Objectives

- Recognize patterns of functional decline for different disease states
- Describe general clinical factors that impact prognosis in cancer, ESRD, and dementia
- Identify prognostic calculators and resources for use in clinical practice

Three Cardinal Skills of Medicine:

1. Diagnosis  2. Treatment  3. Prognostication

- Prognostication is a lost art in the cure vs. care culture of medicine of the 20th century
  - BUT...With renewed focus on value and quality in medical care, perhaps we are becoming more willing to ask:
    - SHOULD we do xxxx, not CAN we do xxxx
    - Prognostication is a core skill in internal medicine

- I don’t want to achieve immortality through my work, I want to achieve it through not dying.
  - Woody Allen
Why Prognosticate?

- Patients want and need prognostic information
  - “Doc, how long do I have?”
  - Patients who understand their prognosis make different decisions
    - Oncology treatments – Weeks et al. JAMA. 1998; Temel et al. JCO 2011

Why Prognosticate?

- Clinical decision making
  - Decisions regarding palliative treatments and procedures may depend on estimated length of survival
- Hospice eligibility
  - Requires estimated prognosis of < 6 months
- Research design and trial enrollment

The Art of Prognostication

- Cancer type tumor markers
- Symptoms Psychosocial factors
- Co-morbidities Novel factors (e.g., cytokines)
- Generic prognosis
- Individualized prognosis (conditional)
- Individualized prognosis (revised)
- Treatment

How do you determine prognosis?
- Best studied in advanced cancer
- Use general data (e.g. median survival) and modify with patient specific factors

Subjective vs actuarial judgment

Factors influencing prognosis
- Disease related
- Patient related
- Environmental / Psychosocial

Subjective Survival Predictions: CPS

Clinical Prediction of Survival (CPS)
- Physicians overestimate survival
  - Only 20% estimates were accurate
  - Average MD overestimates survival by a factor of 5.3x!
- Factors that impact accuracy
  - Length of clinician - patient relationship; experience; training
    - ASK a colleague for a prognostic estimate
- Despite these factors, CPS correlates with survival

Declining functional status
- Markers of poor nutritional status: Low albumin/prealbumin, anorexia
- Multiple comorbid disease processes
- Evidence of acceleration of disease process (e.g. 3 ED visits, 2 admission in 6 months, vs one visit to the ED last year)

General Predictors of Poor Prognosis
Subjective Survival Predictions: 
Surprise Question

- Surprise Question: “Would I be surprised if this patient died in the next year?”
  - 826 of 853 consecutive pts with lung, breast, or colon cancer at WVU cancer center
  - 16% = no, 84% = yes
  - Pts in the “no” category had a HR of death = 7.787, p<0.001
  - Moss, AH, et al. JPM. 2010
  - Also validated in renal, outpatient medicine settings
- If the answer is “No,” have you discussed advance directives (AD)? Values? Prognosis?

Patterns of Functional Decline

Tools /Scales used for Prognostic Assessment

Fig. 1 Different death trajectories—health status is on y axis, time on x axis (adapted from refs 11 and 12). (a) Sudden death; (b) Typical cancer death; (c) Typical death from end-organ failure (e.g. CHF, COPD, or HIV/AIDS); (d) Typical death from dementia.
Performance Status: ECOG and KPS

<table>
<thead>
<tr>
<th>ECOG</th>
<th>Karnofsky</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = normal</td>
<td>100</td>
</tr>
<tr>
<td>1 = decreased work</td>
<td>80</td>
</tr>
<tr>
<td>2 = out of bed &gt; 50%</td>
<td>50-60</td>
</tr>
<tr>
<td>3 = in bed &gt; 50%</td>
<td>40</td>
</tr>
<tr>
<td>4 = moribund</td>
<td>10</td>
</tr>
<tr>
<td>5 = dead</td>
<td>0</td>
</tr>
</tbody>
</table>

Palliative Performance Scale (PPS)

- Based on KPS, uses 5 domains to refine performance status:
  - Ambulation, Activity level, Self care, Intake, Level of consciousness
  - Correlates with survival in hospitalized/inpatient palliative care patients and for use in PC consultation services; validated in cancer and non-cancer patients

Palliative Performance Scale (PPSv2)

<table>
<thead>
<tr>
<th>Activity &amp; Evidence of Disease</th>
<th>Self-Care</th>
<th>Intake</th>
<th>Conscious Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>Full</td>
<td>Full</td>
<td>Full</td>
</tr>
<tr>
<td>90%</td>
<td>Semi-independent</td>
<td>Semi-independent</td>
<td>Semi-independent</td>
</tr>
<tr>
<td>80%</td>
<td>Partially independent</td>
<td>Partially independent</td>
<td>Partially independent</td>
</tr>
<tr>
<td>70%</td>
<td>Partial independence</td>
<td>Partial independence</td>
<td>Partial independence</td>
</tr>
<tr>
<td>60%</td>
<td>Partial dependence</td>
<td>Partial dependence</td>
<td>Partial dependence</td>
</tr>
<tr>
<td>50%</td>
<td>Total dependence</td>
<td>Total dependence</td>
<td>Total dependence</td>
</tr>
<tr>
<td>40%</td>
<td>Total dependence</td>
<td>Total dependence</td>
<td>Total dependence</td>
</tr>
<tr>
<td>30%</td>
<td>Total dependence</td>
<td>Total dependence</td>
<td>Total dependence</td>
</tr>
<tr>
<td>20%</td>
<td>Total dependence</td>
<td>Total dependence</td>
<td>Total dependence</td>
</tr>
<tr>
<td>10%</td>
<td>Total dependence</td>
<td>Total dependence</td>
<td>Total dependence</td>
</tr>
<tr>
<td>0%</td>
<td>Total dependence</td>
<td>Total dependence</td>
<td>Total dependence</td>
</tr>
</tbody>
</table>

"You've got one foot in the grave. Further testing will determine if it's your left or your right."
Case 1:

- Ms. Smith is a 74 yo woman with pancreatic adenocarcinoma dx 6 months ago, metastatic to the liver and lungs.

- Admit for neutropenic fever due to chemo; improves quickly on antibiotics.

- Most of the day watching TV/dozing off. + anorexia, weight loss, dry mouth, dyspnea with exertion. No n/v, no cough, no mental status changes.

Advanced Cancer and Prognosis:

- Follows a more predictable course than dementia, organ failure syndromes.

- “Final common pathway” — regardless of tumor type or tumor biology.
**Typical Death Trajectory for Advanced Cancer Patients**

![Diagram showing typical death trajectory for advanced cancer patients.](image)

**National Hospice Study: KPS and Symptoms**

- National Hospice Study, 1988
  - One of the earliest prognostic indices
  - Combine KPS and presence or absence of key symptoms in advanced cancer patients at the time of hospice enrollment
    - Anorexia
    - Weight loss
    - Dysphagia
    - Dry mouth
    - Dyspnea

**Cancer: Tumor-Related Factors**

- Less important as disease progresses

**National Hospice Study**

- In the NHS:
  - KPS > 50% and no key sx:
    - Median survival 6 mo, 10% chance of living 1.5 yrs
  - KPS > 50% and all key sx:
    - Median survival 2 mo, 10% chance of living 9 mo
  - KPS poor – symptoms less relevant

- Poor functional status and cancer cachexia syndrome: "Common terminal pathway"
Disease Specific Prognostication: ESRD

ESRD

- ESRD patient on HD:
  - Have a symptom burden similar to that of cancer patients
  - Annual mortality rate ~25%
  - High in-hospital mortality
  - High rate of comorbid illnesses
- SICK!

Case 2:

- Mr. Smith is a 64 yo with ESRD requiring HD. He also has a hx of MI, PAD, and DM with retinopathy, and hx of COPD.
- Admit with COPD exacerbation and recovers with appropriate treatment. Hbg 9; A1C 7.5; Alb 3.0
- Functional status: Not able to work, but does his ADLs
- What factors predict poor prognosis?

What is your best estimate of this patient’s annual mortality rate?

A. <18%
B. 19%
C. 27%
D. 49%
E. >50%
Would you be surprised if this patient died in the next year?

A. Yes  
B. No

Factors associated with poor prognosis in ESRD

- Sex  
- Age  
- Functional status  
- Co-morbidities  
- Albumin <3.5

Possible tools to improve prognostic accuracy:
- Surprise question  
- Modified charlson comorbidity index  
- Touchcalc.md app

Albumin

<table>
<thead>
<tr>
<th>Plasma albumin, g/L</th>
<th>Risk of mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>2.5-3.5</td>
<td>2.5</td>
</tr>
<tr>
<td>3.5-4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>4.0-4.5</td>
<td>1.5</td>
</tr>
<tr>
<td>&gt;4.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Correlation of the risk of mortality according to the plasma albumin concentration, obtained within six weeks of starting maintenance dialysis in 2007 patients receiving hemodialysis and the patients treated with CAPD. Hypoalbuminemia was associated with increased mortality, particularly at plasma concentrations below 3.5 g/dL (30 g/L).  

CAPD: continuous ambulatory peritoneal dialysis.  
Data from MedSci. Rent HL.

Surprise Question

- Would I be surprised if this patient died within the next year?  
  - 147 pt at HD units, classified as “yes” or “no”  
  - Followed for 12 months  
  - CCI, KPS, and demographics collected  
  - Odds of dying within 12 months 3.5x higher in “no” group  
    - “No” group older, more comorbidities, lower KPS
Modified Charlson Comorbidity Index used to predict mortality in HD patients

### Prognostic Tools
It has long been recognized that patient comorbidity is strongly correlated with prognosis in ESRD. An age-modified Charlson Comorbidity Index (CCI), which stratifies patients based on medical comorbidities and age, has been successfully used to predict mortality in dialysis-dependent patients (3):

#### Modified Charlson Comorbidity Index
Total score is the sum of the comorbidity points

<table>
<thead>
<tr>
<th>Comorbidity Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 point each for coronary artery disease, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disorder, peptic ulcer disease, mild liver disease, diabetes mellitus, diabetes requiring insulin, diabetes without complication, diabetes with complication (e.g., retinopathy, neuropathy, nephropathy), coronary artery bypass graft (CABG) surgery, peripheral vascular surgery, cerebrovascular surgery, solid tumor without metastasis, solid tumor with metastasis, other solid tumor, hemiplegia, moderate to severe renal disease, end organ damage, cancer (including leukemia or lymphoma), metastatic solid tumor or AIDS</td>
</tr>
</tbody>
</table>

##### Modified CCI Score Totals
- Low score (3)
- Moderate (4-5)
- High (6-7)
- Very High (8+)

#### Annual mortality rate
- Low score: 0.03
- Moderate: 0.13
- High: 0.27
- Very High: 0.49


---

### Case 2:
- Mr. Smith is a 64 yo with ESRD requiring HD. He also has a hx of MI, PAD, and DM with retinopathy, and hx of COPD.
  - Admit with a COPD exacerbation and recovers with treatment.
  - Functional status: Not able to work, but does his ADLs
    - What factors predict poor prognosis?
    - What is his annual mortality rate?
      - Based on his mortality rate, does he need ACP? Palliative care?

---

### Disease Specific Prognosis: Dementia
- Derivation cohort: 512 pts at 5 HD centers
  - CCI
  - Surprise question – 6mo
  - Survival monitored x24 mo
- Validation cohort: 514 pts 8 HD centers

---

### Derivation cohort:
- 512 pts at 5 HD centers
  - CCI
  - Survival monitored x24 mo

### Validation cohort:
- 514 pts 8 HD centers
Case 3:

- Mr. Padilla is an 87 yo man with a long history of Alzheimer’s dementia who was admitted to a NH 2 months ago after his family became unable to care for him at home. He is bedbound, no longer eats regularly and has lost weight, with BMI now 18kg/m2. Speaks several words at time.
  - What are the factors that predict poor prognosis?
  - What tools can you use to help prognosticate?

Dementia: FAST

- Stages
  1. No difficulties
  2. Subjective forgetfulness
  3. Decreased job functioning and organizational capacity
  4. Difficulty with complex tasks, instrumental ADLs
  5. Requires supervision with ADLs
  6. Impaired ADLs, with incontinence
  7. A. Ability to speak limited to six words
     B. Ability to speak limited to single word
     C. Loss of ambulation
     D. Inability to sit
     E. Inability to smile
     F. Inability to hold head up

Dementia

- FAST 7C often used as criteria for hospice enrollment
  - If the patient also exhibits 1/more specific dementia-related co-morbidities:
    - Aspiration
    - Upper urinary tract infection
    - Sepsis
    - Multiple stage 3-4 ulcers
    - Persistent fever
    - Weight loss >10% within six months
  - Median survival: 6.9 months (38% survived >6 months)
Dementia

- 2013 Systematic review of indicators of 6 month mortality in elderly pts with advanced dementia:
  - 7 studies included
  - Commonly ID’ed prognostic variables:
    - Nutritional/eating habits, increased risk on dementia severity scales, comorbidities
  - All but 1 found that FAST 7c was not a reliable predictor a 6-month mortality

Dementia- MRI scale

<table>
<thead>
<tr>
<th>Point Values:</th>
<th>Risk estimate of death within 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.9 Complete dependence with ADLs</td>
<td>Score</td>
</tr>
<tr>
<td>1.9 Male Gender</td>
<td>0</td>
</tr>
<tr>
<td>1.7 Cancer</td>
<td>1-2</td>
</tr>
<tr>
<td>1.6 CHF</td>
<td>3-5</td>
</tr>
<tr>
<td>1.6 02 Tx within 14 days</td>
<td>6-8</td>
</tr>
<tr>
<td>SOB</td>
<td>9-11</td>
</tr>
<tr>
<td>&lt;25% of food eaten at most meals</td>
<td>= 12</td>
</tr>
<tr>
<td>Unstable medical condition</td>
<td></td>
</tr>
<tr>
<td>Bowel incontinence</td>
<td></td>
</tr>
<tr>
<td>Bedfast</td>
<td></td>
</tr>
<tr>
<td>Age &gt;83 years</td>
<td></td>
</tr>
<tr>
<td>Not awake most of the day</td>
<td></td>
</tr>
</tbody>
</table>

Dementia ADEPT tool

- The Advanced Dementia Prognostic Tool: A Risk Score to Estimate Survival in Nursing Home Residents with Advanced Dementia
ADEPT: Score 1-32.5
higher score = higher risk of death

Table 3
Final Multivariable Model of Characteristics Associated with Survival Among NH Residents with Advanced Dementia n = 218,888

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Adjusted Hazard Ratio (95% Confidence Interval)</th>
<th>Regression Coefficient</th>
<th>Points in Risk Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent NH admission</td>
<td>1.72 (1.69–1.75)</td>
<td>0.4295</td>
<td>5.5</td>
</tr>
<tr>
<td>Age (in years, per five-year increment)</td>
<td>1.10 (1.17–1.15)</td>
<td>0.1653</td>
<td>1.0</td>
</tr>
<tr>
<td>05 &lt; 20</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>20 &lt; 25</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>20 &lt; 25</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>60 &lt; 65</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>65 &lt; 70</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>70 &lt; 75</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>75 &lt; 80</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>80 &lt; 85</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>85 &lt; 90</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>90 &lt; 95</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>95 &lt; 100</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Male</td>
<td>1.71 (1.66–1.74)</td>
<td>0.5382</td>
<td>3.5</td>
</tr>
<tr>
<td>Risk factors for heart disease</td>
<td>1.53 (1.35–1.74)</td>
<td>0.4990</td>
<td>2.7</td>
</tr>
<tr>
<td>At least one person living in a Stage 2</td>
<td>1.44 (1.41–1.48)</td>
<td>0.4749</td>
<td>2.2</td>
</tr>
<tr>
<td>M3 score = 20th</td>
<td>1.40 (1.37–1.47)</td>
<td>0.5080</td>
<td>3.2</td>
</tr>
<tr>
<td>Bedrest most of day</td>
<td>1.41 (1.38–1.48)</td>
<td>0.4803</td>
<td>2.1</td>
</tr>
<tr>
<td>Insufficiency of income</td>
<td>1.39 (1.35–1.45)</td>
<td>0.2587</td>
<td>0.9</td>
</tr>
<tr>
<td>Bowel incontinence</td>
<td>1.50 (1.48–1.60)</td>
<td>0.6175</td>
<td>1.9</td>
</tr>
<tr>
<td>BMI &gt; 20.3 kg/m²</td>
<td>1.55 (1.35–1.78)</td>
<td>0.2004</td>
<td>1.0</td>
</tr>
<tr>
<td>Weight loss</td>
<td>1.30 (1.27–1.35)</td>
<td>0.0614</td>
<td>1.6</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.28 (1.26–1.30)</td>
<td>0.2459</td>
<td>1.5</td>
</tr>
</tbody>
</table>

---

Table 4
Number (% of Subjects with Each Possible Total Risk Score and the Six- and 12-Month Probabilities of Death with Each Total Score (n = 218,888)

<table>
<thead>
<tr>
<th>Total Risk Score</th>
<th>Subjects with Each Score, n (%)</th>
<th>Six Months</th>
<th>12 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (minimum score)</td>
<td>84 (0.04)</td>
<td>0.01</td>
<td>0.06</td>
</tr>
<tr>
<td>2</td>
<td>216 (0.11)</td>
<td>0.04</td>
<td>0.08</td>
</tr>
<tr>
<td>3</td>
<td>1,252 (0.50)</td>
<td>0.05</td>
<td>0.11</td>
</tr>
<tr>
<td>4</td>
<td>2,669 (1.20)</td>
<td>0.06</td>
<td>0.15</td>
</tr>
<tr>
<td>5</td>
<td>3,539 (1.60)</td>
<td>0.06</td>
<td>0.15</td>
</tr>
<tr>
<td>6</td>
<td>7,588 (4.40)</td>
<td>0.08</td>
<td>0.19</td>
</tr>
<tr>
<td>7</td>
<td>14,300 (7.90)</td>
<td>0.10</td>
<td>0.25</td>
</tr>
<tr>
<td>8</td>
<td>16,459 (8.65)</td>
<td>0.12</td>
<td>0.26</td>
</tr>
<tr>
<td>9</td>
<td>20,654 (10.92)</td>
<td>0.15</td>
<td>0.30</td>
</tr>
<tr>
<td>10</td>
<td>23,036 (12.30)</td>
<td>0.17</td>
<td>0.35</td>
</tr>
<tr>
<td>11</td>
<td>22,500 (11.80)</td>
<td>0.21</td>
<td>0.37</td>
</tr>
<tr>
<td>12</td>
<td>20,000 (10.60)</td>
<td>0.25</td>
<td>0.42</td>
</tr>
<tr>
<td>13</td>
<td>18,504 (10.20)</td>
<td>0.29</td>
<td>0.47</td>
</tr>
<tr>
<td>14</td>
<td>13,016 (6.90)</td>
<td>0.34</td>
<td>0.52</td>
</tr>
<tr>
<td>15</td>
<td>11,401 (6.06)</td>
<td>0.40</td>
<td>0.52</td>
</tr>
<tr>
<td>16</td>
<td>9,512 (5.16)</td>
<td>0.46</td>
<td>0.62</td>
</tr>
<tr>
<td>17</td>
<td>7,221 (3.96)</td>
<td>0.52</td>
<td>0.62</td>
</tr>
<tr>
<td>18</td>
<td>4,555 (2.77)</td>
<td>0.57</td>
<td>0.71</td>
</tr>
<tr>
<td>19</td>
<td>3,065 (1.64)</td>
<td>0.64</td>
<td>0.76</td>
</tr>
<tr>
<td>20</td>
<td>2,047 (1.47)</td>
<td>0.70</td>
<td>0.79</td>
</tr>
<tr>
<td>21</td>
<td>1,777 (0.83)</td>
<td>0.73</td>
<td>0.84</td>
</tr>
<tr>
<td>22</td>
<td>1,354 (0.65)</td>
<td>0.77</td>
<td>0.87</td>
</tr>
<tr>
<td>23</td>
<td>864 (0.39)</td>
<td>0.83</td>
<td>0.90</td>
</tr>
<tr>
<td>24</td>
<td>365 (0.18)</td>
<td>0.85</td>
<td>0.91</td>
</tr>
<tr>
<td>25</td>
<td>186 (0.09)</td>
<td>0.88</td>
<td>0.94</td>
</tr>
<tr>
<td>26</td>
<td>99 (0.05)</td>
<td>0.88</td>
<td>0.96</td>
</tr>
<tr>
<td>27</td>
<td>58 (0.03)</td>
<td>0.88</td>
<td>0.98</td>
</tr>
<tr>
<td>28</td>
<td>21 (0.01)</td>
<td>0.88</td>
<td>0.99</td>
</tr>
<tr>
<td>29</td>
<td>7 (0.00)</td>
<td>0.88</td>
<td>1.00</td>
</tr>
</tbody>
</table>

---

Fast Facts

- http://www.mypcnow.org/fast-facts
Prognostication is dynamic

Use prognostic tools to improve your prognostic estimates, but remember.. Be flexible

Consider using SPIKES or the Serious Illness Converstation Guide as a cognitive roadmap for prognostic disclosure discussions
Selected References


- eprognosis.com