Evidence-Based Prognostication

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The trouble with weather forecasting is that it’s right too often for us to ignore it and wrong too often for us to rely on it.

-Patrick Young

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, so that men will have confidence to entrust themselves to such a physician.

- Hippocrates

The Book of Prognostics
Overview

• Define benefits and limitations of open frequent prognostication
• Understand theories for accurate formulation of prognostication
• Discover tools for prognostication
• Improve prognostic documentation

Branches of Clinical Science

![Branches of Clinical Science Diagram]

What is Prognostication?

• It is not...
  – Fortune telling
  – Playing God
  – Precognition
  – Divination
• Mantic prognosis vs semiotic prognosis
What is a Prognosis?

An estimation of possible future outcomes of a treatment or a disease process founded upon a combination of experience, statistics and validated models.

Two Parts to Prognostication

• Formulation (Foreseeing)
• Communication (Foretelling)
  – Compassionate
  – To the patient
  – As much as they want to hear
  – Ask – Tell – Ask
  – Many articles about "Breaking bad news"
What Can be Predicted?

• Time to discharge
  – Case management/Utilization Review
  – Hospital throughput
• Functional outcome after therapy
  – Surgical outcomes
• Risk of medical outcome
  – Stroke, heart attack, cancer
  – 30-day re-hospitalization

Think of These Statements

• “I’ll operate if you think he’ll be alive in three months”
• “There’s a 20% chance of the kidney stones recurring”
• “He’ll likely never walk again”
• “No, not every one has severe pain before dying”
• The nausea should wear off in three days

Predicting the 5 D’s

• Disease Progression
• Disability/discomfort
• Drug toxicity
• Dollars
• ...
And Death…

This is Important

Predicting Risk of Death

- Medicare Hospice Benefit
- Eligibility for clinical trial
- Withdrawal or withholding of life-sustaining treatments
- Activating a living will
- Choosing to go home
- Distant relatives
- Talking about important issues
- Providing care
The Research Problem

• Minimal research funding
• Minimal (but increasing) publications
• Most looking at genetic risk factors
• No revenue to be made (?)
• Mystery of prognosis

Who Can We Learn From?

• Weather forecasting
• Predictive analytics
• Clinical decision support systems
• CRM/advertising
• Fraud detection
• Underwriting and insurance
• Sports statistics

(Chart showing percentages of Therapy, Diagnosis, and Prognosis.)
Existing Tools

- Karnofsky Performance Score (KPS)
- Spitzer Quality of Life Index
- APACHE (I, II, III, IV, –L)
- Charlson Comorbidity Index
- SAPS II
- Palliative Performance Scale (PPS)
- Elixhauser Comorbidity Index

Cardona-Morrell and Hillman, BMJ Supportive Care, 2015

Existing Tools

- MEWS
- Palliative Prognostic Score (PaP)
- Rapid Emergency Medicine Score (REMS)
- CSHA Clinical Frailty Scale
- SEWS
- Simple Clinical Score (SCS)

Cardona-Morrell and Hillman, BMJ Supportive Care, 2015

Existing Tools

- EWS
- Palliative Prognostic index
- Clinical Prediction of Survival (CPS)
- ViEWS
- Rothman Index
- MELD (–Na)
Appendix 2

Formula for computing the SUPPORT physiology score and the entire SUPPORT day 3 prognostic model.

SUPPORT Physiologic Score (Range, 0-100)

\[
SPS = 259.9 \times (ARF/MOSF) + 263.4 \times (CO/PD/CHF) + 241.4 \times (Cirrhosis/Coma) + 283.5 \times (Lung/Colon Cancer) - 0.06(74 \times (PaCO2) - 255) - 6.4336 \times (\text{mean BP}) - 60) + 1.0325 \times (WBC - 0.3696 \times (WBC - 8)) - 0.563(\text{WBC} - 11) + 0.2691 \times (\text{min(Alb, 4.8)} + 0.2315 \times (\text{A SG} - 2.562 \times (\text{Temp} - 36.6) + 2.493 \times (\text{Temp} - 34.3) - 1.279 \times 10^5 \times (\text{HR} - 5.770) \times 10^3 \times (\text{HR} - 5.5)^2 - 2.190 \times 10^5 \times (\text{HR} - 8.02) + 1.518 \times 10^7 \times (\text{HR} - 11.02)^3 - 3.062 \times 10^{-7} \times (\text{HR} - 149) + 0.9753 \times (\text{BMI} - 2.78) - 6.8761 \times (\text{Cl} + 11.056 \times (\text{Cl} - 6.609)^2 + 21.843 \times (\text{Cl} - 1.003) + 10.5574 \times (\text{Cl} - 1.003) - 0.1219 \times (\text{Cl} - 5.399)^2 - 0.61079 \times (\text{Na} + 0.00211 \times (\text{Na} - 128)^2 - 0.06357 \times (\text{Na} - 125)^3 + 0.00642 \times (\text{Na} - 139)^2 + 0.00048 \times (\text{Na} - 145)^2 - 6.278 \times (\text{CO/PD/CHF}) \times \min(\text{Alb, 4.8}) - 11.45 \times (\text{Lung/Colon Cancer}) \times \min(\text{Alb, 4.8}) + (\text{ARF/MOSF}) 
\]

Knaus, Annals IM, 1995

Comparison of SUPPORT and MD survival estimates

Knaus, Annals IM, 1995

Unhanska and Lamont, BMJ 2000
Patient Estimates

Unwilling To Estimate, 291, 49%
Willing To Estimate, 299, 51%
Prognostic Disclosure

Enzinger AC et al, JCO 2015

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Median (Q1 to Q3)</th>
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<tbody>
<tr>
<td>Prefers life-prolonging care†</td>
<td></td>
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<tr>
<td>Yes (n = 71)</td>
<td>60.0 (12.0 to 240.0)</td>
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<tr>
<td>No (n = 206)</td>
<td>24.0 (12.0 to 120.0)</td>
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<tr>
<td>DNR order‡</td>
<td></td>
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<tr>
<td>Yes (n = 117)</td>
<td>13.0 (6.0 to 60.0)</td>
</tr>
<tr>
<td>No (n = 174)</td>
<td>60.0 (15.0 to 240.0)</td>
</tr>
<tr>
<td>Living with health care proxy§</td>
<td></td>
</tr>
<tr>
<td>Yes (n = 199)</td>
<td>24.0 (9.0 to 60.0)</td>
</tr>
<tr>
<td>No (n = 92)</td>
<td>97.0 (18.0 to 240.0)</td>
</tr>
</tbody>
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Enzinger AC et al, JCO 2015
Physician-Surrogate Discordance

- <20% discordance, 107, 47%
- > 20% discordance, 122, 53%

White et al, JAMA, 2016
Reasons for Discordance

- Unique strengths/weaknesses
- Maintain hope for patient/family benefit
- Maintain pessimism for protection
- Optimism grounded in religious beliefs
- Physicians are too optimistic

What is the Starting Point?

- Disease–based prognosis
- Function–based prognosis
- Event–based prognosis
  - Therapy
  - Complication
- Mixed method prognosis
- Invasive or non–invasive
The Uncertainty Problem

• Unpredictability deplored and exploited
• Means for avoidance
• Frequent predictions decrease uncertainty

Enhancing Accuracy

• Disinterested – second opinion effect
• Probabilistic vs temporal
• Averaged across clinicians
• Aided by models
• Repeated estimates
• Accuracy increases as event nears
• Unclear discipline/specialty effect

Christakis, Death Foretold, 1999; Glare, JPM, 2008
How We Prognosticate Now

• Mostly by experience
• Occasionally based on research
  – Very specific scenarios
• Rarely communicated to patients
• Rarely by validated models
• Rarely documented
• Rarely documented comprehensively
• Rarely publishing research

How We Prognosticate Now

• Physicians fear and desire prognosis
• Avoid it but engage with it
• Uncertainty leads to avoidance

Christakis, Death Foretold, 1999

What Can You Change?

• Discuss prognosis with other clinicians
• Document prognosis
• Researching prognostic data
• Curate your own trusted tools
• Utilize validated models
• Study your own efforts
• Publish new prognostic studies
Documenting Prognosis

- Just do it!
- Pick your event
  - discharge, function, death
- Give your estimated range
- Explain your key reasoning
- Consider alternatives

Documentation Example

Estimated Prognosis:
Survival likely not more than several days based on MELD 44, respiratory failure in ICU on vent, non-responsive off meds, no matter goals of care. If change to comfort care only, survival may be hours to 1–2 days. Communicated with family.

Curate Trusted Tools

- Pallimed prognosis links
- Pubmed search and alerts
- SEER database (cancer)
- GeriPal ePrognosis (Site and App)
Progress Workgroup

• PROGnosis RESearch Strategy (PROGRESS) Partnership (UK)
• Summer School since 2013
• http://progress-partnership.org/

Study Your Own Efforts

<table>
<thead>
<tr>
<th>Prognosis: Disc. w/ Pt, Fam</th>
<th>Min: Mn, Hrs, Dys, Wks, Mos</th>
<th>Avg: Mn, Hrs, Dys, Wks, Mos</th>
<th>Max: Mn, Hrs, Dys, Wks, Mos</th>
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Conclusions

• Physicians have a duty to prognosticate
  – Accurately, openly, dynamically
• Prognostication can be evidence based
• Tools can aid clinical prognostication
• Prognostication is a skill to be honed

Recommended Readings

• Death Foretold: Prophecy and prognosis in medical care by N. Christakis
• Palliative medicine review: prognostication by Glare and Sinclair
  PMID: 18370898
References

• Fox E et al. Evaluation of prognostic criteria for determining hospice eligibility in patients with advanced lung, heart, or liver disease. SUPPORT Investigators. Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments. JAMA 1999; 282(17): 1638–45. PMID 10553790

References

• Christakis NA. Death Foretold: Prophecy and prognosis in medical care. 1999

References