

## Validation of the Japanese version of the quality of recovery score QoR-40

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Received: 2 April 2010 / Accepted: 11 April 2011 / Published online: 31 May 2011  
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### Abstract

**Purpose** The quality of recovery score QoR-40 is a recovery-specific and patient-rated questionnaire to assess the early postoperative health status of patients. However, the Japanese version of the QoR40 has not been established. The aim of this study was to validate the quality of recovery 40 Japanese version (the QoR-40J) according to the methods adopted by the International Quality of Life Assessment (IQOLA) project.

**Methods** After obtaining ethics committee approval and consent, 192 general and otological surgical patients were studied. The QoR-40J was used to measure postoperative health status on day 3 and 1 month after surgery. The level of quality of life was also evaluated using a general, health-related quality of life questionnaire (Short-Form Health Survey-36 sub-scales; SF-36), at 1 month after the surgery. Psychometric analysis including the following properties: test–retest reliability, internal consistency, predictive validity, and measurement of responsiveness, was performed to validate the QoR-40J.

**Results** Test–retest reliability (Spearman's correlation coefficient) and internal consistency (Cronbach's  $\alpha$ ) of the QoR-40J were 0.887 and 0.91, respectively. A significant relationship was observed between the total QoR-40J score and duration of hospitalization ( $r = -0.291$ ) and between the global QoR-40J score and postoperative scores of the SF-36 sub-scales (physical function,  $\rho = 0.287$ ; vital score,  $\rho = 0.349$ ). The standardized mean of the QoR-40J, a measurement of responsiveness, was 0.70.

**Conclusion** The results of the psychometric analysis indicated that the QoR-40J has characteristics of acceptable validity, reliability, and responsiveness in clinical practice in Japan. The QoR-40J may aid in evaluating the quality of recovery after surgery or the quality of methods of anesthesia.

**Keywords** Japanese · QoR-40 · Translation · Quality of life · Cross-cultural

### Introduction

The quality of recovery score QoR-40 is a recovery-specific and patient-rated questionnaire which contains 40 items and is comprised of five sub-scales: comfort, emotion, patient support, physical independence, and pain [1]. To evaluate the degree of recovery after anesthesia and early postoperative health status, the QoR-40 score has been used after anesthesia and general [1], neurological [2], cardiac [3], and knee surgery [4]. Furthermore, the QoR-40 score has been shown to be significantly correlated with the degree of postoperative quality of life (QoL), measured by the Medical Outcome Study Short-Form Health Survey (SF-36), a general, health-related QoL questionnaire, in patients after cardiac surgery [3]. Bost et al. [4] reported

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that the combined use of the QoR-40 and a general, health-related QoL questionnaire, SF-8, provided useful assessments of postoperative health status after knee surgery. Therefore, the QoR-40 could be an important means to evaluate the impacts of anesthesia and surgery on postoperative QoL, as well as quality of recovery, which may provide information to improve the quality of anesthesia and surgery. However, a Japanese version of the QoR-40 (QoR-40J) has not been established. The development of the QoR-40J and its validation would be of clinical value to improve the quality of anesthesia and surgery in Japan. The present study was therefore conducted to validate the QoR-40J according to the methods adopted by the International Quality of Life Assessment (IQOLA) project [5].

## Methods

### Patients

After approval was obtained from the Ethics Committee of Tenri General Hospital, written informed consent was obtained from all patients. This study enrolled patients who had received general and otological surgery under general anesthesia from October 2002 to April 2003 at Tenri General Hospital, Nara, Japan. Patients were excluded if they were aged less than 17 years or more than 83 years, could not understand Japanese, were psychiatrically disturbed, or had any pre-existing medical condition that limited objective assessment after surgery.

### Development of the QoR-40J

The QoR-40 is a 40-item questionnaire intended to measure quality of recovery after anesthesia and surgery [1]. Each item is scored on a five-point Likert scale, and the items are grouped according to various sub-scales (dimensions) of recovery: emotional state ( $n = 9$ ), physical comfort ( $n = 12$ ), patient support ( $n = 7$ ), physical independence ( $n = 5$ ), and pain ( $n = 7$ ). To construct the QoR-40J, we first obtained development authorization from the original author. With regard to our translation procedure, we referred to the methods adopted by the IQOLA project [5].

### Pilot testing

After obtaining confirmation from the original author regarding the backward translation, a member of our research team conducted pilot testing on 10 randomly selected patients who had received general anesthesia in August 2002. After the pilot testing, we obtained permission from the original author to change one item in the

physical independence sub-category (“able to return to work or usual activity”), which Japanese patients were unable to answer during pilot testing, to another item (“able to go to the lavatory by yourself”). With this change, the Japanese version of the QoR-40 was finalized (Table 1).

### Protocol

In the present study, pre- and postoperative health status was assessed in Japanese patients using the QoR-40J. Preoperative and post-discharge QoL was measured using the SF-36, Japanese version 2.0 [6]. The SF-36 is a general, health-related QoL questionnaire which is composed of eight scales: physical functioning, role-physical, bodily pain, general health perception, vitality, social functioning, role-emotional, and mental health. The SF-36 Japanese version 2.0 has been validated for usage in Japan [6].

To test the clinical feasibility of the QoR-40J, we used rate of completion, recruitment rate, and time taken to complete the questionnaire. We previously conducted a factor analysis (principal factor method) of the QoR-40J to assess whether or not use of the QoR-40J was relevant to count up and had factorial validity [7]. To assess reliability, we used test–retest reliability 3 days after surgery, internal consistency (Cronbach’s  $\alpha$ ), and split-half reliability. To measure test–retest reliability, we performed the QoR-40J in the same patients in the morning and the afternoon 3 days after their operation. To test the validity of the QoR-40J, we assessed predictive, convergent, concurrent, and discriminant validity. For predictive validity, we calculated the correlation between duration of hospitalization and the global QoR-40J score on day 3 and 1 month after surgery, as well as that between the postoperative global QoR-40J score and the sub-scales of the SF-36 1 month after surgery. For concurrent validity, we compared the global QoR-40J score with the recovery visual analogue scale (VAS: see Appendix 1) [8]. To discriminate validity, we assessed the difference of mean score for the global QoR-40J between major and minor surgery 3 days after surgery. In the present study, abdominal surgery was defined as major surgery, whereas operations on the surface of the body and laparoscopic operations were defined as minor surgery. To assess the responsiveness, the standardized responsive mean (SRM) was calculated by dividing the mean change in the score by the standard deviation (SD) of the change [9].

### Statistical analysis

Patient characteristics and preoperative data are presented as means (SD) and ranges. Associations were measured using Pearson’s correlation coefficient ( $r$ ) and Spearman’s

**Table 1** Items included in the Japanese quality of recovery score (QoR-40J) and factor analysis results

Items	Mean	SD	Factor loading	$h^2$
<b>Emotional state</b>				
Feeling comfortable	3.84	1.20	0.795	0.632
Having a feeling of general well-being	3.95	1.19	0.715	0.511
Feeling in control	4.23	1.07	0.688	0.474
Had bad dream	4.59	0.96	0.412	0.169
Feeling anxious	4.45	0.90	0.701	0.491
Feeling angry	4.73	0.65	0.631	0.398
Feeling depressed	4.51	0.87	0.687	0.472
Feeling alone	4.65	0.72	0.626	0.392
Had difficulty falling asleep	4.12	1.19	0.584	0.341
<b>Physical comfort</b>				
Able to breathe easily	4.38	1.00	0.505	0.255
Have had a good sleep	3.73	1.30	0.603	0.364
Been able to enjoy food	2.58	1.75	0.439	0.193
Feel rested	3.69	1.27	0.689	0.475
Nausea	4.67	0.86	0.439	0.193
Had difficulty falling asleep	4.12	1.19	0.584	0.341
Vomiting	4.84	0.73	0.408	0.167
Dry-retching	4.77	0.74	0.409	0.167
Feeling restless	4.18	1.13	0.627	0.394
Shaking or twitching	4.73	0.68	0.549	0.301
Shivering	4.81	0.63	0.544	0.295
Feeling too cold	4.76	0.61	0.452	0.205
Feeling dizzy	4.64	0.80	0.452	0.204
<b>Patient support</b>				
Able to communicate with hospital staff (during hospitalization)	4.49	0.85	0.64	0.410
Able to communicate with family or friends	4.53	0.83	0.600	0.360
Getting support from hospital doctors (when in hospital)	4.64	0.71	0.603	0.363
Getting support from hospital nurses (when in hospital)	4.66	0.71	0.613	0.376
Having support from family or friends	4.71	0.64	0.535	0.286
Able to understand instructions and advice	4.68	0.68	0.530	0.281
Feeling confused	4.79	0.56	0.308	0.095
<b>Physical independence</b>				
Able to go to the lavatory by yourself	3.27	1.89	0.428	0.184
Able to write	3.75	1.54	0.504	0.254
Have normal speech	4.16	1.15	0.524	0.275
Able to wash, brush teeth, or shave	3.76	1.53	0.484	0.234
Able to look after your own appearance	3.74	1.43	0.555	0.308
<b>Pain</b>				
Moderate pain	3.68	1.16	0.507	0.257
Severe pain	4.38	0.97	0.513	0.263
Headache	4.64	0.84	0.398	0.158
Muscle pain	4.48	0.93	0.457	0.209
Backache	4.27	1.07	0.384	0.147
Sore throat	4.42	0.95	0.355	0.126
Sore mouth	4.73	0.74	0.311	0.097

SD standard deviation,  $h^2$  communality

rank correlation coefficient ( $\rho$ ). Comparison of quality of recovery score was analyzed using the Mann–Whitney *U*-test. All analyses were performed using SPSS statistics for Windows, version 17.0 (SPSS, Chicago, IL, USA). Values were considered significant for  $p < 0.05$ .

## Results

### Patients and questionnaire completion

The present study ultimately enrolled 192 patients (mean age 57 years; range 17–83 years) recovering from general and otological surgery (Table 2). The methods of anesthesia included 135 general anesthesia and 57 general anesthesia with epidural anesthesia. No patients approached for enrolment refused to participate and recruitment for the questionnaires was perfectly done. The completion rate of the QoR-40J was 97% before surgery and 96% on the third day after surgery. Of the total of 192 patients enrolled, 156 were further evaluated using the SF-36 1 month after surgery, for which the return rate was 85%.

**Table 2** Patient characteristics and extent of surgery ( $n = 192$ )

Characteristic	Value
Age (years) average (range)	57 (17–83)
Sex ( $n$ , males/females)	99/93
ASA PS ( $n$ , I/II/III)	93/95/4
Surgery ( $n$ )	
Major surgery	104
Minor surgery	88
General surgery	161
Otological surgery	31
Anesthesia time (min)	
Mean	198 (SD = 97)
Range	55–630
Surgical time (min)	
Mean	150 (SD = 93)
Range	50–530

ASA PS American Society of Anesthesiologists performance status

The median duration of hospitalization was 15 days. Completion of the QoR-40J took 5.3 (SD 3.7) min before surgery and 4.8 (SD 2.7) min on the third day after surgery, and most patients were able to complete the QoR-40J without any assistance.

### QoR-40J score

The results of the factor analysis (principal factor analysis) showed that the ratio of explanatory importance of the factors by one factor ( $R^2$ ) was 0.3 [7]. Test–retest reliability (Spearman's correlation coefficient), internal consistency (Cronbach's  $\alpha$ ) of and split-half reliability of the QoR-40J 3 days after surgery were 0.887, 0.91, and 0.75, respectively. The recommended value for these tests of reliability is more than 0.7 [10]. The median item-to-own dimension coefficient  $r$  and Cronbach's  $\alpha$  for each QoR-40J dimension 3 days after surgery were as follows: patient comfort ( $r = 0.840$ ,  $\alpha = 0.791$ ), emotional state ( $r = 0.471$ ,  $\alpha = 0.885$ ), physical independence ( $r = 0.717$ ,  $\alpha = 0.844$ ), patient support ( $r = 0.642$ ,  $\alpha = 0.7446$ ), and pain ( $r = 0.691$ ,  $\alpha = 0.7446$ ) (Table 3). A significant negative correlation was observed between the global QoR-40J score on the third day after surgery and duration of hospitalization ( $\rho = -0.291$ ,  $p < 0.0001$ ). In contrast, a positive correlation was observed between the global QoR-40J score on the third day after surgery and recovery VAS ( $\rho = 0.58$ ,  $p < 0.001$ ). Moreover, there were moderate positive relationships between the global QoR-40J score on the third day and 1 month after surgery and the SF-36 sub-scale 1 month after surgery (physical functioning,  $\rho = 0.287$ , 0.372; vitality,  $\rho = 0.349$ , 0.483).

Although no significant difference in the global QoR-40J score was observed between patients receiving major surgery and those with minor surgery during the preoperative period ( $p = 0.097$ ), a statistically significant difference was noted on the third day after surgery ( $p < 0.001$ ). Changes in perioperative health status for each dimension and responsiveness are summarized in Table 4. The mean global QoR-40J score was 187 (SD = 13) before surgery and 173 (SD = 22) three days after surgery. From these data, the standardized response mean (SRM) of the QoR-40J was calculated to be 0.70. An SRM of 0.2 represents a

**Table 3** Inter-dimension correlation for the QoR-40J (3 days after operation)

	Global QoR-40J	Emotion	Comfort	Patient support	Physical independence	Pain
Emotion	0.471	–				
Comfort	0.840	0.421	–			
Patient support	0.642	0.285	0.429	–		
Physical independence	0.717	0.314	0.589	0.436	–	
Pain	0.691	0.286	0.523	0.348	0.291	–

Each dimension contains multiple items

**Table 4** Changes in health status of patients interviewed before and 3 days after surgery

	Maximum score possible	Preoperative score	Postoperative score	Mean change (95% CI)	SRM
Global QoR-40J QoR-40 dimensions	200	187 (13)	173 (22)	−14 (−11 to −17)	0.70
Emotional state	45	40.2 (5.4)	40.3 (6.0)	−0.08 (−1.0 to 0.9)	0.013
Physical comfort	60	57 (4.0)	29 (4.8)	−28 (−27 to −29)	5.3
Patient support	35	33 (2.9)	32 (4.1)	−0.8 (−0.1 to −1.4)	0.18
Physical independence	25	24 (4.7)	19 (6.0)	−5 (−4 to −6)	0.72
Pain	35	33 (2.5)	31 (4.2)	−2.8 (−2.1 to −3.4)	0.64

CI confidence interval, SRM standardized response mean

small effect of intervention, 0.5 a moderate effect, and 0.8 or greater a large effect [9]. The scores of the sub-scales of the SF-36, physical performance, before operation and 1 month after surgery, were 87.4 and 83.5 (SRM 0.2), respectively, and the scores for vitality were 62.5 and 57.3 (SRM 0.2), respectively.

## Discussion

Here, we assessed the validity, reliability, and clinical acceptability of the Japanese version of the QoR-40 in patients recovering from general surgery and otological surgery. The results of our examination indicated that the QoR-40J has acceptable levels of feasibility, validity, and reliability in clinical practice, extending beyond cultural and institutional differences.

Most patients in the present study were able to complete the 40-item questionnaire in about 5 min, indicating good feasibility, and psychometric tests supported the questionnaire's validity and reliability. Criterion validity assessment showed a negative correlation between the QoR-40J and duration of hospitalization, and a positive correlation between the QoR-40J and the sub-scales of the SF-36, results which are also indicative of the score's predictive validity. With regard to concurrent validity, the QoR-40J showed good correlation with recovery VAS. Further, with regard to known group validity, the QoR-40J score was able to discriminate between recovery states after major surgery and minor surgery. Inter-dimension correlations in the present study were moderate, and each dimension was found to be better correlated with overall correlations, an observation which may support construct validity.

The SRM of the global QoR-40J was 0.70. We note that an SRM of 0.7 indicates moderate ability to detect changes in postoperative recovery [9]. However, the SRM of the emotion-oriented dimension as assessed in the present study was low compared to that of the

original QoR-40 (0.013 vs. 0.35) [1]. This low SRM value may be associated with the difference in measuring times between the present and previous studies. In the original study, the postoperative QoR-40 was assessed 1 day after surgery [1]. In the present study, however, this score was assessed 3 days after surgery. After 3 days, the patient's emotional state may be nearly completely recovered, thus explaining the lower SRM value. We chose to assess the QoR-40J score 3 days after surgery in the present study not only to reduce the burden of responding to a questionnaire but also because the global QoR-40J score 3 days after cardiac surgery has been shown to be correlated with a patient's QoL after surgery [3]. Further, the change in emotional state may have decreased if hospital staff or available amenities were exceptionally good in the patient's opinion. The SRM of the SF-36 sub-categories did not show good responsiveness (SRM 0.2). This may mean that, at 1 month after surgery, in the patients in this study, the health status had returned to preoperative conditions. Concurrent validity assessment for the QoR-40J showed good correlation with the recovery VAS. The reliability was also confirmed. Cronbach's  $\alpha$  was 0.91, a value which exceeded the recommended value of 0.7 [10], and split-half reliability was 0.75. These results suggest that the QoR-40J can provide reliable assessment for evaluating patient recovery.

As a potential strength of our study, we conducted factor analysis, which had not been performed in the original validation study for the QoR-40. Results of the factor analysis showed that the QoR-40J is comprised of one factor (Table 1), a finding that supports the combining of scores into a single index based on factorial validity [7]. Further, the single item that was changed because of cultural and institutional differences in Japan (able to go to the lavatory by yourself) was proven to be functionally relevant, supporting the notion that our validation study exceeded cultural and institutional differences.

Several limitations of the present study warrant mention. First, only patients recovering from elective general surgery and otological surgery were included in this study, potentially affecting the generalizability of the questionnaire. Recent studies of neurosurgical and cardiac surgical patients have shown the usefulness of the original QoR40, although these patients were not included in the validation study of the original QoR40 [1–3]. This feature may be improved in future studies involving a larger pool of patients recovering from a wider range of surgeries. Second, we recognized that the QoR-40J had improbable face validity for the sub-scale of patient support in a Japanese cultural context. Further studies maybe needed to refine the QoR-40J in this respect.

To our knowledge, our study is the first cross-cultural validation of the QoR-40, endowing clinicians with a new tool with which to evaluate the recovery of Japanese patients after surgery. The management of questionnaires involving cross-cultural differences is extremely important in international research projects. Postoperative preventive care in Japanese patients may be facilitated by using this questionnaire, such as in administering intensive care to patients with poor recovery after surgery and facilitating contact with family doctors to care for patients with poor QoL after discharge.

## Conclusion

In the present study, we found that the QoR-40J has acceptable levels of feasibility, validity, and reliability in clinical practice, extending beyond cultural and institutional differences. The QoR-40J may facilitate improvement of recovery in patients with poor QoL, as well as aid in administering intensive care to these patients. Further, the QoR-40J may help doctors to more accurately predict a patient's QoL after discharge.

We presented this study at the 23rd academic congress of the Japanese Society of Anesthesiologists in the Kansai local region.

**Acknowledgments** We thank Professor Paul Myles for granting us permission to translate the QoR40 into Japanese.

## Appendix 1

Please rate the quality of your recovery on this scale by placing an X on the line.

For example, if you have a very good recovery, you would mark the line like this

Poor Recovery	————— X —————	Excellent Recovery
If you have had a poor recovery, you would mark the line like this		
Poor Recovery	————— X —————	Excellent Recovery
.....		
Please mark this line		
Poor Recovery	—————	Excellent Recovery
In severe pain		Pain-free
Nausea & Vomiting		Comfortable
Confused		Alert
Immobilized		Active
Unable to eat		Enjoying food
Unable to communicate		Communicate freely

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