Monograph:
Doherty, Patrick Joseph orcid.org/0000-0002-1887-0237 and Harrison, Alexander Stephen orcid.org/0000-0002-2257-6508 (2016) The National Audit of Cardiac Rehabilitation:Annual Statistical Report 2016. Report. British Heart Foundation , London.

British Heart Foundation

THE NATIONAL AUDIT OF CARDIAC REHABILITATION ANNUAL STATISTICAL REPORT 2016

FIGHT
FOR EVERY
HEARTBEAT

bhf.org.uk

Acknowledgements

The new British Heart Foundation (BHF) strategy remains committed to reducing inequalities in service delivery so that patients with cardiovascular disease (CVD) can have the best possible care and support to achieve the desired outcomes irrespective of where they live. The National Audit of Cardiac Rehabilitation (NACR) is a BHF project which aims to support cardiovascular prevention and rehabilitation services to achieve the best possible outcomes for patients. NACR is very grateful for the continued support from the BHF who also help to communicate our findings effectively through this annual report.

Thanks to the British Association for Cardiovascular Prevention and Rehabilitation (BACPR) which, as the national body for Cardiac Rehabilitation (CR), shares our vision to ensure that all CR programmes in the UK perform to a basic minimum standard that is shown to benefit patients. The ability to change practice relies heavily on the continued education and training of clinicians which is something the BACPR continues to support through its range of courses. The BACPR and NACR collaborative partnership resulted in the launch of the BACPR-NACR Certification Programme for CR (NCP_CR) in 2015.

Thanks also to NHS Digital (previously known as the Health and Social Care Information Centre) for their support and expertise with quality assuring data and helping NACR to reduce inequalities and improve services for the betterment of patients. NACR would like to thank patients for agreeing to take part in the audit and for completing the clinical assessments and questionnaires before and after their programme.

Our gratitude extends to the CR teams who, in collaboration with patients and carers, have helped improve risk factor management, increase exercise frequency and improve psychosocial well-being for tens of thousands of patients in the last 12 months. Special thanks goes to the Cardiovascular Care Partnership (UK) (CCPUK), the national CVD patient voice, for their continued support in helping make NACR and its findings more meaningful for patients and carers.

We would very much like to thank the NACR Steering Committee for their continued support and expertise in shaping recent developments. They are: Martin Cassidy (NHS England), Mel Clark (Patient Representative), Frances Divers (Scotland Representative, NHS Lothian), Trevor Fernandes (CCPUK), Dr Jane Flint (Cardiologist), Professor Gill Furze (Former BACPR President), Dr Chris Gale (MINAP Audit Representative), Julie Henderson (Head of Analytical Services, NHS Digital), Suzanne Indge (NACR Lead for the All Wales Cardiac Rehab Group), Catherine Kelly (Director – Prevention, Survival and Support, BHF), Dr Mike Knapton (Associate Medical Director, BHF), Alana Laverty (Northern Ireland Representative), Dr Gordon McGregor (Clinical Exercise Physiologist), Dr Joe Mills (BACPR President and Cardiologist), Rachel Owen (Wales Representative), Julie Thomas (Chair of the All Wales Cardiac Rehab Group), Irene Thomson (Scotland Representative, NHS Lothian), Iain Todd (Scotland Representative, NHS Lothian) and Alyson Whitmarsh (Programme Manager, Audit Support Unit, NHS Digital).

Contents

Foreword by the British Heart Foundation (BHF)

The BHF warmly welcomes the 2016 NACR report which has achieved an important national audit milestone by reporting on the quality of CR at a local programme level.

The BHF continues to work with the NACR team to produce data that is of direct importance to patients, NHS providers and commissioners and that demonstrates the clinical outcomes for patients, in order to help shape service innovation that delivers sustained CVD prevention.

At a national level, uptake to cardiovascular prevention and rehabilitation programmes continues to improve and has reached an average of 50% of patients now accessing these vital care and support services. Uptake in England made a 2% positive statistical shift which resulted in 2,238 more patients seen than last year, with Northern Ireland yielding a 9% improvement and Wales moving even further ahead with 17% more eligible patients accessing services. Female patients remain underrepresented across all three nations and many programmes still struggle to recruit older patients.

There are positive exceptions, with some programmes recruiting many more women, but the picture, regionally and locally, is that too many centres are recruiting below the national trend average of 30%.

There are examples of high performing CR programmes demonstrating the quality of the services they deliver. However, significant unacceptable variation below the level of published minimum standards exists at Health Regions and local programme levels. For the first time patient outcomes, at a local programme level, have been reported and reveal variation across a range of patient reported outcomes. The new audit approach applied to patient outcomes, where the extent of improvement or change is benchmarked against national average change for each of the outcomes, has brought forward a robust and meaningful appraisal of how services are performing. There are approximately 50% of high performing services demonstrating real change in smoking cessation, physical activity status, fitness and psychosocial well-being, blood pressure, cholesterol control and health related quality of life. However, there is less improvement and in some cases no change, with respect to BMI.

The BHF continues to offer support to enable health care professionals to share their expertise and showcase good service models and approaches for the benefit of NHS services and patients. The BHF will continue to work with NACR to help support Health Regions, funders and local programmes to commission services that align with the evidence base and deliver optimal outcomes for patients.

I would like to acknowledge the dedication, expertise and skills of the individual members of the multidisciplinary CR teams across England, Northern Ireland and Wales, and their commitment to improving the outcomes and health of cardiac patients. I would also like to acknowledge and thank the team at the University of York and colleagues at NHS Digital for their hard work in producing quality data for NACR.

Dr Mike Knapton
Associate Medical Director, British Heart Foundation

Foreword by the British Association for Cardiovascular Prevention and Rehabilitation (BACPR)

The BACPR fully supports and welcomes the new NACR approach to reporting service level and patient outcomes at a local programme level. We see the sharing of data nationally as a means of demonstrating transparency, which is a reflection of the professionalism of the majority of UK CR teams and the genuine aspiration of all those who are insufficiently resourced to permit data submission. The BACPR aims to support these findings by offering even more educational opportunities for its members and through continued lobbying for appropriate funding in line with our service standards.

Average uptake to CR has finally reached 50% which is something the UK clinical programmes should be proud of as it is one of the highest uptake figures globally.

Overall uptake to CR in England has improved by 2% (now at 49% of eligible patients) across the four diagnosis/treatment groups compared to last year. Northern Ireland uptake is 44% (up by 9%) across all groups with a large increase in uptake for Coronary Artery Bypass Graft (CABG) patients. Wales has seen the largest percentage increase of 17%, meaning that Wales now leads the way with 59% total uptake helped by a huge 92% for Myocardial Infarction and Percutaneous Coronary Intervention (MI and PCI).

The quality of CR delivery is of primary importance to the BACPR as we are the leading organisation offering education and training for CR practitioners in the UK. There is more work needed in supporting clinical teams to overcome barriers in delivering high quality CR, as seen by over 45% of all programmes not meeting national benchmarks, most notably in assessment and timely CR. The continuing shortfall of many programmes in recruiting female and older patients generally is a concern and requires urgent action in the form of more novel and flexible approaches to promoting a sensitive, individualised CR offer.

The extent of change evidenced through patient outcomes at a named programme level in this year's NACR report is something that the BACPR actively champions. The BACPR minimum standards place considerable emphasis on assessment, goal setting and a tailored intervention which is key to delivering meaningful patient outcomes. The extent of patient benefit seen through a benchmarked change in pre and post outcome measures is something that should focus the attention of all CR services since it is likely that these metrics will be viewed in the future as surrogates for programme success.

There is huge variation in the reported quality of CR service delivery and patient outcomes shown in this year's NACR report. This reiterates the need for the NCP_CR which is designed to objectively evaluate certain elements of a registered programme and assess them against an updated set of minimum standards. As a direct consequence of this process, it is hoped that commissioning organisations will align funds and resources to the attainment of national certification and thereby enhance the overall performance of CR across the UK. We aim to continue our strong collaboration with NACR and the BHF in our shared mission, with all CR programmes, to deliver the best possible care and outcomes for patients.

Dr Joe Mills
President BACPR

NACR Executive Summary

This year is the 10th Annual Statistical Report on CR which, for the first time, reports patient outcomes at a named local programme level. The UK continues to lead the world in uptake to rehabilitation and prevention for patients following a cardiac event or procedure, with an average of 50% of patients accessing CR. England's mean CR uptake increased by 2% however, Northern Ireland and Wales are leading the way with a 9% and 17% increase respectively.

In terms of equity of access some progress has been made at a national level since the last report, with slightly more females accessing services at or above the national average of 30%. With 82% of programmes predominantly offering a group based approach, greater innovation in the mode of delivery at a local programme level is required to make CR programmes more attractive.

The NACR strategy of reporting key service indicators and patient outcomes at a local programme level is not without its challenges, as considerable variation exists in the extent by which patients are assessed both pre and post CR. Around 21% of patients that start CR do not undergo a pre CR assessment, and of those that have a pre CR assessment, 23% do not have a follow up (post CR) assessment. Notwithstanding these issues, we still feel confident that our programme level findings on patient outcomes, which are based on 56% of patients with a follow up assessment, are relevant.

Due to the challenges of reporting to a large number of programmes in a paper copy of the report, NACR has produced online supplements for key service indicators at programme level. We have also produced a trial outcome supplement to show the extent by which programmes meet the 150 minutes recommendation for physical activity pre and post CR. This approach reports the extent of change locally against the national average for the UK. The NACR team seeks feedback on the physical activity supplement to help inform reporting of other patient outcomes next year.

At a local service level there are around a third of programmes performing at a high level in terms of service delivery by minimum criteria, and around 42% demonstrating above average change following CR in smoking cessation, psycho-social health, Body Mass Index (BMI) and exercise. However, a worrying 47% fail to meet national CR average trends for these outcomes. Despite austerity it is encouraging to see that many providers show improvements in delivery and outcomes which indicates that high quality CR delivery, with above average outcomes, is achievable.

Key recommendations:

1. Most CR programmes need to recruit a greater proportion of eligible female patients
2. Heart Failure (HF) patients should be seen as a priority group for CR
3. The mode of delivery of CR should be broader than just group based approaches
4. CR should start earlier for all patient groups
5. The frequency and quality of patient assessment before and after CR needs to improve

The NCP_CR continues at pace with more programmes signing up for certification based on service level criteria. What is clear from this annual report and our NACR data is that 42% of CR programmes are close to meeting all service level criteria, meaning that many programmes could, with relatively small improvements in service delivery, meet the NCP_CR criteria and become certified as high performing services.

We wish to thank CR teams for their efforts in the delivery of services to patients and for supplying data to NACR which is essential to achieving our shared aim of high-quality CR.

Report main author: **Professor Patrick Doherty** (Director of the NACR)

Co-authors include:

- Corinna Petre, NACR Project Manager
- Nerina Onion, NACR Training and Information Officer
- Alex Harrison, Health Services Researcher (Analyst)
- Jenny Sumner, Health Services Researcher
- Karen Cardy, Audit and Research Secretary
- Lars Tang, International NACR Representative

The BHF National Audit is hosted at the Department of Health Sciences, University of York, UK.

For further information and contact details please visit our webpage:
British Heart Foundation (BHF) National Audit of Cardiac Rehabilitation
http://www.cardiacrehabilitation.org.uk/

Part one
Introduction and methods

Introduction and methods

The NHS is committed to ensuring that all patients receive the highest quality of care and achieve similar benefits no matter where they live. For CR this is accomplished by comparing data collected by NACR, ideally from all programmes in the UK, with agreed national 'minimum standards' on how best to deliver CR. The NACR is the only national audit collecting data on the quality of care and clinical outcomes for patients taking part in CR following a Myocardial Infarction (MI), Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft (CABG). To fulfil this role NACR needs to collect data from routine clinical practice about the type of service offered and the typical benefits patients achieve. To gain the best possible picture we ideally need data from all eligible patients who are offered CR. The data NACR collects serves two purposes. Firstly, to support local hospital or community based CR teams to generate their own local reports about patient progress and secondly, to enable the national audit to monitor and help improve the quality of CR services across the UK. The data seen by the national audit team does not contain personal details of patients.

The recommendations from NICE Clinical Guidance (CG 172, CG 94 and CG 108) and leading British and European cardiovascular professional associations (BACPR 2012, Piepoli et al 2012), reinforced by the most recent Cochrane Reviews (Anderson et al 2016, Taylor et al 2014), is that CR is effective and should be offered to all eligible patients in a timely and appropriate manner. Set against the rapidly changing nature of cardiology and associated innovation in service delivery, some forms of CR are arguably less effective in the modern era (West et al 2011, Wood 2012, Doherty & Lewin 2012, Dalal et al 2015).

A recent clinical review of CR published in the British Medical Journal (Dalal et al 2015) highlights that CR is highly effective but warns that not all programmes are working to the minimum standards. NACR now has sufficient data and statistical power to report national, regional and local performance against agreed minimum clinical standards (BACPR 2012). NACR also generates routine reports used by clinicians, providers and commissioners to evaluate service provision. Local programmes are able to generate similar reports, from their data, for their service.

In 2016 NACR reports against agreed minimum standards locally and tests the extent by which services deliver quality CR (Furze et al 2016). For the first time, the report will present the extent of patient outcomes at a local service level. Continued debate in the research literature suggests that routine clinical practice might be sub-optimal and may not be deriving the expected outcomes (West et al 2011, Doherty & Lewin 2012). There is also huge variability in what constitutes CR in routine practice prompting the BACPR to set basic minimum standards. Data from routine clinical practice (NACR 2015) showed that CR is (1) being delivered later than recommended (2) is not underpinned by pre and post assessment and (3) is shorter in duration than the evidence would suggest (Anderson et al 2016, NICE 2013, Piepoli et al 2012, Vanhees et al 2012).

The NACR 2016 report will show the extent by which CR programmes meet the agreed clinical minimum standards and set out, for the first time, the typical outcomes achieved by patients following CR at a local programme level.

Methods for collecting data for NACR Annual Statistical Report

Registration and data input through NACR is one of the BACPR national minimum standards which aims to use audit data to quality assure CR delivery and drive service improvement. The NACR uses a quality approach with extensive data checking and validating, which has reduced the burden of matching and cleaning audit data. Through our work with NHS Digital and representatives from England, Northern Ireland and Wales we have aligned data collection with key indicators across regional health boundaries. We continue to work with clinical leaders in Scotland to complete a feasibility study that will hopefully result in their inclusion in NACR in the near future. The NACR 2016 report uses data from 2014-2015 and is now able to report CR uptake for patients following MI, MI and PCI, PCI and CABG across England, Northern Ireland and Wales.

Number receiving CR

Detail about the number of patients receiving CR was achieved by collating data from the NACR electronic database and via the NACR postal survey. Where programmes did not provide data the numbers were estimated using either the previous year's figures for that site (if they confirmed that the service had not changed), or using the median number calculated from those sites that had returned data.

Number eligible for CR

Uptake was calculated for the four diagnosis groups; MI, MI and PCI, PCI and CABG. In order to avoid double counting, patients with an MI and CABG in the same year were counted in the CABG group. Due to national coding variations in reporting HF patient numbers we are unable to derive valid numerator and denominator values across the nations of the UK for this diagnosis.

England

Individual anonymised patient level Hospital Episode Statistics (HES) data was provided by NHS Digital on the number of people with a diagnosis of MI and treatment codes of PCI or CABG. Those with death on discharge recorded were excluded.

Northern Ireland

The Department of Health provided aggregated data on people discharged alive after having an MI, MI and PCI, PCI or CABG.

Wales

NHS Wales Informatics Service provided aggregated data on people discharged alive after an MI, MI and PCI, PCI or CABG.

Other Countries

This includes the Isle of Man and the Channel Islands, which are reported in terms of key service indicators and outcomes where applicable.

Approval process for accessing NHS data for the NACR

NACR, through NHS Digital, has approval (under Section 251 of the NHS Act 2006) from the Health Research Authority's Confidentiality Advisory Group (CAG) to collect patient identifiable data without explicit consent from individual patients. The challenge of gaining patient consent, to use their data for national audit purposes, is extremely difficult and would create a huge burden on services and staff during the management of a heart attack or immediately following surgery. For this reason the NHS has in place an 'exemption from consent' process where clinical and personal data is entered into NHS systems without explicit consent. Patients are informed about the purposes of the audit and how the information will be used through face to face communication, and through the assessment questionnaires that are used to collect data for the audit. There is information on the front of these questionnaires to provide patients with details of why the data is being collected, how it is used, who can see it, and their right to opt out without any effect on their treatment. The Section 251 approval covers the roles of the BHF, NHS Digital and the NACR team and ensures the highest quality procedures for collecting, sharing and using only the agreed data about a patient's CR experience. The approval and the role of the national audit are reviewed each year by CAG.

For more information about NACR please visit our web pages.

British Heart Foundation Cardiac Care and Education Research Group
www.cardiacrehabilitation.org.uk
www.york.ac.uk/healthsciences/research/cardiac

Part two
Uptake to Cardiac Rehabilitation by country

Uptake to Cardiac Rehabilitation by country

The number of patients accessing CR continues to increase in terms of number and scope with post MI, MI and PCI, PCI and CABG representing the core CR population, followed by HF and valve surgery who are increasingly accessing CR (Table 1).

The historic practice of excluding certain patient groups, such as HF, from CR has changed since the release of NICE guidance CG108 (NICE 2010). For example, 91% of CR programmes in the UK now offer it to patients with HF which is a marked difference compared to 2010 when less than 30% of programmes included these patients. However, annually the percentage of HF patients represented in CR programmes, as a proportion of all conventional patients attending CR, is 5% in England, 1% in Northern Ireland and 5% in Wales. Figures for the National HF Audit run by National Institute for Cardiovascular Outcomes Research (NICOR) suggest that around 7% to 18% of patients with a diagnosis of HF are referred to CR from general wards compared to cardiology wards respectively. Survival analysis of patients with HF, referred to CR, demonstrated improved survival compared to patients not referred to CR (National Heart Failure Audit, NICOR 2016).

NHS England CVD Outcomes Strategy (2013) set 33% as the uptake ambition for HF meaning that more needs to be done to optimise referral and create a culture where these patients are routinely referred to CR. Additional work is required by programmes and commissioners of health care in offering suitable modes of CR delivery for this distinctive population. NACR, BHF and BACPR encourage and support CR programmes to pursue innovative service designs based on a strong clinical business case so that 'all eligible patients' can access it. The BHF Alliance supports health professionals to apply best practice and learn from each other **www.bhf.org.uk/healthcare-professionals/best-practice.**

NACR and the BHF are close to implementing the NACR Scotland pilot, initially with the Lothian Health Board, to investigate the inclusion of Scotland's CR programmes into NACR.

Table 1
Number and type of patients starting CR

	NUMBER OF PATIENTS			
	ENGLAND	NORTHERN IRELAND	WALES	OTHER
MI	14,435	617	719	37
MI AND PCI	22,509	777	1,353	94
PCI	12,006	634	539	25
CABG	10,840	441	742	71
HF	3,726	36	248	12
ANGINA	2,771	115	397	12
VALVE SURGERY	4,639	153	455	39
OTHER SURGERY	527	1	23	2
CARDIAC ARREST	206	1	4	3
PACEMAKER	294	3	22	2
IMPLANTABLE CARDIOVERTER DEFIBRILLATOR	607	9	20	1
OTHER	5,587	100	431	2
UNKNOWN	1,297	3	29	-
TOTAL	**79,442**	**2,890**	**4,982**	**300**

Based on data from NACR electronic data entry and the NACR annual survey of programmes

Uptake to Cardiac Rehabilitation (CR) services

UK

The 2016 NACR is pleased to report that the overall mean uptake to CR in the UK has achieved a significant milestone by reaching 50%. This improvement brings the UK into the top 2% of countries in Europe (Bjarnason-Wehrens et al 2010) and practitioners should be proud of the part they have played in making this possible. However, this is not a time to sit back, as the UK remains short of national uptake recommendations for England (Cardiovascular Disease Outcomes Strategy CVDOS 2013), Northern Ireland (CREST 2006), Scotland (SIGN 2002) and Wales (All Wales Cardiac Rehabilitation review 2013).

In 2014-2015 over 87,000 patients took up the offer of CR, including an extra 5,487 compared to the previous year when all patient types are considered (Table 1). This is good news as it shows that programmes are being more inclusive of NICE and BACPR patient groups. Almost 3,000 more post MI, MI and PCI, PCI, CABG patients and a further 363 Angina patients took up CR (Table 1 and 2), which is a significant improvement and has clearly helped push the UK to the 50% uptake rate. The largest volume of patients reside in England yet this year the greatest contribution to the UK increase in uptake has come from Northern Ireland and Wales.

England

Overall uptake to CR in England has improved and now stands at 49% of eligible patients across the four diagnosis/treatment groups receiving CR, with over 2,238 more patients treated compared to last year (Table 2). Uptake in post MI patients has dropped by 1% whereas it has increased by 5% in MI and PCI. The percentage of uptake in patients undergoing planned PCI has increased by 3%, whereas, for patients following CABG surgery it has remained unchanged at 58%.

Northern Ireland

Total uptake to CR in Northern Ireland has increased substantially across all four diagnosis/treatment groups by 9% (35-44%), which has made a significant contribution to UK wide uptake figures. The coding issues reported last year for Northern Ireland patient groups is now resolved and data is aligned with that of the other nations. This has been achieved through the hard work of the five Health and Social Care Trusts and national leads.

Wales

CR uptake in Wales has also increased significantly from 42% to 59% (up by 17%) and has been achieved by the concerted efforts of clinical teams and the seven Welsh Health Boards all working across the clinical networks to prioritise CR for all eligible patient groups. The extent of uptake is evident across all diagnosis/treatment groups with the most notable contribution in post MI and PCI patients.

Table 2
CR uptake split by country and main diagnosis/treatment group

	N	RECEIVING CR	%
UK: COMBINED DATA FOR ALL THREE NATIONS			
MI	W,402	15,771	39
MI AND PCI	42,566	24,639	58
PCI	29,418	13,179	45
CABG	19,891	12,023	60
	132,277	**65,612**	**50**
ENGLAND			
MI	36,193	14,435	40
MI AND PCI	39,679	22,509	57
PCI	26,580	12,006	45
CABG	18,550	10,840	58
	121,002	**59,790**	**49**
NORTHERN IRELAND			
MI	1,844	617	33
MI AND PCI	1,423	777	55
PCI	1,821	634	35
CABG*	489	441	90
	5,577	**2,469**	**44**
WALES			
MI	2,365	719	30
MI AND PCI	1,464	1,353	92
PCI	1,017	539	53
CABG	852	742	87
	5,698	**3,353**	**59**

* Denominator may be abnormally low due to an increased number of patients being referred for CABG outside of NI and therefore not counted

Part three
NACR statistics by country, Health Regions and local programme level

NACR statistics by country, Health Regions and local programme level

In 2016, NACR continues to report by the 24 Health Regions (Table 3) as this best represents the three nations and was associated with the significant changes in uptake reported earlier.

Table 3
Country and Health Regions reported in NACR

COUNTRY	HEALTH REGIONS	NACR REGIONAL ABBREVIATIONS
ENGLAND	CHESHIRE AND MERSEYSIDE	C & M
	EAST MIDLANDS	EM
	EAST OF ENGLAND	E O E
	GREATER MANCHESTER, LANCASHIRE AND SOUTH CUMBRIA	GM, L & SC
	LONDON	L
	NORTHERN ENGLAND	NE
	SOUTH EAST COAST	SEC
	SOUTH WEST	SW
	THAMES VALLEY	TV
	WESSEX	W
	WEST MIDLANDS	WM
	YORKSHIRE AND THE HUMBER	Y & TH
NORTHERN IRELAND	BELFAST HEALTH AND SOCIAL CARE TRUST	BH & SCT
	NORTHERN HEALTH AND SOCIAL CARE TRUST	NH & SCT
	SOUTH EASTERN HEALTH AND SOCIAL CARE TRUST	SEH & SCT
	SOUTHERN HEALTH AND SOCIAL CARE TRUST	SH & SCT
	WESTERN HEALTH AND SOCIAL CARE TRUST	WH & SCT
WALES	ABERTAWE BRO MORGANNWG	ABM
	ANEURIN BEVAN	AB
	BETSI CADWALADR	BC
	CARDIFF AND VALE	C & V
	CWM TAF	CT
	HYWEL DDA	HD
	POWYS TEACHING	PT
OTHER (ISLE OF MAN AND CHANNEL ISLANDS)	-	-

CR programme data by country and Health Regions

The total number of programmes entering data electronically is 226 (72% of all programmes) which is encouraging in terms of coverage. However, large variations exist for all nations and across Health Regions (Table 4), most notably in England. Using data from Tables 1 and 4, the average number of patients starting CR per programme in the UK is 282, with a per country breakdown of 295, 192, and 199 for England, Northern Ireland and Wales respectively.

Table 4
CR programme data by country and Health Regions

COUNTRY	HEALTH REGIONS	CCG* NUMBER	TOTAL PROGRAMMES	ELECTRONIC NACR DATA	% ENTERING DATA
ENGLAND	C & M	12	14	12	86
	EM	20	22	16	73
	E O E	19	28	22	79
	GM, L & SC	20	25	20	80
	L	32	35	26	74
	NE	11	20	3	15
	SEC	20	24	18	75
	SW	11	27	19	70
	TV	10	6	6	100
	W	9	7	7	100
	WM	22	28	17	61
	Y & TH	22	33	20	61
NORTHERN IRELAND	BH & SCT	N/A	3	3	100
	NH & SCT	N/A	4	4	100
	SEH & SCT	N/A	3	3	100
	SH & SCT	N/A	3	3	100
	WH & SCT	N/A	2	2	100
WALES	ABM	N/A	4	4	100
	AB	N/A	4	4	100
	BC	N/A	4	4	100
	C & V	N/A	2	2	100
	CT	N/A	2	2	100
	HD	N/A	4	4	100
	PT	N/A	5	4	80
OTHER		3	3	1	33%
TOTAL		**211**	**312**	**226**	**72**

NB: CCG* Clinical Commissioning Groups.
PT (Powys Teaching Health Board) has been removed from future tables due to insufficient NACR data. See Table 3 for abbreviations

Age and gender profile at country, Health Regions and programme level

In 2015 the BHF highlighted that 24,000 females were missing out on CR which led to a key recommendation to offer more females CR. There has been a slight improvement in that 3,044 more female patients are taking up CR. However, in 2014 to 2015 21,236 eligible females were still missing out. At Health Regions 61% of programmes are recruiting at or above the national expectation of 30% of females across all condition groups (Table 5, Figure 1). At the point of accessing CR, mean age for males is 66 years which is significantly lower compared to females at 70 years of age. The age range is fully representative of an adult population which includes patients from 18 to 106 years of age. Published research, using NACR data, has found that CR programmes are more likely to yield benefit across a greater number of risk factors in younger (<65 years) than older (> 65 years) patients (Al Quait and Doherty 2016). These findings suggest that CR programmes should ensure that the intervention is tailored to meet the needs of older patients across a wider range of core components.

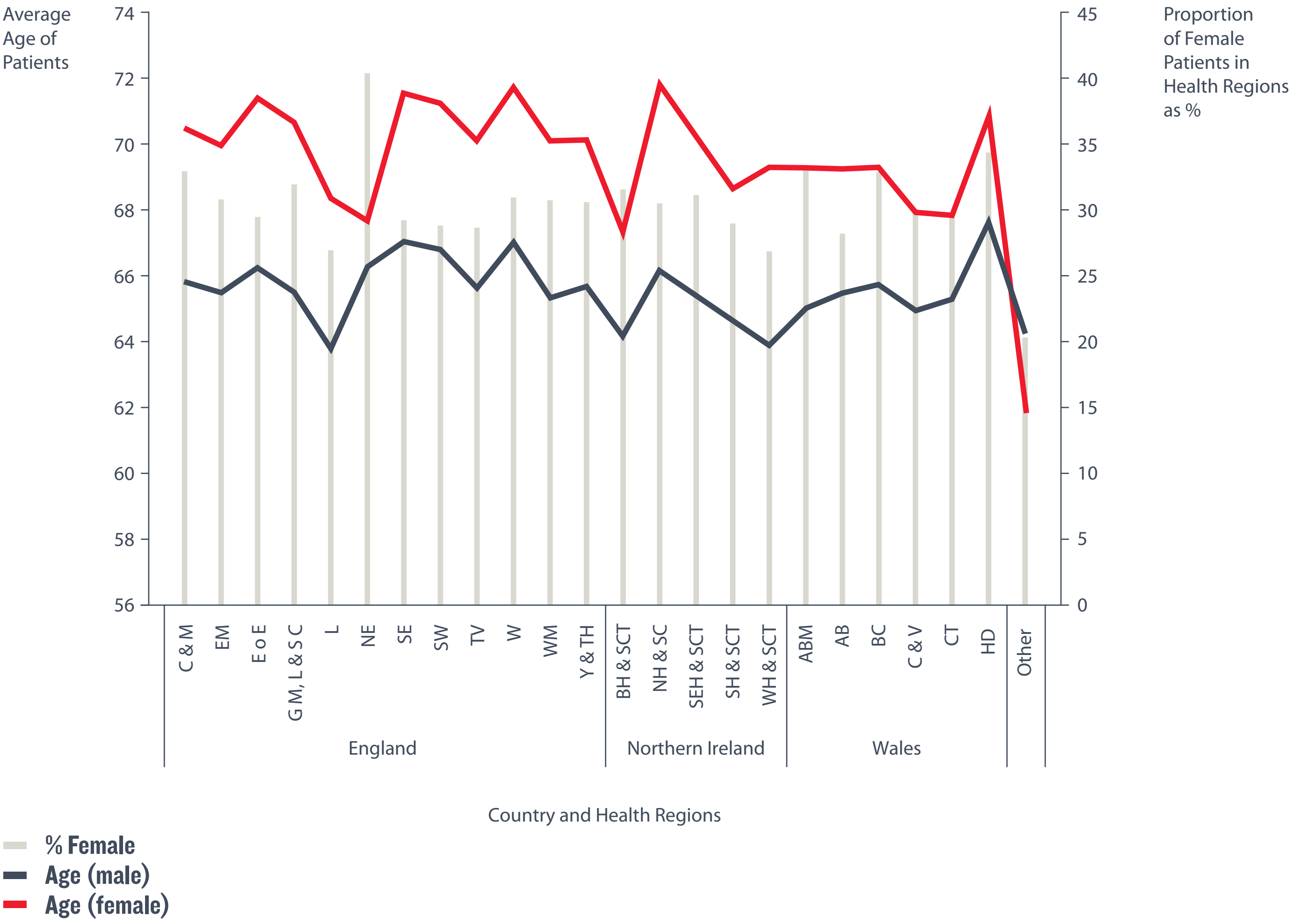
Table 5
NACR demographics for age and gender by country and Health Regions

				MALE		FEMALE		AGE
COUNTRY	HEALTH REGIONS	N	AGE	%	AGE	%	MINIMUM	MAXIMUM
ENGLAND	C & M	6,641	66	67	70	33	18	100
	EM	5,747	66	69	70	31	20	101
	E O E	8,354	66	71	71	29	18	100
	GM, L & SC	12,387	66	68	71	32	18	103
	L	13,829	64	72	68	28	18	101
	NE	310	66	60	67	40	18	92
	SEC	6,912	67	71	71	29	19	106
	SW	7,154	67	71	71	29	18	100
	TV	3,282	66	71	70	29	18	103
	W	6,920	67	69	72	31	18	102
	WM	7,261	65	69	70	31	18	99
	Y & TH	4,924	66	70	70	30	20	100
NORTHERN IRELAND	BH & SCT	1,609	64	68	67	32	20	101
	NH & SCT	933	66	70	72	30	22	95
	SEH & SCT	931	65	69	70	31	29	97
	SH & SCT	811	64	71	69	29	19	97
	WH & SCT	581	64	73	69	27	29	96
WALES	ABM	676	65	67	69	33	20	94
	AB	1,059	66	72	69	28	19	95
	BC	2,018	66	67	69	33	20	97
	C & V	1,252	65	70	68	30	22	94
	CT	634	65	71	68	29	24	96
	HD	850	68	66	71	34	30	94
OTHER		104	64	80	62	20	33	86
TOTAL		**95,181**	**66**	**70**	**70**	**30**	**18**	**106**

See table 3 for health region abbreviations.

Figure 1

Proportion of male and female patients across UK nations and Health Regions



Ethnicity, employment and marital status

The UK CR ethnicity remains predominately white British male (Table 6) although there is substantial variability at regional and local level. We believe that significant variation in ethnic profile may have implications for how CR programmes are resourced (e.g. translation and interpreter costs). NACR has produced an online supplement showing local level variation in ethnicity available from **http://www.cardiacrehabilitation.org.uk/current-annual-report.htm**

Table 6

Ethnicity by gender

ETHNICITY	%	MALE %	FEMALE %
BRITISH	79	70	30
IRISH	3	69	31
ANY OTHER WHITE BACKGROUND	4	72	28
WHITE AND BLACK CARIBBEAN	<1	70	30
WHITE AND BLACK AFRICAN	<1	74	26
WHITE AND ASIAN	<1	77	23
ANY OTHER MIXED BACKGROUND	<1	68	32
INDIAN	2	76	24
PAKISTANI	2	71	29
BANGLADESHI	1	80	20
ANY OTHER ASIAN BACKGROUND	1	80	20
CARIBBEAN	1	58	42
AFRICAN	<1	70	30
ANY OTHER BLACK BACKGROUND	<1	69	31
CHINESE	<1	70	30
ANY OTHER ETHNIC GROUP	1	73	27
NOT STATED	5	71	29
TOTAL	**100**	**70**	**30**

N= 79,008

The dominant social demographic of CR is married (70%) and the remaining categories range from 1% to 11% for the other marital status groups (Table 7). The situation for employment status is mostly retired (56%), followed by employed at 27% when part time and full time employment is combined (Table 8).

A recently published paper by the BHF research group in York, using CR completion data from NACR, found that employment status - in this case 'being unemployed' - was associated with poorer outcomes following CR (Harrison et al 2016). Further research is being conducted by the BHF research group in York on factors that determine the completion of CR which will be published in the spring of 2017.

Table 7
Marital status

MARITAL STATUS	%
SINGLE	9
MARRIED	70
PERMANENT PARTNERSHIP	4
DIVORCED	5
WIDOWED	11
SEPARATED	1
TOTAL	**100**

N=60,414

Table 8
Employment status

EMPLOYMENT STATUS	%
EMPLOYED FULL-TIME	16
EMPLOYED PART-TIME	4
SELF-EMPLOYED FULL-TIME	5
SELF-EMPLOYED PART-TIME	2
UNEMPLOYED - LOOKING FOR WORK	2
GOVERNMENT TRAINING SCHEME	<1
LOOKING AFTER FAMILY/HOME	2
RETIRED	56
PERMANENTLY SICK/DISABLED	4
TEMPORARILY SICK OR INJURED	8
STUDENT	<1
OTHER REASONS FOR NOT WORKING	1
TOTAL	**100**

N= 29,635

Morbidities profile

The profile of CR patients is becoming increasingly multi-morbid across a range of different conditions (Table 9). This is an important consideration when carrying out baseline assessments and tailoring an intervention for patients. This is something the BACPR (2012) continues to emphasise as best managed by a multidisciplinary team approach.

The most dominant morbidity conditions are CVD in origin, followed by diabetes and then a combination of respiratory conditions. Previous NACR data analysis (NACR 2013) has shown that an increasing number of morbidities are associated with reduced outcomes following CR compared to patients with fewer morbidity conditions.

Table 9
Morbidities profile for CR

MORBIDITY CATEGORY	WITH 2 OR MORE
	%
ANGINA	24
ARTHRITIS	18
CANCER	9
DIABETES	30
RHEUMATISM	3
STROKE	8
OSTEOPOROSIS	3
HYPERTENSION	62
CHRONIC BRONCHITIS (COPD)	5
EMPHYSEMA	4
ASTHMA	10
CLAUDICATION	3
CHRONIC BACK PROBLEMS	10
ANXIETY	6
DEPRESSION	7
FAMILY HISTORY OF CVD	29
ERECTILE DYSFUNCTION	3
HYPERCHOLESTEROLAEMIA/DYSLIPIDEMIA	42
OTHER MORBIDITY	36

N= 39,095

Reasons for not taking part in CR

NACR, in collaboration with CR programmes, has prioritised the completion of the 'reasons for not taking part in CR' data field which has resulted in almost 10,000 extra patient responses compared to last year. Of the 33,246 patients with a record across all aspects of the patient journey, the main reason for not taking part in CR was a lack of interest (31%) followed by Did Not Attend (DNA)/no contact at 11% (Table 10). As stated in previous NACR reports, some patients may genuinely not be interested in CR. However, this should not be seen as an excuse, instead providers should positively offer a range of attractive CR programme options preferably matched to patient preferences (Dalal et al 2007). A menu based approach is a logical way to increase uptake. As reported earlier, females are poorly represented generally across CR and positive action is required by clinical teams to try and remedy this situation. The number of responses informing the 'reasons for not taking part' analysis was distributed proportionally between males and females.

Table 10
Reasons for not taking part in CR

REASON FOR NOT TAKING PART	ACUTE HOSPITAL	INTERMEDIATE	CORE DELIVERY*	LONG TERM MAINTENANCE
	%	%	%	%
PATIENT NOT INTERESTED/REFUSED	14	27	39	40
ONGOING INVESTIGATION	1	3	5	3
PHYSICAL INCAPACITY	4	5	9	13
RETURNED TO WORK	<1	1	3	4
LOCAL EXCLUSION CRITERIA	4	7	3	<1
LANGUAGE BARRIER	<1	<1	<1	0
HOLIDAYMAKER	7	<1	1	<1
MENTAL INCAPACITY	3	1	1	<1
NO TRANSPORT	<1	1	1	1
DIED	4	5	2	2
NOT REFERRED	7	1	<1	1
TOO ILL	4	3	4	1
REHAB NOT NEEDED	7	5	3	6
REHAB NOT APPROPRIATE	10	9	8	15
STAFF NOT AVAILABLE	6	<1	<1	<1
RAPID TRANSFER TO TERTIARY CARE	4	<1	<1	0
DNA/NO CONTACT	5	21	10	7
TRANSFER TO ANOTHER PROGRAMME	2	3	3	<1
NO SERVICE AVAILABLE	<1	<1	<1	<1
TRANSFER FOR PCI/TREATMENT	1	<1	<1	0
TRANSFER TO DGH/TRUST	3	1	1	<1
OTHER	12	4	5	5
UNKNOWN	1	2	1	1
TOTAL	**100**	**100**	**100**	**100**
	N=7,874	N=5,925	N=18,288	N=1,159

* UK Core Delivery (previously known as phase III) is equivalent phase II in Europe

Reasons for not completing CR

The percentage of patients that start and then finish core CR is 77%, which represents a positive situation for UK CR. Most well-resourced clinical trials work to a dropout rate of 20-30% between pre and post CR which suggests that routine practice, as delivered in the UK, has good adherence.

The data on reasons for patients not completing CR (N= 10,481 patients) in this period has started to be entered more accurately than previous years. However, with 2,825 patients (35%) with 'DNA/unknown reason' for core delivery, such data remains descriptive at this stage (Table 11). As the data quality on non-completion improves, NACR aims to do more in-depth analysis to help determine which factors influence the likelihood of completing CR.

Table 11
Reasons for not completing CR

REASON FOR NOT COMPLETING	ACUTE HOSPITAL	INTERMEDIATE	CORE DELIVERY*	LONG TERM MAINTENANCE
	%	%	%	%
DNA/UNKNOWN REASON	<1	34	35	72
RETURNED TO WORK	1	2	7	5
LEFT THIS AREA	8	4	2	2
ACHIEVED AIMS	0	0	<1	0
PLANNED/EMERGENCY INTERVENTION	19	4	2	0
TOO ILL	9	9	13	8
DIED	36	7	2	0
OTHER	25	33	32	9
HOSPITAL RE-ADMISSION	<1	3	2	0
UNKNOWN	1	4	5	5
* UK Core Delivery (previously known as phase III) is equivalent phase II in Europe	N=847	N=1,495	N=8,074	N=65

Mode of delivery in modern UK CR

Increasing variation in the mode of delivery of CR is highlighted as a potential solution to poor uptake and high levels of dropout (Dalal et al 2015). Over the last three years the dominant mode of delivery in the UK is group based, with home based remaining at 10% (Table 12). Facilitated home based options such as the Heart Manual are proven to work, yet have not increased their share in the UK. In patients with HF the primary mode of delivery is also group based with even fewer services supporting home based. More should be done to support these options as part of the menu of approaches offered by programmes, as this can only help to improve uptake and adherence to CR. Web based options are presently being used by around 1% of patients and hopefully this approach will become more attractive as ongoing clinical trials are published. The 'other' approaches reported by CR teams (Table 12) reflect a range of ward based and community contacts delivered face to face or via phone calls, but these approaches do not align with formal facilitated or evidence based methods.

Table 12
Mode of delivery of CR

MODE OF DELIVERY	PERCENTAGE ATTENDANCE	
	ALL DIAGNOSIS/ TREATMENT GROUPS	HF
GROUP BASED	82	73
HOME BASED	10	7
WEB BASED	1	1
OTHER	7	19

N=32,140 patients with a mode of delivery completed

Part four

Analysis based on national minimum standards

Analysis based on national minimum standards

Results from BHF-led research, using NACR data, has shown that timely CR is associated with greater patient benefit compared to CR offered late (Fell et al 2016). The BACPR (2012) and NICE service guidance (CMG 39 & 40) recommend that CR programmes should be offered early, and underpinned by assessment prior to and on completion of CR. The duration and frequency of CR, based on NICE guidance (NICE CG 172, 2013) and Cochrane Review (Anderson et al 2016) should ideally be twelve weeks (or no less than eight weeks) at a frequency of twice per week. The CR team should be multi-disciplinary with professionals that possess the skills and competences to support patients in achieving the desired health behaviour change and to enable these same skills, in patients and their carers, as part of a long term self-management approach (BACPR 2012).

Local reporting of demographics: age and gender distribution by centres

The ability of local CR programmes to recruit to the national average age (66 years for male and 70 years for females) is, for most, encouraging (Figure 2) although some programmes appear to be recruiting patients ten years below the national average value.

Figure 2
Age and gender distribution by programme

There are some positive changes in the recruitment of female patients compared to last year yet substantial unacceptable variation still remains. The number of programmes meeting the national average value for recruitment of females (30%) has increased slightly. Given the success of some programmes, it appears that others continue to offer a service that is clearly not attractive to females. NACR plans to investigate which factors determine the likelihood of female participation in CR, the results of which will be shared with programmes in the coming year.

Is CR delivered early enough to meet national guidance?

Published research, using NACR data, has found that timely CR is associated with greater patient benefit compared to when it is offered late (Fell et al 2016). Table 13 shows that most Health Regions are meeting the two national mean wait-time targets (33 days and 46 days) from referral to starting CR.

Table 13
Time from referral to start of CR by country, Health Regions and diagnosis/treatment

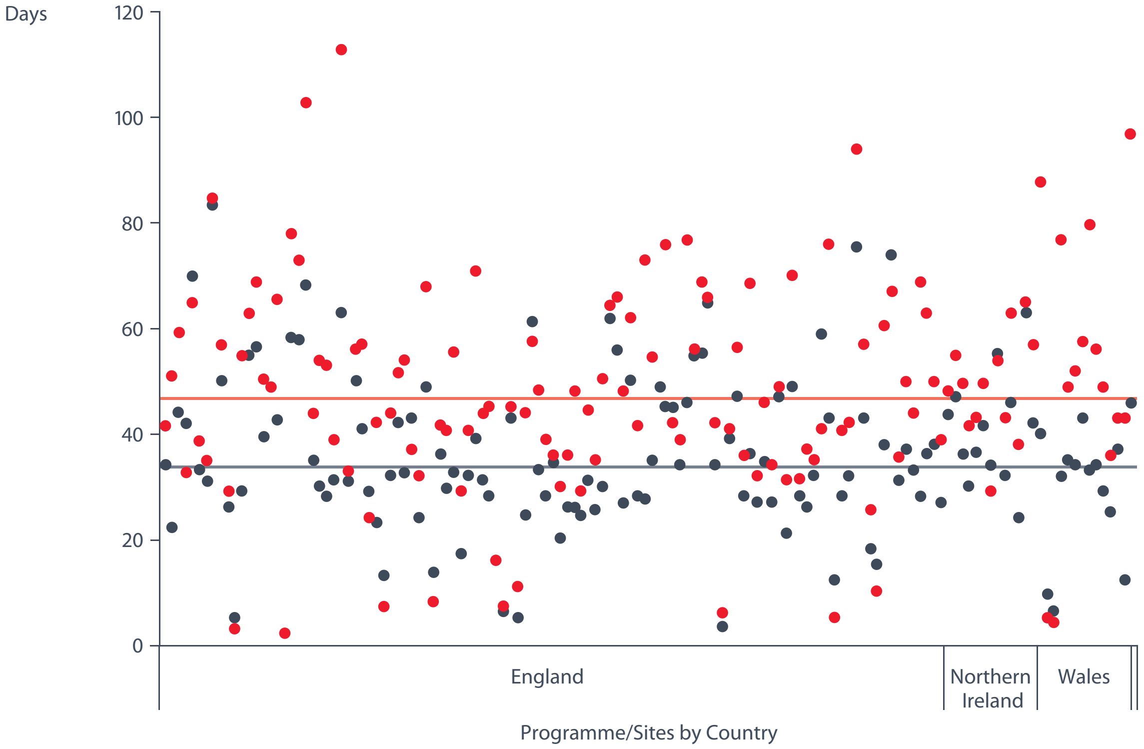
COUNTRY	HEALTH REGIONS	MI AND/OR PCI (33 DAYS)	CABG (46 DAYS)
ENGLAND	C & M	38 -	54-
	EM	41-	52-
	E O E	29+	47-
	GM, L & SC	28+	41+
	L	39-	50-
	SEC	33+	39+
	SW	34-	41+
	TV	30+	54-
	W	43-	55-
	WM	34-	46+
	Y & TH	23+	38+
NORTHERN IRELAND	BH & SCT	41-	54-
	NH & SCT	38-	PARTIAL
	SEH & SCT	40-	57-
	SH & SCT	42-	PARTIAL
	WH & SCT	35-	PARTIAL
WALES	ABM	34-	50-
	AB	31+	43+
	BC	8+*	4+*
	C & V	35-	48-
	CT	31+	78-
TOTAL		**33+**	**46+**

N=26,907
– criteria not met, + criteria met
* figures confirmed by clinical team lead
NE, HD and Other have been removed due to insufficient NACR data
See table 3 for health region abbreviation list.

However, the trend at local programme/site level (Figure 3) shows considerable variation, most notably for MI and/or PCI patients, where 50% of programmes fail to meet the 33 day national average. Despite emerging research that showed bypass patients can safely commence CR earlier than existing guidelines recommend (Eder et al 2010), around 48% of CABG patients are waiting longer than 46 days (national average) before starting CR (Figure 3). Compared to last year, local reporting trends improved showing that, within one audit year, subtle changes in referral and CR assessment timing by programmes can make a significant difference to their performance in NACR.

In order to support innovations in service delivery the BHF Alliance offers programmes the ability to share practice. **https://www.bhf.org.uk/healthcare-professionals/bhf-alliance**

Figure 3
Time from referral to start of CR by programme



● MI/PCI median wait time
● CABG median wait time
▬ MI/PCI national average 33 days
▬ CABG national average 46 days

Proportion of patients starting CR with a record of pre and post CR assessment

The good news is that 79% of patients that started CR had some form of baseline assessment, which is a 3% improvement on last year. This 3% gain was also seen at post CR assessment (Table 14 and Figure 4). The bad news is that only 56% of patients that started CR had a follow up assessment, with a range from zero to 84% for assessment 2 across the Health Regions. The BACPR and numerous clinical guidance and position statements stress the importance of pre and post CR assessment, and these are seen as essential if patients are to experience a tailored intervention and derive the expected outcomes.

The percentage of patients assessed at baseline with a concomitant follow up assessment has improved by 18% on last year (now at 71%) however for the remaining 29% there is no way of knowing if the tailored intervention was successful.

The percentage of completion, based on those patients with a recorded CR start and completion is 77%. Although there is a 6% reduction in the completion rate compared to last year, this is due to increased completeness and data quality. There was a 5,390 increase in the number starting and 5,012 increase in the number of reasons for not completing CR. There was also an actual increase in the number of patients completing CR (661 patients) compared to last year. This new level of data will allow NACR to carry out a more detailed analysis of factors influencing completion rates.

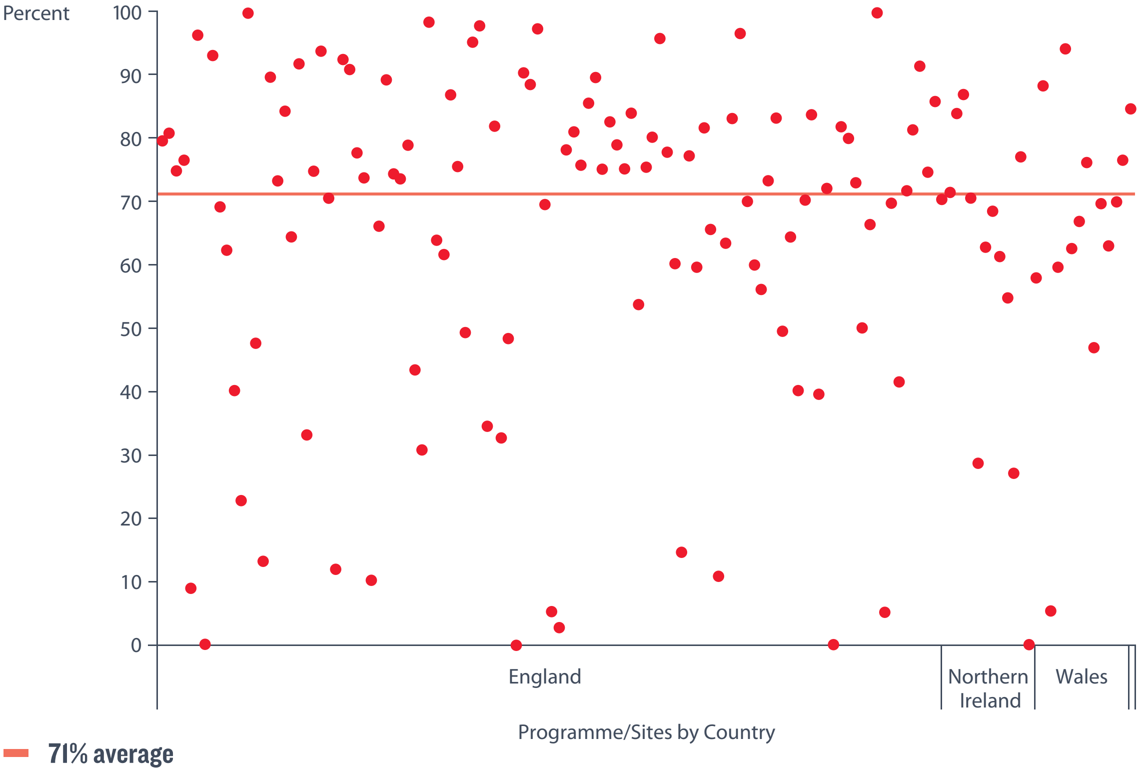
Table 14
Percentage starting CR with a record of pre and post assessment by Health Regions

COUNTRY	HEALTH REGIONS	STARTING REHABILITATION (N)	% WITH PRE (ASSESSMENT 1)	% WITH POST (ASSESSMENT 2)	% OF ASSESSMENT 1 WITH ASSESSMENT 2
ENGLAND	C & M	2,729	82	64	77
	EM	1,951	51	40	78
	E O E	5,000	77	58	76
	GM, L & SC	5,919	75	42	57
	L	5,150	85	61	71
	SEC	3,503	82	60	74
	SW	4,396	91	61	67
	TV	1,424	86	70	81
	W	3,028	92	61	66
	WM	4,022	69	59	85
	Y & TH	2,264	86	70	81
NORTHERN IRELAND	BH & SCT	525	99	76	77
	NH & SCT	592	97	70	72
	SEH & SCT	477	83	61	73
	SH & SCT	316	91	44	48
WALES	ABM	381	82	54	66
	AB	970	96	67	70
	BC	1,587	41	18	43
	C & V	313	90	69	76
	CT	433	61	42	68
	HD	386	79	53	68
OTHER		107	99	84	85
TOTAL		**45,601**	**79**	**56**	**71**

England N=39,402, Northern Ireland N=2,022, Wales N=4,070, Total N=45,601 (includes Other)
NE and WH & SCT have been removed due to insufficient NACR data
See table 3 for health region abbreviations.

These values will differ from the total eligible number as they are based on electronic NACR data only.
See Table 3 for abbreviations.

Figure 4
Percentage of patients with a pre and post CR assessment by programme



▬ **71% average**

Is the duration of CR meeting national guidance?

One of the principle components of effective CR is successful behaviour change as applied to exercise training, physical activity, risk factor management and psycho-social wellbeing, and this requires time to achieve. The most recent Cochrane Review (Anderson et al 2016) of 63 clinical trials found that the median duration was 6 months (range 1 to 48 months). In routine clinical practice, where funding is more likely to be a determinant of CR duration, the range is three months in the USA, five months in Canada and recommended at a minimum of twelve weeks across Europe. In all these countries the preferred frequency is two to three formal sessions per week (Suaya et al 2007, Vanhees et al 2012). What is clear from this is that duration, at or above twelve weeks, is common to successful CR programmes which in essence give patients sufficient time to make the required lifestyle changes.

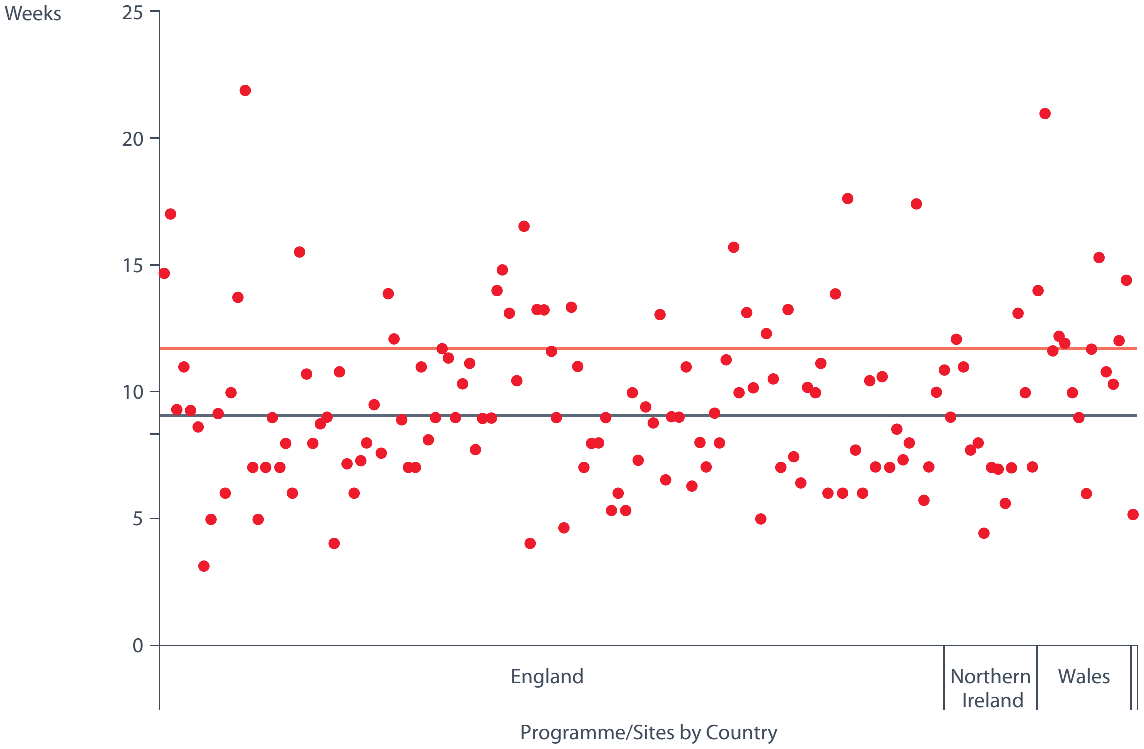
The median national duration of CR in the 2016 report is 63 days (9 weeks) which has increased by three days on average since last year (Table 15). At a local level 56% of programmes met or exceeded the nine-week median duration and 20% met or exceeded 12 weeks which is heading in the right direction. However, 9% of programmes were delivered at a duration below six weeks which is deemed as too short a duration to be effective (Figure 5).

Table 15
Median length of CR (days)

COUNTRY	HEALTH REGIONS	TOTAL PROGRAMME DURATION
ENGLAND	C & M	63
	EM	49
	E o E	63
	GM, L & SC	63
	L	62
	SEC	56
	SW	63
	TV	63
	W	53
	WM	81
	Y & TH	82
NORTHERN IRELAND	BH & SCT	64
	NH & SCT	49
	SEH & SCT	70
	SH & SCT	42
	WH & SCT	49
WALES	ABM	64
	AB	82
	BC	119
	C & V	57
	CT	84
	HD	86
TOTAL		63

N=31,989
NE and Other have been removed due to insufficient NACR data
See table 3 for health region abbreviations.

Figure 5
Duration of CR by programme



▬ Average duration 9 weeks
▬ 12 week recommendation

Summary of CR programmes against national averages: service delivery performance indicators

For the 66% of programmes that report data on service level measures the overall performance of CR programmes, in terms of CR delivery, is at or above national expectations (based on national averages) across the four performance indicators (Table 16). Although the above trend is encouraging, around a third of programmes have insufficient quality data submitted to be included in the analysis. The percentage of programmes that failed to meet performance indicators (the unmet category) remains unacceptably high. With relatively small changes to service delivery, such as reducing the waiting times from referral to starting CR, many programmes/sites could meet or exceed the minimum standards criteria.

Table 16

Percentage of programmes achieving key service performance indicators: averages

KEY PERFORMANCE INDICATORS		CR PROGRAMMES/SITES		
	NATIONAL AVERAGE	UNMET %	MET %	TOTAL
REFERRAL TO START MI/PCI	33 (DAYS)	50	50	136
REFERRAL TO START CABG	46 (DAYS)	48	52	125
DURATION	63 (DAYS)	44	56	143
PERCENTAGE OF PATIENTS WITH A FOLLOW UP ASSESSMENT	71%	45	55	133

Is CR delivered by a multi-disciplinary team as recommended by national guidance?

CR is best delivered by a multi-disciplinary team (MDT) of skilled and experienced staff (BACPR 2012) who aim to support a multi-morbid patient population to achieve optimal outcomes from CR (Table 9). The overall range of professionals supporting CR is comprehensive, however, the variation across different countries is considerable (Table 17).

The upward trend, seen in previous years, of having more dieticians, psychologists and pharmacists has dipped this year with reductions of 5%, 4% and 5% respectively. The situation for secretarial support is particularly challenging with a 15% drop in their involvement evidenced in England and Wales.

On the plus side, there was an upward trend for greater involvement of occupational therapists (5%) and physiotherapists (3%).

A more detailed breakdown of CR staffing by programme/site is available on the NACR webpage.
http://www.cardiacrehabilitation.org.uk/current-annual-report.htm

Table 17
Staffing profile for CR programmes across the UK

CATEGORY	ENGLAND		NORTHERN IRELAND		WALES		UK TOTAL	
	N	%	N	%	N	%	N	%
NURSE	214	97	12	92	18	100	247	97
PHYSIOTHERAPIST	143	65	12	92	16	89	173	68
DIETITIAN	112	51	9	69	9	50	132	52
PSYCHOLOGIST	32	14	4	31	0	0	36	14
SOCIAL WORKER	2	1	0	0	0	0	2	1
COUNSELLOR	16	7	0	0	2	11	18	7
DOCTOR	21	10	2	15	0	0	23	9
HEALTH CARE ASSISTANT	33	15	2	15	0	0	35	15
SECRETARY	134	61	9	69	10	56	154	60
ADMINISTRATOR	19	9	0	0	0	0	19	7
EXERCISE SPECIALIST	124	56	0	0	7	39	131	51
OCCUPATIONAL THERAPIST	72	33	4	31	12	67	89	35
PHARMACIST	85	38	10	77	5	28	102	40
PHYSIOTHERAPY ASSISTANT	59	27	2	15	2	11	64	25
	N=221		N=13		N=18		N=255	

Part five

Evaluation of patient outcomes following CR by country, Health Regions and local programme

Evaluation of patient outcomes following CR by country, Health Regions and local programme

A major change in this year's report is the growing emphasis on local programme level outcomes. The aim is to reveal high and low levels of performance that are often masked by regional and national reporting approaches. In order to achieve this we have created a new graphical approach at local programme level that shows baseline values of the measure (e.g. percentage of non-smokers in a programme) in one colour with the percentage change following CR as a different colour using the same graphical bar.

Analysis of CR contribution to smoking cessation

Supporting patients to stop smoking remains a top priority and there are some programmes doing rather well at it with 12% of patients stopping smoking following CR whilst other programmes are not demonstrating any change. The ability to report the extent of change is made increasingly difficult as the total number of patients entering CR as non-smokers is on average 94% (range 79% to 100%) which is the highest it has been in the last six years (Table 18, Figure 6). The CR contribution to smoking cessation at a national level remains positive with a 1% percentage point change. However, the burden in terms of the percentage of smokers and the ability to support patients with quitting smoking varies across the 24 Health Regions.

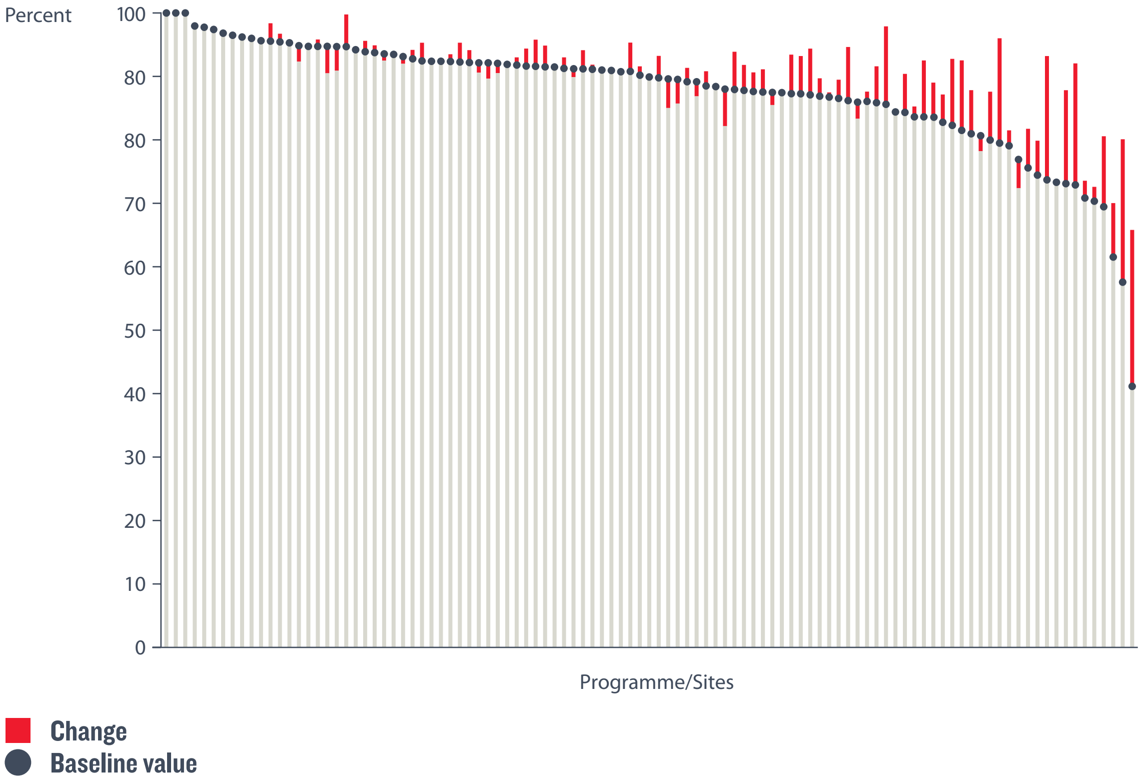
The situation at a local level (Figure 6) is of more of a concern with ten programmes showing a negative impact. The scale of the challenge, in terms of smoking status, at the point patients enter CR, is very different from programme to programme. For instance, in three programmes 100% of patients are not smoking, whereas in one other programme 21% of patients at baseline are still smoking. This makes any comparison of change at a programme level difficult to judge, as the scope for change is non-existent in some and much greater in those programmes with initially high levels of smoking. That said, negative outcomes at a programme level should not be condoned, and every effort should be made to use evidence based smoking cessation approaches with patients that are smoking at the start of CR.

Table 18
Percentage of non-smokers

COUNTRY	HEALTH REGIONS	PRE %	POST %	% POINT CHANGE
ENGLAND	C & M	93	94	2
	EM	91	91	0
	E O E	95	95	0
	GM, L & SC	95	96	1
	L	95	96	1
	SEC	96	97	1
	SW	94	96	2
	TV	95	96	1
	W	94	96	2
	WM	90	95	5
	Y & TH	88	91	2
NORTHERN IRELAND	BH & SCT	91	92	1
	NH & SCT	88	96	8
	SEH & SCT	94	94	0
	SH & SCT	97	98	2
WALES	ABM	96	97	1
	AB	94	93	-1
	BC	97	97	0
	C & V	98	98	0
	HD	98	98	0
OTHER		92	92	0
TOTAL		**94**	**95**	**1**

England N=16,350, Northern Ireland N=995, Wales N=1,132, Total N=18,560 (includes Other)
NB: NE, WH & SCT, CT, and PT are not shown in any outcomes tables as there is insufficient data.
See Table 3 for abbreviations. In all of the following tables the total percentage may be slightly above 100% due to rounding.

Figure 6
Percentage change in non-smokers post CR by programme



Analysis of CR contribution to physical activity status

The achievement of 150 minutes per week of moderate intensity physical activity is a recommendation from the Chief Medical Officers (CMOs) across all nations in the UK, and is a basic minimum standard requirement for the BACPR (2012). At a national level, for the period 2014 to 2015, 40% of patients starting CR met the recommendation of 150 minutes which increased to 70% following CR (Table 19). The percentage change across all Health Regions ranged from 14% to 56% which paints a positive picture, however, the situation from a local perspective is quite different with a range from zero change to 87% following CR (Figure 7). The scale of challenge in terms of physical activity status, at the point patients enter CR, is very different from programme to programme. For instance, in one programme only 4% of patients met the 150 minute recommendation, at baseline, compared to 76% in another programme. This makes any comparison of change at a programme level difficult to judge, as the scope for change is, on the one hand, potentially greater in those programmes with low levels of physical activity status but, on the other hand, these patients may have habituated being less active which could mean they are less likely to change. The same could also be applied to those less active patients in the high baseline groups as they too may be hardened to change.

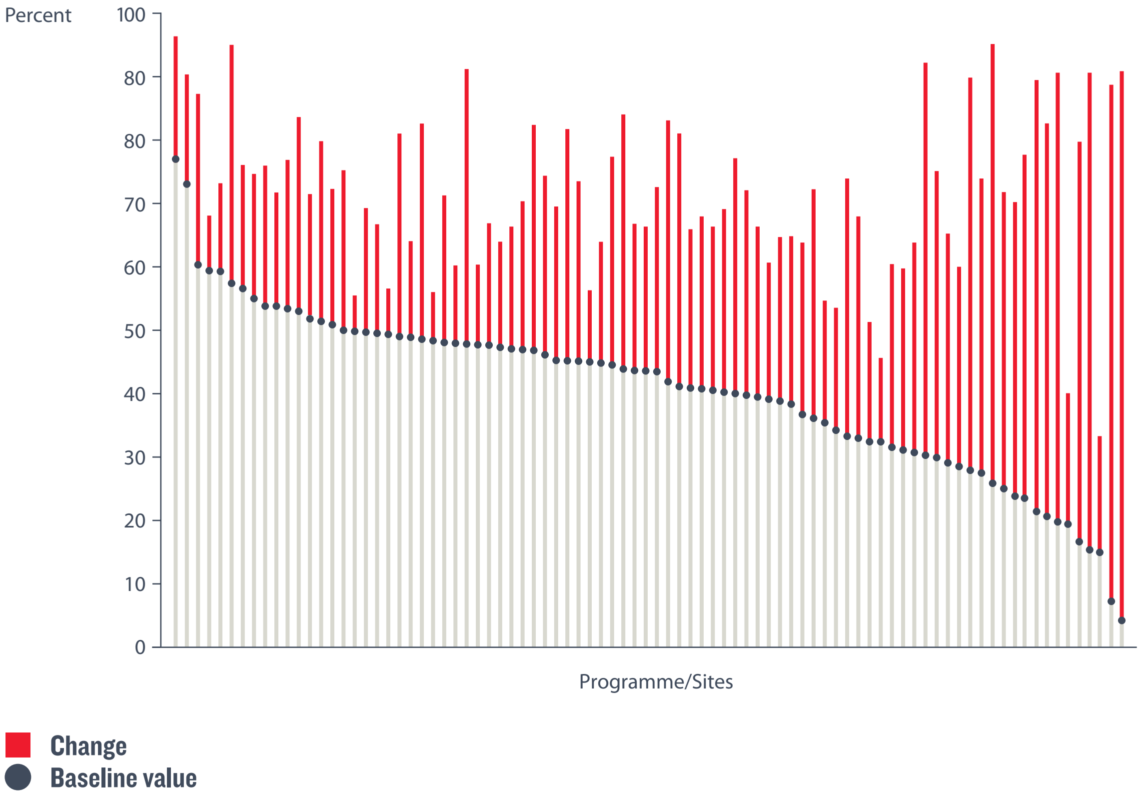
With the above note of caution in mind NACR has produced a numeric online supplement for change in physical activity status (150 minutes per week) following CR at a named programme level. The NACR is keen to receive feedback on this new approach as we intend to apply a similar approach to this and other patient outcomes in next year's report. The report is available from **http://www.cardiacrehabilitation.org.uk/current-annual-report.htm.**

Table 19
Change in physical activity status (150 minutes per week) following CR by Health Regions

COUNTRY	HEALTH REGIONS	PRE %	POST %	% POINT CHANGE
ENGLAND	C & M	33	66	32
	EM	32	51	20
	E O E	41	73	32
	GM, L & SC	45	73	29
	L	38	69	31
	SEC	41	74	32
	SW	50	73	23
	TV	46	73	27
	W	46	76	30
	WM	38	81	44
	Y & TH	30	49	19
NORTHERN IRELAND	BH & SCT	33	73	40
	NH & SCT	39	68	29
	SEH & SCT	25	81	56
	SH & SCT	67	90	24
WALES	ABM	37	64	27
	AB	38	67	30
	BC	18	69	51
	C & V	44	76	32
	HD	46	60	14
OTHER		51	96	45
TOTAL		**40**	**70**	**30**

England N=12,122, Northern Ireland N=625, Wales N=922, Total N=13,749 (includes Other)
See table 3 for health region abbreviations.

Figure 7
Change in physical activity status (150 minutes per week) following CR by programme



Analysis of CR contribution to Body Mass Index (BMI)

Weight management and the achievement of a BMI of <30 continues to be a difficult milestone for CR (Table 20 and Figure 8) with close to zero percentage change in the total population achieving a BMI <30 across most regions. The high performing regions are countered by the five low performing regions (with a negative effect post CR). This is even more disappointing when reported locally as 36 programmes generated negative BMI status following CR.

If we move away from BMI category to actual mean change in BMI there is an overall improvement of 0.4 Kg/m2 which, albeit in the right direction, is insufficient to move most patients from a BMI value above 30 to below 30.

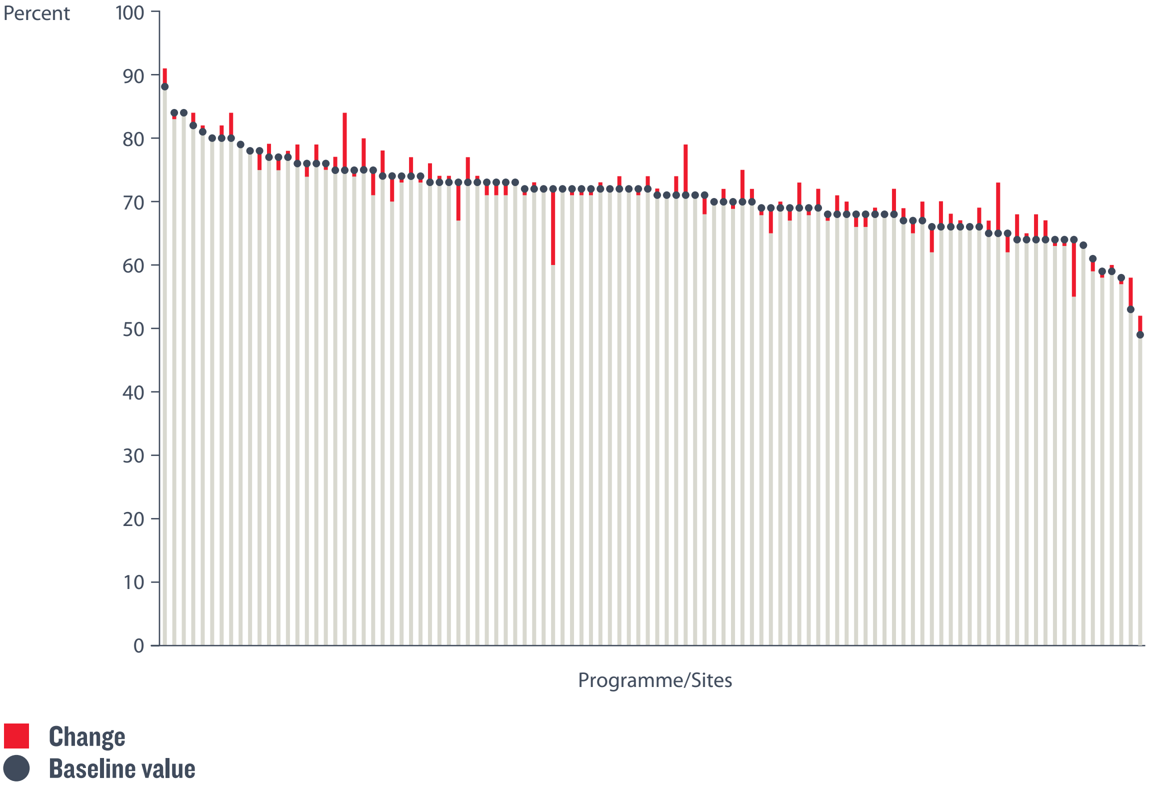
There are, however, additional factors to take account of before drawing conclusions about the performance of CR programmes in supporting weight management. The prevalence of smokers per programme is important, as it is known that patients trying to quit smoking are likely to put on between 3 to 5 kg of weight (Aubin et al 2012) in the first 3 months to a year.

Table 20
Percentage of patients with BMI <30 pre and post CR

COUNTRY	HEALTH REGIONS	PRE %	POST %	% POINT CHANGE
ENGLAND	C & M	68	68	0
	EM	68	66	-2
	E O E	70	71	1
	GM, L & SC	74	75	1
	L	73	72	-1
	SEC	73	74	1
	SW	72	73	2
	TV	68	69	2
	W	74	75	2
	WM	66	67	1
	Y & TH	69	69	-1
NORTHERN IRELAND	BH & SCT	63	61	-2
	NH & SCT	60	60	0
	SEH & SCT	69	69	0
	SH & SCT	69	69	0
WALES	ABM	65	68	3
	AB	63	64	1
	BC	52	57	4
	C & V	68	69	1
	HD	77	78	1
OTHER		77	76	-1
TOTAL		70	71	<1

England N=14,195, Northern Ireland N=980, Wales N=1,083, Total N=16,341 (includes Other)
See table 3 for health region abbreviations.

Figure 8
Change in BMI post CR (<30 BMI) by programme



Analysis of CR contribution to HADS anxiety levels

Around 70% of patients are within the normal HADS anxiety category, with 28% residing in the clinical and borderline categories at the point they enter CR (Table 21). Variation in the burden of anxiety is evident across countries and Health Regions, with averages of 15%, 11% and 9% for clinical levels of anxiety in Wales, England and Northern Ireland respectively. Change in patient status from clinically anxious to borderline and normal categories is well distributed and beneficial across Health Regions (Table 21 and 22). Overall there was a 4% shift from patients in the clinically anxious and 2% shift in borderline to the normal anxiety categories (Table 22). Although national and regional values suggest that most patients benefit, there is huge variation in the extent of this improvement at a local level from 1% to 16% (Figure 9). At a local level 58% of programmes met or exceeded the 6% national average change in anxiety (Table 25) which is encouraging, however, further innovation is required to ensure that more patients are supported to achieve near the average change following CR.

Table 21

Percentage of patients by HADS anxiety categories pre and post CR

		PRE			POST		
COUNTRY	HEALTH REGIONS	NORMAL %	BORDERLINE %	CLINICALLY ANXIOUS %	NORMAL %	BORDERLINE %	CLINICALLY ANXIOUS %
ENGLAND	C & M	70	16	14	76	13	11
	EM	70	18	12	75	16	10
	E O E	74	15	11	80	13	7
	GM, L & SC	71	16	13	76	16	8
	L	70	16	14	78	14	9
	SEC	74	15	10	81	11	7
	SW	74	17	9	82	10	8
	TV	75	15	10	80	13	7
	W	77	15	8	81	13	6
	WM	70	18	12	76	16	7
	Y & TH	70	17	13	77	13	10
NORTHERN IRELAND	BH & SCT	69	15	16	74	12	14
	NH & SCT	77	15	8	83	12	5
	SEH & SCT	81	12	7	86	10	4
	SH & SCT	79	13	8	78	10	13
WALES	ABM	75	13	11	80	12	8
	AB	68	17	16	73	16	11
	BC	66	13	22	81	13	6
	C & V	78	13	9	83	11	6
	HD	74	16	10	76	16	9
OTHER		78	11	11	80	14	6
TOTAL		**73**	**16**	**12**	**79**	**13**	**8**

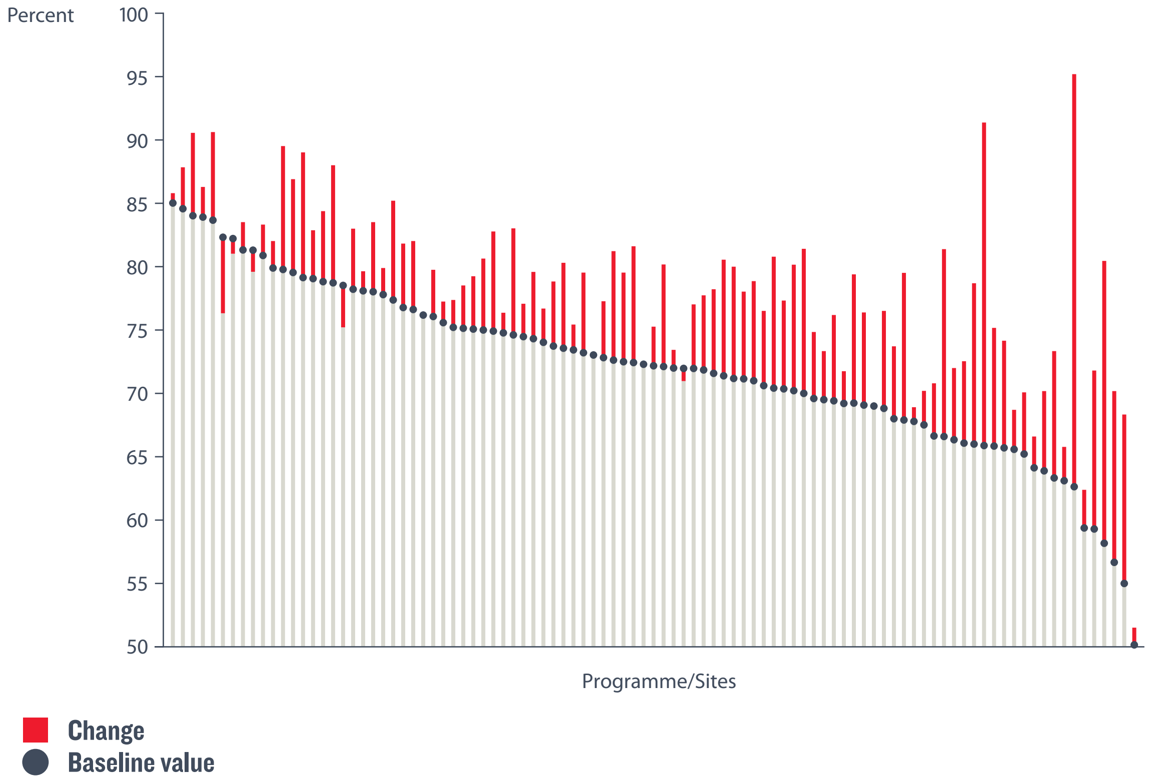
England N=12,463, Northern Ireland N=783, Wales N=1,026, Total N=14,352 (includes Other)
See table 3 for health region abbreviations.

Table 22
Percentage point change in HADS anxiety categories following CR

		POINT CHANGE		
COUNTRY	HEALTH REGIONS	NORMAL %	BORDERLINE %	CLINICALLY ANXIOUS %
ENGLAND	C & M	6	-3	-3
	EM	4	-2	-2
	E O E	7	-2	-5
	GM, L & SC	5	0	-4
	L	7	-2	-5
	SEC	7	-4	-3
	SW	9	-7	-1
	TV	5	-2	-3
	W	4	-2	-1
	WM	6	-2	-4
	Y & TH	7	-4	-4
NORTHERN IRELAND	BH & SCT	4	-3	-2
	NH & SCT	5	-3	-3
	SEH & SCT	5	-2	-3
	SH & SCT	-2	-3	5
WALES	ABM	5	-2	-3
	AB	5	-1	-4
	BC	16	0	-16
	C & V	5	-2	-2
	HD	2	0	-2
OTHER		3	3	-5
TOTAL		**6**	**-2**	**-4**

England N=12,463, Northern Ireland N=783, Wales N=1,026, Total N=14,352 (includes Other)
See table 3 for health region abbreviations.

Figure 9
Change in anxiety post CR by programme (% normal)



Analysis of CR contribution to HADS depression levels

Around 20% of patients are within the clinical and borderline categories at the point they enter CR (Table 23). Variation in the burden of depression is evident across countries and Health Regions, with averages of 10%, 6% and 6% for clinical levels of depression in Wales, England and Northern Ireland respectively. Change in patient status from clinically anxious to borderline and normal categories is well distributed and beneficial across Health Regions (Table 23 and 24). There was a drop in percentage of patients in the clinically anxious and borderline groups, 2% and 3% respectively, and a 5% positive movement to the normal group (Table 24). Performance at national and regional level suggests that most patients benefit, however, there is large variation in the extent of this improvement at a local level from zero to 10% (Figure 10). At a local level 51% of programmes met or exceeded the 5% national average change in depression (Table 25) which is encouraging, however, further innovation is required to ensure that more patients are supported to achieve near average change following CR.

Table 23
Percentage of patients by HADS depression categories pre and post CR

		PRE			POST		
COUNTRY	HEALTH REGIONS	NORMAL %	BORDERLINE %	CLINICALLY DEPRESSED %	NORMAL %	BORDERLINE %	CLINICALLY DEPRESSED %
ENGLAND	C & M	79	13	8	86	10	4
	EM	81	11	8	85	8	7
	E O E	86	9	5	90	6	4
	GM, L & SC	80	13	7	87	9	5
	L	77	14	9	85	11	5
	SEC	83	12	5	90	6	3
	SW	84	10	5	90	7	3
	TV	85	10	5	91	7	3
	W	87	9	4	91	7	2
	WM	77	15	7	86	9	5
	Y & TH	79	12	9	83	11	7
NORTHERN IRELAND	BH & SCT	80	11	8	85	8	7
	NH & SCT	91	6	3	90	9	1
	SEH & SCT	88	9	3	93	4	3
	SH & SCT	84	8	8	86	6	8
WALES	ABM	81	12	7	89	6	5
	AB	76	17	7	86	9	5
	BC	75	13	13	81	16	3
	C & V	86	8	5	91	7	2
	HD	84	10	6	84	10	6
OTHER		91	5	4	96	4	0
TOTAL		**82**	**12**	**7**	**88**	**8**	**4**

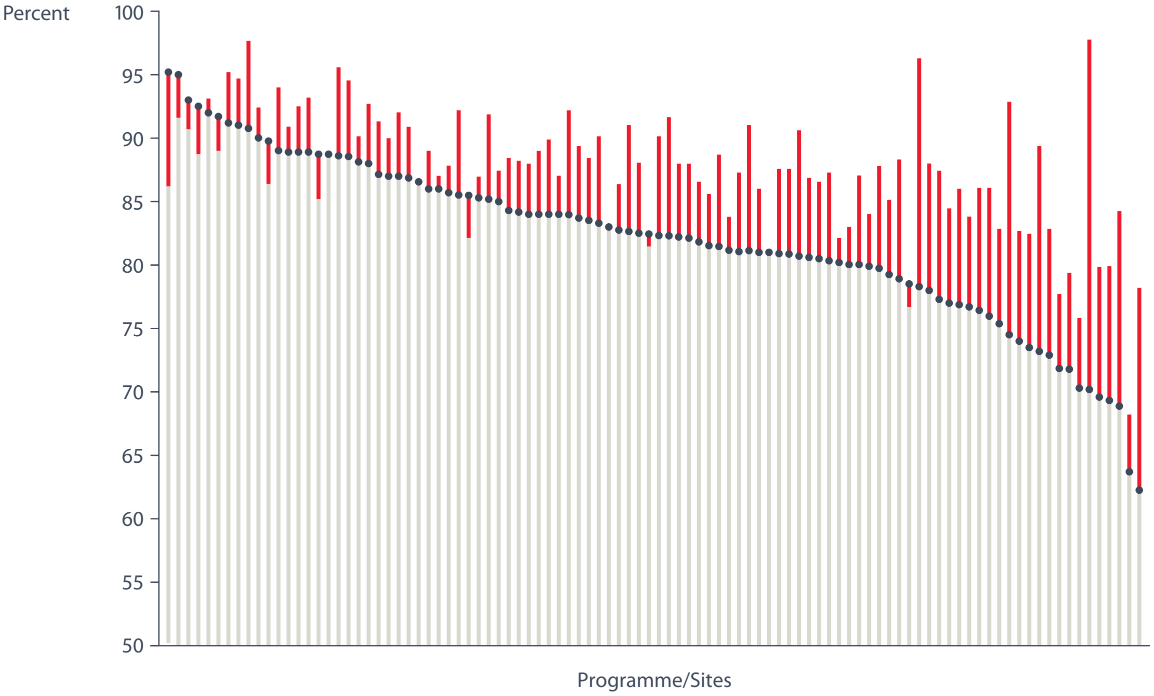
England N=12,462, Northern Ireland N=784, Wales N=1028, Total N=14,353 (includes Other)
See table 3 for health region abbreviations.

Table 24
Percentage point change in HADS depression categories following CR

COUNTRY	HEALTH REGIONS	CHANGE		
		NORMAL %	BORDERLINE %	CLINICALLY DEPRESSED %
ENGLAND	C & M	7	-3	-4
	EM	4	-3	-1
	E O E	4	-3	-1
	GM, L & SC	7	-4	-3
	L	7	-3	-4
	SEC	7	-5	-2
	SW	6	-3	-2
	TV	6	-4	-2
	W	4	-3	-2
	WM	9	-6	-2
	Y & TH	4	-2	-2
NORTHERN IRELAND	BH & SCT	5	-3	-2
	NH & SCT	-1	3	-2
	SEH & SCT	5	-5	0
	SH & SCT	2	-2	0
WALES	ABM	9	-7	-2
	AB	10	-8	-2
	BC	6	3	-9
	C & V	5	-2	-3
	HD	0	1	-1
OTHER		5	-1	-4
TOTAL		**5**	**-3**	**-2**

England N=12,462, Northern Ireland N=784, Wales N=1,028, Total N=14,353 (includes Other)
See table 3 for health region abbreviations.

Figure 10
Change in depression post CR by programme (% normal)



🟥 **Change**
● **Baseline value**

Summary of CR programme performance against national averages for patient outcomes

This is the first year that NACR has reported patient outcomes against national average trends which was a key recommendation of the BHF and NACR Steering Group. Although there are issues about using national trends to benchmark patient outcomes - most notably that they may fall short of clinically relevant expectations - they are used here as no data exists on the meaningful clinical differences for many of the measures collected. Where meaningful clinical differences exist - for instance for a variety of walk tests - these are used in later sections.

The overall average effect of CR on patient outcomes, as seen through national analysis, is modestly positive across all patient measures, with some programmes doing really well whilst others are doing less well.

In terms of physical activity status following CR (e.g. meeting 150 mins per week) the national average trend was high at 31% change with 36% of programmes exceeding this value. In addition to the above average group, 64% of programmes had positive changes in excess of 5%. This suggests that programmes across the board are doing well regarding the support of patients to become more physically active.

In the case of psycho-social wellbeing, as measured by HADS, the average national movement into the normal HADS category was 5% and 6%, for anxiety and depression respectively following CR. The percentage of programmes meeting or exceeding these categories was 58% for anxiety and 51% for depression.

With regards to smoking status, 55% of programmes met or exceeded the national average trend of 1% change, however, 45% failed to achieve this value. For BMI the national average percent change, towards having a BMI of < 30, was poor at half of 1% (0.05) although 64% of programmes equalled or exceeded this value. Alarmingly, 36% of programmes did not meet this low level of change in BMI post CR.

One of the challenges with reporting the extent of patient outcome per measure is that some measures - like smoking and weight (BMI) - are inter-related, as most patients that try to stop smoking will increase body weight. A meta-analysis by Aubin et al 2012, of 62 clinical trials aimed at supporting people to quit smoking, found that body weight increased by an average of 2.85 kg (2.42 to 3.28) at 3 months and as much as 4.67 kg (3.96 to 5.38) by 12 months. With such interaction evident, it would be wrong to judge weight management and smoking cessation success associated with CR programmes at a named local level without taking account of this relationship. Ongoing NACR analysis aims to confirm a suitably valid approach in time for the next annual report.

Analysis of CR contribution to additional risk factors and physical fitness

Seven patient outcome variables have yet to achieve sufficient sample size to allow analysis by regions or at programme level. However, there is sufficient data to report nationally.

Risk factor variables post CR (Table 25) show a 22% improvement in meeting the total cholesterol target (<4.0), and a 23% change meeting the LDL target (<2.0). Smaller positive changes were seen for waist circumference (3%), blood pressure (1%) and alcohol consumption (1%).

Table 25
Change in risk factor outcomes

		PRE %	POST %	% POINT CHANGE
CHOLESTEROL N=2,815 (TOTAL)	<4.0	39	62	22
CHOLESTEROL N=2,815 (LDL)	<2.0	33	57	23
BLOOD PRESSURE N=15,229	SYSTOLIC <140 AND DIASTOLIC <90	68	69	1
WAIST N=7,622	<102cm MALE <88cm FEMALE	58	61	3
ALCOHOL N=10,822		83	85	1

The Incremental Shuttle Walk Test, which is a valid field test of fitness in patients undergoing conventional CR, was recorded for 3,195 patients. Following CR, 62% of patients achieved the minimum clinical difference of >70m (Table 26). An even stronger benefit was seen in the Six Minute Walk Test of walking endurance (aimed at patients with HF) which showed that 75% of patients achieved a minimum clinical difference of >25m (Table 27). Despite BACPR recommendations for the assessment of fitness to classify patients risk and inform the exercise prescription prior to CR, only 27% of patients are receiving a functional capacity measurement at baseline.

Table 26

Measures of walking fitness and level of achievement against clinically meaningful differences

		NO	YES
INCREMENTAL SHUTTLE WALK TEST N=3,195	CLINICAL DIFFERENCE OF >70M (HOUCHEN-WOLLOF 2015)	38	62
SIX MINUTE WALK TEST N=2,026	CLINICAL DIFFERENCE OF >25M (GREMEAUX 2011)	25	75

Analysis of CR contribution to normal health related Quality of Life

Compared to last year health related Quality of Life (QoL), as measured using the Dartmouth COOP tool, changed positively by a further 3% with a national average change of 33% for self-perception of fitness post CR. There was a 4%, 11% and 11% improvement post CR in the sense of patient's positive feelings, extent of daily activities and social activities respectively (Table 27a). Variation in the amount of QoL change following CR is considerable across Health Regions.

The 'social support' question - which asks 'if patients needed support was it there' - remains a difficult question to interpret in respect of the other QoL questions, as a lower value reflects a positive response (Table 27b). The NACR is presently investigating a new approach to the analysis of the Dartmouth COOP data with an aim to produce a robust total QoL reporting method that will enable a more meaningful interpretation of this outcome measure. We intend to implement this new approach at a programme level in next year's annual report.

Table 27a

Percentage of patients with normal health related QoL (Dartmouth COOP) score pre and post CR

		PHYSICAL FITNESS		FEELINGS		DAILY ACTIVITIES		SOCIAL ACTIVITIES	
COUNTRY	HEALTH REGIONS	PRE %	POST %	PRE %	POST %	PRE %	POST %	PRE %	POST %
ENGLAND	C & M	43	76	84	89	86	96	82	93
	EM	40	57	85	88	88	91	86	89
	E O E	48	79	87	89	88	96	86	94
	GM, L & SC	41	74	85	91	84	96	81	94
	L	44	77	84	90	85	96	83	94
	SEC	39	81	85	92	81	97	81	96
	SW	58	81	83	92	86	97	86	96
	TV	58	85	88	93	88	97	84	97
	W	56	82	89	91	89	97	89	96
	WM	34	75	88	92	84	97	80	95
	Y & TH	24	60	85	89	81	93	80	93
NORTHERN IRELAND	BH & SCT	43	74	85	87	89	95	85	92
	NH & SCT	33	63	88	96	92	96	90	94
	SEH & SCT	54	88	87	93	88	99	85	96
	SH & SCT	32	67	86	90	79	100	86	95
WALES	ABM	31	69	81	93	84	95	84	94
	AB	49	75	87	88	89	97	87	96
	BC	42	71	81	87	71	97	87	94
	C & V	47	76	86	94	87	97	85	97
	HD	45	64	86	91	82	85	84	86
OTHER		75	94	81	95	91	100	93	99
TOTAL		**43**	**76**	**86**	**90**	**85**	**96**	**83**	**94**

England N=10,754, Northern Ireland N=539, Wales N=972, Total N=12,345 (includes Other)
See table 3 for health region abbreviations.

Table 27b

Percentage of patients with normal health related QoL (Dartmouth COOP) score pre and post CR

		PAIN		OVERALL HEALTH		SOCIAL SUPPORT		QUALITY OF LIFE	
COUNTRY	**HEALTH REGIONS**	**PRE %**	**POST %**	**PRE %**	**POST %**	**PRE %**	**POST %**	**PRE %**	**POST %**
ENGLAND	C & M	75	80	61	79	88	86	96	97
	EM	77	80	61	69	87	88	95	97
	E O E	82	86	72	83	89	86	96	97
	GM, L & SC	75	83	61	77	86	84	95	98
	L	76	83	63	80	86	85	95	98
	SEC	79	87	65	81	91	86	95	98
	SW	75	86	68	83	85	82	92	98
	TV	86	86	69	84	88	86	97	98
	W	78	84	74	84	91	88	96	98
	WM	82	87	65	83	88	86	94	98
	Y & TH	75	78	61	70	91	87	93	97
NORTHERN IRELAND	BH & SCT	74	80	68	84	89	86	94	97
	NH & SCT	90	85	69	83	90	85	92	100
	SEH & SCT	83	93	73	89	84	86	98	99
	SH & SCT	82	82	66	82	93	92	99	99
WALES	ABM	72	81	66	78	85	84	96	96
	AB	79	85	63	76	84	86	97	98
	BC	74	71	65	87	94	81	90	97
	C & V	82	85	76	84	91	89	98	99
	HD	71	74	68	75	80	86	95	95
OTHER		76	84	79	96	98	99	98	100
TOTAL		**78**	**83**	**65**	**79**	**88**	**86**	**95**	**97**

England N=10,754, Northern Ireland N=539, Wales N=972, Total N=12,345 (includes Other)
See table 3 for health region abbreviations.

Part six
Recommendations and actions

Recommendations and actions

The NACR 2016 annual report has built on last year's report by evaluating CR performance against national averages in service delivery and also UK average change in patient outcome. The report highlights large unacceptable variation in the quality of delivery and outcomes with a mean national change in patient outcomes ranging from 1% to 31%. Our analysis does reveal that some CR services are improving against service level standards with positive patient outcomes, based on national average change, evident across physical, risk factor and psycho-social measures.

Key recommendations:

1. Most CR programmes need to recruit a greater proportion of eligible female patients.

2. Heart failure patients should be seen as a priority group for CR.

3. The mode of delivery of CR should be broader than just group based approaches.

4. CR should start earlier for all patient groups.

5. The frequency and quality of patient assessment before and after CR needs to improve.

Actions:

1. Greater positive action is required to recruit more eligible female patients which will require significant changes to the type and location of CR offered.

2. Programmes need to offer a wider portfolio of CR options, including exercise delivery modes, and strongly promote these to patients with HF.

3. Assessment of a patient's physical and mental health is the cornerstone of effective clinical practice and should be resourced effectively and prioritised before and after CR.

4. Patients are entitled to prompt care which we know increases the likelihood of taking up CR and optimises patient outcomes compared to those that wait longer.

5. The mode of delivery of CR has remained at around 80% in favour of group based which, although effective in those patients who attend, is clearly an unattractive option for the other 50% of eligible patients who decided not to take up CR in 2014-15. Greater innovation in the mode of CR delivery, aligned with core evidence based components, should be undertaken by providers and commissioners to capture the large group of patients that are presently not taking up the offer of CR.

List of tables

LIST OF TABLES

List of figures

References

- Al Quait A, Doherty P. Does cardiac rehabilitation favour the young over the old? Open Heart 2016;3:e000450. doi:10.1136/openhrt-2016-000450
- All Wales Cardiac Rehabilitation Working Group (2010). Cardiac Rehabilitation Pathway. http://www.wales.nhs.uk/sites3/documents/490/All20Wales20Cardiac20Rehab20Pathway20-20Final20Version20-20August202010.pdf
- Anderson L, Oldridge N, Thompson DR, Zwisler A-D, Rees K, Martin N, et al. Exercise-based cardiac rehabilitation for coronary heart disease: Cochrane systematic review and meta-analysis. Journal of the American College of Cardiology 2016;67(1):1-12.
- Aubin HJ et al. Weight gain in smokers after quitting cigarettes: meta-analysis. BMJ 2012;345:e4439 doi: 10.1136/bmj.e4439 (Published 10 July 2012)
- Bjarnason-Wehrens B, McGee H, Zwisler AD, Piepoli MF et al. Cardiac rehabilitation in Europe: results from the European Cardiac Rehabilitation Inventory Survey. Eur J Cardiovasc Prev Rehabil. 2010 Aug;17(4):410-8. doi: 10.1097/HJR.0b013e328334f42d.
- British Association for Cardiovascular Prevention and Rehabilitation (2012). BACPR Standards and Core Components (2nd Edition). http://www.bacpr.com/pages/page_box_contents.asp?pageid=791
- Cardiovascular Disease Outcomes Strategy (CVD_OS) (2013). Improving outcomes for people with or at risk of cardiovascular disease. Department of Health Cardiovascular Disease Team https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/214895/9387-2900853-CVD-Outcomes_web1.pdf.
- Clinical Resource Efficiency Support Team (CREST) 2006. Guidelines for Cardiac Rehabilitation in Northern Ireland. ISBN 1-903982-18-9. www.crestni.org.uk
- Dalal HM, Evans PH, Campbell JL, Taylor RS, Watt A, Read KL, et al. Home-based versus hospital-based rehabilitation after myocardial infarction: A randomized trial with preference arms—Cornwall Heart Attack Rehabilitation Management Study (CHARMS). Int J Cardiol 2007;119:202-11.
- Dalal H, Doherty P, Taylor R. Clinical Review: Cardiac Rehabilitation. BMJ 2015;351:h5000 doi: 10.1136/bmj.h5000
- Danish Cardiac Rehabilitation Database (DCRC) 2013, https://www.sundhed.dk/content/cms/93/59693_hjerterehab2014.pdf)
- Department of Health Cardiac Rehabilitation Commissioning Pack (DH_CP) (2010). http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/Browsable/DH_117504
- Doherty P & Lewin B. The RAMIT trial, a pragmatic RCT of cardiac rehabilitation versus usual care: what does it tell us? BMJ Heart 2012;98:605-606 doi:10.1136/heartjnl-2012-301728

- Doherty P, Harrison A S, Knapton M, Dale V, Observational study of the relationship between volume and outcomes using data from the National Audit of Cardiac Rehabilitation, Open Heart 2015;2:e000304. doi:10.1136/openhrt-2015-000304

- Eder et al. Early 4-week cardiac rehabilitation exercise training in elderly patients after heart surgery. J Cardiopulm Rehabil Prev. 2010 Mar-Apr;30(2):85-92. doi: 10.1097/HCR.0b013e3181be7e32.

- Fell J, Dale V, Doherty P. Does the timing of cardiac rehabilitation impact fitness outcomes? An observational analysis. Open Heart. 2016 Feb 8;3(1):e000369. doi: 10.1136/openhrt-2015-000369. eCollection 2016

- Furze G, Doherty P, Grant-Pearce C. Development of a UK National Certification Programme for Cardiac Rehabilitation (NCP-CR). Br J Cardiol 2016;23:(2)doi:10.5837/bjc.2016.024

- Fidan D, Unal B, Critchley J, et al. Economic analysis of treatments reducing coronary heart disease mortality in England and Wales, 2000–2010. Q J Med 2007;100:277–89.

- Harrison AS, Sumner J, McMillan D, Doherty P. Relationship between employment and mental health outcomes following Cardiac Rehabilitation: an observational analysis from the National Audit of Cardiac Rehabilitation. Int J Cardiol. 2016 Oct 1;220:851-4. doi: 10.1016/j.ijcard.2016.06.142. Epub 2016 Jun 28.

- Gray H, et al. "Early management of unstable angina and non-ST-segment elevation myocardial infarction: summary of NICE guidance CG94." Heart 96.20 (2010): 1662-1668.

- Gremeaux V, Troisgros O, Benaim S, et al. Determining the minimal clinically important difference for the Six-Minute Walk Test and the 200-Meter Fast-Walk Test during cardiac rehabilitation program in coronary artery disease patients after Acute Coronary Syndrome. Arch Phys Med Rehab 2011;92:611-9

- Houchen-Wolloff L, Boyce S, Singh S. The minimum clinically important improvement in the incremental shuttle walk test following cardiac rehabilitation. European Journal of Preventative Cardiology 2015;22;8:972-78

- Joint British Societies' consensus recommendations for the prevention of cardiovascular disease (JBS3). Heart 2014;100:ii1–ii67. doi:10.1136/heartjnl-2014-305693

- Kaiser M, Varvel M, Doherty P. Making the case for cardiac rehabilitation: modelling potential impact on readmissions. NHS Improvement, Heart, 2013. Publication Ref: IMP/heart002. http://www.improvement.nhs.uk/documents/Case_for_CR.pdf .

- National Heart Failure Audit (2016). NICOR (National Institute for Cardiovascular Outcomes Research). http://www.ucl.ac.uk/nicor/audits/heartfailure/documents/annualreports/annual_report_2014_15_v2

- NICE 2013 MI-secondary prevention in primary and secondary care for patients following a myocardial infarction. NICE clinical guideline 172, guidance.nice.org.uk/cg172

- Piepoli M, Corrà U, Adamopoulos S, Benzer W, Bjarnason B, Cupples M, Dendale P, Doherty P et al. Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures for referral and delivery. European Journal of Preventive Cardiology 2012; June 20; doi:10.1177/2047487312449597

- Scottish Intercollegiate Guidelines Network SIGN. Cardiac rehabilitation: A national clinical guideline No. 57. Scottish Intercollegiate Guidelines Network; 2002.

- Taylor RS, Dalal H, Jolly K, Zawada A, Dean SG, Cowie A, et al. Home-based versus centre-based cardiac rehabilitation. Cochrane Database Syst Rev 2015;8:CD007130.

- Taylor R, Sagar V, Davies E, Briscoe S et al. Exercise-based rehabilitation for heart failure. The Cochrane Library 2014, Issue 4. Art.No.:CD003331. DOI:10.1002/14651858.CD003331.pub4.

- Vanhees L, Rauch B, Piepoli M, Van Buuren F, Takken T, Börjesson M, Bjarnason-Wehrens B, Doherty P, Dugmore D, Halle M, et al. Importance of characteristics and modalities of physical activity and exercise in the management of cardiovascular health in individuals with cardiovascular disease (Part III). European Journal of Preventive Cardiology published online 23 January 2012; DOI: 10.1177/2047487312437063 http://cpr.sagepub.com/content/early/2012/01/23/2047487312437063

- West RR, Jones DA, Henderson AH. Rehabilitation After Myocardial Infarction Trial (RAMIT): multi-centre randomised controlled trial of comprehensive cardiac rehabilitation in patients following acute myocardial infarction. Heart 2011;98:637–44.

- Wood D. Is cardiac rehabilitation fit for purpose in the NHS: maybe not. Heart 2012;98:607-8

British Heart
Foundation

For over 50 years we've pioneered research that has transformed the lives of millions of people living with heart disease. Our work has been central to the discoveries of vital treatments that are changing the fight against heart disease.

But heart and circulatory disease still kills around one in four people in the UK, stealing them away from their families and loved ones.

From babies born with life threatening heart problems, to the many mums, dads and grandparents who survive a heart attack and endure the daily battles of heart failure.

Join our fight for every heartbeat in the UK. Every pound raised, minute of your time and donation to our shops will help make a difference to people's lives.

Text FIGHT to 70080 to donate £3*

**FIGHT
FOR EVERY
HEARTBEAT**
bhf.org.uk

*This is a charity donation service for the BHF. Texts cost £3 + 1 standard rate msg. The BHF will receive 100% of your donation to fund our life saving research. To opt out of calls and SMS text NOCOMMS BHF to 70060, or if you have any questions about your gift call 02032827863.

Print code:
NACR2016