Full title in English: Cardiac Rehabilitation Availability and Delivery in Brazil, With Comparison to other Upper Middle-Income Countries

Short title: Cardiac Rehabilitation in Brazil

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Highlights

- CR delivery according to guidelines was evaluated for the first time in Brazil.
- CR is available in all Brazilian regions; however, it must be augmented.
- The greatest barrier for CR was patient referral.
- Staff size and core components is lower than other Upper-Middle Income Countries

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Abstract

Background: Brazil has insufficient cardiac rehabilitation (CR) capacity, yet density and regional variation in unmet need is unknown. Moreover, South America has CR guidelines, but whether delivery conforms has not been characterized. This study aimed to establish: (1) CR volumes and density, and (2) the nature of programs, and (3) compare these by: (a) Brazilian region and (b) to other upper middle-income countries (upper-MICs).

Methods: In this cross-sectional study, a survey was administered to CR programs globally. Cardiac associations were engaged to facilitate program identification. Density was computed using Global Burden of Disease study ischemic heart disease (IHD) incidence estimates. Results were compared to data from the 29 upper-MICs with CR (N=249 programs).

Results: CR was available in all 5 regions (only one program in North), with 30/75 programs initiating a survey (40.0% program response rate). There was only one CR spot for every 99 IHD patient. Most programs were funded by government/hospital sources (n=16, 53.3%), but in 11 programs (36.7%) patients depended on private health insurance. Guideline-indicated conditions were accepted in ≥70% of programs. Programs had a team of 3.8±1.9 staff (versus 5.9±2.8 in other upper-MICs, $p<0.05$), offering 4.0±1.6/10 core components (versus 6.0±1.5 in other upper-MICs, $p<0.01$; more tobacco cessation and return-to-work counselling needed in particular) over 44.5 sessions/patient (Q25-75=29-65) vs 32 sessions/patient (Q25-75=15-40) in other upper-MICs ($p<0.01$).

Conclusion: Brazilian CR capacity must be augmented, but where available, services are consistent across regions, but differ from other upper-MICs in terms of staff size and core components delivered.

Keywords: availability; health services; upper-middle income country

Introduction

Similar to other upper middle-income countries (upper-MICs), cardiovascular diseases (CVD) are among the leading burdens of disease and disability in Brazil[1]. The estimated prevalence of CVD in Brazil is 6,036/100,000 inhabitants[2], and hence secondary prevention is key.

Cardiac rehabilitation (CR) is an established model of care for secondary prevention, which is cost-effective, affordable, and averts costly downstream healthcare utilization[3]. Based on substantive evidence that participation is associated also with 20% reductions in CV mortality and morbidity[4], clinical practice guidelines for CVD[5–7], revascularization[8,9], and heart failure patients[10], among others, recommend referral to CR. There are internationally-agreed core components (e.g., initial assessment, structured exercise training, and risk factor management, including stress)[11,12] which are delivered by a multi-disciplinary team of healthcare professionals with expertise in all the secondary prevention recommendations[13]. It is recommended programs offer a minimum of 12 sessions, although greater benefits could be achieved with 36[14], and these sessions can be delivered in an unsupervised setting if patients have barriers to participation[15].

Unfortunately, data on the availability and characteristics of CR programs in Brazil are scarce[16-22]. A survey published in 2013 suggested there were a mere 39 programs in the entire country, despite the great need[20]. The nature of services offered was only reported across South American countries in this paper, and hence the situation in Brazil specifically is not known. A more recent survey[22] was undertaken of programs in one of Brazil's 26 states, and 41 were identified (each treating very few patients/year); clearly an updated inventory of programs nationally is needed. Results of the state-wide survey revealed programs are often offered in privately-funded settings, and focus primarily on exercise training to the neglect of other core components including tobacco cessation interventions and stress management. Programs were

often staffed by physiotherapists, with a notable absence of regulated health professionals in the areas of diet and mental health (including nurses) on teams[22]. Overall, the current availability of programs, density of CR spots per indicated patient, and the nature of services delivered on a national basis (and how this might vary by region and differ from similar settings outside of South America) are unknown.

Accordingly, the objectives of this investigation were to: (1) characterize the volumes, capacity and density of CR by (1a) Brazilian region, and (1b) nationally in relation to other upper-MICs; as well as (2) characterize the following aspects of CR: (2a) who pays for services, (2b) type of patients served, (2c) number and types of healthcare professionals on the CR team, (2d) number of program sessions / dose, (2e) core components delivered (particularly non-exercise), (2f) delivery of alternative models, and (2g) barriers to delivery, again by Brazilian region, and nationally in comparison to other upper-MICs.

Methods

Design & Procedure

This research was quantitative and cross-sectional in design; detailed methods are reported elsewhere[23]. In brief, countries where CR services were available were identified first through previous reviews[17,24]**.** In countries where CR services were not suspected to be available, the internet was searched and major CR and cardiology societies were contacted to identify any programs or verify lack thereof.

For each country identified to offer CR such as Brazil, first available CR or cardiac societies leadership were contacted, such as the Associação Brasileira de Fisioterapia Cardiorrespiratória (ASSOBRAFIR) and Sociedade Brasileira de Cardiologia (SBC). If there was no society available or response, “champions” were identified. Identified leaders were sent an e-

mail requesting their collaboration to (a) determine the number of programs in their country, and (b) administer the survey to each program in their country.

The most responsible clinician at each program was emailed with the request to complete the survey. The study was reviewed by York University's Office of Research Ethics (Toronto, Canada) and Mayo Clinic's Institutional Review Board (Rochester, United States). Informed consent was secured through an online form. The survey was administered through REDCap, with data collection occurring from June 2016 to December 2017. Contacts were sent 2 e-mail reminders, at 2 week intervals.

Sample

For the global study, the sample consisted of all CR programs identified in the world that offer services to patients following an acute cardiac event or hospitalization (i.e., Phase II). The inclusion criteria were CR programs that offered: (1) initial assessment, (2) structured exercise, and (3) at least one other strategy to control CV risk factors.

For the purposes of this study, CR programs in Brazil were selected as well as in countries with the same income classification as per the World Bank[25] (i.e., other upper-MICs). There are 55 such countries of which, 32 (58.18%) were determined to have CR.

Brazil is geo-politically divided into five regions by the Instituto Brasileiro de Geografia e Estatística (IBGE)[26]. These are: Central-West (includes Federal District where Brazil's national capital, Brasília, is situated), South, Southeast, North and Northeast (see map in Appendix A).

Measures

With regard to the first objective, CR program volume was defined as the median number of patients served by a program annually (program-reported in survey, described below). Region

and national CR capacity were computed by multiplying the median number of patients a program *could* serve annually (program-reported in survey) among the responding programs in a given region or country respectively, multiplied by the total number of programs in that jurisdiction. To compute density, information on ischemic heart disease (IHD) incidence in each Brazilian region and upper-MIC was pulled from the Global Burden of Disease [2] (2016 estimates); CVD incidence included rheumatic heart disease so to be conservative, IHD was used, however this is an under-estimate because heart failure is not considered. The ratio of capacity per annual incident patient for each country was computed (i.e., density or CR spots per indicated patient).

Development of the survey is described in detail elsewhere[27]. In short, items were based on previous national/regional CR programs surveys[20,28,29]. Most items had forced-choice response options, and skip-logic was used to obtain more detail where applicable. The survey was translated to Brazilian-Portuguese (online Appendix). It was reviewed by 10 CR healthcare professionals (i.e., target respondents), who identified some unclear terminology which was revised.

The following variables were assessed: (i) who funds the program (i.e., private sources such as healthcare insurance or patients, public sources such as government, or a combination of these sources [i.e., hybrid]), (ii) the type (e.g., myocardial infarction, as well as non-cardiac indications) and number of patients served per session (as well as staff-to-patient ratio), (iii) the number and types of healthcare professionals on the CR team (part-time staff were counted as 0·5), (iv) dose of CR (in hours; i.e., sessions per week x duration in weeks x duration of exercise sessions in minutes); (v) the type and number of core components delivered (of 10; i.e., initial assessment [including risk factors assessed and type of functional capacity test], risk stratification, structured exercise, patient education, risk factor management, nutrition counselling, stress management, tobacco cessation interventions, prescription/titration of medication, and communication with a primary healthcare provider), and (vi) whether the program offers alternative CR models (i.e.,

home or community-based programs, or hybrid models where patients transition from supervised to unsupervised settings).

Data analysis

SPSS version 24 was used for analysis[30]. All initiated surveys were included. The number of responses for each question varied due to missing data (e.g., respondent did not answer a question due to lack of willingness or potential inapplicability, use of skip logic); for descriptive analyses, percentages were computed with the denominator being the number of responses for a specific item.

Descriptive statistics were used to characterize volume, capacity, density, as well other closed-ended items in the survey (e.g., funding sources, core components delivered, and healthcare professionals on the CR team). All open-ended responses were coded / categorized. Aspects of CR were then compared by region (only descriptively due to limited sample sizes in 2 regions), and nationally versus other upper-MICs using Mann-Whitney U or Chi-square tests as applicable.

Results

CR is available in 5/5 (100.0%) Brazilian regions. Data were collected in 4 (80.0% regional response rate). Nationally, 30 of 75 programs responded (40.0% program response rate). The number of programs and responses per region were 0 of 1 CR in North, 5 of 9 in Northeast, 2 of 6 in Central-west, 21 of 45 in Southeast and 2 of 14 in South (in detail at Appendix A).

Of the 32 upper-MICs that had CR, data were collected in 29 (90.6% country response rate); 249 surveys were completed (mean program response rate=52.5% across these countries)[23]. These countries were: Algeria, Argentina, Belarus, Bosnia and Herzegovina, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Georgia, Iran, Jamaica, Kazakhstan,

Lebanon, Macedonia, Malaysia, Mauritius, Mexico, Panama, Paraguay, Peru, Romania, Russia, Serbia, South Africa, Turkey, Venezuela.

Availability, Volumes, Capacity and Density

Overall, 16 (53.3%) were in a hospital; all of which were academic, tertiary centres (with 1 being military).

As shown in Table 1, program volumes were significantly lower than other upper-MICs. Programs served a median of 4.5 (Quartile25-75=2.7-8.5) patients per exercise session (compared to 7.0 [Q25-75=2.7-8.5] in other upper-MICs; p=0.03). The median number of patients per 1 staff during supervised exercise was 5.0 (Q25-75=3.0-10.0; similar to other UPPER-MICs=6.0, Q25-75=3.0-10.0).

Capacity, density and unmet need are also shown in Table 1. Density is almost three time worse than in other upper-MICs. When compared to the 86 other countries of the world with CR and sufficient information to compute it, Brazil's density is 73rd worst (data shown elsewhere)[31].

Nature of CR Services

Program responders were asked to report who pays for their services, and could check all applicable sources (n=30; only 7.0% reported >1 source). Appendix A displays the funders of CR by region. Nationally, 16 (53.3%) reported government funding (with only 2400 spots nationally funded by government), 11 (36.7%) reported private health insurance, 2 (7.0%) reported both. In upper-MICs No CR program reported that patients pay all program out-of-pocket, however the average percent of the total program patient pay is 75.50±36.15% more than in other upper-MICs (38.93±33.90%, p<0.05).

The most common types of patients accepted in CR programs are shown in Table 2. There were no significant differences between Brazil and other upper-MICs ($p>.05$; only a trend for percutaneous coronary intervention). Many programs also accepted patients with non-cardiac indications, namely: high-risk primary prevention (n=21, 70.0%), diabetes (n=17, 56.6%), intermittent claudication / peripheral vascular disease (n=16, 53.3%), lung disease (n=15, 50.0%), stroke (n=9, 30.0%) and cancer (n=8, 26.7%) patients. This did not differ from other upper-MICs (all $p>.05$).

The number and nature of healthcare professionals on CR teams is shown in Table 3. Brazil programs had significantly fewer staff versus other upper-MICs; specifically, teams were less-often comprised of nurses, cardiologists and pharmacists than other upper-MICs.

CR program dose was just over 44.5 hours (Q25-75=30-70); this was significantly greater than other upper-MICs (30.0 hours; Q25-75=10-45; $p=0.001$). Nationally, programs offered 44.5 sessions/patient (Q25-75=29-65); median frequency was 3 sessions per week, and median program duration was 15 weeks (Q25-75=12-16); this was significantly greater than other upper-MICs (32 sessions/patient, Q25-75=15-40 and 10 weeks, Q25-75=6-12).

Programs offered 4/10 core components on average and the most-frequently delivered components are shown in Table 4. Initial assessment and structured exercise are offered much more frequently than other components (i.e., not comprehensive programs), with communication with primary care (n=10, 33.3%), tobacco cessation (n=6, 20.0%) and return to work counselling (n=4, 13.3%) least commonly offered. Programs in Brazil offered significantly fewer components than other upper-MICs, with less percentage of programs ($p<0.01$) offering the majority of core components except initial assessment and structured exercise.

During the core component of initial assessment, 20 (66.7%) programs had patients undergo an exercise stress test. Risk factors assessed pre-program included blood pressure (n=30, 100.0%), physical inactivity (n=30, 100.0%), tobacco use (n=23, 76.7%), anthropometrics (n=21, 70.0%), lipid profiles (n=20, 66.6%), harmful use of alcohol (n=20, 66.6%), blood glucose (n=15, 50.0%), depression (n= 13, 43.3%), and diet (n=12, 40.0%). Most programs also delivered resistance training (n=19, 63.3%). In 22 (73.3%) programs, patients were re-assessed at program end, and the results were communicated to the patients' primary care physician in 10 (33.3%) programs. Finally, 18 (60.0%) programs had some form of patient contact post-program.

Seven (23.3%) programs reported delivery of any alternative model of CR (6 in Southeast and 1 in Northeast). This proportion did not differ from other upper-MICs (n=49, 19.7%). Five (3.0%) programs reported using smartphones, an "app", or text messaging with patients (i.e., some form of eCR; versus n=32, 12.8% in other upper-MICs, $p<0.05$). Four (13.3%) programs reported offering a "hybrid" model (versus n=16, 6.4% in other upper-MICs) and only one program reported offering community-based CR (versus n=18, 7.2% in other upper-MICs). Nationally, 2 (6.6%) programs offered alternative forms of exercise (e.g., pilates, dancing).

Delivery Barriers

Figure 1 displays barriers to CR delivery by Brazilian region and in other upper-MICs. The greatest barrier in all jurisdictions was patient referral (although tied for Central-West). No barrier differences were found compared to other upper-MICs. Other barriers reported by Brazilian respondents included transportation (n=22, 73.3%), lack of knowledge about CR among healthcare professionals (n=5, 16.7%) and patient motivation (n=3, 10.0%).

Discussion

For the first time, the unmet need for CR in Brazil has been established, with density estimates computed based on indicated patient burden specifically rather than population as in previous studies[19]. Over 500,000 more spots are needed per year to treat IHD patients in Brazil, to ensure they achieve the mortality and morbidity reductions associated with participation[4].

Guideline-indicated patients are appropriately accepted (including over 70% of programs accepting heart failure patients, which is the most recent indication[10]) as in other upper-MICs, with these patients participating generally in 45 sessions (3 times/week over 15 weeks; total 45 hours), which is considered a sufficient dose to achieve mortality and morbidity reductions[14]. Most patients received only 4 of 10 core components (e.g., initial assessment, structured exercise, risk factor management, and patient education), delivered by a multidisciplinary team comprised of only ~4 members (e.g., physiotherapists, cardiologists, administrative assistants and dietitian). There is great need for capacity around return-to-work and tobacco cessation which could be achieved with inclusion of occupational therapists and psychologist on a part-time basis on CR teams. The low degree of communication with primary care physician could be related to the low number of nurses on CR teams in Brazil and reflects the struggle to achieve integrality of health care. Scant programs delivered CR unsupervised.

When compared to previous studies on CR in Brazil[20,21], it does appear the number of programs is increasing (75 identified), although differences could be explained by different methods of program identification. In one of the Southeast region alone 41 programs were identified, however many of them are offering exercise only[22].

For the first time, CR delivery in Brazil was compared inferentially with other comparable countries. There was consistency in CR delivery with other upper-MICs in terms of accepted indications but also major differences in volumes, density and funding source. Brazilian programs were less comprehensive, mainly exercise-based programs, delivered by a limited staff, over a

significantly longer period, when compared to other upper-MICs. When considering overall "quality" (i.e., of 20 structure and process indicators such as wait times, risk factors assessed and components) of programs in Brazil, it was adequate (12 indicators "met" [i.e., ≥75% programs], or 60%), but considered low when compared to other countries globally (ranked 14th or poorest; see)[23].

The implications of this work are many. First, capacity needs to be increased dramatically, both by increasing the number of patients treated per program (particularly through greater referral) and by initiating new programs. Brazilian programs are not exploiting alternative delivery settings such as home-based service and eCR, as is also observed in other upper-MICs. Considering the continental nature of the country and the high number of small cities, increasing delivery of alternative models could improve CR capacity, especially in regions where there are few programs (North and Central-west). Home-based CR has been established as a viable approach to delivery in low-risk patients in the Brazilian context[32].

Second, available programs should be resourced for staffing by a larger team, particularly including nurses and community healthcare workers (who can be trained to deliver several of the core components)[11], and for delivery of comprehensive services, to optimize patient outcomes[33,34]. A CR education curriculum has been validated in Brazilian-Portuguese and demonstrated effective, which covers the majority of core components (https://www.healtheuniversity.ca/pt/CardiacCollege/About/Pages/download-guide.aspx)[35,36]. Moreover, the International Council of Cardiovascular Prevention and Rehabilitation has developed a training and certification program on how to feasibly deliver all core CR components in low-resource settings, which could be used to augment availability of CR professionals to deliver all components (http://globalcardiacrehab.com/training-opportunities/certification/)[37].

This study has several limitations, particularly related to generalizability and measurement. Firstly, response rates to online surveys are notoriously low. The rate was 40% in the current study for Brazilian programs and 50.3% for other upper-MICs, which is fair, but suggests there may be bias.

Second, survey items were piloted, but not validated against real-world CR delivery. Respondents may have been inclined to respond in a socially-desirable manner, such that results were skewed to reflect better provision of CR. However, participants were informed that their responses were confidential. Third, the survey was translated, and although reviewed by CR professionals, all best practices in scale translation and validation were not undertaken. Finally, multiple comparisons were performed, and there were very few respondents in some regions, and hence caution is necessary when interpreting the findings.

Conclusion

CR has been available in Brazil for almost 55 years. There are 75 programs, each treating on average 60 guideline-indicated but also primary prevention and non-communicable disease patients per year, over almost 15 weeks, through 4 core components delivered by a team of 4 staff. Programs were fairly consistent with other upper-MICs, except Brazilian programs offer longer programs, with fewer components and few staff. However, there is only 1 CR spot for every 99 patients in need annually (more than other upper-MICs), with 500,000 more spots needed nationally to meet IHD demand alone. Most programs were funded by government sources but in over one-third of programs patients need private healthcare insurance, further limiting access. CR capacity must be augmented in Brazil, potentially through increased provision of eCR.

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Figure 1 Barriers to Cardiac Rehabilitation Delivery by region, and versus other upper-MICs.

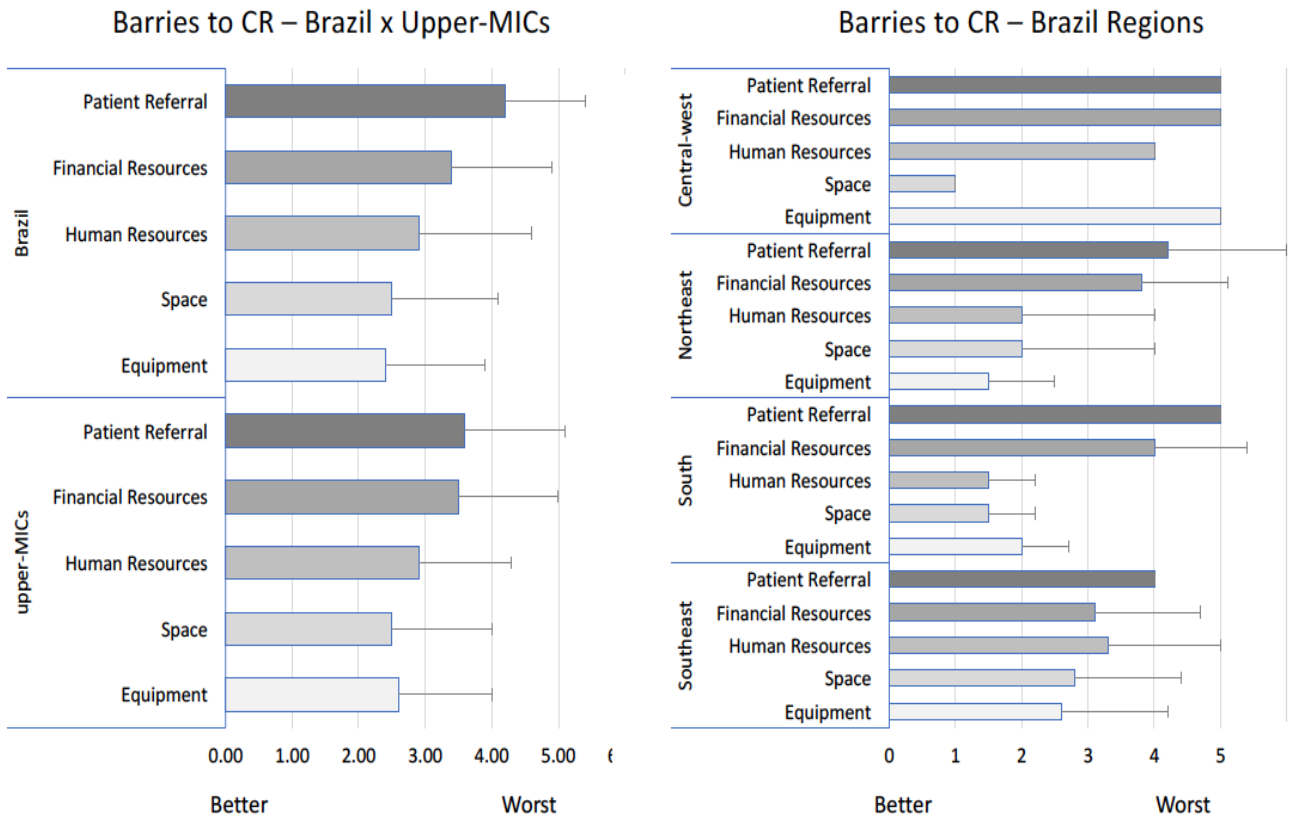

Figure 1 legend:

Respondents did not provide information on barriers for CR in 6/30 Brazil surveys and in 16/249 other UPPER-MICs.

No statistical analyses were performed to compare regions because of the small sample sizes.

Mann-Whitney U were used to test for significant differences in Brazil versus other UPPER-MICs. No significant differences were found.

Upper-MIC= upper middle-income country

Table 1: Volume, Capacity and Density by Brazilian region, and other Upper Middle-Income Countries

Jurisdiction	Total Population§	IHD Incidence†	Year of first program	Median annual volume/ program (Q25-Q75)	National CR Capacity ○	Density□	CR Need≠
Central-west	16,071,860	35,351	1974	-	-	-	-
North	18,127,875	32,287	-	-	-	-	-
Northeast	58,098,240	133,611	1998	51.5 (27-389)	495	269.92	133,116
South	29,870,012	86,634	1973	-	-	-	-
Southeast	87,645,849	247,493	1980	60.0 (41-79)	3,308	74.82	244,185
Brazil (30)	209,813,840	535,377	1973	60 (41-85)	5,400	99.14	529,982
Other upper-MIC (249)	2,557,000,000♦	4,645,662♦	1944	204*** (100-530)	142,200	32.67	4,503,463

- Not provided, available or applicable

§Source: World Bank[25] (accessed August, 2018). †Source: Institute of Health Metrics and Evaluation[2] (accessed August, 2018).

○calculated using median number of patient program could serve per year (from survey) multiplied by the number of programs in the jurisdiction or country. Value represents the number of patients who could receive CR in a year (i.e., CR spots).

□based on ratio of need (i.e., IHD incidence) to supply (i.e., national CR capacity). Represents number of CR spots per patient in need

≠number of additional spots needed to treat all IHD patients

♦considering all 32 other upper-MICs reported.

Mann-Whitney U were used to test for significant difference in program volumes between Brazil and other 29 (of 32) upper-MICs with CR (denoted in other upper-MIC row): ***$p<0.001$.

Acronyms: CR, cardiac rehabilitation, upper-MIC, upper middle-income country; IHD, ischemic heart disease.

Table 2: Most-Commonly Accepted Cardiac Rehabilitation Indications, by Brazilian region, vs Other Upper Middle-Income Countries

Jurisdiction (# responding programs) n (%)	Myocardial Infarction	Bypass Surgery	CAD	Heart Failure	Percutaneous Coronary Intervention
Central-west (2)	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)	1 (50.0)
Northeast (5)	5 (100.0)	5 (100.0)	5 (100.0)	5 (100.0)	4 (80.0)
South (2)	2 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)	2 (100.0)
Southeast (21)	15 (71.4)	15 (71.4)	15 (71.4)	14 (66.6)	14 (66.6)
Brazil (30)	23 (76.7)	23 (76.7)	23 (76.7)	22 (73.0)	21 (70.0)
Other upper-MICs (249)	205 (82.3)	200 (80.3)	197 (79.1)	184 (73.9)	206 (82.7)

No statistical analyses were performed to compare regions because of the small sample sizes. Mann-Whitney U tests were used to test for significant differences between Brazil and other upper-MICs. There were no significant differences. CAD=coronary artery disease (i.e., with no recent event or procedure).

Table 3: Healthcare Professionals on the Cardiac Rehabilitation Team, by Brazilian regions vs other Upper Middle-Income Countries

Jurisdiction (# responding programs) n (%)	**Physiotherapist**	**Cardiologist**	**Admin Asst.**	**Dietitian**	**Exercise Professional**	**Psych or SW**	**Nurse**	**Other Physicians**	**Pharmacist**	**Total number of staff (mean ± SD /17§)**
Central-west (2)	1 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (50.0%)	1.0± 0.0
Northeast (5)	5 (100%)	4 (80%)	2 (40%)	2 (40%)	1 (20.0%)	2 (40%)	1 (20.0%)	3 (60%)	2 (40%)	2.9±1.4
South (2)	1 (50.0%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2.2 ± 1.8
Southeast (21)	11 (52.4%)	11 (52.4%)	9 (42.9%)	9 (42.9%)	10 (47.6%)	9 (42.9%)	7 (33.3%)	5 (23.8%)	3 (14.3%)	4.5 ± 1.8
Brazil (30)	18 (60.0%)	16 (53.3%)	12 (40%)	12 (40%)	12 (40.0%)	11 (36.7%)	8 (26.7%)	8 (26.7%)	5 (16.7%)	3.8 ± 1.9
Other upper-MICs (249)	178 (71.5%)	204 (81.9%)**	145 (58.2%)	164 (65.9%)	121 (48.6%)	132 (53.0%)	177 (71.0%)***	84 (33.7%)	77 (30.9%)**	5.9±2.8

§Includes Cardiologist, Physiatrist, Sports Medicine Physician, other Physician, Physiotherapist, Nurse, Nurse-practitioner, Psychiatrist, Psychologist, Social worker, Dietitian, Kinesiologist, Pharmacist, Exercise specialist, Community Health worker, Administrative assistant/ Secretary, Other

No statistical analyses were performed to compare regions because of the small sample sizes. Chi-square tests were used to test for significant differences between Brazil and other upper-MICs (denoted in other upper-MIC row): *p<0.05, **p<0.01, ***p<0.001.

Acronyms: CR, cardiac rehabilitation; MIC, middle-income country; SD, standard deviation; SW, social worker. Abbreviations: Admin Asst, Administrative Assistant; psych, psychologist or psychiatrist.

Table 4: Key Core Components Delivered by Region, Nationally and in Other Upper Middle-Income Countries

Jurisdiction n (% of responding programs)	**n**	**Initial Assmt.**	**Structured Exercise†**	**Risk Factor Mgmt.**	**Patient Education**	**Stress Mgmt/ Psych**	**Nutrition Counselling**	**Prescription/ Titration medication**	**Total # Components (mean±SD /10)§**
Central-west	2	1 (50.0%)	1 (50.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.0±0.0
Northeast	5	5 (100%)	5 (100%)	4 (80%)	4 (80%)	3 (60%)	2 (40%)	2 (40%)	3.6±1.8
South	2	2 (100%)	2 (100%)	1 (50.0%)	2 (100%)	2 (100%)	1 (50.0%)	1 (50.0%)	5.2±1.8
Southeast	21	16 (76.2%)	16 (76.2%)	13 (61.9%)	12 (57.1%)	11 (13.6%)	9 (52.4%)	8 (38%)	4.2±1.5
Brazil	**30**	**24 (80.0%)**	**24 (80.0%)**	**18 (60.0%)**	**18 (60.0%)**	**16 (53.3%)**	**12 (40.0%)**	**20 (66.6%)**	**4.0±1.6**
Other upper-MICs	249	230 (92.4%)	208 (83.5%)	203 (81.5%)**	215 (86.3%)**	197 (79.1%)**	211 (84.7%)***	11 (33.3%)**	6.0±1.5*

§initial assessment, risk stratification, structured exercise, patient education, risk factor management, nutrition counselling, stress management, tobacco cessation interventions, prescription/titration of medication, and communication with a primary healthcare provider

†includes physical activity counselling, exercise prescription and / or exercise training.

No statistical analyses were performed to compare regions because of the small sample sizes. Chi-square tests were used for significant differences between Brazil and other upper-MICs (denoted in other upper-MICs row): *p<.01; **p<.001; ***p<.0001

Acronyms: upper-MIC, upper middle-income country; SD, standard deviation

Abbreviations: Assmt, assessment; mgmt, management; psych, psychological counselling

Appendix A

Cardiac Rehabilitation (CR) Availability and Funding Source by Brazilian Region