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Cross-cultural adaptation and psychometric validation of the Persian version of the Cardiac Rehabilitation Barriers Scale (CRBS-P)

Mahdieh Ghanbari-Firoozabadi,[1] Masoud Mirzaei,[1] Mohammadreza Vafaii Nasab,[1] Sherry L Grace ,[2,3] Hassan Okati-Aliabad,[4] Farzan Madadizadeh ,[5] Hakimeh Dadras,[1] Najmeh Amrolahi,[1] Mohamadmehdi Entezari,[1] Seyed Mahmood Sadrbafghi[1]

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For numbered affiliations see end of article.

Correspondence to
Dr Farzan Madadizadeh; f.madadizadeh@ssu.ac.ir

ABSTRACT

Objectives This study aimed to translate, cross-culturally adapt and psychometrically validate a Persian version of the Cardiac Rehabilitation Barriers Scale (CRBS-P) and to identify the main barriers in an Iranian setting.

Setting Afshar cardiac rehabilitation (CR) centre, affiliated with the Yazd University of Medical Sciences, in the centre of Iran.

Design This was a multimethod study, culminating in a cross-sectional survey.

Participants Inpatient CR graduates who did not attend their initial outpatient CR appointment.

Method The 21-item CRBS was translated and cross-culturally adapted in accordance with best practices; an expert panel considered the items and previous non-attending patients were interviewed via phone to refine the scale. Next, structural validity was assessed; participants were invited to complete the CRBS on the phone between March 2017 and February 2018. Using exploratory factor analysis (EFA) with principal component analysis extraction and oblique rotation. Second, confirmatory factor analysis (CFA) was used to verify the results; several goodness-of-fit indices were considered. The internal consistency and 3-week test–retest reliability of the scale (5% subsample) were evaluated using Cronbach's α and intraclass correlation (ICC), respectively.

Results Face, content and cross-cultural validity were established by the experts and patients (n=50). One thousand and one hundred (40.7%) of the 2700 patients completed the CRBS-P. Structural validity was established by EFA (Bartlett's test p<0.001; =0.759) and confirmed by the CFA; a four-factor solution with 18 items accounting for 61.256% of variance had the best fit (χ^2/df=3.206, root mean square error of approximation=0.061 and Comparative Fit Index=0.959). The internal consistency and test–retest reliability (n=42) of the scale were acceptable (ICC=0.743 95% CI (0.502 to 0.868); overall α=0.797). The top barriers were not knowing about CR, cost and lack of encouragement from physicians.

Conclusion The four-factor, 18-item CRBS-P had good psychometric properties, and hence can be reliably and validly used to measure CR barriers in Iran and other Persian-speaking populations.

Strengths and limitations of this study

- Little is known about cardiac rehabilitation barriers in low-resource settings, including Iran; this study assessed them in over 1000 Iranian patients.
- A new statistical validation method, namely, the three-faced construct validation method, was used to validate a translated tool that can now be used to reliably assess barriers in Persian-speaking cardiac patients.
- Generalisability is limited, and there may be selection bias due to the fairly low response rate.

INTRODUCTION

Cardiovascular diseases (CVD) are among the leading burdens of disease and cause of disability globally,[1] including Iran.[2] Secondary prevention through cardiac rehabilitation (CR) programmes is highly recommended in international clinical practice guidelines for these patients.[3] This is because CR participation is associated with approximately 20% lower cardiovascular mortality and rehospitalisation[4] and significantly improves quality of life,[5] all in a cost-effective manner.[6] Data from Iran corroborate the benefits of CR.[7–10]

Unfortunately, CR is underused, particularly when compared with other secondary prevention recommendations for CVD.[11] Studies conducted in Iran also demonstrate gross under-referral, enrolment, adherence and completion.[12] A study by Sarrafzadegan *et al* in Isfahan suggested that CR attendance rate was 3.8% among all revascularisation patients[13 14]; another study by Moradi *et al* in Tehran showed that this rate was 87% among the referred patients,[15] suggesting the low use is partially due to lack of referral. According to the data from our centre, 6.9% of patients

with a CR indicated-condition participate in CR and 43% of them do not complete the programme.[16]

Reasons for CR under use are well known and involve factors at the health system, referring provider, programme and patient levels.[17] There have only been 13 studies of CR barriers in low-resource settings,[18] with only a few in Iran.[15 19] However, there has been great recent interest in developing valid tools to assess the barriers to mitigate them. The CR adherence tool, while valid, does not consider factors that may impede initial enrolment.[20] The Cardiac Rehabilitation Barriers Scale (CRBS) is arguably the most widely administered,[21–27] comprehensive and psychometrically validated tool to assess patient barriers to CR enrolment and participation from the patient to health system levels.[28] It was developed following a review of the literature and revised with input from healthcare providers including CR staff. To date, it has been translated to 14 languages (http://sgrace.info.yorku.ca/cr-barriers-scale/crbs-instructions-and-languages-translations/). The purpose of this study was to translate, cross-culturally adapt and psychometrically validate a Persian version of the CRBS (CRBS-P). Second, the objective was to identify the main CR barriers in an Iranian setting.

METHODOLOGY

Design

To translate, cross-culturally adapt and psychometrically validate the CRBS-P, a series of steps were performed, as outlined below. The translation and cross-cultural adaptation of the scale were carried out on the basis of best practice recommendations.[29–32] Elements of the psychometric validation conform with the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) taxonomy.[33]

Research instrument

The 21-item CRBS assesses perceived CR barriers from cardiac patients' perspectives.[28] This scale assesses barriers affecting both patient enrolment and participation, at the levels of patient, healthcare providers and healthcare system in patients with any CR indication. Items are rated on a 5-point Likert-type scale that ranged from 1=strongly disagree to 5=strongly agree. Higher mean scores indicate greater barriers to patient enrolment and participation (not relevant to this study) in CR. The original English 21-item version of the scale comprises four subscales, namely, healthcare system issues, logistical factors, work/time conflicts and comorbidities/functional status.[28]

CRBS translation and cross-cultural adaptation process

To oversee the translation and cross-cultural validation of the questionnaire, a team of four experts comprising a cardiologist, a health educator, a CR specialist and an English language PhD, proficient in both Persian and English, was formed.

The questionnaire was independently translated to Persian by two native persons familiar with CR (forward step), and the two translations were assessed for grammar and wording by the team. Differences in meanings and structures of sentences and phrases were explored, and the translations were harmonised. The Persian forward translation was translated back into English again by two English specialists (backward step), and these two back translations were then harmonised.

This English version of the scale was sent to the original author of the English CRBS (SLG) for consideration. On her final approval, legibility, meaningfulness and usability of the scale items were then assessed through qualitative interviews.

Participants

Patients with the CR indications of myocardial infarction, coronary artery disease, chronic angina pectoris and heart failure and/or who had coronary revascularisation, that had undergone inpatient CR in Afshar CR centre, Yazd, central Iran, and had not presented to the outpatient CR centre at their appointed time between March 2017 and February 2018 comprised the population. The inclusion criterion was cardiac patients without any other condition that would preclude them from participating in CR. There were no exclusion criteria.

Patient and public involvement

Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research.

Previous inpatient CR participants who did not attend CR were telephoned to request their input. This was a convenience sample, but attempts were made to purposively call those of varying ages, sex and literacy levels. The items were discussed with consenting patients; the meaning of the items was discussed, the relationships between the items and how the patients perceived the items. Coauthor HO-A interviewed participants and did the initial analysis. The content and cross-cultural validity were established through these qualitative interviews with participants which were audio-recorded; interviews continued until no new comments arose. Recordings were coded to identify specific potential revisions to items.

Finally, an in-person group discussion of the expert panel was held, to finalise revisions to the scale items based on the results of interviews until consensus was achieved.

Psychometric validation

For the psychometric validation (factor structure, reliability), participants were administered the CRBS-P on the phone, on obtaining verbal informed consent (written consent was not possible given high illiteracy rate).

A random subsample of 5% of the participants (n=55) was telephoned to readminister the scale 3 weeks after the first completion; the random subsample was generated via MS Excel. A 3-week interval was chosen as per the literature.[34]

Tests of psychometric properties and statistical analyses

The face validity, content validity and cross-cultural validity of the Persian translation were considered by the expert team and patient interviewees. All inputs received were considered by the investigators and applied/integrated as applicable.

To establish the structural validity of the scale, exploratory factor analysis (EFA) was first performed and then the results were verified by confirmatory factor analysis (CFA). The 3-faced construct validation method was used[30]; the sample was randomly split into three parts: 20% for EFA (n=220), 40% for CFA and 40% for a cross-validating CFA (n=440 for both). During EFA, the factors were extracted with principal component analysis (PCA) using oblique rotations (direct oblimin) on the basis of correlations among the factors. The results of Bartlett's sphericity test (significant tests demonstrate adequacy) and Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy (≥0.6 is considered good) were used to ascertain the adequacy of the EFA. To determine the factor structure based on the PCA, the scree plot was examined, and factors with Eigenvalues >1 were extracted. To interpret latent factors, factor loadings ≥0.3 were interpreted. If an item loaded on multiple factors, the factor with the greatest factor loadings was considered as the owner of that item.

To compare the performance of various CFA models, χ^2/df, the Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), root mean square error of approximation (RMSEA), Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used; values less than 4 were considered indicative of good model fit for χ^2/df, values > 0.9 for CFI, IFI and TLI and values ≤0.06 for RMSEA.[35] To determine the best-fitting model, the one with the lowest BIC and AIC was selected.

Three-week test–retest reliability of the CRBS-P was assessed using intraclass correlation coefficient (ICC), which calculated from two-way mixed statistical model and absolute agreement type of ICC selected. ICC can range from 0 to 1, and a value >0.7 indicates good reliability. Internal consistency was assessed via Cronbach's α (α ≥0.7 is acceptable)[36] The data were analysed with SPSS V.24 (IBM) and AMOS V.24.

RESULTS

Translation and cross-cultural adaptation

The face validity of the scale was established through the expert panel opinion and content validity through the qualitative interviews with 50 participants. Both groups also confirmed the cross-cultural validity of the CRBS-P. During the process, all the items were clarified and simplified as much as possible. All patients were satisfied with the number and comprehensibility of the items. There was no need for great changes in item content through translation and cross-cultural adaptation of the scale. The participants completed the scale in maximally 5 min.

Table 1 Characteristics of participants included in test of structural validity, n=1100

Characteristic	Descriptive statistics	
Age (years)	Mean=63.13, SD=13.15	
Work status	Unemployed/retired	315 (28.6%)
	Employee	423 (38.5%)
	Housewife	362 (32.9%)
Sex	Male	730 (66.4%)
	Female	370 (33.6%)
Education level	Illiterate	604 (54.91%)
	≤High school	398 (36.18%)
	Associate's or bachelor's degree	82 (7.46%)
	Master's degree or above	16 (1.45%)
Marital status	Single, divorced or widowed	11 (1.0%)
	Married	1089 (99.0%)
Number of children	Mean=4.71, SD=2.29	

Respondent characteristics

One thousand and one hundred (40.7%) of the 2700 cardiac patients who qualified to present to Afshar Outpatient CR centre, Yazd, Iran but did not attend during the period of the study and completed the phone survey comprised the sample. Table 1 displays the sociodemographic characteristics of these participants.

Psychometric validation

Structural validity was investigated via EFA. The KMO value was 0.759, and the results of Bartlett's test were significant (p<0.001). On the basis of scree plot (figure 1) and the EFA, there were four factors extracted with eigenvalues >1 that accounted for 61.26% of the total variance; hence,

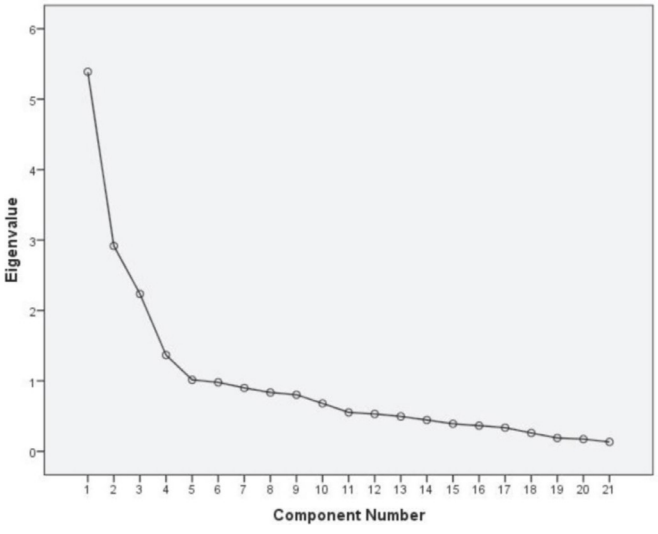

Figure 1 Scree plot from exploratory factor analysis.

Table 2 Exploratory factor analysis (n=20% of data=220)

Subscales CRBS item	Factor loadings				Mean	SD
	Perceived need/healthcare factors	Logistical factors	Comorbidities/functional status	Work/time conflicts		
21)… I prefer to take care of my health alone, not in a group	0.893				2.48	0.609
18)… I can manage my heart problem on my own	0.866				2.55	0.686
19)… I think I was referred, but the rehab program didn't contact me	0.864				2.48	0.558
20)… it took too long to start the outpatient program after referral	0.847				2.53	0.549
17)… many people with heart problems don't go, and they are fine	0.795				2.44	0.639
16)… my cardiologist or thoracic surgeon did not feel it was necessary	0.608				2.56	0.97
03)… of transportation problems		0.905			2.52	1.248
01)… of distance		0.849			2.5	1.252
02)… of cost		0.8			2.59	1.233
04)… of family responsibilities		0.579			2.22	0.962
13)… I don't have the energy			0.916		2.27	1.058
15)… I am too old			0.868		2.29	1.078
09)… I find exercise tiring or painful			0.862		2.27	0.964
14)… other health problems prevent me from going			0.779		2.52	1.203
10)… travel				0.66	2.05	0.825
11)… of time constraints				0.779	2.17	0.988
12)… of work responsibilities				0.785	2.21	1.035
08)… severe weather				0.599	1.95	0.608
07)… I already exercise at home, or in my community				0.439	2.53	1.134
06)… I don't need CR				0.357	2.38	1.082
05)… I didn't know about CR				0.351	3.35	1.31
Eigenvalues	4.669	3.417	2.771	2.006		
Variance explained (%)	22.232	16.273	13.197	9.554		
Cumulative variance explained (%)	22.232	38.505	51.702	61.256		
Reliability: Cronbach's α *	0.877	0.82	0.884	0.668	Overall=0.797	

*Based on 18-item version.

the scale items were categorised into four subscales. The Eigenvalues, EFA results and the variance explained by each factor are displayed in table 2. As shown, the four factors, namely, 'perceived need/healthcare factors', 'logistical factors', 'comorbidities/functional status' and 'work/time conflicts', were consistent with the original English version.

CFA was carried out to confirm the structure suggested by the EFA. The results showed that four factors with 18 items had the best fit with the study data. Items 5, 6 and 8 were omitted from the scale (ie, 'I didn't know about CR; I don't need CR; severe weather'). The CFA path diagram of the recommended model for the CRBS-P plotted with standardised parameter estimates is displayed in figure 2.

Cronbach's α for each factor and for the whole scale, given in table 2, demonstrates its more than satisfactory internal consistency. The 3-week test–retest reliability of the CRBS-P in 42 (76.4%) responding patients was also acceptable (ICC=0.743 95% CI 0.502 to 0.868).

The final 18-item CRBS-P is shown in online supplementary appendix 1 (also available online at http://sgrace.info.yorku.ca/cr-barriers-scale/crbs-instructions-and-languages-translations/). Table 2 presents mean item scores; 'not knowing about CR' was the

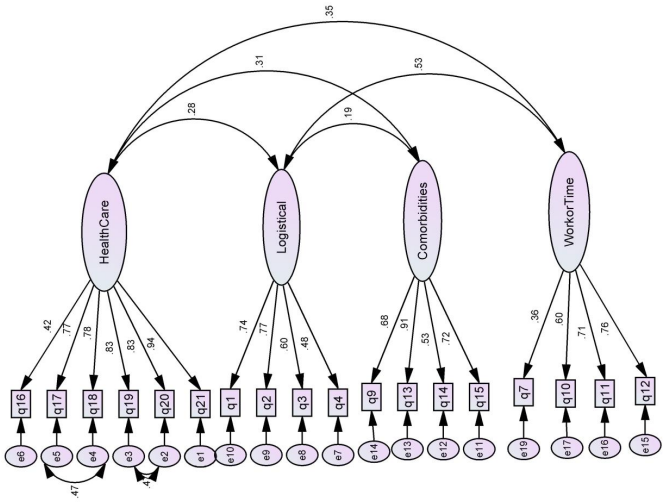

Figure 2 Path diagram for confirmatory factor analysis, displaying the four-factor model, with standardised parameter estimates. Deleted items: 5, 6 and 8 (total items=18/21).

greatest barrier (item 5), followed by cost; severe weather and time constraints hindered enrolment least. Given item 5 was the most highly endorsed item, contrary to the CFA, future researchers should consider including it in the administered scale.

DISCUSSION

Herein, an 18-item CRBS-P was demonstrated to be reliable, internally consistent and to have acceptable face, content, cross-cultural and structural validity. The top barriers identified included not knowing about CR, cost, comorbidities, perceptions of sufficient independent exercise and capacity to self-manage their CVD (reflecting lack of knowledge of what CR entails and potentially denial), lack of perceived encouragement by referring providers, wait times, transportation and distance.

We discovered that another group was simultaneously translating and validating a CRBS-P.[37] Similarly, they used best practices in translation, although the credentials of those who undertook the translation are not clear. Three different items were removed, and four items were added. Inclusion of each item was rated by experts quantitatively. Test–retest reliability was also established, after 2 weeks versus the 3 weeks applied herein. Structural validity was not tested, but criterion validity was, and shown to be evident in that attendees and non-attendees had statistically significantly different barrier scores on items. The top barriers, namely, cost, transport and distance were somewhat comparable to the findings herein. It would be ideal to harmonise the two versions through further psychometric validation.

The CRBS was originally developed in English in Canada[28] and has been psychometrically validated in Brazilian,[38] Korean,[39] Spanish[40] and Malay[41] languages (other non-validated translations are available on CRBS website). The results of the present study, similar to the original English version as well as the Korean, Malay and Spanish versions, identified four factors (table 3). On the contrary, the Brazilian version by Ghisi *et al* identified five factors, namely: comorbidities/functional status, perceived need/healthcare system factors, personal/family issues, travel/conflicts with work schedule and access,[38] and the Korean version by Baek *et al* identified six factors, namely: comorbidities/functional limitations, perceived need, external factors (similar to work/time conflicts), logistical factors, healthcare system factors and already exercising.[39] The Persian CRBS, similar to the Malay version by Chai *et al* and the Colombian version by Sánchez Delgado *et al*, comprised four factors, although the items loading on each factor did differ somewhat for each when compared with the English version.[40 41] This suggests that different barriers may be at play in different contexts. It may be worthwhile to consider all the CRBS translations now available and forward a more internationally relevant revised version for further validation.

The top barriers identified point to some strategies which could potentially increase utilisation. Evidence-based strategies to increase referral[42] as well as enrolment and participation have been established.[43] Ensuring that inpatients are informed about CR prior to discharge is clearly a key factor, including information on what it entails and the benefits, and providing strong, positive CR endorsement.[11] Increasing the number of Iranians with insurance coverage would also facilitate use, given the policy there for such reimbursement.[44] Transportation and distance barriers can be overcome with alternative

Table 3 Goodness of fit indices for factor structure of CRBS translations

Factor structure (translation)	χ^2/df	RMSEA (90% CI)	TLI	CFI	IFI	AIC	BIC
Four oblique factors* (our study)	3.206	0.061 (0.052 to 0.069)	0.946	0.959	0.959	337.648	509.128
Five oblique factors (Brazilian–Portuguese)	3.965	0.070 (.065 to 0.076)	0.875	0.894	0.895	809.738	1047.172
Six oblique factors (Korean)	5.593	0.094 (0.087 to 0.102)	0.874	0.9	0.9	613.302	787.472
Four oblique factors (Malay)	7.18	0.119 (0.113 to 0.125)	0.674	0.716	0.718	1410.706	1606.871
Four oblique factors (Spanish)	4.87	0.094 (0.88 to 0.99)	0.796	0.822	0.823	988.586	1184.751

*This model included specified covariance between error terms such as 4 and 5, 5 and 2 and 3. Item numbers 5, 6 and 8 were deleted.
AIC, Akaike information criterion; BIC, Bayesian information criterion; CFI, Comparative Fit Index; CRBS, Cardiac Rehabilitation Barriers Scale; df, degree of freedom; IFI, Incremental Fit Index; RMSEA, root mean square error of approximation; TLI, Tucker-Lewis Index.

CR delivery models, which are also shown to be effective in Iran.[45–47]

Directions for future research include establishing other psychometric properties of the scale, as per the COSMIN taxonomy,[33]such as criterion validity through comparison of CRBS scores in enrollees and non-enrollees and/or completers and non-completers.[28] It is assumed that criterion validity will be upheld in the CRBS-P, as it has been established in other translations,[28] including the other Persian translation.[37] Discriminant validity has also been established in the English CRBS in terms of sex, age and socioeconomic differences,[23 25 26]but further exploration in an Iranian sample, including consideration of literacy would be useful. Exploration of interpretability of scores would also be important, but consideration of mean scores in enrollees and non-enrollees should be considered, as they are significantly higher in enrollees (as per criterion validity above), and it does appear that scores are higher in lower resource when compared with higher resource settings. Moreover, responsiveness should be investigated; mitigation strategies specific to barriers/subscales could be implemented, and the scale readministered to establish this. Finally, differential item functioning should be explored to examine possible cultural differences.

Limitations

Caution is warranted in interpreting these results. First, the translations were undertaken by bilingual clinician–researchers, but certified translators were not enlisted. Second, generalisability is limited in that participants were recruited from a single, public centre. Generalisability to patients hospitalised in private centres, where many cardiac patients receive care in Iran, remains to be established. Third, participants may have responded in a socially desirable manner as the survey was administered on the phone for logistical reasons (high illiteracy; to reach desired population of patients who do not enroll in CR). The findings from the other CRBS-P do support generalisability and that there was no response bias due to the method of administration, however there were some differences in some of the top barriers.[37] Fourth, we did not systematically document the characteristics of the patients called to provide input on the translation in terms of face, content and cross-cultural validity; therefore it is unknown whether they are representative of the average cardiac patient indicated for CR. Finally, there may be selection bias due to the fairly low response rate for the validation sample.

CONCLUSION

The 18-item, four-factor Persian translation of the CRBS is highly reliable (internally consistent, test–retest), with demonstrated content (including face) and construct (including cross-cultural and structural) validity. Further exploration of CR barriers in the Iranian context can now be explored, and mitigation strategies applied to increase CR utilisation in the country, and hence curtail the burden of CVD.

Author affiliations
[1]Yazd Cardiovascular Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
[2]Faculty of Health, York University, Toronto, Ontario, Canada
[3]KITE-Toronto Rehabilitation Institute, University Health Network, Toronto, Ontario, Canada
[4]Health Promotion Research Center, Zahedan University of Medical Sciences, Zahedan, Iran
[5]Research Center of Prevention and Epidemiology of Non-Communicable Disease, Departments of Biostatistics and Epidemiology, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

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Competing interests None declared.

Patient consent for publication Obtained.

Ethics approval Before beginning the data collection process, approval from the Ethics Committee of Medical Sciences of Shahid Sadoughi University, Yazd, Iran (no. IR.SSU.MEDECINE.REC.1396.51) was obtained.

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Data availability statement Data are available upon reasonable request. The data set for this study is available on reasonable request from the Corresponding author.

ORCID iDs
Sherry L Grace http://orcid.org/0000-0001-7063-3610
Farzan Madadizadeh http://orcid.org/0000-0002-5757-182X

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