

Background

Current guidelines recommend referral for cardiac rehabilitation following acute cardiac events but participation rates are poor.^{1,2} Uptake of cardiac rehabilitation (CR) remains a challenging problem for multiple reasons including: distance/transport, time, cultural, cost and psychological constraints.^{3,4}

This study evaluated the impact on CR participation associated with the introduction of a smartphone enabled app (Cardihab™) for patients declining conventional CR. Information on barriers to CR participation were collected.

Methods

204 consecutive patients were offered CR post angioplasty; 99 in phase one who were offered conventional CR only, and 105 in phase 2, initially offered conventional CR with app-based CR offered to those patients who declined conventional CR. Patients were followed throughout a 6-week CR program and participation rates were compared for Phase 1 and 2. Patients were evaluated based on the mode of CR in which they initially agreed to participate.

Patients declining all forms of CR in phase 2 were interviewed to assess reasons for non-participation.

The occurrence and cause of hospital readmissions within 12 months of the index cardiac event were retrospectively documented for Phase 2 patients.

Results

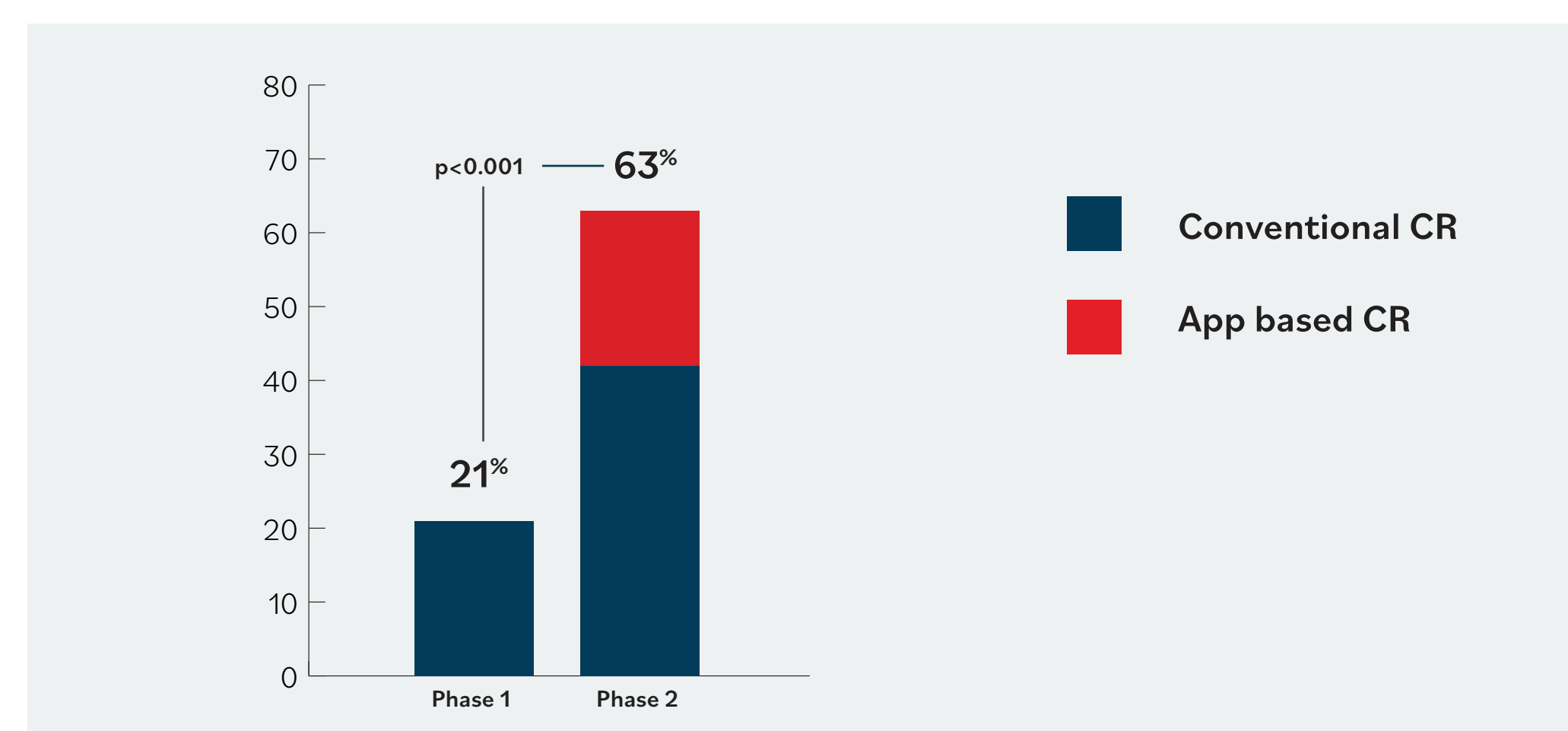
- In Phase 1, 21 patients (21%) undertook conventional CR while in Phase 2, 43 patients (41%) elected to undertake conventional CR (p=0.002). Of the 62 patients declining conventional CR in Phase 2, a further 23 elected to participate in the app-based program. (Table 1)
- In Phase 2 a total of 66 patients (63%) undertook CR, using either the conventional or app-based program. The increase in CR participation from Phase 1 to Phase 2 was statistically significant (p<0.001). (Figure 1)

Table 1: Summary of patient participation by mode of cardiac rehabilitation

	Phase 1 (n=99)		Phase 2 (n=105)		
	Male	Female	Male	Female	
Number Approached	73 (74%)	26 (26%)	79 (75%)	26 (25%)	p=0.806*
Median Age (IQR)	70 (63-74)	73 (68-80)	66 (58-71)	71 (62-77)	M: p=0.005* F: p=0.164*
Conventional CR Enrolled	21 (21%, CI:14%-30%)	8 (31%)	43 (41%, CI:32%-51%)	12 (46%)	p=0.002*
App-based CR Enrolled	n/a		23	2	
Total CR uptake	21 (21%, CI:14%-30%)	8 (31%)	66 (63%, CI: 53%-71%)	14 (54%)	p<0.001*

*p-values for comparison between phase 1 and phase 2. CI, 95% Confidence intervals calculated using the Wilson score interval. IQR, interquartile range; CR, cardiac rehabilitation

Figure 1. Overall CR Participation Rates



- From Phase 1 to Phase 2, participation by males in the CR program increased from 18% to 66% (p<0.001). There was no significant difference for females (p=0.09). The increase in male participation arose from increased participation in the conventional program (18% to 39%), plus a significant contribution from those taking up the app-based program (21/48; 44%).
- Patients participating in the app-based CR were younger (median: 61 vs. 70 years, p=0.005)
- Patients who declined CR during Phase 2 (n=39) were interviewed to identify reasons for non-participation (Table 2). 9 patients (23%) reported psychosocial issues and 9 patients (23%) identified technology issues as reasons for not taking up app-based CR.

Table 2: Patient-reported reasons for declining participation in CR (n = 39)

Reason	Number (%)
Further cardiac procedure scheduled	11 (26%)
Psychosocial issues	9 (23%)
Technical concerns (device or operator) re app-based CR	9 (23%)
Comorbidities (Alzheimer's; hearing difficulties)	3 (0.08%)
Unable to be interviewed or living outside Australia	3 (0.08%)
Completed CR previously and feel another program won't be useful	2 (0.05%)

- Hospital readmissions (by primary diagnosis categories) within 12-months post the initial cardiac event for Phase 2 patients are shown in Table 3. Cardiac readmission was observed to be very low in the app-based (Cardihab) CR cohort at 4%, considerably higher at 33% for conventional CR patients and 13% for the no CR cohort (p=0.025). This may partly reflect a younger cohort in the app-based CR patients.

Note: Study not specifically designed to detect differences in readmission rates.

Disclosures 1. I. Smith has not had an affiliation (financial or otherwise) with a commercial organization that may have a direct or indirect connection to the content of this presentation. **2.** J.T. Rivers and C. Smith work within Queensland Cardiovascular Group which is the clinical development partner for Cardihab Pty. Ltd. and a shareholder of Cardihab Pty. Ltd. J.T. Rivers is a director of Cardihab Pty. Ltd. James Cameron (deceased) worked within Queensland Cardiovascular Group. (Financial interest: Modest <\$10K)

References 1. Chew DP, et al. National Heart Foundation of Australia & Cardiac Society of Australia and New Zealand: Australian Clinical Guidelines for the Management of Acute Coronary Syndromes 2016. *Heart Lung Circ.* 2016;25(9):895-951. 2. Institute. BHaD. No Second Chances: Controlling Risk in Cardiovascular Disease. In. Melbourne, Australia: Baker Heart and Diabetes Institute; 2018 3. Menezes AR, et al. Cardiac rehabilitation in the United States. *Prog Cardiovasc Dis.* 2014;56(5):522-529. 4. Dalal HM, et al. Cardiac Rehabilitation. *BMJ.* 2015;351:h5000.

Table 3: Hospital readmissions within 12 months of index cardiac event

		No CR	Conventional CR	App-based CR
		n	39 (M: 69%)	43 (M: 70%)
Patients (Phase 2)	Age (IQR)	68 (61-74)	70 (63-74)	61 (56-69)
	n	10 (M: 60%)	21 (M: 67%)	5 (M: 100%)
All readmissions	Age (IQR)	65 (61-75)	69 (63-73)	68 (66-70)
	Proportion (%)	26% (15%-41%)	49% (35%-63%)	22% (10%-42%)
Cardiac readmissions	n	5 (M: 60%)	13 (M: 77%)	1 (M: 100%)
	Age (IQR)	66 (59-71)	69 (63-73)	68 (n/a)
	Proportion (%)	13% (6%-27%)	33% (19%-45%)	4% (1%-21%)

IQR, interquartile range; F2F, face to face. No IQR is provided where the number of cases is less than 5. Confidence intervals (95%) shown for proportions were calculated using the Wilson score interval.

Conclusions

- Providing the additional option of an app-based CR program to patients who declined conventional CR was associated with an increase in overall CR participation rate from 21% in phase 1 to 63% in phase 2.
- Use of a clinically validated, smart-phone enabled, digital CR program can improve CR participation and should be considered as a standard component of a CR service, particularly for patients who find conventional CR impractical, inconvenient or unappealing.
- Further trials are needed to assess the value of app-based risk factor modification on long term clinical outcomes.

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