

## A National Survey of Patient Data Capture, Management, Reporting Practice in Australian Cardiac Rehabilitation Programs

Gallagher, Robyn; Cartledge, Susie; Zwack, Clara; Hollings, Matthew; Zhang, Ling; Gauci, Sarah; Gordon, Nicole; Zecchin, Robert; O'Neil, Adrienne; Tirimacco, Rosy; Phillips, Samara; Astley, Carolyn; Briffa, Tom; Hyun, Karice; Chaseling, Georgia K; Candelaria, Dion; Redfern, Julie

*Published in:*  
Heart Lung and Circulation

*DOI:*  
[10.1016/j.hlc.2023.09.013](https://doi.org/10.1016/j.hlc.2023.09.013)

*Licence:*  
CC BY

[Link to output in Bond University research repository.](#)

*Recommended citation(APA):*

Gallagher, R., Cartledge, S., Zwack, C., Hollings, M., Zhang, L., Gauci, S., Gordon, N., Zecchin, R., O'Neil, A., Tirimacco, R., Phillips, S., Astley, C., Briffa, T., Hyun, K., Chaseling, G. K., Candelaria, D., & Redfern, J. (2023). A National Survey of Patient Data Capture, Management, Reporting Practice in Australian Cardiac Rehabilitation Programs. *Heart Lung and Circulation*, 32(11), 1361-1368. <https://doi.org/10.1016/j.hlc.2023.09.013>

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

For more information, or if you believe that this document breaches copyright, please contact the Bond University research repository coordinator.

# A National Survey of Patient Data Capture, Management, Reporting Practice in Australian Cardiac Rehabilitation Programs



Robyn Gallagher, PhD<sup>a,1,\*</sup>, Susie Cartledge, PhD<sup>b,1</sup>, Clara Zwack, PhD<sup>a</sup>, Matthew Hollings, PhD<sup>a</sup>, Ling Zhang, PhD<sup>a</sup>, Sarah Gauci, PhD<sup>c</sup>, Nicole Gordon, PhD<sup>d</sup>, Robert Zecchin, MN<sup>e</sup>, Adrienne O'Neil, PhD<sup>c</sup>, Rosy Tirimacco, BSc<sup>f</sup>, Samara Phillips, MPH<sup>g</sup>, Carolyn Astley, DrPH<sup>h</sup>, Tom Briffa, PhD<sup>i</sup>, Karice Hyun, PhD<sup>a,j</sup>, Georgia K. Chaseling, PhD<sup>a</sup>, Dion Candelaria, PhD<sup>a</sup>, Julie Redfern, PhD<sup>a</sup>

<sup>a</sup>Faculty of Medicine and Health, University of Sydney, Sydney, NSW, Australia

<sup>b</sup>Faculty of Medicine, Nursing and Health Sciences Monash University, Melbourne, Vic, Australia

<sup>c</sup>Faculty of Health Deakin University, Deakin University, Victoria, Australia

<sup>d</sup>Heart Health and Fitness Western Australia, Perth, WA, Australia

<sup>e</sup>Western Sydney Local Health District, Sydney, NSW, Australia

<sup>f</sup>Integrated Cardiovascular Clinical Network Country Health South Australia (iCCnet SA), Adelaide, SA, Australia

<sup>g</sup>Metro South Health Queensland, Brisbane, QLD, Australia

<sup>h</sup>South Australian Academic Health Science and Translation Centre, South Australian Health and Medical Research Institute, Adelaide, SA, Australia

<sup>i</sup>School of Population and Global Health University of Western Australia, University of Western Australia, Perth, WA, Australia

<sup>j</sup>ANZAC Research Institute, Department of Cardiology, Concord Hospital, Sydney, NSW, Australia

Received 16 April 2023; received in revised form 29 July 2023; accepted 12 September 2023; online published-ahead-of-print 25 October 2023

## Background

Lack of service data for cardiac rehabilitation limits understanding of program delivery, benchmarking and quality improvement. This study aimed to describe current practices, management, utilisation and engagement with quality indicators in Australian programs.

## Method

Cardiac rehabilitation programs (n=396) were identified from national directories and networks. Program coordinators were surveyed on service data capture, management systems and adoption of published national quality indicators. Text responses were coded and classified. Logistic regression determined independent associates of the use of data for quality improvement.

## Results

A total of 319 (81%) coordinators completed the survey. Annual patient enrolments/programs were >200 (31.0%), 51–200 (46%) and ≤50 (23%). Most (79%) programs used an electronic system, alongside paper (63%) and/or another electronic system (19%), with 21% completely paper. While 84% knew of the national quality indicators, only 52% used them. Supplementary to patient care, data were used for reports to managers (57%) and funders (41%), to improve quality (56%), support funding (43%) and research (31%). Using data for quality improvement was more likely when enrolments were >200 (Odds ratio [OR] 3.83, 95% Confidence Interval [CI] 1.76–8.34) and less likely in Victoria (OR 0.24 95%, CI 0.08–0.77), New South Wales (OR 0.25 95%, CI 0.08–0.76) and Western Australia (OR 0.16 95%, CI 0.05–0.57).

\*Corresponding author at: Building D17 Charles Perkins Centre, University of Sydney, 2006 New South Wales, Australia; Email: [robyn.gallagher@sydney.edu.au](mailto:robyn.gallagher@sydney.edu.au);

Twitter: @robyndgallagher

<sup>1</sup>Co-first authors

© 2023 The Authors. Published by Elsevier B.V. on behalf of Australian and New Zealand Society of Cardiac and Thoracic Surgeons (ANZSCTS) and the Cardiac Society of Australia and New Zealand (CSANZ). This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

**Conclusions**

The collection of service data for cardiac rehabilitation patient data and its justification is diverse, limiting our capacity to benchmark and drive clinical practice. The findings strengthen the case for a national low-burden approach to data capture for quality care.

**Keywords**

Cardiac rehabilitation • Quality improvement • Informatics • Electronic records • Data • Computerised Medical record system

**Introduction**

Individualised, comprehensive exercise-based cardiac rehabilitation is an effective intervention for secondary prevention of heart disease [1]. Recommended components for cardiac rehabilitation include multidisciplinary input, patient assessment, measurement, and management of cardiovascular risk factors including medications, dietary advice, individualised structured exercise, and psychosocial counselling [2–5]. Cardiac rehabilitation programs delivering these components can effectively reduce acute coronary events and rehospitalisation [1]. However, there is limited information on the quality of cardiac rehabilitation service delivery worldwide and nationally, and where this information is available, there is evidence of substantial inconsistency in cardiac rehabilitation quality [6,7]. For example, benchmarks may be met for wait time but not for program duration [8].

Few countries have a standardised data capture and management system to facilitate engagement in quality assessment and improvement processes of cardiac rehabilitation at the national level. Only 8/42 European countries participating in the Overview of Cardiac Rehabilitation (OCRE) study had a national cardiac rehabilitation registry [6]. The use of such registries is in the early stages, with only one international and seven national cardiac rehabilitation registries identified in a systematic review [9]. The authors note the need for web-based applications or electronic systems with delimited fields to ensure high-quality and accurate data and enable timely feedback, as well as standardised core data elements to enable comparisons and benchmarking [6]. Three European registries have closed in recent years [9], emphasising the importance of considering workload, costs and sustainability [6]. Other barriers to the uptake and sustainability of registries include lack of availability of data systems and standardised indicators. Despite these barriers, registries for multiple chronic diseases, including diabetes, stroke and lung cancer, have been demonstrated to improve understanding of care [10], clinical outcomes and processes of care [11].

Performance indicators are necessary for determining whether a particular service provides optimal or even adequate patient care. Agreement on quality indicators, data points needed, and well-developed definitions are required to ensure harmonisation. In recent years performance indicators have been published by the European Society of Cardiology [5], the International Cardiac Rehabilitation Register (International Council of Cardiovascular

and Pulmonary Rehabilitation) [12] and the National Heart Foundation of Australia (NHFA) [13]. However, progress towards a national cardiac rehabilitation registry in Australia is hampered by the lack of information on current practices of data capture and management and awareness, use and perceptions of national indicators. With this information, barriers to development of a shared platform for quality improvement in Australia can be addressed and other countries may benefit. Therefore, the aim of this study was to describe data capture, management, reporting and usage in Australian cardiac rehabilitation programs and perceptions and use of the national quality indicators.

**Methods and Measures**

A descriptive survey design was used to collect data from cardiac rehabilitation programs across Australia from 1 September to 20 December 2021. The study confirms to the National Health and Medical Research Council Human Research Ethics (HRE) guidance and approval was obtained from the University of Sydney HRE (2021/629) and Monash University HRE (30848) committees.

**Recruitment and Study Protocol**

Recruitment to the study occurred through contacting cardiac rehabilitation program coordinators using details in the public domain; e.g., cardiac rehabilitation directories available from webpages of the National Heart Foundation of Australia and the Australian Cardiovascular Health and Rehabilitation Association (ACRA). Where program details were not current, jurisdictional leaders, hospitals and health districts were directly contacted. These processes identified 396 cardiac rehabilitation programs. Programs were eligible for the study if they provided a multidisciplinary (at least two disciplines), multi-component (at least exercise and education) service. Programs were ineligible if the focus was inpatient education or heart failure services exclusively. Participation in the survey was promoted through several well-publicised state-based webinars on cardiac rehabilitation quality improvement, professional associations, state-based cardiac rehabilitation networks, the SOLVE Coronary Heart Disease (SOLVE-CHD) research program website and known cardiac rehabilitation networks in individual states and by directly contacting program coordinators on the created directory through email, phone call and text message (at least three attempts to contact were made). These

processes were used until 80% of all identified programs nationally had completed the survey.

## Data Collection

Data were collected via a purpose-built online survey using REDCap software. Survey items were developed and modified using an expert panel of cardiac rehabilitation coordinators, researchers and survey designers. Final modifications to the format, sequencing and terms used were made based on feedback from an additional panel of cardiac rehabilitation coordinators (n=8). Support to complete the survey was provided through three webinars and video or telephone calls to support accuracy and reduce uncertainty and stress during survey completion. Explanations were provided, including for quality improvement initiatives as activities that improve the safety, effectiveness and patient experience of the program.

The survey included 30 multiple-choice and open-ended questions. Where the respondent was responsible for multiple programs the respondent completed the survey separately for each individual program. The survey began with an open question with a free-text response asking respondents to outline how they managed patient documentation, data capture and management processes. Fixed response questions then related to the cardiac rehabilitation program characteristics (jurisdiction, postcode, annual patient enrolments), how patient data was captured and managed, electronic data systems, quality platforms and websites used for data management and then any data reporting and usage in addition to patient care. Responses could be made via multiple choice for the type of systems in use, timing of data collection and awareness and use of the National Cardiac Rehabilitation Quality Indicators (NCR QIs) [13]. The usefulness of the NCR QIs was rated on a 5-point scale from 1=very useful to 5=not/no longer useful. Open-response questions were asked on any barriers or strategies for implementation of the quality indicators and for any additional comments at the survey conclusion. The survey typically took between 15–20 minutes to complete.

## Data Analysis

All survey responses were reviewed for missing data and any survey lacking program characteristics and/or having <80% of responses were excluded from the analyses. Descriptive statistics (means, standard deviations, frequencies and proportions) were used to characterise the sample and summarise responses. Postcodes of program location were categorised for remoteness and population size using the Modified Monash Model Category [14].

Free-text responses to questions regarding the process of patient data capture and management were sorted into categories, which included paper and electronic data systems. Electronic systems were categorised based on the capacity for the system to support quality improvement across jurisdictions using the principles listed in [Supplementary Box 1](#)

**Table 1** Cardiac rehabilitation program characteristics

Program characteristics	n	(%)
<i>Type of service</i>		
Public	246	(76.9)
Private	74	(23.1)
<i>State/territory n (% of potential)</i>		
New South Wales	108	(90.1)
Victoria	68	(71.0)
Queensland	58	(83.2)
Western Australia	39	(87.0)
South Australia	24	(95.9)
Tasmania	16	(94.1)
Northern Territory	4	(100.0)
Australian Capital Territory	3	(100.0)
<i>Location (MMMM)</i>		
Metropolitan	148	(46.3)
Rural and remote towns	147	(45.9)
Regional centres	25	(7.8)
<i>Annual patient enrolment</i>		
≤50	72	(22.6)
51–200	148	(46.4)
>200	99	(31.0)

Abbreviation: MMMC, Modified Monash Model Code.

and illustrated in [Supplementary Table 1](#). These principles and categories were created by two investigators (R.G., L.Z.), and reviewed by two other investigators (R.Z., S.P.) until a consensus was reached. Final categorisation of the electronic systems was then undertaken by two investigators (R.G., L.Z.) and where disagreement occurred determination was made by a third investigator (S.C.). Multiple systems were possible. The same process was used for the categorisation of barriers and strategies for implementation of the NCR QIs. Categories and sample texts are provided in the [supplementary tables](#).

The use of paper, electronic systems and multiple systems, for reporting and quality improvement and other supplementary data use beyond patient care were compared for annual patient enrolment categories (>200, 51–200 and ≤50) and the use of data for quality improvement was compared for program characteristics using chi-squared test. The usefulness of the NCR QIs in those who were aware of them was compared using independent *t*-test and chi-squared test (useful/very useful versus not/not very useful/stopped using). The independent associates of using data for quality improvement were determined using logistic regression with forced entry of the states/territories that had at least 20 programs included (Victoria, New South Wales, Western Australia, South Australia, Queensland), annual patient enrolments and location of the service. The assumptions of the analyses were met. The *p*-value was set at 0.05 for all analyses.

**Table 2** Cardiac rehabilitation program data capture and management systems compared by categories of patient enrolments/year

Characteristic	Total (n=319)		Patient enrolment/year						P-value
	n	(%)	≤50 (n=72)		51–200 (n=148)		>200 (n=99)		
			n	(%)	n	(%)	n	(%)	
<i>Patient data systems</i>									
Paper only	67	(21.0)	15	(20.8)	30	(20.2)	21	(21.2)	0.98
Paper and electronic system	200	(62.6)	40	(55.5)	100	(67.6)	61	(61.6)	0.12
Electronic system only	52	(16.3)	17	(23.6)	18	(12.2)	17	(17.2)	0.09
Multiple electronic systems	61	(19.1)	9	(12.5)	31	(20.9)	21	(21.2)	0.27
<i>Quality improvement systems</i>									
Quality Improvement <sup>a</sup> Platform	55	(17.2%)	8	(11.1)	26	(17.6)	21	(21.2)	0.22
Quality Improvement Worksheet	32	(10.0%)	2	(2.8)	25	(16.9)	15	(15.1)	0.01

<sup>a</sup>Classification of Quality Improvement Systems [Supplementary Box 1](#) and [Supplementary Table 1](#).

## Results

Coordinators representing 319 of the 396 cardiac rehabilitation programs across Australia (81%) responded and completed the survey. The program coordinator respondent provided data for 1 (69.1%), 2–5 (21.5%) or ≥6 (9.4%) programs. Most cardiac rehabilitation programs were publicly funded (76.9%) (Table 1). All states and territories had the representation of at least 71% of the programs in their jurisdiction. Metropolitan (46.3%), rural and remote towns (45.9%) and regional centres (7.8%) were included. Annual patient enrolments per program were >200 (31.0%), 51–200 (46.4%) and ≤50 (22.6%).

## Data Capture and Management

Most (78.9%) programs used an electronic system, 62.6% alongside a paper system and 19.1% alongside another electronic system (19.1%) with 20.9% using only paper (Table 2). Regardless, a paper was used by most programs for patient data at the initial assessment (65.6%), during the program (73.1%), and after completion (76.3%) (data not shown). The most common category of electronic systems (classification [Supplementary Box 1](#) and [Table 1](#)) in use were the Electronic Medical Record (38.9%) and Patient Management System (26.3%).

Quality improvement systems were used less often: fully enabled Quality Improvement Platforms (17.2%) and Quality Improvement Worksheets (10.0%). Programs did not differ for the type or mix of data systems being used according to patient enrolment except that lower enrolment programs (≤50/year) were less likely to use a Quality Improvement Database (Table 2).

## Data Reporting and Usage

Supplementary to patient care support, most programs (82.8%) used the patient data collected for reports to local managers (57.0%), quality improvement (56.1%), support for funding (43.2%), required reporting to the jurisdiction/

funder (41.1%) and research projects (30.7%) (Table 3). Programs with large enrolment numbers were more likely to use their data for multiple purposes except for funding support.

The states of Queensland, South Australia, and the Australian Capital Territory were more likely to have >200 people enrolled per year per program. Programs with >200 people enrolled were more likely to use their data for quality improvement (OR 3.83 95% CI 1.76–8.34) and state/jurisdictions (Table 4) of Victoria (OR .24 95% CI 0.08–0.77), New South Wales (OR 0.25 95% CI 0.08–0.76) and Western Australia (OR 0.16 95% CI 0.05–0.57) were less likely to use their data for quality improvement when compared to the combined reference group of Tasmania, Australian Capital Territory, Northern Territory (Table 5).

The majority of program coordinators (84.3%) indicated that the programs for which they were responding were aware of the NCR QIs. Of the programs that were aware, 64.7% had downloaded the indicators and 51.7% had gone on to use these indicators, with 27.2% also downloading the supporting Data Dictionary ([Supplementary Table 2](#)). Programs engaged in quality improvement were more likely to rate the NCR QIs as useful/very useful (69.6% vs 30.4%,  $p=0.001$ ) (Table 4).

Program respondents provided information on barriers (n=89) and strategies for implementation of the NCR QIs—[Supplementary Table 4](#). The most commonly reported barriers to using the NCR QIs were that some/other QIs were already being collected (n=31) and lack of time or resources (n=29). The most commonly reported strategies to support the implementation of the NCR QIs were to embed these into the cardiac rehabilitation patient data platform or spreadsheet (n=60) or modify/add them to routine data collection processes (n=50).

## Discussion

In this first national study investigating cardiac rehabilitation program data capture, management, reporting, and usage, the

**Table 3** Cardiac rehabilitation patient data uses supplementary to patient care compared by categories of patient enrolments/year

Characteristic	Total (n=319)		Patient enrolment/year						P-value
			≤50 (n=72)		51–200 (n=148)		>200 (n=99)		
	n	(%)	n	(%)	n	(%)	n	(%)	
Report to local manager	182	(57.0)	29	(40.2)	83	(56.0)	70	(70.7)	<0.001
Inform quality improvement	179	(56.1)	28	(38.9)	79	(53.3)	72	(72.7)	<0.001
Support for funding	138	(43.2)	23	(31.9)	72	(48.6)	43	(43.4)	0.081
Required reporting to jurisdiction/funder	133	(41.7)	34	(47.2)	51	(34.4)	48	(48.4)	0.041
Research projects	98	(30.7)	13	(18.0)	50	(33.7)	35	(35.3)	0.035
<b>Patient care only</b>	<b>55</b>	<b>(17.2)</b>	<b>17</b>	<b>(23.6)</b>	<b>30</b>	<b>(20.2)</b>	<b>8</b>	<b>(8.1)</b>	<b>0.012</b>

findings revealed that the majority of the 319 respondents (representing 81% of programs across Australia) did not have the accurate standardised data collection and reporting systems needed to enable quality assessment and improvement processes at the national level. The study found data capture and management processes varied substantially, and frequently involved repetitive data entry into multiple different systems, including paper. Few programs used the quality improvement platforms needed for accurate standardised data collection and performance analyses at the jurisdictional level. Programs with the highest numbers of patient enrolments were most likely to use their data for quality improvement, but much less so if located in a state lacking a jurisdictional quality improvement platform. Most programs were aware of the National Cardiac Rehabilitation Quality Indicators (NCR QIs) developed for Australia but only half of the respondents indicated that they collected this data routinely; when they did, the NCR QIs were rated as useful.

Heterogeneous data capture and management processes were present across cardiac rehabilitation programs. This is an important finding in itself, given good quality data are critical for high-quality care, jurisdictional quality improvement processes and justifying associated cardiac rehabilitation clinician workload. Most respondents reported entering data into multiple different disconnected systems, which required double and often triple entry of the same data. Duplication of data entry across systems is known to contribute to reduced data quality, increased clinician workload [15] and contributes to burnout [16]. The inclusion of paper-based records in data collection and management by cardiac rehabilitation programs accentuates these difficulties. Paper-based data cannot be efficiently shared, collated, or analysed across jurisdictions for quality improvement purposes and creates increasing challenges for programs. Storage of paper records for the period required by authorities is rarely accommodated in contemporary health service buildings, and paper and toner are costly and unsustainable [17]. In contrast, well-designed web-based

electronic health data/information systems can improve clinical efficiency, quality and safety.

Ideally, data-driven quality improvement is accurately and efficiently enabled through a national registry, such as the SWEDEHEART<sup>1</sup> cardiac registry [9,18]. However, well-designed quality improvement platforms may also be used to ensure accurate standardised data collection, promote automation and enable reporting and comparisons across a jurisdiction. Our findings indicate that cardiac rehabilitation programs in jurisdictions where this type of platform was not available are much less likely to use their data for quality improvement. To our knowledge, only two jurisdictions in Australia (Queensland and South Australia) have this type of platform. The Queensland Cardiac Outcomes Register (QCOR) was set up by Clinical Excellence in Queensland 2016 to collect and use clinical data and enable quality initiatives, with data entry and achieving benchmarks initially incentivised [19]. The Country Access to Cardiac Health (CATCH) was established by the Integrated Cardiovascular Clinical Network of South Australia providing a cardiac rehabilitation platform for data entry and quality improvement without incentives [20].

Many potential barriers limit the development and sustainability of quality platforms. Furthermore, when a quality improvement platform is added to existing data systems without adequate automation and linking clinician workload escalates with a possible impact on the quality of care [21].

Assessment of quality depends on standardised measures to enable performance comparisons. In Australia, a standardised, defined, minimal set of 11 cardiac rehabilitation quality measures and/or indicators have been published and widely marketed [13]. In the current study, programs that used these recommended NCR QIs rated them as useful and were twice as likely to be using their data for quality improvement. However, while most programs in the study were aware of the NCR QIs only half were using them. Respondents suggested that embedding the quality indicator data into existing data collection processes was an effective

<sup>1</sup> SWEDEHEART, The Swedish Web-system for Enhancement and Development of Evidence-based care in Heart disease Evaluated According to Recommended Therapies.

**Table 4** Cardiac rehabilitation program characteristics and data systems used compared for whether data is for quality improvement or not

Characteristic	Program engaged in quality improvement				P-value
	Yes (n=179)		No (n=140)		
	n	(%)	n	(%)	
<i>Jurisdiction</i>					
New South Wales (n=105)	56	(53.3)	49	(46.7)	0.004
Victoria (n=67)	36	(53.7)	31	(46.3)	
Queensland (n=58)	39	(67.2)	19	(27.8)	
Western Australia (n=38)	16	(42.1)	22	(57.9)	
South Australia (n=24)	14	(58.3)	10	(41.7)	
Tasmania (n=16)	15	(93.8)	1	(6.2)	
Northern Territory (n=3)	1	(33.3)	3	(66.7)	
Australian Capital Territory (n=3)	2	(66.6)	1	(33.4)	
<i>Location</i>					
Metropolitan (n=146)	93	(63.7)	53	(36.3)	0.062
Regional centres (n=25)	14	(56.0)	11	(44.0)	
Rural/remote towns (n=144)	72	(50.0)	72	(50.0)	
<i>Patient enrolment</i>					
≤50/year (n=70)	28	(40.0)	42	(60.0)	<0.001
51-200/year (n=147)	79	(53.7)	68	(46.3)	
>200/year (n=98)	72	(73.4)	27	(26.6)	
<i>Patient data system</i>					
Paper only (n=63)	37	(58.7)	26	(41.3)	0.423
Electronic system only (n=52)	38	(73.0)	14	(27.0)	0.007
Multiple electronic systems (n=65)	38	(58.4)	27	(41.6)	0.439
<i>Quality Improvement Systems</i>					
Quality Improvement Platform (n=55)	34	(61.8)	21	(38.2)	0.251
Quality Improvement Worksheet (n=42)	31	(73.8)	11	(26.2)	0.012
<i>NCR QIs (n=165)</i>					
Useful/very useful <sup>a</sup>	115	(69.6)	50	(30.4)	0.001
Usefulness, mean (SD) <sup>a</sup>	2.07	(0.77)	2.51	(0.83)	<0.001
In use (n=139)	105	(75.5)	34	(24.5)	<0.001

<sup>a</sup>usefulness rated on 5-point scale from 1=very useful – 5=not/no longer useful.

Abbreviation: NCR QIs, National Cardiac Rehabilitation Quality Indicators.

strategy to address uptake. Quality indicators are essential to identifying programs that meet standards of care and accreditation. In high-income/well-resourced countries such as the UK, USA and some European countries, accreditation of cardiac rehabilitation programs enables patients and

**Table 5** Independent associates of cardiac rehabilitation programs using data for quality improvement

Characteristic	OR	(95% Confidence Interval)	P-value
<i>State</i>			
Victoria	0.243	(0.08–0.78)	0.017
New South Wales	0.246	(0.08–0.76)	0.015
Western Australia	0.164	(0.05–0.57)	0.005
South Australia	0.298	(0.08–1.15)	0.08
Queensland	0.437	(0.14–1.42)	0.168
<i>Enrolments</i>			
>200/year	3.83	(1.76–8.34)	0.001
51-200/year	1.67	(0.89–3.13)	0.111
<i>Location</i>			
Metropolitan	1.26	(0.71–2.24)	0.43
Regional centre	0.579	(0.22–1.54)	0.273

Model chi-square=32.37, df 9. P<0.001.

Abbreviation: OR, odds ratio.

referrers to select high-quality services, but this does not occur in Australia [3–5,12]. Furthermore, accreditation, alongside reporting against, and incentives to meet, quality indicators are likely to motivate services to engage in quality improvement initiatives. There is an abundance of disease-specific quality registries for diabetes, stroke and lung cancer, which have established agreed quality indicators and improved clinical outcomes and processes of care [11]. Important lessons from these registries include the need for a sustainable funding model and methods to determine cost benefits and the need to reduce barriers to participation, including time to enter data, identified in a recent evaluation of the Australian National Stroke Audit [22].

This study has several limitations. While a comprehensive and systematic process was followed to identify all cardiac rehabilitation programs in Australia it is possible that some programs were not included, a possibility increased by redeployment of staff and closures of programs during the COVID-19 pandemic. Efforts were made to support survey completion and the response rate of 80.7% is considered high. It is possible that non-responders differed. Similarly, the accuracy of data was promoted by purpose-tailored webinars and one-to-one telephone and Zoom advice, but it is possible that respondents did not understand some questions. It is possible that factors we did not include in the analyses such as public/private institutions or the survey may influence the use of data for quality improvement by cardiac rehabilitation programs, and this should be addressed in future research.

## Conclusions

This study offers insight into data capture, management, reporting and usage in Australian cardiac rehabilitation

programs. Data capture systems and processes were extremely variable, including multiple systems necessitating duplication of data entry. Awareness of the NCR QIs was high, but usage was much lower and only half the programs used their data for quality improvement. The results infer that to engage effectively in quality improvement at the national level, and there is an urgent need for a web-based automated jurisdictional or preferably national-level cardiac registry inclusive of cardiac rehabilitation indicators. For those involved in developing and implementing such a registry or quality improvement platform, this study provides useful information on the issues needing to be addressed, which include a) heterogeneous data capture and management systems, b) potential for poor data quality and increased workload due to duplicate and even triplicate data entry, c) limited use and/or availability of appropriate quality improvement platforms, d) limited use of available quality indicators, and e) limited reporting and usage of cardiac rehabilitation data for quality improvement. Recommendations for national data-driven quality improvement in cardiac rehabilitation include: a) initiation of a low-burden national electronic data entry system, b) incorporation of nationally agreed quality indicators with defined variables, c) using discrete (mutually exclusive) choices as appropriate to promote accuracy, d) enabling data transfer from other electronic health record systems, e) establishing Australian benchmarks for cardiac rehabilitation outcomes and quality processes, and f) inclusion and education of program staff in platform development and quality improvement initiatives at all steps.

## Funding Sources

This research is supported by the SOLVE-CHD Australian Government National Health and Medical Research Council (NHMRC) Synergy Grant [GNT1182301]. J.R. is also funded by a NHMRC Investigator Grant Leadership Level 2 [GNT2007946]. A.O. is supported by NHMRC Emerging Leader 2 Fellowship [GNT2009295]. K.H. is supported by NHMRC Investigator Grant (Emerging leadership 1) [GNT1196724].

## Conflicts of Interest

No conflicts of interest to declare.

## Authors' Contribution

Concept and design of the study (R.G., S.C., J.R., C.Z., M.H., L.Z., A.O., T.B., and C.A.)

Acquisition of the data (S.C., C.Z., M.H., S.G., N.G., R.Z., R.T., and S.P.)

Analysis and interpretation of the data (R.G., S.C., L.Z., R.Z., S.P., D.C., and K.H.)

Drafting of the manuscript (R.G., S.C., C.Z., M.H., L.Z., S.G., A.O., T.B., K.H., G.C., and J.R.)

Critical review of the manuscript (N.G., R.Z., R.T., S.P., C.A., and D.C.)

## Acknowledgements

The authors wish to acknowledge all of the cardiac rehabilitation program staff that took the time to respond to the survey.

## Appendices

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.hlc.2023.09.013>.

## References

- [1] Dibben GO, Faulkner J, Oldridge N, Rees K, Thompson DR, Zwisler AD, et al. Exercise-based cardiac rehabilitation for coronary heart disease: a meta-analysis. *Eur Heart J*. 2023;44(6):452–69.
- [2] Woodruffe S, Neubeck L, Clark RA, Gray K, Ferry C, Finan J, et al. Australian cardiovascular Health and Rehabilitation Association (ACRA) core components of cardiovascular disease secondary prevention and cardiac rehabilitation 2014. *Heart Lung Circ*. 2015;24(5):430–41. <https://doi.org/10.1016/j.hlc.2014.12.008>.
- [3] British Association for Cardiovascular Prevention and Rehabilitation. Standards and Core Components. 2017. Available at: [https://www.bacpr.org/\\_data/assets/pdf\\_file/0026/39437/BACPR\\_Standards\\_and\\_Core\\_Components\\_2017.pdf](https://www.bacpr.org/_data/assets/pdf_file/0026/39437/BACPR_Standards_and_Core_Components_2017.pdf). [accessed 16.10.23].
- [4] American Association of Cardiovascular and Pulmonary Rehabilitation. Guidelines for Cardiac Rehabilitation Programs Web Resource-6th Edition 2017. Champaign: Human kinetics; 2021.
- [5] Visseren FLJ, Mach F, Smulders YM, Carballo D, Koskinas KC, Böck M, et al. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice: developed by the Task Force for cardiovascular disease prevention in clinical practice with representatives of the European Society of Cardiology and 12 medical societies with the special contribution of the European Association of Preventive Cardiology (EAPC). *Eur Heart J*. 2021;42(34):3227–337.
- [6] Ruivo J, Moholdt T, Abreu A. Overview of Cardiac Rehabilitation (OCRE) following post-acute myocardial infarction in European Society of Cardiology (ESC) member countries. *Eur J Prev Cardiol*. 2023;30(9):758–68.
- [7] Gallagher R, Ferry C, Candelaria D, Ladak L, Zecchin R. Evaluation of cardiac rehabilitation performance and initial benchmarks for Australia: an observational cross-state and territory snapshot study. *Heart Lung Circ*. 2020;29(9):1397–404.
- [8] Chaves G, Turk-Adawi K, Supervia M, Santiago de Araújo Pio C, Abu-Jeish AH, Mamataz T, et al. Cardiac rehabilitation dose around the world: variation and correlates. *Circ Cardiovasc Qual Outcomes*. 2020;13(1):e005453.
- [9] Poffley A, Thomas E, Grace SL, Neubeck L, Gallagher R, Niebauer J, et al. A systematic review of cardiac rehabilitation registries. *Eur J Prev Cardiol*. 2017;24(15):1596–609.
- [10] Kilkenny MF, Dewey HM, Sundararajan V, Andrew NE, Lannin N, Anderson CS, et al. Readmissions after stroke: linked data from the Australian Stroke Clinical Registry and hospital databases. *Med J Aust*. 2015;203(2):102–6.
- [11] Hoque DME, Kumari V, Hoque M, Ruseckaite R, Romero L, Evans SM. Impact of clinical registries on quality of patient care and clinical outcomes: A systematic review. *PLOS ONE*. 2017;12(9):e0183667.
- [12] International Council of Cardiovascular Prevention and Rehabilitation. International cardiac rehabilitation registry; 2021. Available at: [https://globalcardiacrehab.com/International-CR-Registry-\(ICRR\)](https://globalcardiacrehab.com/International-CR-Registry-(ICRR)).



- [13] Gallagher R, Thomas E, Astley C, Foreman R, Ferry C, Zecchin R, et al. Cardiac rehabilitation quality in Australia: proposed national indicators for field-testing. *Heart Lung Circ.* 2020;29(9):1273–7.
- [14] Australian Government. Department of health and aged care. Modified Monash model; 2019. Available at: <https://www.health.gov.au/topics/rural-health-workforce/classifications/mmm>.
- [15] Rohani N, Yusof MM. Unintended consequences of pharmacy information systems: A case study. *Int J Med Inform.* 2023;170:104958.
- [16] Yan Q, Jiang Z, Harbin Z, Tolbert PH, Davies MG. Exploring the relationship between electronic health records and provider burnout: A systematic review. *J Am Med Inform Assoc.* 2021;28(5):1009–21.
- [17] Frost ED, Donlon J, Mitwally A, Magnani G, Tomlin S, Berk M, et al. Paper charts: A continued barrier to psychiatric care in the midst of a broken and fragmented mental health system. *J Nerv Ment Dis.* 2023;211(1):1–4.
- [18] Bäck M, Leosdottir M, Hagström E, Norhammar A, Hag E, Jernberg T, et al. The SWEDEHEART secondary prevention and cardiac rehabilitation registry (SWEDEHEART CR registry). *Eur Heart J Qual Care Clin Outcomes.* 2021;7(5):431–7.
- [19] Clinical excellence Queensland. Queensland cardiac outcomes registry. Available at: <https://clinicalexcellence.qld.gov.au/improvement-exchange/cardiac-outcomes-registry>. [accessed 16.10.23].
- [20] Integrated Cardiovascular Clinical Network SA. Country access to cardiac health. Available at: <https://www.iccnetsa.org.au/catch.aspx>. [accessed 16.10.23].
- [21] Winter V, Dietermann K, Schneider U, Schreyögg J. Nurse staffing and patient-perceived quality of nursing care: a cross-sectional analysis of survey and administrative data in German hospitals. *BMJ, (Open).* 2021;11(11):e051133.
- [22] Lynch E, Laver K, Levy T, Schultz T. 'The way that we are collecting and using data has evolved' evaluating the Australian National Stroke Audit programme to inform strategic direction. *BMJ Open Qual.* 2023;12(1):e002136.