

Visual Analogue Scales and Assessment of Quality of Life in Cancer

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Quality-of-life (QOL) assessment is important in cancer clinical trials, especially when prolongation of survival is not expected (eg, with advanced disease or symptomatic treatments). QOL measures may distinguish between treatments of similar efficacy but different treatment burden or toxicities. QOL assessment may also have a role in clinical practice, including in screening for physical and psychosocial distress and evaluation of palliative treatment.¹

There is no single accepted QOL definition.² QOL is generally accepted to encompass the whole of life, including health; satisfaction; happiness; and financial, social, and environmental concerns. Health-related QOL (HRQOL) refers to the impact of illness or treatment on QOL. Health-related QOL is multidimensional (including physical, psychological, social, and functional domains).^{2,3} QOL may also be defined by the individual. The gap theory defines QOL as the gap between an individual's expectation of life and his or her reality.⁴ People in poor health may describe good QOL because their experience meets expectations. Domains such as family, relationships, spirituality, sense of control, and autonomy may be more important to patients than are physical experiences.⁵

Assessing QOL

There is no gold standard for QOL assessment. The choice of instrument is influenced by the situation (clinical or research), the stage of disease (early, advanced, survivor), and the treatment (curative, palliative). Cancer stage and treatment influence relevant domains. QOL instruments for

Abstract Assessment of quality of life (QOL) in cancer clinical trials is important when comparing treatments, especially when prolonged survival is not expected. QOL scores may reflect physical or psychosocial functioning or distress. The choice of QOL instrument depends upon the definition, research hypothesis, cancer population, depth and sensitivity of information required, and frequency of measurement. A visual analogue scale (VAS) is commonly used to rate various subjective experiences. Potential advantages of these scales include their wide score range and high sensitivity; disadvantages include lower completion rates than other rating scales. Single-item VASs are validated for cancer QOL, reliable, and responsive to change. These scales may best represent an individual's global QOL without the constraints of predetermined domains. Single items are useful for frequent measurements in palliative or advanced populations and when information about domains is less important. Multi-item VAS QOL instruments vary in length and domains; they are useful in clinical trials enrolling patients with good performance status, but some are long and disease-specific.

evaluating specific therapies should include the relevant adverse effects (eg, nausea/vomiting, hair loss, sexual function, endocrine symptoms). In patients with advanced cancer, important domains may differ (eg, spirituality, sense of burden). The length, number of questions, and rating scale all influence the ease of a scale's completion. A brief instrument may be more relevant in clinical situations and advanced disease. In research, a balance must be struck between completeness of information and risk of missing data.

Subjective experiences such as QOL and symptoms can be evaluated by different rating scales, including numerical (eg, 0–10), categorical (eg, mild, moderate, severe), or visual (ie, visual analogue scale; VAS). A VAS is a line, usually measuring 10 cm, with descriptors at each end (eg, good to bad, none to severe). Respondents place a mark along the line indicating their subjective experience. The score is measured as the distance of the mark from one end of the line. Usually, the line does not have markings, words, or numbers along it. VASs have been described as simple,

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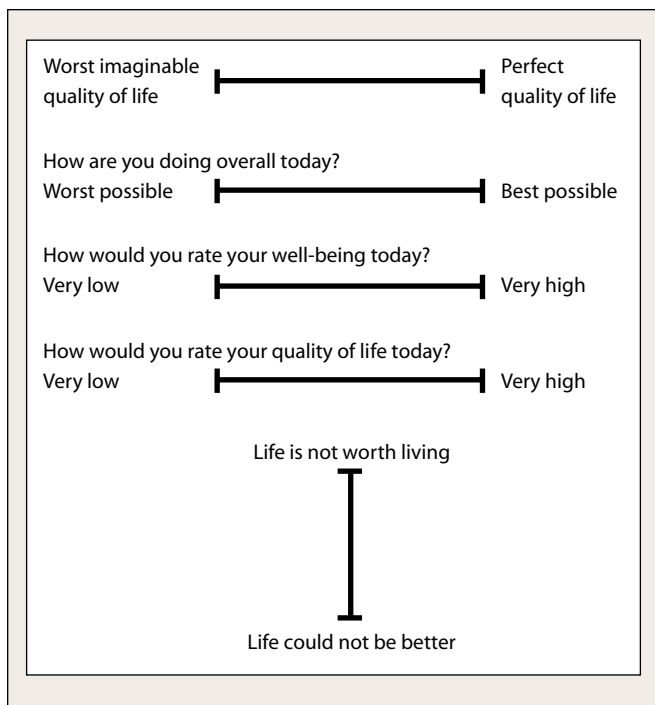


Figure 1 Examples of Global Quality-of-Life Visual Analogue Scale

highly sensitive, and reliable rating scales for subjective experiences.⁶ The main advantage of a VAS is that respondents may indicate any place along the line rather than be restricted by categories or numbers.

VASs have been used to assess cancer QOL since 1976.⁷ This article aims to review the role of VASs in the evaluation of cancer QOL and the methodologic issues associated with their use.

VASs for QOL of Cancer Patients

VASs for QOL of cancer patients may be single-item, global questions (eg, how is your QOL?) or multi-item scales. Multi-item scales include individual questions about many domains of QOL (eg, symptoms, function, relationships) and may also include a global scale. These scales often have a summated score representing overall QOL and may have several subscale scores. Single-item VASs for QOL have been suggested to best represent individual QOL because they do not constrain responses to the domains determined by health care providers.⁵

SINGLE-ITEM VASs FOR QOL

Several single-item VASs for QOL have been validated in oncology. They vary in design (Figure 1), with descriptors including general well-being,⁸ life not worth living,⁹ physical well-being,¹⁰ coping,¹¹ and QOL.^{12,13} Single-item QOL VASs correlate well with multidimensional questionnaires.^{8,9,11-14} Test-retest^{8,12} and interrater¹³ reliability have also been demonstrated. VASs are responsive to chemotherapy-related changes over time and global ratings of change.^{10,12} Single-item

VASs have shown improved QOL with pain relief,^{15,16} stable QOL in patients in hospice care,¹⁷ and response to structured intervention during radiotherapy.¹⁸

One issue with single-item VASs is whether a multidimensional concept like QOL can be captured in a single line. Single-item scales do not evaluate the domains contributing to QOL and thus provide no information explaining the overall rating. However, many multidimensional instruments rely on experts to determine domains and their weighting; they may not truly represent domains important to an individual. Single-item scales leave the definition of QOL to the individual respondent.

In hospice care, single-item QOL correlated well with cognitive, physical, and spiritual well-being and social activity but not with social support.¹⁸ Similarly, the EORTC (European Organization for Research and Treatment of Cancer) QLQ-C30 (Quality-of-Life Questionnaire Core 30) global QOL subscale (numerical) correlated moderately with physical, role, cognitive, emotional, and social functioning; fatigue; and pain domains but less with nausea and vomiting.¹⁹ The meaning of the term “QOL” may vary by age, culture, education, and language. Global indicators (eg, treatment burden) may allow a comparison between different treatments across trials.^{20,21}

The Spitzer Uniscale. The Spitzer Uniscale is a single question: “Please rate your overall QOL.”^{22,23} Originally designed for physician rating, it is now used for both patient and observer QOL ratings.²³ The Spitzer Uniscale is valid, with moderate to high correlations with multidimensional QOL measures; it is sensitive to changes in performance status, symptoms, and progressive disease and correlates with survival.²³ Physician scores agree moderately with patients’ scores, although they tend to underestimate QOL. The completion rate is above 90%.

Respondents mark an X in a box with anchors “lowest quality to highest quality.” The original Uniscale description did not specify the length of the box, nor where on the X the score was measured. Scoring has been described as either 0–14 or 0–100. Some authors adapted it to a single-line VAS with the same anchors.

MULTI-ITEM VASS FOR QOL

Multiple-item VASs for cancer QOL were first described in 1976.⁷ Ten horizontal VASs assessed physical and psychological symptoms, activity, social and role activities, and well-being. Scores were responsive to treatment and toxicity. Several multidimensional VAS QOL instruments have between 8 and 53 items. They may be general (eg, GLQ8²⁴) or disease-specific (Lung Cancer Symptom Scale [LCSS]^{25,26} or the Prostate Cancer Specific QOL Instrument [PROSQOLI]).²⁷⁻²⁹ Although domains vary, they all assess pain and appetite but less often nausea and fatigue. Many are lengthy, limiting their usefulness to clinical trials, and are not relevant for advanced cancer or palliative populations. Completion rates are infrequently reported. When reported, they are high (80%–90%).^{24,30} Family is important in the QOL of cancer patients but infrequently assessed. Similarly, spirituality is assessed in only one multi-

Table 1
Multi-item Quality-of-Life Visual Analogue Scale

AUTHOR OR INSTRUMENT	DESIGN	DOMAINS	PSYCHOMETRICS
Priestman and Baum ^{7,32} (1976, 1983)	10 horizontal VASs	Well-being, mood, activity, pain, nausea, appetite, housework, social activities, anxiety, treatment response	Responsive to change with chemotherapy, endocrine therapy Test-retest reliability at 24 hours
Padilla et al ³³ (1983)	14 horizontal VASs	General physical condition (pain, appetite, nausea, strength) Important activities Overall QOL	Discriminates inpatient/outpatient, analgesic use Internal consistency Test-retest reliability
Selby et al ³⁴⁻³⁶ (1984, 1988, 1992)	29 horizontal VASs	5-factor structure: physical activities, emotional, alimentary, appearance, and concentration and language	Correlations with SIP, KPS Discriminates metastatic disease/early, chemotherapy or not Internal consistency Test-retest reliability at 9–12 hours Interrater reliability
Holmes and Dickerson ³⁷ (1987)	26 horizontal VASs	Symptoms, 11 items Activities of daily living, 15 items	Discriminates inpatient vs outpatient Internal reliability Test-retest reliability at 1 hour
Coates et al GLQ8 ²⁴ (1990)	8 horizontal VASs	Physical symptoms: pain, fatigue, appetite/sense of taste, nausea/vomiting, hair loss numbness/pins and needles Anxiety, depression, sexual interest Thought of having treatment Global QOL	Correlations with FLIC, PACIS, PAC Discriminates chemotherapy and performance status Test-retest reliability at 1 and 24 hours
Ballatori et al ³⁸ (1993)	49 items, 10 cm horizontal VASs	3 factors: psychological, relationship to hospital, and appetite	Discriminates performance status Test-retest reliability at 24 hours
Hollen et al LCSS ^{25,26,39,40} (1993, 1994, 1999)	Patient scale: 9 horizontal VASs Observer scale: 6 symptoms (ordinal scale)	6 symptoms: appetite loss, cough, dyspnea, fatigue, hemoptysis, pain 3 summary scales: symptom distress, normal activity, and overall QOL Each item on a separate card	Correlates with KPS, SIP, POMS Discriminates performance status, cancer stage Internal reliability Test-retest reliability at 1 hour Modified and validated for mesothelioma ⁴¹ Numerical form validated ⁴²
Johnson et al QOL-RTI ³¹ (1994)	24 horizontal VASs	4 domains: functional/health, socioeconomic/family, general QOL, emotional/psychological Subsequently, scaling changed to numerical 0–10, and head and neck module added	Correlates with FPQLI Internal consistency Test-retest reliability at 1 week
Tannock et al, Stockler et al PROSQOLI ²⁸⁻³⁰ (1996, 1998, 1999)	9 horizontal VASs	Physical symptoms (appetite, constipation, fatigue, pain, passing urine, physical activity), mood, family, and global well-being	Correlates with EORTC QLQ-C30 Discriminates performance status, hemoglobin level, analgesic score, and survival Responsive to treatment

Abbreviations: EORTC QLQ-C30 = European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire C30; FLIC = Functional Living Index–Cancer; FPQLI = Ferrans and Powers Quality of Life Index; KPS = Karnofsky Performance Status; LCSS = Lung Cancer Symptom Scale; PAC = Psychological Adjustment to Cancer Scale; PACIS = Perceived Adjustment to Chronic Illness Scale; POMS = Profile of Mood States; PROSQOLI = Prostate Cancer Specific Quality of Life Instrument; QOL = quality of life; QOL-RTI = Quality of Life–Radiation Therapy Instrument; SIP = Sickness Impact Profile; VAS = visual analogue scale

dimensional questionnaire (the QOL-RTI [QOL–Radiation Therapy Instrument]), which has subsequently changed to a numerical format).³¹

General scales. General VAS instruments are described in Table 1.^{7,24–26,28–40} Many include a single-item overall QOL scale or a summated score.

Lung cancer. The self-reported LCSS has six symptom (appetite loss, cough, dyspnea, fatigue, hemoptysis, pain) and three summary scales (symptom distress, normal activity, and overall QOL).^{25,26,39,40} An observer scale rates the six symptoms on ordinal scales. It is well validated by correlations with other in-

struments and performance status and has internal consistency as well as test-retest and interrater reliability. Responsiveness has not been tested. Numerical and mesothelioma scales have been validated.^{41,42} The mean completion time is 8 minutes for patients and 2 minutes for observers. The LCSS reflected the benefit of docetaxel (Taxotere) chemotherapy over vinorelbine or best supportive care in advanced lung cancer^{43,44} and better QOL in non smokers.⁴⁵ The appetite and fatigue subscales independently predict survival.⁴⁶ The LCSS is computerized for hand-held devices, is easy to use, and is able to enhance communication and satisfaction with clinic visits.⁴⁷

Prostate cancer. The PROSQOLI has nine VASs assessing physical symptoms (appetite, constipation, fatigue, pain, passing urine, physical activity), mood, family, and global well-being.^{29,30} Items correlate moderately with the EORTC QLQ-C30. It discriminates patients by performance status, hemoglobin level, analgesic score, and survival. It has demonstrated improved overall QOL in advanced hormone-refractory prostate cancer patients who responded to mitoxantrone and prednisolone.³⁰

PROXY MEASURES OF QOL

A VAS may also be used to evaluate specific domains of QOL (eg, individual symptoms or psychological concerns).

Single-item VASs. Single-item VASs are valid for assessment of pain and depression in cancer.^{48,49} They are useful in clinical trials when change in individual symptoms is expected. They may be paired with a single-item QOL scale to investigate the impact of symptoms on overall QOL.¹⁵

Edmonton Symptom Assessment Scale (ESAS). The ESAS was designed for palliative populations. Nine VASs evaluate symptoms (activity, anxiety, appetite, depression, drowsiness, pain, nausea, shortness of breath, and well-being); scores are summated to a distress score.⁵⁰ It is valid with internal consistency and test-retest reliability.⁵¹ Interrater studies reveal an overestimation of symptoms by caregivers and an underestimation of symptoms by physicians.^{50,52} The completion rates vary by stage of disease. Most general oncology patients can complete it on hospital admission, compared with 63%–84% of palliative medicine cancer patients and only 15% of terminal patients.^{50,51,53} Routine use of ESAS on admission to a palliative medicine unit has shown significant underassessment and documentation of symptoms, especially inactivity, impaired well-being, and anxiety.⁵⁴

The Distress Thermometer. The Distress Thermometer is a modified VAS: a vertical thermometer numbered 0–10 with the words no distress, moderate distress, and severe distress along the scale.^{55–57} It has a 34-item problem checklist, including physical and psychosocial concerns. It is validated in cancer populations and advocated for routine screening.⁵⁸ Scores of at least 4 are recommended as the trigger for further evaluation and intervention. There is no evidence as to the association between Distress Thermometer scores and QOL or clinical outcomes from routine screening.

Methodologic Issues

Many studies validating QOL instruments are convenience or clinical trial samples. This fact potentially limits the relevance of these instruments to selected populations. Other methodologic issues include the potential for measurement error and their unsuitability for telephone follow-up. Scoring a VAS requires measurement rather than simply reading from a paper, potentially adding a source of error. VAS questionnaires must be printed individually, as photocopying can distort the length of the line, leading to inconsistent scoring. A VAS can be computerized, thereby avoiding such difficulties.

At this time, however, only the LCSS has reported results with an electronic version.⁴⁷

Consensus is lacking about the statistical analysis of VAS data.^{59,60} Issues involve whether the data are ordinal or ratio and whether scores are normally distributed and thus applicable for parametric analysis. Comparison of parametric (with and without transformation) and nonparametric analysis of VAS pain scores suggested that parametric tests were accurate and had the greatest power to detect a difference, despite a lack of normal distribution of the data.⁶¹

COMPLETION RATES

Completion of a VAS requires conceptualization of a complex experience to a single line. VAS pain scales have lower completion rates than numerical or categorical scales.^{62,63} Rates are adversely affected by increasing age, higher opioid dose, and the presence of confusion.^{62,63} Training in VAS technique is more time-consuming than for other rating scales.⁶⁴ In QOL studies, the Uniscale has a similar completion rate to other multi-item instruments.²³ Both the PROSQOLI²⁸ and LCSS⁴³ have high completion rates (> 80%) in clinical trials. The ESAS completion rate declines with advancing disease.

SENSITIVITY

VASs are said to be more sensitive to subjective changes than are numerical or categorical scales. However, it is unclear whether such high sensitivity is clinically relevant. Studies of QOL in cardiac and respiratory failure have demonstrated a 7-point verbal descriptor scale had equal sensitivity to a VAS.^{64,65} Validation of a 0–10 numerical LCSS demonstrated good agreement with a VAS.⁴² Comparison of a VAS in the PROSQOLI with equivalent Likert scales of the EORTC QLQ-C30 demonstrated superior sensitivity of the VAS for pain and other physical symptoms.²⁸ All scales differentiated treatment groups, but the VAS was less sensitive in complex domains like family and emotional function.

CLINICAL SIGNIFICANCE

Small changes on a VAS (eg, 0–5 mm) may be statistically significant but clinically irrelevant. The clinical significance can be evaluated by comparing VAS scores with a global change scale (eg, from much better to much worse). For acute pain, the minimal clinically significant VAS change is 13 mm.⁶⁶ Indirect LCSS analysis supported clinically significant changes of 10–25 mm.⁶⁷ Clinically significant change has been suggested as 50% of the scale's standard deviation (ie, 8–10 mm on a 100-mm VAS).²¹ This result would be equivalent to a change of 1 on an 11-point numerical scale.

Instrument Selection

Several factors affect the selection of an instrument. Population characteristics (including age, diagnosis, and performance status) affect completion rates and whether a disease-specific or general questionnaire is appropriate. In research, the definition and hypothesis influence this choice, particu-

larly whether global QOL or specific domains are important or likely to change with intervention.

The choice of scale (VAS, numerical, or categorical) depends upon the data sensitivity required and the desired completion rates. Instruments that appear to be relevant to clinical practice include single-item global scales (QOL, treatment burden), the ESAS, the Distress Thermometer, and the LCSS. Instruments with numerical or categorical scales may be easier to complete and score, and changes may be more relevant to clinical practice. Measurement frequency is important; single-item VASs may be useful for frequent measures and may avoid patient burden. Single-item QOL instruments may be worthwhile in clinical trials (especially longitudinal ones) for clinical screening (pain, depression, advanced cancer) and for global QOL.¹³ In symptom relief trials, combining symptom and single-item QOL VASs assesses the impact of symptoms on QOL. Single items are relevant and may best represent what the patient is experiencing. Whether the score range 0–100 is necessary is debatable; perhaps a score range of only 0–10 is needed.

Future Research

Clarification of the ideal rating scales for QOL is neces-

sary. Development and use of patient-focused instruments may balance the burden on respondents and clinically relevant data. Completion rates need to be documented in unselected clinical populations. Clinically significant cutoff points and score differences should be determined for global and multi-item instruments. In addition, information about the most appropriate QOL instruments for clinical practice and evidence of improved outcomes as a result of their routine use are necessary.

Conclusion

Single-item QOL VASs facilitate an individual definition of QOL and are useful in advanced or palliative populations and longitudinal studies. They are sensitive and responsive to change with time and treatment. Multi-item VAS instruments are often lengthy and disease-specific; they are useful in research studies, given patients have a good performance status. VASs are more difficult to complete than are other rating scales and have the potential for measurement error. The VAS score range may not translate into clinical significance. Further research is needed to determine whether QOL VASs are appropriate for clinical practice.

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