

Prognosis (“foretelling, foreseeing”) is a term for predicting the likely outcome of one’s current standing. One of the earliest written works of medicine is the Book of Prognostics by Hippocrates, written around 400 BC. This work opens with the following statement: “It appears to me a most excellent thing for the physician to cultivate prognosis; for by foreseeing and foretelling, in the presence of the sick, the present, the past, and the future, and explaining the omissions which patients have been guilty of, he will be the more readily believed to be acquainted with the circumstances of the sick; so that men will have confidence to entrust themselves to such a physician.”

For 19th century physicians, particularly those following the French school of medicine, the main aim of medicine was not to cure disease, but rather to give a medical diagnosis and achieve a satisfying prognosis of the patient’s chances. Only several decades later did the focus of efforts in Western medicine shift to curing disease.

At the end of the nineteenth century prognostication took up approximately ten percent of medical textbooks, by 1970 this had fallen to nearly zero. An article on prognostication in Lancet from 1934 reads: “Of the three great branches of clinical science – diagnosis, prognosis, and treatment – prognosis is admittedly the most difficult. Whilst precise predictions of the future are obviously not possible, relatively simple mathematical modeling techniques can make reasonable estimates of likely outcomes for individual patients. Patient’s prognosis not only depends on their age and primary diagnosis, but also on the severity of their illness, their functional capacity both prior to and during the illness and the number of co-morbidities they are suffering from.

### THE COMMON SCENARIO

Imagine you are receiving an unconscious patient on ventilator. On examination, you find out that the patient, a chronic smoker with 40 pack years, k/c/o HT/CAD & DM on treatment for the past 10 years, recently diagnosed right lung cancer on chemotherapy for 8 weeks, developed one episode of GTCS, revived post cardiac arrest in another hospital and connected to ventilator and on inotropic support. CT Brain taken shows multiple metastases. Patient’s family members are called by the doctor to inform the condition. After Doctor’s detailed explanation, the very next common question asked by the family members is “AUR KUCH PROBLEM NAHI HAI KYA?”.

### PROGNOSTICATION

“Doctor, if I am dying, don’t use these machines on me.” This sentence is repeatedly heard by physicians. How are we to know that someone “is dying?”. Most physicians are willing to forego useless medical interventions when a patient is near death or to shape a plan of care so that it reflects an unavoidably grim prognosis. To accomplish that, physicians need a number of skills and tools, including accurate ways of estimating survival prospects. In this article we review current efforts in that regard and evaluate the challenges and opportunities they present to practitioners and patients.

The day, one is born, not only he is growing in age and size; he is also marching towards death. The organ/organ system which has started its functioning slowly starts to fail also. One is growing day by day, means dying day by day. We know that, the patho-physiology for any disease should be congenital / traumatic/ infection/inflammation/ or malignancy. Add one more organ failure.

Every person who is born has to die one day. Date of manufacture/ date of expiry are not only for man made products, but also for man. Every organ which is functioning in our body today will malfunction or stop functioning one day.

How to predict? Are there any biomarkers? Any formula? Any signs /symptoms? Any scoring system? Any prognostication?

### End of Life

Most doctors are over optimistic when giving prognosis. They tend to overstate how long the patient may survive. For patients who are critically ill, especially in an ICU, there are plenty of prognostic scoring systems which are more accurate; the most famous of these is APACHE II scale. Knowing the prognosis helps to decide on treatment modalities or to withhold them, which plays an important role in the end of life decisions? Prognostic scoring is also used for cancer outcome predictions.

Estimators that are commonly used are

1. Prognosis-free survival - Length of time during and after medication or treatment during which the disease being treated does not get worse.
2. Survival rate - % of people in treatment group who are alive for a period of time after diagnosis.

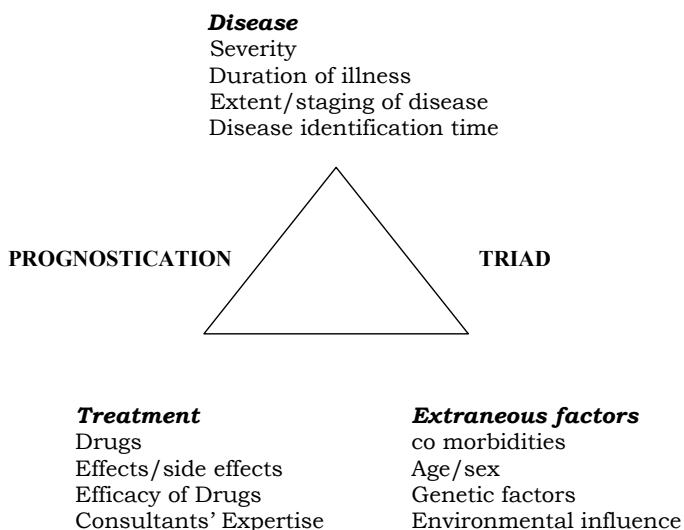
3. Survival time - The remaining duration of life from the time of diagnosis.

What Can Be Accomplished With Objective Estimates of Survival? The best that can be done with high-quality measures on a large population will not reveal the day when a person will die, and it probably will not limit the range of days to the next few, except in cases of persons barely surviving. This is because the pace of dying is affected by many factors over a substantial period of time (Figure 1). Prognosticating will always be inescapably difficult. Dying can be seen as a walk on a long tightrope. Measures of a walker's skill (the illness and the body's response), the gustiness of the wind (the rate of external

events such as pneumonias and falls), and the nature of the assistance available (medical, nursing, and family care) will allow a prediction of how long the walk will go.

### PROGNOSTIC INDICES

Only a few decades ago, all physicians had to offer for prognostication was descriptions of the survival experience of a large group of persons who were defined



**Fig. 1: Prognostication Triad**

%	Criteria
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 personal needs
50	Requires considerable assistance and frequent medical care
40	Disabled; requires special care and assistance
30	Severely disabled; hospitalisation is indicated, although death not imminent
20	Very sick; hospitalisation necessary; active support treatment is necessary
10	Moribund; fatal processes
0	Dead

%	Ambulation	Activity level Evidence of disease	Self-care	Intake	Level of consciousness	Estimated median survival in days		
						(a)	(b)	(c)
100	Full	Normal No <i>disease</i>	Full	Normal	Full	NA	NA	108
90	Full	Normal Some <i>disease</i>	Full	Normal	Full			
80	Full	Normal with effort Some <i>disease</i>	Full	Normal or reduced	Full			
70	Reduced	Cant do normal job or work Some <i>disease</i>	Full	As above	Full	145		
60	Reduced	Cant do hobbies or housework <i>Significant disease</i>	Occasional assistance needed	As above	Full or confusion	29	4	
50	Mainly sit/lie	Cant do any work Extensive <i>disease</i>	Considerable assistance needed	As above	Full or confusion	30	11	41
40	Mainly in bed	As above	Mainly assistance	As above	Full or drowsy or confusion	18	8	
30	Bed bound	As above	Total care	Reduced	As above	5	E	
20	Bed bound	As above	As above	Minimal	As above	4	2	6
10	Bed bound	As above	As above	Mouth care only	Drowsy or coma	1	1	
0	Death							

**Table 3: Palliative Prognostic Index**

Variable	Partial Score Value
<b>PPS</b>	
10-20	4
30-50	2.5
60+	0
<b>Oral Intake</b>	
Severely Reduced	2.5
Moderately Reduced	1.0
Normal	0
<b>Edema</b>	
Present	1.0
Absent	0
<b>Dyspnea at Rest</b>	
Present	3.5
Absent	0
<b>Delirium</b>	
Present	4.0
Absent	0
<b>Total Score</b>	<b>6-week survival</b>
	<b>PPV NPV</b>
>4	<b>0.83 0.71</b>

by one characteristic: perhaps those newly diagnosed with a deadly illness or those who had reached a certain stage of such an illness. With the recent introduction of better computing and statistical tools, dramatically improved objective estimates of prognosis have become available. A statistical model that relies on computer analysis can often weigh the elements more accurately and usefully than projections that rely on the average experience of mixed groups or clinicians' personal experience. A careful consideration of both individual diseases and diseased individuals is required for the restoration of prognosis to the same status as diagnosis and treatment.

### PROGNOSTICATION TOOLS

Prognostication index is a global measurement of patients' functional capacity which includes the following scores/indices.

Only 10 % of patients with < 50 % score survive > 6 months. PPS is a modification of KPS (Tables 1 and 2).

PPI > 6.0, survival < 3 weeks (Sensitivity – 80% Specificity – 85 %) (Table 3).

### Cardinal Symptoms Predicting Survival

National Hospice study data revealed 5 cardinal symptoms that predict survival - Dyspnea, Anorexia, Weight loss, Dry mouth and Dysphagia. Asthenia, Confusion, Drowsiness and Delirium have also been shown to have prognostic values in advanced cancer cases. Dyspnea predicts < 30 days, Anorexia < 58 days, Dry mouth < 50 days, Dysphagia < 30 days and Confusion

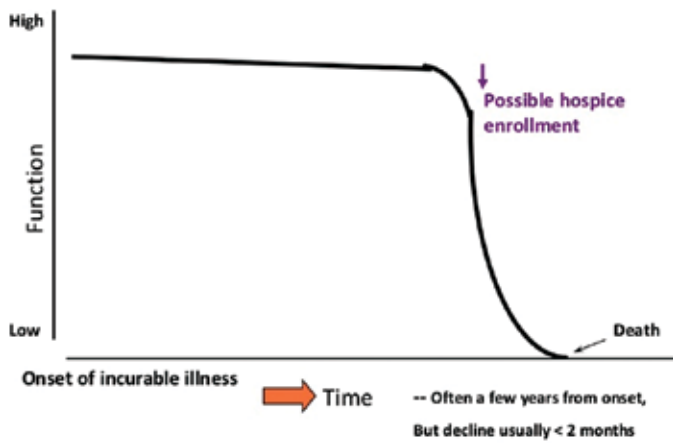
**Table 4: The Palliative Prognostic Score (PnP)**

Criterion	Assessment	Partial Score
Dyspnea	No	0
	Yes	1
Anorexia	No	0
	Yes	1.5
Karnofsky Performance Status	≥3	0
	10-20	2.5
Clinical Prediction of Survival (weeks)	> 12	0
	11-12	2
	7-10	2.5
	5-6	4.5
	3-4	6
	1-2	8.5
Total WBC (x10 <sup>9</sup> /L)	≤8.5	0
	8.6 - 11	0.5
	>11	1.5
Lymphocyte Percentage	20-40%	0
	12-19.9%	1
	<12%	2.5
<b>RISK GROUP</b>	<b>30 DAY SURVIVAL</b>	<b>TOTAL SCORE</b>
<b>A</b>	<b>&gt;70%</b>	<b>0-5.5</b>
<b>B</b>	<b>30-70%</b>	<b>5.6-11</b>
<b>C</b>		<b>11.1-17.5</b>

< 38 days. In general, greater the number of symptoms, worse is the prognosis (Table 4).

### BIOLOGIC PARAMETERS FOR PREDICTING POOR PROGNOSIS

- Low serum Na<sup>+</sup> - Persistent hyponatremia in spite of corrective measures.
- Low serum Albumin – denotes long standing malnutrition/DCLD
- High TC / Low lymphocyte % - denotes immunosuppressive state of the patient.
- Thrombocytosis – negative prognostic indicator in multiple cancers.
- High serum Bilirubin – denotes active liver failure or sepsis.
- High Alk.Phosphatase – denotes increased metabolic state at present.
- High LDH – indicating high cell metabolism.
- High CRP – increased metabolism / cell turnover.
- Vit B 12 >600pmol/L - Hematologic disorders like chronic myelogenous leukemia, promyelocytic leukemia, polycythemia Vera, hyper eosinophilic syndrome, acute hepatitis, cirrhosis, hepatocellular carcinoma and metastatic liver disease.
- Uric Acid >7.2/dl – denotes high cell turnover and hyper metabolism.



**Fig. 2: Cancer Trajectory, Diagnosis to Death**

- Malignant Hypercalcemia - in bone tumor/metastatic disease.

### GSF Prognostic Indicator guidance (gold standards framework)

Earlier identification of people nearing the end of their life and inclusion on the register leads to earlier planning and better coordinated care.

It has three steps

#### IDENTIFY → ASSESS → PLAN

IDENTIFY patients in their last year and what stage are they.

ACCESS Current and future clinical and personal needs.

PLAN Planning the treatment as per the patient / his family's decision

Patients with cancer have sharp decline in functional status and quality of life in the last months of life. Identifying where the patient lies in the course of disease is important (Figure 2).

These models are not dictators, but only tools. They will be most helpful when well understood and thoughtfully applied, and their use warrants careful evaluation. Adjectives such as *rarely* and *usually* are notoriously ambiguous whereas numbers are clear and compact. The strongest argument for prognostic indices is that they facilitate professional communication. Some illnesses are associated with a diagnosis that virtually carries a poor prognosis like pancreatic cancer, biliary tract cancer and metastatic adenocarcinoma of unknown primary and untreated small cell lung cancer. There are circumstances that have a very poor prognosis in specific illnesses, given in Table 5.

### CONCLUSION

Doctors face two challenges in prognosticating near the end of life: formulating accurate predictions and communicating them. If Doctors are better able to anticipate death, they will be likely to help the patient and his family to make judicious use of medical treatments. Increased accuracy of prognosis helps patients and family to make directive decisions, allow for preparations and

**Table 5: Illnesses with Poor Prognosis**

CCF	Cardiac failure requiring inotropic support, Progressive renal failure, Repeated hospital admissions.
CRF	Poor compliance for dialysis, Severe hyperkalemia without treatment
COPD	Respiratory failure
CANCER	Multiple metastases, Refractory hypercalcemia, Bleeding tumor, Bone marrow failure.
OTHERS	Sepsis, Massive CVA, Hypoxic encephalopathy, Coma

help avoid burdensome treatments.

Hippocratic writers characterized the physician's role thus:

"Declare the past, diagnose the present, foretell the future; practice these arts."

"Life is short, the art long, opportunity fleeting, experience treacherous, and judgment difficult."

### REFERENCES

1. Hipócrates, Hippocrates; with an English Translation WHS Jones. 1979: William Heinemann
2. Hancock K, Clayton JM, Parker SM, Wal der S, Butow PN, Carrick S, et al. Truth-telling in discussing prognosis in advanced life-limiting illnesses: a systematic review. *Palliat Med.* 2007; 21: 507-517.
3. Evans LR, Boyd EA, Malvar G, Apatira L, Luce JM, Lo B, et al. Surrogate decision-makers' perspectives on discussing prognosis in the face of uncertainty. *Am J Respir Crit Care Med.* 2009; 179: 48-53.
4. Parker SM, et al. A systematic review of prognostic/end-of-life communication with adults in the advanced stages of a life-limiting illness: patient/caregiver preferences for the content, style, and timing of information. *Journal of pain and symptom management.* 2007; 34: 81-93.
5. Stone PC, Lund S. Predicting prognosis in patients with advanced cancer. *Ann Oncol.* 2007; 18: 971-976.
6. Mack JW1, Smith TJ. Reasons why physicians do not have discussions about poor prognosis, why it matters, and what can be improved. *J Clin Oncol.* 2012; 30: 2715-2717.
7. Barnett MM. Does it hurt to know the worst?--psychological morbidity, information preferences and understanding of prognosis in patients with advanced cancer. *Psychooncology.* 2006; 15: 44-55.
8. Teno JM, Weitzen S, Fennell ML, Mor V. Dying trajectory in the last year of life: does cancer trajectory fit other diseases? *J Palliat Med.* 2001; 4: 457-464
9. Murray SA, et al. Illness trajectories and palliative care. *International Perspectives on Public Health and Palliative Care.* 2013; 30.
10. Maltoni M, Pirovano M, Scarpi E, Marinari M, Indelli M, Arnoldi E, et al. Prediction of survival of patients terminally ill with cancer. Results of an Italian prospective multicentric study. *Cancer.* 1995; 75: 2613-2622.