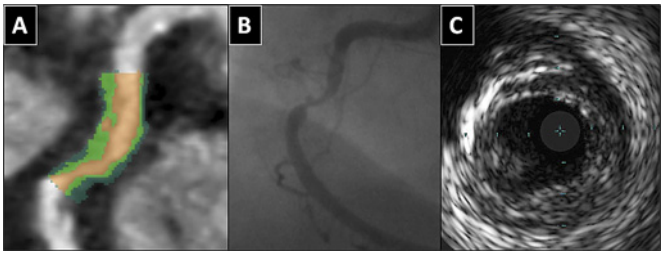
areas co-registered with VH-IVUS and compared to contrast attenuation to create contrast ratios for each plaque component. These ratios were used to create a colour map of the plaque based on the HU of its constituents and used to test: (A) Classification of plaque components against histology in 10 post-mortem human coronary arteries. (B) Quantification of plaque geometry and composition compared with VH-IVUS in 30 coronary segments. (C) Ability to differentiate 63 patients prospectively enrolled with either stable angina or acute coronary syndrome.

Results (A) CT contrast ratio defined HU-colour maps were created for the 10 post-mortem arteries which were then sectioned into eighty-seven 400 μm segments for histological analysis. The maps permitted detection of significant atherosclerosis with sensitivity-92% and specificity-90%, calcified-plaque with sensitivity-80% and specificity-88% and necrotic core sensitivity-55%, specificity-96%. If only necrotic core area >2 mm^2 are considered (above the spatial resolution of CT) there is a significant improvement in sensitivity-75%. (B) Plaque-maps were created for 900 mm of coronary segments and co-registered with VH-IVUS. On average, CT overestimated total plaque area by 44%, vessel volume-33%, lumen-10%, necrotic core-140%, fibrous plaque-70% and calcified plaque-9%. However, correlation between CT and VH-IVUS was highly significant ($p<0.001$) for all measurements: vessel volume ($r=0.86$), lumen ($r=0.74$), necrotic core ($r=0.47$), fibrous plaque ($r=0.74$) and calcified plaque $r=0.69$). (C) Culprit lesions of 31 patients with stable angina and 32 with troponin-positive ACS underwent CT prior to PCI. Features discriminating acute from stable plaque detected using the plaque-maps include: micro-calcification-63% vs 35% ($p=0.03$), distinct necrotic core-56% vs 23% ($p<0.01$) (Abstract 095 figure 1) and positive vessel remodelling-68% vs 26% ($p<0.001$). The percentage of necrotic core (low attenuation plaque) was higher in acute plaques-54% vs 44% ($p<0.01$) while conversely the percentage of calcified plaque (high attenuation plaque) was lower-4% vs 15% ($p<0.01$). Intra-plaque contrast was more common 44% vs 6% ($p<0.001$) with high specificity for acute plaques (94%) and we feel it may represent visualisation of plaque rupture (Abstract 095 figure 1).



Abstract 095 Figure 1 (A) CT image of intra-plaque contrast with colour mapping. (B) Corresponding coronary angiogram. (C) IVUS reveals plaque rupture at this point.

Conclusion Plaque-mapping with contrast ratios allows plaque quantification and may assist diagnosis of acute plaque rupture.

096 A COMPARATIVE STUDY OF STANDARD FILTERED BACK PROJECTION WITH NOVEL ITERATIVE RECONSTRUCTION TECHNIQUES IN CARDIAC CT

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Background Iterative reconstruction (IR) is a novel but significant development in CT image acquisition. There have been a number of studies that have reported on the potential of IR in cardiac CT. These retrospectively applied IR in the image domain to images acquired with standard filtered back projection (FBP) techniques. This study was part of an ongoing randomised control trial [ISRCTN52480460] evaluating the cost effectiveness of cardiac CT.

Methods 250 patients were prospectively enrolled to have a cardiac CT for the investigation of stable chest pain. Written and informed consent was obtained. Data acquisition were performed on a Philips Brilliance 64. The patients were divided into two groups. Cohort A underwent standard FBP imaging, and Cohort B underwent IR with Idose® (Philips, Cleveland, Ohio, USA). Within each cohort the scan parameters (kv, mAs, pitch) and reconstruction protocols (prospective or retrospective) were determined by patient characteristics. Images were assessed for noise and signal quality within regions of interest (ROI) on axial images, and subjectively for image quality by two experienced readers. Noise was defined as the SD of the measured HU, and signal as the HU mean attenuation value. The ROIs were in the ascending aorta, interventricular septum and left ventricular cavity. Subjective image quality was rated blindly using a 5-point Likert scale. Effective radiation dose (ED) of each CTCA was estimated by multiplying the dose-length product by a chest-specific conversion coefficient ($\kappa=0.014$ $mSv \times mGy^{-1} \times cm^{-1}$).

Results Of the 250 patients enrolled 3 withdrew. 146 of the 247 subjects were male with a mean age of 57.93 (SD 9.93). Cohort A consisted of 124 patients, and cohort B 123, with no significant difference in baseline demographics. The mean dose of all FBP was 6.09 mSv, (SD 3.16) compared to an IR mean of 4.23 mSv, (SD 2.01) which was a dose saving of 1.86 mSv (30.54%). This was a significant dose reduction (p value <0.0001.) Mean image quality score obtained from the IR images was 3.67 (SD 1.04) compared to the FBP images of 3.29 (SD 1.17) p value of 0.0067. There was good agreement between the readers—κ coefficient 0.83. Cohort A consisted of 74 retrospective images and 50 prospective. Cohort B had 116 with retrospective and 7 with prospective. The mean ED for a prospective FBP was 3.50 mSv (SD 1.15), with the IR equivalent being 2.00 mSv (0.72), giving a mean dose saving of 1.50 mSv (42.86%). The mean ED for FBP retrospective studies was 7.85 mSv (SD 2.87), with the IR equivalent being 4.36 mSv (SD 1.99), with a mean dose saving of 3.49 mSv (44.46%). There was no statistical difference in noise or mean attenuation between the IR and FBP images in all three areas of interest Abstract 096 table 1.

Abstract 096 Table 1

	Image noise			Attenuation		
Region of interest	FBP	IR	p Value	FBP	IR	p Value
Ascending aorta	29.76±32.00	27.33±10.10	0.42	505.85±95.64	520.72±103.07	0.24
Interventricular septum	28.96±9.63	28.27±7.53	0.53	154.76±35.28	153.63±32.41	0.79
Left ventricle	29.78±9.36	28.55±12.39	0.38	464.27±92.50	484.07±99.38	0.11

Conclusions To our knowledge this is the first study to prospectively compare FBP with IR. It suggests that cardiac IR protocols confer a substantial radiation dose reduction without a compromise in diagnostic quality.

097 CALCIUM SCORES ARE MORE COST EFFECTIVE FOR RISK STRATIFICATION THAN NICE'S MODIFIED DIAMOND FORRESTER CALCULATOR

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Background In March 2010 NICE published clinical guideline 95 (CG95). This proposed a move to a primary imaging strategy for

investigation of stable chest pain. CG95 uses a modified Diamond Forrester (DF) to evaluate individuals' risk of coronary artery disease (CAD) and determine the most appropriate test. Patients with DF likelihood scores <10% do not require further investigation; 10%–29% require calcium scores (CS); 30%–60% stress imaging; and >60% invasive angiography (IA). For those patients requiring CS, the guidance recommends that a score of 0 requires no further investigation; 1–399 CT angiogram (CTCA); and >400 IA. This study compared the cost implications of DF and CS as risk stratification tools as part of a larger ongoing randomised control trial, CAPP (Cardiac CT for the Assessment of Chest Pain and Plaque) [ISRCTN52480460], which aims to evaluate the cost-effectiveness of cardiac CT.

Methods Written and informed consent was obtained from 250 patients with stable chest pain. Age, sex, risk factors and character of pain were documented, and the probability of significant CAD was calculated using the DF. Patients had CS followed by CTCA, performed on a Philips Brilliance 64. CS was assessed using a semi-automated analysis package to determine the Agatston score. CTCA was taken as the reference point for CAD severity, with disease classified according to the most significant lesion, ranging from none to severe. The total number and cost for investigations was determined theoretically by two models. Model 1 used the DF and model 2 the CS criteria. The unit costs of the investigations were obtained from the NHS National Tariff 2011/12 and NICE CG95.

Results Of the 250 patients three withdrew. 146 of the 247 were male with a mean age of 57.93. The mean CS was 175.84. The average DF was 48.21%. CS predicted CAD better than DF score (McNemar's χ^2 =14.52, p<0.0001). OR=2.88 (95% CI 1.60 to 5.44). When the cost implementation of CG95 was assessed using the DF criteria, 52 had scores between 0–9 and no further investigation was needed; 49 between 10% and 29% required CS; 53 between 30% and 60%, needed stress imaging; and 93 above 61% required IA. Of the 49 that would receive CS, 28 had a score of 0 requiring no further investigations; 17 had a CS>0–400 necessitating CTCA; 4 had a CS above 400 and required IA. This model had a projected total cost of £124 130. When the cost implementation of CG95 was assessed using the CS, the cost for investigation would be 247 CS; 126 patients had a CS of 0 and no further investigation was necessary; 94 had a CS>0–400 and CTCA is indicated; and 27 had a CS above 400 and would require IA. This model had a projected total cost of £48 282.

Conclusions The use of CS to triage patients with stable chest pain appears to be more cost effective for the prediction of CAD. This model could replace the subjective and difficult assessment of chest pain symptoms with a more objective assessment of CAD presence.

Abstract 097 Table 1

Investigation	CG95 using DF	CG95 using CS
CS	49×£113=£5537	126×£113=£14 238
Follow on CTCA (minus the price of CS)	17×(173–113)=£1020	94×(173–113)=£5640
IA	97×£1052=£102 044	27×£1052=£28 404
Stress imaging (MPI)	53×£293=£15 529	NA
Total	£124 130	£48 282
Per patient (n=247)	£503	£195

098 QUANTITATIVE CARDIOVASCULAR MAGNETIC RESONANCE MYOCARDIAL PERFUSION IMAGING: INTER-STUDY REPRODUCIBILITY

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Background Absolute quantification of myocardial perfusion with Cardiovascular Magnetic Resonance (CMR) is increasingly available and can potentially improve current qualitative and semi-quantitative analysis. The absence of ionising radiation makes CMR ideal for serial examinations for patient management or in clinical trials. Inter-study reproducibility is crucial for serial examinations but is not known for quantitative CMR perfusion.

Methods 16 healthy volunteers underwent high-resolution stress and rest perfusion imaging at 3 Tesla on 3 occasions during a single day. Scan 1 was at 0900, scan 2 immediately after and scan 3 at 1400. Absolute perfusion was determined in each coronary artery territory and globally by Fermi constrained deconvolution of myocardial signal intensity curves. Left ventricular volumes and function were also calculated. Scan 1 and 2 were used to evaluate perfusion inter-study reproducibility under the same conditions while scan 3 was used to assess for diurnal variation. Inter-study reproducibility was determined by calculation of coefficients of variation (CV) defined as the SD of the differences of the measurements from the first two examinations, divided by the mean.

Results 11 full datasets were suitable for quantitative perfusion analysis. Participants were 27±5 years old and five were male. Myocardial perfusion and haemodynamics for all 3 studies, and the significance of associated differences, are shown in Abstract 098 table 1. Inter-study reproducibility was reasonable; rest perfusion was more reproducible than stress and global more reproducible than territorial. CV was 26.8%, 16.0% and 23.9% for global stress and rest perfusion and myocardial perfusion reserve (MPR)

Abstract 098 Table 1

	Scan 1	Scan 2	Scan 3	p Value
Perfusion-segmental (ml/min/g)				
Stress	2.5±0.8	2.1±0.6	2.2±0.8	0.05
Rest	0.6±0.2	0.5±0.1	0.5±0.2	0.05
Perfusion-global (ml/min/g)				
Stress	2.5±0.5	2.1±0.5	2.2±0.7	0.19
Rest	0.6±0.1	0.5±0.2	0.6±0.2	0.1
MPR				
Stress	4.3±1.3	4.3±1.4	3.8±1.1	0.34
Rest	4.3±0.9	4.2±1.2	3.7±0.6	0.37
Heart rate (bpm)				
Stress	111±14	105±16	106±17	0.03
Rest	74±10	73±9	73±14	0.92
Systolic blood pressure (mm Hg)				
Stress	121±16	120±14	122±16	0.54
Rest	119±21	119±16	120±23	0.92
Rate pressure product (SBP.HR)				
Stress	13 550±2747	12 696±2592	13 009±2758	0.046
Rest	8919±2639	8764±1698	8789±2377	0.90

Abstract 098 Table 2

	Segmental	Global
Stress perfusion (ml/min/g)		
Mean difference±SD	0.35±0.81	0.36±0.62
Coefficient of variation	35.2%	26.8%
Rest perfusion (ml/min/g)		
Mean difference±SD	0.07±0.16	0.07±0.09
Coefficient of variation	27.5%	16.0%
Myocardial perfusion reserve		
Mean difference±SD	0.07±1.43	0.07±1.03
Coefficient of variation	33.5%	23.9%

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Important cost categories not included: transcatheter aortic valve implantation probably less cost-effective

Patients eligible for the transcatheter aortic valve implantation (TAVI) intervention are old (>75 years), face a high risk of mortality, and generally have multiple comorbidities.[1] Healthcare consumption of this group of patients can, therefore, be expected to be high.[2 3] As a consequence, life extension in this group would probably result in additional healthcare consumption in so-called life years gained. Healthcare consumption in life years gained could be due to treatment of a large variety of diseases related to old age and/or consumption of long-term care due to disabilities.

In the article by Watt *et al*,[4] only a limited set of cost categories is included, which results in too favourable estimates of the cost effectiveness of TAVI. Current NICE guidelines do not advocate the inclusion of medical costs in life years gained of diseases not directly related to the intervention under study.[5] Ignoring costs that are relevant for the NHS is difficult to defend using scientific arguments.[6–8] It also results in favouring interventions that primarily increase length of life over interventions that mainly improve quality of life.[9] Broadening the perspective beyond the NHS, as Watts *et al* suggest, would probably result in even less favourable cost-effective estimates, as the target group of TAVI does not participate in the labour market anymore and, therefore, consumes more than they produce.[9] While there may be uncomfortable implications of including more cost categories that warrant discussion, this can never be a reason to exclude foreseeable costs.

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The Authors' reply: Van Baal argues that we have under-estimated the cost associated with transcatheter aortic valve implantation (TAVI) and as a result, we have generated an overly-optimistic picture of its cost effectiveness.[1] This view is based on the fact that we have not allowed for the cost of managing the range of diseases (other than aortic stenosis) that can be experienced during the additional years of life that we estimate will result from the use of TAVI rather than medical management. For example, van Baal implies that we should have included the cost associated with the chance of lung cancer being diagnosed during the additional years of life that have been generated by TAVI. The authors are correct in referring to arguments which have been made in favour of the inclusion of these 'unrelated' costs in economic evaluation. However, only a few of the health systems around the world, which use formal economic evaluation to support decisions about the use of new medical technologies, advocate the inclusion of these costs. Given that our analysis adopted the perspective of the UK NHS and the methodological guidelines published by National Institute for Health and Clinical Excellence,[2] which do not support the inclusion of 'unrelated costs', we did not include these into our model. Furthermore, if we had incorporated these costs, the interpretation of the resulting cost effectiveness ratio would be unclear. This is because the routine inclusion of such costs would also need to be considered for all other interventions provided by the National Health Service which would then impact on the cost effectiveness threshold against which the TAVI cost effectiveness ratio is compared.

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CORRECTION

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S McCusker, P McKavanagh, L Lusk, A Agus, P Ball, M Harbinson, T Trinnick, E Duly, G Walls, S Shevlin, C L McQuillan, M Alkhalil, P Donnelly. BCS Abstracts 2012: 097 Calcium scores are more cost effective for risk stratification than NICE's modified diamond Forrester calculator. *Heart* 2012;**98**(Suppl 1):A55–A56 doi: 10.1136/heartjnl-2012-301877b.97. The first author of this abstract should be P McKavanagh.