Translation and validation of the Patient-Generated Subjective Global Assessment against the Mini-Nutritional Assessment for patients with gastric cancer

Ji Yea Lee, PhD, RN, Eui Geum Oh, PhD, RN, Woo Jin Hyung, PhD, MD, Hyoung-il Kim, PhD, MD

PII: S2347-5625(22)00206-2
DOI: https://doi.org/10.1016/j.apjon.2022.100148
Reference: APJON 100148

To appear in: Asia-Pacific Journal of Oncology Nursing

Received Date: 19 June 2022
Revised Date: 11 September 2022
Accepted Date: 16 September 2022

Please cite this article as: Lee JY, Oh EG, Hyung WJ, Kim H-i, Translation and validation of the Patient-Generated Subjective Global Assessment against the Mini-Nutritional Assessment for patients with gastric cancer, Asia-Pacific Journal of Oncology Nursing, https://doi.org/10.1016/j.apjon.2022.100148.

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Manuscript title:
Translation and validation of the Patient-Generated Subjective Global Assessment against the Mini-Nutritional Assessment for patients with gastric cancer

Corresponding author:
Eui Geum Oh

Article type:
Original Article

Author Agreement Statement

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Zhang San: Conceptualization, Methodology, Software. Priya Singh: Data curation, Writing - Original draft preparation. Wang Wu: Visualization, Investigation. Jan Jansen: Supervision. Ajay Kumar: Software, Validation. Sun Qi: Writing - Reviewing and Editing.

Conceptualization: Ji Yea Lee, Eui Geum Oh
Methodology: Ji Yea Lee, Eui Geum Oh
Data curation: Ji Yea Lee, Woo Jin Hyung, Hyoung-Ill Kim
Writing – original draft: Ji Yea Lee
Writing – review & editing: Eui Geum Oh, Hyoung-Ill Kim

Role of the funding source

Please disclose any funding sources and their role, if any, in the writing of the manuscript or the decision to submit it for publication. Examples of involvement include: data collection, analysis, or interpretation; trial design; patient recruitment; or any aspect pertinent to the study. Please also comment whether you have been paid to write this article by a pharmaceutical company or other agency. The information provided
here must match the role of the funding source statement in the manuscript. If you are the corresponding author, please state that authors were not precluded from accessing data in the study, and they accept responsibility to submit for publication.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Signed by all authors as follows:

[Signatures]

Eui Aeum  Ji Yea  Woo Jin  Hyoung-Ill
1) **Title:** Translation and validation of the Patient-Generated Subjective Global Assessment against the Mini-Nutritional Assessment for patients with gastric cancer

2) **Authors and affiliation**

   Ji Yea Lee\textsuperscript{a}, PhD, RN; Eui Geum Oh\textsuperscript{b}, PhD, RN; Woo Jin Hyung\textsuperscript{c}, PhD, MD; Hyoung-il Kim\textsuperscript{c}, PhD, MD;

   \textsuperscript{a}College of Nursing, Yonsei University, Seoul, Korea

   \textsuperscript{b}College of Nursing and Mo-Im Kim Research Institute, Yonsei University, Seoul, Korea

   \textsuperscript{c}Department of Surgery, College of Medicine, Yonsei University, Seoul, Korea

3) **Correspondence:** Eui Geum Oh, PhD, RN, FAAN.
   
   - Address: Room 410, College of Nursing, Yonsei University, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea.
   
   - Email: euigeum@yuhs.ac

4) **Highlights**

   - The Korean version of PG-SGA has undergone a systematic translation process
   
   - It is a valid instrument for assessing malnutrition in patients with gastric cancer

   - Nurses could assess symptoms patient have related to food intake using PG-SGA
Translation and validation of the Patient-Generated Subjective Global Assessment against the Mini-Nutritional Assessment for patients with gastric cancer

ABSTRACT

Background: Malnutrition is a common issue in patients with cancer, particularly those with gastric cancer. The Patient-Generated Subjective Global Assessment (PG-SGA) is a nutritional assessment tool used in diverse patient populations worldwide. However, no well-translated Korean version of the PG-SGA has been validated in patients with cancer.

Purpose: This study aimed to 1) translate the PG-SGA into Korean according to a translation guideline, 2) validate the translated version against the Mini-Nutritional Assessment, and 3) determine the prevalence of malnutrition in patients with gastric cancer.

Methods: The translation of the PG-SGA was based on the Guidelines for Translation by the International Society for Pharmacoeconomics and Outcomes Research Task Force for Translation and Cultural Adaptation Group. The translated version was validated in 226 patients with gastric cancer, using the area under the receiver operating characteristic curve analysis (AUC-ROC), measures of sensitivity, specificity, and the Youden index. The prevalence of malnutrition was analyzed using descriptive statistics.

Results: The AUC-ROC Korean version of the PG-SGA was 0.85, and a score of 12 was the most optimal cut-off score, with a sensitivity of 78.6% and a Youden index of 0.54. One-third of participants were malnourished, and 70% of them had more than one physical symptom affecting their food intake.

Conclusions: The Korean version of the PG-SGA is an effective and valid assessment tool for evaluating malnutrition in patients with gastric cancer. A new cut-off score could be used in patients with gastric cancer to assess malnutrition.

Keywords: malnutrition; neoplasms; nutrition; screening; validation
1. INTRODUCTION

Approximately 40% of patients with cancer are reported to experience malnutrition, either due to cancer itself or its treatment.\(^1\) The prevalence of malnutrition in patients with gastrointestinal, esophageal, and pancreatic cancers is relatively high, whereas malnutrition in patients with prostate and breast cancer is relatively low.\(^2,3\)

Gastric cancer is the fifth most common cancer worldwide, with more than 70% of all gastric cancer cases occurring in Asia.\(^4\) The incidence of malnutrition is approximately 50–60% in patients with gastric cancer.\(^2,5\) The high incidence of malnutrition is associated with anatomical changes and the effects of reconstruction after gastrectomy, which is the primary treatment for gastric cancer.\(^6\) Patients frequently experience various physical symptoms such as indigestion, postprandial fullness, dysphagia, nausea, and diarrhea after gastrectomy that could lead to malnutrition and weight loss.\(^6,7\) Hence, a well-validated malnutrition assessment tool is essential to identify and monitor patients needing early nutritional intervention.\(^8,9\)

The Patient-Generated Subjective Global Assessment (PG-SGA) is a well-known malnutrition assessment tool for patients with cancer. It has been well validated among various cancer populations in diverse clinical settings.\(^10\) The PG-SGA has been translated and validated in many languages, including German, Greek, Italian, Japanese, and Portuguese.\(^11\) The biggest feature of the PG-SGA is that it includes the assessment of various symptoms related to food and nutritional intake unlike other nutritional assessment tools. This feature of PG-SGA makes it a more suitable tool for patients with gastric cancer as these patients experience various physical symptoms affecting diet after surgery. A well-translated and validated PG-SGA can assist nurses in screening for and diagnosing nutritional deficiencies.
In patients with cancer, in South Korea, PG-SGA was validated in patients with stroke and geriatric patients, but neither study had undertaken a thorough translation process. Only a well-translated instrument can collect valid data, and the translation process should be performed in accordance with evidence-based guidelines using a systematic approach to enhance the instrument’s validity. Therefore, an appropriately translated and validated Korean version of the PG-SGA is required.

For the validation of an instrument, a comparative measurement is essential. Various nutritional assessment tools exist, such as Mini-Nutritional Assessment, Malnutrition Universal Screening Tool (MUST), Nutritional Risk Screening-2002 (NRS-2000), and Global Leadership Initiative on Malnutrition (GLIM); however, each has a limitation in its use as a suitable comparative measurement tool in this study. MUST was originally developed for use in the community setting, not in a clinical setting and NRS-2000 was reported to demonstrate inconsistent validity among different inpatient groups. GLIM deemed not suitable for this study as it includes anthropometry measurement.

We, therefore, selected the Mini-Nutritional Assessment Short Form (MNA-SF) as a comparative instrument. MNA-SF is an internationally renowned instrument with high sensitivity, specificity, and reliability. It is recommended by international nutritional organizations such as the American Society for Parenteral and Enteral Nutrition and the European Society for Parenteral and Enteral Nutrition. Although the MNA-SF was originally developed for use in elderly patients, it has been validated in diverse age groups as well as various other patient groups, and evidence suggests that it is now one of the most used nutritional assessment tools in adult patients with cancer.
This study aimed to translate the PG-SGA into Korean in accordance with guidelines provided by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) and to determine the validity of the PG-SGA for evaluating malnutrition in patients with gastric cancer compared to the MNA-SF as the existing standard. Additionally, the prevalence of malnutrition in our study population was assessed using the Korean version of PG-SGA.
2. MATERIALS AND METHODS

2.1 Study design

This was a validation study of the Korean version of the PG-SGA in relation to the MNA-SF. The study comprised two steps: 1) translation of the PG-SGA into Korean and 2) validation of the PG-SGA against the MNA-SF as the reference standard.

2.2 Participants

The study included 226 patients with gastric cancer treated at the Gastric Cancer Center of * University Hospital. The inclusion criteria were patients over 18 years old and who received gastrectomy after a cancer diagnosis. The exclusion criteria were patients who refused to participate in the study and who did not know about their cancer diagnosis. The sample size of over 200 was determined based on the previous study.25 Due to the study’s timeline, all patients who visited the outpatient department were screened for eligibility during the data collection period.

2.3. Measures

2.3.1 Participant characteristics

Demographic data such as sex, age, marital status, educational level, and employment status were assessed. For clinical data, cancer classification and staging, chemotherapy status, type of gastrectomy, time after surgery (months), comorbidities, and reasons for gastric cancer screening were retrieved from electronic medical records.

2.3.2 Patient-Generated Subjective Global Assessment

The PG-SGA comprises two sections: a patient-generated section (four questions) and a professional-filled section (three questions).11 First, the patient-generated section consists of
four boxes. Box 1 consisted of the items related to current weight, weight history, and weight changes within 2 weeks. Box 2 comprises items of recent changes in food intake. Box 3 included various symptoms within 2 weeks affecting intake. Box 4 was about changes in activity levels. Second, the professional-filled section included items related to diagnosis, such as disease stage, age, components of metabolic demand, and physical assessment.

Scores range from 0 to 36; a high score indicates malnourishment, and a score >9 indicates a critical need for nutritional intervention. The permission to translate PG-SGA into Korean was obtained from the developer of the PG-SGA, Dr. Faith Ottery.

2.3.3 Mini-Nutritional Assessment Short Form

The MNA-SF comprises six items: changes in food intake, changes in weight, mobility, psychological stress, neuropsychological problems, and body mass index. Scores on the MNA-SF range from 0 to 14, and there are three classifications: malnourished (score: 0–7), at risk of malnutrition (score: 8–11), or normal nutritional status (score 12–14). To assess validity and sensitivity, we operationalized the MNA-SF as a binary variable based on the scoring guide: malnutrition (score: 0–7) and normal (score: 8–14).

2.4 Data collection

Data were collected from March 2021 to May 2021. After receiving approval from the clinical department, the main researcher met the patients waiting for their follow-up visits at the outpatient department. After explaining the details of the study, the researcher obtained written consent from those patients who agreed to participate. Participants completed both the MNA-SF and the patient section of the PG-SGA, and the researcher completed the healthcare provider section of the PG-SGA.
2.5 Data analysis

Descriptive statistics of the mean, standard deviation, and percentage were used to describe the participant characteristics. The area under the receiver operating characteristic curve analysis (AUC-ROC) was used to compare the PG-SGA to the MNA-SF. Validity was assessed by analyzing the sensitivity, specificity, positive and negative predictive values, and Youden index of the PG-SGA compared with the MNA-SF. Accordingly, the cut-off scores of the PG-SGA for patients with gastric cancer were determined. Statistical analyses were performed using SPSS version 25.

2.6 Ethical consideration

This study was approved by the Institutional Review Board of XX University Health System in Seoul, Korea (IRB No. X-XXXX-XXXX). When the patients met the main researcher at the outpatient clinic, they were informed about the purpose of the study, the procedures used for data collection, the estimated time required to complete the questionnaires, expected benefits, and possible harms. In addition, the researcher explained the process for ensuring anonymity/confidentiality, and participants were informed that they had the right to withdraw from the study at any time.
3. RESULTS

3.1 Translation

The translation of the PG-SGA was conducted as per the Guidelines of the Translation of Patient-Reported Outcome Measures of the ISPOR Task Force for Translation and Cultural Adaptation Group using the following five steps: 1) preparation, 2) forward translation, 3) reconciliation, 4) back translation, and 5) backward translation review and harmonization. After these five steps, four patients and five healthcare providers were asked to evaluate the Korean version of the PG-SGA for comprehensibility/difficulty and to provide comments or suggestions. Two bilinguals (JL & YB) participated in the translation process. One (JL) had graduated from a university in the United States and is working in an international broadcast that uses English. The other (YB) had graduated from the Hankuk University of Foreign Studies, Graduate School of Interpretation and Translation (Seoul, Korea), and is a certified interpreter and translator with more than five years of work experience.

Preparation

One bilingual (JL) performed forward translation on the original PG-SGA and completed the initial draft.

Forward translation

At least two independent forward translation versions were preferred to enhance the quality of the translation. Hence, along with the initial translation draft by JL and YB, another forward translation version was obtained from a researcher who had translated it into Korean and used it in her previous study.
Reconciliation

The first bilingual translator (JL) reviewed the two forward translation versions and reconciled them into a single version after additional translation. Some words and sino-Korean words were replaced with easy ones, and sentences were improved in terms of coherence.

Backward translation

The second bilingual translator (YB) back-translated the reconciled Korean version to English. The back-translated version and the original English version of the PG-SGA were reviewed. The back-translated version was almost identical to the original version, except for slight differences in word order.

Back translation review and harmonization

After the back translation, the first author and two bilingual translators (JL & YB) reviewed the independent five versions together (the original PG-SGA, the two forward-translated versions, the reconciled version, and the back-translated version). The discrepancies among the five versions were identified and discussed, and the final translated Korean version of the PG-SGA was derived.

Evaluation of comprehensibility

The draft of the PG-SGA Korean version was reviewed by four patients and five healthcare providers (four nurses and one doctor). The patients were two men and two women between the ages of 60 and 70. The healthcare providers were one man and four women in their 30s, and their clinical experience ranged from 5 to 8 years. The researcher asked the patients and healthcare providers about any words, phrases, or sentences that were
1) awkward, 2) unclear, or 3) difficult to understand. The healthcare providers were asked to evaluate Box A from the perspective of an older patient.

One patient commented that one sentence was too long to understand. One nurse commented that the older patients might have trouble understanding the word “tube feeding,” as medical jargon for “tube feeding” was used. Also, the doctor commented that it is unclear whether the “Now I am taking” item is only for people who have answered they eat less than usual. Additional amendments were made based on their feedback and the final Korean version of PG-SGA was completed (Supplementary material).

3.2 Validation

3.2.1 Participant characteristics

More than half of the participants were men (58%), and the mean age of the sample was 61.4 years. Most patients were married (82.3%), had an educational level above high school (73.9%), and were unemployed (68.2%). Most were diagnosed with stage 1 cancer (70.4%) and had a subtotal gastrectomy (74.8%). Their time after gastrectomy ranged from three weeks to five years, with a median of six months. About half of the patients had comorbidities, including hypertension (61.4%), type II diabetes mellitus (28.7%), dyslipidemia (12.3%), coronary artery disease (9%), pulmonary disease (7%), and other diseases such as benign prostate hypertrophy, hypothyroidism, and herniated lumbar disc. Most of the participants were diagnosed after taking a national cancer screening diagnostic test (58.4%), followed by private health screening (19.9%), and diagnostic tests due to the development of physical symptoms (17.7%) (Table 1).
Table 1. Characteristics of patients (N = 226)

| Variables                  | Categories            | n (%)      | M ± SD     |
|---------------------------|-----------------------|------------|------------|
| Gender                    | Men                   | 131 (58.0) |            |
|                           | Women                 | 95 (42.0)  |            |
| Age                       |                       |            | 61.4±11.4  |
| Marital status            | Married               | 186 (82.3) |            |
|                           | Not married           | 40 (17.7)  |            |
| Education                 | ≥ High school         | 167 (73.9) |            |
|                           | < High school         | 59 (26.1)  |            |
| Employment                | Unemployed            | 154 (68.2) |            |
|                           | Employed              | 72 (31.8)  |            |
| Cancer stage              | I                     | 159 (70.4) |            |
|                           | II                    | 37 (16.4)  |            |
|                           | III                   | 25 (11.1)  |            |
|                           | IV                    | 1 (0.004)  |            |
| Type of gastrectomy       | Subtotal              | 169 (74.8) |            |
|                           | Total                 | 57 (25.2)  |            |
| Time after gastrectomy    | 3 weeks               | 32 (14.2)  | Median: 6  |
|                           | 3 months              | 56 (24.8)  |            |
|                           | 6 months              | 42 (18.6)  |            |
|                           | 9–12 months           | 18 (8.0)   |            |
|                           | 15–24 months          | 33 (14.6)  |            |
|                           | 30–36 months          | 20 (8.8)   |            |
|                           | 42–60 months          | 24 (10.6)  |            |
| Currently receiving CTx   | No                    | 203 (89.8) |            |
|                           | Yes                   | 23 (10.2)  |            |
| Comorbidities             | No                    | 104 (46.0) |            |
|                           | Yes*                  | 122 (54.0) |            |
|                           | HTN                   | 75 (61.4)  |            |
|                           | DM II                 | 35 (28.7)  |            |
|                           | Dyslipidemia          | 15 (12.3)  |            |
|                           | CAD                   | 11 (9.0)   |            |
|                           | Pulmonary disease     | 9 (7.0)    |            |
|                           | Others                | 69 (56.6)  |            |
| Reasons for screening     | National cancer screening | 132 (58.4) |            |
|                           | Private health screening | 45 (19.9)  |            |
|                           | Physical symptoms     | 40 (17.7)  |            |

CAD = coronary artery disease; CTx = chemotherapy; DM II = type II diabetes mellitus; HTN = hypertension; M = mean; SD = standard deviation.

*Multiple responses possible.
3.2.2. Validity of the Patient-Generated Subjective Global Assessment

The AUC-ROC value for the PG-SGA was 0.85 (Figure 1). Table 2 shows the sensitivity, specificity, positive predictive value, and negative predictive value. The original PG-SGA suggests a cut-off score of 9 as malnutrition and a need for nutrient intervention. However, a cut-off score of 12 was considered optimal for patients with gastric cancer in this study, with the highest Youden’s index and sensitivity (Table 2) after calculating Youden’s index, sensitivity, specificity, and positive and negative predictive value using cut-off scores of 8–13, based on the MNA-SF. Although the specificity of the cut-off score of 11 is higher than that of 12, it may be beneficial to prioritize sensitivity (i.e., the percentage of patients accurately identified as having malnutrition) over specificity (i.e., the percentage of patients accurately evaluated as well-nourished) when investigating the validity of nutritional assessments.

Table 2. Sensitivity and specificity of the PG-SGA using different cut-off score

|                  | PG-SGA (≥11) | PG-SGA (≥12) | PG-SGA (≥13) |
|------------------|--------------|--------------|--------------|
| Youden’s index   | 0.485        | 0.539        | 0.473        |
| Sensitivity      | 72.2%        | 78.6%        | 73.9%        |
| Specificity      | 76.3%        | 75.3%        | 73.4%        |
| Positive predictive value | 72.2% | 78.6% | 73.9% |
| Negative predictive value | 76.3% | 75.3% | 73.4% |

PG-SGA = Patient-Generated Subjective Global Assessment.

Note. MNA was used as the reference standard.

3.3. Nutritional status and physical symptoms affecting nutritional intake

Table 3 shows the nutritional status of the participants using the cut-off value of 12 and the distribution of patient-reported physical symptoms using the PG-SGA. Approximately 30% of the participants were malnourished, and the proportion of malnourished patients gradually decreased as the time after gastrectomy increased (Figure 2). However,
approximately 70% of the participants reported more than one physical symptom that affects food intake. The most prevalent symptom was diarrhea (27.9%), followed by loss of appetite (16.8%), and nausea and feeling full quickly (11.9%, each). The participants reported other symptoms in short written answers that were not listed on the questionnaire, and feeling bloated was the most common among unlisted symptoms (10.6%).

Table 3. Distribution of malnutrition and physical symptoms affecting intake (N = 226)

| Variables                        | Categories         | n (%)            |
|----------------------------------|--------------------|------------------|
| Nutritional status*              | Well-nourished     | 155 (68.9)       |
|                                  | Malnourished       | 71 (31.4)        |
| Physical symptoms                | None               | 68 (30.1)        |
|                                  | One or more†       | 158 (69.9)       |
|                                  | Diarrhea           | 63 (27.9)        |
|                                  | Loss of appetite   | 38 (16.8)        |
|                                  | Nausea†            | 27 (11.9)        |
|                                  | Feel full quickly  | 27 (11.9)        |
|                                  | Fatigue            | 22 (9.7)         |
|                                  | Loss of taste      | 21 (9.3)         |
|                                  | Vomiting           | 21 (9.3)         |
|                                  | Constipation       | 19 (8.4)         |
|                                  | Difficulty swallowing | 7 (3.1)      |
|                                  | Dry mouth          | 6 (2.7)          |
|                                  | Bothersome smell   | 6 (2.7)          |
|                                  | Pain               | 6 (2.7)          |
|                                  | Mouth sours        | 3 (1.3)          |
|                                  | Others (written answers) | 51 (22.6) |
|                                  | Feeling bloated    | 24 (47.0)        |
|                                  | Indigestion        | 12 (23.5)        |
|                                  | Stomach discomfort | 5 (10.0)         |
|                                  | Etc. (no energy, dizziness, dental problems, acid reflux, cold sweat) | 10 (19.6) |

†Multiple responses possible.

Note. PG-SGA with a cut-off score of 12 was used as the reference standard.
4. DISCUSSION

This study aimed to translate the Korean version of the PG-SGA and assess its validity compared to the MNA-SF. The prevalence of malnutrition and symptoms related to dietary intake in our study population were also assessed using the PG-SGA.

To the best of our current knowledge, this is the first study to translate the PG-SGA into Korean. We believe that the steps of the ISPOR, as well as detailed feedback and comments from patients and healthcare providers, yielded a user-friendly and well-adapted Korean version of the PG-SGA. A systematic and scientific translation process can help reduce measurement bias and assist in collecting valid data. We suggest that other researchers avoid a direct translation and consider various aspects such as colloquial expressions, jargon, word clarity, subtle nuances, linguistic context, and cultural differences when translating an instrument.

An AUC of 0.85 demonstrated that the PG-SGA is an appropriate tool for assessing malnutrition in patients with gastric cancer compared to the MNA. The AUC indicates how well the measure can differentiate the positivity or negativity of the criterion. An AUC of 0.5 indicates non-informative accuracy, $0.5 < \text{AUC} \leq 0.7$ indicates low accuracy, $0.7 < \text{AUC} \leq 0.9$ indicates moderate accuracy, $0.9 < \text{AUC} < 1$ indicates high accuracy and an AUC of 1 indicates perfect accuracy. Hence, healthcare providers could well evaluate malnutrition using PG-SGA.

Different optimal cut-off scores must be applied for different target populations, particularly when the target population’s clinical characteristics are closely related to the clinical condition the tool is measuring. The original PG-SGA defines a score >9 as severely malnourished, however, this study showed that a cut-off score of 12 shows the highest
sensitivity, the probability of a positive case. Researchers might consider using a cut-off score of 12 in patients with gastric cancer when using PG-SGA. It is important for researchers to identify in what population the measurement tool was originally validated before using it.

Notably, 70% of the patients reported more than one physical symptom related to eating, while only approximately 30% of the participants were classified as malnourished. This indicates that many people are classified as well-nourished but experience physical symptoms related to their intake. In one study of patients with cancer treated in an acute care setting, 17% of the patients were severely malnourished, but 72% reported having more than one symptom. In a study targeting patients receiving chemotherapy, 17% were found to be malnourished when assessed using the PG-SGA, but 59% of them reported nutritional impact symptoms. Patients classified as nourished may also experience dietary symptoms that could affect their eating habits, which could further influence their quality of life. Hence, patients should be routinely assessed for malnutrition and managed as necessary. We believe that PG-SGA can assist nurses in assessing various physical symptoms experienced by patients that hindered food intake.

Moreover, our findings demonstrated that malnutrition was highly prevalent among patients within 12 months after gastrectomy. This finding is consistent with previous studies showing that the weight loss and physical symptoms patients with gastric cancer experience are most prevalent within the first year after surgery. Although the routine assessment of nutritional status in patients with gastric cancer is always important, healthcare providers need to pay extra attention in patients after gastrectomy for their first 12 months.

The implications of this study are, first, that an evidence-based, systematic process is essential in the translation of the measurement, since inadequate or inappropriate translation
might harm the validity of the data. As inadequately translated assessment tools could hinder
the accumulation of meaningful evidence, researchers who translate any assessment tool need
to have a great sense of responsibility. Second, different optimal cut-off scores should be
determined based on the different target patient groups. This study suggests healthcare
providers a new cut-off score for evaluating malnutrition in patients with gastric cancer who
had gastrectomy in South Korea. This new cut-off score should also be evaluated in a similar
population in different settings in South Korea, as well as in other Asian countries. Third,
healthcare providers can have more detailed information about nutritional issues the patients
are currently experiencing using this instrument. As most nutritional assessments or screening
tools do not include items regarding dietary symptoms experienced by patients, these
symptoms are likely neglected. By using the Korean version of PG-SGA, healthcare
providers can thoroughly assess and manage these symptoms. Lastly, our study revealed that
the prevalence of malnutrition was significantly high within six months after gastrectomy in
patients with gastric cancer. Healthcare providers should pay close attention to those with
gastrointestinal cancer for six months after surgery.

5. LIMITATIONS

The limitation of this study is that the MNA-SF, the reference instrument used in this
study, is a patient-reported measurement; hence, using an objective nutritional index could
have provided stronger evidence. Moreover, similar studies using other nutritional assessment
tools as the reference criteria, such as the Global Leadership Initiative on Malnutrition
Criteria, might further increase the validity of PG-SGA in patients with gastric cancer.
Additionally, since the PG-SGA was validated only in patients with gastric cancer; hence, for
other patient groups, it is advisable for researchers to use a cut-off score of 9 as suggested in
the original PG-SGA or to use the PG-SGA as a continuous variable. Furthermore, we only
included patients with gastric cancer who underwent gastrectomy; hence, a new cut-off score
might not be applied to patients with advanced gastric cancer who only received
chemotherapy and/or radiotherapy. In addition, this study was conducted at a single hospital
in South Korea, limiting the generalizability of the study finding. Lastly, a bigger sample size
might have yielded more valid results.

6. CONCLUSIONS

A well-translated Korean version of the PG-SGA is an effective and valid assessment
tool for evaluating malnutrition in patients with gastric cancer. It could assist healthcare
providers in assessing malnutrition in patients with gastric cancer who have undergone
gastrectomy, as well as subjective symptoms they have related to food intake.

Acknowledgments: None to declare.

Financial support and sponsorship: This research did not receive any specific grant from
funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest: There are no conflicts of interest.

Author contributions
Conceptualization: Ji Yea Lee, Eui Geum Oh; Methodology: Ji Yea Lee, Eui Geum Oh; Data
curation: Ji Yea Lee, Woo Jin Hyung, Hyoung-Il Kim; Writing – original draft: Ji Yea Lee;
Writing – review & editing: Eui Geum Oh, Hyoung-Il Kim
1 References

1. Zhu C, Wang B, Gao Y, Ma X. Prevalence and relationship of malnutrition and distress in patients with cancer using questionnaires. *BMC Cancer*, 2018;18:1272. http://doi.org/10.1186/s12885-018-5176-x

2. Muscaritoli M, Lucia S, Farcomeni A, Lorusso V, Saracino V, Barone C, et al. Prevalence of malnutrition in patients at first medical oncology visit: the PRIMIO study. *Oncotarget*, 2017;8:79884-79896. http://doi.org/10.18632/oncotarget.20168

3. Bossi P, Delrio P, Mascheroni A, Zanetti M. The spectrum of malnutrition/cachexia/sarcopenia in oncology according to different cancer types and settings: a narrative review. *Nutrients*, 2021;13:1980. http://doi.org/10.3390/nu13061980

4. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*, 2021;71:209-249. http://doi.org/10.3322/caac.21660

5. Son YG, Kwon IG, Ryu SW. Assessment of nutritional status in laparoscopic gastrectomy for gastric cancer. *Transl Gastroenterol Hepatol*, 2017;2:85. http://doi.org/10.21037/tgh.2017.09.08

6. Ajani JA, D'Amico TA, Bentrem DJ, Chao J, Cooke D, Corvera C, et al. Gastric cancer, version 2.2022, NCCN clinical practice guidelines in oncology. *J Natl Comp Cancer Netw*, 2022;20:167-192. http://doi.org/10.6004/jnccn.2022.0008

7. Davis JL, Ripley RT. Postgastrectomy syndromes and nutritional considerations following gastric surgery. *Surg Clin North Am*, 2017;97:277-293. http://doi.org/10.1016/j.suc.2016.11.005
1. Kubota T, Shoda K, Konishi H, Okamoto K, Otsuji E. Nutrition update in gastric cancer surgery. *Ann Gastroenterol Surg*, 2020;8:360-368.

2. http://doi.org/10.1002/ags3.12351

3. Ravasco P. Nutrition in cancer patients. *J Clin Med*, 2019;8.

4. http://doi.org/10.3390/jcm8081211.

5. Jager-Wittenaar H, Ottery FD. Assessing nutritional status in cancer: role of the patient-generated subjective global assessment. *Curr Opin Clin Nutr Metab Care*, 2017;20:322-329. http://doi.org/10.1097/MCO.0000000000000389.

6. PG-SGA/Pt-Global Platform. PG-SGA© Downloads. https://pt-global.org/page_id13/

7. Accessed January 2, 2022.

8. Yoo SH, Lee GE, Oh HJ, Park EY, Kim YJ, An YH. Validity of patient-generated subjective global assessment (PG-SGA) in hospitalized older patients. *J Korean Gerontol Nurs*, 2011;13:215-223.

9. Yoo SH, Oh EG, Yoon MJ. The reliability and validity of patient-generated subjective global assessment (PG-SGA) in stroke patients. *Korean J of Adult Nurs*, 2009;21:559-569.

10. Cha ES, Kim KH, Erlen JA. Translation of scales in cross-cultural research: issues and techniques. *J Adv Nurs*, 2007;58:386-395. http://doi.org/10.1111/j.1365-2648.2007.04242.x

11. Jones PS, Lee JW, Phillips LR, Zhang XE, Jaceldo KB. An adaptation of Brislin's translation model for cross-cultural research. *Nurs Res*, 2001;50:300-304.

12. http://doi.org/10.1097/00006199-200109000-00008

13. Maneesriwongul W, Dixon JK. Instrument translation process: a methods review. *J Adv Nurs*, 2004;48:175-186. http://doi.org/10.1111/j.1365-2648.2004.03185.x.
17. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR task force for translation and cultural adaptation. Value Health, 2005;8:94-104.
http://doi.org/10.1111/j.1524-4733.2005.04054.x.

18. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M; Educational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN). ESPEN guidelines for nutrition screening 2002. Clin Nutr. 2003;22(4):415-421.
http://doi.org/10.1016/s0261-5614(03)00098-0

19. van Bokhorst-de van der Schueren MA, Guaitoli PR, Jansma EP, de Vet HC. Nutrition screening tools: does one size fit all? A systematic review of screening tools for the hospital setting. Clin Nutr. 2014;33(1):39-58.
http://doi.org/10.1016/j.clnu.2013.04.008

20. Jensen GL, Cederholm T, Correia MITD, et al. GLIM Criteria for the Diagnosis of Malnutrition: A Consensus Report From the Global Clinical Nutrition Community. JPEN J Parenter Enteral Nutr. 2019;43(1):32-40. http://doi.org/10.1002/jpen.1440

21. Guigoz Y. The mini nutritional assessment (MNA®) review of the literature-what does it tell us? J Nutr Health Aging, 2006;10:466.
22. Nestle Nutrition Institute. What is the MNA®? Nestle Nutrition Institute. https://mna-elderly.com. Accessed Feb 20 2022.

23. Ruan X, Nakyeyune R, Shao Y, Shen Y, Niu C, Zang Z, et al. Nutritional screening tools for adult cancer patients: A hierarchical Bayesian latent-class meta-analysis. Clini Nutr, 2021;40:1733-1743. http://doi.org/10.1016/j.clnu.2020.09.033

24. Torbahn G, Strauss T, Sieber C, Kiesswetter E, Volkert D. Nutritional status according
to the mini nutritional assessment (MNA®) as potential prognostic factor for health and treatment outcomes in patients with cancer—a systematic review. *BMC cancer*, 2020;20:1-18. http://doi.org/10.1186/s12885-020-07052-4

25. Hanczar B, Hua J, Sima C, Weinstein J, Bittner M, Dougherty ER. Small-sample precision of ROC-related estimates. *Bioinformatics*, 2010;26:822-830. http://doi.org/10.1093/bioinformatics/btq037

26. Squires A, Aiken LH, van den Heede K, Sermeus W, Bruyneel L, Lindqvist R, et al. A systematic survey instrument translation process for multi-country, comparative health workforce studies. *Int J Nurs Stud*, 2013;50:264-273. http://doi.org/10.1016/j.ijnurstu.2012.02.015

27. Hilton A, Skrutkowski M. Translating instruments into other languages: Development and testing processes. *Cancer Nurs*, 2002;25:1-7. http://doi.org/10.1097/00002820-200202000-00001.

28. Swets JA. Measuring the accuracy of diagnostic systems. *Science*, 1988;240:1285-1293. http://doi.org/10.1126/science.3287615

29. Bauer J, Capra S, Ferguson M. Use of the scored patient-generated subjective global assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. *Eur J Clin Nutr*, 2002;56:779-785. http://doi.org/10.1038/sj.ejcn.1601412

30. Abbott J, Teleni L, McKavanagh D, Watson J, McCarthy AL, Isenring E, et al. Patient-generated subjective global assessment short form (PG-SGA SF) is a valid screening tool in chemotherapy outpatients. *Support Care Cancer*, 2016;24:3883-3887. http://doi.org/10.1007/s00520-016-3196-0

31. Taleghani F, Ehsani M, Farzi S, Farzi S, Adibi P, Moladoost A, et al. Nutritional challenges of gastric cancer patients from the perspectives of patients, family
caregivers, and health professionals: A qualitative study. *Support Care Cancer*, 2021;29:3943-3950. http://doi.org/10.1007/s00520-020-05951-7

32. Shan B, Shan L, Morris D, Golani S, Saxena A. Systematic review on quality of life outcomes after gastrectomy for gastric carcinoma. *J Gastrointest Oncol*, 2015;6:544. http://doi.org/10.3978/j.issn.2078-6891.2015.046

33. Gharagozlian S, Mala T, Brekke HK, Kolbjørnsen LC, Ullerud ÅA, Johnson E. Nutritional status, sarcopenia, gastrointestinal symptoms and quality of life after gastrectomy for cancer - a cross-sectional pilot study. *Clin Nutr ESPEN*, 2020;37:195-201. http://doi.org/10.1016/j.clnesp.2020.03.001
AUC=Area Under the Curve; PG-SGA=Patient-Generated Subjective Global Assessment; ROC=Receiver Operating Characteristic curve.
Note. MNA-SF was used as the reference standard.
Figure 2. Distribution of malnourished patients at different timepoints after surgery

M = months; W = weeks; Note. PG-SGA with cutoff score 12 was used as the reference standard.
Author statements

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Manuscript title: Translation and validation of the Patient-Generated Subjective Global Assessment against the Mini Nutritional Assessment for Eui Geum Oh

Corresponding author: Art

Article type: Original Article

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Author contributions

Please insert here the contribution each author made to the manuscript outlining their individual contributions to the paper using the relevant CRediT roles: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing. Authorship statements should be formatted with the names of authors first and CRediT role(s) following. More details and an example.

Sample CRediT author statement

Zhang San: Conceptualization, Methodology, Software. Priya Singh: Data curation, Writing- Original draft preparation. Wang Wu: Visualization, Investigation. Jan Jansen: Supervision. Ajay Kumar: Software, Validation. Sun Qi: Writing- Reviewing and Editing.

Conceptualization: Ji Yea Lee, Eui Geum Oh
Methodology: Ji Yea Lee, Eui Geum Oh
Data curation: Ji Yea Lee, Woo Jin Hyung, Hyoung-II Kim
Writing – original draft: Ji Yea Lee
Writing – review & editing: Eui Geum Oh, Hyoung-II Kim

Role of the funding source

Please disclose any funding sources and their role, if any, in the writing of the manuscript or the decision to submit it for publication. Examples of involvement include: data collection, analysis, or interpretation; trial design; patient recruitment; or any aspect pertinent to the study. Please also comment whether you have been paid to write this article by a pharmaceutical company or other agency. The information provided
here must match the role of the funding source statement in the manuscript. If you are the corresponding author, please state that authors were not precluded from accessing data in the study, and they accept responsibility to submit for publication.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of interests

☑️ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Patient consent (if applicable) - completion of this section is mandatory for any articles including case details, personal information, and/or images of patients or other individuals. Please sign below to confirm that all necessary consents required by applicable law from any relevant patient, research participant, and/or other individual whose information is included in the article have been obtained in writing. The signed consent form(s) should be retained by the corresponding author and NOT sent to Asia-Pacific Journal of Oncology Nursing.

I agree with: the plan to submit to Asia-Pacific Journal of Oncology Nursing; the contents of the manuscript; the statements on data access; to being listed as an author; and to the conflicts of interest statement as summarised.

Signed by all authors as follows:

Eui Geum Ji Yea Woo Jin Hyoung-II