The Untapped Potential of Prognosis Science:
Balancing Certainty, Experience and Research

Christian T Sinclair, MD, FAAHPM
University of Kansas Medical Center
2021
csinclair@kumc.edu

@ctsinclair #PrognosisScience
Disclosures

• I am a Stock/Shareholder: 3M, Cerner, Nektar Therapeutics, Moderna and Tilray.
Objectives

• Discuss the current state of prognosis science

• Identify three tools to help with evidence-based prognostication
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
  – Clinician estimates vs models
  – Rarely done explicitly
  – Rarely documented
  – Rarely tested
  – Not just predicting death

• Communication
  – Permission-based, empathetic
  – What did the patient/family understand?
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
And Death…
Predicting Risk of Death

- Medicare Hospice Benefit
- Withdrawal or withholding treatments
- Activating a living will
- Choosing to go home
- Distant relatives
- Talking about important issues
- Providing care
Table 3: Association between patient overall satisfaction with EOL care and other variables: results from ordinary least squares multiple linear regression*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\hat{\beta}$ (95% CI)</th>
<th>$t$</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion of prognosis</td>
<td>3.57 (0.78 to 6.36)</td>
<td>2.51</td>
<td>0.012</td>
</tr>
<tr>
<td>Age</td>
<td>0.15 (0.02 to 0.28)</td>
<td>2.25</td>
<td>0.025</td>
</tr>
<tr>
<td>Rural</td>
<td>2.57 (0.15 to 4.98)</td>
<td>2.09</td>
<td>0.037</td>
</tr>
<tr>
<td>Female</td>
<td>-1.55 (-3.69 to 0.59)</td>
<td>-1.42</td>
<td>0.156</td>
</tr>
<tr>
<td>Retired</td>
<td>-0.59 (-3.09 to 1.90)</td>
<td>-0.47</td>
<td>0.640</td>
</tr>
<tr>
<td>Married or common-law status</td>
<td>-1.48 (-3.64 to 0.69)</td>
<td>-1.34</td>
<td>0.181</td>
</tr>
<tr>
<td>Has post-secondary education</td>
<td>-0.39 (-2.71 to 2.14)</td>
<td>-0.23</td>
<td>0.815</td>
</tr>
<tr>
<td>Religion stated</td>
<td>1.72 (-1.26 to 4.70)</td>
<td>1.14</td>
<td>0.257</td>
</tr>
<tr>
<td>Caregiver present</td>
<td>0.00 (-2.12 to 2.12)</td>
<td>0.00</td>
<td>0.998</td>
</tr>
<tr>
<td>Functional ability</td>
<td>0.04 (-0.05 to 0.13)</td>
<td>0.83</td>
<td>0.405</td>
</tr>
<tr>
<td>Cancer diagnosis</td>
<td>2.50 (0.37 to 4.62)</td>
<td>2.31</td>
<td>0.022</td>
</tr>
</tbody>
</table>

*F = 2.21 ($p = 0.014$); df₁ = 11, df₂ = 346; adj. $R^2 = 0.036$

EOL = end of life, CI = confidence interval.

Note: The $\hat{\beta}$ estimates the increase in the dependent variables (satisfaction scores) per unit increase of continuous predictors or in the yes versus no group for binary predictors.
The Research Problem

• Minimal research funding
• Minimal publications
• Mostly looking at genetic risk factors
• No revenue to be made (?)
• Lack of unified terminology
• Mystery of prognosis
Unified Terminology?

- Prognosis
- Prognostication
- Prediction
- Risk
- Risk Score
- Risk Tool
- Outcome
- Outcome Risk
- Event Rate

- Predictive Model
- Predictive Analytics
- Nomogram
- Decision Support
- Big Data
- Artificial Intelligence
- Genetic Risk
- Predictive Biomarkers
<table>
<thead>
<tr>
<th>Variable</th>
<th>Prognostication Is Stressful (n = 381)</th>
<th>Prognostication Is Not Stressful (n = 250)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean, y</td>
<td>45.3</td>
<td>46.2</td>
<td>.28</td>
</tr>
<tr>
<td>Sex, % male</td>
<td>79.5</td>
<td>82.0</td>
<td>.44</td>
</tr>
<tr>
<td>Specialty, % generalists</td>
<td>48.0</td>
<td>47.6</td>
<td>.92</td>
</tr>
<tr>
<td>Board certification, % certified</td>
<td>79.8</td>
<td>79.2</td>
<td>.86</td>
</tr>
<tr>
<td>Time spent in patient care, %</td>
<td>90.1</td>
<td>86.5</td>
<td>.04</td>
</tr>
<tr>
<td>Prognostic queries, mean No. of patients</td>
<td>23.8</td>
<td>21.1</td>
<td>.44</td>
</tr>
<tr>
<td>Life support withdrawal, mean No. of patients</td>
<td>16.1</td>
<td>18.3</td>
<td>.55</td>
</tr>
<tr>
<td>Difficulty, % finding prognostication difficult</td>
<td>68.0</td>
<td>44.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Patient expectations, % thinking that their patients expect too much certainty</td>
<td>85.2</td>
<td>72.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Training, % with inadequate training in prognostication</td>
<td>61.4</td>
<td>49.8</td>
<td>.004</td>
</tr>
<tr>
<td>Patient confidence, % feeling that patients would lose confidence after a prognostic error</td>
<td>55.6</td>
<td>42.3</td>
<td>.001</td>
</tr>
<tr>
<td>Statement</td>
<td>% Agreeing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I were to make an error in diagnosis, my patients might lose confidence in me</td>
<td>88.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I were to make an error in prognosis, my patients might lose confidence in me</td>
<td>50.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I were to make an error in diagnosis, my colleagues might lose confidence in me</td>
<td>81.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I were to make an error in prognosis, my colleagues might lose confidence in me</td>
<td>28.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a physician colleague made an error in prognostication, I would probably lose some confidence in the colleague</td>
<td>17.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Who Can We Learn From?

• Weather forecasting
• Underwriting
• Engineering
• Sports statistics
• Online advertising
• Fraud detection
• Predictive analytics
• Artificial intelligence/ machine learning
ARE PHYSICIANS REALLY TERRIBLE AT PROGNOSIS?

Reply hazy...
RESEARCH ARTICLE

A Systematic Review of Predictions of Survival in Palliative Care: How Accurate Are Clinicians and Who Are the Experts?

Nicola White\textsuperscript{1*}, Fiona Reid\textsuperscript{2†}, Adam Harris\textsuperscript{3†}, Priscilla Harries\textsuperscript{4†}, Patrick Stone\textsuperscript{1*}

1 Marie Curie Palliative Care Research Department, Division of Psychiatry, University College London, London, United Kingdom, 2 Department of Primary Care & Public Health Sciences, King’s College London, London, United Kingdom, 3 Department of Experimental Psychology, University College London, London, United Kingdom, 4 Department of Clinical Sciences, Brunel University London, London, United Kingdom

\* These authors contributed equally to this work.
† These authors also contributed equally to this work.
* n.g.white@ucl.ac.uk
<table>
<thead>
<tr>
<th>Study</th>
<th>% Accuracy (95% CI)</th>
<th>Total Estimates</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addington-Hall (1990)</td>
<td>78.4 (75.8, 80.7)</td>
<td>1128</td>
<td>2</td>
</tr>
<tr>
<td>Bruera (1992)</td>
<td>31.9 (22.7, 42.3)</td>
<td>94</td>
<td>2</td>
</tr>
<tr>
<td>Shih (2008)</td>
<td>30.2 (24.6, 36.4)</td>
<td>246</td>
<td>2</td>
</tr>
<tr>
<td>Buchan (1995)</td>
<td>36.5 (13.9, 68.4)</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Brandt (2006)</td>
<td>55.8 (51.3, 60.1)</td>
<td>511</td>
<td>3</td>
</tr>
<tr>
<td>Muers (1999)</td>
<td>56.7 (49.5, 63.6)</td>
<td>203</td>
<td>3</td>
</tr>
<tr>
<td>Gripp (2007)</td>
<td>33.3 (29.4, 37.3)</td>
<td>580</td>
<td>3</td>
</tr>
<tr>
<td>Yigano (1999)</td>
<td>51.5 (44.9, 58.1)</td>
<td>233</td>
<td>3</td>
</tr>
<tr>
<td>Gwiliam (2013)</td>
<td>57.4 (54.3, 60.6)</td>
<td>987</td>
<td>3</td>
</tr>
<tr>
<td>Lidbera (2000)</td>
<td>23.3 (20.0, 26.9)</td>
<td>600</td>
<td>4</td>
</tr>
<tr>
<td>Fairchild (2014)</td>
<td>27.6 (23.2, 32.3)</td>
<td>395</td>
<td>4</td>
</tr>
<tr>
<td>Fremme (2010)</td>
<td>57.9 (52.7, 62.2)</td>
<td>429</td>
<td>4</td>
</tr>
<tr>
<td>Kao (2011)</td>
<td>32.0 (19.5, 46.7)</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Zibelman (2014)</td>
<td>41.0 (35.1, 47.1)</td>
<td>273</td>
<td>5</td>
</tr>
<tr>
<td>Glare (2001)</td>
<td>27.3 (15.0, 42.8)</td>
<td>44</td>
<td>6</td>
</tr>
<tr>
<td>Glare (2004)</td>
<td>45.0 (35.0, 55.3)</td>
<td>100</td>
<td>6</td>
</tr>
<tr>
<td>Thomas (2009)</td>
<td>72.8 (66.9, 78.2)</td>
<td>254</td>
<td>7</td>
</tr>
<tr>
<td>Stiel (2010)</td>
<td>31.7 (21.9, 42.9)</td>
<td>82</td>
<td>7</td>
</tr>
<tr>
<td>Hui (2011)</td>
<td>34.0 (31.8, 36.2)</td>
<td>1835</td>
<td>7</td>
</tr>
<tr>
<td>Selby (2011)</td>
<td>56.6 (38.1, 72.1)</td>
<td>36</td>
<td>7</td>
</tr>
<tr>
<td>Holmabakk (2011)</td>
<td>27.2 (21.7, 33.2)</td>
<td>243</td>
<td>8</td>
</tr>
</tbody>
</table>

Fig 2. Summary data from studies in which clinicians provided categorical survival estimates (grouped by number of categories). The data represented is the percentage of accurate estimates given out of the total number of estimates given. Note: The study by Gwiliam et al (2013) included doctor, nurse and MDT estimates. However, since the estimates were not independent of each other, only the MDT estimates have been presented here.

doi:10.1371/journal.pone.0161407.g002
Fig 3. Professional Error Score (PES) of clinicians’ estimates of survival those studies where clinicians were asked to provide a continuous temporal estimate of survival. The black bar in this figure indicates the overall accuracy of the clinicians’ estimates (0 indicates perfect accuracy, positive values indicate over-estimates and negative values indicate under-estimates).
Types of Predictions

• Categorical
  – 0-30d, 31-60d, 61d-90d
  – Days, weeks, months, years

• Continuous
  – Any number of any time period

• Probabilistic
  – 20% chance to survive this hospital stay
Comparison of SUPPORT and MD survival estimates

Knaus, Annals IM, 1995
Table 2. Comparison of the Various Models for Prediction of 180-Day Survival*

<table>
<thead>
<tr>
<th>Disease class</th>
<th>SUPPORT Model</th>
<th>SUPPORT Model with APS†</th>
<th>Physician’s Estimate</th>
<th>SUPPORT Model and Physician’s Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>All (n = 4028, deaths = 1899)</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.82</td>
</tr>
<tr>
<td>Acute respiratory failure and multiple organ system failure (n = 2057, deaths = 993)</td>
<td>0.77</td>
<td>0.78</td>
<td>0.78</td>
<td>0.82</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease congestive heart failure, cirrhosis (n = 1111, deaths = 346)</td>
<td>0.71</td>
<td>0.70</td>
<td>0.70</td>
<td>0.75</td>
</tr>
<tr>
<td>Coma (n = 281, deaths = 205)</td>
<td>0.74</td>
<td>0.75</td>
<td>0.78</td>
<td>0.82</td>
</tr>
<tr>
<td>Colon and lung cancer (n = 579, deaths = 345)</td>
<td>0.78</td>
<td>0.70</td>
<td>0.77</td>
<td>0.82</td>
</tr>
</tbody>
</table>

*All calculations are based on 4028 SUPPORT phase II patients who completed 180 days of follow-up and had a physicians’ prognostic estimate at study day 3. Each statistic is the area under the receiver-operating characteristic curve for 180-day vital status.
†APS = APACHE III acute physiology score.
Understanding AUROC/AUC
AUC/AUROC

0.5 = worthless
0.6 = eh
0.7 = promising
0.8 = pretty good
0.9 = excellent
1.0 = perfection

Figure 5

The summary receiver operating characteristic (SROC) curves of CA19-9 in diagnosis of CCA.
<table>
<thead>
<tr>
<th>Disease class</th>
<th>SUPPORT Model</th>
<th>SUPPORT Model with APS†</th>
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† APS = APACHE III acute physiology score.
Association of Emergency Clinicians' Assessment of Mortality Risk With Actual 1-Month Mortality Among Older Adults Admitted to the Hospital

Kei Ouchi, MD, MPH; Tarna Strout, PhD, RN, MS; Samir Haydar, DO, MPH; Olesya Baker, PhD; Wei Wang, PhD; Rachelle Bernard, MD, MS; Rebecca Sudore, MD; Jeremiah D. Schuur, MD, MHS; Mara A. Schonberg, MD, MPH; Susan D. Block, MD; James A. Tulsky, MD

Abstract

IMPORTANCE The accuracy of mortality assessment by emergency clinicians is unknown and may affect subsequent medical decision-making.

OBJECTIVE To determine the association of the question, "Would you be surprised if your patient died in the next one month?" (known as the surprise question) asked of emergency clinicians with actual 1-month mortality among undifferentiated older adults who visited the emergency department (ED).

DESIGN, SETTING, AND PARTICIPANTS This prospective cohort study at a single academic medical center in Portland, Maine, included consecutive patients 65 years or older who received care in the ED and were subsequently admitted to the hospital from January 1, 2014, to December 31, 2015. Data analyses were conducted from January 2018 to March 2019.

EXPOSURES Treating emergency clinicians were required to answer the surprise question, "Would you be surprised if your patient died in the next one month?" in the electronic medical record when placing a bed request for all patients who were being admitted to the hospital.

MAIN OUTCOMES AND MEASURES The primary outcome was mortality at 1 month, assessed from the National Death Index. The secondary outcomes included accuracies of responses by both emergency clinicians and admitting internal medicine clinicians to the surprise question in identifying older patients with high 6-month and 12-month mortality.
No. at risk
Would be surprised | 12,899 | 12,709 | 12,490 | 12,338 | 12,216 | 12,106 | 12,016
Would not be surprised | 3,324 | 3,094 | 2,946 | 2,826 | 2,752 | 2,693 | 2,644

Ouchi, JAMA Net Open, 2019
Table 3. Diagnostic Test Characteristics of the Surprise Question Asked of Emergency Clinicians for the Actual 1-Month Mortality<sup>a</sup>

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Patient Vital Status at 1 mo From ED Visit</th>
<th>Test Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deceased</td>
<td>Alive</td>
</tr>
<tr>
<td>Clinician response to the surprise question&lt;sup&gt;b&lt;/sup&gt;</td>
<td>685&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2639&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Yes, I would be surprised</td>
<td>896&lt;sup&gt;d&lt;/sup&gt;</td>
<td>12 003&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total, No. (%)</td>
<td>1581 (9.8)</td>
<td>14 642 (90.3)</td>
</tr>
<tr>
<td>Predictive values</td>
<td>PPV: 0.43</td>
<td>NPV: 0.82</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; NPV, negative predictive value; PPV, positive predictive.

<sup>a</sup> Analysis was performed at individual patient visit level with general estimate equation model to account for repeated visits by the same patients.

<sup>b</sup> At the time of requesting a bed through the electronic medical record system for the patient to be admitted to the hospital, the treating clinician was required to answer the surprise question, “Would you be surprised if your patient died in the next one month?” Clinicians could respond, “No, I would not be surprised,” or “Yes, I would be surprised.”

<sup>c</sup> Accurate prediction.

<sup>d</sup> Inaccurate prediction.
I wish.

ARE HOSPICE ADMISSION CRITERIA EVIDENCE-BASED?
% Alive vs Months

- ▲ Chronic Obstructive Pulmonary Disease
- ■ Congestive Heart Failure
- ● End-Stage Liver Disease

Fox, JAMA, 1999
Survived to Hospital Discharge, N = 2607

Fox, JAMA, 1999
WHAT DO PATIENTS AND FAMILIES THINK?

Surprise!
Pediatric Considerations

- Prognostic discussions more likely with PC
- Prognostic discussions earlier with PC
- Context is important, many patients want some information
- Parents consider both difficult & necessary
- Very little on accuracy

Ullrich 2016; Brand 2017; Nyborn 2016
SUPPORT Study

• Doctors provided formulated prognoses

• 59% of physicians acknowledged receiving

• 15% of physicians reported discussing w/ patients/families
Discordance

- 236 patients and 38 community oncologists
- Compared 2-year survival estimates
- 161 (68% discordant)
  - More common among non-white (95% vs 65%)
  - 144 (89%) of discordant patients did not know they were discordant
  - 155 (96%) were more optimistic

Gramling et al, JAMA Onc, 2016
Figure 2. Receiver Operating Characteristic Curves for Accuracy of Prognostic Estimates of Patient Survival to Hospital Discharge

- Physicians: C statistic = 0.829; 95% CI, 0.77-0.88
- Surrogates: C statistic = 0.735; 95% CI, 0.66-0.80

White et al, JAMA 2016
Enzinger, JCO, 2015
Assessment of Self-reported Prognostic Expectations of People Undergoing Dialysis
United States Renal Data System Study of Treatment Preferences (USTATE)

Ann M. O'Hare, MD; Manjula Kurella Tamura, MD; Danielle C. Lavallee, PhD; Elizabeth K. Vig, MD; Janelle S. Taylor, PhD; Yoshio N. Hall, MD; Ronit Katz, DPhil; J. Randall Curtis, MD; Ruth A. Engelberg, PhD

**IMPORTANCE** Prognostic understanding can shape patients' treatment goals and preferences. Patients undergoing dialysis in the United States have limited life expectancy and may receive end-of-life care directed at life extension. Little is known about their prognostic expectations.

**OBJECTIVE** To understand the prognostic expectations of patients undergoing dialysis and how these relate to care planning, goals, and preferences.

**DESIGN, SETTING, AND PARTICIPANTS** Cross-sectional survey study of 996 eligible patients treated with regular dialysis at 31 nonprofit dialysis facilities in 2 metropolitan areas (Seattle, Washington, and Nashville, Tennessee) between April 2015 and October 2018. After a pilot phase, 1434 eligible patients were invited to participate (response rate, 69.5%). To provide a context for interpreting survey participants' prognostic estimates, United States Renal Data System standard analysis files were used to construct a comparison cohort of 307,602 patients undergoing in-center hemodialysis on January 1, 2006, and followed for death through July 31, 2017. Final analyses for this study were conducted between November 2018 and March 2019.
O’Hare, JAMA Int Med, 2019
Prognostic expectations of survey participants.

Survival of US patients on hemodialysis.

Survival of US patients on hemodialysis who received a kidney transplant.

Patients Dying in Each Interval, %

<5 Years | 5-10 Years | >10 Years

O’Hare, JAMA Int Med, 2019
Ha. No.

DO DOCS OWN PROGNOSIS?
Nurse Perceived Barriers

- Logistics
- Discomfort with discussion
- Perceived lack of skill or training
- Fear of conflict

Aslakson et al, JPM 2012
## Table 2. Practical Advice for Breaking Down Barriers to Communication About Serious Illness in Primary Care

<table>
<thead>
<tr>
<th>Domain</th>
<th>Practical Advice</th>
<th>Possible Solutions</th>
</tr>
</thead>
</table>
| Knowledge, skills, and attitudes| Primary care team builds knowledge, skills, and attitudes to conduct conversations about goals and values with patients with serious illnesses | Build training into medical school and primary care-track training programs  
Generate postgraduate training programs aimed at learning and practicing communication skills about serious illness  
Incentivize training time with professional requirement credits (eg, CME, CEU) and reimbursement (eg, RVU) for time spent in training |
| Prognostication                 | Primary care team identifies appropriate patients for discussions               | Develop predictive analytic algorithms that identify high-risk patients  
Combine analytic approaches with clinician judgment to generate clinician buy-in  
Creation of registries, such as those driven by patient-centered medical homes, to track patients eligible for conversation |
| Timing and initiation of conversations | Primary care team create systems to prompt high-quality discussions with patients at the right time | Use integrated systems (eg, patient preparation, reminders) to facilitate the conversation  
Train nonclinician members of the primary care team (eg, social workers, nurses) to lead and follow up on these conversations  
Create care models and policies that incentivize primary care teams to have conversations |
| Lack of coordination            | Primary care team takes responsibility for coordination with specialists and interdisciplinary services needed to follow up on conversations | Delineate explicit responsibilities for elements of conversation among clinicians  
Build care models that incentivize coordination of care between clinicians in a fragmented care delivery system  
Use policy to ensure follow-up and management of needs generated by conversations about patients’ wishes |
| Documentation                   | Documentation of all information relevant to advance care planning is placed in a single location in the medical record | Create a single documentation site in the electronic medical record for all advance care planning, information, including MOLST or POLST forms  
Create standards and audit adherence to ensure use of the single chosen site |
| Feedback and quality improvement| Primary care team respond to appropriate metrics measuring quality, timing, and proportion of documentation for high-risk patients | Build practice metrics on timing, quality, and quantity of conversations completed for selected patients  
Develop national consensus and promulgation of key metrics for timing, quality, and number of conversations for different patient populations |

Abbreviations: CEU, continuing education unit; CME, continuing medical education; MOLST, Medical Orders for Life-Sustaining Treatment; POLST, Physician Orders for Life-Sustaining Treatment; RVU, relative value unit.
I think so.

SHOULD I WRITE A PROGNOSIS IN MY NOTE?
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All patients (n=412)</th>
<th>Symptom management consults (n=181)</th>
<th>Goals of care consults (n=108)</th>
<th>Both (n=123)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation of functional status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECOG only</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>KPS only</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ECOG and KPS</td>
<td>8</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Palliative Performance Scale</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ADLs</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Documentation of EBP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palliative Prognostic Score</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Palliative Prognostic Index</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MELD score</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Walter Index&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Lee Index&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

<sup>1</sup>The Walter Index and the Lee Index were documented for the same patient.

ADLs, Activities of Daily Living; ECOG, Eastern Cooperative Oncology Group; KPS, Karnofsky Performance Scale; MELD, Model for End Stage Liver Disease.
Documentation of Discussions about Prognosis with Terminally Ill Patients

Elizabeth H. Bradley, PhD, Anna G. Hallemeier, BA, Terri R. Fried, MD, Rosemary Johnson-Hurzeler, MPH, RN, Emily J. Cherlin, MSW, Stanislav V. Kasl, PhD, Sarah M. Horwitz, PhD

PURPOSE: Previous studies have suggested the importance of communicating with patients about prognosis at the end of life, yet the prevalence, content, and consequences of such communication have not been fully investigated. The purposes of this study were to estimate the proportion of terminally ill inpatients with documented discussions about prognosis, describe the nature and correlates of such discussions, and assess the association between documented discussions about prognosis and subsequent advance care planning.

SUBJECTS AND METHODS: Inpatients (n = 232) at least 65 years old who had brain, pancreas, liver, gall bladder, or inoperable lung cancer were randomly selected from six randomly chosen community hospitals in Connecticut. The presence and content of discussions about prognosis, advanced care planning efforts, and sociodemographic and clinical factors were ascertained by comprehensive review of medical records using a standardized abstraction form.

RESULTS: Discussions about prognosis were documented in the medical records of 89 (38%) patients. Physicians and patients were both present during the discussion in 46 (52%) of these cases. Time until expected death was infrequently documented. Having a documented discussion about prognosis was associated with documented discussions of life-sustaining treatments (adjusted odds ratio [OR] = 5.8; 95% confidence interval [CI]: 2.8 to 12.0) and having a do-not-resuscitate order (adjusted OR = 2.2; 95% CI: 1.1 to 4.2).

CONCLUSIONS: Among terminally ill patients with cancer, discussions about prognosis as documented in medical charts are infrequent and limited in scope. In some cases, such documented discussions may be important catalysts for subsequent discussions of patient and family preferences regarding treatment and future care. Am J Med. 2001;111:218–223. ©2001 by Excerpta Medica, Inc.
**Table 3.** Percentage of Records Containing the 4 Key Parameters of Critical Results, Prognosis, Care Options, and Care Plan.

<table>
<thead>
<tr>
<th>Documented Item</th>
<th>Primary Team</th>
<th>Palliative Care</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical results</td>
<td>86.80%</td>
<td>81.57%</td>
<td>.329</td>
</tr>
<tr>
<td>Prognosis</td>
<td>31.57%</td>
<td>83.33%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Care options</td>
<td>50.00%</td>
<td>81.58%</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Care plan</td>
<td>46.49%</td>
<td>81.58%</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
So meta...

WHAT IS THE FUTURE OF PROGNOSTICATION?
Improving Palliative Care with Deep Learning

Anand Avati*, Kenneth Jung†, Stephanie Harman‡, Lance Downing†, Andrew Ng* and Nigam H. Shah†
*Dept of Computer Science, Stanford University
Email: {avati,ang}@cs.stanford.edu
†Center for Biomedical Informatics Research, Stanford University
Email: {kjung,ldowning,nigam}@stanford.edu
‡Dept of Medicine, Stanford University School of Medicine
Email: {smharman}@stanford.edu

Abstract— Improving the quality of end-of-life care for hospitalized patients is a priority for healthcare organizations. Studies have shown that physicians tend to over-estimate prognoses, which in combination with treatment inertia results in a mismatch between patients wishes and actual care at the end of life. We describe a method to address this problem using Deep Learning and Electronic Health Record (EHR) data, which is currently being piloted, with Institutional Review Board approval, at an academic medical center. The EHR data of admitted patients are automatically evaluated by an algorithm, which brings patients who are likely to benefit from palliative care services to the attention of the Palliative Care team. The algorithm is a Deep Neural Network trained on the EHR data from previous years, to predict all-cause 3-12 month mortality of patients as a proxy for patients that could benefit from palliative care. Our predictions enable the Palliative Care team to take a proactive approach in reaching out to such patients, rather than relying on referrals from treating physicians, or conduct time consuming chart reviews of all patients. We also present a novel interpretation technique which we use to provide explanations of the model’s predictions.

The criteria for deciding which patients benefit from palliative care can be hard to state explicitly. Our approach uses deep learning to screen patients admitted to the hospital to identify those who are most likely to have palliative care needs. The algorithm addresses a proxy problem - to predict the mortality of a given patient within the next 12 months - and use that prediction for making recommendations for palliative care referral. This frees the palliative care team from manual chart review of every admission and helps counter the potential biases of treating physicians by providing an objective recommendation based on the patient’s EHR. Currently existing tools to identify such patients have limitations, and they are discussed in the next section.

II. RELATED WORK
Fig. 5. Receiver Operating Characteristic (ROC) of the model performance on the test set.
What Can I Start Doing Next Week?

- Think more deliberately
- Talk with your colleagues
- Start documenting prognosis estimates
- Change your template
- Curate trusted tools
Curate Trusted Tools

- PredictSurvival.com
- #PrognosisScience on social media
- HemOnc.org (cancer)
- GeriPal ePrognosis (Site and App)
- Pallimed prognosis links
- Pubmed search and alerts
This calculator provides survival estimates for patients with advanced cancer based on multiple validated prognostic indices, including the Palliative Prognostic Score (PaP), Palliative Prognostic Score with Delirium (D-PaP), Palliative Prognostic Index (PPI), Performance Status-Based Palliative Prognostic Index (PS-PPI), and several Performance Status/Scales (KPS, PPS, and ECOG).

Intended only for patients with a survival of six months or less. Data is most valid in the one to three month range.

Enter as many variables as possible and this prognostic calculator will provide survival data based on published studies.

**Notes:**

1. In the PPI delirium is counted as absent if it is due to a single medication. The D-PaP study makes no such allowance for medication induced delirium, hence there are three options.
2. This is the clinical symptom of anorexia (ie, lack of appetite), not to be confused with cachexia or weight loss.

**Disclaimer:** Please keep in mind the information given on this website represents survival estimates only – it is important to use clinical judgement to interpret the results accordingly. Do not use this information without the input of a healthcare provider.
### Estimating Survival in Patients with Advanced Cancer using Multiple Prognostic Models

This calculator provides survival estimates for patients with advanced cancer based on multiple validated prognostic indices, including the Palliative Prognostic Score (PaP), Palliative Prognostic Score with Delirium (D-PaP), Palliative Prognostic Index (PPI), Performance Status-Based Palliative Prognostic Index (PS-PPI), and several Performance Status/Scales (KPS, PPS, and ECOG).

**Intended only for patients with a survival of six months or less. Data is most valid in the one to three month range.**

Enter as many variables as possible and this prognostic calculator will provide survival data based on published studies.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Enter as Much as You Can</th>
<th>Required For</th>
</tr>
</thead>
<tbody>
<tr>
<td>How Long do You Think the Patient Will Live?</td>
<td>30 days</td>
<td>PaP, D-PaP</td>
</tr>
<tr>
<td>Palliative Performance Scale (PPS) <a href="#">Help?</a></td>
<td>30%</td>
<td>PPS, PPI</td>
</tr>
<tr>
<td>Karnofsky Performance Status (KPS) <a href="#">Help?</a></td>
<td>30%</td>
<td>KPS, PaP, D-PaP</td>
</tr>
<tr>
<td>ECOG Performance Status <a href="#">Help?</a></td>
<td>4</td>
<td>ECOG, PS-PPI</td>
</tr>
<tr>
<td>Edema</td>
<td></td>
<td>PPI, PS-PPI</td>
</tr>
<tr>
<td>Oral Intake</td>
<td>Reduced but more than mor</td>
<td>PPI, PS-PPI</td>
</tr>
<tr>
<td>Dyspnea at Rest</td>
<td>No</td>
<td>PPI, PS-PPI, PaP, D-PaP</td>
</tr>
<tr>
<td>Delirium(^1)</td>
<td>No</td>
<td>PaP, D-PaP</td>
</tr>
<tr>
<td>Anorexia(^2)</td>
<td>Yes</td>
<td>PaP, D-PaP</td>
</tr>
<tr>
<td>Total WBC (cell/cc)</td>
<td>Less than 8,500</td>
<td>PaP, D-PaP</td>
</tr>
<tr>
<td>Lymphocyte Percentage</td>
<td>Greater than 20.0%</td>
<td>PaP, D-PaP</td>
</tr>
</tbody>
</table>

[Help?](#) - Additional information or help available for each variable.
## Summary Results, Scroll Down for More Detailed Results by Location and Publication

Keep in mind these outputs represent survival estimates only – use clinical judgement to interpret the results accordingly.

<table>
<thead>
<tr>
<th>Model</th>
<th>Score</th>
<th>Median Survival</th>
<th>Communicating with Patients and Families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palliative Prognostic Index (PPI):</td>
<td>5.0/15</td>
<td>12 to 25 days</td>
<td>Predicts weeks of survival</td>
</tr>
<tr>
<td>Performance Status-Based Palliative Prognostic Index (PS-PPI):</td>
<td>6.5/15</td>
<td>15 to 20 days</td>
<td>Predicts weeks of survival</td>
</tr>
<tr>
<td>Palliative Prognostic Score (PaP):</td>
<td>7.0/17.5</td>
<td>25 to 35 days</td>
<td>Predicts weeks of survival</td>
</tr>
<tr>
<td>Palliative Prognostic Score with Delirium (D-PaP):</td>
<td>7.0/19.5</td>
<td>65 to 85 days</td>
<td>Predicts months of survival</td>
</tr>
<tr>
<td>Palliative Performance Scale (PPS):</td>
<td>30%</td>
<td>13 to 22 days</td>
<td>Predicts weeks of survival</td>
</tr>
<tr>
<td>Karnofsky Performance Status (KPS):</td>
<td>30%</td>
<td>29 to 49.8 days</td>
<td>Predicts weeks of survival</td>
</tr>
<tr>
<td>ECOG Performance Status:</td>
<td>4</td>
<td>25 5 days</td>
<td>Predicts weeks of survival</td>
</tr>
<tr>
<td>Your Estimate:</td>
<td>---</td>
<td>30 days</td>
<td>Predicts weeks of survival</td>
</tr>
</tbody>
</table>

The inputs you gave were: ECOG: 4, KPS: 30, Edema: absent, Lymphocytes: Greater than 20.0%, PPS: 30, WBC: Less than 8,500, Oral Intake: reduced, Delirium: none, Anorexia: present, Dyspnea: absent.

**Summary Result Notes:**

- Median survival ranges are taken from the original validation studies for the models as well as select large validation studies (except for ECOG and PS-PPI, which each use one study currently).

- The 'Communicating with Patients and Families' column gives summary prognostic information based on the following definitions: 'days' of expected survival is 10 days or less, 'weeks' is 11 to 60 days, and months includes 61 days and greater.

- Prognostic estimates can differ significantly for the same patient input depending on the clinical scenario in which they are being evaluated. In the detailed results below, papers have been divided by patient location or scenario if available, which may give more accurate information.
**Predicting Impending Death (less than 72 hours) in Advanced Cancer Patients**

This data has only been validated in advanced cancer patients admitted to Acute Palliative Care Units.

These two models may help predict the probability of death over 72 hours. The first model requires a pretest probability of death within 72 hours. Based on the presence of clinical signs associated with impending death, it will modify that probability using likelihood ratios. The second model was derived from the same data, does not require a pretest probability but does require a Palliative Prognostic Scale, see the reference for details on how it was derived.

If you are unsure about entering a pretest probability, it may be helpful that the average advanced cancer patient admitted to an Acute Palliative Care Unit in the cited studies had a pretest probability of 38% of dying within 72 hours.

<table>
<thead>
<tr>
<th>Estimated Probability of Death in the Next 72 Hours:</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palliative Performance Scale (PPS):</td>
<td></td>
</tr>
<tr>
<td>[Reference to look up the PPS if needed]</td>
<td></td>
</tr>
</tbody>
</table>

For each of the following signs, check the box if present and leave blank if not. **If unfamiliar scroll below for some explanations.**

<table>
<thead>
<tr>
<th>Sign</th>
<th>Present?</th>
<th>Present?</th>
<th>Present?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drooping of Nasolabial Fold:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death Rattle:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheyne-Stokes Breathing:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased Response to Visual Stimuli:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vocal Cord Grunting:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper GI Bleed:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulseless Radial Artery (either side):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Reactive Pupils:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inability to Close Eyelids:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral Cyanosis:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine output &lt; 100 cc in 12 hrs:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respirations with Mandibular Movement:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased Response to Verbal Stimuli:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperextension of the Neck:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Probability of Death in the Next 72 hrs:**

- RPA Model:
- Likelihood Ratio Model:
### PPI

<table>
<thead>
<tr>
<th>Source</th>
<th>Location</th>
<th>Probability Survival</th>
<th>Median Survival:</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morita, 1999</td>
<td>palliative care unit</td>
<td>42 days or less: Sens 79%, Spec 77%, PPV 83%, NPV 71%</td>
<td>23 days (95% CI 20-26 days)</td>
<td>All cancer, admitted to inpatient hospice, 350 pts in training cohort, 95 in validation cohort.</td>
</tr>
<tr>
<td>Baba, 2015</td>
<td>inpatient with palliative care consult</td>
<td>Not reported</td>
<td>~18 days</td>
<td>All metastatic cancer, no chemotherapy, 554 pts, median survival approximated from figures</td>
</tr>
<tr>
<td>Baba, 2015</td>
<td>palliative care unit</td>
<td>Not reported</td>
<td>~12 days</td>
<td>All metastatic cancer, no chemotherapy, 820 pts, median survival approximated from figures</td>
</tr>
<tr>
<td>Baba, 2015</td>
<td>home palliative care</td>
<td>Not reported</td>
<td>~25 days</td>
<td>All metastatic cancer, no chemotherapy, 472 pts, median survival approximated from figures</td>
</tr>
</tbody>
</table>

### PS-PPI

<table>
<thead>
<tr>
<th>Source</th>
<th>Location</th>
<th>Probability Survival</th>
<th>Median Survival:</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yamada, 2016</td>
<td>inpatient with palliative care consult</td>
<td>At 21 days: Sens 79.4%, Spec 68.2%, PPV 50.4%, NPV 71.1%</td>
<td>~15 days</td>
<td>All advanced cancer, ~40% on chemotherapy, 906 pts, median survival approximated from figures</td>
</tr>
<tr>
<td>Yamada, 2016</td>
<td>palliative care unit</td>
<td>At 21 days: Sens 85.0%, Spec 51.8%, PPV 58.3%, NPV 81.4%</td>
<td>~15 days</td>
<td>All advanced cancer, 8.5% on chemotherapy, 892 pts, median survival approximated from figures</td>
</tr>
<tr>
<td>Yamada, 2016</td>
<td>home palliative care</td>
<td>At 21 days: Sens 74.0%, Spec 63.6%, PPV 47.5%, NPV 84.6%</td>
<td>~20 days</td>
<td>All advanced cancer, 14% on chemotherapy, 548 pts, median survival approximated from figures</td>
</tr>
</tbody>
</table>

### PaP

<table>
<thead>
<tr>
<th>Source</th>
<th>Location</th>
<th>Probability Survival</th>
<th>Median Survival:</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maltoni, 1999</td>
<td>mix of outpatient and inpatient hospice</td>
<td>30 days or more: 51.6%</td>
<td>32 days (95% CI 28-39 days)</td>
<td>Advanced solid cancers only, enrolled in hospice, 451 pts in validation cohort</td>
</tr>
<tr>
<td>Baba, 2015</td>
<td>inpatient with palliative care consult</td>
<td>Not reported</td>
<td>~35 days</td>
<td>All metastatic cancer, no chemotherapy, 554 pts, median survival approximated from figures</td>
</tr>
<tr>
<td>Baba, 2015</td>
<td>palliative care unit</td>
<td>Not reported</td>
<td>~25 days</td>
<td>All metastatic cancer, no chemotherapy, 820 pts, median survival approximated from figures</td>
</tr>
<tr>
<td>Baba, 2015</td>
<td>home palliative care</td>
<td>Not reported</td>
<td>~28 days</td>
<td>All metastatic cancer, no chemotherapy, 472 pts, median survival approximated from figures</td>
</tr>
</tbody>
</table>

**Score:**
- **PPI: 5.0/15**
- **PS-PPI: 6.5/15**
- **PaP: 7.0/17.5**
Announcement: please learn about our trainee travel award here; we hope you will consider applying!

Use of this site is subject to you reading and agreeing with the terms set forth in the disclaimer. If you are a new visitor, we suggest you read the tutorial.

HemOnc.org - A Free Hematology/Oncology Reference

Regimens: 3,248
Regimen variants: 4,920

Solid Tumors

Malignant Hematology

Cross-Disciplinary

Classical Hematology

Mobile Version

Editorial Board

Desktop Version

Disease Index

Intervention index

Regimen index

General reference

If this is your first time visiting, please go to the tutorial page or just start exploring!

Links to all main disease pages

Solid Tumors

Breast Oncology

Breast cancer

Breast cancer, ER/PR-positive

Breast cancer, HER2-positive

Breast cancer, triple negative (TNBC)

Breast cancer, BRCA-mutated

Breast cancer, PIK3CA-mutated

Dermatologic Oncology

Cutaneous BCC

Cutaneous SCC

Melanoma

Melanoma, BRAF-mutated
Gastric cancer

Note: there is significant overlap between regimens for gastric cancer and esophageal cancer, if you can't find the regimen you're looking for here, please try the esophageal cancer page. If you still can't find it, it is possible that we've moved it to the historical regimens page.

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1 Guidelines
   1.1 CAP/ASCP/ASCO
   1.2 ESMO
   1.3 ESMO/ESSO/ESTRO
   1.4 NCCN
2 Neoadjuvant chemotherapy
   2.1 Cisplatin & Fluorouracil
   2.2 ECF
   2.3 ECX
   2.4 EOF
   2.5 EOX
   2.6 ELOT

Page editor

Ivy Abraham, MD
University of Illinois at Chicago
Chicago, IL

Section editor

Neeta K. Venepalli, MD, MBA
University of Illinois at Chicago
Chicago, IL

51 regimens on this page
75 variants on this page
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  4.1 Capecitabine monotherapy
  4.2 CapeOx
  4.3 Carboplatin & Paclitaxel
  4.4 Cisplatin & Docetaxel
  4.5 Cisplatin & Fluorouracil
  4.6 Cisplatin & S-1
  4.7 CLF
  4.8 CX
  4.9 CX & Trastuzumab
  4.10 DCF
  4.11 mDCF
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  4.18 Irinotecan monotherapy
  4.19 OLF
  4.20 Paclitaxel & S-1
  4.21 S-1 monotherapy
  4.22 UFTM
5 Maintenance after first-line therapy
  5.1 Capecitabine monotherapy
6 Metastatic or locally advanced disease, subsequent lines of therapy
  6.1 Best supportive care
  6.2 Docetaxel monotherapy
  6.3 Fluorouracil, Folinic acid, Mitomycin
  6.4 Irinotecan monotherapy
  6.5 Irinotecan liposomal monotherapy
  6.6 Nivolumab monotherapy
  6.7 Paclitaxel monotherapy
  6.8 nab-Paclitaxel monotherapy
  6.9 Paclitaxel & Ramucirumab
  6.10 Pembrolizumab monotherapy
  6.11 Placebo
  6.12 Ramucirumab monotherapy
  6.13 Regorafenib monotherapy
  6.14 Trifluridine and tipiracil monotherapy
# Nivolumab monotherapy

## Regimen

<table>
<thead>
<tr>
<th>Study</th>
<th>Evidence</th>
<th>Comparator</th>
<th>Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kang et al. 2017 (ATTRACTION-2)</td>
<td>Phase III (E)</td>
<td>Placebo</td>
<td>Superior OS</td>
</tr>
<tr>
<td>Janjigian et al. 2018 (CheckMate-032)</td>
<td>Phase II</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*ATTRACTION-2* included patients with GE junction malignancy (82.6% gastric, 8.5% GE junction) and 12.3% of patients had a PD-L1 CPS score of at least 1.

## Immunotherapy

- **Nivolumab (Opdivo)** 3 mg/kg IV once on day 1

## 14-day cycles

## References


Nivolumab in patients with advanced gastric or gastro-oesophageal junction cancer refractory to, or intolerant of, at least two previous chemotherapy regimens (ONO-4538-12, ATTRACTION-2): a randomised, double-blind, placebo-controlled, phase 3 trial

Prof Yoon-Koo Kang, MD » Narikazu Boku, MD » Prof Taroh Satoh, MD » Prof Min-Hee Ryu, MD » Prof Yee Chao, MD » Ken Kato, MD » et al. Show all authors

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Summary

Background

Patients with advanced gastric or gastro-oesophageal junction cancer refractory to, or intolerant of, two or more previous regimens of chemotherapy have a poor prognosis, and current guidelines do not recommend any specific treatments for these patients. We assessed the efficacy and safety of nivolumab, a fully human IgG4 monoclonal antibody inhibitor of programmed death-1 (PD-1), in patients with advanced gastric or gastro-oesophageal junction
Findings

Between Nov 4, 2014, and Feb 26, 2016, we randomly assigned 493 patients to receive nivolumab (n=330) or placebo (n=163). At the data cutoff (Aug 13, 2016), median follow-up in surviving patients was 8·87 months (IQR 6·57–12·37) in the nivolumab group and 8·59 months (5·65–11·37) in the placebo group. Median overall survival was 5·26 months (95% CI 4·60–6·37) in the nivolumab group and 4·14 months (3·42–4·86) in the placebo group (hazard ratio 0·63, 95% CI 0·51–0·78; p<0·0001). 12-month overall survival rates were 26·2% (95% CI 20·7–32·0) with nivolumab and 10·9% (6·2–17·0) with placebo. Grade 3 or 4 treatment-related adverse events occurred in 34 (10%) of 330 patients who received nivolumab and seven (4%) of 161 patients who received placebo; treatment-related adverse events led to death in five (2%) of 330 patients in the nivolumab group and two (1%) of 161 patients in the placebo group. No new safety signals were observed.
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<tr>
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<th>Nivolumab</th>
<th>Placebo</th>
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<tbody>
<tr>
<td><strong>Median Overall Survival</strong></td>
<td>5.26 mos</td>
<td>4.24 mos</td>
</tr>
<tr>
<td><strong>12-month Overall Survival</strong></td>
<td>26.2%</td>
<td>10.9%</td>
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*Never bother with progression-free survival*
Curate Trusted Tools

- PredictSurvival.com
- #PrognosisScience on social media
- HemOnc.org (cancer)
- GeriPal ePrognosis (Site and App)
- Pallimed prognosis links
- Pubmed search and alerts
Recommended Reading

- Death Foretold: Prophecy and Prognosis in Medical Care by Nicholas A. Christakis
- The Signal and the Noise: Why So Many Predictions Fail—but Some Don’t by Nate Silver
- Superforecasting: The Art and Science of Prediction by Philip E. Tetlock and Dan Gardner
Summary

• Seek out prognosis research
• Learn from other fields
• Document, document, document
• Curate trusted tools
• Palliative care should own prognosis
• Learn from our success and failure
References


References


References


