

# Performance Status Revisited (I): Are there Differences between the Karnofsky (KPS) and ECOG Performance Status Scales which can be Important in Clinical Decision Making? Using Evaluations in Non-Small Cell Lung Cancer (NSCLC) as an Example

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## Abstract

**Background:** Prior studies indicated that both ECOG and KPS methods are useful and correlate fairly well. However, new findings and practice patterns have encouraged investigation to determine if differences relevant to clinical decision making exist between the two methods. Suitability for chemotherapy is often based on PS (1-0 ECOG or 80-100 KPS), and trials correlating single nucleotide polymorphisms with chemotherapy resistance and survival have found PS to be an important factor with specific mutations.

**Methods:** 75 patients with advanced NSCLC were evaluated at 9 COMET sites in Ontario. Both the ECOG and KPS methods, as well as the LCSS-QL (a validated QL instrument) were given prior to receiving initial docetaxel + platinum chemotherapy. Eligibility: PS 0-2 ECOG, and KPS ≥60, Stage III-IV. Descriptive methods and linear regression were used to explore sensitivity and specificity.

**Results:** Median age 68 (range 46-81); men=55%; median ECOG PS=1 (11%-0, 61%-1, 28%-2); median KPS=80 (5%-100, 28%-90, 47%-80, 12%-70, 8%-60). Correlation of the two PS methods was fairly high at 0.75 (Pearson r). While this was a positive result, of concern was the finding that the 21 patients with ECOG PS=2 were as likely to be rated as having a KPS of 60 or 70 or 80, indicating a broad range of activity encompassed by the ECOG 2 category. In contrast, of those with KPS <80, only 2 patients (3%) had ECOG PS <1. Sensitivity / specificity results: for KPS are 0.86 / 0.87; for ECOG are 0.96 / 0.62.

**Conclusions:** Both methods have a high degree of sensitivity; however, the greater specificity of the KPS indicates that it is a better choice for: 1) decision making for suitability for chemotherapy (fewer appropriate patients missed), and 2) more accurately identifying which patients would benefit from genomic studies to determine individualized chemotherapy selection.

## Background

- Performance Status is one of the most widely accepted patient evaluations used in clinical practice and in clinical trials in oncology.
- Both the Karnofsky Performance Scale (KPS) and the ECOG Performance Scale are used in many countries. Oncologists have generally found these scales easy to use in typical practice.
- Baseline values of both scales have shown correlations with survival and with anti-tumor response for several different malignancies, including lung cancer, when used as part of prospective clinical trials.
- In prior studies, both the KPS and the ECOG performance status scales have correlated reasonably well with each other.
- Performance Status has taken on enhanced importance in clinical practice in oncology. Although the largest meta-analysis in non-small cell lung cancer concluded that chemotherapy improves survival in all PS groups, studies have indicated that the magnitude of survival improvement is less for those presenting with poorer PS, and the baseline PS score is often used to decide whether or not to recommend chemotherapy to specific patients.
- Additionally, recent trials correlating single nucleotide polymorphisms with chemotherapy resistance and survival have found PS to be an important factor with specific mutations.

## Objectives

1. To evaluate prospectively the correlation of KPS and ECOG performance status scales in patients about to undergo their initial cycle of combination chemotherapy for advanced non-small cell lung cancer.
2. To determine the sensitivity and specificity of each of the two instruments (using each as the "gold standard"), in this patient population in terms of evaluating the accuracy of both for clinical decision making.
  - Should one PS scale be preferred in identifying patients appropriate for chemotherapy, or for genetic testing for agent selection?

## Methods

- All patients had advanced NSCLC, KPS ≥ 60, no prior chemotherapy, and are receiving their initial courses of docetaxel + platinum.
- Patients were entered in the community settings of 10 COMET Group clinics in Ontario, Canada.
- 102 patients with non-small cell lung cancer were prospectively evaluated.
- All patients were evaluated with both the KPS and ECOG PS scales immediately prior to their initial chemotherapy treatments. Definitions of the categories of both scales (KPS and ECOG) were given to the observers, as part of the observer version of the electronic LCSS (LCSS-QL). All patients also completed the LCSS questionnaire.
- This current study, comparing KPS and ECOG scales, examines only the results of the baseline PS determinations. Correlation coefficients were obtained and calculations were made for sensitivity and specificity for each of the measures.

## Patients

Demographic and Disease-related Characteristics of the Sample of Patients with NSCLC (N = 102)

Characteristic	Median or #	Range or %
Age	68	(42 - 81)
Age Group		
< 45 years	0	0%
> 45 - 72 years	46	73%
> 72 years	17	27%
Gender		
Male	56	55%
Female	46	45%
Stage of Disease		
IIIA	1	1%
IIIB	21	21%
IV	80	78%
ECOG Performance Status		
2	28	27%
1	63	62%
0	11	11%
Karnofsky Performance Status		
60%	7	7%
70%	14	14%
80%	49	48%
90%	25	24%
100%	7	7%

## Instruments

Patients completed both the patient and observer versions in both paper and electronic formats.

- Original paper version (LCSS)

### Patient version

Items measured on a 100-mm visual analogue scale (0=best score)  
Total score = mean of 9 items  
Average symptom burden index (ASBI) = mean of 6 symptoms

### Observer version

6 categorical scales

- A new computerized version (LCSS-QL):
  - Preserves both the patient and the observer versions
  - Hand-Held PC device using stylus pen
  - Provides immediate color graphic reporting of current scores and change over time
- Published reliability and validity (see Hollen et al. *Cancer* 1994; 73: 2087-2098, and [www.lcss-ql.com](http://www.lcss-ql.com) for full reference list)
- Demographic forms for the patient, observer, and the physician
- Evaluation forms to capture time to completion and perceptions of acceptability (patient, observer, physician)

## KARNOFSKY PERFORMANCE SCALE (KPS)

Grade:	Definition:
100	Normal, no complaints, no evidence of disease.
90	Able to carry on normal activity, minor signs or symptoms of disease.
80	Normal activity with effort, some signs or symptoms of disease.
70	Cares for self. Unable to carry on normal activity or to do active work.
60	Requires occasional assistance, but is able to care for most needs.
50	Requires considerable assistance and frequent medical care.
40	Disabled, requires special care and assistance
30	Severely disabled, hospitalization is indicated although death not imminent.
20	Hospitalization necessary, very sick, active supportive treatment necessary.
10	Moribund, fatal processes progressing rapidly.
0	Dead

## Instruments

### ECOG PERFORMANCE STATUS SCALE\*

Grade:	Definition:
0	Fully active, able to carry on all pre-disease performance without restriction
1	Restricted in physically strenuous activity but ambulatory and able to carry out work of a light or sedentary nature
2	Ambulatory and capable of all selfcare but unable to carry out any work activities. Up and about more than 50% of waking hours
3	Capable of only limited selfcare, confined to bed or chair more than 50% of waking hours
4	Completely disabled. Cannot carry on any selfcare. Totally confined to bed or chair
5	Dead

\* As published in Oken, M.M., et al.: *Am J Clin Oncol* 5:649-655, 1982.

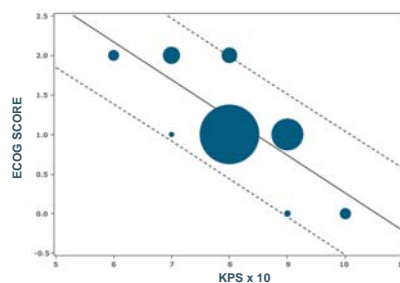
## Results

### ECOG and KPS Comparisons

Correlation:	N	Pearson r	p value
ECOG with KPS	102	0.77	p <0.0001
		Sensitivity*:	Specificity*:
ECOG	102	0.96	0.64
KPS	102	0.86	0.88

\* sensitivity = true positive rate; specificity = false positive rate

### Comparing the Distribution of KPS Scores with ECOG PS Scores (N=102)



Sensitivity / Specificity: KPS (0.85 / 0.88), ECOG PS (0.96 / 0.64)

## Conclusions

- The KPS and ECOG PS scales, as expected, correlate well with each other (Pearson r = 0.77).
- Both the KPS and ECOG methods have high sensitivity scores (0.86 and 0.96, respectively).
- However, important differences in specificity were found, favoring the Karnofsky Performance Status scale (0.88 versus 0.64 for the ECOG scale). This greater accuracy for the KPS is illustrated by the finding that patients with a score on the ECOG scale = 2 were equally likely to have a KPS score of 60 or 70 or 80.
- While both PS scales are useful, the greater specificity of the KPS indicates that it is a better choice for:
  - 1) decision making for suitability for chemotherapy (fewer appropriate patients missed), and
  - 2) more accurately identifying which patients would benefit from genomic studies guiding the choice of specific chemotherapeutic agents