

# Validation of the Arabic version of the quality of life impact of refractive correction questionnaire

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## Abstract:

**PURPOSE:** To validate the Arabic version of the quality of life impact of refractive correction (QIRC) questionnaire.

**METHODS:** This was a cross-sectional study included participants with refractive errors (myopia, hypermetropia, or astigmatism) aged between 19 and 40 years who were pre or postrefractive surgeries. Uncorrected distance visual acuity, refraction, and corneal topography were collected. The 20-item QIRC questionnaire was translated to the Arabic language and then back translated to the English language. Participants were asked to answer all items of the Arabic QIRC. The validity and reliability of the translated questionnaire were tested using Rasch analysis.

**RESULTS:** A total of 145 participants with refractive errors participated in this study. The mean age  $\pm$  standard deviation of participants was  $26.29 \pm 5.1$  years. Person separation (2.01) and reliability (0.80) indicates good precision and stability of the Arabic QIRC questionnaire. Item infit was ranged between 0.82 and 1.23; and item outfit was range between 0.76 and 1.32. The items were well targeted to the persons with a mean difference of 0.30. Skew and kurtosis values were within the normal limits ( $-2.00$  to  $+2.00$ ). Cronbach's  $\alpha$  for the scale was 0.79, which indicates good reliability of the Arabic 20-item QIRC.

**CONCLUSION:** The Arabic 20-item QIRC questionnaire is a valid tool to assess the impact of refractive correction on Arabian participants' quality of life.

## Keywords:

Arabic version, quality of life impact of refractive correction questionnaire, Rasch analysis, validation

## INTRODUCTION

Validation of instruments to assess vision-related quality of life (VRQOL) for ophthalmic ailment has been widespread in different languages. However, many instruments are not applied for subjects with refractive errors and for treatment by surgery due to lack of reliability and validity of instruments on this population. The quality of life impact of refractive correction (QIRC) questionnaire<sup>[1]</sup> was developed and validated in the English language to measure QIRC (i.e., spectacles and contact lenses [CL]) and refractive surgery (e.g., laser-assisted *in situ* keratomileusis [LASIK] or photorefractive keratectomy). There is a need for a valid VRQOL instruments which

enable to assess VRQOL of Arabic-speaking participants with refractive error wearing refractive correction or having refractive surgery.

This is important for refractive error correction, especially in Arabic countries, such as Saudi Arabia (SA), where refractive errors are one of the top five causes of visual impairment among adults.<sup>[2]</sup> The most frequent type of refractive error in SA is myopia, followed by hyperopia and astigmatism.<sup>[3,4]</sup> Refractive errors can affect the economy of many countries of the world.<sup>[5,6]</sup> The prevalence of refractive errors can be affected by many factors, including age, gender, ethnicity, and geographic borders, all which have an impact on treatment planning for refractive error.<sup>[7,8]</sup>

There are some disadvantages of most popular traditional correction (i.e., spectacles and CLs)

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for correcting refractive errors.<sup>[9,10]</sup> Spectacles can negatively affect a person's cosmetic appearance, that can lead to confidence issues,<sup>[11]</sup> and can obstruct sports activities such as football.<sup>[12]</sup> CL can lead to some complications including redness, pain, discomfort, and corneal infection,<sup>[13,14]</sup> which can lead to visual loss and affect clarity of vision and quality of life. The disadvantages of both spectacles and CLs play a role in many individuals seeking alternative correction of refractive errors, such as refractive surgery.<sup>[12]</sup>

Many ophthalmologists recommend the correction of refractive errors by refractive surgery (e.g., radial keratotomy, photorefractive keratectomy, LASIK, and laser thermal keratoplasty) to eliminate the dependence on spectacles or CLs, especially in myopic patients.<sup>[15,16]</sup> Refractive surgeries are efficacious, safe, and result in stable and predictable visual results. It was reported that patients who underwent LASIK were satisfied with their rapid vision recovery and minimal pain. Instruments for patients reports outcomes were reviewed and revealed the option of a suitable measure in refractive error with the recommendation for the need of a comprehensive and precisely strong refractive error-specific instrument to assess subjects.<sup>[17]</sup> Despite the extensive advertising for and media attention given to refractive surgery, not all patients are satisfied with the result of refractive surgeries.<sup>[15]</sup> Thus, ophthalmic clinicians should consider potential complications of these surgeries as well as the patients' perspective on their QOL.

Many validated questionnaires have been developed to measure refractive surgery outcomes, including the National Eye Institute Refractive Error Quality of Life Instrument (NEI-RQL),<sup>[18]</sup> the refractive status vision profile (rapid serial visual presentation [RSVP]),<sup>[19]</sup> and the QIRC questionnaire.<sup>[1]</sup> The NEI-visual function questionnaire (NEI-VFQ) and RSVP have been shown to be insensitive to QOL issues relevant to CL wearers.<sup>[20]</sup> Other studies assessed QOL before and after refractive surgery using invalid questionnaires,<sup>[1,21-23]</sup> and these questionnaires can assess some domains of QOL, such as psychosocial issues only in spectacles, CL, or low vision aids.<sup>[1,24]</sup> Kandel *et al.* conducted a systemic review to identify the questionnaires which can be used to assess refractive surgery outcomes regarding the psychometric properties, reliability, validity and found that the QIRC is one of the higher quality questionnaires with a standard psychometric properties that includes 20 items that assess many domains of QOL such as visual function, symptoms, convenience, cost, health concerns, and well-being.<sup>[25]</sup> The QOL impact of refractive corrections on Arabic-speaking subjects has not been assessed. Although there are few valid Arabic questionnaires available in the literature such as the Arabic NEI-VFQ,<sup>[26]</sup> Arabic visual functioning index VF-14<sup>[27]</sup> and Arabic SF-6D questionnaire;<sup>[28]</sup> however, these measures are not refractive error-specific Arabic instruments that can be used to assess VRQOL in subjects with refractive errors. The Arabic NEI-VFQ is insensitive for contact lens wearer and Arabic visual functioning index VF-14 is specific for subjects with cataract, while the Arabic SF-6D

questionnaire is health-related quality of life but not specific for vision. Thus, this study aimed to validate the Arabic version of the QIRC questionnaire on subjects with refractive errors using Rasch analysis, with the aim of enabling the assessment of the impact of refractive surgery on the QOL of adult Arabic speakers.

## METHODS

### Subjects

This was a cross-sectional study included participants with refractive errors (myopia, hypermetropia, or astigmatism) aged between 19 and 40 years who were pre- or post-refractive surgeries. Participants were recruited from anterior segment clinics at ophthalmology department of Al-Habib medical group hospitals in Riyadh, Saudi Arabia. Participants included in this study were prerefractive surgery who had a spherical equivalent of  $>-10$  diopters and corneal thickness of 490  $\mu\text{m}$  or greater, and who were postrefractive surgery had undergone the surgery no longer than 5 years prior. In addition, participants who had refractive error and wore refractive correction (i.e., spectacles, CLs) with no ocular disease or previous ocular surgery were also included in this study. Participants included in this study had no other ophthalmic problems and were required to be pre-presbyopic. This is important as presbyopia could be a confounding factor affecting the subject's perspective on their QOL.

Ocular measurements were collected, including uncorrected distance visual acuity (VA) (using the Snellen chart and recorded in LogMAR), refraction, and corneal topography (measured using Oculus Pentacam HR). Corneal topography was measured for all subjects for the inclusion criteria of the study, to evaluate the corneal surface as it is one of important measures for prerefractive correction and it allows to evaluate the optical zone reveals the significant gradient within the visual axis. Subject demographic information (e.g., age and gender) were also obtained.

Ethics approval was obtained from the Institutional Review Board at Dr. Sulaiman Al-habib medical group hospitals. In addition, a certificate of "protecting human research participants online training" was obtained. Informed consent was obtained from participants after explanation of the nature and possible consequences of the study, and the research followed the tenets of the declaration of Helsinki.

### Translation of the quality of life impact of refractive correction

The English version of 20-item QIRC questionnaire is a specific refractive correction questionnaire that was validated with a standard psychometric properties.<sup>[1]</sup> In this study, the English version of the QIRC questionnaire was translated into the Arabic language then back-translated into English by a bilingual speaker to ensure that the meaning of each item was consistent. The content and meaning of items in the original English QIRC questionnaire have been

matched with items in the translated Arabic version QIRC questionnaire by a bilingual person to ensure the integrate translation process. The translation process conducted with consideration of cultural adaptation process for subjects in the Arabic society.<sup>[29]</sup> All 20 items included in the QIRC questionnaire are specific to refractive correction and included domains (e.g. visual function, symptoms, convenience, cost, health concerns, and well-being) which are appropriate for Arabian societies.

In this study, participants were asked to answer all items of the Arabic QIRC in a single rating scale across all the items. The response scale for each item included a category response scale (1, 2, 3, 4, 5) plus a “not applicable” response. “Not applicable” or items left blank were considered missing data and not included when testing the validity of the Arabic QIRC scores.

### The 20-item quality of life impact of refractive correction questionnaire

The validity and reliability of the translated Arabic questionnaire were tested using Rasch analysis. Criteria used to identify the validity of the questionnaire<sup>[30]</sup> were followed as: Infit mean square between 0.80 and 1.20, outfit mean square between 0.70 and 1.30, mean difference between item and subject, high proportion of missing data (<50%), a ceiling effect of a high proportion in item end-response category (<50%), and skew and kurtosis between +2.00 and -2.00.

In the present study, sufficient power may not always provide meaningful answers to certain research questions. This is because the validation of a questionnaire by Rasch analysis requires each item to be answered by three to five subjects to achieve the acceptable value of person separation and reliability.<sup>[31]</sup> Thus in this study, of the 20-item questionnaire, the sample size required for validation of the questionnaire was 60–100 subjects, with statistical power of >80%.

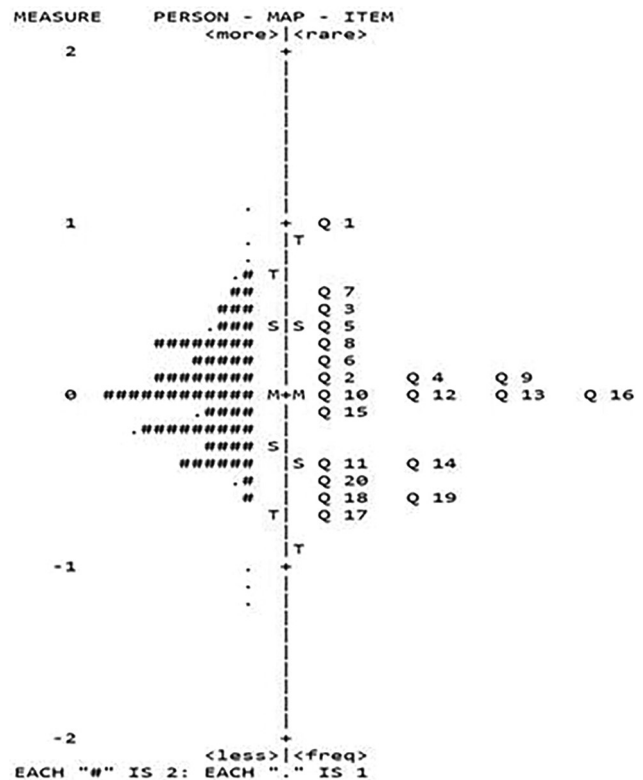
## RESULTS

### Participants

A total of 145 subjects participated in this study. The mean age ± standard deviation of participants was 26.29 ± 5.1 years. Table 1 shows the demographic data and visual measurements of participants. The age of the groups (pre -and post-surgery) was significantly different ( $P < 0.001$ ). The postrefractive surgery group was older than the prerefractive surgery because the postrefractive surgery group follow-up visits were recorded over a different period after surgery. Subjects in both groups (pre- and post-refractive surgeries) were similar to population norms. Most participants in the prerefractive surgery group were myopic, with an uncorrected VA of <0.4 LogMAR. All participants in the postrefractive surgery group had a corrected VA ranging from 0 to 0.1 LogMAR. All participants understood the translated content of the Arabic QIRC questionnaire without any problems.

### Assessment of the validity and reliability of the Arabic 20-item quality of life impact of refractive correction

Rasch analysis demonstrated that the Arabic version of QIRC had good precision and reliability. Cronbach’s  $\alpha$  for the scale was 0.79, which indicates good reliability for the Arabic 20-item QIRC. Person separation (2.01) and reliability (0.80) indicated good stability of the questionnaire. Items were well targeted to the subjects, with a mean difference of 0.30 [Figure 1]. Figure 1 shows that items at the top of the scale (i.e., item no. 1 and 7) are difficult items whereas items at the bottom of the scale (i.e., items no 17–19) are difficult items). Item infit ranged from 0.81 to 1.23, and item outfit ranged from 0.76 to 1.32, which indicates good fit statistics to Rasch model. Table 2 shows the 20 items included in the Arabic QIRC questionnaire with corresponding Rasch fit statistics. Skew and kurtosis values were within normal limits (-2.00 to +2.00). The response categories was tested and showed good ordered threshold for all items. Figure 2 demonstrates example of ordered threshold



**Figure 1:** Person/item map for the Arabic QIRC 20-item questionnaire with the crossover point for each response category for each item shown on the right. On the left of the dashed line are the subjects, represented by ‘#’ and ‘.’ (# = 2 subjects). On the right are the cross-over points between each item category (point of the scale where the answer category is most likely to be chosen by a subject with that quality of life). This question group exhibits excellent targeting of items to subjects. Subjects with poorer QOL are near the bottom of the diagram, and subjects with better QOL are near the top. Items that are unaffected in patients with refractive correction are near the bottom of the diagram, and items near the top are those strongly affected by refractive corrections. The scale is in units (+2.00 to -2.00). Abbreviations on the diagram: M = mean, S = SD from the mean, and T = SD's from the mean

**Table 1: Characteristics of participants**

	Prerefractive surgery (n=101)	Postrefractive surgery (n=44)	P
Age, mean±SD	23.44±4.36	28.89±5.43	<0.001
Gender			
Female	56 (55)	29 (66)	0.679
Type of refractive error, n (%)			
Mild myopia	16 (15.9)	2 (4.5)	
Moderate myopia	37 (36.6)	18 (40.9)	
High myopia	5 (5.0)	1 (2.3)	
Hyperopia	2 (1.9)	0	
Astigmatism	41 (40.6)	23 (52.3)	
Optical correction, n (%)			
Spectacles	83 (82.1)	-	0.187
Contact lenses	3 (3.0)	-	
Spectacles and CL	15 (14.9)	-	
CCT (R), mean±SD	556.02±37.87	557.98±37.50	0.928
VA SC LogMAR (R), n (%)			
0-0.1	4 (4)	0	<0.0001
0.2-0.3	7 (7)	0	
0.4-0.6	17 (16.8)	3 (6.8)	
0.7≤	73 (72.2)	41 (93.2)	
VA CC LogMAR (R), n (%)			
0-0.1	98 (97.0)	44 (100)	0.396
0.2-0.3	3 (3.0)	0	

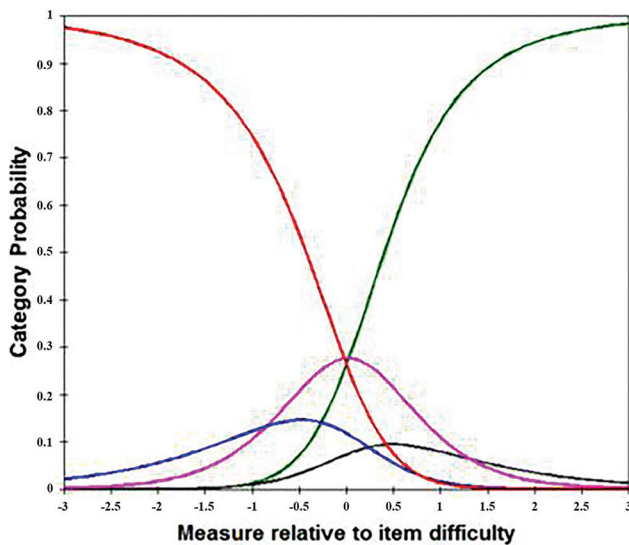
CCT: Central corneal thickness, VA: Visual acuity, VA SC: VA without correction, VA CC: VA with correction, R: Right eye, SD: Standard deviation, CLs: Contact lenses, LogMAR: Logarithm of the Minimum Angle of Resolution

**Table 2: Rasch fit statistics of the 20 items included in the Arabic quality of life impact of refractive correction questionnaire**

20-items Arabic QIRC	MnSq±ZStd		Item measure (SE)
	Infit	Outfit	
1. How much difficulty do you have driving in glare conditions?	1.23±2.80	1.32±4.10	0.98 (0.8)
2. During the past month, how often have you experienced your eyes feeling tired or strained?	0.87±1.30	0.88±1.20	0.10 (0.6)
3. How much trouble is not being able to use off-the-shelf (nonprescription) sunglasses?	1.08±0.70	0.99±0.0	0.49 (0.6)
4. How much trouble is having to think about your spectacles or CLs or your eyes after refractive surgery before doing things, e.g., traveling, sport, going swimming?	0.90±1.0	0.90±1.0	0.13 (0.6)
5. How much trouble is not being able to see when you wake up, e.g., to go to the bathroom, look after a baby, see alarm clock?	0.95±0.50	0.93±0.40	0.37 (0.6)
6. How much trouble is not being able to see when you are on the beach or swimming in the sea or pool, because you do these activities without spectacles or CLs?	0.93±0.60	0.93±0.70	0.23 (0.7)
7. How much trouble are your spectacles or CLs when you wear them when using the gym/doing keep-fit classes/circuit training, etc.?	1.13±1.1	1.11±1.10	0.59 (0.6)
8. How concerned are you about the initial and ongoing cost to buy your current spectacles/CLs/refractive surgery?	0.82±3.3	0.76±3.4	0.32 (0.6)
9. How concerned are you about the cost of unscheduled maintenance of your spectacles/CLs/refractive surgery, e.g., breakage, loss, new eye problems?	0.87±2.5	0.79±2.6	0.13 (0.6)
10. How concerned are you about having to increasingly rely on your spectacles or CLs since you started to wear them?	0.99±0.1	0.99±0.1	-0.1 (0.6)
11. How concerned are you about your vision not being as good as it could be?	0.81±2.0	0.83±1.7	-0.4 (0.6)
12. How concerned are you about medical complications from your choice of optical correction (spectacles, CLs, and/or refractive surgery)?	0.87±2.9	0.87±2.8	0.1 (0.6)
13. How concerned are you about eye protection from UV radiation?	0.95±0.5	0.95±0.4	0.5 (0.6)
14. During the past month, how much of the time have you felt that you have looked your best?	1.02±0.3	1.11±1.0	-0.42 (0.7)
15. During the past month, how much of the time have you felt that you think others see you the way you would like them to (e.g., intelligent, successful, cool, etc.)?	1.22±2.4	1.26±2.5	-0.07 (0.6)
16. During the past month, how much of the time have you felt complimented/flattered?	1.22±2.2	1.22±2.1	-0.04 (0.6)
17. During the past month, how much of the time have you felt confident?	1.13±1.1	1.29±2.3	-0.73 (0.7)
18. During the past month, how much of the time have you felt happy?	0.98±0.2	0.98±0.1	-0.63 (0.7)
19. During the past month, how much of the time have you felt able to do the things you want to do?	1.16±1.5	1.15±1.3	-0.58 (0.7)
20. During the past month, how much of the time have you felt eager to try new things?	1.10±1.0	1.09±0.9	-0.50 (0.7)

MnSq: Mean square fit statistic, ZStd: Fit statistic standardized as a z-score, SE: Standard error, QIRC: Quality of life impact of refractive correction, CLs: Contact lenses, UV: Ultraviolet





**Figure 2:** Category probability curve showing good ordered thresholds for item number 1 "How much difficulty do you have driving in glare conditions?" of the translated Arabic QIRC questionnaire. 1= never; 2=almost never; 3= sometimes; 4=almost always; 5= always

for category probability curve for item number 1 "How much difficulty do you have driving in glare conditions?" of the translated Arabic QIRC questionnaire.

Rasch analysis indicated that subjects with corrected refractive error have problems with some visual function, such as glare conditions when driving (item 1) and trouble participating in sport activities while wearing spectacles or CLs [item 7; Figure 1]. It also showed that most participants (98%) in the present study were confident and happy, as shown in item 17, "During the past month, how much of the time have you felt confident?" and item 18, "During the past month, how much of the time have you felt happy?" as shown in Figure 1. However, three participants in the prerefractive surgery group had problems in these two items.

## DISCUSSION

The Arabic QIRC questionnaire was validated using Rasch analysis to assess the impact of refractive correction on Arabic speaker subjects. It includes many aspects of QOL, such as visual function, symptoms, convenience, cost, health concerns, and well-being. All items included in the Arabic QIRC were fitted and tended to have different levels of floor effects and therefore targeted well to Arabic speaker population. Unlike, other QOL questionnaires, such as the RSVP,<sup>[19]</sup> included items that lack sensitivity in subjects with refractive errors. Similarly, similar problems were found with the Activity Limitations and Glare subscales<sup>[1]</sup> of the NEI-RQL questionnaire.<sup>[18]</sup>

The validity of the Arabic version of the QIRC questionnaire was tested in this study on samples of Arabic speakers in the Saudi Arabian population. Similarly, the English QIRC questionnaire was developed for the samples of the UK population with matching demographics (e.g., age, gender, and

ethnicity). The age of postrefractive surgery group included in our study was older than that of the prerefractive surgery group. Similarly, Pesudovs *et al.*<sup>[1]</sup> reported that the refractive surgery groups for both the pilot and main data collection were older than spectacle and CLs wearers.

The QIRC was intentionally validated for the prepresbyopic population to avoid issues related to reading spectacles, such as problems with bifocal segments and multifocal distortions, which could cause problems with Rasch model fit, targeting to subjects and measurement integrity. Similarly, subjects participating in this study were prepresbyopic individuals who wore spectacles or CLs to correct their refractive errors.

Our results showed that few participants in the prerefractive surgery group had problems in confidentiality and happiness items (no 17 and 18). This could be due to the negative impact of spectacles that can lead to confidence issues,<sup>[11]</sup> or CLs complications (e.g., redness, discomfort, and corneal infection)<sup>[13,14]</sup> that can lead to visual loss and affect clarity of vision and QOL. Similarly, Pesudovs *et al.*<sup>[32]</sup> found that QOL in spectacle group was lower than CLs groups, while CLs wearers had significantly higher QIRC score than spectacle group. It also found that the score of QIRC in refractive surgery group was significantly higher than both spectacles and CLs groups. The assessment of QOL between the groups will be a topic of future research.

The item-person map of the Arabic QIRC questionnaire [Figure 1] showed the most difficult item for participants was item no. 1 (*How much difficulty do you have driving in glare conditions?*) while the easiest item for participants was item no. 17 (*During the past month, how much of the time have you felt confident?*) [Figure 1], although confidence domain was problem for prerefractive surgery group. Pesudovs *et al.*<sup>[1]</sup> found that visual function were easiest items for subjects and problems such as convenience, health concerns, appearance and cost can define the effect of refractive error correction on QOL. However, this is population dependent and therefore, the Arabic QIRC questionnaire was validated to suit all Arabic speaker subjects with refractive correction.

Our results showed that the Arabic QIRC questionnaire is reliable and valid [Table 2 and Figure 1] by Rasch model and Cronbach's  $\alpha$ . The value of Cronbach's  $\alpha$  of the Arabic QIRC questionnaire was similar to the value of Cronbach's  $\alpha$  (0.78) of the English QIRC questionnaire.<sup>[1]</sup> Pesudovs *et al.*, reported that the value of Cronbach's  $\alpha$  indicates the reliability coefficient and implies the unidimensionality of a questionnaire, as it is fundamentally determined by the correlation coefficients average between items. However, high values of Cronbach's  $\alpha$  (>0.90) can indicate redundancy of some items in the questionnaire,<sup>[1,33,34]</sup> which is considered as an issue for measuring the overall score for the questionnaire.

Unidimensionality is a fundamental measurement property and an important assumption of Rasch analysis. Dimensional structure of the Arabic QIRC questionnaire was not evaluated

in this study as it is not the purpose of this study. The result of Cronbach's in our study was strong for reliability of the Arabic QIRC questionnaire. Ang *et al.*<sup>[35]</sup> compared VRQoL scores and clinical outcomes between small-incision lenticule extraction and laser *in situ* keratomileusis (LASIK) using QIRC questionnaire. It found the scores of VRQoL were not statistically differ between small-incision lenticule extraction and LASIK. It also found that the QIRC questionnaire is multidimensional, comprising of functional and emotional dimensions.

Factorial validity of the Arabic QIRC was not measured in this study as our results showed good validity of the Arabic QIRC questionnaire represented by persons and items separation and reliability, targeting between items and subjects, and items measure. In the 20-item Arabic QIRC questionnaire,<sup>[1]</sup> all items had a factor loading between 0.40 and 0.76, which indicated significant correlation. This provide evidence that Rasch analysis is appropriate results and indicating that all items of the Arabic QIRC questionnaire contributed to the overall score and all domains of QOL concepts. Therefore, they are all related to the correction of refractive error.

## CONCLUSION

In conclusion, the Arabic version of the 20-item QIRC questionnaire is a valid and reliable instrument for pre-presbyopic Arabic speaking participants. The questionnaire can be used to assess VRQoL of subjects with refractive errors wearing refractive correction (i.e., spectacles, CLs, and refractive surgeries).

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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