Development and validation of Arabic version of the postoperative quality of recovery scale

ABSTRACT
Introduction: The postoperative quality of recovery scale (PostopQRS) is a widely used tool to assess the postoperative quality of recovery. Our aim was to translate, culturally adapt, and validate the PostopQRS questionnaire in Arabic.

Methodology: A systematic translation process was used to translate the original English PostopQRS into Arabic. After the pilot study, the translated version was validated among patients who underwent different types of surgeries. We examined the reliability (using internal consistency) and validity of the translated version. To examine the responsiveness of the translated PostopQRS, the questionnaire was administered 6 times among the same group of patients (once before surgery as baseline measure, and 5 times after surgery, up to 1 week after surgery).

Results: A total of 190 patients (10 men, 180 women) were included. Internal consistencies vary across each domain and overtime, with mostly good to excellent reliability. Most patients found the PostopQRS questions to be clear and easy to understand and thought the questionnaire items covered all their problem areas regarding their quality of recovery. In general, patients showed recovery across all five domains starting from postoperative day 1 (POD1). Patients showed the fastest recovery in the emotional domain, and the proportion of recovered patients remained stable over time. Most patients were recovered in the cognitive domain by POD1. Although only a small proportion of patients were recovered in the physiological and activities of daily living domains in POD1, most patients were recovered by POD3. The proportion of patients recovered in the nociceptive domain declined initially, but more patients showed recovery by POD3 and most were recovered by POD7. Furthermore, quality of recovery was related to the extent of surgery (major vs. minor).

Conclusion: Our translated version of PostopQRS was reliable and valid for use among Arabic-speaking patients. In addition, we showed that the PostopQRS was able to track the changes in recovery among patients in our study.

Key words: Anesthesia; Arabic; postoperative quality of recovery scale; quality of recovery; reliability; validity

Introduction
Postoperative quality of recovery has become an important measure that reflects on the surgeon, the anesthesiologist, and the institute performance. It has become an important primary endpoint in many clinical trials. A recent study...
suggests that using a single outcome (e.g., pain scores) as a surrogate measure for quality of recovery does not necessarily correlate with other important outcomes (e.g., length of hospital stay or patient satisfaction). Thus, a more comprehensive scale was suggested to be used as a primary endpoint for assessing quality of recovery.[11]

Multiple quality of recovery scales were developed in the last two decades, among which the postoperative quality of recovery scale (PostopQRS) is the most comprehensive and objective instrument. The PostopQRS is designed to be administered at multiple time points and includes the assessment of patients’ cognition across time. Furthermore, recovery is dichotomized as recovered versus not recovered, which is clinically useful.[2]

The PostopQRS was designed as a verbal only scale, so that it can be used either face-to-face or through telephone interview. In English version, face validity, feasibility, and discriminate validity have been shown, and it has been translated into eight languages.[3‑7] The background and use of the scale have been described elsewhere,[3] including the recalibration of cognitive scoring.[4] The PostopQRS assess quality of recovery in five domains: physiological, emotive, nociceptive, functional (i.e., activities in daily living), and cognitive.[5] Baseline measurements are acquired before surgery. Recovery is a dichotomized outcome defined by a return to baseline values or better at each of the postoperative measurement time points. “Overall recovery” requires recovery in all domains being assessed.

The cognitive domain consists of five verbal tests, and domain recovery requires recovery in all five tests. Variance in cognitive performance is a normal event and accordingly, the definition of recovery in cognitive tests was modified to include a tolerance factor to account for normal variability. Participants are allowed to perform a little worse than their baseline performance and still be scored as recovered. However, if the baseline scores in participants are lower than the tolerance factor, they would automatically be scored as recovered. As such, patients with low baseline scores cannot be evaluated for cognitive recovery. These patients are further excluded from scoring overall recovery if they fail recovery in another recovery domain. However, these participants are not excluded from other recovery domains.

The aim of this study was to translate, culturally adapt, and validate PostopQRS questionnaire into Arabic.

Methodology

A repeated measures’ study was conducted between April 2015 and December 2016 in three tertiary hospitals; Corniche Hospital, Abu Dhabi, United Arab Emirates (Institutional Review Board [IRB] approval No. Ch10041501), King Fahad Medical City (IRB approval No. 14‑107), Riyadh, Saudi Arabia, and King Faisal Specialist Hospital and Research Center (IRB approval No. ORA/0626/36), Riyadh, Saudi Arabia.

Translation and cultural adaptation

Initial translation (forward translation)

Five bilingual translators, from five Arabic countries (Syria, Saudi Arabia, Yemen, Sudan, and Egypt) with different dialects, were assigned. All translators speak Arabic as their mother language. Two of them are naive translators with no prior knowledge of the concepts being quantified; they are also not from the medical field. Each translator produced a written report of the translation that they complete, after which all the translators met and discussed translation and came to a consensus of the translation.

Backward translation

Two translators who were blinded to the original (English) questionnaires were assigned to translate the final Arabic version back into English. This is a process of validity checking to make sure that the translated version is reflecting the same item content as the original version. These two translators have their source language (English) as their mother tongue. The two translators were not aware of the concepts explored.

Expert committee

It was composed of methodologist, health professionals, and language professionals. The expert committee’s role was to consolidate all the versions of the questionnaire and develop the prefinal version of the questionnaire for field testing. The committee eventually reviewed all the translations and reaches a consensus on any discrepancy.

Measures

Postoperative quality of recovery scale

The questionnaire consists six domains:[8]

1. Physiology: It measures systolic blood pressure, heart rate, temperature, respiratory rate, and oxygen saturation. Airway control, level of agitation, level of consciousness, and activity on command relate to emergence and airway safety. This domain is tested in the immediate and early period. It is designed to assess physiologic safety and “home readiness” for day care surgery

2. Nociceptive: Assesses of pain and nausea, using 1–5 Likert rating scale

3. Emotional: Assesses of feelings of anxiety and depression at the time of measurement with scoring as for nociceptive domain

4. Activities of daily living: Assesses physical return to normality through activities of daily living (ADL). Ability
to stand, walk, and dress without assistance and ability to eat and drink and scored as 3 - easily, 2 - with difficulty, and 1 - not at all

5. Cognitive: Assess orientation, verbal memory, executive functioning, attention, and concentration. Tests produce performance scores. The tests are derived from validated and extensively used neurocognitive tests. Performance variability tolerance factor is applied. Participants not included in subsequent analysis if baseline scores are equal to or less than the tolerance factor. The tolerance factors are orientation – no tolerance factor, digits forward – tolerance factor = 2, digits back – tolerance factor = 1, word recall – tolerance factor = 3, and word generation – tolerance factor = 3

6. Overall patient perspective: Patients rate of their recovery with respect to their ADL, clarity of thought, ability to work, and satisfaction with anesthetic care. This domain differs from the others because there are no baseline measurements. It is complimentary to the other “recovery domains” but is not included in analysis of return to baseline.

**Study protocol**

An Arabic version of the PostopQRS questionnaire was administered six times to patients undergoing predetermined variable surgical procedures as follows [Figure 1]: patients were administered the questionnaires preoperation (T0), postanesthesia care unit (PACU) 15 min (T0 + 15 min), pre-PACU discharge (T0 + 40 min), day 1 postoperative (T0 + 1 day), day 3 postoperative (T0 + 3 days), and day 7 postoperative (T0 + 7 days). Data were entered into the PostopQRS website (www.postopqrs.com), which automatically scores recovery for each question and domain. The website also calculates the recovery in each domain and provides summary figures and tables. Eligible patients were any patient who are between 17- and 80-year-old undergoing any one of the procedures listed in Table 1. Exclusion criteria were patients with psychosis, significant visual impairment, physical disability, or patient’s refusal to participate in the study. Data were entered in a special data entry template that where designed on http://www.postopqrs.com.

**Pilot study**

The prefinal version was pilot tested on a group of 31 patients (all females), data not shown. The committee met at this point and approved the prefinal version as final. Examples from the final Arabic version presented in the Appendices 1 and 2, the complete English version is available at the website http://www.postopqrs.com and for Arabic versions contact support@postopqrs.com.

**Assessing face validity**

After completing the PostopQRS for the first time, patients responded to five statements regarding the PostopQRS items on a 5-point Likert-type scale: 1 = totally disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. The five statements were (1) questions were clear and easy; (2) questions covered all your problem areas with your recovery; (3) you would like the use of this questionnaire for future assessments; (4) the questionnaire lacks important questions regarding your recovery; (5) any of the questions violate your privacy.

**Statistical analysis**

All data analyses were performed in R version 3.3.2 (2016-10-31). Descriptive statistics (number of patients,
mean, standard deviation [SD]) was presented for the PostopQRS factors.

Reliability
The internal consistency of the PostopQRS was examined using Cronbach’s $\alpha$. Cronbach’s $\alpha$ ranges from 0 (no internal consistency; none of the items are correlated with each other) to 1 (perfect internal consistency; all of the items are perfectly correlated with each other). $\alpha$ was computed for each dimension in the PostopQRS. An instrument with $\alpha \geq 0.70$ is typically considered to have adequate internal consistency.\(^\text{9}\) As $\alpha$ is a function of the questionnaire’s length, $\alpha$ is expected to be lower for the scales with fewer items than those with more items.

As two of the PostopQRS factors (nociceptive and emotional) consist of only two items, Spearman–Brown coefficients were estimated instead.\(^\text{10}\) The Spearman–Brown coefficients can be interpreted similarly as with the Cronbach’s $\alpha$.

Validity
Responsiveness
Responsiveness was modeled as changes in the number of recovered items in each PostopQRS factor over time. Considering the repeated nature of the multiple assessments, generalized linear mixed effects models (GLMMs) are used to take into account the correlated observations within patients. The changes in the number of recovered items were estimated using GLMMs, modeled as count data. Time of administration (in days) was modeled as fixed effects and patients as the random effect.

To examine the extent to which patients’ characteristics (e.g., gender, age, ASA, in/out patient) and surgical information (e.g., type of surgery, anesthesia duration) were associated with changes in patients’ responses, these variables were included as fixed effects in the subsequent GLMMs as well. Results from these GLMMs provide information with respect to whether patients’ responses in overall patient satisfaction (averaged across time) are associated with patients’ characteristics and surgical information.

Results
A total of 190 patients (10 men, 180 women) participated in the validation study of the PostopQRS questionnaire. The average age was 37.1 (SD = 8.8), with an average body mass index of 31.8 (SD = 9.0). Most patients had university level education (66.3%), with smaller proportions having received some high school (22.1%), less than high school (6.8%), or no education (4.7%). Of the enrolled patients, 21.6% were rated as 1, 68.4% were rated as 2, and 8.9% were rated as 3 on the ASA score. 138 (72.6%) patients were from Corniche Hospital, Abu Dhabi, 42 (22.1%) from King Fahad Medical City, and 10 (5.2%) from King Faisal Specialized Hospital.

Twenty-seven (14.2%) patients were outpatient admission, and 163 (85.8%) were inpatient admission. Most patients ($n = 187$; 98.4%) did not report having previous anesthesia problems. One hundred and forty-three (75.2%) patients underwent major surgery, and 47 (24.7%) underwent minor surgery [Table 1], 148 underwent obstetrics and gynecology surgery, 19 abdominal surgery, 14 orthopedic and spine surgery, and 9 breast and endocrine surgery. The majority of the operations were open surgery ($n = 182$), with seven being endoscopic and one being closed surgery. The average duration of anesthesia time was 80.7 min (SD = 73.5, median = 60, range = 15–600). Completion and missing rates are presented in Table 2. The proportion of patients recovered in each factor of the PostopQRS are presented in Table 3 and plotted in Figure 2.

Reliability
Reliability estimates for the PostopQRS factors are presented in Table 4. Cronbach’s $\alpha$s were computed for the physiological, ADL, cognitive, and overall patient perspective factors. Spearman–Brown estimates were computed for the nociceptive and emotive factors as these two factors consisted of only two items. Internal consistencies for the physiological factor were good for baseline and T0 + 15 min, poor for T0 + 40 min, and excellent for T0 + 1 day. The
reliability for the two nociceptive items was consistently poor across all assessments, whereas reliability for the two emotional items was moderate to good, except at the T0 + 40 min assessment. Internal consistencies for the ADL and cognitive factors were consistently good across all assessment time points. The overall patient perspective showed moderate to good internal consistencies at different time points.

Validity

Face validity

Patients’ responses to the five questions assessing the face validity of the PostopQRS are presented in Table 5. The majority of the patients endorsed agree or strongly agree that the PostopQRS questions to be clear and easy to understand, the questionnaire items covered all their problem areas regarding their postoperative recovery, and that most would
Table 3: Percentage of patients recovered on all items of the postoperative quality recovery scale

| Domains          | PACU (T15) | PACU (T40) | POD1 | POD3 | POD7 |
|------------------|------------|------------|------|------|------|
| All domains      | 15.8       | 5.3        | 12.6 | 19.9 | 35.3 |
| Physiological    | 64.5       | 25.9       | 94.0 | —    | —    |
| Blood pressure   | 92.5       | 88.1       | 98.4 | —    | —    |
| Heart rate       | 94.8       | 91.5       | 98.9 | —    | —    |
| Ventilation rate | 90.8       | 84.7       | 98.4 | —    | —    |
| Temperature      | 63.3       | 89.8       | 98.9 | —    | —    |
| SpO2             | 93.1       | 93.3       | 98.4 | —    | —    |
| Airway           | 94.3       | 76.3       | 98.9 | —    | —    |
| Agitation        | 86.2       | 81.4       | 97.8 | —    | —    |
| Consciousness    | 90.2       | 67.2       | —    | —    | —    |
| Response to      | 89.5       | 69.5       | —    | —    | —    |
| commands         |            |            |      |      |      |
| Nociceptive      | 61.0       | 47.5       | 37.9 | 51.9 | 74.8 |
| Pain             | 79.7       | 52.5       | 42.6 | 53.5 | 76.2 |
| Nausea           | 76.2       | 78.0       | 84.2 | 94.7 | 96.0 |
| Emotional        | 84.3       | 83.1       | 81.0 | 87.2 | 88.1 |
| Depressed        | 89.0       | 94.9       | 85.8 | 89.8 | 91.4 |
| Anxious          | 91.9       | 86.4       | 92.1 | 95.7 | 95.4 |
| Activities of    | —          | —          | 28.7 | 68.6 | 82.6 |
| daily living     |            |            |      |      |      |
| Ability to stand | —          | —          | 36.0 | 76.3 | 86.0 |
| Ability to walk  | —          | —          | 35.6 | 74.2 | 86.7 |
| Ability to eat   | —          | —          | 59.3 | 89.8 | 97.3 |
| Ability to dress | —          | —          | 52.9 | 85.9 | 95.3 |
| Cognitive        | 50.7       | 41.2       | 79.8 | 89.4 | 77.5 |
| Name, date, place| 92.9       | 75.9       | 98.9 | 100.0 | 97.3 |

Data are presented as percentage of recovery (return to baseline values or better) for individual tests within each domain. 51.3% of the patients had low baseline recovery scores.

PACU: Postanesthesia care unit; T15: 15 min after the patient admitted to PACU; T40: Before patient discharge from PACU (roughly 40 min after PACU admission); POD: Postoperative day.

Figure 2: Proportion of patients recovered at each time point by postoperative quality of recovery scale factors

Like to use the PostopQRS for their long-term follow-up assessment. Most patients disagreed that the PostopQRS lacks important questions regarding their postoperative recovery, suggesting that the PostopQRS addressed most, if not all, of the important issues associated with their postoperative recovery. Finally, most patients felt that the PostopQRS questions did not violate their privacy.

Responsiveness

The extent to which recovery (in terms of the number of items recovered in each factor) is associated with varying patient and surgical characteristics was examined using GLMMs. Time (in days) was modeled as the fixed effect (from T0 + 15 min to 7 days when appropriate), with patients modeled as the random effect. Patients’ characteristics (gender, age, ASA, in/outpatient) and surgical features (major/minor surgery) were also modeled as fixed effects. Age was divided by 10 to assist with model convergence. Results are presented in Table 6. Consistently across all five factors, the number of recovered items increased over time as to be expected with patients’ recovery.

On average, older patients were more likely to have more recovered items in the physiological factor than younger patients. However, the difference was small that it is not clinically meaningful. Patients who underwent minor surgery were more likely to have more recovered items in the nociceptive, ADL, and cognitive factors than those who underwent major surgery.

Patients’ average responses to the items in the overall patient perspective factor are illustrated in Figure 3. The extent to which patients’ responses changes are associated with varying patient and surgical characteristics were examined using LMMs, and other model specifications are similar to those with the GLMMs. Results are presented in Table 7. Consistently across all four items in the overall patient perspective factor, patients’ responses decreased over time, indicating being less impacted as they recover. On average, patients who underwent minor surgery were more likely to indicate being less impacted in their work and ADL than those who underwent major surgery.

Discussion

In this study, we translated and validated the PostopQRS questionnaire among patients undergoing a variety of operations in three major medical centers in two countries. We strived to develop a questionnaire that can be easily administered to Arabic-speaking patients speaking different dialects. The current results demonstrated validity of this Arabic version, sufficient for incorporation into clinical practice. Our study is the first cross-cultural validation of the
Terkawi, et al.: Arabic version of the PostopQRS

Quality of recovery is a relatively new area for anesthesiology as it is a deviation from hospital- and doctor-based outcomes to patient-reported outcomes. These outcomes are complimentary rather than competitive. As recovery will change over time, it is important that the assessment tool is objective and designed for repeated measures. The PostopQRS was designed specifically for this purpose.[1]

The scale also includes assessment of the cognitive domain and is designed for verbal use. A completely verbal scale allows the instrument to be administered face-to-face or through telephone interview, which is vital once patients are discharged from the hospital. Surveys, which rely on face-to-face interviews typically, have low follow-up rates as many patients do not wish to return to the hospital for research purpose.

Further, the PostopQRS was designed to be a clinically useful tool. Recovery was dichotomized into “recovered” or “not recovered,” allowing the instrument to identify patients who recovered well versus those who did not recover in one or more domains. The practical implication is that patients have recovered well early will remain recovered and can be fast tracked. By identifying patients who did not recover in one or more domains at different time points, clinicians can make use of the information to implement additional treatments to improve the patients’ recovery profile.[13]

The PostopQRS Scientific Committee approves groups to translate the scale. The standard procedure is both forward and reverse translation, followed by a validation in clinical practice in the countries where the language is primarily spoken. This allows assessment of cultural appropriateness as well as any language differences. For example, in the cognitive scale, lists of words or letters used for the word generation task may have different frequencies in different languages.

In this study, we showed that recovery improves over time, which is consistent with studies found in English.[4,5] Certain items (such as the emotive domain) typically show high early recovery, which remained that way, whereas nociception and cognition tend to have a slower recovery profile over days to

| Table 4: Reliability estimates for Postoperative Quality of Recovery Scale factors at different assessment timepoints |
|---------------------------------------------------------------|
| **Factor** | **Baseline (T0)** | **T0 + 15 min** | **T0 + 40 min** | **T0 + 1 day** | **T0 + 3 days** | **T0 + 7 days** |
|---------------------------------------------|-----------|-------------|-------------|-------------|-------------|-------------|
| Physiological                             | 0.74*     | 0.74        | 0.43        | 0.90        | —           | —           |
| Nociceptive                                | 0.29      | 0.05        | 0.41        | 0.44        | 0.29        | 0.25        |
| Emotional                                  | 0.62      | 0.83        | 0.30        | 0.82        | 0.88        | 0.76        |
| ADL                                         | 0.96      | —           | —           | 0.86        | 0.85        | 0.82        |
| Cognitive                                   | 0.83      | 0.87        | 0.84        | 0.84        | 0.85        | 0.87        |
| Overall patient perspective                | —         | —           | —           | 0.67        | 0.66        | 0.82        |

Cronbach’s αs were computed for the physiological, ADL, cognitive, and overall patient perspective factors. Spearman-brown estimates were computed for the nociceptive and emotional factors. *Items 5, 6, 8, and 9 had no variance and were removed when estimating Cronbach’s α. ADL: Activities of daily living

| Table 5: Descriptive statistics for face validity |
|-----------------------------------------------|
| **Item** | **Mean** | **SD** | **Totally disagree (%)** | **Disagree (%)** | **Undecided (%)** | **Agree (%)** | **Strongly agree (%)** |
|------------------------------------------------|
| Questions were clear and easy                 | 4.3      | 0.59  | 0.0                        | 0.0               | 6.8           | 55.8          | 36.8          |
| Questions covered all my problem areas with   | 4.2      | 0.65  | 0.0                        | 0.53              | 12.1          | 55.8          | 31.1          |
| recovery after surgery                        |          |       |                            |                   |               |               |               |
| I would like the use of this questionnaire for | 3.8      | 0.75  | 1.1                        | 1.58              | 27.4          | 53.7          | 15.8          |
| future assessments                            |          |       |                            |                   |               |               |               |
| The questionnaire lacks important questions   | 2.2      | 0.71  | 10.5                       | 57.89             | 27.9          | 2.1           | 1.1           |
| regarding my recovery                        |          |       |                            |                   |               |               |               |
| Some of the questions violate my privacy      | 1.9      | 0.75  | 25.3                       | 58.42             | 12.6          | 2.1           | 1.1           |

SD: Standard deviation

Figure 3: Patients’ average responses to the overall patient perspective items at different time points. Error bars represent standard deviations.
weeks. The findings of this study were consistent with prior studies conducted in English. The tool was well received by the patients indicating feasibility for clinical use. We also showed that the quality of recovery was related to patients’ age and the extent of surgery (major vs. minor). The overall low baseline scores can be explained by the fact that the majority of our patients were pregnant coming for cesarean delivery and had the negative effects of late-term pregnancy.

Our study has some limitations. First, there was no cohort of nonoperative controls in the current study. Test-retest reliability cannot be performed in a clinical cohort, as the actual recovery is a dynamic process, rather than a static (unchanging) process. Second, as the types of surgery among our patients were relatively homogeneous, discriminant validation was not performed for the translated PostopQRS. However, discriminant validation has been shown in English version. Finally, as the majority of our

### Table 6: Fixed effects from generalized linear mixed effects models estimating the change in the number of recovered items in each Postoperative Quality of Recovery Scale factor over time

|                          | Estimate | SE   | Z     | P     |
|--------------------------|----------|------|-------|-------|
| **Physiological**        |          |      |       |       |
| Intercept                | 1.44     | 0.10 | 14.69 | <0.001|
| Time (days)              | 0.28     | 0.04 | 6.92  | <0.001|
| Gender (male)            | 0.05     | 0.15 | 0.38  | 0.707 |
| Age (1/10)               | 0.06     | 0.02 | 2.50  | 0.012 |
| ASA                      | −0.02    | 0.04 | −0.48 | 0.631 |
| Admission type (outpatient) | −0.14  | 0.08 | −1.83 | 0.067 |
| Surgery type (minor)     | 0.03     | 0.06 | 0.41  | 0.678 |
| **Nociceptive**          |          |      |       |       |
| Intercept                | 0.06     | 0.16 | 0.39  | 0.697 |
| Time (days)              | 0.04     | 0.01 | 3.58  | <0.001|
| Gender (male)            | 0.15     | 0.23 | 0.64  | 0.52  |
| Age (1/10)               | −0.02    | 0.04 | −0.45 | 0.656 |
| ASA                      | −0.01    | 0.06 | −0.11 | 0.91  |
| Admission type (outpatient) | −0.07 | 0.12 | −0.62 | 0.537 |
| Surgery type (minor)     | 0.31     | 0.10 | 2.96  | 0.003 |
| **Emotional**            |          |      |       |       |
| Intercept                | 0.01     | 0.14 | 0.05  | 0.964 |
| Time (days)              | 0.02     | 0.01 | 2.21  | 0.027 |
| Gender (male)            | 0.03     | 0.21 | 0.16  | 0.874 |
| Age (1/10)               | 0.03     | 0.03 | 0.97  | 0.33  |
| ASA                      | 0.08     | 0.05 | 1.57  | 0.116 |
| Admission type (outpatient) | −0.03  | 0.11 | −0.30 | 0.768 |
| Surgery type (minor)     | 0.17     | 0.10 | 1.75  | 0.08  |
| **ADL**                  |          |      |       |       |
| Intercept                | 0.72     | 0.16 | 4.63  | <0.001|
| Time (days)              | 0.05     | 0.01 | 4.65  | <0.001|
| Gender (male)            | 0.03     | 0.24 | 0.12  | 0.907 |
| Age (1/10)               | −0.01    | 0.04 | −0.21 | 0.831 |
| ASA                      | −0.02    | 0.05 | −0.41 | 0.681 |
| Admission type (outpatient) | 0.07    | 0.11 | 0.66  | 0.506 |
| Surgery type (minor)     | 0.34     | 0.10 | 3.41  | 0.001 |
| **Cognitive**            |          |      |       |       |
| Intercept                | 0.24     | 0.22 | 1.13  | 0.257 |
| Time (days)              | 0.05     | 0.01 | 5.56  | <0.001|
| Gender (male)            | 0.73     | 0.31 | 2.37  | 0.018 |
| Age (1/10)               | 0.04     | 0.05 | 0.83  | 0.407 |
| ASA                      | −0.02    | 0.08 | −0.25 | 0.804 |
| Admission type (outpatient) | −0.05  | 0.16 | −0.32 | 0.75  |
| Surgery type (minor)     | 0.65     | 0.14 | 4.60  | <0.001|

A positive estimate reflects a positive association between the independent variable and the number of recovered items, controlling for all the other variables in the model, indicating worse recovery. A negative estimate reflects a negative association between the independent variable and the number of recovered items, controlling for all the other variables in the model, indicating better recovery.

### Table 7: Fixed effects from generalized linear mixed effects models estimating the change in the responses in each overall patient satisfaction item over time

|                          | Estimate | SE   | t     | P     |
|--------------------------|----------|------|-------|-------|
| **Work**                 |          |      |       |       |
| Intercept                | 3.13     | 0.39 | 8.08  | <0.001|
| Time (days)              | −0.18    | 0.02 | −11.19| <0.001|
| Gender (male)            | −0.16    | 0.49 | −0.32 | 0.749 |
| Age (1/10)               | −0.02    | 0.10 | −0.24 | 0.812 |
| ASA                      | 0.12     | 0.13 | 0.90  | 0.367 |
| Admission type (outpatient) | −0.25  | 0.28 | −0.89 | 0.374 |
| Surgery type (minor)     | −1.02    | 0.25 | −4.07 | <0.001|
| **ADL**                  |          |      |       |       |
| Intercept                | 2.70     | 0.32 | 8.55  | <0.001|
| Time (days)              | −0.18    | 0.02 | −11.02| <0.001|
| Gender (male)            | −0.08    | 0.40 | −0.20 | 0.839 |
| Age (1/10)               | −0.02    | 0.08 | −0.20 | 0.842 |
| ASA                      | 0.11     | 0.10 | 1.04  | 0.301 |
| Admission type (outpatient) | −0.17  | 0.22 | −0.77 | 0.444 |
| Surgery type (minor)     | −0.70    | 0.20 | −3.48 | <0.001|
| **Clarity of thought**   |          |      |       |       |
| Intercept                | 1.60     | 0.31 | 5.16  | <0.001|
| Time (days)              | −0.05    | 0.01 | −4.40 | <0.001|
| Gender (male)            | −0.30    | 0.39 | −0.76 | 0.448 |
| Age (1/10)               | 0.03     | 0.08 | 0.36  | 0.722 |
| ASA                      | −0.08    | 0.10 | −0.77 | 0.441 |
| Admission type (outpatient) | −0.26  | 0.22 | −1.17 | 0.245 |
| Surgery type (minor)     | 0.05     | 0.20 | 0.23  | 0.818 |
| **Satisfaction**         |          |      |       |       |
| Intercept                | 1.56     | 0.36 | 4.29  | <0.001|
| Time (days)              | −0.03    | 0.01 | −3.54 | <0.001|
| Gender (male)            | 0.07     | 0.46 | 0.16  | 0.876 |
| Age (1/10)               | −0.07    | 0.09 | −0.74 | 0.46  |
| ASA                      | 0.13     | 0.12 | 1.07  | 0.288 |
| Admission type (outpatient) | −0.31  | 0.26 | −1.20 | 0.233 |
| Surgery type (minor)     | 0.12     | 0.24 | 0.49  | 0.626 |

A positive estimate reflects a positive association between the independent variable and the number of recovered items, controlling for all the other variables in the model, indicating better recovery. A negative estimate reflects a negative association between the independent variable and the number of recovered items, controlling for all the other variables in the model, indicating worse recovery. ASA: American Society of Anesthesiologists; SE: Standard error; ADL: Activities of daily living.
patients were female, we were unable to examine whether the quality of postoperative recovery differs by gender in the current study.

**Conclusion**

Our Arabic version of the PostopQRS was translated using forward and reverse translation. The translated PostopQRS was found to be valid and was shown to be feasible for application in a clinical population.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Terkawi AS, Mavridis D, Sessler DI, Nunemaker MS, Doais KS, Terkawi RS, et al. Pain Management Modalities after Total Knee Arthroplasty: A Network Meta-analysis of 170 Randomized Controlled Trials. Anesthesiology 2017. doi: 10.1097/ALN.0000000000001607.
2. Bowyer A, Jakobsson L, Ljungqvist O, Royse C. A review of the scope and measurement of postoperative quality of recovery. Anaesthesia 2014;69:1266-78.
3. Royse CF, Newman S, Chung F, Stygall J, McKay RE, Boldt J, et al. Development and feasibility of a scale to assess postoperative recovery: The post-operative quality recovery scale. Anesthesiology 2010;113:892-905.
4. Royse CF, Williams Z, Ye G, Wilkinson D, De Steiger R, Richardson M, et al. Knee surgery recovery: Post-operative quality of recovery scale comparison of age and complexity of surgery. Acta Anaesthesiol Scand 2014;58:660-7.
5. Royse CF, Williams Z, Purser S, Newman S. Recovery after nasal surgery vs. tonsillectomy: Discriminant validation of the postoperative quality of recovery scale. Acta Anaesthesiol Scand 2014;58:345-51.
6. Royse CF, Newman S, Williams Z, Wilkinson DJ. A human volunteer study to identify variability in performance in the cognitive domain of the postoperative quality of recovery scale. Anesthesiology 2013;119:576-81.
7. Newman S, Wilkinson DJ, Royse CF. Assessment of early cognitive recovery after surgery using the post-operative quality of recovery scale. Acta Anaesthesiol Scand 2014;58:185-91.
8. Shadlen MF, Siscovick D, Fitzpatrick AL, Dulberg C, Kuller LH, Jackson S. Education, cognitive test scores, and black-white differences in dementia risk. J Am Geriatr Soc 2006;54:898-905.
9. Nunnally J. Psychometric Theory. New York: McGraw-Hill; 1978.
10. Eisenga R, Grotenhuis MT, Pelzer B. The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? Int J Public Health 2013;58:637-42.
11. Bowyer A, Royse C. The importance of postoperative quality of recovery: Influences, assessment, and clinical and prognostic implications. Can J Anaesth 2016;63:176-83.
| العوامل الفسيولوجية | 1. ضغط الدم | 2. معدل نبضات القلب | 3. درجة الحرارة | 4. معدل التنفس | 5. استخدام الأكسجين للحفاظ على نسبة الأكسجين في الدم | 6. مجرى التنفس | 7. الانفعال والتهيج | 8. الوعي والإدراك | 9. عزيزي المريض، فضلاً تذكر أنك أرفع رأسك؟ |
|---------------------|----------------|------------------|----------------|----------------|---------------------------------------------------|--------------|----------------|----------------|----------------------------------|
|                     | أقل من 70 أو أكثر من 180 | أقل من 35 أو أكثر من 140 | أقل من 35 أو أكثر من 39 | أقل من 5 أو أكثر من 30 | الأكسجين في دم المريض > 90٪، وتتوقف تزويد المريض بالأكسجين | المريض يحتاج لوجود أداة في مجرى التنفس | المريض يحتاج للمساعدة للحفاظ على بقاء مجرى التنفس | المريض لا يستجيب أبداً أو غائب عن الوعي | المريض لا يستجيب، أو يتحرك ببطء |
|                     | من 70 إلى 89 أو 141 إلى 180 | من 35 إلى 44 أو من 101 إلى 139 | من 35 إلى 39.9 أو 37.7 إلى 37.6 | من 5 إلى 9 أو من 21 إلى 30 | نسبة الأكسجين في دم المريض > 95٪، وتتوقف تزويد المريض بالأكسجين | المريض يحتاج لوجود أداة في مجرى التنفس | المريض يحتاج للمساعدة للحفاظ على بقاء مجرى التنفس | المريض يستجيب برد فعل نشط، ولكن غير قادر على إكمال الطلب | المريض يستجيب للأمر بشكل تام |
|                     | من 90 إلى 140 | من 45 إلى 100 | من 36 إلى 37.6 | من 10 إلى 20 | الأكسجين بسهم الأورتوكونت معلم أو لا يحتاج |

**Appendix 1a: Example from the questionnaire**
## العوامل المؤسسية

1. عزيزي المريض، سأقوم بعرض مجموعة من الوجوه عليك، فضلاً، قم بتحديد الوجه أو الرقم أو الوصف الذي سيوضح مستوى الألم لديك في هذه اللحظة.

من فضلك، اعرض للمريض رسومات الوجه المناسبة وقم بتدوين الرقم المقابل للاستجابة الفعلية للمريض (من 1 إلى 5).

و إذا كان المريض غير قادر على الجلوس لقراءة الرسومات، حدث استجابة المريض بواسطة قولك:

عزيمي المريض، أريد أن أned لأي من أوصاف الألم التالية، اكتب بشكل أفضل عن مستوى الألم لديك الآن:

من فضلك، قم بقراءة الوصف للمريض ودُون ردة فعل له (من 1 إلى 5)

| رقم | وصف |
|-----|------|
| 1   | لا يوجد ألم |
| 2   | ألم خفيف |
| 3   | ألم متوسط |
| 4   | ألم شديد |
| 5   | أسوأ ألم يمكن تحميله |

## العوامل العاطفية

1. عزيزي المريض، سأقوم بعرض مجموعة من الوجوه عليك، فضلاً، قم بتحديد الوجه أو الرقم أو الوصف الذي سيوضح مستوى شعورك بالاكتئاب أو الحزن في هذه اللحظة.

من فضلك، اعرض للمريض رسومات الوجه المناسبة وقم بتدوين الرقم المقابل للاستجابة الفعلية للمريض (من 1 إلى 5).

و إذا كان المريض غير قادر على الجلوس لقراءة الرسومات، حدث استجابة المريض بواسطة قولك:

عزيمي المريض، أريد أن أعد لأي من الأوصاف التالية، اكتب بشكل أفضل عن مستوى شعورك بالاكتئاب أو الحزن في هذه اللحظة.

من فضلك، قم بقراءة الوصف للمريض ودُون ردة فعل له (من 1 إلى 5)

| رقم | وصف |
|-----|------|
| 1   | لا أشعر أبداً بالاكتئاب أو الحزن |
| 2   | أشعر بقليل من الاكتئاب أو الحزن |
| 3   | أشعر ببعض الاكتئاب أو الحزن |
| 4   | أشعر بالكثير من الاكتئاب أو الحزن |
| 5   | أنا مكتئب أو حزين جداً |

Appendix 1b: Example from the questionnaire
Appendix 2: Example from the faces used with the questionnaire