Title: Validation of the Physician Attitudes toward Cardiac Rehabilitation & Referral (PACRR) Scale

Running Head: Physician Attitudes toward Cardiac Rehabilitation & Referral

Authors: Gabriela Lima de Melo Ghisi, PhD[1,2], Sherry L Grace, PhD[1,2].

Institutional Affiliations:

[1]Cardiovascular Prevention and Rehabilitation Program, Toronto Rehabilitation Institute (TRI), University Health Network (UHN), University of Toronto, Toronto, Canada.

[2]School of Kinesiology and Health Science, Faculty of Health, York University, Toronto, Canada.

Names of institutions where the work was done:

TRI-UHN, 347 Rumsey Road, Toronto, ON M4G1R7, Canada

York University, Bethune 368, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada

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Abstract

Background: One of the key drivers of cardiac rehabilitation under-utilization is physician referral failure. The Physician Attitudes toward Cardiac Rehabilitation & Referral (PACRR) scale was developed to understand factors that impact their referral practices, so they can be ultimately reliably be identified and mitigated. The objectives of this study were to assess the reliability, factor structure, and validity of the PACRR.

Methods: Data were retrospectively analyzed from 3 cohorts administering the PACRR, a 19-item scale. The first cohort consisted of 185 cardiologists or family physicians; the second of 51 of the same, and the third of 97 cardiologists. Internal consistency was assessed by Cronbach's alpha, factor structure by confirmatory factor analysis, construct validity by significant differences in PACRR scores by physician specialty, and criterion validity by testing for significant differences in PACRR scores by referral.

Results: Cronbach's alpha was 0.81, 0.71, and 0.69 in each of the 3 cohorts, respectively. Factor analysis in the latter 2 cohorts revealed 4 factors: referral norms, preference to manage patients independently of CR, perceptions of program quality, and referral processes. Construct validity was established in the first cohort, as significant differences in PACRR scores were found by physician specialty. Criterion validity was supported by significant differences in mean scores by referral in each cohort. Physicians rated bad experiences with CR programs, poor program quality, skepticism of CR benefits and lack of familiarity with local programs as the most important factors that affected their referral to CR.

Conclusions: In conclusion, the PACRR scale was demonstrated to have good reliability and validity.

Introduction

Cardiovascular diseases (CVDs) are among the leading burdens of disease and cause of disability worldwide [1,2]. Cardiac rehabilitation (CR) is an outpatient secondary prevention program comprised of structured exercise training and comprehensive education and counseling designed to mitigate this burden [3]. Indeed, participation in CR has been shown to reduce morbidity and mortality by 20%, in a cost-effective manner [4-7]. Despite these well-established benefits and clinical practice guideline recommendations to refer CVD patients [3,8-12], CR is grossly under-used [13].

Previous research has examined the multifactorial reasons utilization rates are so low, at the health system, physician, program and patient levels [14-17]. Given CR use is dependent upon physician referral [18,19] physician factors are key. In our review of the literature on physician factors associated with referral to CR programs, medical specialty, perceptions of patient motivation to attend, familiarity with local programs, automatic referral systems, ease / accessibility of referral forms, and their attitudes toward CR were identified [14]. It has also been well-established that patients are more likely to enroll if physicians strongly and positively endorse the importance of CR participation [20]; this requires positive attitudes about CR services.

Upon a rapid review of the literature, no psychometrically-validated scale to assess physician attitudes toward CR and referral could be found (see below). Our group developed a 19-item scale to assess this, and it has now been administered in three cohorts (results from the scale are presented in two publications for two of the cohorts) [15-18, 21]. We have received several requests to use the scale, and although some preliminary validation work has been done [16], clearly there is need to establish its' psychometric properties. Hence, the objectives of this

study were to assess the reliability, factor structure, and validity (construct and criterion) of the

Physician Attitudes toward Cardiac Rehabilitation & Referral (PACRR) scale.

Methods

First, a rapid literature search to identify measures of physician attitudes toward CR was

performed with the help of an information specialist. Literature published from database

inception until July 2017 was searched in MEDLINE, PsycINFO, Google Scholar and HaPI

computerized databases. Search results were downloaded into bibliographic software.

Design

Herein, data from 2 cross-sectional, observational studies (again, data from one is

presented in two papers) [15-17] and 1 prospective, multi-level study (with data presented in two

papers) [18-21] were retrospectively analyzed. Ethics approval was obtained for each study, and

participants completed a consent form on paper or online. In each study, response rate was

optimized through repeated contacts using a modified Dillman approach [22]. The sample size

and response rate for each are shown in Table 1.

Cohorts and Associated Procedures

In the first cohort [16,17], a stratified, random sample of physicians who treat patients

indicated for CR (i.e., family physicians and cardiac specialists) listed in the Canadian Medical

Directory were invited to participate in the study in 2003; 185 consented. Physicians were mailed

a survey including the PACRR; please note the survey also included an additional seven items

where physicians were asked whether various patient-related factors promoted or discouraged (5-

point Likert scale as well) referral (e.g., patient expresses disinterest, patient has arthritis; these

were included in the original factor analysis). A case scenario was provided, and physicians were

asked whether or not they would refer a hypothetical patient (yes/no) and why. There were also

questions to assess training, specialty and practice characteristics.

In the second cohort [15], a random sample of family physicians and cardiac specialists

were again recruited from the Canadian Medical Directory, between February-June 2012. Fifty-

one consented; of these, there was complete, valid data from 36. Physicians made referral

judgments and decisions regarding 32 hypothetical cardiac patients (e.g., would you refer this

patient for cardiac rehabilitation, yes or no?) online and completed a questionnaire containing the

PACRR, among other items.

In the third cohort [18,21], cardiologists in Ontario, Canada were recruited again through

the Canadian Medical Directory in 2005. Ninety-seven consenting cardiologists completed the

PACRR. They were also visited by a research assistant to extract a consecutive sample of

approximately 20 each of their recent CVD outpatients who were eligible for CR, who were

subsequently invited to participate in the study. CR referral and enrollment were ascertained

(self-report verified with programs) in these 1490 consenting patients 9 months later (i.e.,

prospective design).

Measure: the PACRR scale

The PACRR was developed to assess CR attitudes among healthcare providers who refer

patients to CR via self-report, which consists primarily of cardiologists, cardiovascular surgeons,

internists, primary care physicians and nurse-practitioners. Factors affecting referral were

considered through the lens of Anderson's Behavioral Model of Healthcare Utilization [21, 23].

Development followed several steps. First, an extensive review of literature was

undertaken. The factors affecting physician referral identified formed the basis for item

development. Input on the long list of 36 drafted items was solicited from healthcare

professionals with expertise in CR (including family doctors, internists, cardiologists, and cardiovascular surgeons) to ensure content and face validity. Finally, some items were deleted and many others revised based on the input.

The PACRR comprises 19 items to assess physicians' attitudes and beliefs about CR and referral (see appendix; includes instructions for scale completion to respondents). Response options were 1 = strongly disagree, 2 = agree, 3 = neutral, 4 = agree, and 5 = strongly agree. Five items are reverse-scored to mitigate acquiescence bias (denoted with *), such that higher scores reflect more positive attitudes toward CR and referral. A mean score is computed for the total (where at least 80% of items were completed; i.e., 15/19) scale and subscales. A final open-ended item asks physicians to list the most important factor that influence their decision to refer a patient to CR (not administered in second cohort).

Statistical analysis

SPSS Version 24.0 was used [24]. Psychometric properties were tested as per the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) taxonomy [25]. In each cohort, first, internal consistency or reliability was assessed by Cronbach's alpha. Values higher than 0.60 were considered acceptable [26].

Second, factor structure observed in the first cohort [16] was assessed for fit in the second [15] and third [18] cohorts using confirmatory factor analysis (again, please note there were an additional seven patient-related items in the original paper not administered in subsequent studies and therefore some differences in factor structure were expected). The main component method for factor extraction was used, considering only those with eigenvalues > 1.0. After the selection of the factors, a correlation matrix was generated, where the associations between items and

factors were observed through factor loadings greater than 0.30 on only one factor. The varimax

method with Kaiser normalization was used to interpret the matrix [27].

Finally, 2 forms of validity were tested. Construct validity was established in the first

cohort, as significant differences in PACRR scores were observed by physician specialty (see

below) [17]. This was not assessed in the second cohort [15] due to the small sample size, and

could not be undertaken in 3rd cohort [18,21] as it consisted of cardiologists only.

Lastly, criterion validity was considered by testing for significant differences in PACRR

scores by referral. This was already established in the first and third cohorts (see below). The

overall association with the total PACRR was computed using a Student's t-test or Pearson's

correlation (number of hypothetical patients referred) in cohorts one and two respectively.

Results

Availability of other scales

The literature search for measures of physician attitudes toward CR yielded 537 unique

records. Upon consideration of the citations, 8 studies were identified. In addition to the five

studies being analyzed herein [15-18,21], in 2 papers an unvalidated semi-structured

questionnaire was administered [28,29], and in another physician attitudes were assessed via

interview in German [30]. Therefore, it can be concluded there are no other validated scales of

physician attitudes toward CR and referral available.

Participant characteristics

The characteristics of physician participants from the three cohorts are described in Table

1. Overall, 318 physicians completed the PACRR, of which 209 (65.7%) were male and 189

(59.4%) were cardiologists.

Psychometric Validation

First, the internal consistency was assessed by Cronbach's alpha in each cohort. Results for cohorts one (without the 7 patient-related items), two and three were 0.81, 0.71, and 0.69 respectively.

In regards to factor analysis, the four factors identified in the first cohort (with 7 additional patient-related items) were: skepticism / preference to self-manage patients; patient characteristics; site referral processes; and, referral norms. This was assessed for fit in the second and third cohorts. For the second cohort, results from the Kaiser-Meyer-Olkin index (KMO=0.49) and Bartlett's Sphericity tests ($X^2=266,154$, $p<0.001$) indicated that the data were suitable for factor analysis. Four factors were extracted, accounting for 50.4% of the total variance. Factors were generally internally consistent and well-defined by the items. Factor one reflected referral norms, factor two preference to manage patients on own, factor three referral processes, and factor four perceptions of CR quality.

For the third cohort, results from the KMO index (0.64) and Bartlett's Sphericity tests ($X^2=458,286$, $p<0.001$) also indicated that the data were suitable for factor analysis. Four factors were also extracted (accounting for 52.2% of the total variance). Again, factors were generally internally consistent and well-defined by the items, with similar factors from cohort two. Table 2 shows the factor loadings for each item, as well as the factors extracted in each cohort, based on loadings greater than 0.30 on only one factor. Cronbach's alpha for the factor subscales are also shown; most are at or above the acceptable threshold.

With regard to construct validity, in cohort one [16] significant differences in PACRR scores by physician specialty were demonstrated. Primary care physicians were more likely to endorse lack of familiarity with CR site locations ($p<0.001$), lack of standardized referral forms ($p<0.001$), inconvenience ($p=0.04$), program quality ($p=0.004$), and lack of discharge

communication from CR (p<0.001) as factors negatively impacting CR referral practices than cardiac specialists. Cardiac specialists were significantly more likely to perceive that their colleagues and department would regularly refer patients to CR than primary care physicians (p<0.001).

Finally, in regard to criterion validity, this was established in cohort one [17]. A hierarchical logistic regression analysis was computed to predict CR referral of the hypothetical patient. After considering sex, specialty, graduation year, patient volume, and CR program availability within 30 minutes the "referral norms" factor of the PACRR was significantly associated with referral of the patient. A t-test was computed to test the association of the total PACRR score to referral of the patient, and it was significant (t=5.68, p<0.001).

In cohort two, a total score summing how many of the 36 hypothetical patients the physician would refer was computed (mean=35.00±27.08). We then ran a Pearson's correlation to test the association between the total PACRR score and number of patients referred. Results showed that physician attitudes were significantly related to referrals (r=0.40, p<0.01).

Finally, in the third cohort, in one of the publications it was reported that the following PACRR items were associated with verified referral of the cardiologists' actual patients: standard referral in department/practice, intention to refer, standard referral forms, perceptions of the benefits of CR, perceptions of the quality of the CR programs, and experiences with the CR programs [18]. Most of these attitudes sustained adjustment in hierarchical analysis. In the other publication from this cohort, some of these attitudes (i.e., intention to refer, perceptions of CR benefit, and previous experiences with CR) were even associated with patient enrolment [21], demonstrating PACRR items have excellent criterion validity.

Physicians' attitudes toward CR and referral

Table 3 displays the means and standard deviations of each PACRR item in each cohort, as well as total scores. Items generally with the highest scores across all cohorts (i.e., the most important factors) were with regard to: being skeptical about the benefits of CR, poor quality programs available, bad experience with a program, and lack of familiarity with local programs. The least important factors (i.e., items with lowest scores) generally across all cohorts were with regard to: lack of familiarity with programs outside their local area and lack of standardized referral forms.

Physicians were also asked to state the most important factors that affect their referral of patients to CR. In the first cohort, the most common responses were: geographic accessibility (n=48, 9.5%), perceptions of patient motivation (n=34, 6.7%), physical characteristics of patients (n=13, 2.6%), and patient benefit (n=20, 3.9%), among some other responses. In the third cohort the most common responses were: perceptions of patient benefit (n=22, 5.7%), patient motivation / willingness to participate (n=18, 4.7%), geographic accessibility (n=13, 3.4%), and characteristics of the program (such as long wait to start, presence of core components like education; n=12, 3.1%).

Discussion

Although physician-related factors have been well-established as major barriers to CR utilization, until now there was no available validated tool to assess these. Herein, the reliability, factor structure, as well as content, face, construct and criterion validities of the PACRR were all established, across several cohorts. Moreover, validity was demonstrated prospectively, with PACRR scores related to not only actual patient referral, but also their subsequent enrolment, thus lending particular credence to the strength of this scale. The four subscales of the PACRR

are referral norms, preference to manage patients independently of CR, perceptions of program quality, and referral processes.

The open-ended responses physicians provided were generally reflected well in the PACRR items; this again supports the content and face validity of the PACRR. Researchers may wish to add the following items to the scale: "I don't refer when my patient expresses disinterest", and/or "I don't refer when I perceive my patient is unlikely to enroll" (as per the patient-related factors our group administered in cohort one). Geographic accessibility should not be a barrier to referral given evidence of benefit of home-based programs. The scale contains items regarding lack of familiarity of sites to which they can refer patients. However if there is lack of reimbursement of home-based models, lack of physician awareness regarding such models, or limited capacity for home-based services at programs, researchers may wish to add an item such as: "sometimes my patients live too far from available programs, and there are limited home-based CR offerings".

The key attitudes related to referral were being skeptical about the benefits of CR, poor quality programs available, and negative experiences with a program. Now that we can reliably measure these, we need interventions to address the issues identified to ensure patients access CR. Strategies such as systematic referral work because they circumvent physician referral failure [18], but standardized interventions to educate providers about CR and its' benefits should be developed using rigorous approaches (e.g., intervention mapping) [31] and then be rigorously tested in a randomized trial, as physician encouragement to patients promotes their subsequent enrolment. At a health systems level, these findings reiterate the need for more programs, that are properly-resourced to provide high-quality care.

There are several clinical and policy implications of this research. By understanding the factors that impede physician referral through the PACRR, we can then develop strategies to mitigate them. This may ensure more patients access CR, and hence can achieve the associated benefits of reduced morbidity and mortality. The PACRR could be administered in institutions where CR referral and enrolment rates are low, to reliably and accurately identify the issues impeding utilization. Institutions could then work with physicians to address identified factors. The PACRR could then be re-administered and referral rates revisited to see if utilization has increased. However, while it is low-cost to administer a self-report paper-and-pencil scale of only 19 items, feasibility may be limited by low response rates of busy clinicians.

Future research is needed to further establish the psychometric properties of the PACRR. First, in relation to the potential strategies to address low physician referral above, it should be determined whether the scale is sensitive to change (i.e., responsiveness), such as after physician education or changes in referral practices at their institution (e.g., initiation of systematic referrals). Second, there are other measurement properties of the scale that require assessment, such as test-retest reliability. Third, the PACRR should be administered in other health systems and countries than Canada, to ensure it is appropriate and performs well more generally. In addition, the translation and cross-cultural validation of this tool is warranted, in order to understand physicians' attitudes toward CR in different contexts, given the great burden of CVD globally [1, 2]. Finally, the interpretability of PACRR scores is low, and this is a limitation of the scale. It would be valuable to have the ability to assign qualitative meaning to scores, such as for example a threshold value over which physician scores reflect that they consistently refer their patients.

In conclusion, the PACRR proved to have strong psychometric properties, with evidence of its reliability and validity to assess physicians' attitudes toward CR and referral provided herein. The availability of this tool can enhance our understanding of factors that affect CR referral and management of cardiac patients, which in turn could increase identification of impeding factors, and ultimately give rise to actions to overcome them.

Conflict of interest

No conflict of interest reported.

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Table 1 – Participant Characteristics by Cohort

	Cohort 1[16,17]	Cohort 2[15]	Cohort 3[18,21]
N	185	51	97
Response rate	41.8%	5.0%	33.0%
Sex (% male)	105 (56.8%)	30 (58.0%)	32 (85.6%)
Mean years in practice (± SD)	33.0±9.75	22.2±10.4	35.0±8.5
Specialty (% cardiology)	58 (31.4%)	11 (22.0%)	97(100.0%)
Mean patient volume / week (± SD)	75.0±59.2	NR	46.3±33.5

NR= not reported; SD=standard deviation

Table 2: Factor loadings from factor analysis in cohorts 2 and 3

PACRR Item	Cohort 2[15]				Cohort 3[18,21]			
	Factor 1: Referral norms	Factor 2: Preference to self-manage patients	Factor 3: Referral processes	Factor 4: Perceptions of CR quality	Factor 1: Perceptions of CR quality	Factor 2: Referral processes	Factor 3: Preference to self-manage patients	Factor 4: Referral norms
1. Practice guidelines promote referral	0.45							0.54
2. Colleagues generally refer to CR	0.77							0.80
3. Department refers all eligible patients	0.67							0.75
4. Reimbursement policy is disincentive	0.46							0.38
5. Referral completed by	0.37					0.44		

other professional							
6. Intend to refer patients	0.74						0.41
7. Not familiar with local CR programs		0.41			0.47		
8. Not familiar with non-local CR programs				0.68	0.47		
9. No standard referral for sites closer to home			0.80			0.69	
10. Need help filling out referral forms			0.46			0.78	
11. Inconvenient to make referral				0.30		0.48	

Item							
12. Manage patient on his/her own		0.70					0.69
13. Educational materials in office		0.62					0.88
14. Prescribe exercise regimen		0.56					0.85
15. Female patients do not like exercise		0.68			0.52		
16. Skeptical of CR benefits		0.70			0.76		
17. CR program poor quality				0.39	0.86		
18. Bad experience with CR program		0.38			0.85		

19. No patient discharge summaries			0.30	0.40			
Eigenvalue	3.9	2.5	1.7	1.5	4.0	2.3	1.9	1.7
Percentage of variance	20.4%	12.9%	9.0%	8.0%	21.2%	12.1%	10.2%	8.7%
Cronbach's alpha	0.69	0.65	0.55	0.52	0.74	0.55	0.73	0.57

Table 3: PACRR item scores in each cohort

Variable	Cohort 1		Cohort 2		Cohort 3	
	Mean	SD	Mean	SD	Mean	SD
1. Clinical practice guidelines promote referral to CR*	4.02	0.78	4.18	0.65	4.11	0.85
2. My colleagues generally refer patients to CR*	3.30	0.99	3.46	0.81	3.76	0.87
3. My department/practice generally refers all eligible patients to CR as a standard of care*	3.30	1.15	3.60	1.16	3.67	0.96
4. Reimbursement policies are a financial disincentive to CR referral	3.29	0.98	4.09	1.44	2.91	1.22
5. Follow-up care, including referral, is handled by another healthcare professional	3.34	1.10	3.40	1.36	3.43	1.07
6. I generally intend to refer patients to CR*	3.96	1.07	4.02	1.14	4.28	0.77
7. I am not familiar with the CR programs in my area	3.93	1.19	4.13	1.21	4.54	0.69
8. I am not familiar with CR sites outside my geographic area	2.56	1.22	3.02	1.57	3.17	1.33

Statement						
9. There is no standard referral form for CR, making it more effort to refer to sites closest to patients' homes	2.90	1.39	2.76	1.23	3.1	1.43
10. An allied health professional fills out referral forms on my behalf*	2.09	1.03	2.54	1.26	2.26	1.12
11. It is inconvenient to make a referral to CR	3.46	1.14	3.81	1.12	3.71	1.06
12. I prefer to manage my patients' secondary prevention myself	3.51	1.05	3.51	1.14	3.24	1.15
13. I have patient education materials in my office that are sufficient for promoting behavioural change	3.72	0.94	4.02	1.05	3.84	1.05
14. I can prescribe an exercise regimen for my patients myself	3.59	1.03	3.85	1.10	3.73	1.11
15. Female cardiac patients generally don't like to exercise	4.11	0.89	3.96	1.08	3.95	0.98
16. I am skeptical about the benefits of CR	4.48	0.71	4.62	0.64	4.60	0.54
17. The available CR program is of poor quality	4.33	0.82	4.28	0.78	4.44	0.75
18. I have had a bad experience with a CR program	4.39	0.80	4.60	0.88	4.55	0.68
19. The CR program does not provide me with patient discharge summaries	3.93	1.12	3.89	1.34	4.53	0.72

	Mean	SD	Mean	SD	Mean	SD
Factor: Skepticism	3.93	0.58	4.10	0.56	4.24	0.54
Factor: Patient characteristics	2.09	1.03	-	-	-	-
Factor: Referral process/ CR policies	3.55	0.76	2.62	0.75	3.11	0.54
Factor: Referral norms	3.66	0.78	3.80	0.67	3.77	0.55
Factor: Perceptions of the CR program	-	-	3.75	0.77	3.61	0.86
Total	3.66	0.45	3.78	0.43	3.78	0.38

Items were scored in a range from 1 (strongly agree) to 5 (strongly disagree).
*Reverse-scored items.
NA=not applicable; SD=standard deviation.

Appendix: Physician Attitudes Toward Cardiac Rehabilitation & Referral Scale (PACRR)

Please indicate how much you agree or disagree with the following statements regarding cardiac rehabilitation (CR):

Response options for each item: Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | N/A

1. Clinical practice guidelines promote referral to CR*
2. My colleagues generally refer patients to CR*
3. My department/practice generally refers all eligible patients to CR as a standard of care*
4. Reimbursement policies are a financial disincentive to CR referral
5. Follow-up care, including referral, is handled by another healthcare professional
6. I generally intend to refer patients to CR*
7. I am not familiar with the CR programs in my area
8. I am not familiar with CR sites outside my geographic area
9. There is no standard referral form for CR, making it more effort to refer to sites closest to patients' homes
10. An allied health professional fills out referral forms on my behalf*
11. It is inconvenient to make a referral to CR
12. I prefer to manage my patients' secondary prevention myself
13. I have patient education materials in my office that are sufficient for promoting behavioural change
14. I can prescribe an exercise regimen for my patients myself
15. Female cardiac patients generally don't like to exercise
16. I am skeptical about the benefits of CR
17. The available CR program is of poor quality
18. I have had a bad experience with a CR program
19. The CR program does not provide me with patient discharge summaries
20. What are the most important factors that affect your referral of patients to cardiac rehabilitation?

*Reverse-scored items
n/a = not applicable.