Japanese Version of the Quality of Life Measurement for Limb Lymphedema (leg) (J-LYMQOL-l): its Reliability and Validity

Toyoko Yoshizawa¹, Maho Aoyama², Yoko Takeishi¹, Yasuka Nakamura¹ and Fumi Atogami¹

Department of Women’s Health Nursing, Division of Health Sciences, Tohoku University Graduate School of Medicine
Department of Palliative Nursing, Division of Health Sciences, Tohoku University Graduate School of Medicine

ABSTRACT

BACKGROUND: Lymphedema is a condition that manifests as swelling when the lymphatic system fails to remove excess interstitial fluid from the tissues. Cancer treatments, such as radical surgery including lymph node dissection, chemotherapy, and radiotherapy, contribute to the risk of secondary lymphedema. To plan the treatment for lymphedema and monitor the patient’s progress, leg or arm swelling and function of the limbs need to be assessed.

OBJECTIVE: The purpose of this study was to investigate the reliability (test-retest, internal consistency) and validity (criteria-related validity, construct validity) of data obtained with the Japanese version of the Quality of Life Measurement for Limb Lymphedema (leg) (J-LYMQOL-l).

METHOD: Two hundred and eleven women with lower limb lymphedema were recruited between September 2012 and October 2013 from the lymphedema outpatient services in four Tohoku areas and one Kanto area of Japan, and were assessed by self-administered questionnaires that included the J-LYMQOL-l.

RESULTS: The Cronbach’s alpha coefficient of the J-LYMQOL-l was .925, and subscales ranged from .898 to .944, p<.05, indicating a high internal reliability of the tool. Test-retest reliability was moderate (r=.589, p<.05). A confirmatory factor analysis revealed that the four-factor model of the J-LYMQOL-l fitted the data. The Pearson correlation coefficient, between the J-LYMQOL-l and J-EORTC QLQ-C30, was .702, indicating a high criteria-related validity for all domains, except one.

CONCLUSION: The J-LYMQOL-l has high construct validity and reliability and can be used for clinical assessment of QOL in patients with lower limb lymphedema.

KEY WORDS: lymphedema, quality of life, LYMQOL, reliability, validity, condition-specific QOL
INTRODUCTION

Lymphedema is a condition that manifests as swelling when the lymphatic system fails to remove excess interstitial fluid from the tissues. Cancer treatments, such as radical surgery including lymph node dissection, chemotherapy, and radiotherapy, contribute to the risk of secondary lymphedema. Secondary lymphedema is common in female survivors of breast or uterine cancers. Lymphedema can be associated with reduced quality of life (QOL). Female cancer survivors with lymphedema experience physical problems including fatigue, pain, and cutaneous dryness. Additionally, these survivors can experience psychological and social problems, including impaired self-esteem, negative life outlook, reduced desire to leave home, decreased activity levels, and decreased income. Secondary upper or lower limb lymphedema alters the female cancer survivor’s appearance. Therefore, appropriate assessment of patient condition, including QOL, is required for timely treatment and care of lymphedema.

Initially, most investigators assessed patient QOL using a health-related quality of life (HRQOL) instrument, such as the Medical Outcome Study 36-item short form health survey (SF-36)\(^1\). The Japanese version of the SF-36 was developed in 1998. However, this general questionnaire was not suitable for determining the well-being of patients with cancer. Therefore, the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core30 question (EORTC QLQ-C30)\(^2\) and Function Assessment of Cancer Therapy (FACT)\(^3\) were developed, along with several condition-specific QOL instruments. For example, the EORTC QLQ-LC13\(^4\) and FACT-L\(^5\) were developed for lung cancer patients, whereas the EORTC QLQ-BR23\(^6\) and FACT-P\(^7\) were developed for breast cancer patients. These instruments were translated and are used widely as clinical tools in Japan. The EORTC QLQ-CX24\(^8\) and EORTC QLQ-EN24\(^9\) were developed for patients with gynecological cancers. However, the EORTC QLQ-EN24 has not yet been translated into Japanese. The difficulty in using these instruments includes lack of sensitivity to issues regarding lymphedema. For example, the EORTC QLQ-EN24 consists of 13 factors and 24 items. However, it contains only two items related to lymphedema. The two items regarding lower limb lymphedema are questions concerning “swelling of the lower limb” and “sensation of heaviness of the lower limb.” It cannot be said that the QOL of patients with lymphedema is adequately evaluated using only these two items. It is important to use a condition-specific instrument to assess the patient-specific effects of all kinds of lymphedema. In recent literature, several lymphedema/chronic edema condition-specific functional or health-related QOL assessment instruments are described. The Upper Limb Lymphedema 27 (ULL27)\(^10\) and the Lymphedema Functioning, Disability and Health Questionnaire (Lymph–ICF)\(^11\) are only applicable to breast cancer-related lymphedema. The Freiburg Life Quality Assessment Lymphedema (FLQA–L)\(^12\) and the Lymphedema Quality of Life Inventory (LQOLI)\(^13\) can be used for a wide range of patients with lymphedema. However, these instruments lack sensitivity towards issues that relate to upper or lower limb lymphedema. Few patient-reported outcome-measuring instruments exist to measure the impact of all types of lymphedema and lymphedema of different extremities. The Quality of Life Measure for Limb Lymphoedema (LYMQOL)\(^14\) is the only known English QOL instrument available to measure all types of lymphedema. Although some health–related QOL instruments and condition-specific QOL instruments for cancer were translated into Japanese, no condition-specific QOL instrument for lymphedema has been developed and translated specifically for Japan. The purpose of this study was to create a Japanese version of the LYMQOL and test its reliability and validity in Japanese patients with lymphedema. At this time, we will focus only the results of LYMQOL (leg).

METHODS

1. Procedure

The LYMQOL\(^15\) was developed by experienced healthcare professionals in the lymphedema service in Derby, UK. It consists of two instruments, one for arm lymphedema and one for leg lymphedema (the LYMQOL [arm and leg]). The LYMQOL (arm and leg) comprises self-report questionnaires consisting of 23 statements (arm ver.) or 22 statements (leg ver.).
The LYMQOL [leg] has four domains: function (8 items), appearance (7 items), symptoms (5 items), and emotion (6 items). It also includes an overall QOL value, between 0–10, as patient–indicated QOL. Except for the overall QOL, the scale indicates the patient’s perception of each item, with scores ranging from 1 (not at all) to 4 (a lot). The scores for each domain are added and divided by the total number of questions answered to provide a total score. If answered questions constituted <50% of items, the whole domain is scored as 0. A higher score on the LYMQOL indicates more functional problems related to leg lymphedema. The developer of the original LYMQOLP obtained permission to develop the Japanese version. The original LYMQOL was translated into Japanese by independent translators. The translation considered the cultural and lifestyle context, making use of appropriate idioms. Any differences in the translations were discussed, and once resolved, they were integrated into the provisional LYMQOL questionnaire. An initial back translation was done, and then, the process of forward and back translation was repeated until a satisfactory translation was achieved and the Japanese version of the LYMQOL finalized.

2. Participants
The present study investigated the reliability and validity of data obtained using the Japanese version of LYMQOL (leg). Two hundred eleven patients with gynecological cancer participated in this study. The patients were recruited between September 2012 and October 2013 from the lymphedema outpatient services in four Tohoku areas and one Kanto area, Japan. Patients over 20 years of age, who consented to take part in this study, were included. Exclusion criteria were active malignancy and current chemotherapy and radiotherapy.

3. Study design
Each patient completed three questionnaires: the LYMQOL, the EORTC QLQ C-30 (ver. 3)\(^{16}\), and an author–developed questionnaire. The following data were collected from patient medical records: age, body weight, height, date and type of gynecological surgery, and International Society of Lymphology (ISL) lymphedema staging. Some patients received a second LYMQOL at home (with an interval of 2 weeks), which they returned to our department by mail.

4. Data analysis
All data were managed and analyzed using Microsoft\textsuperscript{®} Excel\textsuperscript{®} and SPSS (Version 22.0J for Windows; SPSS Inc., Chicago, IL).

1) Reliability
Intraclass correlation coefficients were used to determine test–retest reliability of the total score of the LYMQOL. Cronbach’s alpha coefficients (range 0 to 1.0), a measure of internal consistency, wherein a coefficient = 1.0 indicates perfect internal consistency, were used to assess reliability. Generally, values > .70 are considered significant. Internal consistency was used to measure the correlation between questions on a particular scale. A high inter–item correlation suggests that all of the questions assess the same factor of interest.

2) Validity
The validity of LYMQOL was investigated in two ways. First, we assessed criterion validity by comparing the Japanese version of the LYMQOL with the Japanese version of the EORTC QLQ-C30 (ver. 3)\(^{16}\). We used the Pearson correlation coefficient for all scores. Second, construct validity was assessed. We postulated that patients with more severe lymphedema would have poorer QOL. In the Japanese version of the LYMQOL, a higher domain score indicated lower patient QOL. We compared the ISL staging consensus with scores for each domain, using a nonparametric Kruskal–Wallis test. To analyze the factor structure and stability of the LYMQOL, we conducted a longitudinal confirmatory factor analysis using IBM SPSS AMOS version 22. To account for the four domains of QOL (function, appearance, symptoms, emotion), as in the original LYMQOL, we used aggregate analysis, which appropriately adjusts parameter standard errors and goodness-of-fit statistics in response to a nested data structure. The model is illustrated in Figure 1.

5. Ethical considerations
Ethical approval was obtained from the Ethics Committee of Tohoku University Graduate School of Medicine (No. 2011–178). Patients were asked to sign a consent form prior to participation and were informed of the risks and benefits associated with participation.

---
RESULTS

1. Descriptive characteristics

In total, 211 patients participated in the study. All patients had undergone pelvic dissection for gynecological cancer. The patient demographics are presented in Table 1. All patients were stratified according to the ISL staging: 16.6% patients were stage 1, 24.4% were stage 2a, 29.9% were stage 2b, and 13.3% were stage 3. The patients in this study had a mean age of 59.53 (standard deviation [SD] = 13.08) years, a mean height of 157 (SD = 5.31) cm, a mean weight of 56.04 (SD = 9.65) kg, and a mean BMI of 22.74 (SD = 3.61).

2. Reliability

The internal consistency reliability coefficients for each domain and total LYMQOL were high (Cronbach’s alpha coefficients, 0.898 and 0.944, respectively), as shown in Table 2. There were no pronounced floor or ceiling effects. Test–retest reliability was examined using 25 patients (Table 3). The test–retest reliability of the questionnaire total score was moderate (.589, p < .05).

3. Validity

The content and face validity were assessed using the original version of the LYMQOL, as the Japanese version of the LYMQOL did not examine these. This time, we investigated criteria-related validity and construct validity in two ways.

1) Criteria-related validity

Table 4 provides an overview of the Pearson correlation coefficients between the different domains of the LYMQOL and EORTC QLQ–C30. Each of the four domains “function,” “symptoms,” “emotion,” and “overall quality of life” showed strong or moderate correlations with the corresponding domains of the EORTC QLQ–C30. However, there was no corresponding domain in the EORTC QLQ–C30 for “appearance”; therefore, no comparison could be made for this factor.

2) Construct validity

Three domains (function, appearance, and symptoms) showed significant differences in the LYMQOL score by one-way ANOVA (p = .00), and one domain (emotion) showed a marginally significant difference (Table 5). With higher ISL stages, we observed worse scores on three LYMQOL domains (function, appearance, and symptoms). Figure 1 presents the longitudinal confirmatory factor analysis model. The model fit was acceptable, but not outstanding, with a comparative fit index (CFI) = .985, and a root mean square error of approximation (RMSEA) = .113. The Chi square model index was not significant. Nevertheless, all LYMQOL subscales maintained high loadings on LYMQOL. The lowest factor loading was for the “emotion” factor, which was still moderately strong at .61.

DISCUSSION

The purpose of this study was to translate the English LYMQOL questionnaire into Japanese for validation in Japanese patients with lymphedema of the lower limb, and to produce a disease-specific QOL tool for patients with lymphedema that could be used in routine clinical practice and research for assessing QOL and other outcome measures in Japan. The availability of such a questionnaire also makes it possible to compare the data collected in other international studies.

1. Participant characteristics

The proportion of women with lower lymphedema in this study suggests that leg lymphedema is an essential issue post gynecologic cancer treatment. The EORTC QLQ–CX24 and EORTC QLQ–EN24 were developed for gynecological cancer patients [8–17], and although they have a sub-scale for lymphedema, the subscale does not adequately evaluate QOL for all patients with lower limb lymphedema.

The participants ranged from ISL stage 1 to 3, and the proportion of participants in each stage rate was similar. Consequently, this study is appropriate for assessing QOL of patients with lower limb lymphedema with a range of ISL stages.
We investigated Cronbach’s alpha coefficients and test-retest reliability in two ways. The reliability of the LYMQOL (leg) was good for patients with lower limb lymphedema. Cronbach’s alpha coefficient showed good reliability of >.925 for all domains in the Japanese version of the LYMQOL (leg), compared with >.8 in the original version. The Japanese version also showed high internal consistency. The test-retest reliability of the total score in the questionnaire was moderate (>.589), but those of function, appearance, and symptoms were weak (>.42). Test-retest reliabil-

### Table 1 Socio-demographic and Clinical characteristics of the study sample (n=211)

<table>
<thead>
<tr>
<th>Socio-demographic</th>
<th>Cause Disease</th>
<th>International Society of Lymphology (ISL) Lymphedema staging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 59.53 (13.08)</td>
<td>Endometrial cancer 32.4%</td>
<td>ILS Stage1 16.6%</td>
</tr>
<tr>
<td>Length 157 (5.31)</td>
<td>Cervical cancer 31.8%</td>
<td>ILS Stage2a 24.4%</td>
</tr>
<tr>
<td>Weight 56.04 (9.65)</td>
<td>Ovarian cancer 22.3%</td>
<td>ILS Stage2b 29.9%</td>
</tr>
<tr>
<td>BMI 22.74 (3.61)</td>
<td>Others 13.5%</td>
<td>ILS Stage3 13.3%</td>
</tr>
<tr>
<td>Unknown 15.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: mean (SD)

**Note.** ILS Staging
Stage0 = A subclinical state where swelling is not evident impaired lymph transport
Stage1 = This represents early onset of the condition where there is accumulation of tissue that subsides with limb elevation. The edema may be pitting at the stage
Stage2a = Limb elevation alone rarely reduces swelling and pitting manifest
Stage2b = There may or may not be pitting as tissue fibrosis is more evident
Stage3 = The tissue is hard (fibrotic) and pitting is absent. Skin changes such as thickening, hyperpigmentation, increased skin folds, fat deposits and warty over growths develop

### Table 2 Reliability (Internal consistency)

<table>
<thead>
<tr>
<th>LYM QOL Domain</th>
<th>Number of Items</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYMQOL total 26</td>
<td>0.925*</td>
<td></td>
</tr>
<tr>
<td>Function 8</td>
<td>0.904*</td>
<td></td>
</tr>
<tr>
<td>Appearance 7</td>
<td>0.915*</td>
<td></td>
</tr>
<tr>
<td>Symptoms 5</td>
<td>0.898*</td>
<td></td>
</tr>
<tr>
<td>Emotion 6</td>
<td>0.944*</td>
<td></td>
</tr>
</tbody>
</table>

Note.: *p<.05

### Table 3 Reliability (Stability) N=25

<table>
<thead>
<tr>
<th>LYM QOL Domain</th>
<th>Test-retest</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYMQOL total 0.589*</td>
<td></td>
</tr>
<tr>
<td>Function 0.496*</td>
<td></td>
</tr>
<tr>
<td>Appearance 0.460*</td>
<td></td>
</tr>
<tr>
<td>Symptoms 0.421*</td>
<td></td>
</tr>
<tr>
<td>Emotion 0.247</td>
<td></td>
</tr>
</tbody>
</table>

Note.: *p<.05

### Table 4 Validity (Criterion related validity)

<table>
<thead>
<tr>
<th>EORTC QLQ-C30</th>
<th>LYMQOL Physical</th>
<th>Symptoms</th>
<th>Emotion</th>
<th>Overall QOL</th>
<th>Role</th>
<th>Cognition</th>
<th>Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function 0.702**</td>
<td>0.653**</td>
<td>0.483**</td>
<td>−0.494**</td>
<td>0.586**</td>
<td>0.396**</td>
<td>0.717**</td>
<td></td>
</tr>
<tr>
<td>Appearance 0.732**</td>
<td>0.522**</td>
<td>0.452**</td>
<td>−0.406**</td>
<td>0.447**</td>
<td>0.339**</td>
<td>0.496**</td>
<td></td>
</tr>
<tr>
<td>Symptoms 0.595**</td>
<td>0.669**</td>
<td>0.532**</td>
<td>−0.458**</td>
<td>0.521**</td>
<td>0.423**</td>
<td>0.570**</td>
<td></td>
</tr>
<tr>
<td>Emotion 0.533**</td>
<td>0.630**</td>
<td>0.738**</td>
<td>−0.509**</td>
<td>0.486**</td>
<td>0.510**</td>
<td>0.518**</td>
<td></td>
</tr>
<tr>
<td>Overall QOL −0.541**</td>
<td>−0.627**</td>
<td>−0.607**</td>
<td>0.613**</td>
<td>−0.438**</td>
<td>−0.294**</td>
<td>−0.596**</td>
<td></td>
</tr>
</tbody>
</table>

Note.: **p<.01

2. Reliability

We investigated Cronbach’s alpha coefficients and test–retest reliability in two ways. The reliability of the LYMQOL (leg) was good for patients with lower limb lymphedema. Cronbach’s alpha coefficient showed good reliability of >.925 for all domains in the Japanese version of the LYMQOL (leg), compared with >.8 in the original version. The Japanese version also showed high internal consistency. The test–retest reliability of the total score in the questionnaire was moderate (>.589), but those of function, appearance, and symptoms were weak (>.42). Test–retest reliabil-
ity results were not satisfactory. One reason for this is that the time interval between testing and retesting was 2 weeks, which is rather long, and QOL changes may occur during this time period. However, in the study by Marx et al.\(^\text{18}\), there was no significant difference in test-retest results when comparing intervals between 2 days and 2 weeks. Therefore, another reason may be that the measurement of emotion is susceptible to various influences, and generally, its stability may be low.

3. Criteria-related validity

Since the original LYMQOL was compared with the EORTC QLQ C-30, the Japanese version EORTC QLQ C-30 was also used to determine criterion validity in the development of the Japanese version of the LYMQOL. As a result, the “function” in the LYMQOL and the “physical” of the EORTC QLQ C-30 showed the highest correlation; “symptom,” “emotion,” and “overall QOL” were similar. However, there is no comparable domain in the EORTC QLQ C-30 or the other disease-specific HRQOL instrument for the “appearance” domain of the LYMQOL; therefore, although “appearance” showed the highest correlation with “physical”, it was weakly correlated with other domains. On the basis of the above result, we verified the reference validity of the Japanese LYMQOL (leg).

4. Construct validity

Patients with higher ISL staging tended to have higher LYMQOL scores. This supports our hypothesis that “patients with more severe lymphedema have lower QOL.” In the original LYMQOL, the developers did not extract the four-factor structure using exploratory factor analysis; however, in this study, a confirmatory factor analysis revealed that data fit the four-factor model of the LYMQOL in the same manner as the original LYMQOL. Therefore, the model fit was extremely good, and the Japanese version of the LYMQOL (leg) is considered a validated QOL assessment tool.

A number of other condition-specific QOL tools for lymphedema have been developed and reported. However, these tools have not been translated into Japanese and contain many questions. The LYMQOL is a short tool, covering both arm and leg edema.

5. Implications for further research

Improving both QOL and disease condition in cancer survivors is one of the most important issues in cancer care. Consequently, HRQOL assessments are becoming an essential component of research that focuses on medical outcomes in various situations, especially in cancer care. Although lymphedema has no direct effect on the health of the cancer survivors, it has a great impact on their QOL. Further research is required to integrate QOL assessments with lymphedema care outcomes.

Since the original LYMQOL is the only measurement tool with both arm and leg versions, future examinations of the Japanese version should be considered the reliability and validity of the LYMQOL (arm).

CONCLUSION

The Japanese version of the LYMQOL (leg) is a validated condition-specific QOL assessment tool that can be widely used both for clinical assessment of QOL and as a measure of treatment outcomes in Japan.

### Table 5  LYMQOL score in each ILS staging

<table>
<thead>
<tr>
<th></th>
<th>Stage1</th>
<th>Stage2a</th>
<th>Stage2b</th>
<th>Stage3</th>
<th>unknown</th>
<th>F-value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>1.95 (0.73)</td>
<td>2.29 (0.71)</td>
<td>2.53 (0.78)</td>
<td>2.95 (0.74)</td>
<td>1.95 (0.75)</td>
<td>7.72</td>
<td>0.000</td>
</tr>
<tr>
<td>Appearance</td>
<td>1.76 (0.64)</td>
<td>2.33 (0.78)</td>
<td>2.85 (0.76)</td>
<td>3.14 (0.63)</td>
<td>1.65 (0.89)</td>
<td>17.10</td>
<td>0.000</td>
</tr>
<tr>
<td>Symptoms</td>
<td>1.96 (0.64)</td>
<td>2.44 (0.63)</td>
<td>2.64 (0.65)</td>
<td>2.97 (0.67)</td>
<td>2.19 (0.99)</td>
<td>8.71</td>
<td>0.000</td>
</tr>
<tr>
<td>Emotion</td>
<td>2.23 (0.92)</td>
<td>2.31 (0.62)</td>
<td>2.40 (0.79)</td>
<td>2.77 (0.67)</td>
<td>2.40 (0.77)</td>
<td>2.33</td>
<td>0.058</td>
</tr>
<tr>
<td>Total</td>
<td>51.07 (15.49)</td>
<td>60.90 (13.95)</td>
<td>66.65 (15.96)</td>
<td>77.20 (17.49)</td>
<td>48.58 (19.33)</td>
<td>9.78</td>
<td>0.000</td>
</tr>
<tr>
<td>Overall QOL</td>
<td>6.68 (2.47)</td>
<td>6.44 (2.10)</td>
<td>5.70 (2.31)</td>
<td>4.21 (2.41)</td>
<td>6.62 (5.91)</td>
<td>6.14</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: One-way ANOVA
Acknowledgements

The authors would like to acknowledge and thank the participants who generously shared their time and experiences with us. This study was supported by the JSPS KAKENHI (grant number 23390506).

Conflict of interest statement

My coauthors and I do not have any interests that might be interpreted as influencing the research. We do not have any relation with the manufacture or distributor of the product.

References

Japanese Version of the Quality of Life Measurement for Limb Lymphedema (leg) (J-LYMQOL-l): 日本語版の信頼性と妥当性の検討

吉沢豊子1) 青山 眞帆2) 武石 陽子1) 中村 康香1) 跡上 富美1)