). The methodology to estimate the CAD likelihood and predict first-line investigations was then discussed with the Croydon RACPCs' clinical team and validated.

### Comparison with NICE CG95 predictions

The first-line investigations predicted using CG95 were then compared with actual planned first-line investigations in Croydon RACPC. Significance testing was done to obtain *P*-values and ascertain whether the difference between the proportion of cases having a particular first-line investigation according to RACPC data and the proportion of cases having the same investigation according to CG95 was statistically significant or not. The null hypothesis was that there was no

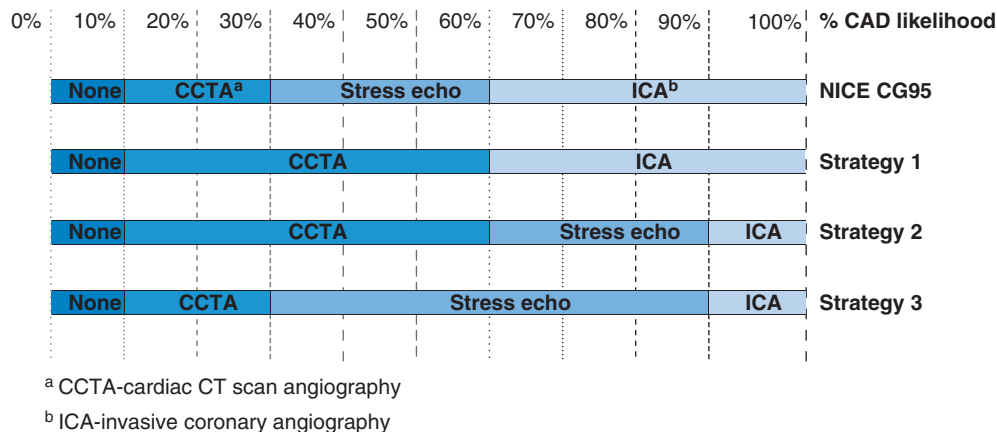


Fig. 1 First-line investigation options according to CAD (Coronary Artery Disease) likelihood.

difference in the proportions of actual first-line investigations in Croydon RACPC and those predicted using CG95.

### Comparisons with SW London and London, and alternative strategies

LCSN undertook a survey of 17 London areas RACPCs in four of five Cardiac Networks, as part of a national RACPC survey and provided data on output and costs for London, and regionally including for SW London. The Croydon RACPC audit overlapped the timeframe of the LCSN survey—and because the Croydon data were not included in the survey, it was possible to reliably compare Croydon with SW London and London overall. Furthermore, the LCSN survey proposed three alternative strategies to CG95 (Fig. 1), which are essentially variations of the CG95 algorithm and were drafted at a pan-London clinical consensus meeting, assigning first-line investigations according to varying CAD likelihood intervals. It is assumed that the three alternative strategies are at least as likely as CG95 to identify patients with CAD. These strategies were also mapped on the Croydon RACPC dataset. In order to make comparisons with the LCSN survey data for SW London and London, the Croydon audit dataset (which spans 71 days) was annualized to a 48-week year (as was done in the LCSN data).

### Cost analysis and comparisons

The costs of actual first-line investigations, and those predicted using CG95 and the three alternative strategies were estimated and then compared with each other using two different costing strategies. The cost assumptions for costing analysis 1 (CA1) were based on average London tariffs outlined in the LCSN survey, which were agreed through a pan-London clinical consensus meeting. According to these estimates, the tariff for the outpatient clinic (which includes ETT) is £215, stress echocardiography £500, CCTA £300 and ICA £1127. This analysis bundled ETT costs into the outpatient tariff and consequently any potential savings made by the cessation of ETT could not be demonstrated. Costing analysis 2 (CA2) used unit costs from the CG95 costing model itself,<sup>13</sup> which included ETT unit costs to demonstrate any potential savings ensuing from cessation of ETT. The CG95 unit cost for ETT is £75, CCTA £286, stress echo £236 and ICA £1052. Outpatient tariff was excluded from CA2 since it would have been applied uniformly to all the scenarios and thereby would not have changed the estimates. The cost comparisons are important in the relative changes to cost they demonstrate, more than the absolute values.

## Results

### RACPC output and demographics

The audit sample consisted of 204 consecutive case records of which 120 (59%) were male and 84 (41%) were female. Ages ranged from 31–91 years with a mean age of 58 years. Where ethnicity was specified, majority were white British and few were from Pakistani, Indian, other Asian and Afro-Caribbean backgrounds. In terms of risk factors, 15% of patients were diabetic, 39% had high cholesterol, 16% were current smokers, 27% were ex-smokers and 56% had never smoked. Ninety percent of the cases had no previous history of cardiac disease. The annual data for 2010 showed that 1149 cases had been seen by the Croydon RACPC. Of these, 55% were male and 45% female.

### Actual planned first-line investigations

The records for planned first-line investigations in the Croydon RACPC showed that 10% ( $n = 21$ ) did not have any investigations, 90% ( $n = 183$ ) had ETT, 25% ( $n = 50$ ) had stress echocardiography and 27% ( $n = 56$ ) had ICA planned. Of the cases with ICA planned, 49 actually had one (24% of sample) and 80% of these cases had significant findings— with 55% subsequently undergoing cardiac revascularization surgery, 6.1% having medical angina therapy and 18% being treated with aggressive risk factor reduction. Approximately, 50% of cases ( $n = 101$ ) seen in the RACPC were discharged to their general practitioners (GPs). Of those discharged, 97% ( $n = 98$ ) had a chest pain assessment of atypical/possible chest pain, 98% ( $n = 99$ ) had ETT prior to discharge with ETT negative in 89% (88/99) and inconclusive in 11% (11/99) cases. Overall in 2010, out of the 1149 cases seen at the Croydon RACPC 240 underwent an ICA— 21% of the cases.

### Comparisons with SW London and London

Planned first-line investigations in Croydon, South West London and London RACPCs were compared, using annualized data with 95% confidence intervals (Table 1). The proportion of cases that did not require an investigation ('none' category) was statistically similar in Croydon and SW London, but both were significantly lower than London. For ETT, at 90%, the Croydon proportion was significantly higher than both SW London and London. While functional testing (stress echocardiography) was similar in both SW London and London, Croydon was statistically significantly lower than both. CCTA was not done at all in Croydon. Percentages of planned ICAs in Croydon and SW London were very similar but both were statistically significantly higher than London.

**Table 1** Comparison of planned first-line investigations in Croydon, SW London and London calculated for 48 weeks (annual) with 95% confidence intervals on percentages

Investigation	RACPC, n = 965, % (95% CI)	SWL <sup>a</sup> , n = 1632, % (95% CI)	London <sup>a</sup> , n = 12 960, % (95% CI)
None	99, 10 (8, 12)	216, 13 (12, 15)	2568, 20 (19, 21)
ETT	866, 90 (88, 92)	792, 49 (46, 51)	5400, 42 (41, 43)
Functional testing <sup>b</sup>	237, 25 (22, 27)	672, 41 (39, 44)	5808, 45 (44, 46)
CCTA	0, 0 (0, 0)	72, 4 (4, 6)	480, 4 (3, 4)
ICA	265, 27 (25, 30)	432, 26 (24, 29)	2232, 17 (17, 18)

<sup>a</sup>Source: London Cardiac and Strokes Network; SWL does not include Croydon data.

<sup>b</sup>Includes Stress ECHO.

**Table 2** Planned preliminary investigations in RACPC compared with those predicted using NICE CG95

Investigation	RACPC (%), n = 204	NICE (%), n = 204	Change (%) <sup>a</sup>	Significance, (P-value) <sup>b</sup>
None	21 (10)	22 (11)	+ 5	0.87
ETT	183 (90)	0 (0)	- 100	<0.001
Functional testing (Stress ECHO)	50 (25)	57 (28)	+ 14	0.44
CCTA	0 (0)	32 (16)	∞	<0.001
ICA	56 (27)	93 (46)	+ 66	<0.001

∞ An immeasurable/infinite value.

<sup>a</sup>Change % indicates the percentage increase (+) or decrease (-) in the number of investigations when NICE guidance is used, compared with RACPC as the baseline.

<sup>b</sup>Significance or P-values indicate whether or not there are statistically significant differences between the percentages of a particular investigation done in RACPC compared with NICE.

### NICE CG95 predictions

Mapping CG95 on the audit dataset predicted 'no investigations' in 11% cases ( $n = 22$ ), ETT in 0% cases, stress echocardiography in 28% cases ( $n = 57$ ), CCTA in 16% cases ( $n = 32$ ) and ICA in 46% cases ( $n = 93$ ).

### Comparisons with NICE CG95 predictions

Applying CG95 (Table 2) resulted in a 5% increase in the proportion of cases not having any investigations, a 14% increase in stress echocardiography, introduction of CCTA (since none are done at present in the RACPC) and a steep

66% increase in the number of ICAs compared with actual planned first-line investigations. As ETT is not recommended in CG95, a 100% reduction occurred when CG95 was applied. There were statistically significant differences ( $P < 0.001$ ) for all the first-line investigations except for functional testing ( $P = 0.44$ ). The P-values indicated areas where the application of CG95 was likely to have a significant impact on first-line investigations—ETT, CCTA and ICA (ICA with significant increases).

### Cost comparisons with NICE CG95

The annual RACPC costs for planned first-line investigations were compared with the costs of those predicted using CG95. The application of CG95 resulted in a 14% increase in the cost of functional testing (stress echocardiography) an absolute increase in CCTA cost (since none were currently done in the RACPC), a 100% decrease in the cost of ETT (since CG95 does not recommend ETT) and a 66% increase in the cost of ICA. CA1 estimated an overall cost increase of 42% using average London tariffs and CA2 which adjusted for savings resulting from the cessation of ETT using CG95 unit costs, estimated a 43% increase in cost despite savings from ETT. Using average London tariffs, the total annual cost estimated for actual planned first-line investigations in Croydon RACPC was £743 040 and on applying the CG95 algorithm this increased by £309 043 to £1 052 083 (Table 3).

### Cost comparisons of alternative strategies

In CA1, alternative strategy 1 resulted in a 33% increase (+£244 843) in cost compared with the actual annual RACPC cost. Alternative strategy 2 resulted in a 0.1% increase (+£940) and alternative strategy 3 in a 9% increase (+£65 140). In CA2 (where ETT is unbundled from outpatient tariff), alternative strategy 1 resulted in a 46% increase in cost, alternative strategy 2 in 21% savings and alternative strategy 3 in 24% savings (Table 3).

## Discussion

### Main findings of this study

This study shows that when NICE CG95 stable chest pain algorithm is applied to the Croydon RACPC audit dataset, the volume and cost of stress echocardiography, CCTA (by virtue of not being done by Croydon RACPC currently) and ICA increase. If CG95 was implemented as written, this could result in a 42% (CA1) to 43% (CA2) increase in the RACPC's annual cost. When the three alternative LCSN strategies are mapped on the dataset, in CA1 this results in annual cost increases ranging from negligible (0.1%) to 33%.

**Table 3** The cost associated with planned first-line investigations for the annualized Croydon RACPC audit sample, with the changes to the costs had the NICE CG95 and alternative treatment algorithms been applied ( $n = 1149$ ), using two different cost analyses (CA1 and 2)

Cost Analysis 1 (CA1): using LCSN average London tariffs (includes ETT cost in outpatient clinic charges)							
	Stress echo (@ £500)	CCTA (@ £300)	ICA (@ £1127)	Total charge of diagnostics (£)	Outpatient Clinic charges (£215 × 1149 patients) (£)	Total charge with clinic charge <sup>a</sup> (£)	Difference in total charges to current practice (£) (% change)
RACPC	141 000	0	355 005	496 005	247 035	743 040	
NICE CG95	160 500	54 000	590 548	805 048	247 035	1 052 083	+309 043 (+42)
Alternative strategy 1	0	150 300	590 548	740 848	247 035	987 883	+244 843 (+33)
Alternative strategy 2	194 500	150 300	152 145	496 945	247 035	743 980	+ 940 (+0.1)
Alternative strategy 3	355 000	54 000	152 145	561 145	247 035	808 180	+ 65 140 (+9)
Cost Analysis 2 (CA2): using NICE CG95 unit costs (unbundles ETT cost from outpatient clinic charges)							
	ETT (@ £75)	Stress echo (@ £236)	CCTA (@ £286)	ICA (@ £1052)	Total charge of diagnostics <sup>b</sup> (£)	Difference in total diagnostic charges to current practice (£) (% change)	
RACPC	77 325	66 552	0	331 380	475 257		
NICE CG95	0	75 756	51 480	551 248	678 484	+203 227 (+43)	
Alternative strategy 1	0	0	143 286	551 248	694 534	+219 227 (+46)	
Alternative strategy 2	0	91 804	143 286	142 020	377 110	−98 147 (−21)	
Alternative strategy 3	0	167 560	51 480	142 020	361 060	−114 197 (−24)	

<sup>a</sup>The cost of ETT has been left out of the total cost of the planned investigations, as it is included in the outpatient clinic charges.

<sup>b</sup>Outpatient clinic charge has been excluded as it would have applied equally to all scenarios and would not change overall % differences in costs compared with current practice.

In CA2 by unbundling the cost of ETT from the outpatient tariff using NICE's own unit costs and thereby adjusting for savings resulting from the cessation of ETT, this increases costs by 46% in strategy 1, and very significantly decreases costs by 21–24% in strategies 2 and 3.

### What is already known on this topic

Limited published evidence exists regarding the impact of CG95 on out-patient cardiac services. Patterson *et al.*<sup>14</sup> recently reported their findings on the cost effects of applying CG95 to two London RACPCs and theirs appears to be the only published data about this. Relative to existing practice in the two RACPCs, their study predicts that the application of CG95 would result in a 24% reduction in functional cardiac testing, no significant change in CCTA and a 508% increase in ICA. The study estimates a 24% increase in cost on existing practice by applying CG95. Garg *et al.*<sup>15</sup> used CG95 to predict first-line investigations of 500 RACPC patients but did

not compare with existing practice or undertake a cost analysis.

### What this study adds

This study adds to the body of evidence that the application of CG95 can result in significant increases in cost and volume of first-line investigations in RACPCs. It shows increases in stress echocardiography, predicts significant increases in ICAs and provides detailed analysis of the increases in costs associated with the application of CG95. It also demonstrates the cost effects of applying three alternative strategies and puts the Croydon data in context by comparing it with the rest of SW London and London.

ETT has been an important first-line investigation in Croydon RACPC as it undoubtedly has been in many RACPCs across the country, but CG95 stable chest pain algorithm does not include ETT. In Croydon, as in most of London, the cost of ETT is bundled into the outpatient tariff.



Therefore from a cost perspective, doing or not doing ETT has no effect on the RACPC costs. In Croydon, 90% of cases have ETT and stopping it could potentially help offset some of the costs of introducing new technology like CCTA. It follows that the cost structures and tariff arrangements for RACPCs need to be re-examined by acute commissioning units and perhaps reconfigured if there are significant savings that can be made. Indeed, CA2 confirms that significant savings can be made by unbundling ETT from outpatient tariff and demonstrates the unhelpful effects of combined tariffs, showing why commissioners need to unbundle them. While the implementation of CG95 can result in significant increases in cost and volume of planned first-line investigations, incorporating a modified version of CG95 (alternative strategies 2 and 3) could enable the introduction of cardiac CT scanning and the discontinuation of ETT, without significant increases in cost and in fact with potentially significant savings.

### Limitations of this study

The main limitation of this audit is around unit cost and tariff assumptions. Actual unit costs for Croydon were sought for cost analysis but these could not be obtained. This would have provided an accurate local picture for commissioners and health professionals. Therefore, the size of the true cost pressures for Croydon is assumed to be broadly similar to those estimated using the average London tariffs. The predictions in this study in relation to the application of CG95 and alternative strategies were limited to changes in first-line investigations at the RACPC and do not factor in any changes in subsequent investigation(s), treatment(s) or patient outcomes. Therefore in the cost analysis, it was not possible to predict the cost from first patient contact to discharge in the RACPC. As the London data represent submissions from four out of five London Cardiac Networks representing 17 provider organizations, this is only a sample of the overall London picture.

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### Disclaimer

The opinions and conclusions expressed in this paper are those of the authors alone and in no way reflect the opinions of the authors' employers or affiliations.

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