Development of a Refractive Error Quality of Life Scale for Thai Adults (The REQ-Thai)

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Objective: *To develop a scale for measuring refractive error quality of life (QOL) for Thai adults.*
Material and Method: *The full survey comprised 424 respondents from 5 medical centers in Bangkok and from 3 medical centers in Chiangmai, Songkla and KhonKaen provinces. Participants were emmetropes and persons with refractive correction with visual acuity of 20/30 or better. An item reduction process was employed by combining 3 methods-expert opinion, impact method and item-total correlation methods. The classical reliability testing and the validity testing including convergent, discriminative and construct validity was performed.*
Results*: The developed questionnaire comprised 87 items in 6 dimensions: 1) quality of vision, 2) visual function, 3) social function, 4) psychological function, 5) symptoms and 6) refractive correction problems. It is the 5-level Likert scale type. The Cronbach's Alpha coefficients of its dimensions ranged from 0.756 to 0.979. All validity testing were shown to be valid. The construct validity was validated by the confirmatory factor analysis. A short version questionnaire comprised 48 items with good reliability and validity was also developed.*
Conclusion: *This is the first validated instrument for measuring refractive error quality of life for Thai adults that was developed with strong research methodology and large sample size.*

Keywords: *Questionnaire, Scale development, Vision-targeted health-related quality of life, Factor analysis, Refractive error, Refractive correction, Refractive surgery, Reliability, Validity, Thai adults*

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Reports have shown a spectrum of complications after refractive surgery. These complications, including impaired binocular function, halo, glare disability, and night-vision disturbance create a poor quality of vision after refractive correction[1,2]. Evidence shows that current standard vision measurements such as uncorrected visual acuity and the number of visual acuity lines lost or gained after correction, cannot be used to measure the quality of vision[3].

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The need to measure quality of vision and vision-targeted health-related quality of life (HRQOL) has led to the development of particular scales to measure this concept[4-13]. None of the existing scales contained all essential dimensions of refractive error QOL. Currently, there are no validated, patient-centered scales to be used for assessing the refractive error QOL for Thai adults. From January 2008 to April 2008, the authors conducted a large cross-sectional survey of 424 respondents with refractive correction from a diverse geographical area in Thailand. In the present study, the authors aimed to develop the refractive error quality of life scale for Thai adults (the REQ-Thai) and validate the scale using a combination of expert opinion, the impact method and the psychometric

method including internal consistency (item-total correlation) and construct validity.

Material and Method

Participants

Enrollment targets were set up at each center for 5 clinical subgroups: natural emmetropes, persons after refractive surgery, contact lenses wearers, eye glasses wearers and preoperative evaluation patients for refractive surgery. To be eligible, respondents had to be 18-60 years old, be a Thai citizen and be able to complete a self-administered questionnaire. Respondents were required to have visual acuity of 20/30 or better for near and far vision in the worse eye while using their current correction, if any. Exclusion criteria were chronic ocular disease, diabetes, and neurological disease.

Participating centers

The eight medical centers participating in the full scale survey were Ramathibodi Hospital, Siriraj Hospital, Chulalongkorn Hospital, Bhumipol Adulyadej Hospital and Rutnin Eye Hospital in Bangkok. Also, Maharaj Nakorn Chiangmai Hospital, Srinagarind Hospital and Songklanakarind Hospital are outside Bangkok.

Dimensions of the scale

The reviews of 8 refractive error quality of life (REQ) questionnaires demonstrated 40 dimensions[5-13]. Of these, the authors selected 22 appropriate dimensions to be included in the authors' first draft scale. Further, the authors grouped the 22 dimensions into 6 dimensions, 3 sub-dimensions and 12 aspects (Table 1).

Formatting items and response options

The 115 initial items were developed and measured on a seven-point rating scale. They were constructed to measure 2 dimensions: the amount of problem and the importance of the problem. The amount of problems in part A measures the symptoms, negative feelings or difficulty in doing activity. The scales of which range from 1 to 7: 1 = not bother or very little negative feeling or do not have difficulty in doing activity and 7 = have a great deal of symptoms or a great deal of negative feeling or a great deal of difficulty, and 0 = no symptom or do not have negative feeling or do not do this activity. The amount of importance of the problems in the part B scale range from 1 to 7: 1 = not important at all and 7 = a very great deal of importance. Due to very rare responses in the extreme side of the rating scale, the tentative questionnaire (the REQ-Thai) was changed to be a five-point rating scale.

Item reduction

In the present study, the item reduction was performed twice. First the item pooled questionnaire was reduced to create a tentative questionnaire. Second, the tentative questionnaire was reduced to obtain a short form questionnaire.

The item reduction to create a tentative questionnaire

First, the ranking lists of 115 items from the rating of the amount of problem and the rating of clinical importance were prepared from the results provided by 52 respondents. The correlation score for each item was derived from the rating of the amount of problem using the internal consistency (item-total correlation) method. The clinical importance score was derived from the mean rating of importance. After that, these 2 ranking lists were sent to 5 experts. The 87 items which were selected by all experts were selected to form a tentative questionnaire.

Table 1. Details of grouped dimension for the item pool questionnaire

Dimension	Sub-dimension	Aspects	
Quality of vision	-	A. Quality of night vision	B. Clarity of vision
Visual function	Driving	A. Daytime driving	B. Night driving
	Vision	A. Distant vision	B. Near vision
	Activity limitations	A. Daily activities	B. Sports/Exercises/ Outdoor activities
Social function	Social function	-	-
Psychological	-	A. Self perception	B. Concern/Worry/Annoy
Symptoms	Symptoms	-	-
Refractive correction problems	-	A. Refraction-related problems	B. Convenience/Cost

The item reduction to create a short form questionnaire

To get a short form questionnaire, the ranking lists of 87 items from the 3 methods were sent to 5 content experts. The methods used were the impact and item-total correlation methods and the clinical importance score. In brief, in the impact method[14,15], the 424 patients were asked to rate the amount and the importance of the problem, using a five-point scale for each. Then, the frequency (proportion of patients experiencing a particular item) and the mean importance of that item were multiplied to create its impact score. After that, all of the items were ranked by the impact score, starting from the highest one. The 48 items selected from four or more than 4 out of 5 raters were used to form a short version questionnaire.

Measures

Three types of measures were used in this research: questionnaire, global rating questions, and data record form.

Questionnaire

The item pool questionnaire contained 115 items while the tentative questionnaire (the REQ-Thai) contained 87 items and the short form questionnaire contained 48 items.

Two global rating questions

The global rating questions consisted of a set of questions inquiring about quality of vision and refractive error QOL. The respondents rated the global rating questions to use as continuous variables for validity testing.

Data record form

The data record form consisted of 2 aspects of data: 1) baseline clinical factors such as the degree of refractive error, the type of refractive error and prior dry eyes; and 2) treatment factors such as the type of refractive error correction, uncorrected visual acuity (UCVA) and best spectacle corrected visual acuity (BSCVA) after correction.

Data collection

All appropriate institutional review boards approved the semi-structured interviews, the pilot study and the full scale survey protocol. All respondents signed written informed consent forms before participation. Trained research assistants distributed, collected and checked the completeness of the questionnaire and the data record form. A central coordinating center in Bangkok monitored the data collection process and the adherence to the recruitment guidelines.

Pilot test

Fifty two respondents at 2 medical centers in Bangkok completed the item pooled questionnaire.

Full scale survey

Four hundred and twenty four respondents at 8 medical centers in Thailand completed the tentative questionnaire (the REQ-Thai), the two global rating questions and the data record form.

Test-retest assessment

Thirty five respondents from the full scale survey completed the questionnaire twice. The duration before the second administration was 2 to 4 weeks after their original completion of the first questionnaire.

Data analysis

SPSS version 13 and LISREL version 8.72 were used to analyze the data for the present study. The descriptive statistics, the Cronbach's Alpha reliability coefficients, the test-retest intraclass correlation coefficient were presented. Correlations between the overall REQ-Thai score and the clinical variables, discriminative and construct validity testing were performed.

Results

A total of 424 respondents completed the tentative questionnaire. Their average age was 34.3 years. Most were female (75.7%). The majority were myopia (66.9%), followed by emmetropia (26.7%) and hyperopia (6.4%). The most prevalent mode of refractive correction was eye glasses (35.6%), followed by no correction-natural emmetrope (17.7%), contact lenses (16.5%), no correction-post surgery (15.3%) and preoperative evaluation for refractive surgery (14.9%). Most of those responding were recruited from the hospitals in Bangkok (77%).

Cronbach's Alpha reliability coefficients, test-retest intraclass correlation coefficient

The questionnaire had 6 dimensions (Table 2). The Cronbach's Alpha coefficients of the dimensions were good for every form: the item pool (0.756 to 0.979),

Table 2. Comparison of Cronbach's Alpha reliability coefficients for the item pool questionnaire, the REQ-Thai (long form) and its short form

Dimension	Item pool questionnaire		The REQ-Thai (long form)		Short form	
	No. of items	Cronbach's alpha	No. of items	Cronbach's alpha	No. of items	Cronbach's alpha
Quality of vision	25	0.955	8	0.922	6	0.906
Visual function	43	0.979	39	0.960	20	0.902
Social function	9	0.876	9	0.744	6	0.687
Psychological	14	0.923	11	0.950	6	0.900
Symptoms	7	0.756	6	0.849	3	0.709
Refractive correction problems	17	0.933	14	0.917	7	0.811
Total	115	0.968	87	0.985	48	0.942

Test-retest intraclass correlation coefficient for the overall REQ-Thai score (long form) = 0.92 (n = 35)

Table 3. [1]CFA factor loading estimates, standard error (SE), T values and construct reliability estimates of the refractive error quality of life scale for Thai adults (the REQ-Thai) (long form/short form)

	Long form				Short form			
Observed variable	*b	**SE	***T	[2]CR	*b	**SE	***T	[2]CR
First order CFA								
Quality of night vision	1.000			0.789	1.000			0.735
Clarity of vision	0.954	0.031	30.676	0.864	1.102	0.044	25.027	0.844
Daytime driving	1.000			0.990	1.000			0.989
Night driving	1.187	0.033	35.549	0.745	1.163	0.042	27.841	0.636
Distant vision	1.000			0.984	1.000			0.596
Near vision	1.019	0.085	11.968	0.968	0.941	0.079	11.938	0.433
Daily activities	1.000			0.809	1.000			0.919
Sports/Exercises	1.144	0.118	9.732	0.573	0.900	0.095	9.45	0.461
Social function	0.593	0.034	17.429	0.889	1.598	0.303	5.279	0.538
Self perception	1.000			0.726	1.000			0.673
Concern/worry	1.165	0.043	26.807	0.868	1.166	0.053	21.973	0.672
Symptoms	0.848			0.706	8.473	0.418	20.276	0.835
Refraction problems	1.000			0.834	1.000			0.764
Convenience/cost	1.084	0.038	28.400	0.766	1.039	0.048	21.534	0.660
Second order CFA								
Driving	0.495	0.070	7.080	0.189	0.469	0.072	6.519	0.605
Vision	0.675	0.039	17.335	0.629	0.544	0.043	12.647	0.865
Activity	0.711	0.034	21.123	0.877	0.675	0.075	8.963	0.259
Third order CFA								
Quality of vision	0.524	0.077	6.776	0.282	0.526	0.053	9.897	0.299
Visual function	0.355	0.060	5.928	0.165	0.608	0.085	7.152	0.341
Social function	0.870	0.075	11.614	0.665	0.347	0.085	4.105	0.707
Psychological	1.019	0.057	18.004	0.839	0.921	0.071	12.896	0.826
Symptoms	0.367	0.063	5.815	0.135	0.063	0.008	7.488	0.283
Refractive problems	0.937	0.039	23.765	0.971	0.862	0.041	21.139	0.937
Construct to be tested = the refractive error quality of life scale for Thai adults	Long form: Chi-square = 54.21, [3]df = 41, [4]p = 0.081, [5]GFI = 0.982, [6]AGFI = 0.953, [7]RMSEA = 0.028				Short form: Chi-square = 50.19, [3]df = 36, [4]p = 0.058, [5]GFI = 0.983, [6]AGFI = 0.951, [7]RMSEA = 0.031			

[1]CFA = confirmatory factor analysis, *b = factor loading estimates, **SE = standard error, ***T = T values, [2]CR = construct reliability, [3]df = degree of freedom, [4]p = p-value, [5]GFI = goodness-of-fit index, [6]AGFI = Adjusted goodness-of-fit index, [7]RMSEA = Root mean square error of approximation

the long form (0.744 to 0.985) and the short form (0.687 to 0.942). The test-retest intraclass correlation coefficient for the overall scale (long form) was high (0.92) (n = 35).

Validity testing

Correlations between the overall REQ-Thai score and the clinical variables

The analysis showed that the spherical equivalent refraction before correction and the global rating of vision-related QOL had low correlations with opposite direction with the overall REQ-Thai score (r = -0.240 and -0.292 respectively). The correlation between the logMAR best spectacle corrected visual acuity and the overall REQ-Thai score was low and not significant.

Discriminative validity

The analysis showed that emmetropia had the lowest mean score of the REQ-Thai, followed by hyperopia and myopia. This means that emmetropia had a better quality of life while hyperopia and myopia had a poorer quality of life (Low score of the REQ-Thai indicates good quality of life).

Among various types of refractive correction, this scale showed that emmetropia scored the best; eye glasses wearers, post surgery persons and contact lenses wearers scored nearly the same while preoperative evaluation persons scored the worst.

Construct validity testing by the confirmatory factor analysis (CFA)

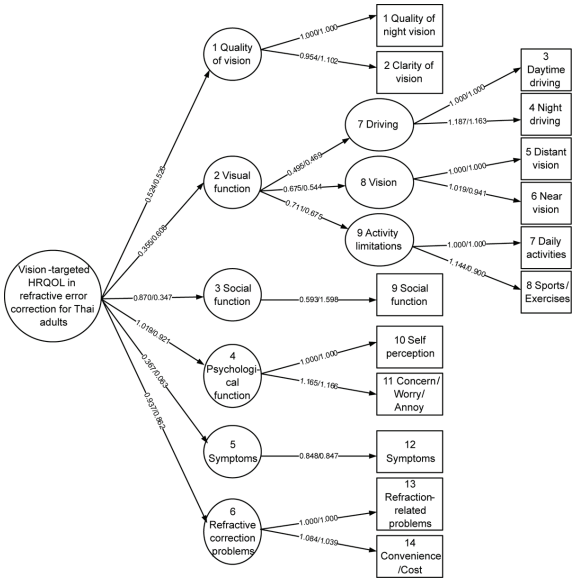
Analysis of the confirmatory factor analysis demonstrated that the refractive error quality of life scale for Thai adults measurement model was valid (Fig. 1, Table 3). All indicators had significant factor loadings of more than 0.5. The indicator that had the highest factor loading (1.187) was night driving. The latent variable that had the highest factor loading (1.019) was psychological dimension. Construct reliability of the indicators ranged from 0.573 to 0.990. Construct reliability of the latent variables ranged from 0.135 to 0.971.

For the short form, the results of CFA were consistent with the long form and confirmed that the short form was valid.

Discussion

This is the first scale for measuring vision-targeted HRQOL in refractive correction for Thai adults that was developed with strong research methodology and large sample size. The 8 medical centers participating in the present study were located in all parts of Thailand. The aim was to obtain a good representative sample of Thai adults. This scale with 6 dimensions completely covers all essential dimensions for HRQOL. None of the existing refractive error-specific QOL questionnaires contained all these 6 dimensions together in their work[5,6,8-10,11-13]. However, these 6 dimensions are not specific to Thai people but can be applied for use with persons in other countries. To the authors' knowledge, the vision-related quality of life scales which have been validated by confirmatory factor analysis are scarce. Nonetheless, the construct validity of this scale performed by the confirmatory factor analysis showed a satisfactory result.

Correlations between the REQ-Thai and the spherical equivalent refraction and the global rating of vision-related QOL were low with statistical significance. This could mean that the vision-targeted HRQOL and the clinical standard measurement, *i.e.*, spherical equivalent refraction, are not as closely related as expected. This is consistent with other



Long form: Chi-Square GOF = 54.21, df = 41, p = 0.081, GFI = 0.982, AGFI = 0.982, RMSEA = 0.028
Short form: Chi-Square GOF = 50.19, df = 36, p = 0.058, GFI = 0.983, AGFI = 0.951, RMSEA = 0.031

Fig. 1 CFA factor loading estimates of the long form/short form measurement model of the refractive error quality of life scale for Thai adults (the REQ-Thai)

studies[5,12]. Correlation between the REQ-Thai and the logMAR best spectacle corrected visual acuity was very low and not significant. This could be in part because the range of visual acuities included was quite narrow (all respondents were required to have BSCVA of 20/30 or better in their worse eye). For discriminative validity, this scale showed that emmetropia scored the best but could not show the difference between myopia and hyperopia. For discriminating between the types of refractive correction, this scale showed that emmetropia scored the best; followed by post surgery persons, eye glasses wearers and contact lenses wearers. Preoperative evaluation persons scored the worst. These factors were consistent with other studies in that their scale can discriminate between the types of refractive error and the types of refractive correction[8,10,11].

Comparable high values for Cronbach's Alpha reliability coefficients were obtained with both long and short version questionnaire. This indicates an adequate reliability of both versions of the questionnaire. The test-retest intraclass correlation coefficient was very high (0.92). The confirmatory factor analysis also demonstrated the good construct validity of both versions of the questionnaire. For its acceptability, the short version questionnaire is recommended for use in clinical practice or in a research setting.

Potential conflicts of interest

None.

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การพัฒนามาตรวัดคุณภาพชีวิตสำหรับคนไทยวัยผู้ใหญ่ที่มีสายตาผิดปกติ

รุ่งทิพย์ สุขวรรณ์, นงลักษณ์ วิรัชชัย, ปิยทัศน์ ทัศนาวิวัฒน์, สมหวัง พิธิยานุวัฒน์, มานพ คณะโต, สบง ศรีวรรณบูรณ์, Gordon H Guyatt

วัตถุประสงค์: *การศึกษานี้มีวัตถุประสงค์เพื่อพัฒนามาตรวัดคุณภาพชีวิตสำหรับคนไทยวัยผู้ใหญ่ที่มีสายตาผิดปกติ*
วัสดุและวิธีการ: *ได้ทำการเก็บข้อมูลจากผู้มารับการตรวจตา 424 คน จาก โรงพยาบาล 5 แห่ง ในกรุงเทพ และอีก 3 แห่งจากเชียงใหม่ สงขลา และขอนแก่น ผู้เข้าร่วมการศึกษาเป็นผู้มีสายตาปกติ หรือ ผิดปกติที่แก้ไขแล้วมองเห็นระดับ 20/30 หรือ ดีกว่า การลดข้อคำถามทำโดย 3 วิธีร่วมกัน ได้แก่ ความคิดเห็น ของผู้เชี่ยวชาญ Impact method และ Item total correlation method การตรวจสอบความเที่ยงทำโดยวิธีมาตรฐาน ตรวจสอบความตรงทั้งแบบ convergent, discriminative และ construct validity*
ผลการศึกษา: *แบบสอบถามที่พัฒนาขึ้นประกอบด้วย 87 ข้อ ใน 6 มิติ ดังนี้ 1) คุณภาพการมองเห็น 2) การใช้สายตา 3) สังคม 4) จิตวิทยา 5) อาการ และ 6) ปัญหาจากการแก้ไขสายตา เป็นมาตรลิเคิร์ท 5 ระดับ สำหรับความเที่ยง ค่าสัมประสิทธิ์แอลฟา ของครอนบาคของแต่ละมิติมีค่าตั้งแต่ 0.756 ถึง 0.979 ผลการตรวจสอบความตรงทุกแบบพบว่ามีความตรงดี โดยความตรงเชิงโครงสร้างตรวจสอบด้วยการวิเคราะห์องค์ประกอบเชิงยืนยัน นอกจากนั้นยังได้พัฒนาแบบสอบถาม ฉบับสั้นขึ้นประกอบด้วย 48 ข้อคำถาม ตรวจสอบแล้วมีความเที่ยง และความตรงดี*
สรุป: *แบบสอบถามนี้เป็นมาตรวัดคุณภาพชีวิตสำหรับคนไทยวัยผู้ใหญ่ที่มีสายตาผิดปกติฉบับแรกที่มีการตรวจสอบความเที่ยง และความตรงได้รับการพัฒนาขึ้นด้วยระเบียบวิธีวิจัยที่ถูกต้อง และใช้กลุ่มตัวอย่างขนาดใหญ่*