

# Perceptions of barriers to cardiac rehabilitation use in Brazil

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**Abstract:** Cardiovascular diseases (CVD) are the leading cause of mortality in middle-income countries, such as Brazil. However, given the diversity in health care systems in Brazil, access to proven services, such as cardiac rehabilitation (CR), varies widely.

**Purpose:** To describe and compare multilevel barriers to CR enrollment and participation in three Brazilian cohorts: (1) cardiac outpatients not attending CR (public or private system); (2) cardiac outpatients paying for CR; and (3) residents at high-risk of CVD with access to a free comprehensive exercise program but not making use of the program.

**Methods:** Brazilian residents from two cities were invited to participate – Florianopolis, an urban center; and Luzerna, a rural center. Respondents completed a survey including the Cardiac Rehabilitation Barriers Scale. Mann–Whitney *U* tests were used to compare barriers between cohorts cross-sectionally.

**Results:** Six hundred twenty-eight Brazilians consented to participate: 237 (37.7%) from Florianopolis, of which 139 (22.1%) participated in CR; and 391 (62.3%) from Luzerna. The mean total CR barriers for the sample were  $1.66 \pm 0.6$  and differed significantly by cohort ( $P < 0.001$ ). CR nonattendees from Florianopolis (eg, distance and not knowing about CR) and participants from Luzerna (eg, work and family responsibilities) reported significantly higher barriers than CR attendees from Florianopolis.

**Conclusion:** CR nonattendees reported significantly greater barriers than CR attendees. It is hoped that the provision of CR will increase, and that the development of the programs will be in a manner which mitigates the chief barriers identified herein.

**Keywords:** cardiac rehabilitation, barriers, participation, enrollment, comparison study

## Introduction

Cardiovascular diseases (CVDs) are the leading cause of mortality worldwide, with more than 80% of CVD deaths occurring in low- and middle-income countries.<sup>1</sup> Yet a treatment–risk paradox exists, such that people with CVDs in middle-income countries, such as Brazil, have even less access to proven therapies than those in high-income countries.<sup>2</sup> This limitation, unfortunately, includes low-cost secondary prevention programs, such as cardiac rehabilitation (CR).<sup>3,4</sup>

The Brazilian health care system is structured into public and private systems, and more than 75% of the population is covered exclusively by the former.<sup>5</sup> Most of the secondary and tertiary health institutions providing cardiac care are private and are located in the wealthiest and more populated regions of the country, resulting in gross socioeconomic disparities in health care.<sup>6</sup>

In Brazil, few outpatient CR programs are reimbursed in the public system. No studies have evaluated the cost of supervised CR programs in Brazil; however, a study<sup>7</sup> showed that the average cost of home-based programs was US\$502.71 per patient. We would estimate that attending supervised CR costs roughly 40% of a low-income Brazilian family's wages per month (personal communication, M Benetti, January 2013). Despite the established benefits and efficient low-cost approach of CR in Brazil,<sup>7-9</sup> these programs are scarce and, hence, scantily utilized. For instance, in Latin America less than 60% of the hospitals that treat acute cardiac patients with advanced interventions offer CR.<sup>10</sup> Accordingly, rates of enrollment around 14% have been observed in middle-income countries.<sup>8</sup>

Health system-, provider-, and patient-level barriers to CR utilization have been examined in a few studies in Brazil.<sup>11,12</sup> However, given the multiplicity in Brazilian health care systems (among other countries), comparison of barriers to CR use in these different contexts could inform future efforts to promote access. Accordingly, the aim of this study was to describe and compare multilevel barriers to CR enrollment and participation in three Brazilian cohorts: (1) cardiac outpatients not attending CR (public or private system); (2) cardiac outpatients paying for CR; and (3) residents at high-risk of CVD with access to a free comprehensive exercise program but not making use of the program.

## Methods

### Design and procedure

This was a cross-sectional comparative study. Consent to participate, according to the human rights' Research Ethics Review Committee of the World Health Organization (WHO), was obtained from all participants. They were asked to complete a sociodemographic survey, the Cardiac Rehabilitation Barriers Scale (CRBS), and to report their use of CR (yes/no). The survey was administered in Brazilian-Portuguese. Clinical data were extracted from medical charts.

Data from Cohort 1 were collected in Florianopolis (the capital of Santa Catarina state in southern Brazil) between March 2011 and June 2011. Cardiac outpatients from two health care institutions – one private and one public – were approached to participate when they came for a cardiology visit. CR attendees from both institutions were also invited to complete the questionnaire during the program. This sample comprised the second cohort. Both programs in Florianopolis focused on exercise. Patients were invited to participate three times per week. Patients could easily access the program by using public transport.

Data from the third cohort was collected in Luzerna, a small rural town located in the Midwest of Santa Catarina state, 410 km from Florianopolis, between January 2012 and May 2012. Luzerna can be considered as an exception in Brazil based on its care model for cardiac patients. Luzerna has a very small population of only 5,600 inhabitants (51% women) and a very high literacy rate of 93.1%.<sup>13</sup> There is a high burden of hypertension (n = 863; 15.4%) among residents, and 13.4% of hospital admissions and 27% of mortality are due to CVD.<sup>13</sup> The town has twelve health care workers who go from door-to-door identifying patients with CVD risk factors and referring them to more specialized care as appropriate. The town offers a free public program similar to CR, which includes the core components of supervised exercise, medical consultations for risk factor management, patient education, cardioprotective therapies, such as medication prescription, and psychosocial health to residents.<sup>13,14</sup> Residents identified by the health care workers as hypertensive, sedentary, and not participating in the free exercise program offered were approached at their house to solicit their participation in this study. Since Luzerna is a rural city, the program is not easily accessible by public transport.

### Participants

This study included residents at high-risk of developing cardiac disease or outpatients with established cardiac disease, all of whom were considered eligible to participate in CR, based on guidelines from Brazil.<sup>15</sup> The exclusion criteria were: age less than 18 years; lack of English- or Portuguese-language proficiency; and any visual, cognitive, or serious mental condition that would preclude the participant from completing the survey.

### Measures

Select clinical characteristics were obtained from the medical chart. These included cardiac history (ie, prior myocardial infarction [MI]) and cardiac risk factors (ie, hypertension and diabetes). The Luzerna cohort was also characterized by family history of CVD. Sociodemographic characteristics were self-reported (age and sex for both cohorts, and educational level for the Florianopolis cohort). CR enrollment was self-reported (yes/no).

The CRBS was administered to assess patient's perceptions of the degree to which patient-, provider-, and health system-level barriers affect their CR enrollment and participation.<sup>16</sup> Regardless of CR referral or enrollment, participants are asked to rate their level of agreement with each of the 21 statements. Items were rated on a five-point

Likert-type scale that ranged from 1 = strongly disagree to 5 = strongly agree. Higher scores indicated greater barriers to participation or adherence to CR. A total mean score was computed.

The CRBS was originally developed in Canada by Grace et al<sup>17</sup> in English and psychometrically validated by Shanmugasegaram et al.<sup>16</sup> It was later translated, culturally adapted, and psychometrically validated to Brazilian-Portuguese by Ghisi et al.<sup>11</sup> The Brazilian-Portuguese version consists of five subscales: perceived need; work/time conflicts; comorbidities/functional status; personal/family issues; and access.

## Statistical analysis

Statistical Product and Service Solutions software, version 20 (IBM Corporation, Armonk, NY, USA), was used. Respondents were categorized into one of the following three cohorts: high-risk residents not using free exercise program (ie, Luzerna sample); outpatient CR attendees; and outpatient CR nonattendees (Florianopolis sample). Descriptive statistics were used to describe the sociodemographic and clinical characteristics of each cohort. Pearson's Chi-square, *t*-tests, and analyses of variance (as applicable) were computed to test for significant differences by cohort.

To establish the reliability of the CRBS in this study, Cronbach's alpha was computed for the total scale and for each subscale. To establish the validity of the scale, mean barrier scores were compared by CR enrollment (yes/no).

A descriptive examination of mean item, subscale, and total barriers' scores by cohort was performed. To test for cohort differences in barriers, nonparametric tests (Mann-Whitney *U*) were used considering the unequal sample sizes. A Bonferroni correction was applied (0.05/21), such that differences were considered significant at the  $P < 0.002$  level.

## Results

### Respondent characteristics

With regard to the Florianopolis cohort, 93 (28.2%) participants were not included in this study. The reasons were as follows: patients did not complete the questionnaire properly ( $n = 31$ ; 33.3%); or, they refused to participate for any reason ( $n = 62$ ; 66.6%). Of these, 237 (71.8%) cardiac outpatients consented to participate and fully completed the CRBS; 131 (55.2% of the total) were recruited from a private health care system; and 106 (44.8% of the total) were recruited from a public health care system. Of these, 139 (22.1% of the total) participated in CR. Their highest educational attainment was as follows: 99 (41.8%) completed college or university; 36 (15.2%) completed high school; and 89 (37.6%) completed less than Grade 9 (first year of secondary school).

With regard to the Luzerna cohort, 71 (15.4%) participants were not included in this study, because they did not complete the questionnaire properly. Of these, 391 residents (7% of the town's population) agreed to participate in this study and completed the survey correctly. Their family history of heart disease was also assessed, with 157 (40.2%) responding affirmatively.

Table 1 displays the other available characteristics of these participants. Overall, Luzerna respondents (high-risk) were significantly more likely to be female, to have hypertension, to have a prior MI, and less likely to have diabetes than the cardiac outpatients from Florianopolis. Florianopolis CR attendees were significantly more likely to have diabetes than Luzerna respondents, and all attendees were male. Florianopolis CR nonattendees were less likely to have a prior MI than Florianopolis CR attendees and Luzerna respondents.

### Cardiac rehabilitation barriers

The CRBS performed reliably in this study, with Cronbach's alpha = 0.85. Cronbach's alpha for the subscales ranged from

**Table 1** Sociodemographic and clinical characteristics of respondents by cohort and CR participation status, N = 628

Characteristic	Cohorts			Total (n = 628; 100%)
	Luzerna (n = 391; 62.3%)	Florianopolis CR attendees (n = 139; 22.1%)	Florianopolis CR nonattendees (n = 98; 15.6%)	
<b>Sociodemographic<sup>†</sup></b>				
Age, years (mean ± SD)	64.6 ± 12.9	62.7 ± 9.1	64.09 ± 14.4	64.07 ± 12.4
Sex, female n (%)	276 (70.6%)	0 (0%)	81 (82.7%)	357 (56.8%)**
<b>Clinical<sup>§</sup> n (%)</b>				
Hypertension	391 (100%)	60 (43.2%)	55 (56.1%)	506 (81.4%)*
Diabetes	15 (4%)	41 (29.5%)	21 (21.4%)	77 (12.3%)**
Previous MI	83 (21.2%)	46 (33.1%)	30 (30.6%)	159 (25.3%)*

**Notes:** Significant differences between cohorts, \* $P < 0.01$ ; \*\* $P < 0.001$ ; <sup>†</sup>self-reported; <sup>§</sup>extracted from medical chart.

**Abbreviations:** CR, cardiac rehabilitation; MI, myocardial infarction.

0.57 to 0.77. Validity of the CRBS was also supported in this study. As shown in Table 2, overall CR nonattendees (respondents from Luzerna and Florianopolis CR nonattendees) reported significantly greater barriers than CR attendees ( $P < 0.01$ ).

Table 2 displays the item, subscale, and total scores overall and by cohort. The mean total CRBS for the entire sample was  $1.66 \pm 0.6/5$ . As shown overall, the Luzerna high-risk cohort reported significantly higher total barriers than the Florianopolis CR attendees and significantly lower total barriers than the Florianopolis CR nonattendees. In regards to the subscales (perceived need, work/time conflicts, comorbidities/functional status, personal/family issues, and access), the Luzerna high-risk cohort reported significantly higher comorbidities/functional status barriers than the Florianopolis CR attendees and significantly

lower comorbidities/functional status barriers than the Florianopolis CR nonattendees. The Luzerna high-risk cohort reported significantly lower perceived need and access barriers than the Florianopolis CR nonattendees. Finally, the Luzerna high-risk cohort reported significantly higher personal/family issues and travel/work conflict barriers than the Florianopolis CR attendees. The most highly endorsed barriers among the high-risk Luzerna residents with free access were work and family responsibilities.

Overall, the Florianopolis nonattending cohort reported significantly higher total barriers than the Florianopolis CR attendees and Luzerna high-risk cohort. Similarly, the Florianopolis nonattendees reported significantly higher comorbidities/functional status, perceived need, and access barriers than the Florianopolis CR attendees and Luzerna

**Table 2** Mean CRBS item scores/subscales for respondents by cohort and CR participation status, N = 628

CRBS item/subscale (mean $\pm$ SD)	Cohorts			Total (n = 628; 100%)
	Luzerna (n = 391; 62.3%)	Florianopolis CR attendees (n = 139; 22.1%)	Florianopolis nonattendees (n = 489; 15.6%)	
... of distance	1.88 $\pm$ 1.5	1.81 $\pm$ 1.4	2.96 $\pm$ 1.8	2.03 $\pm$ 1.6 <sup>**b,c</sup>
... of cost	1.53 $\pm$ 1.1	2.22 $\pm$ 1.5	2.61 $\pm$ 1.7	1.86 $\pm$ 1.4 <sup>**a-c</sup>
... of transportation problems	1.48 $\pm$ 1.0	1.45 $\pm$ 1.2	2.58 $\pm$ 1.7	1.64 $\pm$ 1.3 <sup>**b,c</sup>
... of family responsibilities	2.08 $\pm$ 1.6	1.41 $\pm$ 1.0	1.80 $\pm$ 1.2	1.89 $\pm$ 1.4 <sup>**a,c</sup>
... I didn't know about CR	1.28 $\pm$ 0.7	1.70 $\pm$ 1.4	2.70 $\pm$ 1.8	1.60 $\pm$ 1.2 <sup>**a-c</sup>
... I don't need CR	1.32 $\pm$ 0.8	1.27 $\pm$ 0.8	1.99 $\pm$ 1.2	1.41 $\pm$ 0.9 <sup>**b,c</sup>
... I already exercise at home, or in my community	2.10 $\pm$ 1.5	1.21 $\pm$ 0.7	1.72 $\pm$ 1.1	1.84 $\pm$ 1.4 <sup>**a-c</sup>
... severe weather	1.42 $\pm$ 1.0	1.25 $\pm$ 0.8	1.63 $\pm$ 1.0	1.42 $\pm$ 0.9 <sup>**b,c</sup>
... I find exercise tiring or painful	1.62 $\pm$ 1.2	1.60 $\pm$ 1.2	2.47 $\pm$ 1.5	1.75 $\pm$ 1.3 <sup>**b,c</sup>
... travel	1.38 $\pm$ 0.9	2.28 $\pm$ 1.4	1.82 $\pm$ 1.1	1.65 $\pm$ 1.1 <sup>**a-c</sup>
... of time constraints	1.99 $\pm$ 1.5	1.53 $\pm$ 1.2	1.73 $\pm$ 1.1	1.85 $\pm$ 1.4 <sup>*a</sup>
... of work responsibilities	2.19 $\pm$ 1.6	1.88 $\pm$ 1.4	1.62 $\pm$ 1.0	2.03 $\pm$ 1.5 <sup>**a,b</sup>
... I don't have the energy	1.73 $\pm$ 1.3	1.44 $\pm$ 1.1	2.40 $\pm$ 1.6	1.77 $\pm$ 1.3 <sup>**a-c</sup>
... other health problems prevent me from going	1.89 $\pm$ 1.4	1.53 $\pm$ 1.2	2.36 $\pm$ 1.5	1.88 $\pm$ 1.4 <sup>**a-c</sup>
... I am too old	1.36 $\pm$ 0.9	1.17 $\pm$ 0.6	1.65 $\pm$ 0.9	1.36 $\pm$ 0.8 <sup>**a-c</sup>
... my doctor did not feel it was necessary	1.25 $\pm$ 0.7	1.48 $\pm$ 1.2	2.66 $\pm$ 1.7	1.52 $\pm$ 1.1 <sup>**a-c</sup>
... many people with heart problems don't go, and they are fine	1.30 $\pm$ 0.7	1.27 $\pm$ 0.8	1.99 $\pm$ 1.2	1.40 $\pm$ 0.9 <sup>**b,c</sup>
... I can manage my heart problem on my own	1.39 $\pm$ 0.9	1.30 $\pm$ 0.8	2.05 $\pm$ 1.2	1.47 $\pm$ 1.0 <sup>**b,c</sup>
... I think I was referred, but the rehab program didn't contact me	1.26 $\pm$ 0.7	1.10 $\pm$ 0.6	1.13 $\pm$ 0.5	1.20 $\pm$ 0.6
... it took too long to get referred and into the program	1.26 $\pm$ 0.7	1.06 $\pm$ 0.4	1.13 $\pm$ 0.6	1.19 $\pm$ 0.6
... I prefer to take care of my health alone, not in a group	1.33 $\pm$ 0.8	1.27 $\pm$ 0.9	1.63 $\pm$ 1.2	1.36 $\pm$ 0.9 <sup>**b,c</sup>
Total	1.63 $\pm$ 0.6	1.48 $\pm$ 0.5	2.03 $\pm$ 0.6	1.66 $\pm$ 0.6 <sup>**a-c</sup>
Subscale 1 Comorbidities/functional status	1.52 $\pm$ 0.6	1.36 $\pm$ 0.6	2.02 $\pm$ 0.9	1.56 $\pm$ 0.7 <sup>**a-c</sup>
Subscale 2 Perceived need	1.46 $\pm$ 0.6	1.48 $\pm$ 0.9	2.33 $\pm$ 1.1	1.60 $\pm$ 0.8 <sup>**b,c</sup>
Subscale 3 Personal/family issues	1.86 $\pm$ 0.9	1.30 $\pm$ 0.6	1.86 $\pm$ 0.8	1.73 $\pm$ 0.8 <sup>**a,c</sup>
Subscale 4 Travel/work conflicts	1.78 $\pm$ 1.0	2.07 $\pm$ 1.2	1.72 $\pm$ 0.8	1.83 $\pm$ 1.0 <sup>**a,c</sup>
Subscale 5 Access	1.48 $\pm$ 0.8	1.55 $\pm$ 0.7	1.96 $\pm$ 0.78	1.57 $\pm$ 0.8 <sup>**b,c</sup>

**Notes:** The mean difference is significant at the 0.05 level between the following cohorts: <sup>a</sup>Luzerna and Florianopolis CR attendees; <sup>b</sup>Luzerna and Florianopolis CR nonattendees; <sup>c</sup>Florianopolis CR attendees and nonattendees. Significant differences by cohort: \* $P < 0.01$ ; \*\* $P < 0.001$ .

**Abbreviations:** CRBS, Cardiac Rehabilitation Barriers Scale; CR, cardiac rehabilitation; SD, standard deviation.

high-risk cohort. The Florianopolis nonattendees reported significantly higher personal/family barriers and significantly lower travel/work barriers than the Florianopolis CR attendees. The most highly endorsed barriers among the Florianopolis CR nonattendees were distance, no knowledge about CR, their doctor not considering it necessary, cost, and transportation problems (Table 2).

Finally, as outlined above the Florianopolis CR attendee cohort reported significantly lower total barriers than the Florianopolis CR attendees, and Luzerna high-risk cohort (Table 2). Similarly, the Florianopolis attendees reported significantly lower comorbidities/functional status, and personal/family barriers than the Florianopolis nonattendees, and Luzerna high-risk cohort. The Florianopolis CR attendees reported significantly lower perceived need and access barriers than the Florianopolis nonattendees. However, the Florianopolis CR attendees reported significantly higher travel/work barriers than the Florianopolis nonattendees and Luzerna high-risk cohort. Specifically, one barrier, namely travel, was rated significantly higher by CR attendees than nonattendees. Moreover, the most highly endorsed barriers among the Florianopolis CR attendees were these same barriers – travel and cost.

## Discussion

This study investigated CR barriers across cohorts at high-risk of developing cardiac disease and among those with established disease covered by private and public health care in Brazil, for the first time to our knowledge. Outpatient CR has been offered in a small number of Brazilian institutions for more than three decades.<sup>18</sup> Consistent with previous research,<sup>11,12</sup> CR nonattendees reported significantly greater barriers than CR attendees; however, overall barriers were surprisingly low across each cohort in this sample. The most highly endorsed barriers to CR attendance were distance and work responsibilities.

In the Luzerna context, there was high access to the free program, yet generally low perceived need. While, indeed, these residents did not have established disease, they were verified by health care workers to have two risk factors for CVD (risk factors which are lessened with physical activity). Moreover, they were of similar age to respondents from the disease cohort from Florianopolis, yet they were more likely to perceive work and family responsibilities as a barrier to program participation than those with established disease. The other notable barrier to attendance was already exercising at home or in the community, despite the fact that health care workers identified these participants as sedentary.

The CR nonattenders reported the greatest barriers of the three cohorts. These barriers included: comorbidities; access barriers, such as distance, cost, and transportation; and most notably not knowing about CR and perceiving that their physicians did not consider it necessary. What is notable about this is that the mean overall score for “not knowing about CR” was actually quite low, suggesting that most Brazilians are aware of CR. However, these findings do raise the question of how familiar physicians are with CR in this middle-income country in terms of its nature, benefits, and local program availability. Future research is needed to examine the attitudes of referring health care providers in Brazil across the various health care systems and better understand how this is related to messaging about CR as perceived by patients.

In regards to Florianopolis CR attendees, while overall they reported lower total barriers as expected, the nature of their barriers differed substantively. Similar to a previous report by our group, travel was a common barrier among those with the means to participate.<sup>12</sup> Likely, this is indicative of high socioeconomic status (ie, financial means to pay for CR or employment with benefits to reimburse their participation). Moreover, it was striking that there were no female CR participants in the sample. Clearly, the sex bias seen in the plethora of studies conducted in the developed world is persistent in Brazil as well.

In a recent study by our group,<sup>19</sup> the investigation of CR barriers across Brazil and Canada was described. Despite the significantly lower availability of CR in Brazil and the universal health care system in Canada, cardiac outpatients in Canada perceived significantly greater CR barriers. The nature of barriers identified suggests Canadians have higher expectations of outpatient care, and that different strategies would be required to promote enrollment in these countries.

The identification of barriers is, however, the first step to overcome barriers to rehabilitation services. According to WHO,<sup>20</sup> a series of actions should take place to equalize barriers imposed by different health systems, including the following: reforming policies, laws, and delivery systems; developing funding mechanisms to address barriers related to financing of rehabilitation; increasing human resources for rehabilitation; expanding and decentralizing service delivery; increasing the use and affordability of technology and assistive devices; and expanding research programs, including improving information and access to good practice guidelines.

Caution is warranted when interpreting results. The chief limitation is possible selection bias. These were convenience samples, and the response rate is unknown; therefore, it is unknown how generalizable the samples are in relation to the

average cardiac outpatient or resident. Moreover, given the high rates of CR enrollment observed in this sample, likely barriers are underrepresented. In addition, there were significant differences in the sociodemographic and clinical characteristics of the cohorts, which may have affected their report of CR barriers (especially sex differences). Replication in a matched sample is warranted, using a multivariate approach. Finally, the applicability of these results to other low- and middle-income country contexts is not known. The availability of CR in other such countries is likely to be much lower.

Moreover, the prevalence of female subjects in non-CR cohorts (Luzerna, 70.6%; and Florianopolis CR nonattenders, 82.7%) can lead to sex bias and have a significant impact on the results. In previous studies,<sup>21,22</sup> it was demonstrated that women are not only less likely to participate and to complete CR, but they may not have a greater number of CR barriers overall, and the nature of their CR barriers may differ from those of men.

Future research is needed to understand whether provision of low-cost more flexible and accessible models of CR could mitigate many of these barriers. For instance, home-based CR programs have been shown to be of equitable benefit to supervised programs, at lower cost.<sup>23</sup> Web-based CR programs are currently under development and testing in high-income countries.<sup>24</sup> Pending positive findings, these models might be particularly appropriate in this context. Finally, given again that these results have demonstrated relatively low overall barriers scores in this low-resource setting when compared to scores observed in high-income countries (namely Canada),<sup>16</sup> it would be informative to learn whether there are differences in program adherence in these middle- versus high-income countries.

In conclusion, while CR is not highly available and accessible in this middle-income country, this study has revealed significantly greater barriers in nonattenders, when compared to attenders. Moreover, the most common barriers identified which need to be overcome include cost, distance, work, and family responsibilities, as well as transportation. It is hoped that the provision of CR will increase, and that the development of the programs will be in a manner which mitigates the barriers identified herein.

## Disclosure

The authors report no conflicts of interest in this work.

## References

- World Health Organization [homepage on the Internet]. Cardiovascular disease fact sheet number 317. World Health Organization; 2013 [updated Mar 2013]. Available from: <http://www.who.int/mediacentre/factsheets/fs317/en/index.html>. Accessed June 20, 2013.
- Roger VL, Go AS, Lloyd-Jones DM, et al. Heart disease and stroke statistics – 2012 update: a report from the American Heart Association. *Circulation*. 2012;125(1):e2–e220.
- Papadakis S, Reid RD, Coyle D, Beaton L, Angus D, Oldridge N. Cost-effectiveness of cardiac rehabilitation program delivery models in patients at varying cardiac risk, reason for referral, and sex. *Eur J Cardiovasc Prev Rehabil*. 2008;15(3):347–353.
- Cortes-Bergoderi M, Lopez-Jimenez F, Herdy AH, et al. Availability and characteristics of cardiovascular rehabilitation programs in South America. *J Cardiopulm Rehabil Prev*. 2013;33(1):33–41.
- Polanczyk CA, Ribeiro JP. Coronary artery disease in Brazil: contemporary management and future perspectives. *Heart*. 2009;95(11):870–876.
- Rebello FP, Garcia AS, Andrade DF, Werner CR, Carvalho Td. Clinical and economic outcome of a cardiopulmonary and metabolic rehabilitation program. *Arq Bras Cardiol*. 2007;88(3):321–328. Portuguese [with English abstract].
- Salveti XM, Oliveira JA, Servantes DM, Vincenzo de Paola AA. How much do the benefits cost? Effects of a home-based training programme on cardiovascular fitness, quality of life, programme cost and adherence for patients with coronary disease. *Clin Rehabil*. 2008;22(10–11):987–996.
- Avram A, Iurciuc S, Craciun L, et al. Euroaspire III Romania: the need to reinforce cardiac rehabilitation patients with coronary artery disease. *TMJ*. 2010;60(4):299–304. Available from: [http://www.tmj.ro/pdf/2010\\_number\\_4\\_1549939052129828.pdf](http://www.tmj.ro/pdf/2010_number_4_1549939052129828.pdf). Accessed July 20, 2013.
- Kühr EM, Ribeiro RA, Rohde LE, Polanczyk CA. Cost-effectiveness of supervised exercise therapy in heart failure patients. *Value Health*. 2011;14(5 Suppl 1):S100–S107.
- Korenfeld Y, Mendoza-Bastidas C, Saaavedra L, et al. Current status of cardiac rehabilitation in Latin America and the Caribbean. *Am Heart J*. 2009;158(3):480–487.
- Ghisi GL, Santos RZ, Schweitzer V, et al. Development and validation of a Brazilian Portuguese version of the Cardiac Rehabilitation Barriers Scale. *Arq Bras Cardiol*. 2012;98(4):344–351. Portuguese [with English abstract]. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0066-782X2012005000025&lng=en&nrm=iso&tlng=pt](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0066-782X2012005000025&lng=en&nrm=iso&tlng=pt). Accessed July 20, 2013.
- de Melo Ghisi GL, Oh P, Benetti M, Grace SL. Barriers to cardiac rehabilitation use in Canada versus Brazil. *J Cardiopulm Rehabil Prev*. 2013;33(3):173–179.
- The Brazilian Institute of Geography and Statistics. Data from Lucerne, Santa Catarina. The Brazilian Institute of Geography and Statistics (IBGE); 2011. Available from: <http://www.ibge.gov.br/cidadesat/painel/painel.php?codmun=421003>. Accessed January 10, 2013.
- British Association for Cardiovascular Prevention and Rehabilitation. *The BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation*, 2nd ed. London: British Association for Cardiovascular Prevention and Rehabilitation; 2012. Available from: [http://www.bacpr.com/resources/15E\\_BACPR\\_Standards\\_FINAL.pdf](http://www.bacpr.com/resources/15E_BACPR_Standards_FINAL.pdf). Accessed February 1, 2013.
- Moraes RS, Nobrega ACL, Castro RRT, et al. Diretriz de Reabilitação Cardíaca. [Guidelines for Cardiac Rehabilitation]. *Arq Bras Cardiol*. 2005;84(5):431–440. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0066-782X2005000500015&lng=pt&nrm=iso&tlng=pt](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0066-782X2005000500015&lng=pt&nrm=iso&tlng=pt). Accessed July 20, 2013. Portuguese.
- Shanmugasegaram S, Gagliese L, Oh P, et al. Psychometric validation of the Cardiac Rehabilitation Barriers Scale. *Clin Rehabil*. 2012;26(2):152–164.
- Grace SL, Russell KL, Reid RD, et al. Effect of cardiac rehabilitation referral strategies on utilization rates: a prospective, controlled study. *Arch Intern Med*. 2011;171(3):235–241.
- Guzman SV, López-Grillo L, Dorossiev DL, Fehér J, Rosenthal J. Cardiac rehabilitation in different geographic areas. *Adv Cardiol*. 1986;33:142–151.

19. de Melo Ghisi GL, Oh P, Benetti M, Grace SL. Barriers to cardiac rehabilitation in Canada versus Brazil. *J Cardiopulmonary Rehabil Prev*. 2013;33(3):173–179.
20. World Health Organization. *World Report: Disabilities, Chapter 4*. Geneva: World Health Organization; 2011. Available from: [http://www.who.int/disabilities/world\\_report/2011/chapter4.pdf](http://www.who.int/disabilities/world_report/2011/chapter4.pdf). Accessed February 1, 2013.
21. Scott LA, Ben-Or K, Allen JK. Why are women missing from outpatient cardiac rehabilitation programs? A review of multilevel factors affecting referral, enrollment, and completion. *J Womens Health (Larchmt)*. 2002;11(9):773–791.
22. Lieberman L, Meana M, Stewart D. Cardiac rehabilitation: gender differences in factors influencing participation. *J Womens Health*. 1998;7(6):717–723.
23. Taylor RS, Dalal H, Jolly K, Moxham T, Zawada A. Home-based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev*. 2010;(1):CD007130.
24. Neubeck L, Redfern J, Fernandez R, Briffa T, Bauman A, Freedman SB. Telehealth interventions for the secondary prevention of coronary heart disease: a systematic review. *Eur J Cardiovasc Prev Rehabil*. 2009;16(3):281–289.

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