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Clinical Research

Women's Cardiac Rehabilitation Barriers: Results of the International Council of Cardiovascular Prevention and Rehabilitation's First Global Assessment

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ABSTRACT

Background: Cardiac rehabilitation (CR) programs are underutilized globally, especially by women. In this study we investigated sex differences in CR barriers across all world regions, to our knowledge for the first time, the characteristics associated with greater barriers in women, and women's greatest barriers according to enrollment status.

RÉSUMÉ

Introduction : Dans le monde entier, les patients, particulièrement les femmes, ont peu recours aux programmes de réadaptation cardiaque (RC). Dans la présente étude, nous avons examiné les différences entre les sexes en matière d'obstacles à la RC dans toutes les régions du monde, à notre connaissance pour la première fois, les caractéristiques

Cardiovascular diseases (CVDs) are among the leading causes of morbidity in men and women worldwide.[1] Although this is unfortunate, women might have even poorer CVD outcomes than men, with regard to quality and quantity of life.[2,3] Cardiovascular rehabilitation (CR) is an outpatient model of secondary preventive care that effectively mitigates this burden.[4-6] Indeed, the substantive benefits of participation are established among women attending CR as well.[7-9]

Despite its benefits, CR is grossly underutilized globally,[10] with rates even lower in marginalized populations such as

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Methods: In this cross-sectional study, the English, Simplified Chinese, Arabic, Portuguese, or Korean versions of the Cardiac Rehabilitation Barriers Scale was administered to CR-indicated patients globally via Qualtrics from October 2021 to March 2023. Members of the International Council of Cardiovascular Prevention and Rehabilitation community facilitated participant recruitment. Mitigation strategies were provided and rated.

Results: Participants were 2163 patients from 16 countries across all 6 World Health Organization regions; 916 (42.3%) were women. Women did not report significantly greater total barriers overall, but did in 2 regions (Americas, Western Pacific) and men in 1 (Eastern Mediterranean; all $P < 0.001$). Women's barriers were greatest in the Western Pacific ($2.6 \pm 0.4/5$) and South East Asian (2.5 ± 0.9) regions ($P < 0.001$), with lack of CR awareness as the greatest barrier in both. Women who were unemployed reported significantly greater barriers than those not ($P < 0.001$). Among nonenrolled referred women, the greatest barriers were not knowing about CR, not being contacted by the program, cost, and finding exercise tiring or painful. Among enrolled women, the greatest barriers to session adherence were distance, transportation, and family responsibilities. Mitigation strategies were rated as very helpful ($4.2 \pm 0.7/5$).

Conclusions: CR barriers—men's and women's—vary significantly according to region, necessitating tailored approaches to mitigation. Efforts should be made to mitigate unemployed women's barriers in particular.

Méthodes : Dans la présente étude transversale, nous avons fait passer les versions anglaise, chinoise simplifiée, arabe, portugaise ou coréenne de la Cardiac Rehabilitation Barriers Scale (échelle CRBS) aux patients en RC dans le monde via Qualtrics d'octobre 2021 à mars 2023. Les membres de la communauté de l'International Council of Cardiovascular Prevention and Rehabilitation (ICCPR) ont facilité le recrutement des participants. Des stratégies d'atténuation ont été fournies et évaluées.

Résultats : Les participants étaient 2163 patients de 16 pays de 6 régions de l'Organisation mondiale de la Santé ; 916 (42,3 %) étaient des femmes. Dans l'ensemble, les femmes n'ont pas déclaré d'obstacles totaux significativement plus grands, mais en ont déclarés dans deux régions (Amériques, Pacifique Ouest), et les hommes, dans une région (Méditerranée orientale ; toutes les valeurs $P < 0{,}001$). Les obstacles des femmes étaient plus grands dans les régions du Pacifique Ouest ($2{,}6 \pm 0{,}4/5$) et de l'Asie du sud-est ($2{,}5 \pm 0{,}9$) ($P < 0{,}001$), et l'obstacle le plus grand dans ces deux régions était le manque de sensibilisation à la RC. Les femmes qui étaient sans emploi ont déclaré des obstacles significativement plus grands que celles qui n'étaient pas sans emploi ($P < 0{,}001$). Parmi les femmes aiguillées non inscrites, les obstacles les plus grands étaient le fait de ne pas connaître la RC, de ne pas avoir été jointe par le programme, les coûts et le fait de trouver l'exercice épuisant ou pénible. Parmi les femmes inscrites, les obstacles les plus grands à l'observance des séances étaient la distance, le transport et les responsabilités familiales. Les stratégies d'atténuation ont été considérées comme très utiles ($4{,}2 \pm 0{,}7/5$).

Conclusions : Les obstacles à la RC (hommes et femmes) qui varient significativement selon la région exigent des approches d'atténuation adaptées. Des efforts devraient être faits pour particulièrement atténuer les obstacles des femmes sans emploi.

women. Indeed, meta-analyses show that fewer women than men are referred to CR,[11] and even after referral, women are less likely to enroll[12] and adhere to the program.[13] Interestingly, one population-based study from Sweden showed greater CR use in women[14]; they attributed this to the greater gender equality in the country.[15] Barriers to CR utilization are multifactorial, from the health system to the patient levels.[16]

There has been substantial qualitative research on women's CR barriers and sex differences in CR barriers,[17,18] but few quantitative studies. Women's greatest CR barriers have been identified as lack of CR awareness, lack of encouragement and support by their physicians, transportation/distance, family obligations, as well as finding exercise tiring or painful.[19] Recently, strategies to mitigate these specific barriers have been forwarded.[20]

To our knowledge, there have only been 2 quantitative studies of sex differences in CR barriers using a validated scale, namely the **C**ardiac **R**ehabilitation **B**arriers **S**cale (CRBS).[21,22] One—undertaken in the high-income, highly gender-equal country of Canada[15]—revealed no overall sex differences in CR barriers, but many differences at the item level with women endorsing some barriers to a significantly greater degree than men and vice versa[19]; the other—undertaken in the middle-income, gender-unequal country of Iran[15]—revealed significantly greater overall barriers in women.[23] Results similarly showed some item-level sex differences as observed in the Canadian study, but also some other differences likely related to the lower-resource context (eg, cost).[15]

Considering the global epidemic of CVD, clearly more research is needed in this area; indeed, of the approximately 45 studies using the CRBS in 25 countries, none are multicountry, let alone multiregion nor do they cover multiple country income classifications.[21,24] Moreover, the study of CR barriers has been siloed; researchers consider barriers in ethnic minorities in some studies,[25] those of low socioeconomic status,[26] or older patients[27] in others for example. Despite the recognition that social determinants affect women's health care utilization,[28] there is little research considering the intersectionality of these factors.[29] Accordingly, the objectives of this study were to examine: (1a) women's greatest CR barriers and (1b) sex differences in CR barriers, according to region. We also examined (2) differences in women's CR barriers according to their sociodemographic and other characteristics (ie, intersectionality). Moreover, (3) women's greatest barriers according to CR enrollment status (ie, barriers to enrollment vs program adherence) were compared; and (4) perceived usefulness of the mitigation strategies for identified barriers was explored in women and men.

Methods

Design and procedure

This study was cross-sectional in design. It was undertaken through the International Council of Cardiovascular Prevention and Rehabilitation (ICCPR; globalcardiacrehab.com). York University's Office of Research Ethics (Toronto, Canada) approved the study (e2021-013). Further methodological details are in the *Supplemental Methods* section of the Supplementary Material.

All ICCPR member associations were invited to be part of this study. An invitation to participate was also shared through ICCPR's mailing list. In return for their participation, barrier-specific mitigation strategies were shared with patients for quality improvement purposes.[20]

Data were collected from October 2021 to March 2023 via Qualtrics. It was available in 4 languages: Arabic (274 million speakers globally), Portuguese (257 million), English (1.45 billion), and Mandarin/Simplified Chinese (1.12 billion).[30] The Korean CRBS[31] was also administered at participating centres via paper-and-pencil.

Participants

CR sites that wanted to be involved in the study had to have an available CR program in which survey-participating patients could enroll. This study included a convenience sample of in- or outpatients with a cardiovascular diagnosis or procedure that is indicated for participation in CR (eg, acute coronary syndrome, revascularization, heart failure).[32,33] Patients were eligible to participate whether or not they had been referred to CR at the time of study recruitment.

Inclusion criteria consisted of age 18 years or older. Patients were excluded if they had any significant impairments that would preclude them from participating in CR (eg, inability to ambulate, ventricular arrhythmias, terminal cancer, residing in long-term care)[10] or in completing the surveys (eg, major sensory impairments, advanced dementia). They were also excluded if they had completed CR.

Measures

The CRBS is used to assess patients' perceptions of multilevel (patient, provider, and health system) barriers to phase II CR enrollment and adherence.[22] It comprises 21 items, each scored on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree); higher scores indicate greater barriers. At the end of the survey, there is an open-ended item where respondents can add additional barriers. The original English scale and most of the 17 translations (https://sgrace.info.yorku.ca/cr-barriers-scale/crbs-instructions-and-languages-translations) consist of 4 subscales, namely: perceived need/health care factors, logistical factors, work/time conflicts, and comorbidities/functional status. The validity and reliability of the English,[22] Simplified Chinese,[34] Arabic,[20] Portuguese,[35] and Korean[31] translations of the CRBS administered herein have been established.

Mitigation responses for each barrier were created by senior author (S.L.G.), on the basis of a review of quality improvement strategies in the CR field.[36] Where patients rate a barrier as 4 or 5 of 5, the corresponding mitigation strategy is proffered at the end of the survey within Qualtrics. After reviewing them, respondents were asked how helpful these were on a Likert-type scale ranging from 1 = very unhelpful to 5 = very helpful; a mean score was computed.

The survey was prefaced by sociodemographic items. Country was also categorized according to World Health Organization region[37] and World Bank Country Income Classification.[24]

The 2021 **G**ender **E**quality **I**ndex (GEI) score of all countries where CR sites were participating was obtained.[15] GEI scores ranges from 0% (the lowest possible gender equality) to 100% (highest possible gender equality); in 2021 the highest rating was 89.2% and lowest 44.4%. To compute a mean GEI rating for each region, GEIs were averaged across applicable represented countries.

Data analysis

Data were analyzed using SPSS (version 28; IBM Corp, Armonk, NY). Sex differences in participant characteristics as well as CR utilization were tested using Pearson correlation, independent samples *t* tests, and analysis of variance (ANOVA), as applicable.

ANOVA with post hoc Tukey tests were used to test for sex differences in total CRBS and subscale scores according to region. Pearson correlation, independent samples *t* tests, and ANOVA were used as applicable to explore differences in women's CRBS scores (total and subscale) according to their sociodemographic and other characteristics. Referred women were selected, and differences in total CRBS and subscale scores were tested according to CR enrollment status using independent samples *t* tests. Finally, the mitigation strategy helpfulness rating was compared according to sex using an independent sample *t* test.

Results

Global response and respondent characteristics

Overall, 2163 surveys were sufficiently completed. As shown in Table 1, these responses were received from across all 6 World Health Organization regions, and were from all country income classifications but low. The mean GEI for each region is shown in Table 2, ranging from 59 to 73. Respondents' characteristics are shown in Table 1; their mean age was 62.0 ± 12.8 years and 916/2163 (42.3%) were women. Details on number of participants per country in each region and their income class, interpretation of GEI, and further details on women's characteristics are shown in the *Supplemental Results* section of the Supplementary Material. As shown, women were significantly older, more often reported being from an ethnic minority group, were less often working, worried less about having enough money to pay for health care, and were more physically active before their cardiac diagnoses than were men.

Women's CR barriers according to region and other characteristics

CRBS scores are shown according to item in women in Table 3. "Other" barriers reported by women are shown in Figure 1. Top barriers overall and in men are reported in the *Supplemental Results* section of the Supplementary Material;

Table 1. Self-reported characteristics and CR use* of study participants, according to sex† and total CRBS score in women (N = 2163)

Characteristic	Total (N = 2163)	Women (n = 916; 42.8%)	Men (n = 1223; 57.2%)	P‡	Total CRBS scores§ in women‖	Association with CR participation in women¶
World region				< 0.001	< 0.001	< 0.001
Africa	5 (0.2%)	0 (0.0%)	4 (0.3%)		–	–
Americas	362 (16.9%)	165 (18.1%)	194 (15.9%)		1.9 ± 0.7	130 (78.8%)
Eastern Mediterranean	199 (9.3%)	80 (8.8%)	119 (9.7%)		2.2 ± 0.8	31 (38.8%)
Europe	497 (23.2%)	353 (38.8%)	140 (11.5%)		2.2 ± 0.7	86 (24.4%)
South-East Asian	307 (14.3%)	148 (16.3%)	155 (12.7%)		2.5 ± 0.9	34 (23.0%)
Western Pacific	773 (36.1%)	164 (18.0%)	609 (49.9%)		2.6 ± 0.4	3 (1.8%)
Age				< 0.001	0.65	0.60
Younger than 65 years old	1153 (53.3%)	444 (48.5%)	702 (57.4%)		2.2 ± 0.8	146 (32.9%)
65 Years old or older	966 (44.7%)	460 (50.2%)	505 (41.3%)		2.3 ± 0.7	135 (29.3%)
Ethnic minority				0.004	0.68	< 0.001
Yes	146 (7.1%)	75 (9.1%)	69 (5.7%)		2.2 ± 0.9	32 (42.7%)
No	1897 (92.9%)	752 (90.9%)	1136 (94.3%)		2.2 ± 0.7	249 (33.1%)
Work status				< 0.001	< 0.001	< 0.001
Full or part-time	878 (41.2%)	277 (30.7%)	597 (49.1%)		2.3 ± 0.8	77 (27.8%)
Retired	699 (32.8%)	376 (41.6%)	319 (26.2%)		2.1 ± 0.7	154 (41.0%)
Unemployed	453 (21.2%)	189 (20.9%)	261 (21.4%)		2.6 ± 0.5	24 (12.7%)
Disability/sick leave/ modified duties	64 (3.0%)	41 (4.5%)	22 (1.8%)		2.0 ± 0.7	23 (56.1%)
Looking to get a paid job	38 (1.8%)	20 (2.2%)	18 (1.5%)		2.2 ± 0.5	5 (25.0%)
Social support (/5)	4.2 ± 1.1	4.3 ± 1.0	4.1 ± 1.1	0.30	0.08	< 0.001
Definitely or most of the time	993 (77.0%)	543 (81.8%)	441 (72.4%)		2.1 ± 0.8	223 (41.1%)
Sometimes, rarely or never	292 (22.7%)	121 (18.2%)	168 (27.6%)		2.2 ± 0.8	56 (46.2%)
Years of formal education	12.5 ± 5.5	12.4 ± 5.1	12.6 ± 5.9	0.28	0.44	0.08
12 Years or less	745 (55.8%)	399 (54.9%)	342 (57.1%)		2.2 ± 0.7	152 (38.1%)
More than 12 years	591 (44.2%)	328 (45.1%)	257 (42.9%)		2.1 ± 0.8	121 (36.9%)
Worrying about having money to pay for health care				0.002	0.30	< 0.001
I often worry	390 (30.2%)	181 (27.1%)	203 (33.2%)		1.9 ± 0.8	97 (53.6%)
I worry sometimes	535 (41.4%)	278 (41.6%)	254 (41.6%)		2.2 ± 0.8	111 (39.9%)
I never worry	367 (28.4%)	210 (31.4%)	154 (25.2%)		2.1 ± 0.7	74 (35.2%)
Physical activity before heart problem				< 0.001	0.04	0.05
Yes	574 (45.0%)	328 (50.0%)	238 (39.1%)		2.0 ± 0.7	126 (38.4%)
No	701 (55.0%)	328 (50.0%)	370 (60.9%)		2.3 ± 0.8	151 (46.0%)
Referral to CR				< 0.001	0.08	< 0.001
Yes	1239 (57.8%)	368 (40.4%)	866 (71.0%)		2.3 ± 0.7	166 (45.1%)
No/I do not know	906 (42.2%)	544 (59.6%)	353 (29.0%)		2.4 ± 0.8	100 (18.3%)
Participated in CR				< 0.001	< 0.001	–
Yes	571 (27.8%)	284 (34.1%)	283 (23.5%)		2.0 ± 0.6	–
No	1482 (72.2%)	550 (65.9%)	923 (76.5%)		2.3 ± 0.8	–

Values are n (% valid) or mean ± standard deviation.

CR, cardiac rehabilitation; CRBS, **C**ardiac **R**ehabilitation **B**arriers **S**cale.

* The Korean data were collected via paper-and-pencil and some of the sociodemographic items differed slightly, and were therefore excluded.

† Note some participants selected "other/prefer not to answer."

‡ Test for significant difference in characteristics according to sex.

§ Scores range from 1 to 5, with higher scores denoting greater barriers.

‖ *P* values shown in the row with the name of the characteristic for test for significant difference in total CRBS score according to characteristic among participants who identified as women.

¶ *P* values for χ^2 test shown in the row with the name of the characteristic as well as n (%) women participating in CR according to characteristic shown in rows with the categories.

the greatest CR barriers for men included: prefer to take care of health alone (2.6 ± 1.1) as well as logistical factors (eg, cost [2.6 ± 1.2] and distance [2.6 ± 1.3]).

As shown in Table 1, there were significant differences in total barrier scores in women according to region, with post hoc Tukey tests showing women in the Western Pacific and South-East Asian (ie, India) regions had significantly greater barriers than those in the Americas (ie, Brazil), Eastern Mediterranean, and Europe (all $P < 0.05$). Top barriers for women in each region—regardless of referral—are shown in Figure 2.

As shown in Table 2, globally, there was no sex difference in total CR barriers, nor in terms of subscales. But regionally, with regard to total barriers, there were significant sex differences in the American (ie, Brazil) and Western Pacific (women had greater barriers) as well as Eastern Mediterranean (men had greater barriers) regions (could not be tested for Africa); there were no total sex differences in South East Asia only, with subscale differences only observed in Europe. The significant differences in CRBS subscales in these 4 regions are also shown in Table 2. In the Americas (ie, Brazil), women reported significantly greater barriers related to logistical

Table 2. Sex differences in CR barriers* (total and subscales) according to WHO region[35]

Region (n participants)	Mean gender equality ± SD[14]	Women (n = 916; 42.8%)					Men (n = 1223; 57.2%)				
		Total barriers, mean ± SD	Subscales, mean ± SD				Total barriers, mean ± SD	Subscales, mean ± SD			
			Perceived need/health care factors	Logistical factors	Work/time conflicts	Comorbidities /functional status		Perceived need /health care factors	Logistical factors	Work/time conflicts	Comorbidities /functional status
Africa (5)	62.9 ± 1.9	†	†	†	†	†	2.1 ± 1.3	2.3 ± 1.4	2.2 ± 1.4	1.8 ± 1.0	2.3 ± 1.6
Americas (362)	69.5 (‡)	1.9 ± 0.7*	2.0 ± 0.8	2.2 ± 1.1**	1.9 ± 0.9	1.8 ± 0.8*	1.7 ± 0.6	1.8 ± 0.8	1.9 ± 0.9	2.1 ± 1.1	1.6 ± 0.7
Eastern Mediterranean (199)	59.3 ± 1.5	2.2 ± 0.8	2.5 ± 0.8	2.6 ± 1.2	2.0 ± 1.2	2.0 ± 1.0	2.7 ± 0.8***	3.1 ± 0.9***	3.1 ± 1.2**	2.1 ± 1.1	2.5 ± 1.1***
Europe (497)	72.7 ± 3.4	2.2 ± 0.7	2.4 ± 0.9	2.2 ± 1.0	2.1 ± 1.1	2.2 ± 0.9	2.3 ± 0.8	2.3 ± 0.9	2.5 ± 1.0**	2.1 ± 1.1	2.5 ± 1.0***
South-East Asia (307)	62.5 (‡)	2.5 ± 0.9	2.8 ± 1.0	2.7 ± 1.1	2.7 ± 1.2	2.5 ± 1.0	2.5 ± 0.7	2.7 ± 0.9	2.5 ± 0.9	2.5 ± 1.0	2.4 ± 0.8
Western Pacific (773)	72.1 ± 4.7	2.6 ± 0.4**	3.0 ± 0.4	2.8 ± 0.6***	2.1 ± 0.6	2.9 ± 0.9***	2.5 ± 0.3	3.0 ± 0.4	2.5 ± 0.6	2.4 ± 0.7***	2.2 ± 0.8
All regions	66.5 ± 1.9	2.3 ± 0.7	2.5 ± 0.9	2.4 ± 1.0	2.2 ± 1.0	2.3 ± 1.0	2.3 ± 0.6	2.6 ± 0.8	2.5 ± 0.9	2.3 ± 0.9	2.2 ± 0.8

Significant sex difference indicated by the symbol shown for the sex with greater barriers: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.
CR, cardiac rehabilitation; WHO, World Health Organization.
* Mean scores range from 1 to 5, with higher scores denoting greater barriers.
† There were no female survey respondents from Africa.
‡ Not applicable because responses were received only from 1 country in the region.

factors ($P = 0.003$) and comorbidities/functional status ($P = 0.03$) compared with men, and fewer barriers related to work/time conflicts ($P = 0.02$). In the Western Pacific region, women had significantly greater barriers related to logistical factors ($P < 0.001$) and comorbidities/functional status ($P < 0.001$), and significantly fewer barriers related to work/time conflicts ($P < 0.001$) than men. In the Eastern Mediterranean (region with lowest gender equality), women had significantly fewer barriers related to perceived need/health care access ($P < 0.001$), logistical factors ($P = 0.003$), and comorbidities/functional status ($P < 0.001$) compared with men. Finally, in Europe (region with the greatest gender equality), women had significantly fewer barriers related to logistical factors ($P = 0.001$), and comorbidities/functional status ($P < 0.001$) compared with men.

To further consider intersectionality, Supplemental Table S1 shows CRBS scores in women and in men separately according to country income classification. Moreover, in Table 1, CRBS scores in women are shown according to their sociodemographic and other health-related characteristics. Sex differences were observed for work status (unemployed women had significantly greater barriers), and for physical activity history (women who were physically active before their diagnosis reported significantly fewer barriers than those who were inactive). Other than the regional difference outlined, no other sociodemographic differences were observed.

CR barriers according to women's CR use

Some women were significantly more likely to participate in CR than others, and this is considered in the *Supplemental Results* section of the Supplementary Material. Nonreferred women had somewhat higher CRBS scores than those referred (Table 1). As shown in Table 3, among referred women, there were significant differences in total CRBS scores according to enrollment ($P < 0.001$), as well as in all subscales (all $P < 0.01$), with nonenrolling women experiencing more barriers. Among nonenrolling women, the greatest barriers were: not knowing about CR, program not contacting them after referral, cost, and finding exercise tiring or painful. Among enrolling women, the greatest barriers to session adherence were: distance, travel, family responsibilities, and difficulties in accessing sessions that require attendance in person (ie, transportation).

With regard to mitigation strategies, 658/916 (71.8%) women and 525/1247 (42.1%) men rated the barrier-specific information provided as either "helpful" or "very helpful." Only 12 women and 20 men indicated that the mitigation strategies were "unhelpful" or "very unhelpful." No sex differences were found in mean mitigation strategy rating scores (overall mean = 4.2 ± 0.7; $P = 0.50$).

Discussion

To the best of our knowledge, this is the first international study of CR utilization barriers, including data from all world regions—and the first quantitative barrier data from Africa as well as Australia, some European countries (Georgia, Italy, Serbia), and the Philippines.[21,38,39] Because fewer women access CR despite great need, examination of key CR barriers for women was needed, so they can be addressed. Overall,

Table 3. Referred women's CRBS scores, and CR enrollment status (n = 368)

CRBS Item	Referred to CR (n = 368)	CR enrollment status		
		Enrolled (n = 166; 45.1%)	Did not (n = 202; 54.9%)	*P*
1. …distance (eg, there is not a program in the same area, too far to travel)	2.5 ± 1.4	2.2 ± 1.4	2.8 ± 1.2	–
2. …costs (eg, program participation costs, transportation and parking costs, supplies such as shoes, exercise, equipment/educational materials, equipment costs)	2.6 ± 1.3	2.1 ± 1.4	3.0 ± 1.1	–
3. …difficulties in accessing sessions that require attendance in person (for example, lack of car or suitable transportation)	2.6 ± 1.3	2.3 ± 1.4	2.8 ± 1.1	–
4. …family responsibilities (eg, caregiving)	2.4 ± 1.2	2.2 ± 1.4	2.5 ± 1.0	–
5. …I didn't know about cardiac rehab (eg, doctor didn't tell me about it)	2.8 ± 1.4	2.1 ± 1.4	3.4 ± 1.0	–
6. …I don't need cardiac rehab (eg, feel well, heart problem treated, not serious)	1.9 ± 1.0	1.7 ± 1.0	2.2 ± 0.9	–
7. …I already exercise at home, or in my community	2.2 ± 1.1	1.8 ± 1.1	2.6 ± 1.1	–
8. …severe weather	2.4 ± 1.2	2.1 ± 1.4	2.6 ± 1.0	–
9. …I find exercise tiring or painful	2.5 ± 1.3	1.8 ± 1.0	3.0 ± 1.2	–
10. …travel (eg, holidays, business, cottage)	2.2 ± 1.2	2.4 ± 1.5	2.1 ± 0.8	–
11. …time constraints (eg, too busy, inconvenient class time)	2.1 ± 1.1	1.8 ± 1.1	2.3 ± 0.9	–
12. …work responsibilities	1.9 ± 1.1	1.6 ± 1.2	2.1 ± 0.9	–
13. …I don't have the energy (down, depressed)	2.5 ± 1.3	2.0 ± 1.3	2.9 ± 1.2	–
14. …other health problems prevent me from going	2.2 ± 1.5	1.7 ± 1.6	2.6 ± 1.2	–
15. …I am too old	2.2 ± 1.2	1.5 ± 0.7	2.9 ± 1.1	–
16. …my doctor did not feel it was necessary	2.0 ± 1.0	1.8 ± 1.1	2.3 ± 0.8	–
17. …many people with heart problems don't go, and they are fine	2.1 ± 0.9	1.6 ± 0.9	2.4 ± 0.8	–
18. …I can manage my heart problem on my own	2.0 ± 0.9	1.5 ± 0.9	2.4 ± 0.8	–
19. …I think I was referred, but the rehab program didn't contact me	2.4 ± 1.3	1.5 ± 0.9	3.1 ± 1.2	–
20. …it took too long to get referred and into the program	2.1 ± 1.1	1.9 ± 1.3	2.3 ± 0.9	–
21. …I prefer to take care of my health alone, not in a group	2.4 ± 1.2	1.6 ± 0.9	3.0 ± 1.0	–
Factor 1: perceived need/healthcare factors	2.5 ± 0.9	1.9 ± 0.8	2.9 ± 0.6	< 0.001
Factor 2: logistical factors	2.5 ± 0.9	2.2 ± 1.0	2.7 ± 0.8	< 0.001
Factor 3: work/time conflicts	2.1 ± 0.9	1.9 ± 1.0	2.2 ± 0.7	0.006
Factor 4: comorbidities/functional status	2.3 ± 1.0	1.7 ± 0.8	2.8 ± 0.9	< 0.001
Total CRBS score	2.3 ± 0.7	1.9 ± 0.6	2.6 ± 0.5	< 0.001

CR, cardiac rehabilitation; CRBS, **C**ardiac **R**ehabilitation **B**arriers **S**cale.

women did not report significantly greater total barriers than men, but there were some barriers that were particularly problematic for women as well as others for men, which also deserve attention. Women who were unemployed and lived in the Western Pacific or South East Asia (ie, India) had significantly greater barriers than others. The greatest CR barriers for women according to region were identified, and included logistical factors (eg, travel and transportation problems) for those in the Americas (ie, Brazil), not knowing about CR for those in South East Asia (ie, India), the Eastern Mediterranean and Western Pacific regions, and comorbidities for those in Europe. Women who did not enroll had significantly greater barriers; the nature of their barriers provide clues for mitigation.

Intersectionality was considered for the first time. Results show that women's context matters; women's barriers differed according to region and work status. Although retired women and those receiving disability payments had fewer barriers and higher CR participation rates, unemployed women had the greatest barriers and lowest participation rates; this association might be explained by some of the main barriers identified by women: those unemployed might not have funds to pay for CR or transportation to sessions, or have household responsibilities that constrain their time availability for CR. These results are consistent with the literature,[40] but the fact that some factors commonly shown to relate to CR use were not associated with barriers in women in this study (eg, age, years of education, ethnic minority status) suggests that perhaps gender is one of the most important drivers of CR barriers. Moreover, women who had a history of exercising had fewer CR barriers, but it is the nonexercising women who have the most to gain from CR participation.[41] Ultimately however, it is the association of social and economic determinants of health as they relate to use of CR that is important.

Sex differences in CR barriers were directly tested using a quantitative measure in 2 previous publications: 1 in Canada, which showed no overall sex difference[19] and 1 in Iran that showed greater barriers in women than men.[23] This third international study showed similarly no overall difference, but women reported greater barriers in 2 regions and men reported greater barriers in 1 region, indicating context matters. Specifically, it was observed in this larger study that Eastern Mediterranean (which includes Iran, but there were also many participants from Saudi Arabia in this study) men contrarily had significantly greater barriers than women, including on 3 of the 4 subscales. Moreover, in the Iranian study, men had significantly greater barriers scores on the other subscale—work/time conflicts—whereas no significant difference was shown in this study. Iran and Saudi Arabia offer only sex-specific CR (ie, different classes for men and women), which could mitigate some barriers for women. Moreover,

Figure 1. Cloud chart of other barriers women face to participate in cardiac rehabilitation.

fewer women work outside the home in this region than others whereas most men do, which again could be the reason why women reported fewer barriers than men. Overall though, for every subscale, there was at least 1 region where men reported significantly greater barriers than women, underscoring the importance of addressing CR barriers for all.

Because of the excellent criterion validity of the CRBS,[21] as expected barriers differed among nonenrolling and enrolling women. Among the former, the greatest barriers were not knowing about CR, not being contacted by the program, cost, and finding exercise tiring or painful. Among enrolling women, the greatest barriers to session adherence were distance, transportation, and family responsibilities. These findings are consistent with previous studies of women who did[17,42] and did not enroll in CR.[37,43,44] Implications of the findings are in the *Supplemental Discussion* section of the Supplementary Material.

Limitations

Caution is warranted in interpreting these results. Although this is the largest, most comparative study of CR barriers to date, there remain limits to generalizability. A convenience sample of in- and outpatients was recruited, from centres with a CR program across few countries in every region. Therefore, we caution against overinterpretation of the sex differences according to region because of the disparate cultures and health systems across these countries. Moreover, there were no women participants from Africa and all participants from the Americas and South East Asia were from 1 country. We also caution against inferring that results from some CR centres in a given country are representative of the situation in the country as a whole.

Prudence is also due because there were some sex differences in the sociodemographic characteristics of the sample (eg, women older, more often minorities,

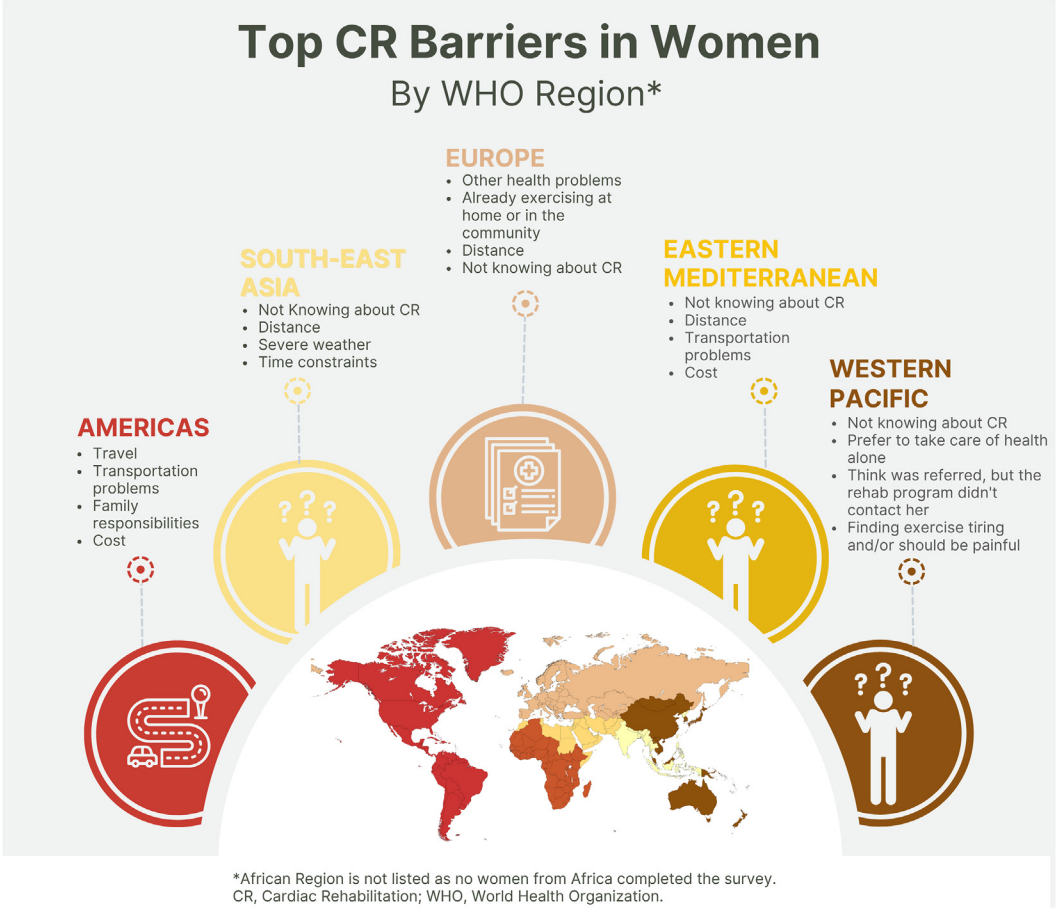

Figure 2. Top cardiac rehabilitation (CR) barriers in women according to World Health Organization region. The African region is not shown because there were no female survey respondents from Africa.

unemployed) which would likely affect their barriers, although the intersectionality of these factors was considered. Nevertheless, it is difficult to disentangle whether the observed differences in the barrier scores for both sexes are attributable to sex, or to other characteristics. Moreover, this was a sample for which—as is usual—significantly fewer women than men were referred to CR,[11] but more women enrolled in CR than men, which is not the norm globally.[12] But this does lend itself to more fulsome examination of CR adherence and completion barriers in women. Further limitations are considered in the *Supplemental Discussion* section of the Supplementary Material.

Conclusions

Results from this first-ever global survey on CR barriers according to sex revealed that although female cardiac patients have a somewhat greater burden of barriers in the Western Pacific and Americas than men, men and women have major barriers, which need to be addressed to optimize CR utilization. Women's greatest barriers to enrollment included lack of awareness, cost, and finding exercise tiring or painful; women's greatest barriers to program adherence included distance, transportation, and family responsibilities. Women's barriers were greatest in the Western Pacific and South East Asian regions, and were topped by lack of CR awareness in both. However, men in the Eastern Mediterranean had significantly greater barriers than women there, including on 3 of 4 CRBS subscales, beckoning more research. Nonworking women experienced greater CR barriers. Although tailored barrier strategies proffered to patients were considered very helpful, the implementation of automatic referral and offering a choice of (reimbursed) CR model with women-focused elements is warranted to address the main barriers identified.

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Ethics Statement

The research reported has adhered to the relevant ethical guidelines.

Patient Consent

The authors confirm that patient consent forms have been obtained for this article.

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Disclosures

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Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Cardiology* at www.onlinecjc.ca and at https://doi.org/10.1016/j.cjca.2023.07.016.