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ORIGINAL ARTICLE

Evaluation of Cardiac Rehabilitation Performance and Initial Benchmarks for Australia: An Observational Cross-State and Territory Snapshot Study

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Background Australia, unlike most high-income countries, does not have published benchmarks for cardiac rehabilitation (CR) delivery. This study provides cross-state data on CR delivery for initial benchmarks and assesses performance against international minimal standards.

Methods A prospective observational study March–May 2017 of CR programs in NSW (n=36), Tasmania (n=2) and ACT (n=1) was undertaken. Data were collected on 11 indicators (published dictionary), then classified as higher or lower performing using the UK National Audit of Cardiac Rehabilitation (NACR) criteria. Equity of access to higher performing CR was assessed using logistic regression.

Results Participants (n=2,436) had a mean age of 66.06±12.54 years, 68.9% were male, 16.2% culturally and linguistically diverse (CALD) and 2.6% Aboriginal and Torres Strait Islander peoples. At patient level, waiting time was median 15 (Interquartile range [IQR] 9–25) days, 24.3% had an assessment before starting, 41.8% on completion, a median 12 sessions (IQR 6–16) were delivered, which 59.1% completed and 75.4% were linked to ongoing care.
At program level, using NACR criteria, 18.0% were classified as higher performing and ≥87.1% met waiting time criteria, however, only 20.5% met duration criteria. Evidence of inequitable access to higher performing programs was present with substantially higher odds for participants living in major cities (OR 28.11 95%CI 18.41, 44.92) and with every decade younger age (OR 1.89–2.94) and lower odds by 89.0% for principal referral hospital-based services (OR 0.11 95%CI 0.08, 0.14) and 31.0% for people having a CALD background (OR 0.69 95%CI 0.49, 0.97).

Conclusions This study provides initial national CR performance benchmarks for quality improvement in Australia. While wait times are minimised, few programs are higher performing or met minimum duration standards. There is an urgent need to resource and support CR quality and access outside of major cities, in principal referral hospitals and for older and diverse patients.

Keywords Cardiac rehabilitation • Quality • performance • Benchmarks • Equity • Access

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Introduction

Cardiovascular disease (CVD) is the leading cause of death globally and is responsible for 29% of deaths and more than 1.1 million hospitalisations in Australia in 2015–16 [1]. Once diagnosed with CVD, cardiac events are common, emphasising the importance of secondary prevention. The most effective, well-established method of secondary prevention intervention is cardiac rehabilitation (CR) [2–5] and referral to CR is recommended in guidelines for CVD patient care internationally [6–9]. To be effective, CR must be multidisciplinary, multi-component, individually tailored and available equitably, therefore guidelines are provided to standardise content, delivery and access internationally [6–9].

In practice, CR delivery varies substantially from these guidelines at international and local levels. A recent global study of 93 countries including Australia reported that only 9 of 11 core/essential components were typically delivered, for example, smoking cessation and return to work advice were often omitted [10]. Furthermore, inequitable access for older and socioeconomically disadvantaged populations is common [11]. Similar variability in CR performance is reported in Australia. Referrals are low at 30.2% overall [12] and 46% following acute coronary syndrome (ACS) [13] and notably lower for older, female and private hospital patients [12,13]. The Australian model of CR is typically outpatient based, comprehensive (including structured supervised exercise and education) and delivered by a multidisciplinary team, with the oversight but not close involvement of physicians. However, within this model, components such as structured exercise delivery varies substantially—many rural and remote areas do not provide this component [14] and duration is typically much lower than international standards at 1–2 sessions per week for 7 weeks [15,16]. Other comparisons to international standards cannot be made due to the lack of published reports on CR services nationally. This deficit is in striking contrast to other high income countries, such as the USA, Canada, Japan, and European countries [16–20]. The UK has a 10-year history of a National Audit of Cardiac Rehabilitation (NACR) providing benchmarks and promoting quality improvement [20].

This study addressed this deficit. A minimal set of locally relevant quality measures were implemented that had been developed in a rigorous process including a modified Delphi method and pilot-tested in 16 sites (938 patients) with median performance of 93% (IQR 47–100%) across the indicators [19]. The study aimed to describe CR delivery across Australian states and territories, provide initial benchmarks for quality improvement and compare the performance of Australian CR programs to international minimal standards.

Methods

A prospective observational study was undertaken, with data collected for 3 months, March through May 2017. The study is reported using the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines [21].

Setting and Sample

Cardiac rehabilitation services were eligible to participate in the study if they provided Phase II (early post discharge) programs with reference to national guidelines [6,22,23]. Recruitment of CR coordinators occurred via a call for volunteers from 1) the New South Wales (NSW) Cardiac Rehabilitation Working Group pilot-study participants, and 2) participants of the Australian Cardiovascular Health and Rehabilitation Association (ACRA) national conference in 2016. The study had approval from Human Research Ethics and Research Governance Committees for all participating sites (HREC Ref. 5472 LNR/17/WMEAD/585); informed consent was not required from CR participants. Data was submitted by 39 sites: 36 from NSW (25% of programs), two from Tasmania (50% of programs) and one from Australian Capital Territory (ACT) (33% of programs). Participating versus nonparticipating programs was compared using the ACRA CR directories and no differences were found for program location (rural or metropolitan) or models of delivery.

Data Collection and Procedure

Data were collected on process indicators and patient variables as defined in the NSW CR Quality Indicators Data Dictionary and Definition Guide (2017) [19] and included:

1) Patient level sociodemographic and clinical variables (Aboriginal/Torres Strait Islander status, culturally and linguistically diverse [CALD] status, gender, age, principal referral diagnosis, clinical interventions and complications and diabetes); and
2) Measures of CR delivery including a) initial comprehensive assessment, hereafter referred to as a recorded assessment before starting and including sociodemographic data, exercise capacity and depressive symptoms and at CR discharge assessment of exercise capacity, b) referral for smokers and participants screening positive for depressive symptoms, c) delivery of a symptom management plan, d) transition of care/referral, and e) recorded assessment at program completion.

Data were also collected on geography (in/outside of major cities) and associated service level (hospital level) [1]. Data were entered and submitted by CR coordinators using a formatted electronic data sheet (Microsoft Excel). Data accuracy was promoted through a 1.5-hour training session (either face-to-face or teleconference) which included data dictionary definitions and spreadsheet format and provided time for questions and discussion. One research team member acted as the contact for queries and troubleshooting during data collection and submission.

In the absence of any Australian standards or benchmarks for CR performance, programs were classified according to the UK NACR published minimal standard benchmarks [24].

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These criteria have demonstrated rigour and utility for distinguishing program performance in 170 CR programs in the UK. One of the six criteria, *offered to all priority groups*, was not used because it was not possible to obtain the data linkage to administrative databases for service-level information on who was offered CR. The following five criteria were used:

- ≥69% of core CR patients with recorded assessment before starting program;
- ≥48% of core CR patients with recorded assessment after completing program;
- Median waiting time for myocardial infarction (MI)/percutaneous coronary intervention (PCI) ≤28 days;
- Median waiting time for coronary artery bypass graft surgery (CABG) ≤42 days;
- Median duration of program ≥54 days.

Achievement of a single criteria earned a score of 1 and scores were totalled for a potential 0–5 points, which were then used to initially classify site performance into high (4–5), moderate (2–3) and low (0–1). As few programs fell into the lowest category, the moderate and low categories were combined for analyses into 'lower' performing (as compared to 'higher' performing).

Data Analysis

Patient, program, program delivery and performance characteristics are reported as medians and interquartile ranges (IQRs) and frequency and percentages according to the level of the variable. Missing data was not replaced. Data were supplied for ≥80% for all indicators except waist circumference and functional assessment, which was ≤50%. Assessment of equity in accessing a high performing CR program was determined using the variables age, gender, Aboriginal/Torres Strait Islander status and CALD, geographic location and affiliation with a Principal Referral Hospital. Analyses included Chi-squared test for association followed by logistic regression analyses which included all of these variables. The p-level was set at <0.05 for all analyses.

Results

Patients (n=2,436) participating in CR at the 39 study sites had a mean age of 66.06 (SD 12.54) years, 68.9% were male, 2.6% were Indigenous Australians (Aboriginal or Torres Strait Islander peoples) and 16.2% came from diverse CALD backgrounds (Table 1). The most common referral diagnosis was ACS (45.9%) (including unstable angina [19.0%], non-ST elevation myocardial infarction [NSTEMI] [13.8%] and STEMI [13.1%]) and cardiothoracic surgery (24.1%). Modifiable risk factors were common—49.3% had an at-risk waist circumference, 35.3% had depressive symptoms and 11.3% were smokers.

Cardiac rehabilitation sites were most often located in major cities (64.1%), at principal referral hospitals (33.3%) or Public and/or Private Acute Group A hospitals (30.8%) (Table 2). Most programs (62.5%) served >50 participants in the 3 months of audit. The most common services offered at each site included comprehensive centre-based programs (94.8%) as well as education-based only programs (51.3%).

Table 1 Patient characteristics (n=2,436).

	Mean	SD
Age	66.06	12.54
	N	%
Male	1,680	68.9
Aboriginal/Torres Strait Islander	62	2.6
Culturally and Linguistically Diverse	326	16.2
Principal referral diagnosis		
Cardiothoracic surgery	584	24.1
Unstable angina	463	19.0
Non-ST Elevation MI (STEMI)	336	13.8
STEMI	319	13.1
Elective PCI	246	10.1
AF/SVT/ICD/PPM	190	7.9
Heart failure/cardiomyopathy	188	7.5
Other	110	4.6
Risk factors		
Current smoker	276	11.3
Diabetes	542	22.2
High risk waist	1,201	49.3
Depressive symptoms	873	35.8

Abbreviations: PCI, percutaneous coronary intervention; AF, atrial fibrillation; SVT, supraventricular tachycardia; ICD, implantable cardioverter defibrillator; PPM, permanent pacemaker.

Table 2 Program (site) characteristics (n=39).

	N	%
Enrolments in 3 mo		
<50	15	38.5
50-99	19	48.7
≥100	5	12.8
Located in major city[a]	25	64.1
Service types offered		
Comprehensive centre-based	37	94.8
Education-based	20	51.3
Home-based	13	33.3
Telehealth-based	9	4.3
All types	5	12.9
Associated service level[b]		
Principal Referral Hospital	13	33.3
Public and Private Acute Group A	12	30.8
Public Acute Group B	8	20.5
Public Acute Group C/D	6	15.2

[a]Australian Bureau of Statistics classification.
[b]Australian Institute of Health and Welfare classification.

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Table 3 Program delivery.

	Median	IQR
Waiting time (d)	15	9-25
Program duration (number of sessions)	12	6-16
	N	%
Completion	1,439	59.1
Initial assessment[a]	593	24.3
Completion assessment[b]	1,018	41.8
Symptom management plan	1,837	75.4
Smokers offered referral/treated	216	78.3
Depression positive offered referral/treated	240	27.5
Transition of care/referrals	1,837	75.4

[a]Includes diagnosis, age, gender, ethnicity, culture and language, smoking, depression, exercise capacity.
[b]Includes exercise capacity.

Quality of Delivery

For individual patient level performance, the median waiting time was 15 (IQR 9–25) days, median program duration was 12 (IQR 6–16) days and 59.1% completed (Table 3). A recorded comprehensive assessment before starting occurred in 24.3% and at completion in 41.8%. Referral for specific support was offered (or participants were being treated) to 78.3% of smokers and 27.5% of participants who screened positive for depressive symptoms. Referrals at CR completion for transition of care was provided for 75.4% for a general practitioner (97.3%), specialist (72.9%), follow-up assessment (31.4%) and/or Phase III CR (18.6%).

Overall and individual program level program performance on each of the UK NACR minimal standard criteria and overall are illustrated in Figures 1 and 2. One program met all five criteria and one program met only one criteria. The criteria were met most often for waiting times (MI/PCI 87.1%, coronary artery bypass graft [CABG] 97.4%), much less so for initial assessment (<50%) and duration (20.5%) (Table 4). Programs were then categorised as high (18.0%), moderate (76.9%) and low (5.1%) performance; the moderate and low performance categories were combined into a 'lower' category for analyses and 'high' category renamed 'higher'.

Access to Higher Performing Programs

Initial analyses indicated patients who were >80 years, 60–69 years and <50 years, living outside of a major city or referred to a principal referral hospital-based service were less likely to be attending a higher performing CR program (Table 5). Taking all factors into account, the odds of attending a higher performing program were increased >28 times by living in a major city (OR 28.11 95%CI 18.41, 44.92) and with decreasing age <80 years (OR 1.89–2.94) (Table 6). Whereas the odds of attending such a program were decreased by 89.0% if attending a principal referral hospital-based service (OR 0.11 95%CI 0.08, 0.14) and by 31.0% with a CALD background (OR 0.69 95%CI 0.49, 0.97).

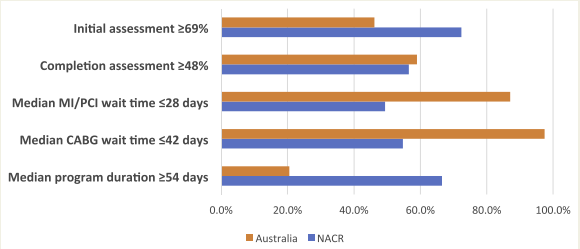

Figure 1 Program performance Australia versus UK National Audit of Cardiac Rehabilitation 2017.
Abbreviations: MI, myocardial Infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass graft surgery.

Discussion

This study provides initial benchmarks for the performance of CR programs in Australia (NSW, ACT and Tasmania) in several areas of delivery. Performance was highly variable, with a small proportion achieving international minimal standards. The majority of programs were achieving wait time minimal standards; however, few programs were of sufficient duration to achieve optimal outcomes. Moreover, access to high performing programs was shown to be inequitable for rural patients, those attending principal referral hospitals, of older age and from CALD backgrounds.

One of the higher performing areas in Australian CR programs was rapid access. Most patients wait approximately 2 weeks, which is the minimum reported in a global survey of CR [10]. The vast majority of programs met the NACR minimum standard for wait time (87.1% for MI/PCI patients and 97.4% for CABG patients) in contrast to 54.7% and 51.6% correspondingly for UK programs [24]. Early access to CR is safe [25], improves anxiety and depression [26] and exercise capacity outcomes [27], whereas each day of delay reduces exercise outcomes by 1% following MI [28]. However, early access may occur as a compromise for program duration/intensity. Few of the study programs (20.5%) met the UK NACR minimal standard for CR duration, which is 54 days [24]. In contrast, 42.5% of UK programs met this standard [24] and programs in Canada and USA are typically of 12 weeks duration [18,29]. Short duration programs have previously been reported in Australia [15] and flag the potential for reduced effectiveness. Multiple factors may influence program duration, including guidelines, funding models and patient preference. International guidelines recommend that CR programs are 12 weeks duration [7], whereas Australian guidelines recommend 6–8 weeks [22] and it is unclear why. However, given there is a strong dose-response decrease in mortality of 18% for every 10 CR sessions attended [30], and, a systematic review of 33 trials reported lower all-cause mortality and subsequent PCI for ≥36 versus ≤12 sessions [31], shorter program duration may not be justified. Perhaps pressures to achieve patient flow through decreased program duration may be occurring, such as in principal referral

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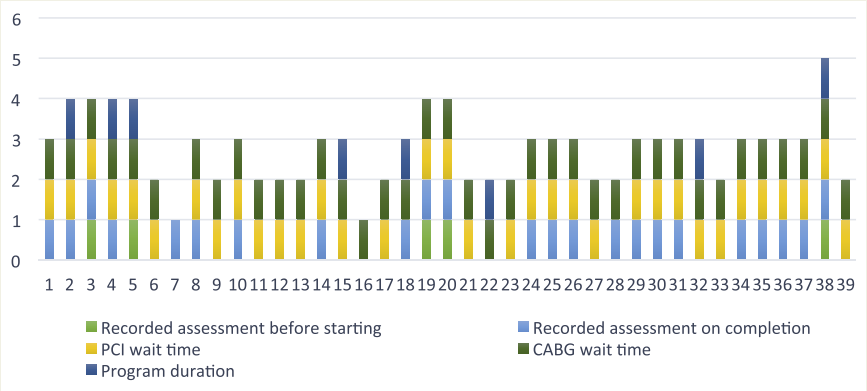

Figure 2 Individual program performance on UK National Audit of Cardiac Rehabilitation criteria. Abbreviations: PCI, percutaneous coronary intervention; CABG, coronary artery bypass graft surgery.

hospitals, which in our study were far less often high-performing, and warrants further investigation. This study provides an important baseline against which programs can benchmark performance for this purpose.

Inequitable access to CR programs, particularly high performing programs, is a global issue. Geographical distance, age and cultural/language differences reported in our study have been reported in a systematic review [32] and specifically in relation to high performing CR programs [11]. In the current study, rural patients were substantially disadvantaged and it is a pattern common to countries with low population density and geographic expanse such as Australia and Canada [29]. It is highly likely that these factors limit program demand and supply of expert professionals to deliver programs and thus performance [33]. However, multiple social determinants of health combine for rural inhabitants that inflate their CVD risk and thus their need for CR, such as less physical activity and more smoking, while at the same time creating barriers for attendance [34]. These barriers include difficult road access and weather, extra transport costs and driver's licence issues. Lack of availability of interpreters and bilingual staff may also hamper performance by creating barriers to referral and uptake by patients who have limited English, such as migrants [35]. However, the treatment-risk paradox occurring in rural patients also occurs for migrants, whereby increased CVD risk factors are concurrent with increased barriers to CR participation which include difficulty in taking time off work and costs of transport [34]. For older patients, worse access may also have arisen from lack of referral and uptake. However, personal factors such as transport, motivation and concurrent health issues also contribute [11]. These results emphasise the need for different models of cardiac rehabilitation delivery that overcome access barriers to promote participation while meeting minimum quality standards.

Table 4 Program performance using UK NACR minimum criteria (n=39).

Criteria	N	%
≥69% of core CR patients with recorded assessment before starting program	18	46.2
≥48% of core CR patients with recorded assessment after completing program	23	59.0
Median waiting time for MI/PCI ≤28 d	34	87.1
Median waiting time for CABG ≤42 d	38	97.4
Median duration of program ≥54 d	8	20.5
Program performance rating		
High (4-5 criteria met)	7	18.0
Medium (2-3 criteria met)	30	76.9
Low (0-1 criteria met)	2	5.1

Abbreviations: MI, myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass graft surgery; CR, cardiac rehabilitation; NACR, United Kingdom National Audit of Cardiac Rehabilitation.

Lack of consensus on the components required for initial and completion CR assessments contributes to difficulty in benchmarking performance internationally and nationally. Study program performance was similar to UK NACR performance of initial and completion assessment (46.2% and 59.0% correspondingly versus UK NACR 41.5% and 45.8%) [24], but much lower than Canada (90.6%) [29] and other countries involved in the global survey of CR (82.1–100%) [10]. There is a paucity of published reports on CR quality within Australia. One report is that 85% have an initial timely CR assessment (within ≤28 days) in Queensland programs [36] and that in comparison to international standards, short program duration of 6–8 weeks have been reported by the majority of the 251 CR programs surveyed [15]. There is an urgent need for a minimal set of CR performance indicators that are internationally accepted, locally

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Table 5 Comparison of patient characteristics for program performance (n=2,436).

Characteristic	Program performance				P level
	Higher N=525		Lower N=1911		
	n	%	n	%	
Female	170	32.4	586	30.7	0.57
Male	355	67.6	1325	69.3	
Aboriginal/Torres Strait Islander	8	1.6	54	2.8	0.09
Non-Aboriginal/Torres Strait Islander	1,857	97.2	478	98.4	
Culturally and linguistically diverse	64	13.2	262	17.1	0.04
Non-culturally and linguistically diverse	422	86.8	1,268	82.9	
Major city location	496	94.5	1,079	56.5	<0.001
Non-major city location	29	5.5	832	43.5	
Principal referral hospital-based	165	31.4	977	51.1	<0.001
Non-principal referral hospital-based	360	68.6	934	48.9	
Age					
<50 yr	68	13.0	175	9.2	<0.001
50-59 yr	112	21.3	339	17.7	
60-69 yr	160	31.5	537	28.1	
70-79 yr	141	26.9	561	29.4	
≥80 yr	44	8.4	299	15.6	

relevant and used as the basis for performance assessment in Australia.

The study results have many implications for policy, practice, education and research. The most important of these is the need for collaboration so that a long-overdue national survey of CR quality can be undertaken that includes the collection and collation of raw data. A recent editorial outlined the development of a joint taskforce co-chaired by ACRA and the Heart Foundation Australia, which has initiated the first necessary steps in achieving feasible, useful and sustainable national CR quality data collection [37]. These steps included development of national indicators and a web-based platform for data-entry and management, creation of a national governance committee that involves policy-makers and securing sustained funding. However, CR practitioners should not hesitate to undertake quality improvement processes using published indicators [19] and web-based guidance available from the Australian Commission on Safety and Quality in Healthcare [38].

Table 6 Factors associated with higher performing program participation.

Characteristic	OR	95% CI
Major city location	28.11	(18.41, 44.92)
Age (reference ≥ 80 yr)		
<50 yr	2.94	(1.74, 4.96)
50-59 yr	2.54	(1.59, 4.08)
60-69 yr	2.17	(1.39, 3.93)
70-79 yr	1.89	(1.20, 2.96)
Principal referral hospital location	0.11	(0.08, 0.14)
Culturally and linguistically diverse	0.69	(0.49, 0.97)
Male gender	0.90	(0.69, 1.18)
Aboriginal/Torres Strait Islander	0.53	(0.23, 1.23)
Constant	0.04	

Model statistics $X^2 = 571$ df=9 $p<0.001$.

Limitations

While the sample was broadly representative of the CR programs in states and territories, application of the study results is limited by a relatively small number of sites and two states and one territory of Australia. Only limited data are available to compare participating and nonparticipating sites and it is possible that unknown factors that influenced participation may have also influenced the study results. The quality of the data submitted while high overall, was affected by incomplete data and some data was withheld for depression assessment where data were inconsistent. Furthermore, we were unable to use the UK NACR referral criteria due to lack of data linkage, and the related minimal standards may not be a perfect match for the Australian context.

Conclusion

This study aimed to provide baseline benchmarks for CR delivery in Australia as the foundation for future quality improvement endeavours. Evidence of the need for quality improvement at a national level is established as few programs (18.0%) are high performing. Wait times were

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minimised, however, few programs were of sufficient duration, potentially limiting effectiveness. There was substantial variation in access to high performing programs for patients on the basis of where they live, their age and backgrounds. Alternative CR models must be considered to ensure quality improvement and minimise compromise of one standard for another. Further research is urgently required at national level to investigate these findings, establish a set of agreed measures to support quality improvement for people with heart disease and influence system-level change.

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Conflicts of Interest

All authors declare there are no conflicts of interest.

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