The Untapped Potential of Prognosis Science:

Balancing Certainty, Experience and Research

Christian T Sinclair, MD, FAAHPM
University of Kansas Medical Center
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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
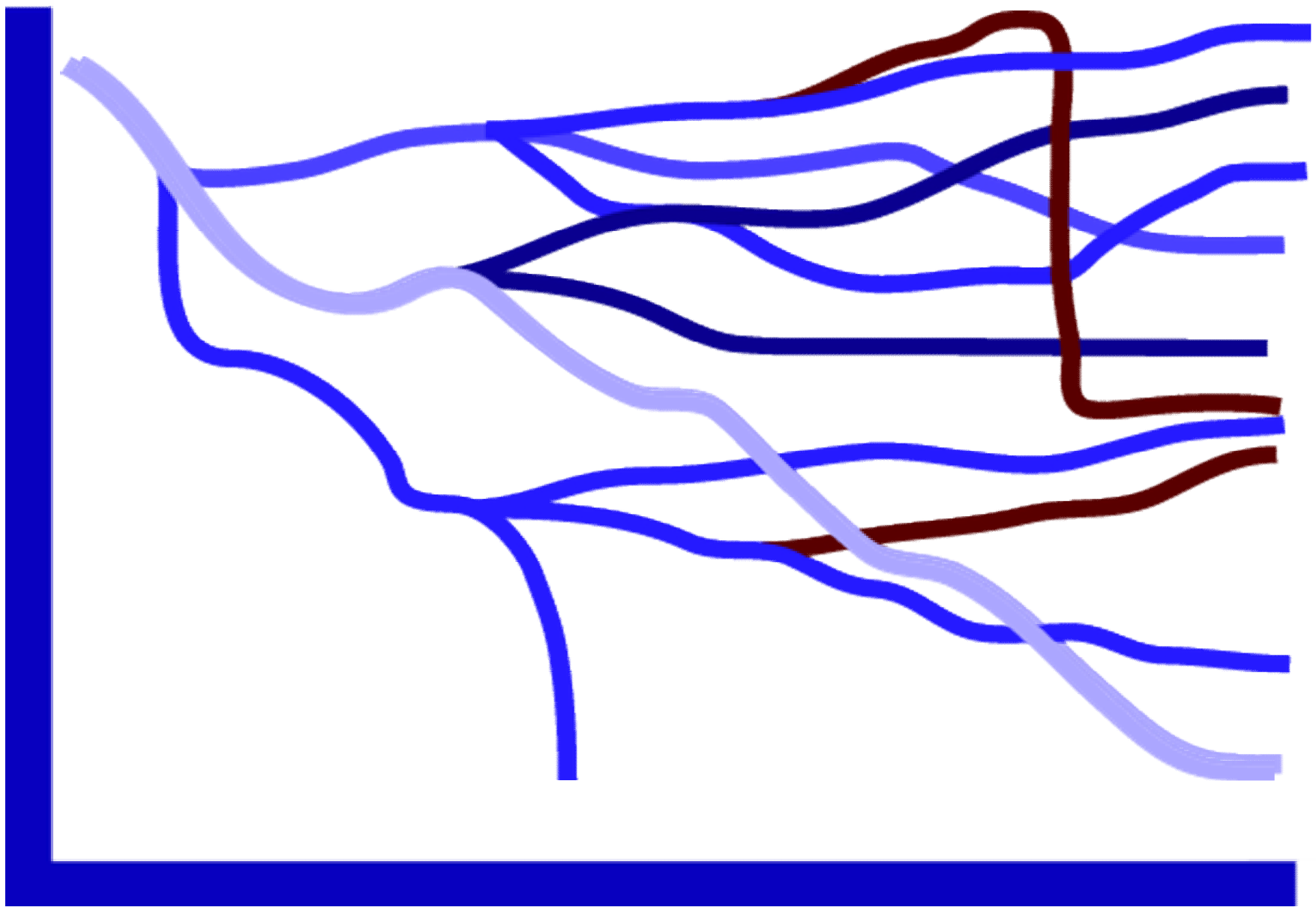
Two Parts to Prognostication

- 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*

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

*$F = 2.21$ ($p = 0.014$); $df_1 = 11$, $df_2 = 346$; adj. $R^2 = 0.036$

EOL = end of life, CI = confidence interval.

Note: The ß 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.

Heyland et al, Open Med 2009

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

MESH Subject Headings
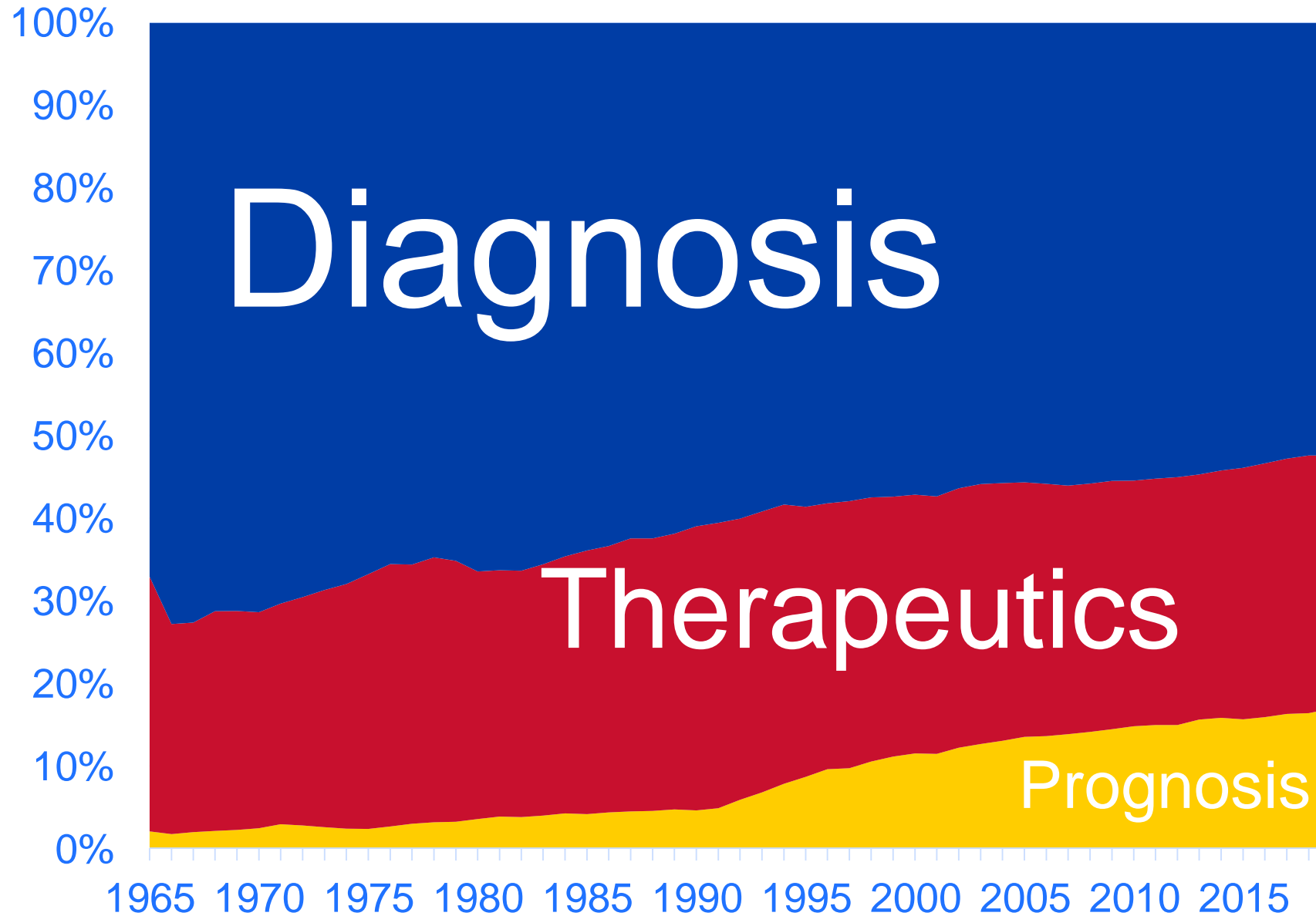
Unified Terminology?

- 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 2. Demographic and Attitudinal Factors Associated With Internists' Perception That Prognostication Is Stressful

Variable	Prognostication Is Stressful (n = 381)	Prognostication Is Not Stressful (n = 250)	P*
Age, mean, y	45.3	46.2	.28
Sex, % male	79.5	82.0	.44
Specialty, % generalists	48.0	47.6	.92
Board certification, % certified	79.8	79.2	.86
Time spent in patient care, %	90.1	86.5	.04
Prognostic queries, mean No. of patients	23.8	21.1	.44
Life support withdrawal, mean No. of patients	16.1	18.3	.55
Difficulty, % finding prognostication difficult	68.0	44.1	<.001
Patient expectations, % thinking that their patients expect too much certainty	85.2	72.1	<.001
Training, % with inadequate training in prognostication	61.4	49.8	.004
Patient confidence, % feeling that patients would lose confidence after a prognostic error	55.6	42.3	.001

Christakis, Arch Int Med, 1998

Table 3. Internists' Perceptions About How Prognostic Errors Would Be Regarded by Patients and Colleagues

Statement	% Agreeing
If I were to make an error in *diagnosis*, my *patients* might lose confidence in me	88.0
If I were to make an error in *prognosis*, my *patients* might lose confidence in me	50.2
If I were to make an error in *diagnosis*, my *colleagues* might lose confidence in me	81.3
If I were to make an error in *prognosis*, my *colleagues* might lose confidence in me	28.7
If a physician colleague made an error in prognostication, I would probably lose some confidence in the colleague	17.2

Who Can We Learn From?

- Weather forecasting
- Underwriting
- Engineering
- Sports statistics
- Online advertising
- Fraud detection
- Predictive analytics
- Artificial intelligence/ machine learning

Reply hazy...

ARE PHYSICIANS REALLY TERRIBLE AT PROGNOSIS?

RESEARCH ARTICLE

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

Nicola White[1]*, Fiona Reid[2‡], Adam Harris[3‡], Priscilla Harries[4‡], Patrick Stone[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
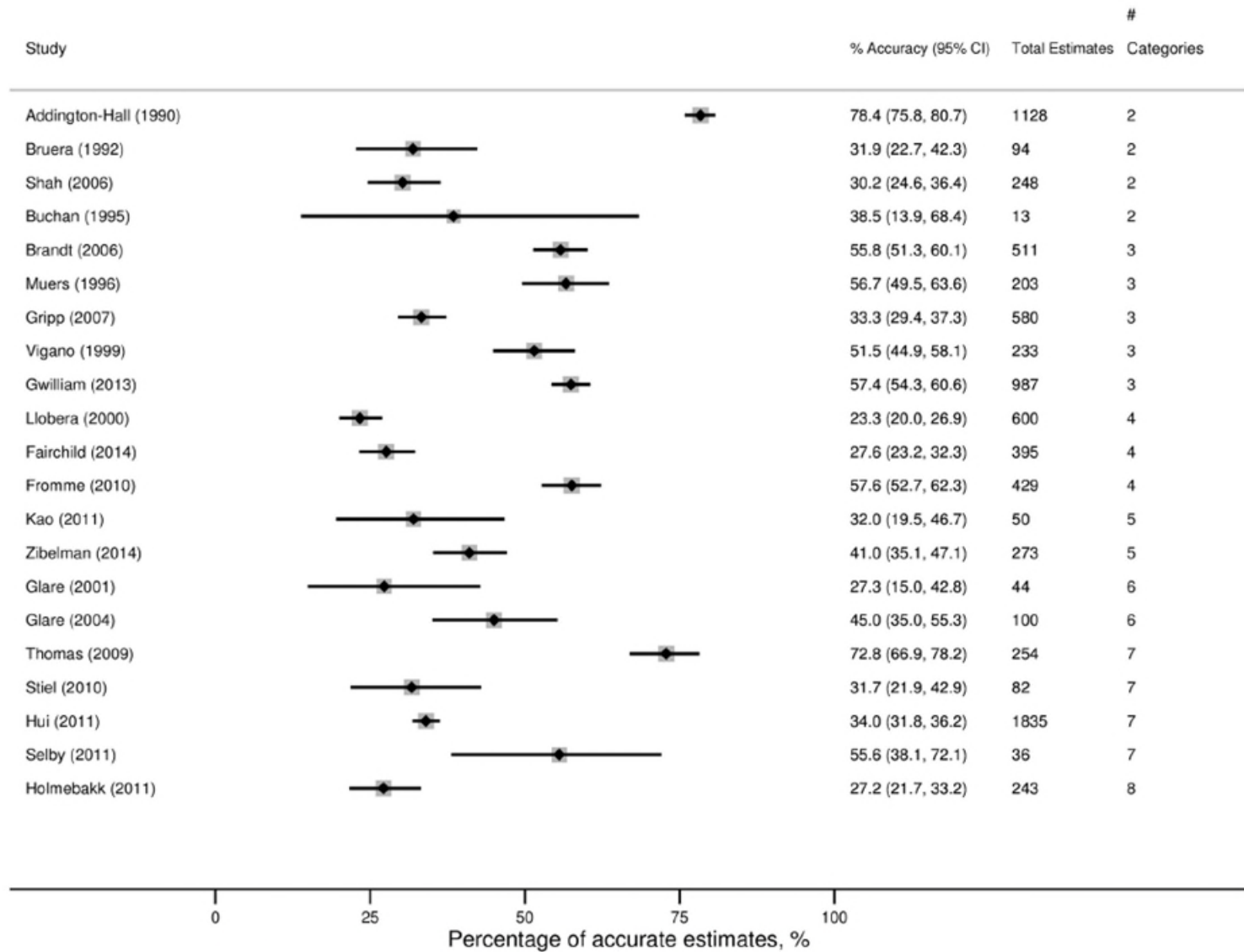
● These authors contributed equally to this work.
‡ These authors also contributed equally to this work.
* n.g.white@ucl.ac.uk

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 Gwilliam 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
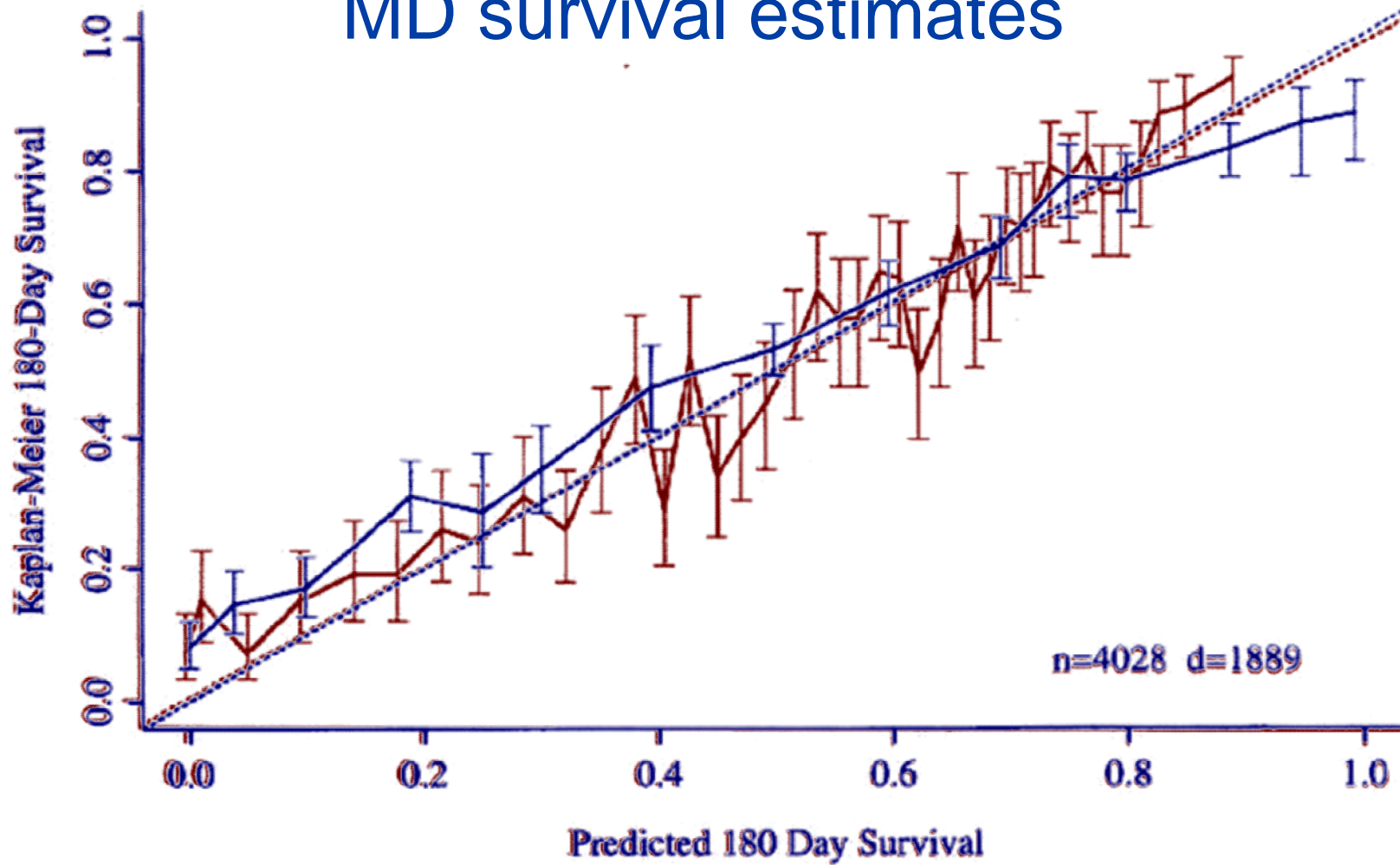
White, PLOS One, 2016
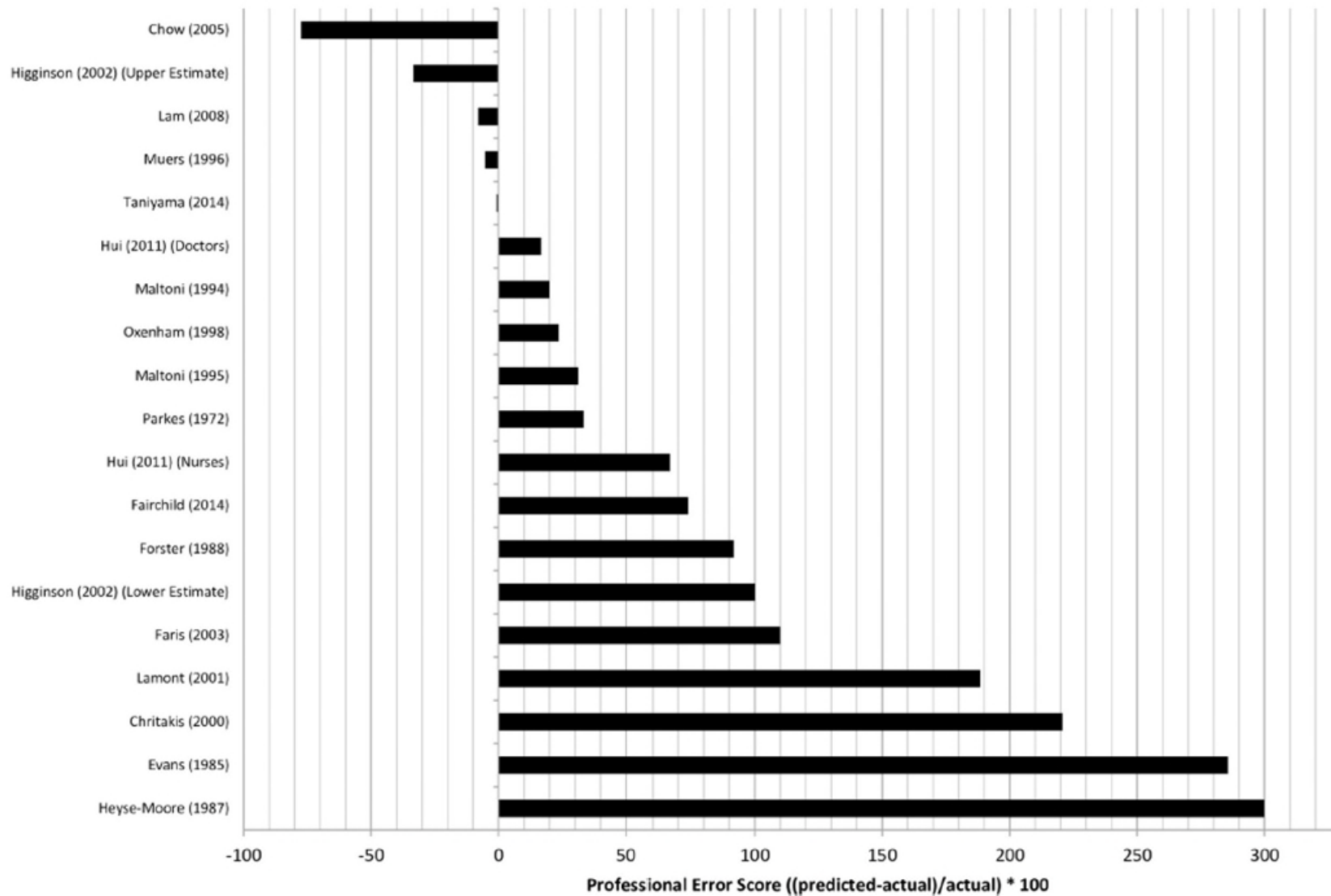
Fig 3. Professional Error Score (PES) of clinicians' estimates of survival those studies where clinicians were asked to provide a continuous temporal estimate of survival. The black bar in this figure indicates the overall accuracy of the clinicians' estimates (0 indicates perfect accuracy, positive values indicate over-estimates and negative values indicate under-estimates).

doi:10.1371/journal.pone.0161407.g003

White, PLOS One, 2016

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

n=4028 d=1889

Kaplan-Meier 180-Day Survival (y-axis)

Predicted 180 Day Survival (x-axis)

Knaus, Annals IM, 1995

Table 2. Comparison of the Various Models for Prediction of 180-Day Survival*

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

* 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.

Knaus, Annals IM, 1995

Understanding AUROC/AUC

SROC curve

Symmetric SROC
AUC=0.8300
SE(AUC)=0.0181
Q*=0.7626
SE(Q*)=0.0165

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.

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† APS = APACHE III acute physiology score.

Knaus, Annals IM, 1995

Association of Emergency Clinicians' Assessment of Mortality Risk With Actual 1-Month Mortality Among Older Adults Admitted to the Hospital

Kei Ouchi, MD, MPH; Tania Strout, PhD, RN, MS; Samir Haydar, DO, MPH; Olesya Baker, PhD; Wei Wang, PhD; Rachelle Bernacki, 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.

Key Points

Question What is the association of emergency clinicians' assessment of mortality risk with the actual 1-month mortality among older adults who are admitted to the hospital from the emergency department?

Findings In this prospective cohort study including 10 737 older adults who visited the emergency department, emergency clinicians' response of no to the question, "Would you be surprised if your patient died in the next one month?" was associated with 1-month mortality after controlling for confounders. However, the diagnostic test characteristics of the surprise question were poor.

Meaning Asking emergency clinicians the surprise question may be a valuable tool to identify older patients in the ED with high risk of 1-month mortality.
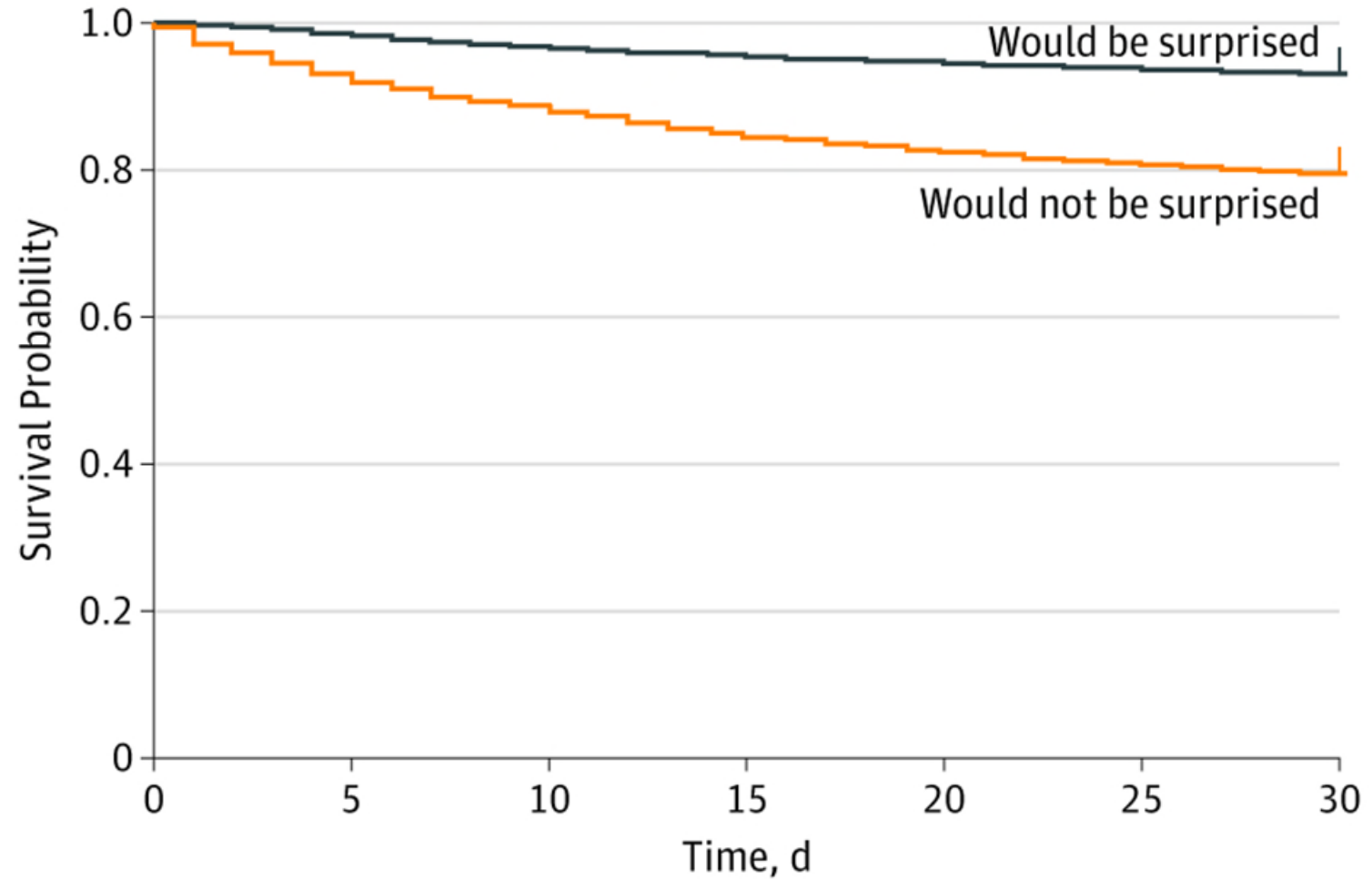
No. at risk						
Would be surprised	12 899	12 709	12 490	12 338	12 216	12 106	12 016
Would not be surprised	3324	3094	2946	2826	2752	2693	2644

Ouchi, JAMA Net Open, 2019

Table 3. Diagnostic Test Characteristics of the Surprise Question Asked of Emergency Clinicians for the Actual 1-Month Mortality[a]

Characteristic	Patient Vital Status at 1 mo From ED Visit			
	Deceased	Alive	Total, No. (%)	Test Characteristic
Clinician response to the surprise question[b]				
No, I would not be surprised	685[c]	2639[d]	3324 (20.5)	Sensitivity: 0.20
Yes, I would be surprised	896[d]	12 003[c]	12 899 (79.5)	Specificity: 0.93
Total, No. (%)	1581 (9.8)	14 642 (90.3)	16 223 (100)	
Predictive values	PPV: 0.43	NPV: 0.82		Accuracy: 0.78

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

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

[b] 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."

[c] Accurate prediction.

[d] Inaccurate prediction.

Ouchi, JAMA Net Open, 2019

I wish.

ARE HOSPICE ADMISSION CRITERIA EVIDENCE-BASED?

Narrow Inclusion Criteria, n = 19

Intermediate Inclusion Criteria, n = 300

Broad Inclusion Criteria, n = 923

109   184   97

456   167

1302   382
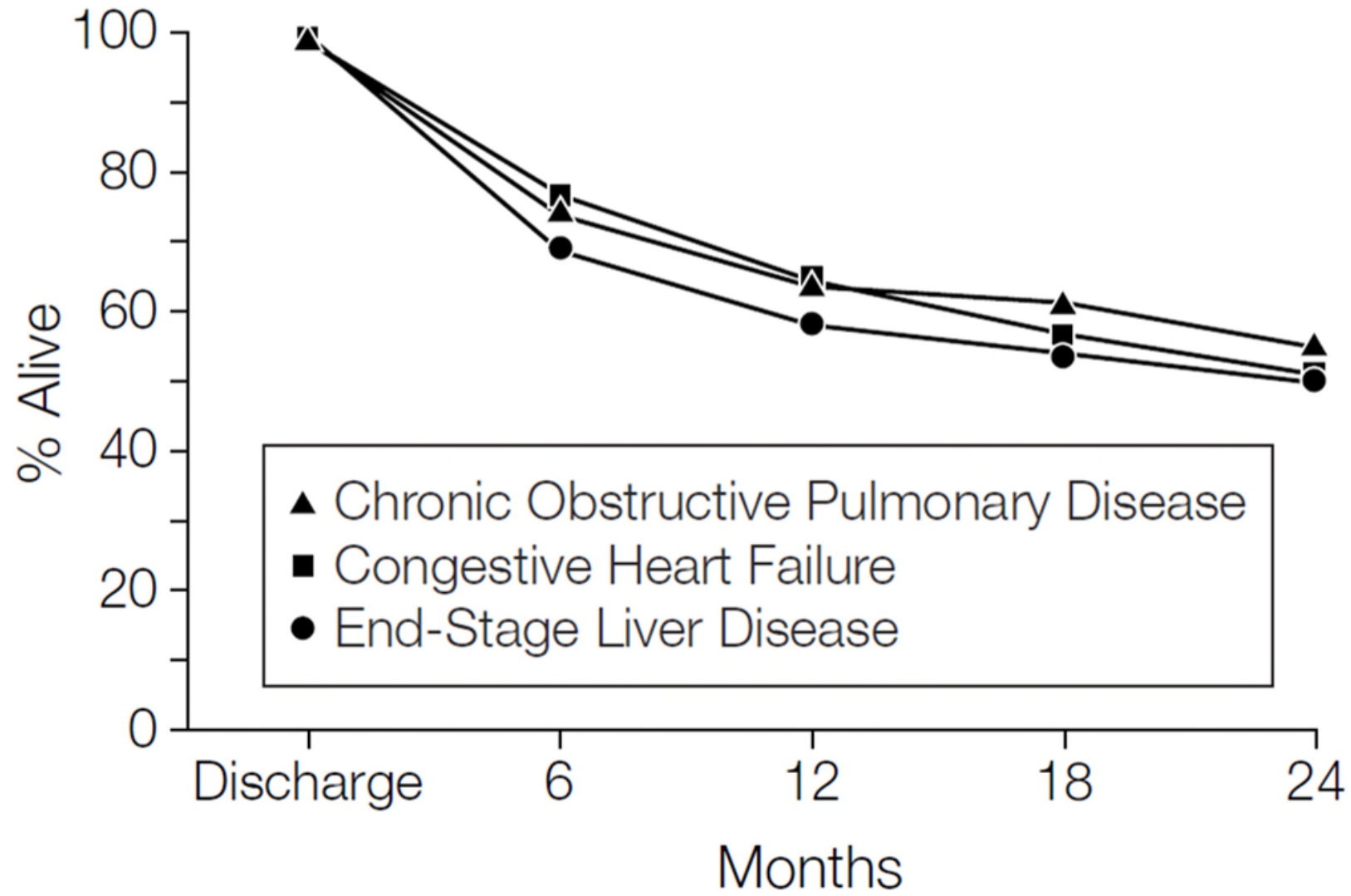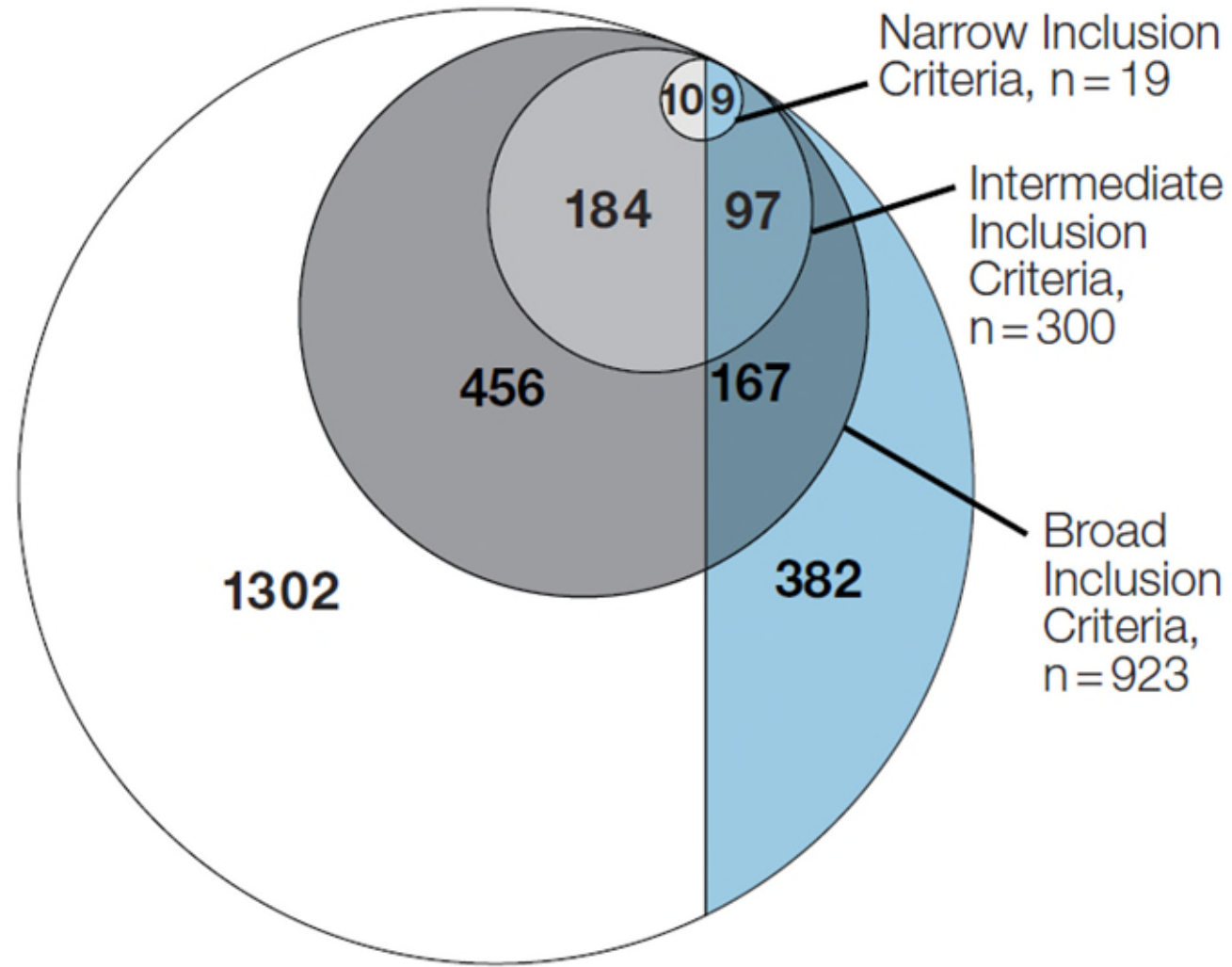
Survived to Hospital Discharge, N = 2607

Fox, JAMA, 1999

Surprise!

WHAT DO PATIENTS AND FAMILIES THINK?

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

White et al, JAMA

Legend:
- Patient self-estimates of life expectancy
- Survival from baseline (available for 252 of 299 patients)
- Life expectancy estimates conveyed by physicians, as reported by patients

Patients reporting previous prognostic disclosure (n = 69)

(n = 63)

Patients denying previous prognostic disclosure (n = 230)

(n = 189)

Years

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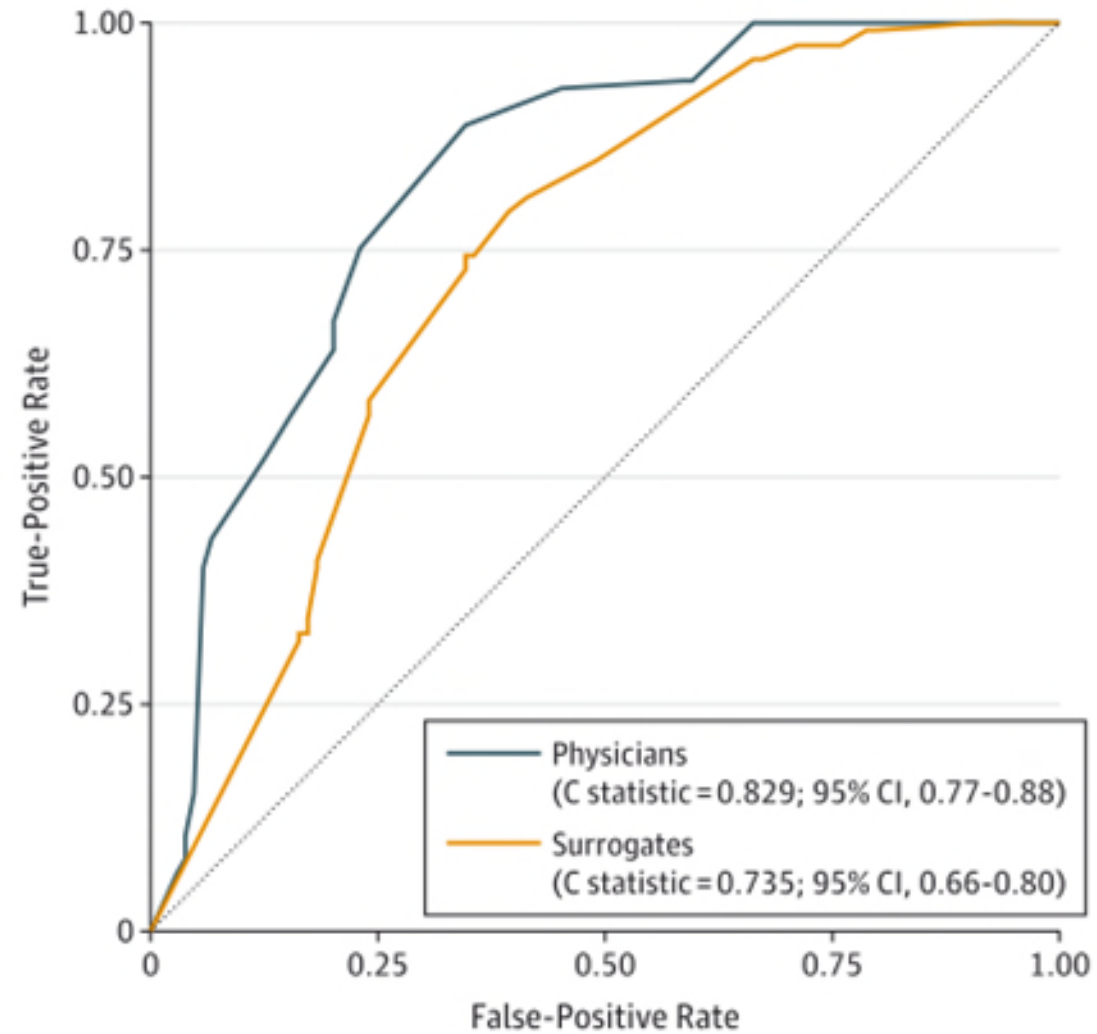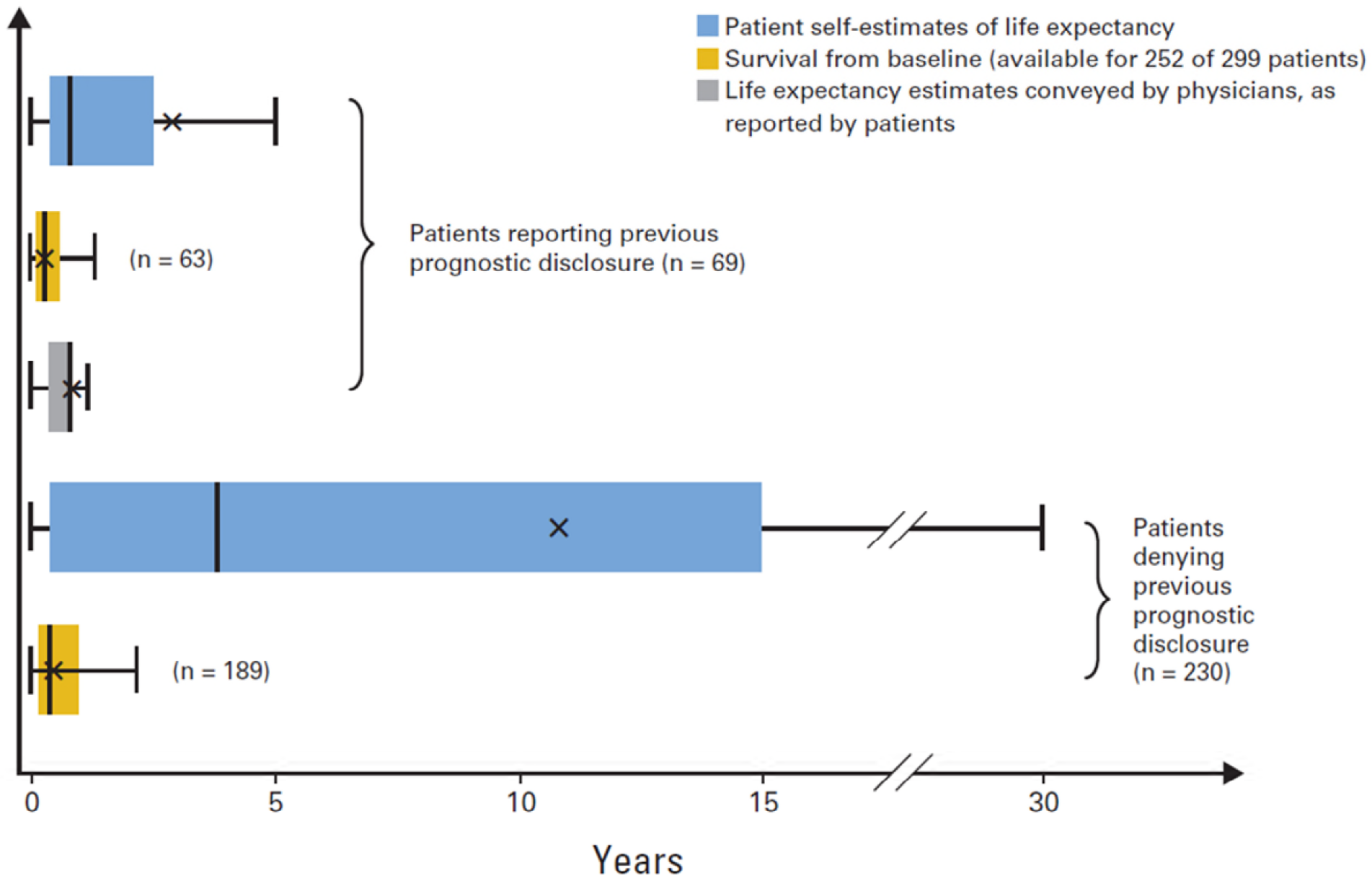
Assessment of Self-reported Prognostic Expectations of People Undergoing Dialysis
United States Renal Data System Study of Treatment Preferences (USTATE)

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
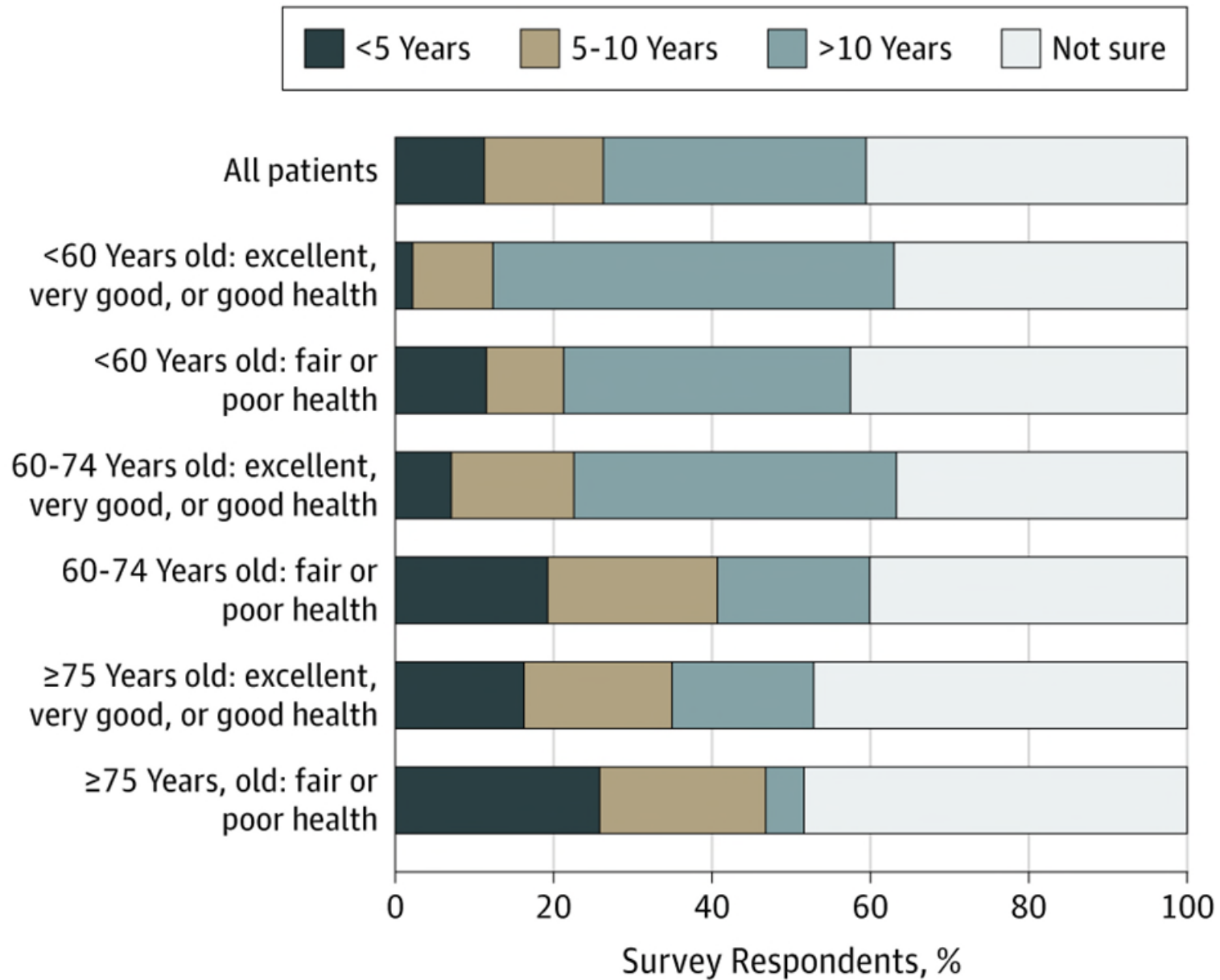
IMPORTANCE Prognostic understanding can shape patients' treatment goals and preferences. Patients undergoing dialysis in the United States have limited life expectancy and may receive end-of-life care directed at life extension. Little is known about their prognostic expectations.
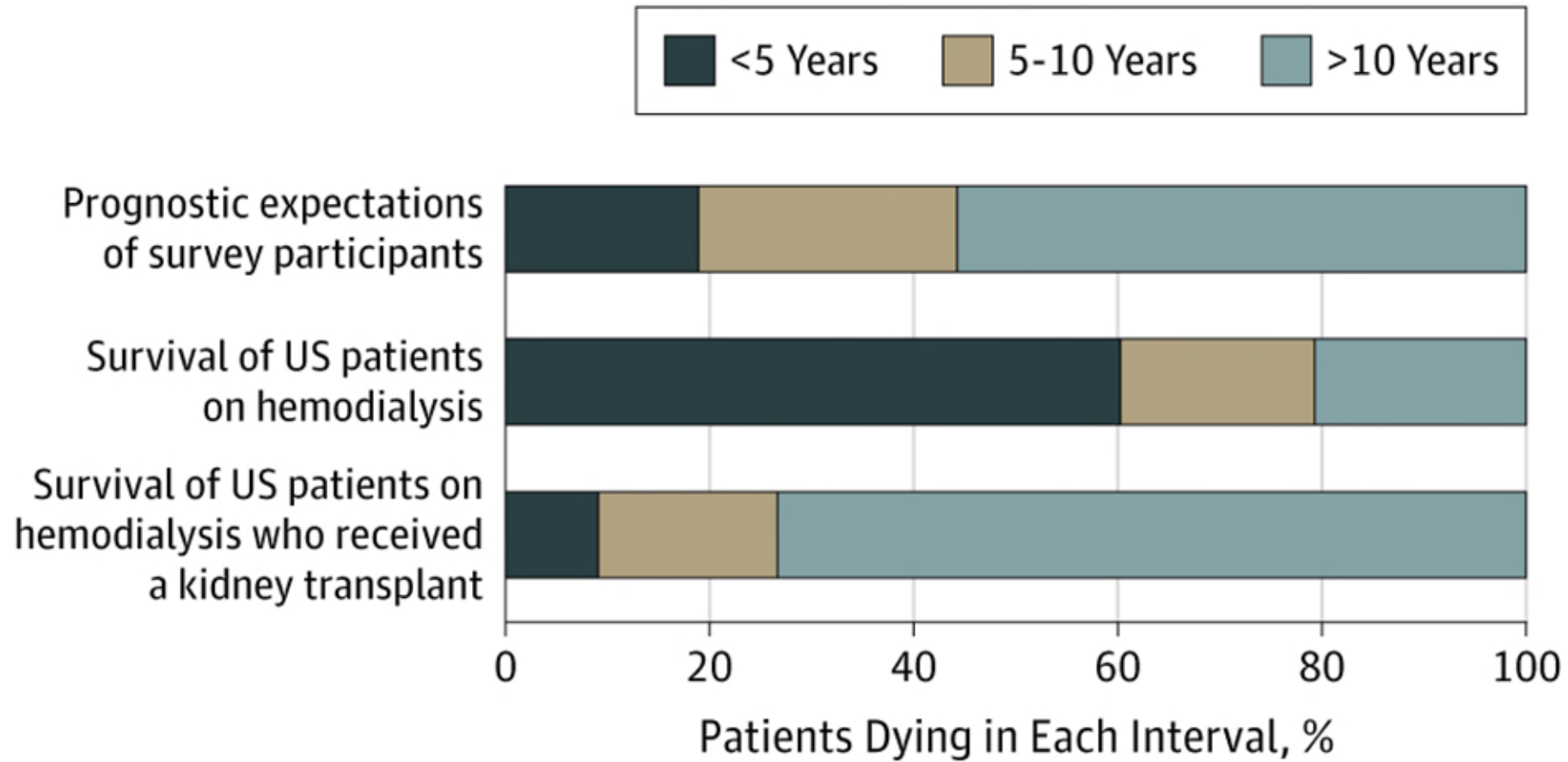
OBJECTIVE To understand the prognostic expectations of patients undergoing dialysis and how these relate to care planning, goals, and preferences.

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.

Legend: ■ <5 Years ■ 5-10 Years ■ >10 Years □ Not sure

Categories (y-axis):
- All patients
- <60 Years old: excellent, very good, or good health
- <60 Years old: fair or poor health
- 60-74 Years old: excellent, very good, or good health
- 60-74 Years old: fair or poor health
- ≥75 Years old: excellent, very good, or good health
- ≥75 Years, old: fair or poor health

X-axis: Survey Respondents, % (0, 20, 40, 60, 80, 100)

O'Hare, JAMA Int Med, 2019

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

Domain	Practical Advice	Possible Solutions
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.

Lakin et al JAMA Int Med, 2016

I think so.

SHOULD I WRITE A PROGNOSIS IN MY NOTE?

TABLE 2. DOCUMENTATION OF PROGNOSTIC INFORMATION BY REASON FOR CONSULTATION

Characteristic	All patients (n=412)	Symptom management consults (n=181)	Goals of care consults (n=108)	Both (n=123)
Documentation of functional status				
ECOG only	12	3	2	7
KPS only	3	0	2	1
ECOG and KPS	8	3	2	3
Palliative Performance Scale	0	0	0	0
ADLs	1	0	1	0
Documentation of EBP				
Palliative Prognostic Score	0	0	0	0
Palliative Prognostic Index	0	0	0	0
MELD score	3	2	1	0
Walter Index[1]	1[1]	0	0	1
Lee Index[1]	1[1]	0	0	1

[1]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.

Bruggeman et al. , JPM 2015

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.

Bradley, Am J Med, 2001

Table 3. Percentage of Records Containing the 4 Key Parameters of Critical Results, Prognosis, Care Options, and Care Plan.

Documented Item	Primary Team	Palliative Care	P Value
Critical results	86.80%	81.57%	.329
Prognosis	31.57%	83.33%	<.001
Care options	50.00%	81.58%	<.001
Care plan	46.49%	81.58%	<.001

Bear, J Palliat Care, 2017

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.

sive care. Second, a shortage of palliative care professionals makes proactive identification of candidate patients via manual chart review an expensive and time-consuming process.

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.
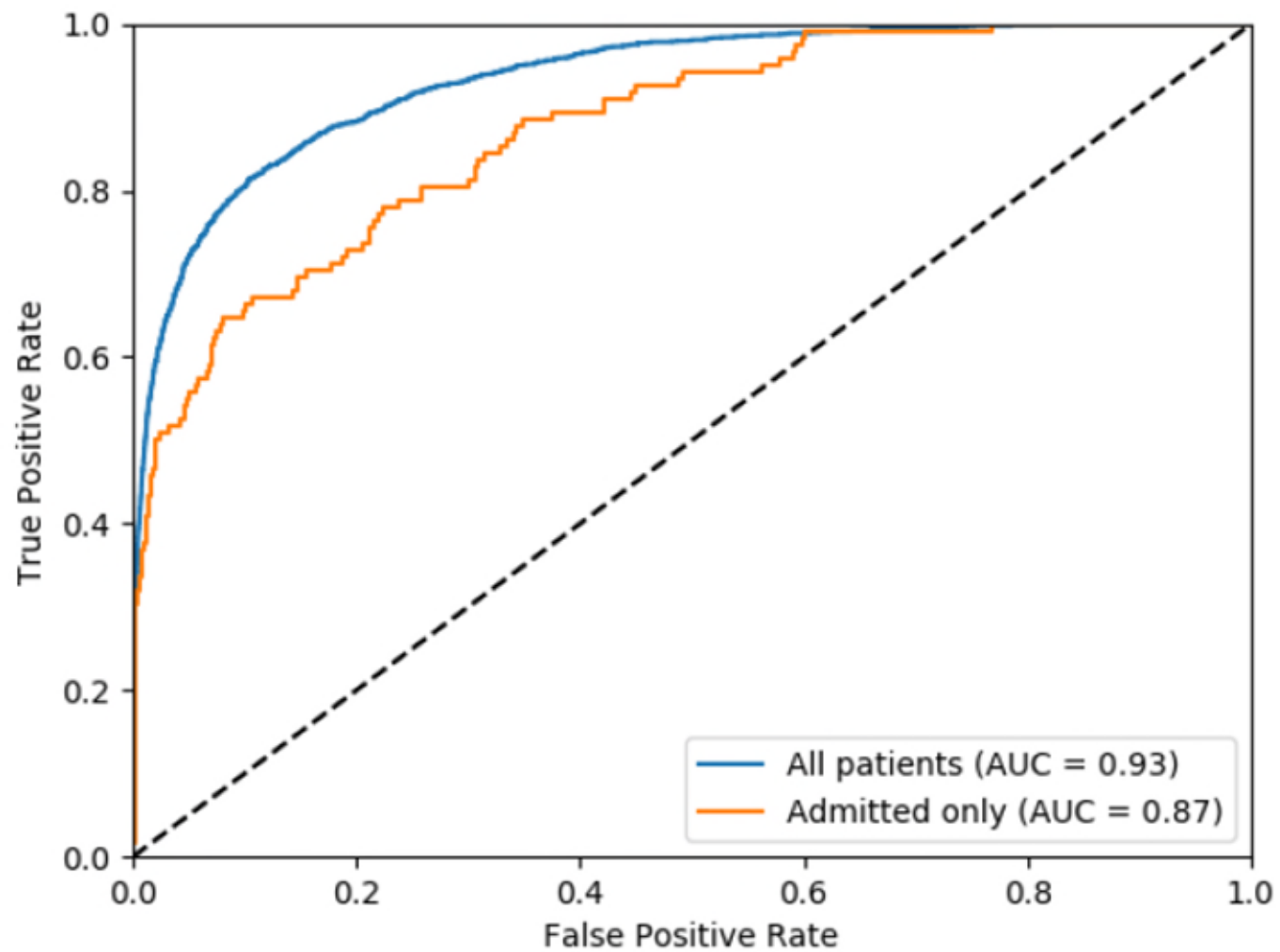
II. RELATED WORK

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
  – http://bit.ly/**HPMprognosis**
- Pubmed search and alerts

PredictSurvival.com

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.

	Enter as Much as You Can:	Required For:
How Long do You Think the Patient Will Live?	[ ] days ▾	PaP, D-PaP
Palliative Performance Scale (PPS) Help?	Unavailable ▾	PPS, PPI
Karnofsky Performance Status (KPS) Help?	Unavailable ▾	KPS, PaP, D-PaP
ECOG Performance Status Help?	Unavailable ▾	ECOG, PS-PPI
Edema	Unavailable ▾	PPI, PS-PPI
Oral Intake	Unavailable ▾	PPI, PS-PPI
Dyspnea at Rest	Unavailable ▾	PPI, PS-PPI, PaP, D-PaP
Delirium[1]	Unavailable ▾	PPI, PS-PPI, D-PaP
Anorexia[2]	Unavailable ▾	PaP, D-PaP
Total WBC (cell/cc)	Unavailable ▾	PaP, D-PaP
Lymphocyte Percentage	Unavailable ▾	PaP, D-PaP

Prognosticate!

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.

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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.

	Enter as Much as You Can:		Required For:
How Long do You Think the Patient Will Live?	30	days ▼	PaP, D-PaP
Palliative Performance Scale (PPS) Help?	30% ▼		PPS, PPI
Karnofsky Performance Status (KPS) Help?	30% ▼		KPS, PaP, D-PaP
ECOG Performance Status Help?	4 ▼		ECOG, PS-PPI
Edema	No ▼		PPI, PS-PPI
Oral Intake	Reduced but more than mol ▼		PPI, PS-PPI
Dyspnea at Rest	No ▼		PPI, PS-PPI, PaP, D-PaP
Delirium[1]	No ▼		PPI, PS-PPI, D-PaP
Anorexia[2]	Yes ▼		PaP, D-PaP
Total WBC (cell/cc)	Less than 8,500 ▼		PaP, D-PaP
Lymphocyte Percentage	Greater than 20.0% ▼		PaP, D-PaP

Prognosticate!

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.

Model	Score	Median Survival	Communicating with Patients and Families
Palliative Prognostice Index (PPI):	5.0/15	12 to 25 days	Predicts *weeks* of survival
Performance Status-Based Palliative Prognostic Index (PS-PPI):	6.5/15	15 to 20 days	Predicts *weeks* of survival
Palliative Prognostic Score (PaP):	7.0/17.5	25 to 35 days	Predicts *weeks* of survival
Palliative Prognostic Score with Delirium (D-PaP):	7.0/19.5	65 to 85 days	Predicts *months* of survival
Palliative Performance Scale (PPS):	30%	13 to 22 days	Predicts *weeks* of survival
Karnofsky Performance Status (KPS):	30%	29 to 49.8 days	Predicts *weeks* of survival
ECOG Performance Status:	4	25.5 days	Predicts *weeks* of survival
Your Estimate:	---	30 days	Predicts *weeks* of survival

The inputs you gave were: ECOG: 4, KPS: 30, Edema: absent, Lymphocyte: 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.

PredictSurvival.com

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[3] 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.[2]

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 probabilty of 38% of dying within 72 hours.[2,3,4]

Estimated Probability of Death in the Next 72 Hours: [____] %
Palliative Perfomance Scale (PPS): [--- ▾]   [Reference to look up the PPS if needed](#)

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

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

[Calculate]

Probability of Death in the Next 72 hrs:

- RPA Model:
- Likelihood Ratio Model:

Further Details, by Paper and Patient Location:

PPI   Score: 5.0/15

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

PS-PPI   Score: 6.5/15

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

PaP   Score: 7.0/17.5

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

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4. DLBCL
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7. AML
8. Pancreatic cancer
9. HER2+ Breast cancer
10. B-ALL

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Regimens: 3,248		Regimen variants: 4,920	
Solid Tumors	**Malignant Hematology**	**Cross-Disciplinary**	**Classical Hematology**
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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		
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Gastric cancer

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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.

Contents [hide]

51 regimens on this page

75 variants on this page

Nivolumab monotherapy

Regimen

Study	Evidence	Comparator	Efficacy
Kang et al. 2017 (ATTRACTION-2)	Phase III (E)	Placebo	Superior OS
Janjigian et al. 2018 (CheckMate-032)	Phase II		

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

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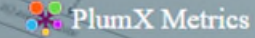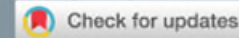Purchase   Subscribe   Save   Share   Reprints   Request

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.

|	**Nivolumab**	**Placebo**
Median Overall Survival	5.26 mos	4.24 mos
12-month Overall Survival	26.2%	10.9%

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
  - http://bit.ly/**HPMprognosis**
- Pubmed search and alerts

Recommended Reading
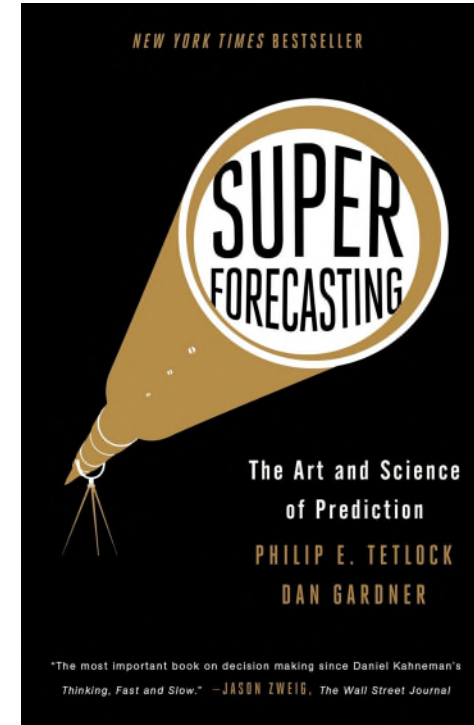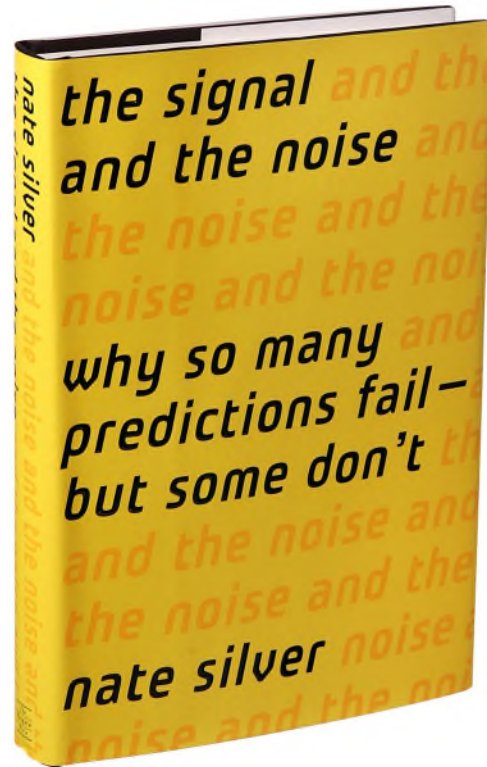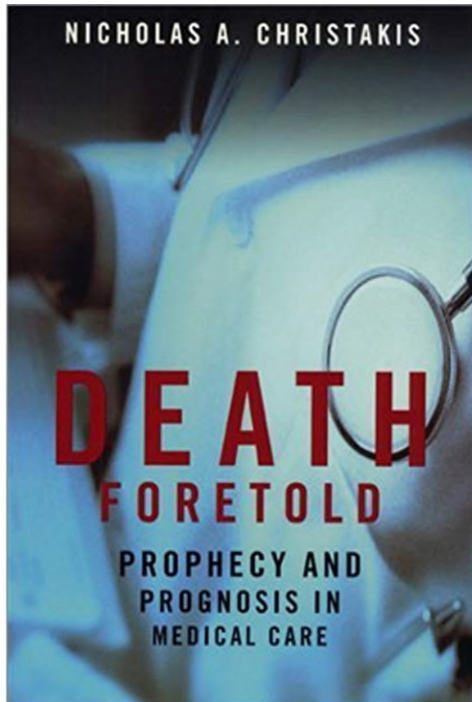
Summary

- 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

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