

# Quick Guide to Prognostication Tools

31/07/2008

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# The SUPPORT Model

## **Citation 10**

The Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments is a complex model designed to look at the outcomes and clinical decision making for seriously ill hospitalised patients. It is designed to predict survival over a 180 day period.

This model is of limited use in the Palliative Care setting. It is incredibly cumbersome to use, requiring many variables be put into a complex equation.

## **Using the SUPPORT Model**

This model is extremely complex and requires well over 100 mathematical operations. It is available in the article (10).

It includes several variables including diagnosis, age, number of days in the hospital, presence of cancer, neurological function, expected survival and various physiological factors including mean blood pressure, HR, pulmonary function, serum creatinine & sodium, bilirubin, temperature, respiratory rate, leukocyte count & albumin.

## **Critical Appraisal of the SUPPORT Model**

### **Was the sample of patients representative?**

Yes. The study cohort included patients with 1 of 9 diseases. Some patients with certain diseases were excluded because there were too few patients to draw conclusions from. Other diseases were excluded because there was a lack of research into their prognosis. As well, patients were excluded if they were children, died within 48 hours of admission, couldn't speak English, or had a variety of other mitigating factors that made their entry into the study impractical. However, the patients are representative of the 9 diseases for which the model is based.

### **Were the patients sufficiently homogeneous with respect to prognostic risk?**

N/A. Patients were included in the model on admission to the hospital with 1 of 9 diseases. They could have come into hospital at any point in their disease and the different diseases all have different prognoses. The model takes into account the different disease prognoses, however, and the purpose of developing this prognostic model is to predict survival at any point in the disease trajectory.

### **Was follow-up sufficiently complete?**

This is not mentioned in the article or any of the supplemental pieces of literature for this study.

### **Were objective and unbiased outcome criteria used?**

Yes. Survival.

### **How likely are the outcomes over time, and how precise are the estimates of likelihood?**

<b>Disease Class</b>	<b>SUPPORT Model</b>	<b>Physician's Estimate</b>	<b>Physician's Estimate with SUPPORT Model</b>
All	0.78	0.78	0.82
Acute respiratory failure and multiple organ system failure	0.77	0.78	0.82
COPD, CHF, cirrhosis	0.71	0.70	0.75
Coma	0.74	0.78	0.82
Colon and lung cancer	0.78	0.77	0.82

The statistics reported here are receiver-operator characteristic area under the curves. For an explanation of [this](#), [click](#) [here](#).

The authors report that while physicians and the model have the same receiver-operator characteristics curve, that the model makes fewer extreme errors. However, physicians are better at discriminating between patients who will have different survival times.

**Were the study patients and their management similar to those in my practice?**

The types of patients in this study may be similar to those in the palliative care setting. The patients in this study are simply every patient admitted to one of these hospitals that fit the inclusion criteria. Many of them would probably not be treated by a Palliative Care Team.

**Was follow-up sufficiently long?**

Yes. The follow-up was for 180 days. The primary outcome of the study was survival at 180 days.

**Can I use the results in the management of patients in my practice?**

Likely not. With the complexity of the model and the uninspiring accuracy of the model over physician estimates it is unlikely that this model will be used very often.

# Simple and Accurate Model for Cancer

## Citation 1

This model looks at 5 variables to determine the probability of cancer patients to die in hospital.

This model can be very useful in the Palliative Care setting. With 5 easily obtained variables and a relatively simple formula it is possible to predict whether a patient will die in hospital or not.

## Using the Simple and Accurate Model for Cancer

The following variables are needed for use in the model.

- Eastern Cooperative Oncology Group Performance Status (ECOG)
- Lactate dehydrogenase (LDH)
- Whether or not the patient admitted electively or emergently
- Haemoglobin (Hb)
- Duration of the disease

The formula for the model is shown below.

$$\log\left(\frac{P}{1-P}\right) = [5.53 + 4.89(S) - \log(D) - 1.91(A) - [0.18(Hb(g/dL)) * L]$$

P = probability of death in hospital

S = 1 if ECOG = 4, 0 otherwise

D = duration of disease in days

A = 1 If elective admission, 0 if emergency

L = 1 if LDH > 378µmol/ml, 0 if otherwise

After using this equation and solving for P, you have the probability that a patient will die while in hospital.

## Critical Appraisal of the Simple and Accurate Model for Cancer

### Was the sample of patients representative?

Yes. The study group included all patients with non-haematological malignancies who died at a Turkish teaching hospital. Assuming diagnostic criteria for cancer are similar in Turkey as in Canada, the sample of patients is representative.

### Were the patients sufficiently homogeneous with respect to prognostic risk?

Yes. Although the patients had a variety of cancer diagnoses, and were diagnosed at different stages in their disease, the retrospective nature of the study ensures that the patients' prognoses were similar. The purpose of the study was to determine specific likelihood of patients with cancer dying in hospital.

### Was follow-up sufficiently complete?

Yes. No patients in the prospective arm of the study were lost to follow-up and in the retrospective arm no loss to follow-up is possible.

**Were objective and unbiased outcome criteria used?**

Yes. The primary outcome of the study was whether or not a patient would die in hospital.

**How likely are the outcomes over time, and how precise are the estimates of likelihood?**

The ROC area for the retrospective study was 0.88 while the ROC area for the prospective study was 0.82. This makes this model quite accurate. For a description of receiver-operator characteristic statistics, [click here](#).

**Were the study patients and their management similar to those in my practice?**

This information is not included in this study. There are few published reports comparing cancer treatment in Canada to Turkey, also the Fraser Institute reported on selected cancer outcomes in several countries including Canada and Turkey. Canada ranks 10th and 2nd when it comes to breast and colorectal cancer mortality respectively while Turkey ranks 28th for both (5). Based on this is not possible determine that cancer patients are managed differently, although it may be a clue.

**Was follow-up sufficiently long?**

The retrospective arm of the study had, by virtue of being retrospective, complete follow-up. The prospective arm also had complete follow-up. The patients were followed until they either died or were discharged.

**Can I use the results in the management of patients in my practice?**

There have been no independent validation studies of this model. Physicians must be cautious when using this model for their patients. The patients in this study may have been managed differently than those in Canadian hospitals.

# Palliative Performance Scale

## **Citation 11**

The Palliative Performance Scale is a simple chart that is used to classify the functional ability of a patient.

This model is very useful for palliative care. It is useful for communicating information about the functional status of patients as well as predicting lifespan in patients. The ease of use and reproducibility between different health care providers make it a practical addition to any palliative care practice.

## **Using the Palliative Performance Scale**

The Palliative Performance Scale is a simple chart that is used to classify the functional ability of a patient.

To see the chart, and the instructions to use it visit <http://www.victoriahospice.org/health-professionals-volunteers/clinical-tools>.

## **Critical Appraisal of the Palliative Performance Scale**

### **Was the sample of patients representative?**

Yes. The study cohort included all patients admitted to the Palliative Care Unit of the Victoria Hospice Society of a 28 month period. The only patients excluded were patient for whom not all the data was available (9 excluded leaving a cohort of 733)

### **Were the patients sufficiently homogeneous with respect to prognostic risk?**

N/A. Patients receive palliative care and enter hospice with any one of a number of diseases each of which has its own course. Furthermore, 2 patients with the same disease will not begin to receive palliative care at the same time in their disease. They begin to receive it as their symptoms dictate or as their families are not longer able to provide care at home. The purpose of this study was to determine if survival could be predicted regardless of these things, based just on functional status.

### **Was follow-up sufficiently complete?**

Yes. Only 7 patients have unknown death dates. They are censored in the study.

### **Were objective and unbiased outcome criteria used?**

Yes: Length of survival.

**How likely are the outcomes over time, and how precise are the estimates of likelihood?**

<b>PPS</b>	<b>Median Survival, in days (95% C.I.)</b>
10%	1 (1, 1)
20%	2 (2, 2)
30%	9 (7, 11)
40%	17 (13, 21)
50%	27 (18, 36)
60%	40 (20, 60)

**Were the study patients and their management similar to those in my practice?**

It is probably safe to assume that management of the diseases reported in this paper (cancer, heart, lung, kidney, neurological and liver disease) are managed similarly in the rest of Canada as they are in Victoria B.C. Their palliative management being symptom driven is different from patient to patient, but likely similar across the Country.

**Was follow-up sufficiently long?**

Yes.

**Can I use the results in the management of patients in my practice?**

Yes. This paper demonstrates that patients at the end of life can have their life span predicted with reasonable accuracy with the PPS.

**Validation of the Palliative Performance Scale**

Several Studies have validated the Palliative Performance Scale (PPS). ( 8, 9, 11, 18, 19 )

# Predicting Mortality - Hospitalised for Heart Failure

## Citation 13

### Using the model Hospitalised for Heart Failure

This model is designed to be used at presentation of the patient to help predict mortality in heart failure patients.

Because this model is designed to be used when patients initially present with heart failure, it may have limited application in the Palliative Care setting. Its use may be in knowing when to refer patients to palliative or hospice care.

Variable	Number of Points	
	30-Day Score	1-Year Score
Age, in years	+Age (years)	+Age (years)
Respiratory rate/min (min 20; max 45)	+Rate (in breaths/min)	+Rate (in breaths/min)
<u>Systolic blood pressure</u>		
180+ mmHg	-60	-50
160 - 179 mmHg	-55	-45
140 - 159 mmHg	-50	-40
120 - 139 mmHg	-45	-35
100 - 119 mmHg	-40	-30
90 - 99 mmHg	-35	-25
< 90 mmHg	-30	-20
Urea Nitrogen (max 60mg/dL)	+Level (in mg/dL)	+Level (in mg/dL)
Sodium concentration < 136 mEq/L	+10	+10
Cerebrovascular disease	+10	+10
Dementia	+20	+20
COPD	+10	+10
Hepatic cirrhosis	+25	+35
Cancer	+15	+15
Hemoglobin < 10.0g/dL (100g/L)	N/A	+10

The corresponding 30 day and 1 year mortality rates are taken from the validation study for this model.

<b>Risk Category</b>	<b>30-Day Mortality</b>	<b>1-Year Mortality</b>
<b>Very Low:</b> < 60 points	0.6%	2.7%
<b>Low:</b> 61 - 90 points	4.2%	14.4%
<b>Intermediate:</b> 91 - 120 points	13.7%	30.2%
<b>High:</b> 121 - 150 points	26.0%	55.5%
<b>Very High:</b> > 150 points	50.0%	74.5%

## **Critical Appraisal for Hospitalised for Heart Failure**

### **Was the sample of patients representative?**

Yes. The study cohort included patients who presented to one of 34 Ontario hospitals with heart failure as defined by the Framingham heart failure criteria and the International Classification of Diseases, 9th revision. The study did exclude patients who were transferred from one tertiary centre to another and those who were non-residents or who had invalid health cards. The cohort had 2624 patients.

### **Were the patients sufficiently homogeneous with respect to prognostic risk?**

Yes. Patients were all presenting with heart failure according to the criteria listed in the paper and summarized above.

### **Was follow-up sufficiently complete?**

Yes. This was a retrospective study so there were no patients lost to follow up.

### **Were objective and unbiased outcome criteria used?**

Yes. They were 30 day and 1 year mortality rates.

### **How likely are the outcomes over time, and how precise are the estimates of likelihood?**

The receiver-operator characteristic area under the curve was 0.81 for 3-month survival and 0.78 for 1-year survival. For a description of receiver-operator characteristic statistics, [click here](#). For complete details about the precision of the variables used in this model see tables 2 and 3 in the paper.

### **Were the study patients and their management similar to those in my practice?**

No. While some heart failure patients are seen by a palliative care team upon admission, this is not typically the case. However, this model might be useful for deciding when to have patients introduced to a Palliative Care doctor and begin thinking about end-of-life issues.

### **Was follow-up sufficiently long?**

Yes.

**Can I use the results in the management of patients in my practice?**

Only if your palliative patients had all the variables required for the model measured on admission will you be able to use the model to predict their lifespan. If you do have patients that you see on admission, this model is very easy to use and the variables that it uses are readily accessible.

# Palliative Prognostic Score

## Citation 21

The Palliative Prognostic Score (PaP Score) is used to estimate survival for terminally ill cancer patients who are not receiving curative treatment and who don't have myelomas, renal tumours or haematological neoplasms.

This model is moderately useful for palliative care. It does include the possibility of palliative radiotherapy, but output is only a likelihood of surviving for 30 days, and the range of probabilities of surviving the 30 days are very wide.

## Using the Palliative Prognostic Score

The Palliative Prognostic Score (PaP Score) is used to estimate survival for terminally ill cancer patients who are not receiving curative treatment and who don't have myelomas, renal tumours or haematological neoplasms.

The model can be seen below.

Symptom	Score
<b>Dysnpea</b>	
No	0.0
Yes	1.0
<b>Anorexia</b>	
No	0.0
Yes	1.5
<b>Karnofsky Performance Score</b>	
> 50	0.0
30-40	0.0
10-20	2.5
<b>Clinical Estimate of Survival (weeks)</b>	
> 12	0.0
11-12	2.0
9-10	2.5
7-8	2.5
5-6	4.5
3-4	6.0
1-2	8.5
<b>Total WBC</b>	

Normal (4800 - 8500 cells/mm <sup>3</sup> )	0.0
High (8501 - 11000 cells/mm <sup>3</sup> )	0.5
Very high (> 11001 cells/mm <sup>3</sup> )	1.5
<b>Lymphocyte percentage</b>	
Normal (20.0 - 40.0%)	0.0
Low (12.0 - 19.9%)	1.0
Very low (0% - 11.9%)	2.5
<b>TOTAL SCORE</b>	

Add up the partial scores for your patient, and then determine which Risk Group they belong in to determine their probability of surviving 30 days.

<b>Risk Group</b>	<b>Total Score</b>
A - 30-day survival probability > 70%	0 - 5.5
B - 30-day survival probability 30% - 70%	5.6 - 11.0
C - 30-day survival probability < 30%	11.1 - 17.5

## **Critical Appraisal of the Palliative Prognostic Score**

### **Was the sample of patients representative?**

Yes. The study cohort included 519 patients who were admitted at serially to 22 Italian cancer centres. It excluded patients who were being given curative treatment, although included patients who were receiving palliative radiotherapy. The cohort excluded patients who had myelomas, renal tumours, or haematological neoplasms.

### **Were the patients sufficiently homogeneous with respect to prognostic risk?**

Yes. The patients all had terminal cancer, and the purpose of the study was to differentiate them based on various factors and to determine a formula that would allow their survival to be predicted.

### **Was follow-up sufficiently complete?**

Yes. All the patients were followed to death.

### **Were objective and unbiased outcome criteria used?**

Yes: Length of survival.

## How likely are the outcomes over time, and how precise are the estimates of likelihood?

PaP Score	30 Day Survival Probability
0 - 5.5	>70%
5.6 - 11.0	30-70%
11.1 - 17.5	<30%

### Were the study patients and their management similar to those in my practice?

This is difficult to determine. Whether or not Italian cancer management is similar enough to Canadian cancer management is one question. As well, you must consider whether or not the standards of care have changed significantly in the last 8 years from when this study was published. The authors do mention that some of the patients in their study do receive palliative radiotherapy, which is often done in Canada as well. This is one management strategy that is similar between the patients that you are likely to encounter and the patients used in this study.

### Was follow-up sufficiently long?

Yes.

### Can I use the results in the management of patients in my practice?

It is unlikely that this model will be used heavily by Palliative Care Doctors. Knowing a very rough likelihood of patient survival to 30 days is of limited usefulness.

### Validation of the Palliative Prognostic Score

This tool has been validated, but not independently (15).

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