Assessing nutritional status in cancer: role of the Patient-Generated Subjective Global Assessment

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Purpose of review
The Scored Patient-Generated Subjective Global Assessment (PG-SGA) is used internationally as the reference method for proactive risk assessment (screening), assessment, monitoring and triaging for interventions in patients with cancer. This review aims to explain the rationale behind and data supporting the PG-SGA, and to provide an overview of recent developments in the utilization of the PG-SGA and the PG-SGA Short Form.

Recent findings
The PG-SGA was designed in the context of a paradigm known as 'anabolic competence'. Uniquely, the PG-SGA evaluates the patient's status as a dynamic rather than static process. The PG-SGA has received new attention, particularly as a screening instrument for nutritional risk or deficit, identifying treatable impediments and guiding patients and professionals in triaging for interdisciplinary interventions. The international use of the PG-SGA indicates a critical need for high-quality and linguistically validated translations of the PG-SGA.

Summary
As a 4-in-1 instrument, the PG-SGA can streamline clinic work flow and improve the quality of interaction between the clinician and the patient. The availability of multiple high-quality language versions of the PG-SGA enables the inclusion of the PG-SGA in international multicenter studies, facilitating meta-analysis and benchmarking across countries.

Keywords
anabolic competence, malnutrition, nutritional assessment, Patient-Generated Subjective Global Assessment, screening

INTRODUCTION

Diagnosis and treatment of malnutrition and disturbed metabolism are of critical importance in patients with cancer. Because of the disease and the effects of anticancer therapies, many patients with cancer are at risk for malnutrition. Malnutrition is associated with poorer prognosis and decreased quality of life [1]. Nutritional assessment serves as the basis for the malnutrition diagnosis, which also includes cause, severity and type of malnutrition [2].

The Scored Patient-Generated Subjective Global Assessment (PG-SGA; Copyright FD Ottery, 1996, 2001, 2005, 2006 and 2015) is broadly used in both clinical practice and in academic research as the reference method for assessing the nutritional status of patients with cancer. One of the considerations underlying this wide acceptance is the fact that the PG-SGA is a 4-in-1 instrument: nutritional screen, assessment, interventional triage and an instrument to monitor interventional success. The PG-SGA is recommended in various countries and/or included in various national guidelines for nutrition in oncology, for example Australia, Brazil, The Netherlands [3], United Kingdom [4] and the United States. It is not, however, an oncology-specific instrument.

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KEY POINTS

- The PG-SGA was designed in the context of a paradigm known as 'anabolic competence' and addresses a multimodality approach, including nutrition, hormonal milieu and exercise.
- The PG-SGA and PG-SGA Short Form cover all domains of the conceptual definitions of malnutrition, as defined by ESPEN and ASPEN.
- The PG-SGA and PG-SGA Short Form are validated and sensitive instruments that can easily be used as nutritional screen completed by patients (Short Form), and as nutritional screen, assessment or monitoring instrument by trained professionals (full or Short Form).
- The PG-SGA facilitates interdisciplinary planning across the patient's cancer care continuum by triaging for interventions, for example dietitian, nurse, physician or other relevant individuals in the clinical care process.
- The growing number of translated and culturally adapted versions of the PG-SGA enables global meta-analysis of data, as well as benchmarks for malnutrition outcomes globally.

Since the introduction of the PG-SGA in the 1990s [5], it has been validated and utilized in both cancer and non-cancer patient populations internationally. Numerous studies have shown the association between PG-SGA scores and specific nutritional parameters, for example weight loss, BMI, skinfold measures and hand grip strength [6]. Both earlier and recent data have demonstrated the PG-SGA's ability to predict clinical outcomes, for example survival, postoperative complications, length of stay, quality of life and hospitalization costs (Table 1) [7▪▪,8▪,9–13]. The PG-SGA is sensitive to changes in nutritional status over time, for example in response to nutritional interventions [14].

Recently, the PG-SGA (full and Short Form) has received new attention, particularly as a screening instrument for nutritional risk or deficit. The PG-SGA is often described as a nutritional assessment instrument to diagnose malnutrition, and a recent systematic review showed that both the PG-SGA and PG-SGA Short Form (i.e. Boxes 1–4) cover all domains of the conceptual definitions of malnutrition, as defined by the European Society for Clinical Nutrition and Metabolism (ESPEN) and the American Society for Parenteral and Enteral Nutrition (ASPEN) [15▪]. Current interest also focuses on the PG-SGA's ability to identify treatable impediments and to guide patients and professionals in triaging for interdisciplinary interventions. The PG-SGA not only identifies existing malnutrition, but also risk factors that predispose the patient to future malnutrition. The PG-SGA's triaging system includes nutritional, pharmacologic, exercise and other interventions to facilitate proactive identification, prevention and treatment of malnutrition in at-risk patients.

HISTORICAL BASIS

The PG-SGA was developed as a modification of the original clinician-generated subjective global assessment (SGA) developed at the University of Toronto by Drs. Jeejeebhoy, Baker and Detsky. The original SGA was based on the hypothesis that restoration of food intake can rapidly reduce the risks associated with malnutrition. Specifically, it was hypothesized that if nutrient intake can be restored to optimal levels to meet requirements, the risk of complication is lower, even though the patient may be still wasted and underweight. Changing from a clinician-generated to patient-generated approach aimed to address patient-centric concerns, streamline the clinic flow across the care continuum (inpatient, outpatient, home care and palliative care) and to optimize time for patient–clinician interaction. As patients complete the form prior to interacting with their clinician that is any professional who is involved in the clinical care of the patients with patient self-identification of those issues that impact him/her, clinic flow can be shortened with accompanying improvement in quality and productivity of interaction.

The PG-SGA was originally developed as a one-page instrument that globally assessed a patient in terms of nutritional risk and nutritional deficit and was unscored. The PG-SGA was subsequently scored, to stimulate its use in clinical and clinical trial settings and to limit interobserver variability. A scoring system was developed based on combined input from both medical/oncologic and nutritional perspectives, with the following considerations included, particularly for Boxes 1–4:

(1) Patient perception and patient-reported concerns
(2) Variables of risk for malnutrition or prediction of degree of nutritional deficit
(3) Options for intervention for nutritional intake and nutrition impact symptoms to prevent or reverse malnutrition and weight loss, for example behavioral, educational and pharmacologic interventions
(4) Known prognostic variables, such as degree and acuteness of weight loss and performance status, for example a score of at least 2
(5) A scoring schema of 0–4 points, consistent with scoring used throughout oncology and in

Table 1. Relationship between Patient-Generated Subjective Global Assessment scores and outcomes ($n = 1402$), published between 2015 and 2017

Author	Year of publication	Setting	Population (*N*)	Outcomes
Rodrigues *et al.* [7▪▪]	2015	Hospital	146 women with gynecologic cancer	Significant association between PG-SGA numerical score (>10 points versus 0–10 points) and mortality within 1 year [odds ratio = 30.7; 95% confidence interval (CI): 11.8–79.4] Significant association between PG-SGA Categories and mortality within 1 year (PG-SGA C versus A: hazard ratio = 2.04 95% CI: 1.03–4.05; $P = 0.041$) Significant association between PG-SGA Categories and length of hospital stay [PG-SGA B (median length of stay 8.5 days; range 1–51 days) or C (median 12 days; range 2–32 days) versus A (median 7 days; range 2–17 days); $P = 0.002$]
Guerra *et al.* [8▪]	2016	University hospital	637 hospitalized patients (within 72 h of admission)	Significant association between PG-SGA Categories (PG-SGA C versus A) and increased hospitalization costs (27.5%; 95% CI: 14.0–41.1%; $P < 0.001$)
Hsieh *et al.*[9]	2016	Hospital	256 patients with metastatic gastric cancer (within 1 week before start of chemotherapy)	Significant association between PG-SGA Categories (PG-SGA C versus A/B) and overall survival (hazard ratio = 2.73; 95% CI: 1.73–4.29; $P < 0.001$)
Barata *et al.* [10]	2017	Hospital	37 non-resectable lung cancer patients	Significant association between PG-SGA Categories (PG-SGA A, B/C) and hand grip strength ($P = 0.026$; 95% CI: 0.023–0.029)
Härter *et al.* [11]	2017	Hospital	60 oncology patients admitted for elective surgery	Significant association between PG-SGA numerical score (≥4 versus 0–3 points) and severe postoperative complications ($P = 0.020$)
Kim *et al.* [12]	2017	Hospital	216 patients with multiple myeloma (prior to start of chemotherapy	Significant association between PG-SGA numerical score (≥9 versus 0–3 points) and overall survival (hazard ratio = 2.347; 95% CI: 1.271–4.334; $P = 0.006$)
El Ghammaz *et al.* [12]	2017	Hospital	50 patients undergoing allogeneic hematopoietic stem cell transplantation	Significant association between PG-SGA Categories (PG-SGA B/C versus A) at admission (hazard ratio = 21.542; 95% CI = 1.163–399.076; $P = 0.039$) and day 180 post-transplantation (hazard ratio = 281.879; 95% CI = 1.642–48.399; $P = 0.032$) and overall survival, respectively

toxicity criteria, indicating normal or minimal impact on nutritional status or risk (0); mild impact (1); moderate impact (2); severe impact (3) and potentially life-threatening impact (4)

(6) Total PG-SGA score predominantly from patient input rather than clinician evaluation

ANABOLISM VERSUS CATABOLISM: THE CORE TENET OF THE PATIENT-GENERATED SUBJECTIVE GLOBAL ASSESSMENT

The PG-SGA was designed in the context of a paradigm known as 'anabolic competence', that is the state that optimally supports protein synthesis and lean body mass, global aspects of muscle and organ function and immune response [6]. The paradigm of anabolic competence depicts the primary components of optimal interventions: nutrition, hormonal milieu (including classic hormones and cytokines) and exercise (Fig. 1). Although defined in the 1990s, this integrative approach is increasingly being appreciated as critical in shaping how we think of intervention during cancer treatment, particularly in the context of optimizing oncologic outcomes and quality of survivorship.

The PG-SGA addresses a multimodality and interdisciplinary approach. The Boxes are complementary to each other, as each addresses factors that place the patient at risk for nutritional deficit or poorer outcome. In addition, the PG-SGA includes catabolic factors hindering protein synthesis and increase in lean body mass, for example fever and

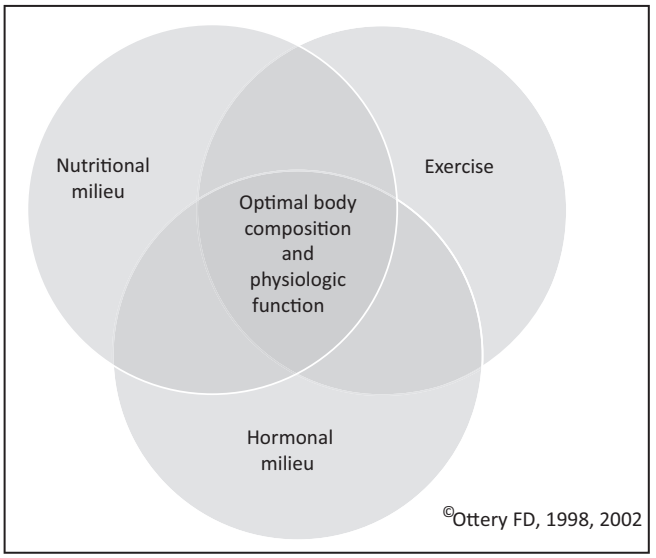

FIGURE 1. Anabolic competence: core tenet of the PG-SGA nutritional intervention. Anabolic competence is that state which optimally supports protein synthesis and lean body mass, global aspects of muscle and organ function and immune response [8▪]. PG-SGA, Patient-Generated Subjective Global Assessment.

the use of corticosteroids (Worksheet 3). Identifying these catabolic factors has therapeutic implications: fever increases nutritional requirements correlated with degree and duration of fever, and, depending on dose/route of administration/duration, the use of corticosteroids also increases protein requirements. Unfortunately, in daily practice, the use of corticosteroids may be overlooked as a contributing catabolic factor.

In contrast to other screening and assessment instruments, the PG-SGA evaluates the patient's status as a dynamic rather than static process. Although weight history is included in many other screening and assessment instruments, the PG-SGA uniquely uses weight history as an indicator of anabolism or catabolism. By scoring acute weight change in addition to intermediate or chronic weight change, the PG-SGA distinguishes a 'U-curved shape' of weight from a linear decrease in body weight. Addressing acute weight change characterizes the specificity of the PG-SGA as compared to other screening and assessment instruments. In a recent Portuguese study, long-stay nursing home residents were evaluated by both PG-SGA and Mini Nutritional Assessment (MNA). Interestingly, half of patients categorized as 'Well nourished' by PG-SGA were categorized as 'Risk of malnutrition' by MNA [16]. This discrepancy can be explained by differences in the scoring of weight history: whereas the PG-SGA 'corrects' for short-term weight stabilization or weight gain, the MNA does not 'correct' for recent improvements.

STRUCTURE OF THE PATIENT-GENERATED SUBJECTIVE GLOBAL ASSESSMENT

The PG-SGA was early in adopting the concept that the patient – not the clinician or carer – is better at reporting what she/he is experiencing. The PG-SGA empowers patients (and indirectly their carers) by asking them about matters that can often be overlooked, or that can be seen to be of lesser importance. The PG-SGA identifies variables that patients may avoid addressing so as not to be seen as complainers; because they do not know that intervention is possible; or because they believe that the symptoms may mean the cancer is worsening or returning. The variety of factors addressed by the Boxes and Worksheets (Table 2) characterizes the PG-SGA as a global assessment of patient risk, rather than solely nutritional deficit.

The PG-SGA consists of two components. First, the patient-generated component, that is Boxes 1–4 (Fig. 2A), officially known and separately used as the PG-SGA Short Form, was designed to be completed by the patient and to reflect approximately 80–90% of the score [5]. The PG-SGA Short Form has been validated as independent screening tool [17]. Second, the items in the professional component (Fig. 2B) were developed as Worksheets to provide self-contained training and to raise awareness of contributors to malnutrition that in clinical practice may easily be overlooked, for example fever and corticosteroids [5]. The five Worksheets are completed by the healthcare professional, which may include the dietitian, nurse, physician, physiotherapist or others involved in the patient's clinical care.

PATIENT-GENERATED SUBJECTIVE GLOBAL ASSESSMENT AS 4-IN-1 INSTRUMENT: SCREEN, ASSESSMENT, TRIAGE AND MONITORING

Although the PG-SGA has mostly been described as a nutritional assessment tool [2], the PG-SGA should be considered a 4-in-1 instrument: nutritional screen, assessment, interventional triage and an instrument to monitor interventional success. As such, the PG-SGA has the advantage of not only being able to diagnose a problem, but also to efficiently guide appropriate intervention and gauge improvement.

The inclusion of nutrition impact symptoms and other factors (Box 3) as risk factors may explain why the PG-SGA Short Form may categorize more patients at risk when compared to other screening

Table 2. Explanation of the Patient-Generated Subjective Global Assessment's Boxes and Worksheets

Box or Worksheet	Explanation
Box 1	Chronic, intermediate and acute weight change
Box 2	Changes in amount/type/consistency of food intake
Box 3	Symptoms/impediments that negatively influence food intake/absorption/utilization of nutrients
Box 4	Activities and function based on the Eastern Cooperative Oncology Group (ECOG) performance status, converted to layman's language
Worksheet 1	Instructions on scoring of percentage weight loss (Box 1)
Worksheet 2	Conditions that may increase nutritional risk or requirements
Worksheet 3	Metabolic stress, for example fever (degree/duration) and corticosteroids (type/dose)
Worksheet 4	Scoring of muscle status (deficit/loss of muscle mass/tone), fat stores and fluid status, based on the nutrition-focused physical examination
Worksheet 5	Overall patient global assessment categorization, utilizing the findings of Boxes 1–4 and the physical examination (Worksheet 4). Categories: Stage A = well nourished, or 'not undernourished'; Stage B = moderately malnourished or suspected malnutrition; or Stage C = severely malnourished

instruments. An exploratory study in Dutch head and neck cancer patients showed that 28% of patients scored at least 9 points, and were considered 'at high risk' by the PG-SGA Short Form, compared to 21% categorized as 'high risk' according to the Malnutrition Universal Screening Tool (MUST) or Short Nutritional Assessment Questionnaire (SNAQ). The PG-SGA Short Form also had better diagnostic accuracy than the MUST and SNAQ, using the full PG-SGA as reference [18].

It is hypothesized that identifying nutrition impact symptoms, especially in an early stage during the cancer continuum, may facilitate proactive malnutrition prevention. For example, a patient may not have lost any significant weight on the initial assessment with an Eastern Cooperative Oncology Group performance status of 0. If the patient checks off several nutrition impact symptoms for which she/he does not receive timely intervention, nutritional status and quality of life are at risk for deterioration. Historically, studies utilizing the PG-SGA have predominantly been observational. Future clinical interventions trials should elucidate the impact of proactively addressing risk factors in the prevention of malnutrition or stabilization of nutritional status.

The PG-SGA (full or Short Form) also facilitates patient monitoring over time. The scoring of the PG-SGA (Table 3) was added to the PG-SGA Categories to identify incremental changes in the patient's global status. Earlier data from Australia confirmed that a change in PG-SGA score of ± 9.0 points [95% confidence interval (CI): 7.2–10.9] was required to change by one category (Stages A, B or C) – improvement or deterioration – and showed that risk status may change even without

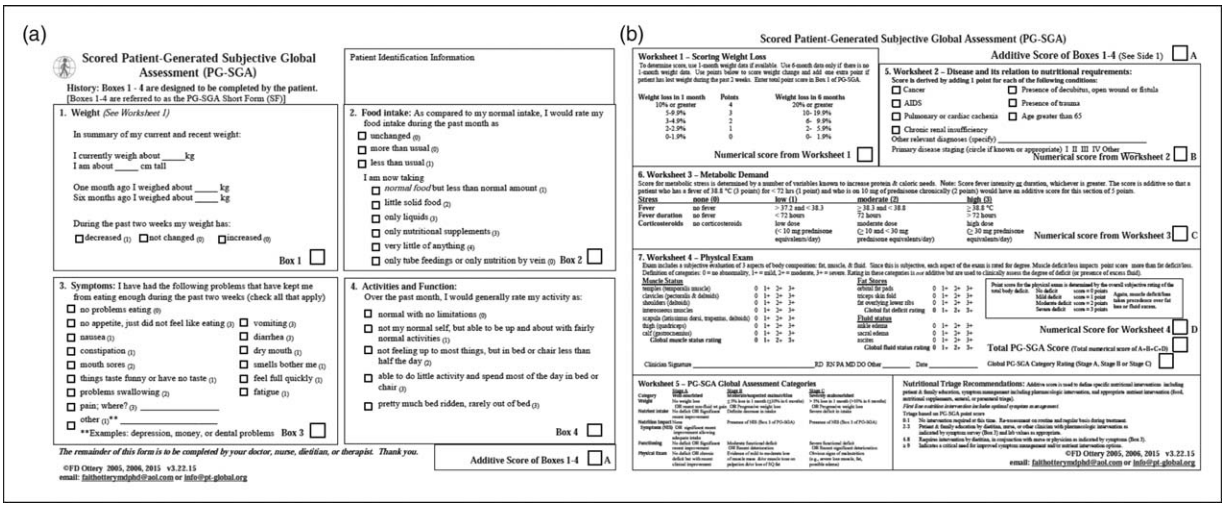

FIGURE 2. (a) Patient component of the PG-SGA, that is PG-SGA Short Form. (b) Professional component of the PG-SGA. PG-SGA, Patient-Generated Subjective Global Assessment.

Table 3. Patient-Generated Subjective Global Assessment numerical scoring system

Boxes and Worksheets	Score range (points)
Box 1 – weight (maximum 5 points) – ADDITIVE	
Self-reported weight change (1 month or 6 months[a])	0–4
Self-reported weight change in past 2 weeks	0–1
Box 2 – food intake (maximum 4 points) – highest score	
Self-rated food intake during the past month	0–1
Self-reported actual type of food intake	0–4
Box 3 – self-reported symptoms affecting eating (maximum 24 points) – ADDITIVE	
No problems eating	0
No appetite, just did not feel like eating	3
Nausea	1
Constipation	1
Mouth sores	2
Things taste funny or have no taste	1
Problems swallowing	2
Pain	3
Vomiting	3
Diarrhea	3
Dry mouth	1
Smells bother me	1
Feel full quickly	1
Fatigue	1
Other	1
Box 4 – activities and function (maximum 3 points) – HIGHEST SCORE	
Self-rated activity level	0–3
Worksheet 1 – scoring weight loss – ADDITIVE	
Is included in point score of Box 1	
Worksheet 2 – disease and its relation to nutritional requirements (no maximum) – ADDITIVE	
Cancer	1
AIDS	1
Pulmonary or cardiac cachexia	1
Chronic renal insufficiency	1
Presence of decubitus, open wound or fistula	1
Presence of trauma	1
Age greater than 65	1
Other	1 for each condition
Worksheet 3 – metabolic demand (maximum 6 points) – additive	
Fever intensity and fever duration	0–3
Corticosteroids type and dose	0–3
Worksheet 4 – physical examination (maximum 3 points for the entire examination) (Fig. 1B)	
Muscle status	0–3
Fat stores	0–3
Fluid status	0–3

[a]To determine score, use 1-month weight data if available. Use 6-month data, only if there is no 1-month weight data.

significant changes in the patient's nutritional status. The PG-SGA point score is also the basis for triaging for specific interdisciplinary interventions, including patient education.

PRACTICAL CONSIDERATIONS ON THE USE OF THE PATIENT-GENERATED SUBJECTIVE GLOBAL ASSESSMENT

As 80–90% of the scoring results from the first four Boxes, it is consistent that the PG-SGA Short Form shows high sensitivity and specificity when compared to the full PG-SGA [17,18]. An Australian study in ambulatory patients undergoing anticancer treatment found a sensitivity and specificity of 80 and 72%, respectively, while using a PG-SGA Short Form risk cutoff score of at least 3 points [17]. A Dutch study in head and neck cancer patients that used a higher cutoff, that is at least 9 points, indicating critical need for intervention as described in the PG-SGA triage for nutritional recommendations, showed a sensitivity and specificity of 73 and 100%, respectively [18]. The good sensitivity and specificity of the PG-SGA Short Form supports its use as screening and monitoring instrument.

At the 2016 ESPEN Congress, it was articulated that screening should use simple questions that can be quickly answered by the patients, relatives or carers [19]. As early as the 1990s, the PG-SGA was reported as easy to use. Recent data collected during the PG-SGA translation and cultural adaptation process to the Dutch setting confirmed that patients consider the PG-SGA Short Form comprehensible and easy [20]. The PG-SGA Short Form has also been reported as a quick instrument to complete. It generally takes the patient less than 5 min, and this is often completed prior to seeing the healthcare provider. Interestingly, the Dutch study in head and neck cancer patients also showed that completing the PG-SGA Short Form may increase the patient's awareness of malnutrition risk [21].

Although patients perceive the PG-SGA as comprehensible and easy, PG-SGA-naive professionals may perceive the professional component, especially the physical examination, as comprehensible but difficult [20]. Studies in the Netherlands and Portugal have shown that improving PG-SGA knowledge, for example by a training course, significantly improves perceived difficulty of the PG-SGA [22,23]. Training may tackle potential barriers in performing the physical examination, but may also ensure reliability. In an Australian study in 189 adult inpatients, 16 dietitians trained in use of the PG-SGA showed good inter-rater reliability (intraclass correlation coefficient = 0.901; $P < 0.001$) [24].

GLOBAL USE: IMPORTANCE OF TRANSLATION AND CULTURAL ADAPTATION

With PG-SGA use internationally, there is a critical need for high-quality and linguistically validated translations of the PG-SGA. A high-quality translation of the PG-SGA can be defined as a translation that has maintained conceptual, semantic and operational equivalence to the original English PG-SGA. Since 2014, all new PG-SGA language versions are developed following a 'translation and cultural adaptation process', based on the Principles of Good Practice for the Translation and Cultural Adaptation Process for PRO Measures (ISPOR). The Dutch [20] and Portuguese [25] PG-SGA are the first two versions of the PG-SGA that have been developed according to the ISPOR Principles and are available for download (www.pt-global.org). Multiple official new PG-SGA translations will become available, for example Brazilian, Danish, French, German, Italian, Japanese, Norwegian, Persian, Polish, Swedish and Thai.

The availability of multiple high-quality language PG-SGA versions has numerous implications for both clinical practice and the research setting. For example, in addition to its use on the local level, availability of the PG-SGA across the globe also enables the inclusion of the PG-SGA in international multicenter studies, facilitating meta-analysis and benchmarking across countries.

CONCLUSION

The scored PG-SGA (including the PG-SGA Short Form) is used internationally as the reference method for proactive risk assessment (screening), assessment, monitoring and triaging for interventions in patients with cancer. Studies have consistently confirmed high sensitivity and specificity and the ability to predict both adverse and improved clinical outcomes. Importantly, as the majority input is patient-generated, the use of the PG-SGA can streamline clinic work flow and improve the quality of interaction between the clinician and the patient.

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None.

Conflicts of interest

H.J.W. is co-developer of the PG-SGA based Pt-Global app. F.D.O. is President of Ottery & Associates LLC, copyright holder of the Patient-Generated Subjective Global Assessment (PG-SGA), co-owner and co-developer of the PG-SGA based Pt-Global app.

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