The National Audit of Cardiac Rehabilitation

Quality and Outcomes Report 2018

British Heart
Foundation

Strategic mission

The National Audit of Cardiac Rehabilitation (NACR) is a British Heart Foundation (BHF) strategic project supporting cardiovascular prevention and rehabilitation services to achieve the best possible outcomes for people with cardiovascular disease irrespective of where they live.

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Foreword by the BHF

The BHF supports the report's recommendation for greater service innovation, so that more patients benefit from cardiac rehabilitation.

This year, the NACR has close to 100,000 registered patients, which represents a comprehensive picture of the diversity of people being treated for CVD.

The BHF is encouraged to see that half of eligible patients are taking up cardiac rehabilitation (CR) services. CR recruitment continues to be comprehensive in terms of age – however, the proportion of women recruited to programmes from those eligible is lower than expected. Women from certain ethnic backgrounds are also less likely to attend, and CR programmes must focus on increasing uptake in these groups.

The BHF works with health systems across the country to support development of innovative forms of CVD service delivery, building the evidence of 'what works'. Through our Health Services Engagement team, we promote examples of best practice, sharing innovation in approaches that allow CR services to attract more patients from the wider eligible population.

However, as the population ages, more people than ever before will be living with three or more long term conditions, often experiencing fragmented referral pathways to address each condition individually, which can result in conflicting care advice and confusion. There is a growing need for integrated, person-centred recovery services that address multiple morbidities and provide support for self-management and recovery. We would therefore like to see more integrated and personalised recovery models that harness emerging digital solutions and address the growing needs of these patients.

From a national perspective, the quality of service delivery is improving, with patients being seen much earlier and the duration, for most, at or above the minimum standard requirement of eight weeks. However, considerable variation exists between countries, across health systems and most notably at an individual programme level.

We would like to acknowledge and thank the team at the University of York and colleagues at NHS Digital for producing the quality data needed to measure progress. The NACR forms part of the BHF strategy to ensure credible and robust data across the CVD health and care landscape, share good practice and support innovation in the prevention and treatment of cardiovascular disease. We will continue to work with NACR and the BACPR to achieve the recommendations highlighted in this report and build further on this success.

Jacob West, Director of Healthcare Innovation, BHF

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

The proportion of programmes meeting four to seven CR service quality key performance indicators (KPIs) is at 60%.

The BACPR welcomes the NACR Quality and Outcomes Report 2018, which is strongly aligned with our mission to support practitioners in delivering the best possible service for the benefit of patients.

The proportion of patients starting CR (87,200) is very encouraging, as is the number completing CR (76%). However, greater progress is needed. This is particularly true regarding the proportion of women accessing CR, which stands at 29% compared to men who represent 71% of the population taking up CR. The situation for patients with heart failure (HF) starting CR also remains a concern.

The mode of delivery is dominated by group-based CR at 82% of patients, with only 10% taking up home-based options. The BACPR is taking major steps in developing online education modules that will support clinical teams with the skills and competences to deliver alternative modes of CR delivery.

There is better news for CR programmes in this year's report with a three percentage point improvement in the number of patients starting CR with a baseline assessment (86.3%) compared to last year, which is a four percentage point improvement on 2016. Albeit a modest improvement, a higher percentage of patients are receiving assessments at the end of CR (63.4%) compared to last year.

The new 2018 approach to the BACPR/NACR National Certification Programme for CR (NCP_CR) has meant that, for the first time, a national picture exists on the quality of CR delivery for 229 programmes in the UK. There are 46 programmes fully certified, meeting all seven KPIs (Green status), 90 programmes meeting four to six KPIs (Amber status) and 67 meeting one to three KPIs (Red status). Unfortunately, 26 programmes failed to meet any NCP_CR KPIs.

The NCP_CR is keen to use this data and associated feedback on certification as an opportunity, supported by the BACPR, NACR and the BHF, to share good practice, with an aim to have more programmes achieving certification by this time next year.

Dr Scott Murray, President, BACPR
Sally Hinton, Executive Director, BACPR

NACR Executive Summary

Only 40% of people from areas of high deprivation start CR, compared to 54% from areas of low deprivation

This year, the quality of CR was assessed against seven KPIs as part of the national certification programme (NCP_CR). Of all CR programmes (N=229) across England, Northern Ireland and Wales, 46 were fully certified (Green status), 90 programmes were classed as Amber status (meeting four to six KPIs) and 67 were classified as Red status (meeting one to three KPIs). A total of 26 programmes failed to meet any NCP_CR KPIs. The proportion of programmes across England, Northern Ireland and Wales meeting full certification was 18%, 46% and 23.5%, respectively.

The proportion of patients who completed CR is 76%, which is an encouraging statistic comparable with the retention of participants in well-resourced clinical trials. However, 13% of patients completed CR without a final assessment, which we know to be important for achieving long-term behaviour change.

A new finding this year is that the likelihood of starting and completing CR is strongly influenced by the Index of Multiple Deprivation (IMD) with only 40% of patients from areas of high deprivation (lowest IMD quintile) starting CR, compared to 54% from areas of low deprivation compared to 54% from areas of low deprivation (highest IMD quintile).

Group-based supervised CR continues to dominate the mode of delivery across age and diagnostic groups with a slightly higher proportion of males, on average, carrying out group-based CR compared to females (73.1% for female participants compared with 78.7% for men taking up CR). The average age of people taking part in group-based CR was 65 years, whereas the average age of those taking part in home-based CR was 67 years.

A high proportion of people entering CR are non-smokers (average 93.4%). At a national level the contribution of CR programmes to smoking cessation remains positive overall and an improvement on last year with the impact most evident in Northern Ireland (3.6 percentage points) followed by England (1.5 percentage points) and then Wales with 0.5 percentage point change.

The proportion of people meeting the recommended 150 minutes of moderate activity per week increased following CR, from an average of 44% before rehab to 73.1% upon

NACR Executive Summary

completion. The mean percentage point change for each nation was considerable: 27.9, 50.1 and 29.4 for England, Northern Ireland and Wales, respectively, representing a very positive behavioural outcome as a result of CR programmes.

By contrast, the overall change in patient BMI as a result of CR was low across England, Northern Ireland and Wales. Northern Ireland had a negative shift in the proportion of patients with BMI <30 (negative one percentage point change) and England and Wales had an improvement of only 0.4 to 0.5 percentage point respectively. Regional and local programme variation exists, with a range of change from -6.2 to 5.2 percentage points, which suggests that some programmes are doing slightly better than others, and could highlight an opportunity for sharing good practice.

It is also important to note that NACR data analysis found that the extent of weight gain associated with smoking cessation in patients attending CR is much less than previous studies suggest.

With regards to other cardiovascular risk factors, women were less likely to meet target levels of cholesterol, and waist circumference at baseline, and were also less likely than men to achieve cholesterol and walking fitness targets following CR.

Finally, patient responses to the Hospital Anxiety and Depression Scale (HADS) showed that there was a 6.4 and 5.9 percentage point shift in the proportion of people who improved from a baseline measure of borderline-clinical anxiety and depression, respectively, to a diagnosis of ‘normal’ on the HADS scale following CR.

Key recommendations from NACR 2018 report:

1. **Recruit more female patients**
2. **Ensure that CR programmes are better tailored to the needs of female patients**
3. **Carry out a comprehensive CR assessment prior to, and on completion of, CR**
4. **Offer facilitated home-based modes of CR delivery for all CVD patients, including those with heart failure**
5. **Ensure programmes are working to certification standards and aim to secure certified status for the delivery of CR**

We thank CR teams for their time and 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 across the UK.

The BHF and NACR teams look forward to working with Health Boards in Scotland on

NACR Executive Summary

piloting data entry to NACR in 2019.
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The BHF National Audit of Cardiac Rehabilitation is hosted at the Department of Health Sciences, University of York, UK.
For further information and contact details please visit: www.cardiacrehabilitation.org.uk

Part One:
Introduction and methods

In more deprived areas, a lower percentage of patients start CR.

40%

Areas of high deprivation

54%

Areas of low deprivation

Introduction

CR represents an evidence-based intervention, delivered by a multidisciplinary team (MDT), that is proven to be clinically and cost effective in the modern era of healthcare.

NICE Guidance (CG172, CG94 and NG106) and leading British and European cardiovascular professional associations including the BACPR and the Scottish Intercollegiate Guidelines Network (SIGN) reinforced by the most recent systematic reviews (Shields et al 2018, CROS 2017, Anderson et al 2016, Taylor et al 2014), state that CR is clinically and cost effective, and recommend that it should be offered to all eligible patients in a timely and appropriate manner (BACPR 2017, Piepoli et al 2012, SIGN 2017).

Set against the rapidly changing nature of cardiology and associated innovation in service delivery, some forms of CR in routine practice are arguably less effective in the modern era (West et al 2011, Wood 2012, Doherty and Lewin 2012, Dalal et al 2015). A 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 achieving the minimum standards set by the BACPR (BACPR 2017).

NACR is a clinical registry embedded within routine care and is one of the core components of the BACPR's national standards that require CR teams to register and submit their data with NACR (BACPR 2017). The BHF and NACR, working in collaboration with the BACPR and local health authorities and providers in England, Northern Ireland, Scotland and Wales, are collectively committed to ensuring that all patients receive the highest quality of care and achieve similar benefits no matter where they live.

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) or 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 need data from all eligible patients who are offered CR.

The data that NACR collects serves two purposes. First, to support local hospital or community-based CR teams to generate their own local reports about patient progress and, second, 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.

Continued debate in the research literature suggests that routine CR clinical practice might be sub-optimal and may not be deriving the expected outcomes (West et al 2011, Doherty and Lewin 2012). There is also huge variability in what constitutes CR in routine practice. NACR data from routine clinical practice (NACR 2017) 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 is effective (Anderson et al 2016, NICE 2013, Piepoli et al 2012, Vanhees et al 2012). This has prompted the BACPR to set minimum clinical standards, which NACR now has sufficient data and statistical power to report against at national, regional and local level.

In addition to generating 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. A recent paper, using NACR local reporting functions and hospital readmission data, has produced programme-level evidence that CR represents a viable business case (Gore and Doherty 2017). For the third year running, the report will present data on patient outcomes at a local service level.

The 2018 report also shows the extent by which CR programmes meet the agreed seven KPIs that form the NCP_CR. These include three minimum standards and four current national averages relating to referral times and assessment at CR completion.
See www.cardiacrehabilitation.org.uk/NCP-CR.htm

In recent years, NACR has moved away from just reporting statistical data to reporting on the quality and outcomes of CR. This leads us, in 2018, to change the name of the annual report from ‘Annual Statistical Report’ to ‘Quality and Outcomes Report’, which reflects our aim to provide data that will help to monitor and support improvements in CR performance and patient outcomes.

Methods for collecting data for NACR Quality and Outcomes Report 2018

The BACPR standards and NCP_CR KPIs both require CR programmes to register with, and enter data through, NACR as an essential part of quality assurance in CR delivery and to drive service improvement (BACPR 2017, www.cardiacrehabilitation.org.uk/NCP-CR.htm).

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 Health Regions in England, Northern Ireland and Wales, we have aligned data collection with KPIs, such as timing and duration of CR, and across regional health boundaries. The NACR 2018 report uses data from 2016-2017 and reports CR uptake for patients following MI, MI + PCI, PCI and CABG across England, Northern Ireland and Wales. We continue to pursue the inclusion of Scotland in NACR, allowing us not only to capture the good work that is happening, but also help evaluate their new integrated approach to CR.

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 annual email survey. Where programmes did not provide data, the number of patients receiving CR was estimated using either the previous year's figures for that programme (if they confirmed that the service had not changed), or using the average number calculated from those sites that had returned data.

Number eligible for CR

Uptake was calculated for four diagnosis groups; MI, MI + PCI, PCI and CABG. 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 of HF patient numbers, the audit was unable to derive valid numerator and denominator values across the nations of the UK for this diagnosis.

England

NHS Digital provided individual anonymised patient level Hospital Episode Statistics (HES) data 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 + PCI, PCI or CABG.

Wales

NHS Wales Informatics Service provided aggregated data on people discharged alive after an MI, MI + 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. We are working with the Channel Islands on the feasibility of them entering CR data via NACR.

Approval process for accessing NHS data for 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. NACR is General Data Protection Regulation (GDPR) compliant and has a privacy notice available on the website (www.cardiacrehabilitation.org.uk/patient-privacy-notice.htm).

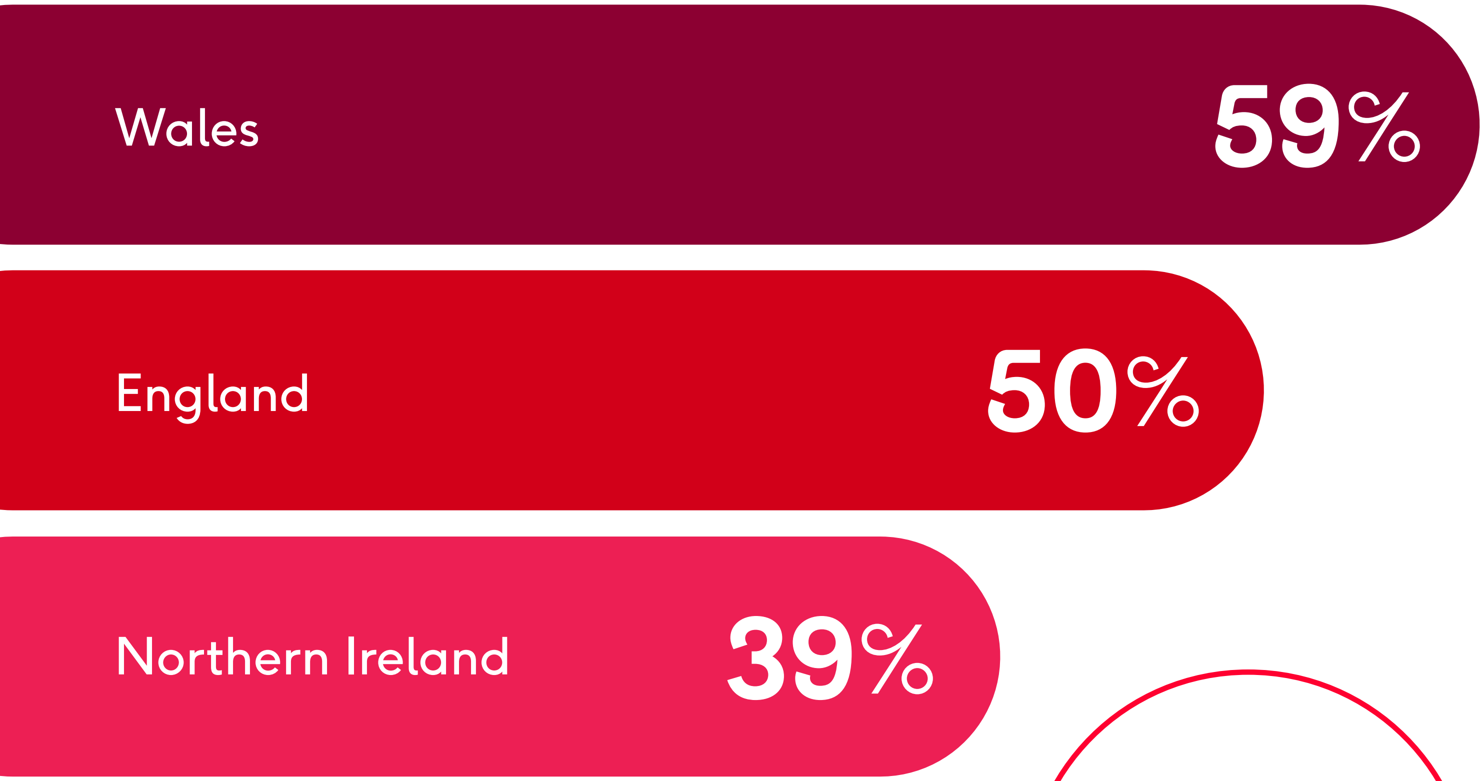
Gaining the consent of patients to use their data for national audit purposes is extremely difficult during the management of a heart attack or immediately following surgery. For this reason, the NHS has in place an 'exemption from consent' process where clinical and personal data is entered into NHS 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. Section 251 approval covers the roles of the BHF, NHS Digital and NACR team and ensures the highest quality procedures for collecting, sharing and using only the agreed data about a patient's CR experience. NACR's approval and the purpose of the national audit are reviewed each year by CAG.

For more information about NACR please visit the web pages:

www.york.ac.uk/healthsciences/research/cardiac
www.cardiacrehabilitation.org.uk

Part Two:

Uptake to CR by country



Number of eligible patients accessing CR by country

Number and type of patients starting CR by country

Across the UK, CR programmes continue to recruit large number of patients with 87,200 of 99,847 patients registered on NACR taking up the service (Table 1). The number of people starting CR by country is 78,997 for England, 2,741 for Northern Ireland, 5,190 for Wales and 272 for Other. Of these, most have a diagnosis of MI + PCI (25,578 patients) followed by PCI (14,588 patients). Unfortunately, the proportion of females taking part in CR remains low at 29% and is down by one percentage point on last year.

CR should be offered to all post-MI, MI + PCI, PCI and CABG patients, which we refer to as the in-scope CR population. In recent years this has been extended to people who have had heart valve surgery, and an increasing number of these patients are now taking up CR.

The number of patients accessing CR remains well below the ambition of 65% for conventional CR and 33% uptake for patients with HF set in the NHS England Cardiovascular Disease Outcomes Strategy (CVDOS 2013). Over 93% of CR programmes in the UK state that they do not exclude patients with HF, yet very few patients take up the offer. More needs to be done to rectify this situation, and business cases for resources to support CR should prioritise this group of patients. We are hopeful that the recent positive evaluation and rollout of a facilitated CR home-based manual for patients with HF (the National Institute for Health Research REACH-HF research programme) will increase the number of people with HF entering CR in the next few years (Dalal 2018).

Part Two: Uptake to cardiac rehabilitation by country

Table 1

Number and type of patients starting CR

				Number of patients
	England	Northern Ireland	Wales	Other
MI	12,830	263	765	30
MI + PCI	22,938	1,015	1,528	97
MI + CABG	2,655	74	231	15
CABG	9,010	303	610	23
PCI	13,444	573	530	41
MI with HF	358	22	4	-
HF	4,270	74	446	10
Angina	2,771	168	350	7
Valve surgery	4,923	31	30	27
Other surgery	569	11	26	3
Cardiac arrest	161	94	225	1
Pacemaker	382	2	11	5
Implantable cardioverter defibrillator	801	12	18	8
Other	2,519	99	384	5
Unknown	1,366	-	32	-
Total	**78,997**	**2,741**	**5,190**	**272**

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

Part Two: Uptake to cardiac rehabilitation by country

Uptake to CR Services

UK

The 2018 NACR report shows that the overall mean uptake to CR in the UK is around 50%, which falls short of national uptake recommendations for England (CVDOS 2013), Northern Ireland (CREST 2006), Scotland (SIGN 2017) and Wales (All Wales Cardiac Rehabilitation Review 2013).

The number of eligible patients was 134,191, which is an increase on last year (Table 2). Fewer patients from in-scope CR populations (1,759) started CR across England, Northern Ireland and Wales compared with last year.

England

CR uptake in England has dropped slightly from its position last year by two percentage points and now stands at 50% across the four in-scope CVD populations receiving CR (Table 2). The main change in CR uptake was because more people were eligible for CR this year, but fewer people took it up, with the exception of CABG patients, where there was a seven percentage point increase in uptake.

Northern Ireland

The proportion of patients taking up CR in Northern Ireland is 39%, which is down by two percentage points overall on last year. This is partly explained by a five percentage point drop in MI patients. There was a one percentage point increase in the number of MI + PCI patients taking up CR, bringing the proportion taking part up to 65%.

Wales

CR programmes in Wales have shown an overall eight percentage point increase in participation, resulting in 59% uptake overall. This can be explained by notable improvements in people taking part after MI (now at 30%) and after PCI (52%) and an impressive increase in uptake of CABG patients to 96%. There was a seven percentage point decrease in MI + PCI patients, however, the overall proportion of uptake from this group remains high at 89%.

Part Two: Uptake to cardiac rehabilitation by country

Table 2

CR uptake split by country and main diagnosis/treatment group

Country		N	Receiving CR	Uptake %
UK	MI	41,745	13,884	33%
	MI + PCI	44,655	25,481	57%
	PCI	29,721	14,547	49%
	CABG	18,070	12,883	71%
Total		**134,191**	**66,795**	**50%**
England	MI	37,343	12,830	34%
	MI + PCI	41,391	22,938	55%
	PCI	26,823	13,444	50%
	CABG	16,720	11,665	70%
Total		**122,277**	**60,877**	**50%**
Northern Ireland	MI	1,767	263	15%
	MI + PCI	1,552	1,015	65%
	PCI	1,879	573	30%
	CABG	471	377	80%
Total		**5,669**	**2,228**	**39%**
Wales	MI	2,635	791	30%
	MI + PCI	1,712	1,528	89%
	PCI	1,019	530	52%
	CABG	879	841	96%
Total		**6,245**	**3,690**	**59%**

Part Three:
NACR statistics by country, Health Region and local programme level

The average person receiving CR is 67 years old

67

Range 18 – 105 years

NACR statistics by country, Health Region and local programme level

The trends seen in CR at a national level are important; however, local programme and regional levels are where many of the innovations are taking place. NACR reports across 24 Health Regions for England, Northern Ireland and Wales shown in Table 3 below (and hereafter abbreviated throughout the report as indicated).

Table 3

Country and Health Region reported in NACR

Country	Health Region	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	BHSCT
	Northern Health and Social Care Trust	NHSCT
	South Eastern Health and Social Care Trust	SEHSCT
	Southern Health and Social Care Trust	SHSCT
	Western Health and Social Care Trust	WHSCT
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 Region

Year-on-year, more programmes are entering data on CR through NACR. This year, 80% of programmes entered data electronically, thus enabling greater audit coverage. Data entry in England has improved but, as with Wales and Northern Ireland, there are some areas of low data entry between Health Regions (Table 4). Using data from Table 1 (number and type of patient starting CR) and Table 4 below, we see that the average number of patients starting CR per programme in the UK is 380, with a per-country breakdown of 380, 210 and 305 for England, Northern Ireland and Wales, respectively.

Table 4

CR programme data by country and Health Region

Country	Health Region	CCG number	Total programmes	Electronic NACR registration	% registered
England	C & M	12	12	11	92
	EM	20	15	10	67
	E o E	19	21	18	86
	GM, L & SC	20	18	15	83
	L	32	33	26	79
	NE	11	13	4	31
	SEC	20	15	13	87
	SW	11	17	16	94
	TV	10	5	5	100
	W	9	7	7	100
	WM	22	19	15	79
	Y & TH	22	21	15	71
Northern Ireland	BHSCT	N/A	1	1	100
	NHSCT	N/A	4	4	100
	SEHSCT	N/A	3	3	100
	SHSCT	N/A	3	3	100
	WHSCT	N/A	2	2	100
Wales	ABM	N/A	3	3	100
	AB	N/A	4	4	100
	BC	N/A	3	3	100
	C & V	N/A	1	1	100
	CT	N/A	1	1	100
	HD	N/A	3	3	100
	PT	N/A	2	1	50
Other		3	3	1	33
Total			**229**	**184**	**80**

Abbreviations: CCG = Clinical Commissioning Groups. See Table 3 for Health Region abbreviations.
PT (Powys Teaching Health Board) has been removed from subsequent tables due to insufficient NACR data.
Eight programmes in England have been omitted as they provided Early/Phase 1 CR data and from this point this audit only refers to to Core/Phase 3 Delivery. Four of these programmes are registered with, and enter data through, NACR.

Part Three: NACR statistics by country, Health Region and local programme level

Based on feedback from last year's report, we have clarified detail around Health Regions, the number of programmes associated with the different aspects of NACR and certification (Table 5).

Table 5

Number of programmes, programmes submitting data via NACR and inclusion in certification by country

Number of Health Regions	
England	12
Northern Ireland	5
Wales	7
Total	**24**
Number surveyed	
Total number of programmes	237*
Total number of core/phase 3 programmes	229
Number of programmes included in certification report	
(Core/phase 3 programmes surveyed)	
England	199
Northern Ireland	13
Wales	17
Total	**229**
Number of NACR users	
England	155
Northern Ireland	13
Wales	16
Total	**184**

*Eight of the total programmes were phase 1/early.

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

The number of patient events entered on NACR remains high (99,847), suggesting that NACR data represents a valid reflection of clinical practice. As more CR programmes merge, we are seeing a reduction in the number of duplicate patient events being created, which is helping to improve the reporting accuracy of the audit.

Engaging women with CR remains a concern, as the percentage of female patients as a proportion of the total (29%) has dropped by one percentage point compared to last year (Table 6). The variation in female CR attendance between nations is considerable ranging from 17% to 46% with Wales and Northern Ireland having less variability (Figures 1 a-c). Given the emphasis in recent years on improving uptake of CR for women, this overall reduction and variability is of concern and requires further attention and greater innovation to optimise the CR offer for women.

NACR data represents a more comprehensive profile of CR patients than recent systematic reviews of CR effectiveness, such as Anderson et al (2016), where the mean age was 56 years (range from 49 to 71) compared to an average age of 67 years (range from 18 to 105) for patients seen in routine practice (NACR). The proportion of patients above 75 years of age registered with NACR was ~30%, which is markedly different to the research population in most randomised controlled trials, where virtually no patients above 71 years are recruited. It is commendable that UK CR programmes have recruited such a diverse age range of patients.

Part Three: NACR statistics by country, Health Region and local programme level

Table 6

NACR demographics for age and gender by country and Health Region

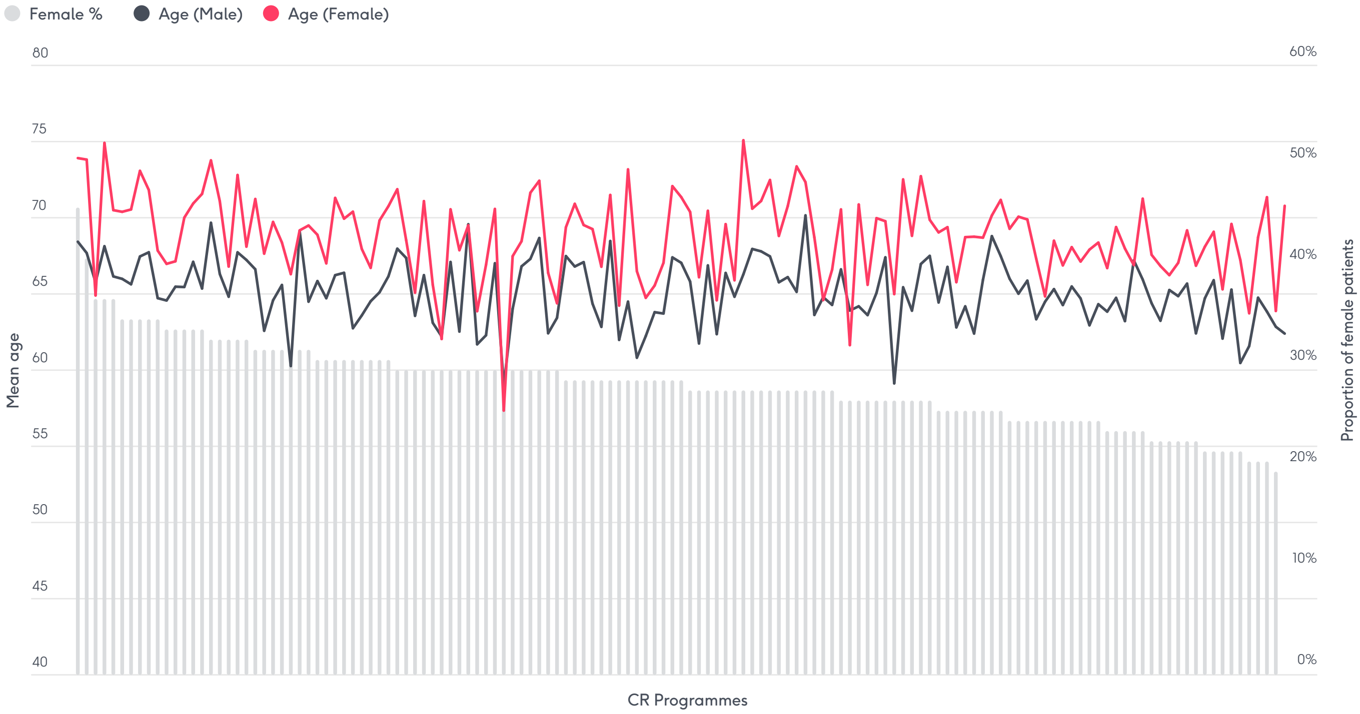
			Male		Female		Age range	
Country	**Health Region**	**N**	**Mean age**	**%**	**Mean age**	**%**	**Minimum**	**Maximum**
England	C & M	6,826	66	66	70	34	18	105
	EM	7,699	66	71	69	29	18	101
	E o E	9,489	66	72	71	28	18	102
	GM, L & SC	13,270	65	69	70	31	18	105
	L	11,384	64	73	68	27	18	98
	SEC	8,550	67	72	70	28	18	102
	SW	5,909	68	73	71	27	18	100
	TV	2,449	66	76	70	24	20	101
	W	6,955	67	70	71	30	20	104
	WM	7,702	66	69	70	31	19	101
	Y & TH	7,598	66	69	70	31	18	102
Total		**87,843**	**66**	**71**	**70**	**29**	**18**	**105**
N. Ireland	BHSCT	878	64	70	66	30	19	93
	NHSCT	1,110	67	69	70	31	31	100
	SEHSCT	1,235	66	70	70	30	25	100
	SHSCT	926	65	72	67	28	23	98
	WHSCT	508	64	75	68	25	21	95
Total		**4,657**	**65**	**71**	**69**	**29**	**19**	**100**
Wales	ABM	1,055	66	69	70	31	30	97
	AB	887	65	72	68	28	24	94
	BC	2,251	66	68	68	32	18	98
	C & V	1,225	65	72	69	28	19	97
	CT	577	65	67	67	33	20	94
	HD	1,158	67	67	70	33	21	97
Total		**7,153**	**66**	**69**	**69**	**31**	**18**	**98**
Other		126	64	72	65	28	31	86
Total		**99,847**	**66**	**71**	**70**	**29**	**18**	**105**

See Table 3 for Health Region abbreviations
Due to insufficient data in NACR, gender has been reported as Male and Female only throughout the report, but there are additional categories of gender in the dataset.
NE has been removed due to insufficient NACR data.

Part Three: NACR statistics by country, Health Region and local programme level

Figure 1 a/b/c: Proportion of male and female patients by age and country/programme

Fig. 1a. England



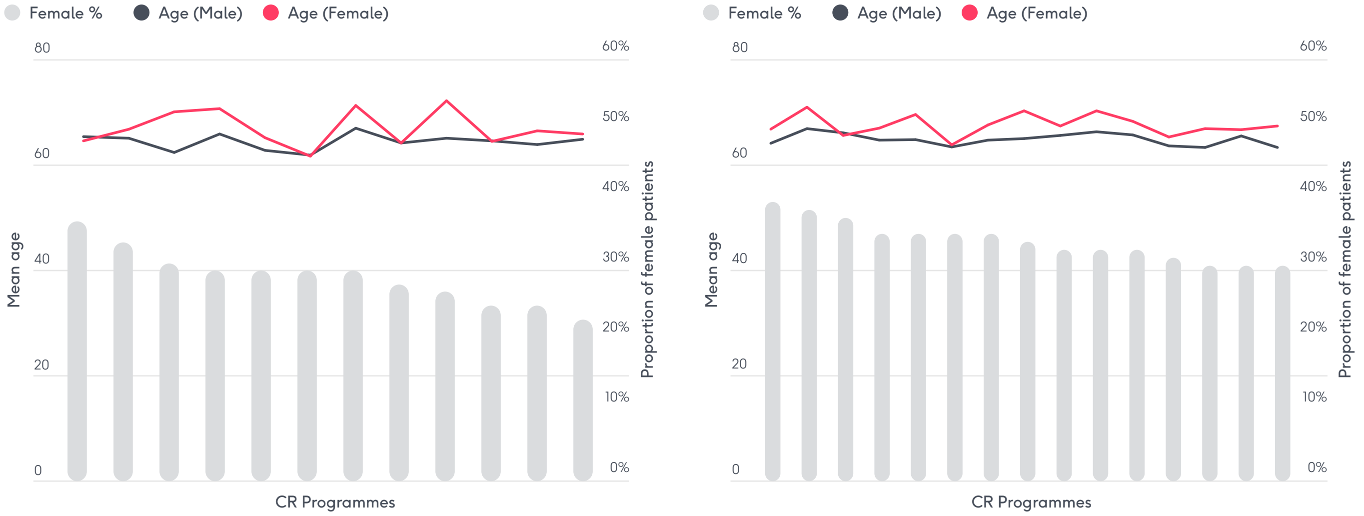


Fig. 1b. Northern Ireland

Fig. 1c. Wales

Ethnicity, employment and marital status

A person's CVD risk factor profile and their uptake of related NHS services is often strongly associated with their cultural and ethnic background. This places a duty of care on CR programmes to ensure that all eligible patients are offered opportunities to join CR that align with their individual preferences. Although the ethnicity of patients attending CR remains predominately White-British (80.5%) and male (Table 7) there is considerable variability at regional and at a local programme level (see NACR supplement cited below for more details). The greatest gender disparity in CR uptake was seen within the Mixed White and Asian ethnic group with 84.2% male and 15.8% female attending CR. Variation in the ethnic profile between Health Regions may have implications for how CR programmes are designed and resourced (for example, where translation and interpreter costs may be required). NACR has produced an online supplement showing local level variation in CR by ethnicity available from:

www.cardiacrehabilitation.org.uk/current-annual-report.htm

Table 7

Ethnicity by gender

Ethnicity		%	Male %	Female %
White	British	80.5	70.3	29.7
	Irish	1.4	68.7	31.3
	Any other white background	3.2	72.5	27.5
Mixed	White and black Caribbean	0.1	67.9	32.1
	White and black African	0.1	77.6	22.4
	White and Asian	0.2	84.2	15.8
	Any other mixed background	0.3	77.8	22.2
Asian or Asian British	Indian	2.5	73.6	26.4
	Pakistani	2.0	74.3	25.7
	Bangladeshi	0.4	80.9	19.1
	Any other Asian background	1.3	78.4	21.6
Black or black British	Caribbean	0.4	60.1	39.9
	African	0.3	67.0	33.0
	Any other black background	0.2	67.2	32.8
Other	Chinese	0.1	74.3	25.7
	Any other ethnic group	0.9	73.5	26.5
	Not stated	6.0	73.1	26.9
Total		**100**	**71**	**29**

N = 79,515

Research has shown that a person's relationship with a significant other has a bearing on their engagement with CR services (Al Quait et al 2017). This year's data in Table 8 shows that the majority of CR participants are married (68.4%) and the proportion of people in the remaining marital status categories ranges from 2.3% (separated) to 10.3% (single).

Research from NACR on CR completion has also shown that being unemployed was associated with poorer outcomes following CR (Harrison et al 2016). The employment status of most CR participants in the current analysis was 'retired' (55.4%), followed by employed (28.6%) when part-time and full-time employment are combined (Table 9).

Table 8

Marital status	%
Single	10.3
Married	68.4
Permanent partnership	4.4
Divorced	5.0
Widowed	9.6
Separated	2.3
Total	**100**

N=61,388

Table 9

Employment status	%
Employed full-time	16.9
Employed part-time	4.2
Self-employed full-time	5.3
Self-employed part-time	2.2
Unemployed - looking for work	1.9
Government training scheme	<0.01
Looking after family/home	1.8
Retired	55.4
Permanently sick/disabled	3.3
Temporarily sick or injured	7.9
Student	0.1
Other reasons for not working	0.9
Total	**100**

N=38,157

Morbidities profile

The proportion of people attending CR presenting with at least one co-morbidity alongside their main event/treatment is increasing across a range of different conditions (Table 10a).

In a change from last year, where we only reported patients with two or more co-morbidities, we are now reporting all patients who have at least one co-morbidity. Therefore, the co-morbidity percentages may have dropped, however, the number of patients included in this part of the report has increased.

Hypertension is the most common singular diagnosis as a co-morbidity, affecting 49.9% of CR patients, followed by hypercholesterolaemia/dislipidaemia and then diabetes. With an increasing number of co-morbidities patients are less likely to engage, attend and complete CR and, in those who do attend, there is an association of multi-morbidity with poorer outcomes (Al Quait 2017). To improve uptake and outcomes, programmes need to align their CR offer with the needs and morbidity profile of patients.

A family history of CVD is also evident in 26.3% of patients, reiterating the importance of engaging with families and relations as part of a preventative approach. The BHF has support and resources for healthcare professionals and for people with a family history of CVD and their carers. You can find more information about family history here: www.bhf.org.uk/informationsupport/risk-factors/family-history

The proportion of patients with two or more co-morbidities has increased substantially in the last ten years to the extent that over 50% of patients start CR with a multi-morbid profile (Table 10b).

Part Three: NACR statistics by country, Health Region and local programme level

Table 10a

Morbidities profile for CR

Morbidity	%
Angina	15.9
Arthritis	13.3
Cancer	7.2
Diabetes	24.5
Rheumatism	2.1
Stroke	5.3
Osteoporosis	1.8
Hypertension	49.9
Chronic bronchitis (COPD)	4.0
Emphysema (COPD)	3.1
Asthma	8.2
Claudication	2.0
Chronic back problems	7.7
Anxiety	5.6
Depression	6.2
Family history of CVD	26.3
Erectile dysfunction	2.4
Hypercholesterolaemia/dyslipidaemia	31.7
Other co-morbid complaint	31.6

N = 67,659

Table 10b

Proportion of patients starting CR with two or more co-morbidities

	Mean age (SD)	Proportion of total population
Male	66 (11)	52%
Female	68 (11)	56%

N = 49,312

Reasons for not taking part in CR

This year we have made a change to the way NACR reports 'Reasons for Not Taking Part' (Table 11). Rather than presenting the individual reasons reported (which generated small percentages), we have grouped them more informatively into three broader categories – patient, service and work/social. A full list of reasons for not taking part is provided in Appendix 1. We have also split these groups further by gender and age. This allows us to show the variation between demographic groups, and identifies where in the treatment pathway patients are deciding not to engage with services or where services do not meet patients' needs.

We see that on average, older patients were more likely to provide their reasons for not taking part. At the inpatient/pre-discharge/early stage of the pathway, the most common reasons for not taking part among men and women were related to service level (63.9% and 60.7%, respectively). At the outpatient/post-discharge/core stage, the reasons for not participating were more likely to be personal to the individual patient for both men and women (57.3% and 59.5%, respectively).

We know from previous research that patient preferences are important in defining uptake and outcomes (Dalal et al 2007). By providing insight into the reasons why people decline to take part, we hope to provide CR programme staff with a better understanding of what constitutes a 'lack of interest' in their patients to help in the development of initiatives aimed at making CR a more attractive option. A menu-based approach offering different modes of delivery is a natural step in aligning services with patient needs and preferences.

Table 11

Reasons for not taking part in CR

		Inpatient/pre-discharge/early			Outpatient/post-discharge/core		
Gender	Reason for not taking part grouped	Reason %	Mean age	Age range	Reason %	Mean age	Age range
Male	Patient	28.0	71	18-99	57.3	70	18-99
	Service	63.9	65	19-100	33.7	65	19-100
	Work/social	8.0	66	22-97	9.0	64	22-97
Female	Patient	32.6	77	22-101	59.5	74	22-101
	Service	60.7	71	18-102	33.4	70	18-102
	Work/social	6.7	68	32-96	7.1	71	32-96
Total	Patient	29.5	73	18-101	58.0	71	18-101
	Service	62.9	67	18-102	33.6	67	18-102
	Work/social	7.6	67	22-97	8.4	66	22-97
	Total	**8,639 (male 5,868 + female 2,771)**			**18,667 (male 12,580 + female 6,087)**		

Reasons for not completing CR

The number of patients completing CR has increased by 2,000 from last year, but this is partly because the number starting CR has also increased by 4,000. Overall though, the percentage of patients that complete core CR is 76%, which is a strong position for UK CR. Most well-resourced clinical trials of CR have shown a dropout rate of 20-30% between the pre- and post-CR assessment, which suggests that routine practice, as delivered in the UK, has good adherence.

NACR analysis has shown that the likelihood of starting and completing CR is strongly influenced by the IMD with 40% of patients from areas of high deprivation (lowest IMD quintile) starting CR, compared to 54% from areas of low deprivation (highest IMD quintile). Completion of CR follows a similar trend with 67% from lowest quintile and 80% from highest quintile.

Data on the reason for patients not completing core CR was collected for 76% of non-completers (N = 7,232; Table 12). An analysis of this yields some important differences across age and gender. This is in line with recent research and previous NACR findings which showed that older and younger patients vary in their likelihood to engage and attend CR by gender.

Patients who did not complete but stated an unknown reason were of a younger age. This was particularly the case for men, with a mean age of 59. The two other dominant reasons for not completing were being ‘too ill’ where patients tended to be older and ‘returned to work’, where patients were from a younger population, especially males (10.1%). Planned or emergency interventions or hospital re-admissions played a small part in non-completion of CR.

Part Three: NACR statistics by country, Health Region and local programme level

Table 12

Reasons for not completing CR by age and gender

		Reason %	Mean age	Age range
Male	DNA unknown reason	37.4	59	19-95
	Returned to work	10.1	55	18-81
	Left this area	1.8	62	37-94
	Achieved aims	0.1	65	41-81
	Planned/emergency intervention	2.5	65	24-88
	Too ill	12.0	69	35-94
	Died	1.4	74	42-92
	Other	29.3	67	19-97
	Hospital re-admission	1.7	68	38-91
	Unknown	3.8	61	27-87
Female	DNA unknown reason	33.5	63	21-92
	Returned to work	4.2	54	23-86
	Left this area	0.9	67	40-86
	Achieved aims	0.1	62	51-70
	Planned/emergency intervention	1.6	64	33-89
	Too ill	18.3	70	32-93
	Died	1.9	77	39-100
	Other	34.0	70	25-99
	Hospital re-admission	1.9	69	43-86
	Unknown	3.6	65	27-86
Total	DNA unknown reason	36.2	60	19-95
	Returned to work	8.4	55	18-86
	Left this area	1.5	63	37-94
	Achieved aims	0.1	64	41-81
	Planned/emergency intervention	2.2	65	24-89
	Too ill	13.8	69	32-94
	Died	1.5	75	39-100
	Other	30.6	68	19-99
	Hospital re-admission	1.8	68	38-91
	Unknown	3.7	62	27-87

N= 7,232 (male 5,135 and female 2,097)

Mode of delivery in modern UK CR

Evidence from clinical trials continues to show that CR can be delivered successfully through different modes such as group or individually as part of a facilitated home-based programme (Anderson et al 2017, Dalal et al 2010). Additionally, recent observational studies have shown facilitated self-managed programmes to be comparable in terms of psychosocial outcomes and walking ability (Harrison and Doherty 2018, Harrison et al 2018). Web-based options are also being investigated at this present time through the WREN trial.

Based on the need for a tailored approach to CR and the importance of supporting patient preference, NACR is continuing to develop its methodology for reporting mode of delivery. We have split out in-scope CR patients from HF patients and reported the mode of delivery with average age (Table 13). The table also reports on HF patients separately, as this diagnosis is thought to impact on the type of service offered by providers and may help inform patient preference. CR uptake is higher in the in-scope CR patient group with slightly higher use in females compared to the HF group.

Group-based supervised CR continues to dominate the mode of delivery across age and diagnosis, with a slightly higher proportion of males on average participating in group-based CR compared to females (73.1% of women compared with 78.7% of men). The average age of people participating in group-based CR was slightly lower than other modes such as home-based and home visits. Web-based CR generally appears to attract younger patients: men who opted for web-based CR were on average nine years younger compared with women (mean 55 years versus 64 years in women).

The low uptake of CR in people with HF may be attributed to the lack of a wide-scale adoption of alternatives to group-based CR. This has now changed as the REACH-HF trial, which was an NIHR programme of research (Taylor et al 2015), concluded that the REACH-HF facilitated home-based CR intervention is clinically effective in people with HF with reduced ejection fraction (Dalal et al 2018). We now have a valid HF-specific home-based CR alternative with an evidence base to offer people with HF. Later in the year, NACR will include a new mode of delivery data choice (REACH-HF CR Manual) for this intervention with an aim to monitor (1) uptake (2) quality of delivery and (3) outcomes from the REACH-HF manual in routine practice. Roll out of REACH-HF is intended to commence in 2019. Further details are available from:

www.royalcornwall.nhs.uk/services/research-development-innovation/rehabilitation-enablement-chronic-heart-failure-reach-hf/

Part Three: NACR statistics by country, Health Region and local programme level

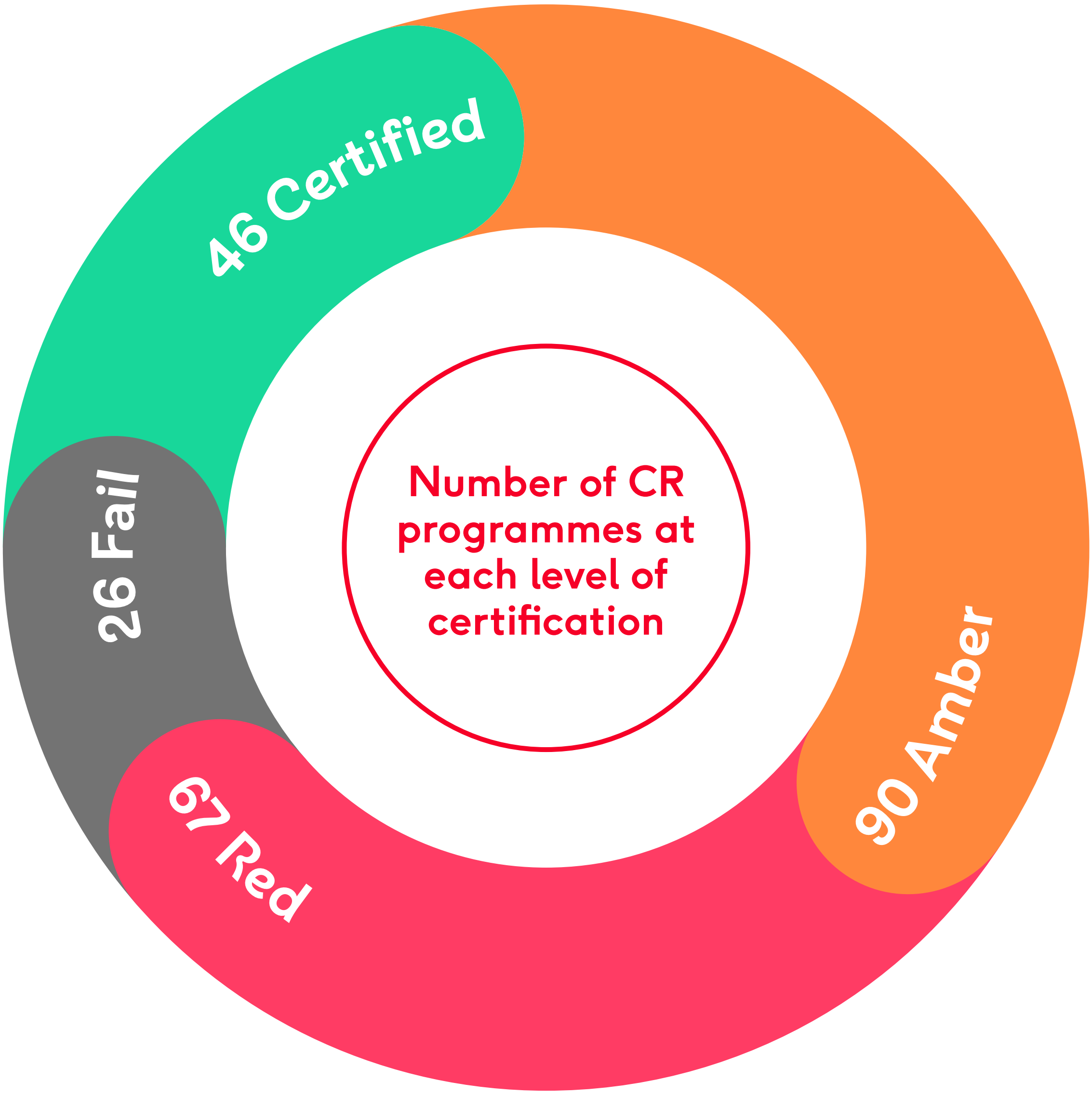
Table 13

Mode of delivery split by age, gender and diagnosis/treatment groups

		All diagnosis/treatment groups			Heart failure patients		
		Mode %	Mean age	Age range	Mode %	Mean age	Age range
Male	Group-based	78.7	64	18-99	79.9	67	18-97
	Home-based	7.5	66	19-96	5.0	71	33-94
	Web-based	0.2	55	19-82	-	-	-
	Home visits	7.4	66	27-96	7.6	73	35-94
	Telephone	16.7	65	18-99	17.7	69	22-93
	Other mode	4.9	64	19-95	4.8	66	29-88
Female	Group-based	73.1	66	18-100	75.0	68	18-92
	Home-based	8.8	70	18-97	7.2	73	29-93
	Web-based	0.1	64	40-83	-	-	-
	Home visits	9.8	70	19-98	9.4	75	41-93
	Telephone	18.9	68	18-100	17.8	70	19-93
	Other mode	5.3	66	19-93	4.7	68	31-85
Total	Group-based	77.2	65	18-100	78.4	67	18-97
	Home-based	7.9	67	18-97	5.7	72	19-94
	Web-based	0.1	57	19-83	-	-	-
	Home visits	8.0	68	19-98	8.2	74	35-94
	Telephone	17.3	66	18-100	17.8	69	19-93
	Other mode	5.0	64	19-95	4.8	67	29-88

All diagnosis N=40,340 (male 29,528 + female 10,812), HF N=3,592 (male 2,502 + female 1,090)

Part Four:
Analysis based on national minimum standards



Analysis based on national minimum standards

In its new standards and core components for CR (BACPR 2017), the BACPR has outlined six minimum standards:

1. **The delivery of six core components by a qualified and competent multidisciplinary team, led by a clinical coordinator.**
2. **Prompt identification, referral and recruitment of eligible patient populations.**
3. **Early initial assessment of individual patient needs which informs the agreed personalised goals that are reviewed regularly.**
4. **Early provision of a structured cardiovascular prevention and rehabilitation programme (CPRP), with a defined pathway of care, which meets the individual's goals and is aligned with patient preference and choice.**
5. **Upon programme completion, a final assessment of individual patient needs and demonstration of sustainable health outcomes.**
6. **Registration and submission of data to NACR and participation in the National Certification Programme for Cardiovascular Rehabilitation (NCP_CR).**

Research shows that timely CR is associated with greater patient benefit, in terms of physical and psychosocial outcomes, compared to CR offered later (Fell et al 2016, Sumner et al 2017). The BACPR (2017), NICE Guidance (CG172, NG106) and SIGN (2017) recommend that CR programmes should be offered early, and underpinned by assessment prior to, and on completion of, CR. The minimum duration of CR is recommended as eight weeks with two sessions per week (BACPR 2017, standard four). Given the range of CVD risk factors and the multimorbid profile of patients attending CR, a further recommendation is that CR be delivered by a team of multidisciplinary staff, with the skills and competencies to support patients in achieving the desired health behaviour change (BACPR 2017).

Is CR delivered early enough to meet national guidance?

Key recommendations from the BACPR, NICE and SIGN, and KPIs for the NCP_CR programme (NCP_CR 2016), advise that CR is commenced early.

Yet, because each nation of the UK has different health commissioning or provider infrastructure and processes supporting cardiology and CR, the use of UK-wide national averages can lead to unfair benchmarks. BHF Cardiovascular Research Group has shown that the solutions to poor CR engagement are as much to do with service level factors in each country as they are with patient choice (Al Quait and Doherty 2017). The ability to address service-level quality and inequalities in delivery and patient outcomes is dependent on the infrastructure, resources and financial models supporting CR services.

For this reason, NACR has recently adopted nation-specific averages to enable a more relevant analysis of the quality and outcomes from CR. In-country reporting enables each nation to more clearly identify average trends and high/low performance within their service delivery and can be used to inform country-specific benchmarking and shared learning.

Scotland is not presently entering data into NACR, however, working with Frances Divers, the Scottish CR Champion, and Dr Iain Todd, Consultant in CR at NHS Lothian, we are working on a data governance agreement which will allow a pilot study of data sharing between Health Boards in Scotland and NHS Digital in 2019.

Table 14 shows that waiting times vary substantially within each country. However, overall waiting times have improved compared to last year's report. National wait time averages (medians) were 27 days for MI/PCI (MI and/or PCI) and 40 days for CABG patients in England. The national averages for Wales were 21 days for MI/PCI and 31 days for CABG patients. Northern Ireland had the shortest wait times at 15 and 32 days for MI/PCI and CABG, respectively. A BMJ clinical update (Dalal et al 2015) noted that 90% of patients admitted with STEMI (ST-elevation MI) have a primary PCI and are discharged within three days allowing little time for referral to CR from hospital. An integrated approach across primary and community care has potential to support early engagement with services (Dalal et al 2017).

Part Four: Analysis based on national minimum standards

Table 14

Time (days) from post-discharge referral to start of core CR by country, Health Region and diagnosis/treatment group

Country	Health Region	MI and/or PCI	CABG
England	C & M	32-	44-
	EM	27+	34+
	E o E	19+	36+
	GM, L & SC	26+	40+
	L	32-	41-
	SEC	28-	39+
	SW	35-	45-
	TV	29-	48-
	W	23+	38+
	WM	31-	45+
	Y & TH	15+	36-
Total		27	40
Northern Ireland	BHSCT	22-	41-
	NHSCT	11+	21+
	SEHSCT	13+	30+
	SHSCT	45-	59-
	WHSCT	10+	32+
Total		15	32
Wales	ABM	26-	35-
	AB	36-	42-
	BC*	6+	6+
	C & V	32-	37-
	CT	30-	35-
	HD	40-	32-
Total		21	31
Other		46-	59-
Total		26	39

N=24,986
– or + nation-specific referral time criteria: - = not met, + = met
* figures confirmed by clinical team lead
NE has been removed due to insufficient NACR data
See Table 3 for Health Region abbreviations

Wait times vary considerably at local programme level in all three nations. However, one common feature is that for all but 34 programmes, patients with MI/PCI wait for shorter periods than those with CABG (Figure 2 a-c). For England (Figure 2a), around half of all MI/PCI and CABG patients start CR within a reasonable time frame after discharge, with some programmes indicating that patients are started within just a few days. There are around nine programmes in England with much shorter wait times (less than eight days and as low as just two days) than the BACPR target of ten days for MI/PCI and CABG patients, and a similar situation is seen for Wales (Figure 2c).

By contrast, the trend in Northern Ireland is different (Figure 2b). There has been a change from last year for Northern Ireland, as programmes have halved their waiting times for MI/PCI and reduced them by ten days for patients following CABG. Their wait times are within guideline-recommended periods which suggests that in England and Wales some programmes may have a different understanding of what constitutes starting CR. NACR and the BHF's Health Services Engagement team are working with clinicians to clarify reasons for such variability, and to learn from other programmes about innovations to promote early CR.

Innovation in service delivery is important, and is supported by the BHF's professional network, the BHF Alliance, which offers programmes the opportunity to share best practice. See www.bhf.org.uk/alliance

Part Four: Analysis based on national minimum standards

Figure 2 a/b/c: Time from referral to start of CR by programme and country

Fig. 2a. England

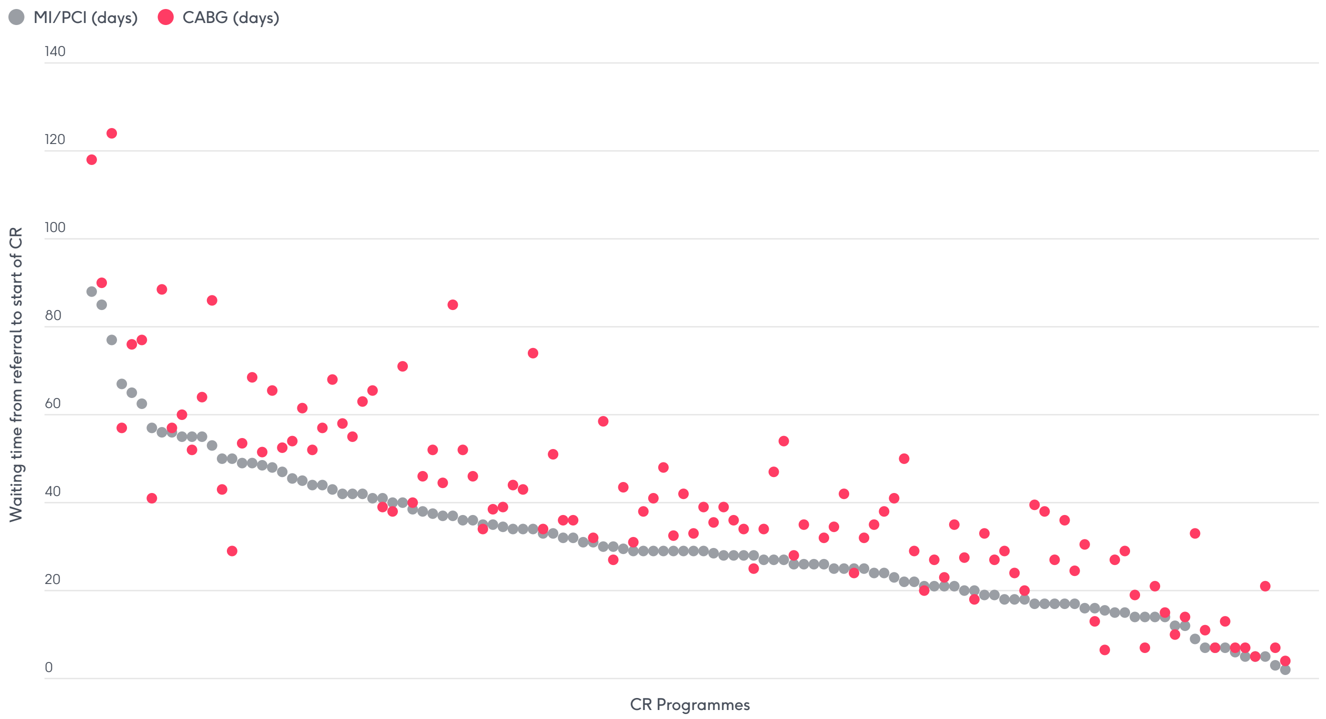


Fig. 2b. Northern Ireland

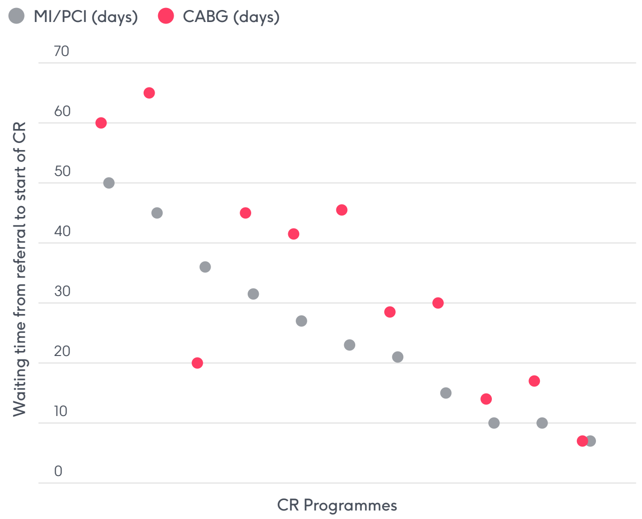
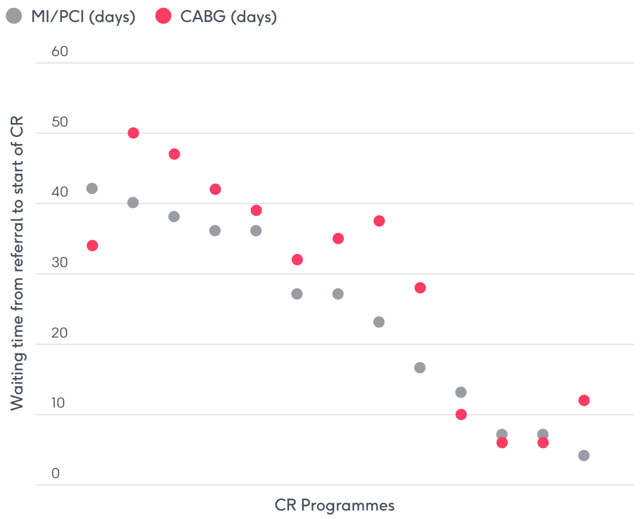


Fig. 2c. Wales



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

A comprehensive assessment at the start and end of CR is fundamental to achieving a tailored CR intervention, and represents a key recommendation of SIGN 2017 and NICE CG172, and forms one of the minimum standards of the BACPR. There is positive news for CR programmes in this year's report, with an improvement of three percentage points in the number of patients starting CR with a baseline assessment (86.3%) compared to last year (Table 15).

There is a similar, although smaller, shift in the proportion of patients who have a follow-up assessment post-CR, which increased from 62% to 63.4%. In real terms, an increase of one percentage point represents 3,140 more patients having a follow-up assessment. Variation remains between countries. For example, Northern Ireland reported a greater proportion of assessments at both baseline and following CR compared with England and Wales.

The proportion of patients completing CR is 76%, which is an encouraging statistic comparable with well-resourced clinical trials. However, 13% of patients completed CR without an assessment (6,589 patients). Patients completing CR with a follow-up assessment will be informed of progress made and have the potential to use their feedback (e.g. knowledge of results) to build on progress as part of a tailored long-term health behaviour change. Patients without an end-of-CR assessment will have missed out on this opportunity.

Part Four: Analysis based on national minimum standards

Table 15

Percentage starting CR with a record of pre- and post- assessment by Health Region

Country	Health Region	Starting rehabilitation	% with pre (assessment 1)	% with post (assessment 2)
England	C & M	3,068	85.1	63.8
	EM	3,462	89.2	60.0
	E o E	5,158	80.3	62.2
	GM, L & SC	5,977	80.7	59.5
	L	5,688	90.9	64.9
	SEC	5,038	91.6	65.4
	SW	3,548	88.7	65.1
	TV	1,574	89.1	76.5
	W	3,577	87.4	62.0
	WM	3,087	76.6	56.5
	Y & TH	3,879	91.4	77.2
Total		44,077	86.3	64.8
Northern Ireland	BHSCT	802	99.1	79.8
	NHSCT	500	97.6	75.6
	SEHSCT	733	94.0	59.5
	SHSCT	353	91.5	41.9
	WHSCT	144	96.5	65.3
Total		2,531	96.1	67.0
Wales	ABM	695	94.7	80.3
	AB	879	97.5	66.8
	BC	1,808	62.0	32.6
	C & V	335	94.6	79.1
	CT	391	93.1	54.2
	HD	365	78.9	54.5
Total		4,428	80.7	54.2
Other		107	99.1	89.7
Total		**51,221**	**86.3**	**63.4**

England N=44,077, Northern Ireland N=2,531, Wales N=4,428, Total N=51,221 (includes Other)
See Table 3 for Health Region abbreviations.
NE has been removed due to insufficient NACR data

Is the duration of CR meeting national guidance?

Health behaviour change mediated through comprehensive CR – including exercise training, physical activity promotion, risk factor management and psychosocial wellbeing interventions – requires time to achieve the desired clinical and patient goals. The most recent Cochrane Review on CR (Anderson et al 2016), analysing evidence from 63 clinical trials, found that the median duration was six months (range one 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 12 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). In summary, a duration at or above 12 weeks is common to successful CR programmes, thus allowing patients sufficient time to acquire the skills to make the required lifestyle changes.

The median duration for CR in this year's report is 71 days or ten weeks (Table 16) which represents an increase of one week on last year and is two weeks above the BACPR minimum recommendation of eight weeks (BACPR 2017). Overall, the duration of CR has improved, with all three nations reporting average durations of CR at or above ten weeks. Differences in the order of two weeks exist between Wales, Northern Ireland and England. Variation across Health Regions ranged from five to 16 weeks (Table 16) with five weeks being well below the BACPR minimum recommendations. More worrying is the variation across local programme level which ranged from three to 25 weeks (Figures 3 a-c).

Future reports will include an analysis of the dose of CR (duration x frequency of sessions) which is a relationship increasingly associated with patient outcomes.

Part Four: Analysis based on national minimum standards

Table 16

Total programme duration of CR in days and weeks (median)

Country	Health Region	Duration (days)	Duration (weeks)
England	C & M	70	10.0
	EM	56	8.0
	E o E	73	10.4
	GM, L & SC	66	9.4
	L	64	9.1
	SEC	64	9.1
	SW	65	9.3
	TV	63	9.0
	W	70	10.0
	WM	83	11.9
	Y & TH	86	12.3
Total		70	10.0
Northern Ireland	BHSCT	97	13.9
	NHSCT	67	9.6
	SEHSCT	97	13.9
	SHSCT	36	5.1
	WHSCT	65	9.3
Total		81	11.6
Wales	ABM	74	10.6
	AB	91	13.0
	BC	116	16.6
	C & V	70	10.0
	CT	83	11.9
	HD	109	15.6
Total		88	12.6
Other		38	5.4
Total		**71**	**10.1**

N=36,593
See Table 3 for Health Region abbreviations.
NE has been removed due to insufficient NACR data

Part Four: Analysis based on national minimum standards

Figure 3 a/b/c: Duration of CR by programme

Fig. 3a. England

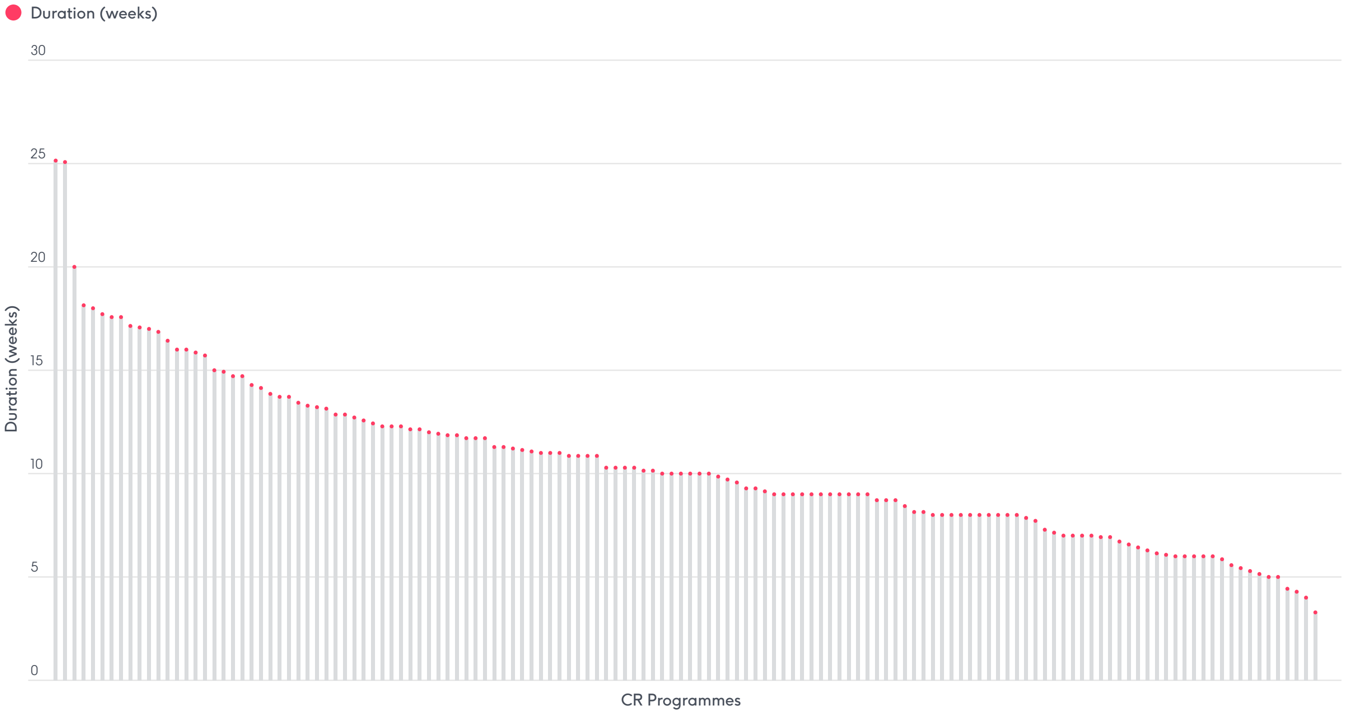
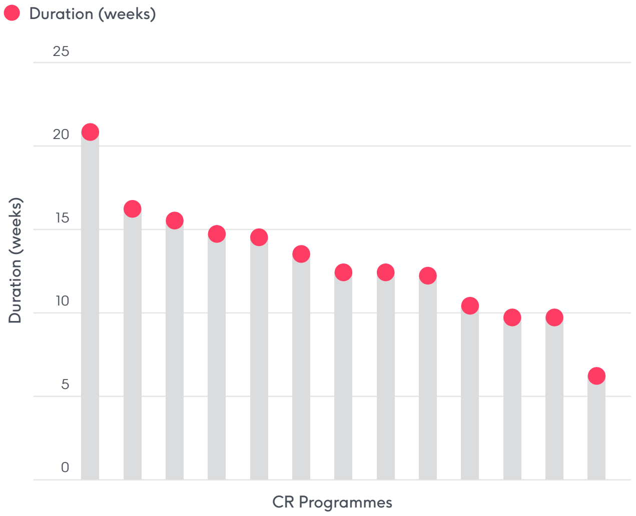


Fig. 3b. Northern Ireland

Fig. 3c. Wales



Is CR delivered by a multidisciplinary team as recommended by national guidance?

As a multi-component intervention aligned with an increasingly multi-morbid patient population, CR is best delivered by a MDT of skilled and experienced staff (BACPR 2017).

Overall, there is a comprehensive range of health professionals supporting CR. However, large variation in the number and types of roles involved in delivering CR exists between different countries (Table 17). Nurses, physiotherapists, secretaries, dietitians and exercise specialists form the dominant professional groups (by frequency) with a notable increase of eight percentage points in psychologist involvement from last year (Table 17). Staffing analysis is also part of NCP_CR which is covered further in the next section.

A more detailed breakdown of CR staffing by programme is available on the NACR webpage:

www.cardiacrehabilitation.org.uk/current-annual-report.htm

Table 17

National overall staffing profile for CR programmes

	England		Northern Ireland		Wales		UK total	
	N*	%	N*	%	N*	%	N*	%
Nurse	173	98%	12	100%	16	100%	201	98%
Physiotherapist	114	64%	10	83%	14	88%	138	67%
Dietitian	91	51%	10	83%	8	50%	109	53%
Psychologist	41	23%	7	58%	2	13%	50	24%
Social worker	0	0%	0	0%	0	0%	0	0%
Counsellor	13	7%	0	0%	0	0%	13	6%
Doctor	18	10%	2	17%	0	0%	20	10%
Health care assistant	24	14%	2	17%	2	13%	28	14%
Secretary	136	77%	7	58%	14	88%	157	77%
Administrator	7	4%	0	0%	0	0%	7	3%
Exercise specialist	102	58%	3	25%	9	56%	114	56%
Occupational therapist	39	22%	6	50%	8	50%	53	26%
Pharmacist	68	38%	10	83%	8	50%	86	42%
Physiotherapy assistant	53	30%	2	17%	4	25%	59	29%

N* = number of programmes with staff type

Part Four: Analysis based on national minimum standards

Quality of delivery through the NCP_CR

The NCP_CR is a joint programme from the BACPR and NACR which uses KPIs to certify the quality of CR service delivery. This approach has been updated in 2018 and is now operationalised through NACR with oversight from the NCP_CR Steering Group composed of the BACPR, NACR and clinical staff along with patient representatives.

Before any CR programme can be considered to be assessed against NCP_CR KPIs, they must be entering data into NACR. The KPIs are based on NCP_CR agreed standards that relate to the BACPR standards and core components (2017) but do not match them. Certification (Green status) is achieved through meeting all seven KPIs – the three minimum standards (one to three) and the four standards based on national averages (Table 18).

Table 18

NCP_CR KPIs

Minimum standard 1: MDT	At least three health professions in the CR team who formally and regularly support the CR programme
Minimum standard 2: Patient group	Cardiovascular rehabilitation is offered to all these priority groups: MI, MI+PCI, PCI, CABG, HF
Minimum standard 3: Duration	Duration of core CR programme: ≥ national median of 56 days
Standard 4: National average for assessment 1	Percentage of patients with recorded assessment 1: ≥ England 80%; Northern Ireland 88%; Wales 68%
Standard 5: National average for CABG wait time	Time from post-discharge referral to start of core CR programme for CABG: ≤ national median of England 46 days, Northern Ireland 52 days, Wales 42 days
Standard 6: National average for MI/PCI wait time	Time from post-discharge referral to start of core CR programme for MI/PCI: ≤ national median of England 33 days, Northern Ireland 40 days, Wales 26 days
Standard 7: National average for assessment 2	Percentage of patients with recorded assessment 2 (end of CR): ≥ England 57%, Northern Ireland 61%, Wales 43%

* Information on staffing profile and MDT, which forms one of the NCP_CR KPIs, is taken from the NACR annual paper survey. This information is not available from the electronic NACR database. In order for certification to be validated each CR team must return the NACR annual paper survey form with staffing detail section completed.

Measuring KPI metrics as part of NCP_CR

Two years ago the NACR introduced service-level metrics to assess the overall performance against six KPIs and published a peer-reviewed version of this approach and analysis (Doherty et al 2017). This year we have expanded our reporting of service-level metrics to include staffing profile for each nation, which enables monitoring of progress against the KPI relating to MDT (Table 17). We now have seven key KPIs (Table 18).

To monitor progress against the four standards based on the national averages, year-on-year, for each country, we have used country-specific averages and compared programmes within countries for meeting their national averages (Table 19). As CR service quality improves in respect of these four standards, evidenced through increased national averages, the BACPR and NACR will agree a minimum standard for assessment and timeliness of CR.

Our new NCP_CR reporting approach using nation-specific analysis of programme quality allows national leads and CR programmes in each country to see their strengths and weaknesses and use this to inform their strategy for improvement. This approach best reflects the context, infrastructure and resources in each country, which will help set realistic expectations. In this year's analysis, it is clear that a fully inclusive approach to all patient priority groups, as seen in Wales, and shorter duration of CR, as seen in Northern Ireland, were influential in defining high and low performance category allocations.

The following section summarises certification status for all programmes across the UK (Table 19). For this section, we have reported the extent to which programmes meet the seven KPIs for each country in Figure 4 a-c. The rating scale used as part of NCP_CR has four categories (Table 20) with Green status representing full certification where all seven KPIs have been achieved.

To support programmes in learning from each other and innovating CR service provision, the BHF Health Services Engagement team are working with NACR and BACPR to support innovation and sharing best practice. See:

www.bhf.org.uk/for-professionals/healthcare-professionals/commissioning-and-services/service-innovation

Part Four: Analysis based on national minimum standards

Table 19

Number of programmes achieving CR KPIs as part of NCP_CR

NCP_CR KPIs	Standard	CR programmes meeting standards		
		England N=155	N. Ireland N=13	Wales N=16
Agreed minimum standards				
Multidisciplinary team	>=3 different staff types	135	12	14
Receiving all patient priority groups	Each group >0	120	9	15
Duration	56 (days)	95	10	14
Standards based on 2016 national averages				
Assessment 1	England 80% Northern Ireland 88% Wales 68%	94	10	13
Assessment 2	England 57% Northern Ireland 61% Wales 43%	87	8	11
Referral to CR start (MI/PCI)	England 33 days Northern Ireland 40 days Wales 26 days	83	10	6
Referral to CR start (CABG)	England 46 days Northern Ireland 52 days Wales 42 days	83	9	10

Table 20

NCP_CR classification scale

NCP_CR Status	KPIs
🟢 Green (Certified)	Meeting all seven KPIs ('certified')
🟡 Amber	Meeting four to six KPIs
🔴 Red	Meeting one to three KPIs
● Fail	Meeting no KPIs

Part Four: Analysis based on national minimum standards

Analysis of quality of CR delivery by country

The NCP_CR criteria and the rating scale outlined above (Tables 18 and 20) are used in this part of the report to summarise the quality of CR service delivery at a national and Health Region level across the UK.

Certification status for all CR programmes (N=229) across England, Northern Ireland and Wales (Table 21) shows that 46 programmes are fully certified (Green status) which represents ten more than last year under the previous NCP_CR approach. Our new NCP_CR approach means we can identify how close programmes are to achieving full certification. This year there were 90 programmes classified as Amber (four to six KPIs), 67 programmes classified as Red (meeting one to three KPIs) and 26 programmes failed to meet any NCP_CR KPIs (classified as Fail). The proportion of programmes across England, Northern Ireland and Wales meeting full certification (Green status) was 18%, 46% and 23.5%, respectively.

This analysis and classification includes 45 programmes registered on NACR that do not enter any data which effectively means they have no potential to meet NCP_CR criteria. NCP_CR classifications are for programmes that enter data and therefore have potential to meet NCP_CR.

Table 21

NCP_CR certification status for all CR programmes across England, Northern Ireland and Wales

Certification status for all CR programmes

	England N=199	Northern Ireland N=13	Wales N=17	UK N=229
● Green	36	6	4	46
● Amber	77	3	10	90
● Red	63	3	1	67
● Fail	23	1	2	26

Quality of CR across Health Regions in England

All but one of the 13 Health Regions have a certified CR programme with one region, London (L), having nine (Figure 4a). Encouragingly, the predominate trend is towards classification as Amber (meeting four to six KPIs), which means most programmes are close to achieving certification. One Health Region (NE) has no programmes meeting the standards for Amber status, and has a large number of programmes classified as Red (meeting between one and three KPIs). There are eleven Health Regions failing to meet any KPIs (shown by grey bars) and only two Health Regions without any failing programmes in their regions.

Quality of CR across Health and Social Care Trusts in Northern Ireland

Two of the five Health and Social Care Trusts (BHSCT and NHSCT) have certified programmes in their region that meet all KPIs (green bars) whereas SEHSCT has programmes classified in all three categories (Green, Amber and Red bars; Figure 4b). The two other Trusts have no certified programmes as yet and one failing programme.

Quality of CR across Health Boards in Wales

Three of the seven Health Boards in Wales have the four certified programmes and the other six programmes in these regions are classified as Amber (Figure 4c). Three of the remaining Health Boards have programmes that are all classified as Amber and Red. One Health Board with only one CR programme in the region failed to meet any KPIs (PT).

Part Four: Analysis based on national minimum standards

Figure 4 a/b/c: NCP_CR Key Performance Indicators and certification categories by country/region

Fig. 4a. England

Fig. 4b. Northern Ireland

Fig. 4c. Wales

Part Five:
Evaluation of patient outcomes following CR by country, Health Region and local programme

65%

Men

56%

Women

A greater proportion of men than women see improvements in physical fitness after CR

Analysis of CR contribution to smoking cessation

Smoking cessation remains key in reducing premature death, preventing CVD and managing excess CVD risk in patients following a cardiac event. An open data meta-analysis study across Europe and the United States (CHANCES) of smoking habits in 503,905 participants concluded that smoking is the strongest independent risk factor for CVD and mortality in the over 60s age group (Mons et al 2015). They also concluded that quitting smoking is highly beneficial in reducing excess CVD risk, and that excess CVD risk was much higher in females who continue to smoke. A large systematic review of 12 studies following 5,878 patients after an MI also found quitting smoking reduced the relative risk of premature death by between 15% and 61% (Wilson et al 2000). These studies are highly relevant to the patient population receiving CR in the UK where the mean age is 67 years.

On average 93.4% of patients entering CR are non-smokers which is similar to last year (range 84% to 96.5%) (Table 22, Figure 5 a-c) with proportions comparable in each of the three nations at baseline.

At a national level, the CR contribution to smoking cessation remains positive overall and an improvement on last year with the impact most evident in Northern Ireland followed by England and then Wales. The mean change for the UK was 1.5 percentage points with a range of change from -0.1 to 4.5 percentage points for England, -0.7 to 5.1 percentage points for Northern Ireland and -2.3 to 2.4 percentage points for Wales (Table 22).

As with many nation-specific analyses there is a tendency for overall trends to look good but the situation at a local level to be more complex (Figure 5 a-c). A recent NACR e-survey of clinicians found that 93% of CR programmes in the UK offer smoking cessation support for CR attenders. Stopping smoking remains a top priority and there are some programmes doing rather well with a 4.5 percentage point reduction in the number of patients smoking following CR. However, other programmes are not demonstrating any change or, even worse, some are seeing an increase in the number of patients identified as smokers post-CR. We see from this year's data that 24 programmes in England (Figure 5a), two in Northern Ireland (Figure 5b) and four in Wales (Figure 5c) saw a negative impact of CR on smoking levels in participants.

The scale of the challenge, in terms of smoking status at the point patients enter CR, is very different from programme to programme. For this reason, NACR wants to avoid drawing potentially misleading conclusions about the impact of CR performance on outcomes at a local programme level at this stage as many of the outcomes such as smoking status, weight loss, physical activity status and depression may be interrelated. Future analyses will investigate the extent of interaction between different outcome variables following CR with an aim to validate an audit reporting methodology for CR outcome assessment at a local programme level.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 22

Percentage of non-smokers pre- and post-CR

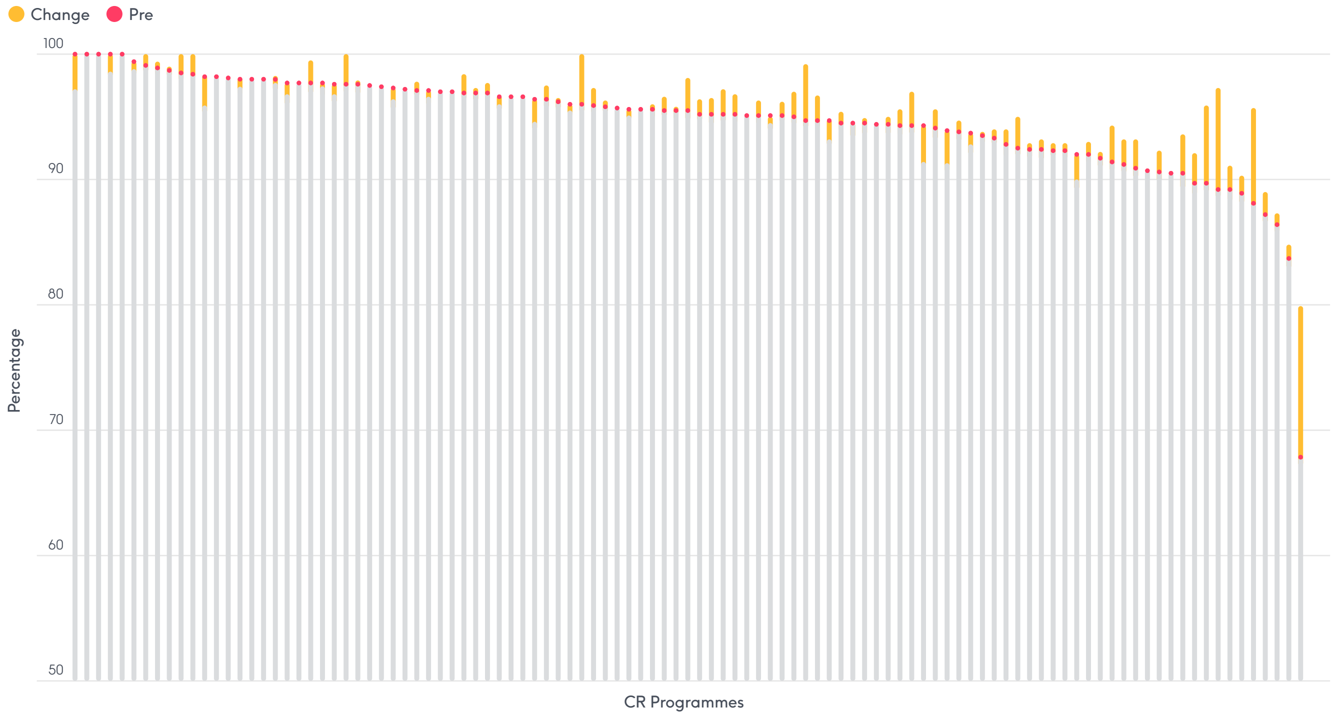
Country	Region	Pre-CR %	Post-CR %	% point change
England	C & M	95.6	95.5	-0.1
	EM	94.8	95.1	0.3
	E o E	96.1	96.5	0.3
	GM, L & SC	94.0	94.7	0.7
	L	94.3	95.6	1.3
	SEC	96.1	96.9	0.8
	SW	94.6	96.1	1.5
	TV	94.5	95.7	1.2
	W	94.6	96.8	2.2
	WM	91.9	95.8	3.9
	Y & TH	84.0	88.5	4.5
Total		93.4	94.9	1.5
Northern Ireland	BHSCT	90.2	89.5	-0.7
	NHSCT	91.7	96.8	5.1
	SEHSCT	96.5	97.6	1.1
	SHSCT	96.1	96.1	0.0
Total		91.1	94.7	3.6
Wales	ABM	95.7	95.2	-0.5
	AB	96.3	97.2	0.9
	BC	94.6	92.3	-2.3
	C & V	95.1	96.9	1.8
	CT	96.5	95.3	-1.2
	HD	93.2	95.6	2.4
Total		95.2	95.7	0.5
Other		94.3	96.6	2.3
Total		93.4	95.0	1.5

England N=21,540, Northern Ireland N=1,347, Wales N=1,680 Total N=24,668 (includes Other)
NE, WHSCT and PT are not shown in any outcomes tables as there is insufficient data.
See Table 3 for Health Region abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Figure 5 a/b/c: Percentage change in non-smokers post-CR by programme

Fig. 5a. England



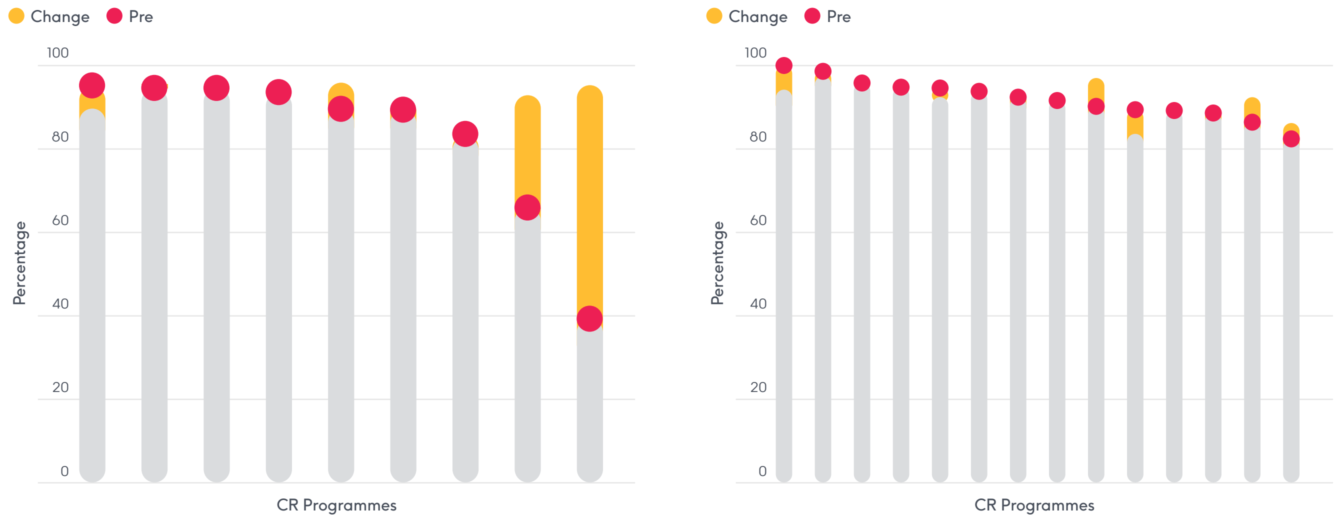


Fig. 5b. Northern Ireland

Fig. 5c. Wales

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Analysis of CR contribution to physical activity status

Physical activity status (e.g. routine daily walking minutes) is an important part of long-term management of CVD risk factors and psychosocial wellbeing. Although physical fitness improvement as measured by fitness testing (e.g. shuttle walk test) is an evidence based expected outcome from CR, it is not inevitable that CR leads to an increase in physical activity (Alotaibi and Doherty 2017). This means that CR programmes should have clearly defined strategies, independent of recommended fitness training, to increase overall physical activity status. All UK Chief Medical Officers (CMOs) recommend 150 minutes per week of moderate intensity physical activity, and this is also stated as a minimum requirement by the BACPR (2017) and SIGN (2017).

In this year's audit, 44% of patients met the recommendation of 150 minutes physical activity per week as they entered CR. This increased considerably to 73.1% after CR completion (Table 23). The mean percentage point increase for each nation was 27.9, 50.1 and 29.4 for England, Northern Ireland and Wales, respectively (Table 23) indicating a very positive outcome following CR (Figure 6 a-c).

The extent of change in Northern Ireland, albeit strongly positive compared to the other nations (>50 percentage points), was achieved despite large variability in the extent of physical activity status change across the five Health Regions (range 32.4 to 68.8). The extent of physical activity status at the point patients enter CR is also very different at a local programme level. For example, the proportion of patients meeting the 150 minutes target at the start of CR ranged from three percentage points in one programme to 100% in another. This makes it difficult to compare outcomes (percentage point changes) at programme level, as the potential for change is greater in those programmes where participants started with low physical activity status. Conversely, these patients who start with low baseline physical activity may be habitually less active which could mean they are less likely to change their behaviour as a result of the CR intervention.

Physical activity is an important lifestyle risk factor for CVD and NACR is keen to receive feedback on how local programmes facilitate and monitor physical activity during CR and encourage long-term maintenance (Dibben et al 2018). The BHF has produced helpful summaries of physical activity statistics and advice on how on to achieve 150 minutes of physical activity which may be helpful to programmes looking to improve their performance on this outcome.

See BHF resources:

www.bhf.org.uk/informationsupport/support/healthy-living/staying-active

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 23

Change in physical activity status (proportion of CR participants achieving 150 minutes per week) following CR by Health Region

Country	Health Region	Pre-CR %	Post-CR %	% point change
England	C & M	41.5	67.1	25.5
	EM	35.2	53.3	18.2
	E o E	47.1	77.6	30.5
	GM, L & SC	48.1	78.3	30.3
	L	39.8	71.2	31.4
	SEC	48.8	78.0	29.2
	SW	50.2	72.5	22.3
	TV	48.0	80.0	32.0
	W	49.3	77.5	28.2
	WM	44.1	83.9	39.7
	Y & TH	42.7	65.2	22.5
Total		44.7	72.6	27.9
Northern Ireland	BHSCT	33.8	70.4	36.6
	SEHSCT	25.9	79.6	53.7
	SHSCT	67.6	100.0	32.4
	WHSCT	21.9	90.6	68.8
Total		28.6	78.7	50.1
Wales	ABM	41.3	76.2	34.9
	AB	47.3	80.5	33.2
	BC	38.0	62.6	24.6
	C & V	53.1	80.8	27.6
	CT	31.0	66.2	35.2
	HD	52.3	64.9	12.6
Total		44.8	74.3	29.4
Other		58.5	87.8	29.3
Total		**44.0**	**73.1**	**29.0**

England N=14,520, Northern Ireland N=760, Wales N=1,369, Total N=18,575 (includes Other).
NE, WHSCT and PT are not shown as there is insufficient data.
NHSCT has been removed due to one programme biasing the overall figures for the region; detail for this programme is presented in the supplements.
See Table 3 for Health Region abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Figure 6 a/b/c: Change in physical activity status (proportion of patients achieving 150 minutes per week) following CR by programme

Fig. 6a. England

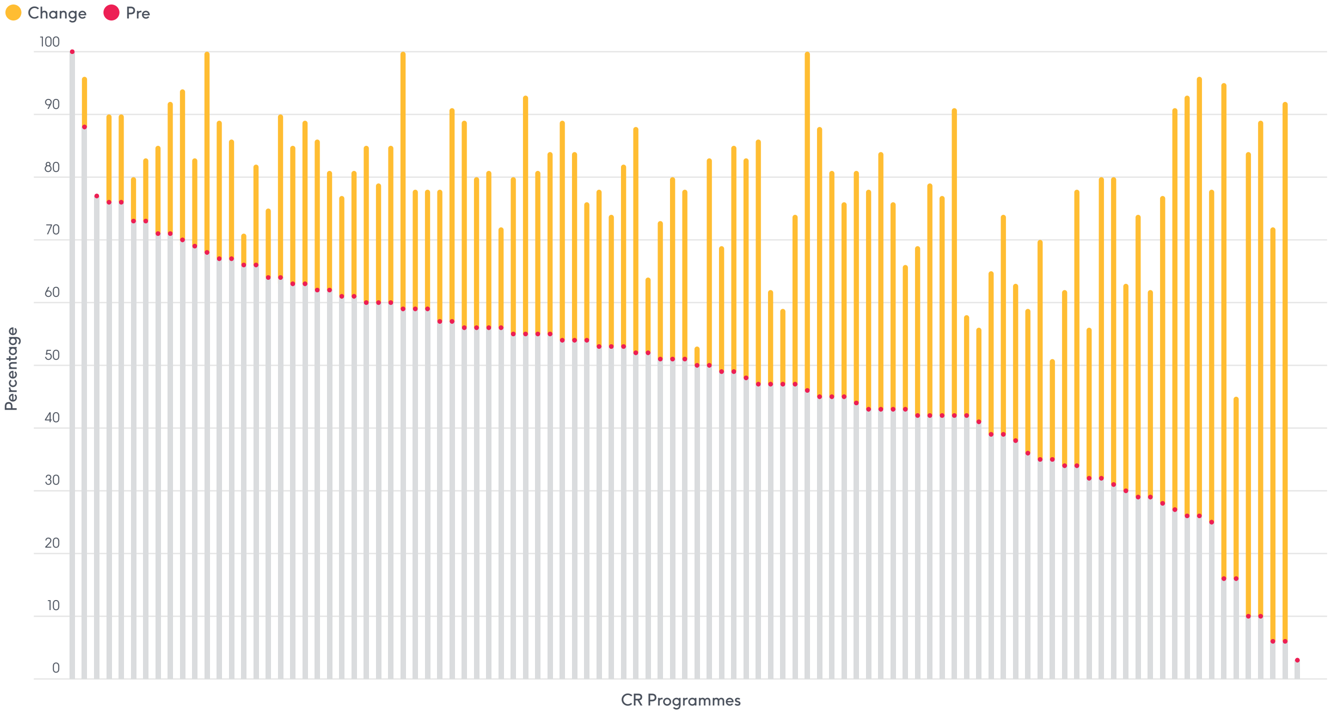


Fig. 6b. Northern Ireland

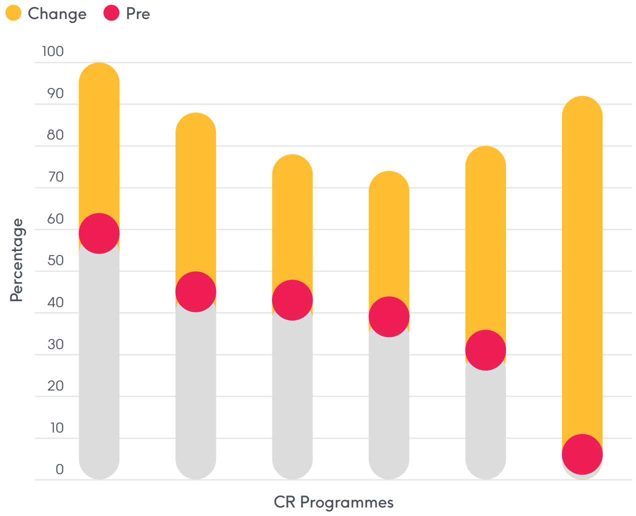
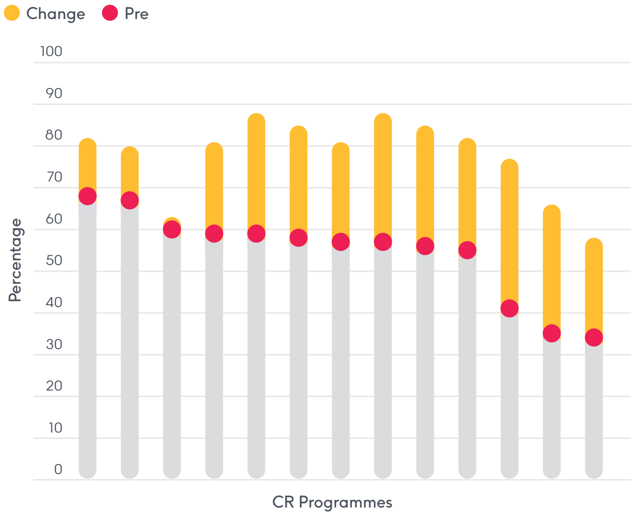


Fig. 6c. Wales



Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Analysis of CR contribution to Body Mass Index (BMI)

The ability of a CR programme to make substantial change in BMI is influenced by other factors such as smoking cessation, physical activity levels and level of depression. Evidence suggests that patients trying to quit smoking are more likely to put on between three and five kilograms in the first three months to a year (Aubin et al 2012, Tian et al 2015). Results from the EUROASPIRE IV survey on smoking cessation in Europe in patients with coronary heart disease also found a five percentage point increase of weight in quitters (Snaterse et al 2018). These substantial associations may obscure the results for BMI, and can underestimate the success of weight loss programmes. However, NACR data analysis concludes that the extent of weight gain associated with smoking cessation in patients attending CR is much less than previous studies suggest (Salman and Doherty 2018, PhD awaiting publication).

On average, around 30% of CR patients start rehabilitation with a BMI greater than 30 (Table 24). The overall mean BMI at baseline is 28 (Standard Deviation five). Using NACR national level data we can confirm that many patients are losing weight and moving to a BMI <30, which is positively associated with weight management. However, the overall change seen across England, Northern Ireland and Wales is low, with Northern Ireland seeing negative impact of CR on BMI levels (negative one percentage point) and England and Wales achieving an increase in the proportion of patients with a BMI <30 of only 0.4 and 0.5 percentage points, respectively (Table 24). This highlights the difficulty in addressing this risk factor. Regional and local programme variation also exists, with a range of change from -6.2 to 5.2 percentage points (Figure 7 a-c), suggesting that some programmes may be doing slightly better than others, and could highlight an opportunity for sharing best practice.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 24

Percentage of patients with BMI <30 pre- and post-CR

Country	Health Region	Pre-CR %	Post-CR %	% point change
England	C & M	68.4	67.8	-0.6
	EM	65.9	65.5	-0.5
	E o E	71.0	71.4	0.4
	GM, L & SC	71.1	71.8	0.6
	L	72.3	72.3	0.0
	SEC	72.8	73.2	0.4
	SW	74.3	75.2	0.9
	TV	70.0	70.3	0.3
	W	72.6	73.5	0.9
	WM	63.6	65.0	1.4
	Y & TH	67.7	69.0	1.3
Total		70.5	71.0	0.4
Northern Ireland	BHSCT	65.0	64.5	-0.5
	NHSCT	59.5	57.3	-2.3
	SEHSCT	64.3	65.6	1.3
	SHSCT	65.5	60.0	-5.5
Total		63.1	62.2	-1.0
Wales	ABM	64.6	65.7	1.1
	AB	65.2	65.5	0.3
	BC	74.0	74.6	0.6
	C & V	65.5	64.8	-0.8
	CT	50.0	54.5	4.5
	HD	72.1	72.6	0.6
Total		66.5	66.9	0.5
Other		66.7	66.7	0.0
Total		69.8	70.1	0.3

England N=18,853, Northern Ireland N=1,308, Wales N=1,524, Total N=21,772 (includes Other)
NE, WHSCT and PT are not shown as there is insufficient data
See Table 3 for Health Region Abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Figure 7 a/b/c: Change in BMI post-CR (<30 BMI) by programme

Fig. 7a. England

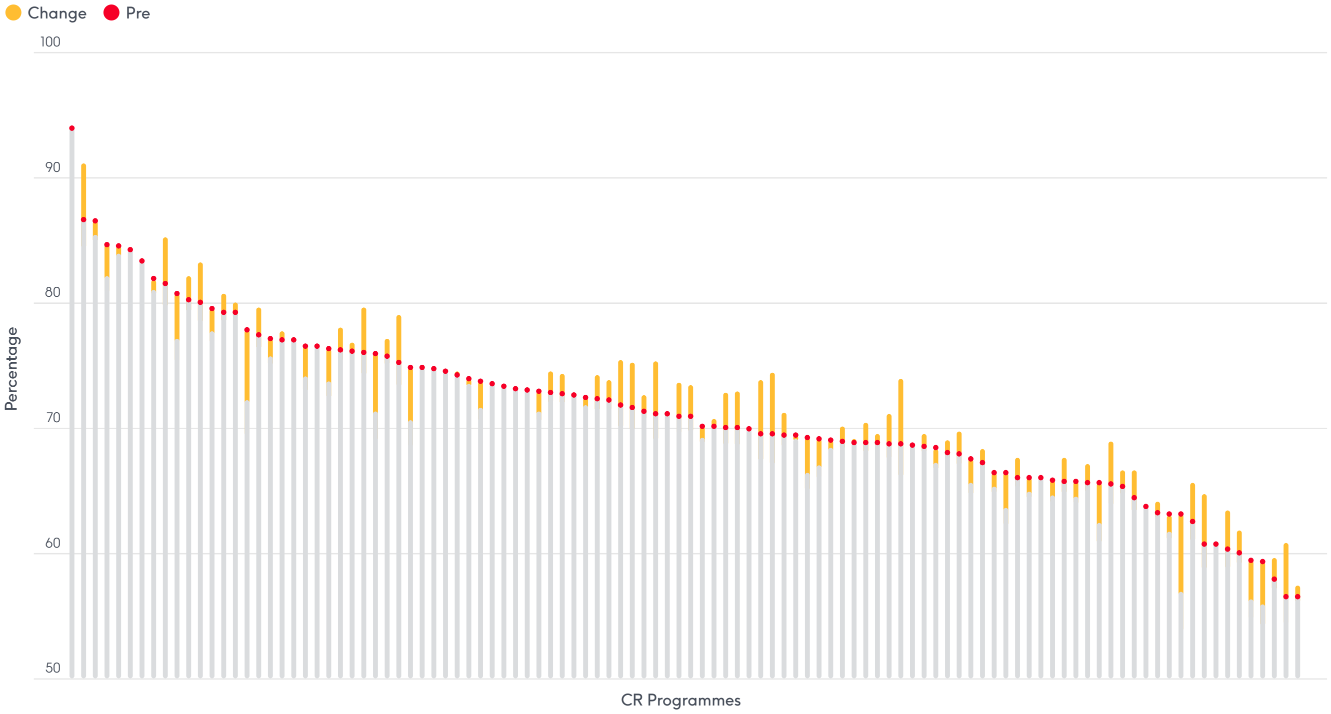


Fig. 7b. Northern Ireland

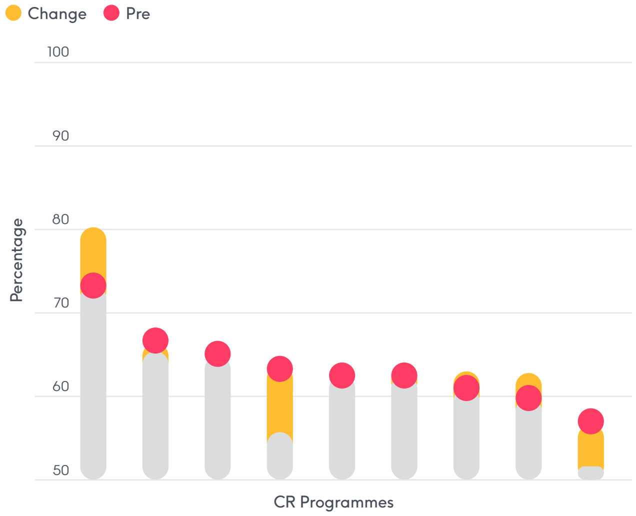
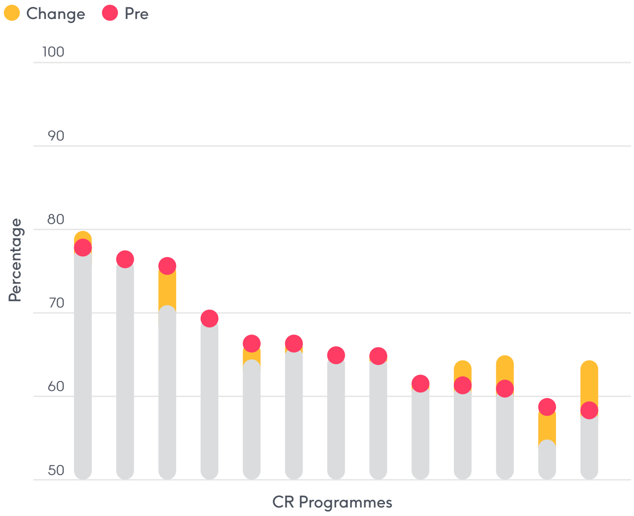


Fig. 7c. Wales



Analysis of CR contribution to HADS anxiety levels

Around 72.5% of patients present at the start of CR with anxiety levels within the 'normal' category of the HADS, and the remaining 27.5% are classed as having borderline or clinical anxiety (Table 25 and 26). Variation in the burden of anxiety is evident across Health Regions and countries, with averages of 14.9%, 14.3% and 11.2% for clinical levels of anxiety in Wales, Northern Ireland and England, respectively.

A post-CR improvement in patient status from clinical or borderline anxiety to borderline or normal anxiety was observed for most programmes across different Health Regions (Table 25 and 26) and adds to previous evidence that shows CR is known to lower anxiety.

Overall, at the national level there was a 6.4 percentage point shift from borderline or clinical anxiety to the normal anxiety category (Table 26). National and regional values suggest that most patients benefit from improvements in anxiety after CR. However, there is large variation in the extent of this improvement at a local level ranging from -13.0% to 43.6% (Figure 8 a-c). Encouragingly, around 42% of programmes met or exceeded the 6.3 percentage point national average change in anxiety following CR.

NACR recognises the use of the PHQ9 and GAD7 tools for anxiety and depression. When sufficient data is available we will include this in future reports.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 25

Percentage of patients by HADS anxiety categories pre- and post-CR

		Pre-CR			Post-CR		
Country	**Health Region**	**Normal %**	**Borderline %**	**Clinical anxiety %**	**Normal %**	**Borderline %**	**Clinical anxiety %**
England	C & M	71.0	15.6	13.4	77.6	12.7	9.7
	EM	71.6	16.4	12.0	79.0	12.6	8.4
	E o E	74.9	16.6	8.5	81.7	12.5	5.9
	GM, L & SC	71.8	16.7	11.5	76.6	14.3	9.1
	L	70.7	16.7	12.6	77.0	13.0	10.0
	SEC	74.9	15.1	10.0	82.5	10.4	7.1
	SW	73.0	16.5	10.5	81.8	11.9	6.3
	TV	74.4	15.7	9.9	80.7	11.7	7.6
	W	75.7	14.8	9.5	81.4	12.2	6.4
	WM	72.6	15.7	11.7	79.5	12.4	8.2
	Y & TH	70.3	16.5	13.2	75.7	14.0	10.4
Total		72.8	16.1	11.2	79.2	12.6	8.2
Northern Ireland	BHSCT	63.7	15.9	20.3	72.5	12.5	14.9
	NHSCT	77.6	13.0	9.3	83.2	10.2	6.5
	SEHSCT	72.2	13.7	14.1	83.1	10.9	6.0
	SHSCT	69.1	17.3	13.6	72.7	15.5	11.8
Total		71.2	14.6	14.3	78.7	11.7	9.5
Wales	ABM	68.7	14.6	16.6	72.7	17.7	9.6
	AB	63.2	19.0	17.8	75.1	13.8	11.1
	BC	70.4	16.4	13.2	75.7	11.8	12.5
	C & V	75.9	12.4	11.7	78.5	13.7	7.8
	CT	57.1	19.0	23.8	57.1	23.8	19.0
	HD	71.0	15.9	13.0	75.4	12.3	12.3
Total		69.7	15.4	14.9	75.0	14.7	10.3
Other		72.4	12.6	14.9	80.5	9.2	10.3
Total		72.5	15.9	11.6	78.9	12.6	8.5

England N=15,301, Northern Ireland N=988, Wales N=1,226, Total N=17,604 (includes Other)
NE, WHSCT and PT are not shown as there is insufficient data
See Table 3 for Health Region abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 26

Percentage point change in HADS anxiety categories following CR

		Point change		
Country	**Health Region**	**Normal %**	**Borderline %**	**Clinical anxiety %**
England	C & M	6.6	-2.9	-3.7
	EM	7.4	-3.8	-3.6
	E o E	6.8	-4.1	-2.7
	GM, L & SC	4.8	-2.4	-2.4
	L	6.3	-3.7	-2.6
	SEC	7.7	-4.7	-2.9
	SW	8.8	-4.6	-4.2
	TV	6.2	-4.0	-2.2
	W	5.7	-2.6	-3.1
	WM	6.8	-3.3	-3.5
	Y & TH	5.3	-2.5	-2.8
Total		6.4	-3.5	-2.9
Northern Ireland	BHSCT	8.8	-3.4	-5.4
	NHSCT	5.6	-2.8	-2.8
	SEHSCT	10.9	-2.8	-8.1
	SHSCT	3.6	-1.8	-1.8
Total		7.6	-2.8	-4.8
Wales	ABM	3.9	3.1	-7.0
	AB	11.9	-5.1	-6.7
	BC	5.3	-4.6	-0.7
	C & V	2.6	1.3	-3.9
	CT	0.0	4.8	-4.8
	HD	4.3	-3.6	-0.7
Total		5.4	-0.7	-4.6
Other		8.0	-3.4	-4.6
Total		**6.4**	**-3.3**	**-3.2**

England N=15,301, Northern Ireland N=988, Wales N=1,226, Total N=17,604 (includes Other)
NE, WHSCT and PT are not shown as there is insufficient data
See Table 3 for Health Region abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Figure 8 a/b/c: Change in anxiety post-CR by programme (% normal) in England, Northern Ireland and Wales

Fig. 8a. England

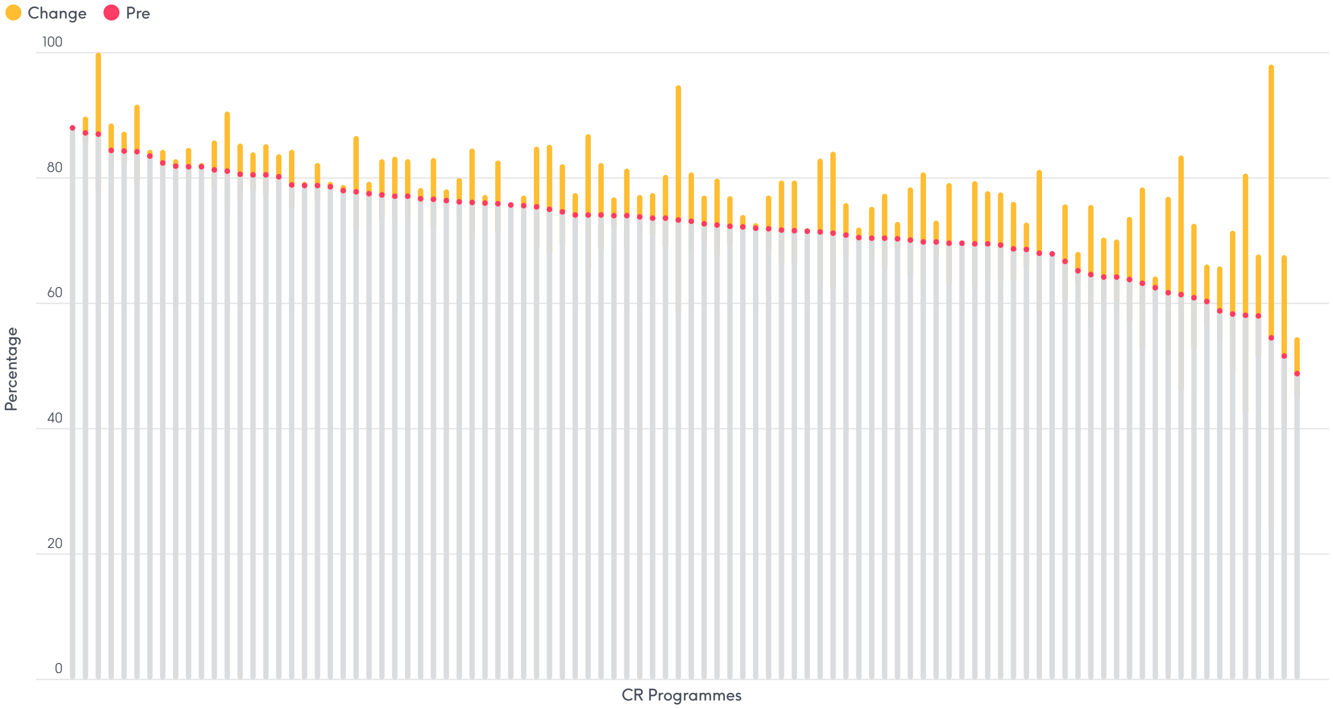


Fig. 8b. Northern Ireland

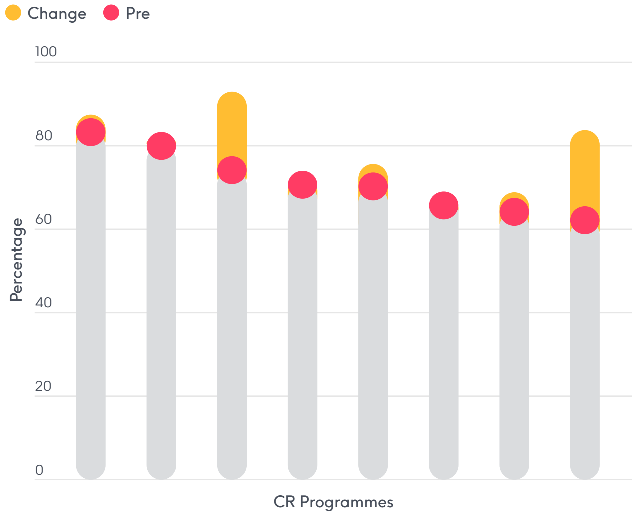
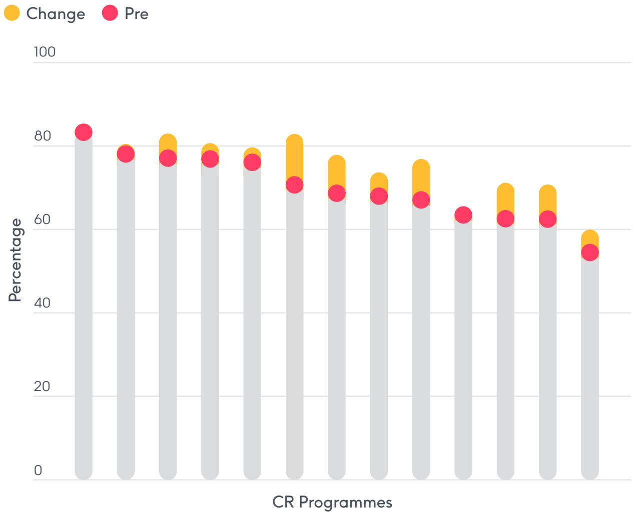


Fig. 8c. Wales



Analysis of CR contribution to HADS depression levels

Overall around 18% of patients starting CR are classed by HADS score as having borderline or clinical depression (Table 27). Variation in the presentation of depression is evident across countries and Health Regions, with 6.4%, 6.1% and 10.0% of CR participants reported to have clinical depression at baseline in England, Northern Ireland and Wales, respectively. Performance at national and regional level suggests that most patients benefit from reduced levels of depression after CR (Tables 27 and 28). Improvements in patient status from clinical depression to borderline or normal were evenly distributed across all Health Regions.

At national level, there was an overall decrease in the proportion of patients diagnosed with borderline or clinical depression of 2.3 and 3.5 percentage points, respectively, after CR. A 5.9 percentage point increase was also seen at national level in the proportion of patients classed as normal on the HADS scale after CR (Table 27).

Notwithstanding the overall positive effect there is large variation in the extent of this improvement at a local programme level from -12.5 to 36.4 percentage points (Figure 9 a-c). Encouragingly, at a regional and local level, 51.3% of programmes met or exceeded the 5.9 percentage point national average change in depression after CR.

We are publishing HADS categories for patients before and after CR and the change in each category at a named local programme level as supplements to the main report. These will be produced for both anxiety and depression, which are indicators for psychosocial health, a key aim for programmes to address with patients. This is the direction the audit is continuing to adopt across patient outcome measures and we appreciate feedback on its methodology and impact.

Supplementary reports available:

www.cardiacrehabilitation.org.uk/current-annual-report.htm

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 27

Percentage of patients by HADS depression categories pre- and post-CR

				Pre-CR			Post-CR
Country	Health Region	Normal %	Borderline %	Clinical depression %	Normal %	Borderline %	Clinical depression %
England	C & M	80.7	12.3	7.0	87.2	8.4	4.4
	EM	82.7	12.7	4.7	88.2	8.5	3.3
	E o E	87.1	9.4	3.6	91.3	6.1	2.6
	GM, L & SC	80.2	11.6	8.2	87.0	9.0	4.0
	L	78.4	12.8	8.8	84.5	10.3	5.3
	SEC	83.6	11.4	5.0	89.4	7.2	3.4
	SW	83.1	11.4	5.5	88.9	7.7	3.3
	TV	81.9	11.2	6.9	87.7	7.9	4.5
	W	85.4	9.2	5.4	90.6	6.4	3.0
	WM	80.8	12.6	6.6	90.3	6.0	3.8
	Y & TH	80.0	12.9	7.1	84.2	9.5	6.3
Total		**82.1**	**11.6**	**6.4**	**87.8**	**8.1**	**4.0**
Northern Ireland	BHSCT	76.6	15.3	8.1	84.7	8.5	6.8
	NHSCT	90.1	6.8	3.1	92.2	4.7	3.1
	SEHSCT	81.5	11.3	7.3	89.5	7.7	2.8
	SHSCT	75.5	17.3	7.3	80.9	13.6	5.5
Total		**82.4**	**11.5**	**6.1**	**88.1**	**7.5**	**4.4**
Wales	ABM	74.6	14.1	11.3	84.2	8.5	7.3
	AB	73.1	16.2	10.7	84.2	9.1	6.7
	BC	79.6	13.8	6.6	83.6	6.6	9.9
	C & V	80.8	11.7	7.5	86.3	7.2	6.5
	CT	72.7	9.1	18.2	81.8	9.1	9.1
	HD	73.2	13.8	13.0	76.8	15.2	8.0
Total		**76.3**	**13.8**	**10.0**	**83.8**	**8.8**	**7.4**
Other		86.2	5.7	8.0	92.0	3.4	4.6
Total		**81.7**	**11.7**	**6.6**	**87.6**	**8.1**	**4.3**

England N=15,304, Northern Ireland N=989, Wales N=1,226, Total N=17,608 (includes Other)
NE, WHSCT and PT are not shown as there is insufficient data.
See Table 3 for Health Region abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Table 28

Percentage point change in HADS depression following CR

		Point change		
Country	**Health Region**	**Normal %**	**Borderline %**	**Clinical depression %**
England	C & M	6.5	-3.9	-2.6
	EM	5.6	-4.2	-1.4
	E o E	4.2	-3.3	-1.0
	GM, L & SC	6.8	-2.7	-4.2
	L	6.1	-2.5	-3.6
	SEC	5.8	-4.2	-1.7
	SW	5.8	-3.7	-2.1
	TV	5.7	-3.4	-2.4
	W	5.2	-2.8	-2.4
	WM	9.5	-6.6	-2.9
	Y & TH	4.2	-3.4	-0.8
Total		**5.8**	**-3.4**	**-2.4**
Northern Ireland	BHSCT	8.1	-6.8	-1.4
	NHSCT	2.2	-2.2	0.0
	SEHSCT	8.1	-3.6	-4.4
	SHSCT	5.5	-3.6	-1.8
Total		**5.7**	**-4.0**	**-1.6**
Wales	ABM	9.6	-5.6	-4.0
	AB	11.1	-7.1	-4.0
	BC	3.9	-7.2	3.3
	C & V	5.5	-4.6	-1.0
	CT	9.1	0.0	-9.1
	HD	3.6	1.4	-5.1
Total		**7.5**	**-5.0**	**-2.5**
Other		5.7	-2.3	-3.4
Total		**5.9**	**-3.5**	**-2.3**

England N=15,304, Northern Ireland N=989, Wales N=1,226, Total N=17,608 (includes Other)
NE, WHSCT and PT are not shown as there is insufficient data.
See Table 3 for Health Region abbreviations.

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Figure 9 a/b/c: Change in depression post-CR by programme (% normal)

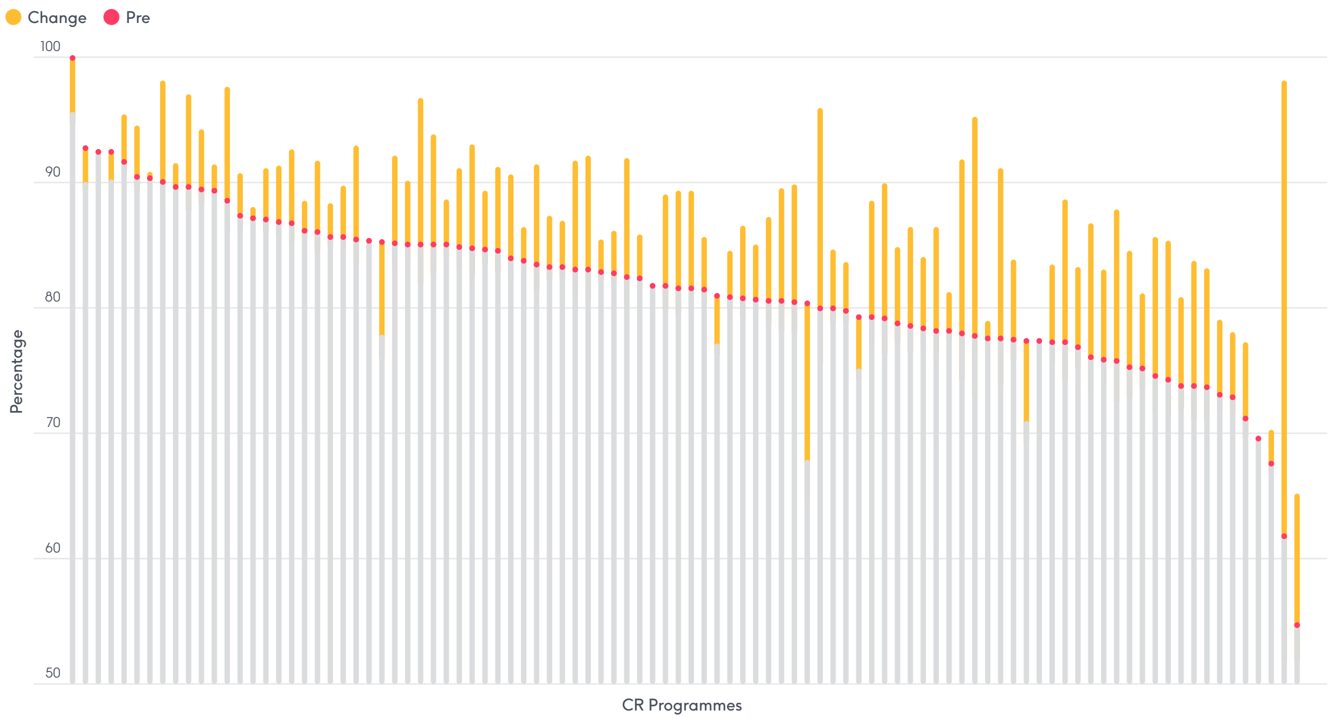


Fig. 9a. England

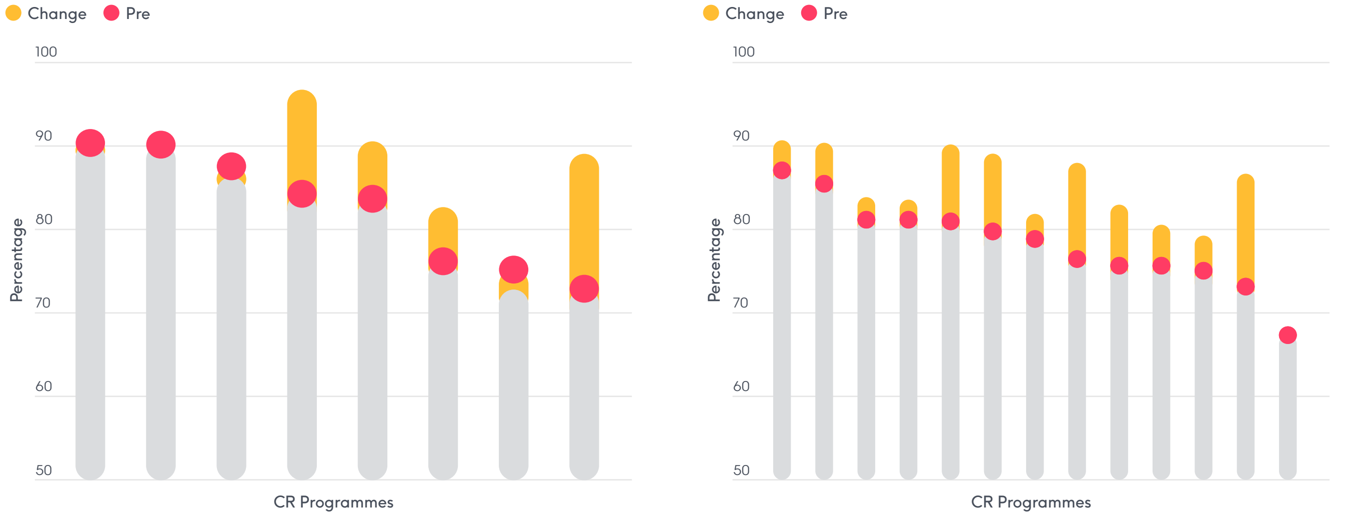


Fig. 9b. Northern Ireland

Fig. 9c. Wales

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Analysis of CR contribution to additional cardiovascular risk factors and physical fitness

Cardiovascular risk factors

Management of CVD risk factors in people with heart disease is multifaceted and involves long-term commitment to behaviour change which is known to vary by gender. Data from a study of 10,112 patients (29% female) across Europe, Asia, and the Middle East showed that women were less likely to achieve risk factor treatment targets for CVD secondary prevention than men (Zhao et al 2017).

The quality and size of the NACR dataset now allows us to report on CVD risk factors in greater detail. In agreement with the aforementioned studies, Table 29 shows that fewer females met target levels for cholesterol, blood pressure and alcohol consumption at baseline and females were less likely to benefit from CR compared to men in terms of achieving cholesterol targets.

Table 29

Change in CVD risk factor outcomes

		Gender	Pre-CR %	Post-CR %	% point change
Total cholesterol (N=4,250)	<4.0	Male	40	68	28
		Female	28	49	21
LDL cholesterol (N=4,250)	<2.0	Male	36	62	26
		Female	30	50	20
Blood pressure (N=22,291)	Systolic <140 and Diastolic <90	Male	71	72	1
		Female	69	71	2
Waist circumference (N=11,077)	<102 cm Male <88 cm Female	Male	62	64	2
		Female	34	36	2
Alcohol consumption (N=54,432)	<14 units per week	Male	82	84	2
		Female	96	97	1

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Physical fitness

Pre- and post-CR physical fitness tests using the Incremental Shuttle Walk Test (ISWT) and the Six Minute Walk Test (6MWT) were recorded for 8,285 participants, which is an improvement on last year's data (Table 30).

The primary measure of physical fitness was the ISWT (5,038 patients) where the proportion of patients achieving a minimal clinically important difference (MCID) of >70 metres following CR was 65% for males and 56% for females.

The equivalent for the 6MWT, which is a measure of walking endurance aimed at patients with low functional capacity, showed that 77% of male patients and 73% of females achieved a MCID of >25m following CR (Table 30). As previously highlighted in this report, fewer eligible females are accessing CR and, of those who do start and complete CR, fewer achieve MCID compared with men. To improve female uptake and outcomes, CR programmes should look closely at the exercise prescription and ensure that it is tailored to the needs of female patients so that they can be supported to achieve comparable gains for CR.

All major guidelines on CR recommend physical fitness assessment to (1) help classify patient's risk prior to starting CR (2) inform the exercise prescription (3) evaluate the effectiveness of the intervention (change in pre- and post- scores) following CR (BACPR 2017). However, our data shows that less than a third of patients are receiving a functional capacity measurement at baseline and a further 36.6% of patients do not have an end-of-programme functional capacity assessment. This remains a major concern, as it could increase risk if patients start exercise without knowing their overall risk status (ACPICR 2016).

Table 30

Proportion of patients achieving minimal clinically important difference (MCID) in walking fitness post-CR

		Male		Female	
		% no	% yes	% no	% yes
Incremental Shuttle Walk Test (male = 3,991 female = 1,047)	Clinical difference of >70m (Houchen-Wollof 2015)	35	65	44	56
Six Minute Walk Test (male = 2,283 female = 964)	Clinical difference of >25m (Gremeaux 2011)	23	77	27	73

Part Five: Evaluation of patient outcomes following CR by country, Health Region and local programme

Analysis of CR contribution to normal health-related Quality of Life

Improvement of patient health-related quality of life (QoL) following CR is measured using the Dartmouth COOP questionnaire and is presented for England, Northern Ireland and Wales in Table 31.

Overall, QoL improved for participants receiving CR in all countries and across all domains of the Dartmouth COOP, with the greatest perceived benefit seen in physical fitness (33.2 percentage point increase) followed by overall health (15.2 percentage point increase). A recently published paper based on NACR data shows that a similarly positive change in QoL is seen for both supervised and facilitated home-based CR approaches (Harrison and Doherty 2018).

Table 31

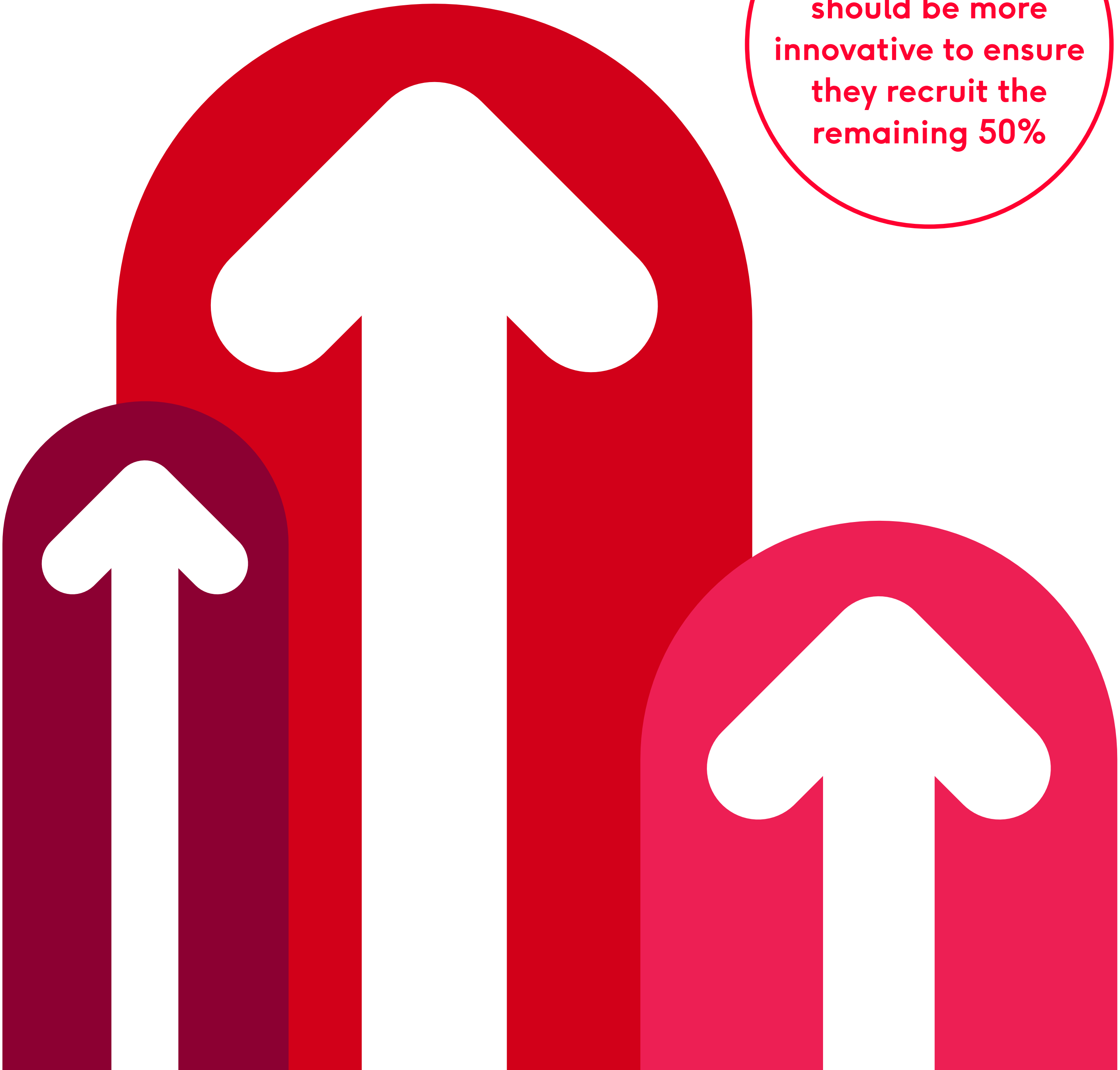
Percentage of patients with normal health-related QoL (Dartmouth Coop) score pre- and post-CR

	Country							
	England		Northern Ireland		Wales		Total	
	Pre-CR %	Post-CR %	Pre-CR %	Post-CR %	Pre-CR %	Post-CR %	Pre-CR %	Post-CR %
Physical fitness	43.8	76.9	36.3	73.6	41.9	73.4	43.4	76.6
Feelings	84.8	90.2	82.0	91.4	83.6	89.4	84.6	90.2
Daily activities	85.7	96.0	82.3	93.8	83.7	94.7	85.4	95.8
Social activities	83.7	94.2	79.6	91.4	82.8	93.0	83.4	94.0
Pain	78.0	84.1	76.6	83.3	77.3	81.0	77.9	83.8
Overall health	64.2	79.5	64.5	81.8	64.6	77.9	64.3	79.5
Social support	87.7	85.1	88.4	86.5	87.4	84.3	87.7	85.2
Quality of life	95.1	97.3	95.4	97.5	95.0	96.4	95.1	97.2

England N=13,180, Northern Ireland N=628, Wales N=1,180, Total N=15,078 (includes Other)

Part Six: Recommendations and actions

CR programmes should be more innovative to ensure they recruit the remaining 50%



Recommendations and actions

The NACR Quality and Outcomes Annual Report 2018 highlights that more patients than ever are taking up high quality CR and that outcomes for most patients are positive. At the same time the report highlights some unacceptable variation in the quality of delivery and outcomes.

These recommendations from NACR will be delivered in partnership with CR programmes and key strategic partners.

Key recommendations:

1. **Recruit more female patients**
2. **Ensure that CR programmes are better tailored to the needs of female patients**
3. **Carry out a comprehensive CR assessment prior to and on completion of CR**
4. **Offer facilitated home-based modes of CR delivery for all CVD patients, including those with HF**
5. **Ensure your programme is working to certification standards and aim to secure certified status for the delivery of CR.**

Actions:

1. **Radical change in recruitment with a high priority given to female patients evident through service redesign**
2. **Ensure that CR is tailored to the needs of female patients, particularly interventions aimed at managing CVD risk factors and encouraging more physical activity**
3. **Make CR assessment a priority as part of CR service delivery plans and resources**
4. **Clearly define and resource home-based options for CVD patients generally, and more specifically, for people with HF**
5. **Liaise with the NACR team about acquiring or maintaining certification of CR delivery against clinical standards**
6. **Utilise BHF Health Services Engagement team to help share good practice.**

Acknowledgements

NACR is indebted to the BHF and its Health Service Engagement Team in supporting our shared ambition to promote cardiovascular health and the prevention of cardiovascular disease. A special thank you to Jacob West (Director of Healthcare Innovation), Sally Hughes (Head of Health Services Engagement) and Jenny Hargrave (Director of Innovation in Health and Wellbeing) who, through their teams, have helped NACR shape its strategic vision.

NACR and the BACPR are committed to ensuring that all CR programmes in the UK offer quality CR that is known to benefit patients. Services benefit from the BACPR's commitment to offering education and training for CR clinicians. The BACPR/NACR joint NCP_CR is a world-leading quality assurance project that owes much to the leadership of the BACPR. A big thank you to Sally Hinton (Executive Director), Vivienne Stockley (Education Coordinator), Dr Scott Murray (President) and Dr Hayes Dalal (NCP_CR co-chair).

Thank you to NHS Digital for hosting our CR patient data and for support and expertise with quality-assuring our data. Through NHS Digital we are able to utilise routine practice data to reduce inequalities and improve services for patients.

NACR owes much to the willingness of clinical teams in choosing to take part, and in completing the clinical assessments and questionnaires before and after their programme. Our acknowledgement extends to patients for allowing their data to be used as part of NACR, and thus helping shape the future quality of services offered by the NHS. The patient voice is very important to us, hence we acknowledge support from the Cardiovascular Care Partnership (UK) (CCPUK), which makes NACR and its findings more meaningful for patients and carers. Special thanks to Ken Timmis and Trevor Fernandes.

We would very much like to thank the NACR Steering Committee for their continued support and expertise in shaping recent developments. They are: Alison Allen (Wales User Representative), Elaine Allen (England User Representative), Mel Clark (Patient Representative), Dr Hayes Dalal (Co-Chair NCP_CR), Chris Dew (Programme Manager, Audit Support Unit, NHS Digital), Frances Divers (Scotland Representative, NHS Lothian), Trevor Fernandes (CCPUK), Dr Jane Flint (Cardiologist), Jenny Hargrave (Director of Innovation in Health and Wellbeing, BHF), Sally Hinton (Executive Director, BACPR), Sally Hughes (Head of Health Services Engagement, BHF), Suzanne Indge (NACR Lead for the All Wales Cardiac Rehab Group), Alana Laverty (Northern Ireland Representative), Dr Scott Murray (Cardiologist and President, BACPR), Lorraine Oldridge (National Lead - NCVIN, Public Health England), Rachel Owen (Wales Representative), Irene Thomson (Scotland Representative, NHS Lothian), Iain Todd (Scotland Representative, NHS Lothian).

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Appendix 1:
Reasons for not taking part

Grouped categories of reasons for not taking part	Individual reasons for not taking part
Patient	Patient not interested/refused
	Physical incapacity
	Holidaymaker
	Mental incapacity
	Died
	Too ill
	Patient requested transfer to another programme
Service	Ongoing investigation
	Local exclusion criteria
	Not referred
	Rehab not needed
	Rehab not appropriate
	Staff not available
	Rapid transfer to tertiary care
	DNA/no Contact
	No Service Available
	Transfer for PCI/treatment
	Transfer to DGH/trust
Work/Social	Returned to work
	Language barrier
	No transport

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