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CANCER CARE

Designing for Implementation: Clinical Decision Support Barriers and Needs

Hung-Jui Tan, MD, MSHPM

Cancer Outcomes Research Program

November 16, 2021



Disclosures

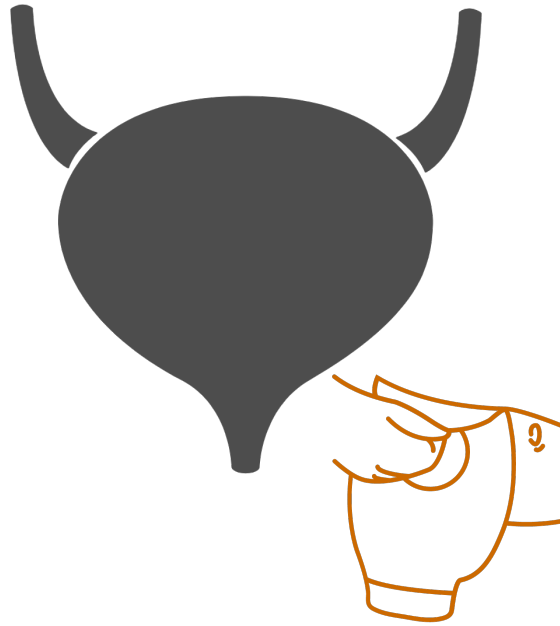
- Funding from the American Cancer Society



Common Cancers – Morbid Treatments



Prostate Cancer
2nd most common
66 years old



Bladder Cancer
5th most common
73 years old



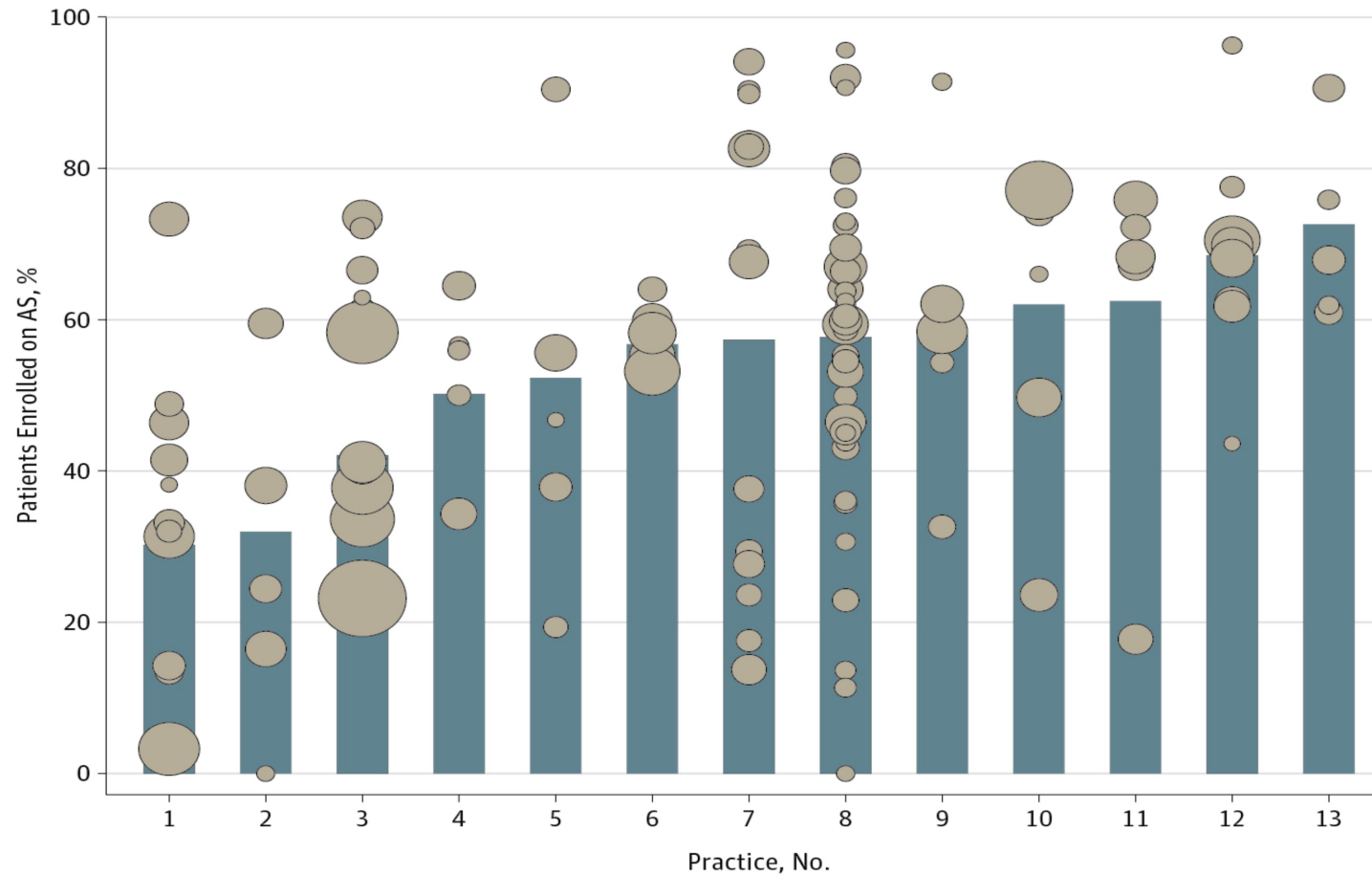
Kidney Cancer
6th most common
64 years old



Substantial Surgeon-Level Variation

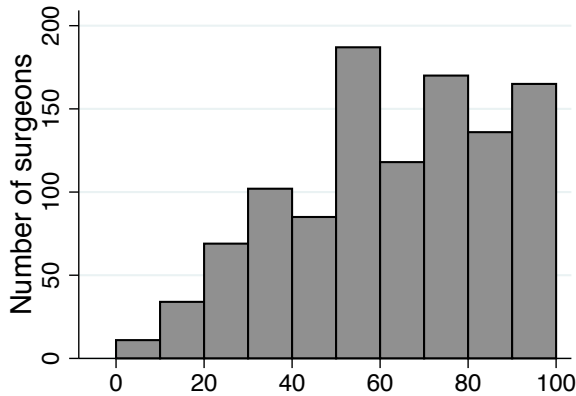
From: **Practice- vs Physician-Level Variation in Use of Active Surveillance for Men With Low-Risk Prostate Cancer Implications for Collaborative Quality Improvement**

JAMA Surg. 2017;152(10):978-980. doi:10.1001/jamasurg.2017.1586

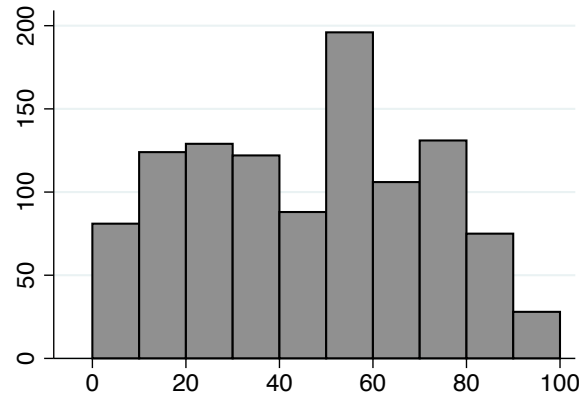


Vastly Different Perceptions + Judgments

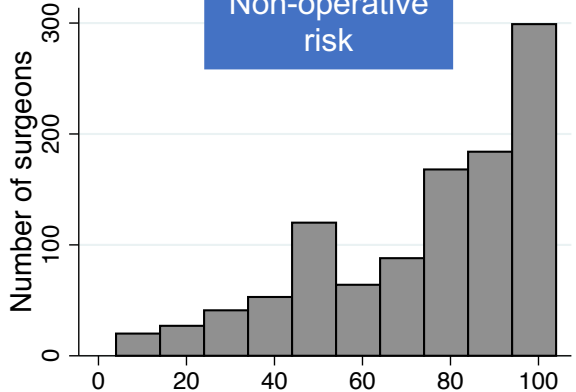
Operative risk



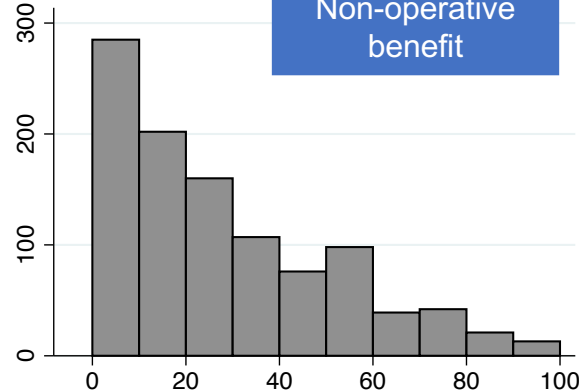
Operative benefit



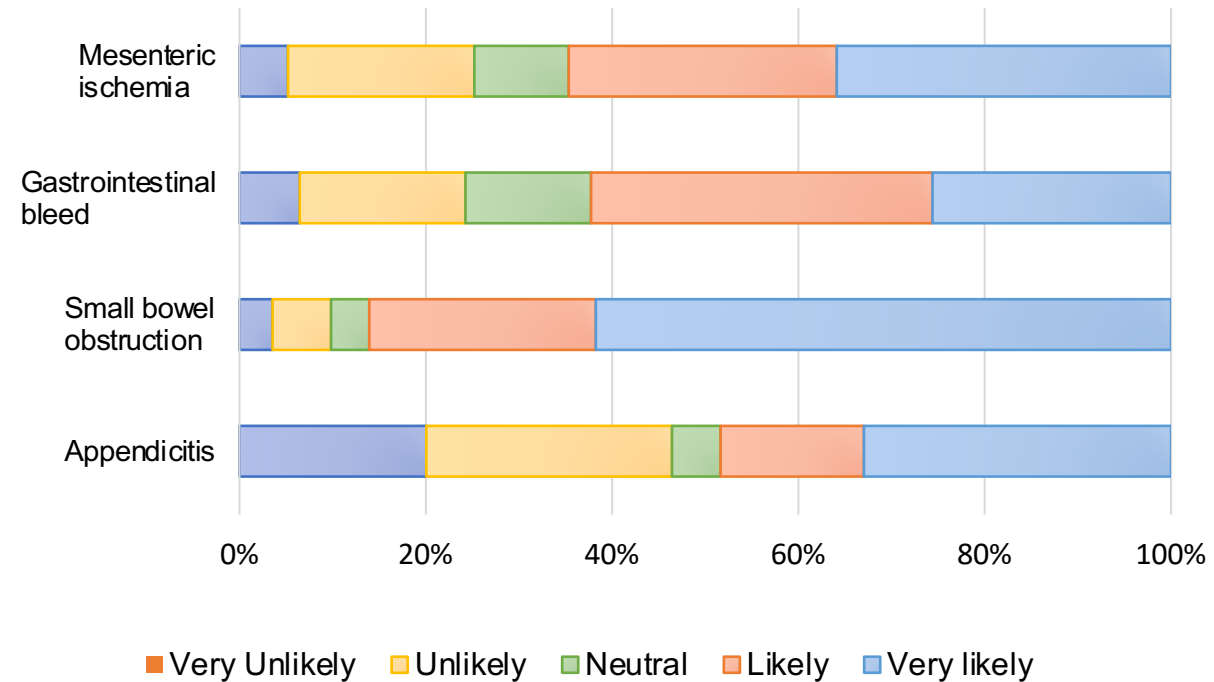
Non-operative risk



Non-operative benefit



40% of variation



Slide courtesy of Greg Sacks, MD, PhD (Sacks, Ann Surg, 2016)



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Risk Prediction to the Rescue?

10/30/2021Prostate Cancer Nomograms: Pre-Radical Prostatectomy | Memorial Sloan Kettering Cancer Center

Memorial Sloan Kettering Cancer Center

Prediction Tools / Prostate Cancer Nomograms

Pre-Radical Prostatectomy

Your Results

Primary Treatment Outcomes

+

PROBABILITY OF CANCER-SPECIFIC SURVIVAL AFTER RADICAL PROSTATECTOMY

10 YR9915 YR99

+

PROGRESSION-FREE PROBABILITY AFTER RADICAL PROSTATECTOMY

5 YR8510 YR74

Extent of Disease Probability

Each extent-of-disease probability percentage is an independent prediction. We therefore would not expect these percentages to equal 100.

+

ORGAN-CONFINED DISEASE

59

+

EXTRACAPSULAR EXTENSION

39

+

LYMPH NODE INVOLVEMENT

3

+

SEMINAL VESICLE INVASION

3

https://www.mskcc.org/nomograms/prostate/pre_op1/3

Procedure: 50220 - Nephrectomy, including partial ureterectomy, any open approach including rib resection;

Risk Factors: 85 years or older, ASA Severe systemic disease, HTN

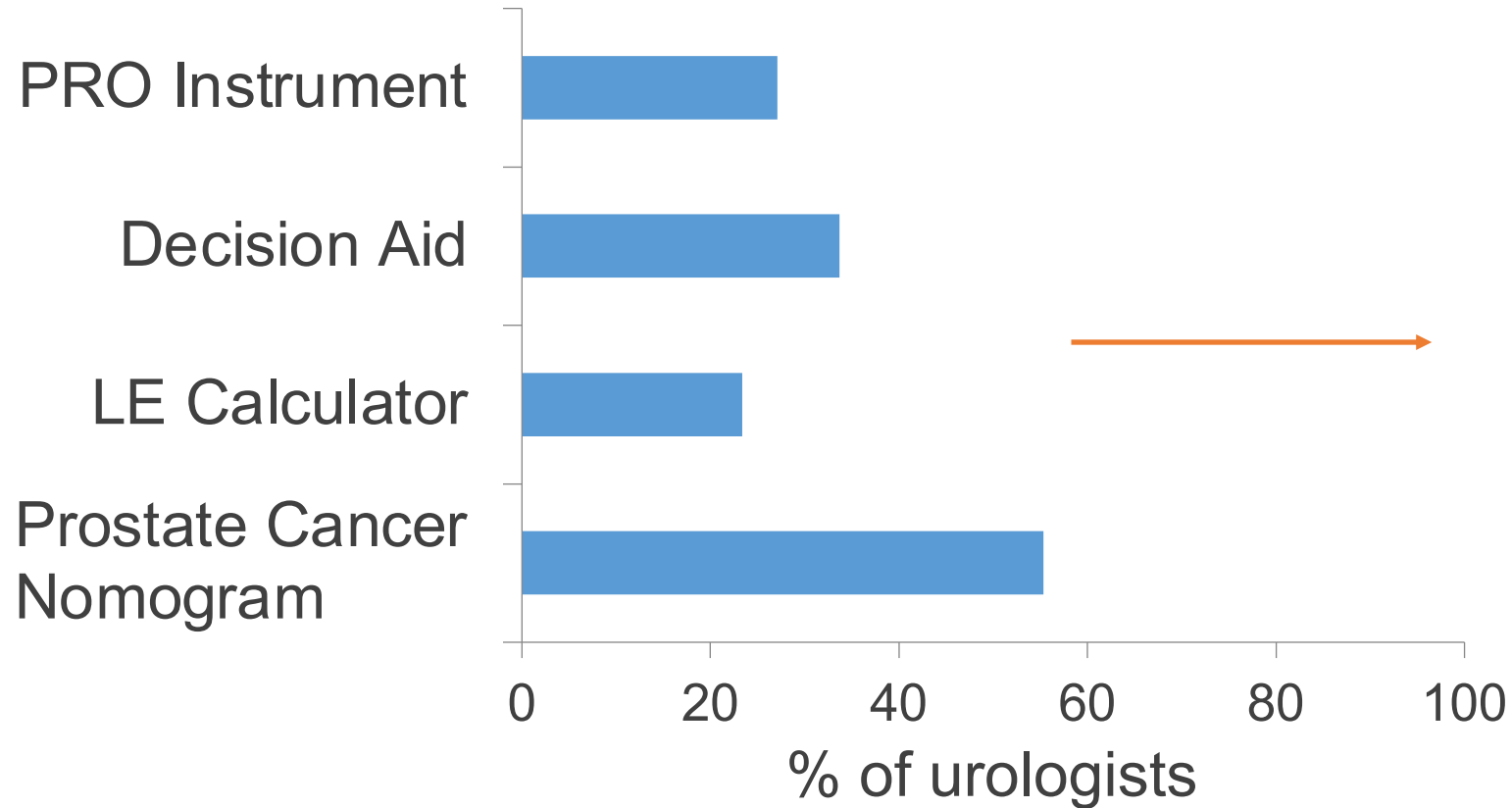
Change Patient Risk Factors

Outcomes ⓘ

	Your Risk	Average Risk	Chance of Outcome
Serious Complication	12.3%	10.9%	Above Average
Any Complication	13.4%	12.4%	Average
Pneumonia	2.6%	1.6%	Above Average
Cardiac Complication	1.9%	0.8%	Above Average
Surgical Site Infection	1.9%	2.9%	Below Average
Urinary Tract Infection	2.7%	1.2%	Above Average
Venous Thromboembolism	1.7%	1.6%	Average
Renal Failure	1.6%	1.7%	Average
Readmission	8.7%	7.1%	Above Average
Return to OR	1.8%	2.3%	Below Average
Death	2.3%	0.6%	Above Average
Discharge to Nursing or Rehab Facility	22.7%	3.7%	Above Average

Predicted Length of Hospital Stay: 6.5 days

Real-World Usage Remains Low



Barriers:

- Experience level
- Visit duration
- Patient comprehension
- Relative accuracy



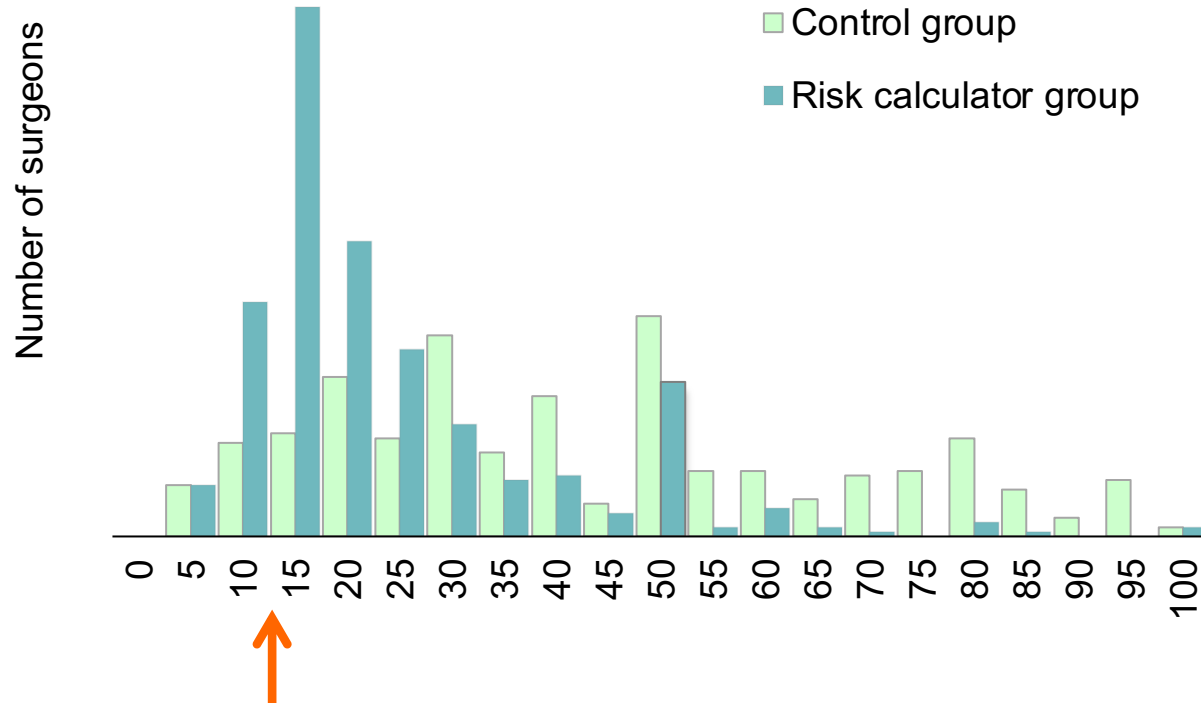
Kim, J Urol, 2013; Wang, JAMA Int Med, 2015



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Potential Impact Also Limited

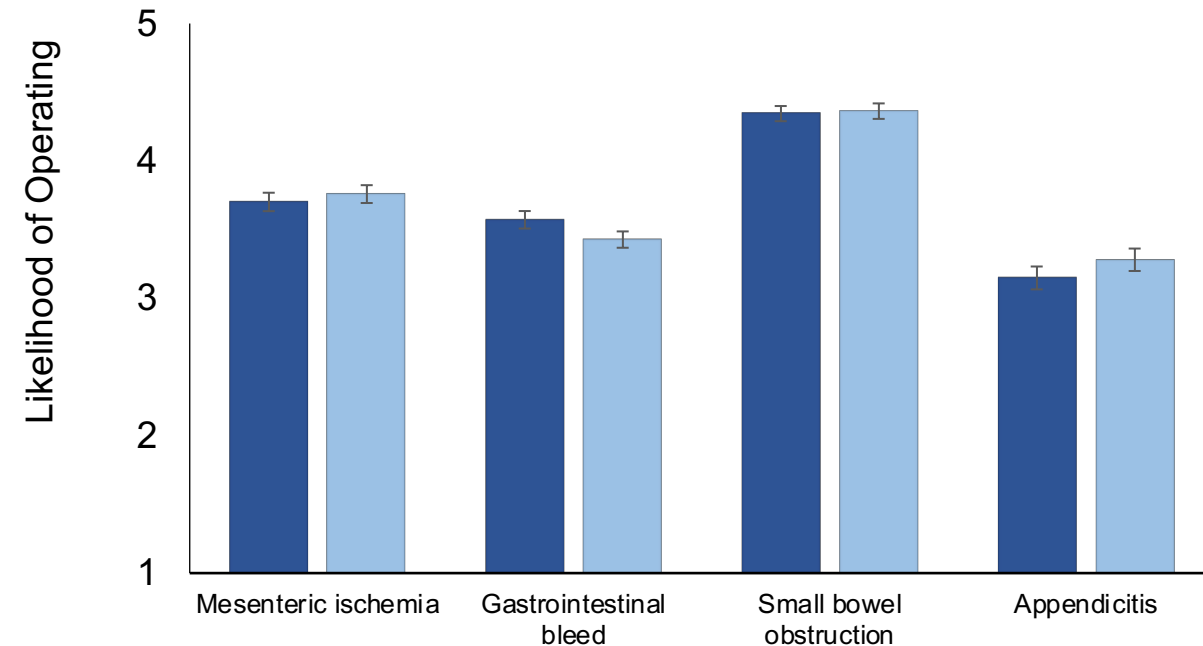
Estimated Risk of Death from Surgery for Mesenteric Ischemia



Actual Risk of Death

Slide courtesy of Greg Sacks, MD, PhD (Sacks, Ann Surg, 2016)

■ Control group ■ Risk calculator group

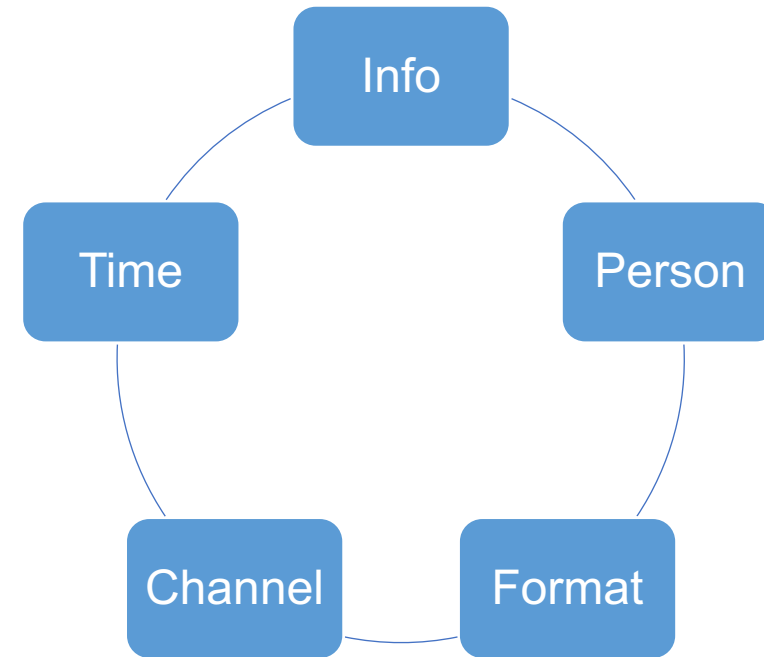


Clinical Decision Support

“provides clinicians, staff, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.”

- healthit.gov

5 Rights of CDS



- HIMSS



Risk Assessment: Diversifying + Improving

Research Letter

July 11, 2017

Overall Survival Results of a Trial Assessing Patient-Reported Outcomes for Symptom Monitoring During Routine Cancer Treatment

Ethan Basch, MD, MSc^{1,2}; Allison M. Deal, MS¹; Amylou C. Dueck, PhD⁴; Howard I. Scher, MD³; Mark G. Kris, MD³; Clifford Hudis, MD⁵; Deborah Schrag, MD, MPH^{2,6}

[□ Author Affiliations](#) | [Article Information](#)

JAMA. 2017;318(2):197-198. doi:10.1001/jama.2017.7156


Patient Reported vs Claims Based Measures of Health for Modeling Life Expectancy in Men with Prostate Cancer

Hung-Jui Tan,*,† Xi Zhou, Brooke N. Spratte,‡ Stephen McMahon, Matthew E. Nielsen, Jennifer Lund, Alex H. S. Harris, Angela B. Smith and Ethan Basch

Impairment and Longitudinal Recovery of Older Adults Treated with Radical Cystectomy for Muscle Invasive Bladder Cancer

Chelsea K. Osterman,* Allison M. Deal, Hannah McCloskey, Kirsten A. Nyrop, Marc A. Bjurlin, Hung-Jui Tan, Matthew E. Nielsen, Matthew I. Milowsky, Hyman B. Muss and Angela B. Smith†,‡

Validation of a 5-Year Mortality Prediction Model among U.S. Medicare Beneficiaries

Rachael K. Ross, MPH,*  Tzy-Mey Kuo, PhD,[†] Michael Webster-Clark, PharmD, PhD,* Carmen L. Lewis, MD, MD, MPH,[‡] Christine E. Kistler, MD, MASc,[§] Michele Jonsson Funk, PhD,* and Jennifer L. Lund, PhD*

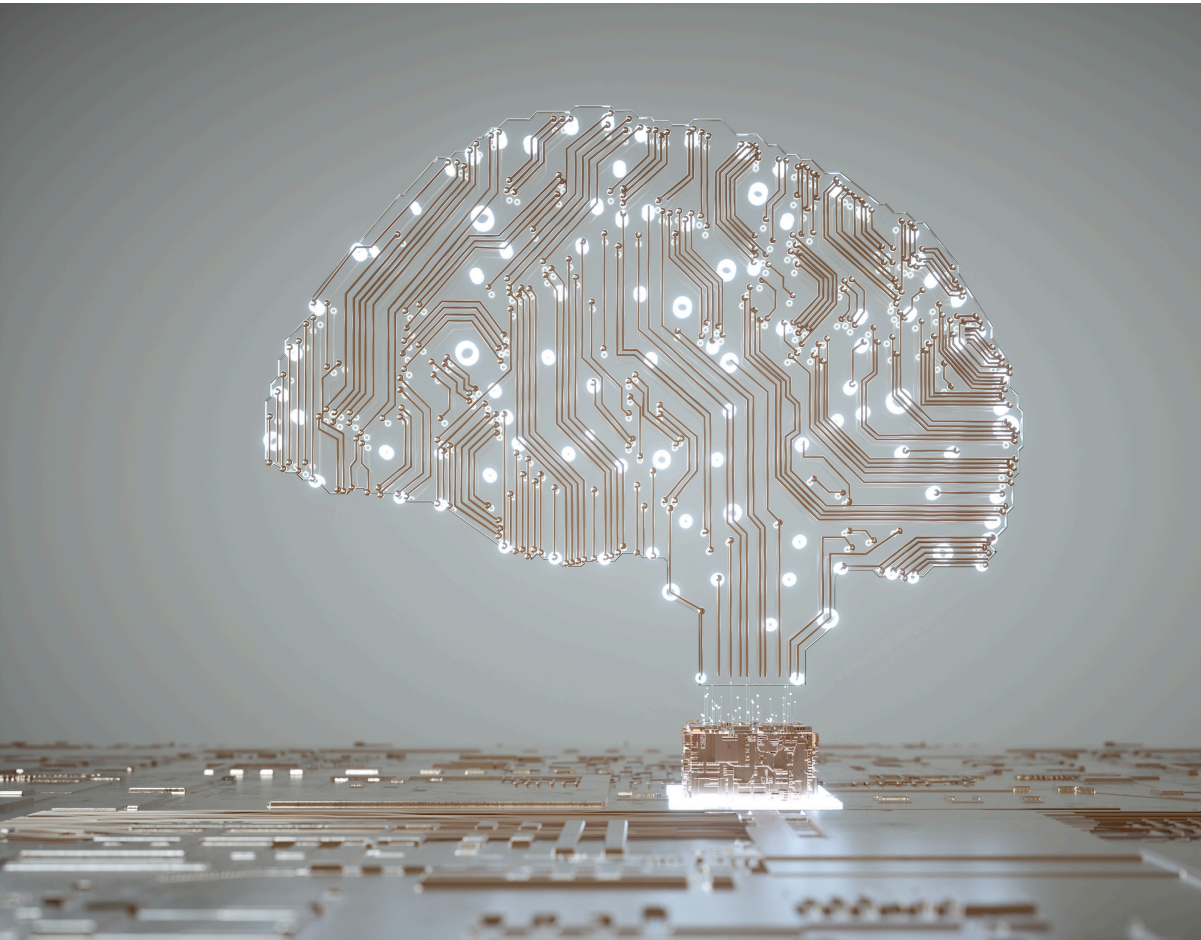
Evaluation of pedometry as a patient-centered outcome in patients undergoing hematopoietic cell transplant (HCT): a comparison of pedometry and patient reports of symptoms, health, and quality of life

Antonia V. Bennett^{1,5} · Bryce B. Reeve^{1,5} · Ethan M. Basch^{2,5} · Sandra A. Mitchell³ · Mathew Meenaghan^{2,5} · Claudio L. Battaglini^{4,5} · Abbie E. Smith-Ryan⁴ · Brett Phillips⁵ · Thomas C. Shea^{2,5} · William A. Wood^{2,5}



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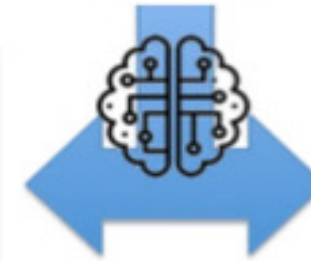
Artificial Intelligence + Risk Prediction



Using AI techniques, a computer can determine from a 12-lead ECG:



Whether you are male or female with an accuracy of over 90%



Your age, if you're healthy, within 7 years ...
And may determine your physiologic age if you have other comorbidities



Zachi I. Attia. Circulation: Arrhythmia and Electrophysiology. Age and Sex Estimation Using Artificial Intelligence From Standard 12-Lead ECGs, Volume: 12, Issue: 9, DOI: (10.1161/CIRCEP.119.007284)



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CDS – Best Practices + Strategies

Journal of the American Medical Informatics Association Volume 10 Number 6 Nov / Dec 2003

523

Synthesis of Research Paper ■

Ten Commandments for Effective Clinical Decision Support: Making the Practice of Evidence-based Medicine a Reality

DAVID W. BATES, MD, MSc, GILAD J. KUPERMAN, MD, PhD, SAMUEL WANG, MD, PhD,
TEJAL GANDHI, MD, MPH, ANNE KITTLER, BA, LYNX VOLK, MHS, CYNTHIA SPERR, RN, MBA,
RAMIN KHORRAMI, MD, MILENKO TANASIEVIC, MD, BLACKFORD MIDDLETON, MD, MSc, MPH

Abstract While evidence-based medicine has increasingly broad-based support in health care, it remains difficult to get physicians to actually practice it. Across most domains in medicine, practice has lagged behind knowledge by at least several years. The authors believe that the key tools for closing this gap will be information systems that provide decision support to users at the time they make decisions, which should result in improved quality of care. Furthermore, providers make many errors, and clinical decision support can be useful for finding and preventing such errors. Over the last eight years the authors have implemented and studied the impact of decision support across a broad array of domains and have found a number of common elements important to success. The goal of this report is to discuss these lessons learned in the interest of informing the efforts of others working to make the practice of evidence-based medicine a reality.

■ J Am Med Assoc. 2003;10:523-530. DOI 10.1197/jamia.M1370.

Delivering outstanding medical care requires providing care that is both high-quality and safe. However, while the knowledge base regarding effective medical therapies continues to improve, the practice of medicine continues to lag behind, and errors are distressingly frequent.¹

Regarding the gaps between evidence and practice, Lomas et al.² evaluated a series of published guidelines and found that it took an average of approximately five years for these guidelines to be adopted into routine practice. Moreover, evidence exists that many guidelines—even those that are broadly accepted—are often not followed.³⁻⁷ For example, approximately 50% of eligible patients do not receive beta blockers after myocardial infarction,⁸ and a recent study found that only 33% of patients had low-density lipoprotein (LDL) cholesterol levels at or below the National Cholesterol Education Program recommendations.⁹ Of course, in many instances, relevant guidelines are not yet available, but even in these instances, practitioners should consider the evidence if they wish to practice evidence-based medicine, and a core part of practicing evidence-based medicine is considering guidelines when they do exist.

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Correspondence and reprints: David W. Bates, MD, MSc, Division of General Medicine and Primary Care, Brigham and Women's Hospital, 75 Francis Street, Boston, MA 02115; e-mail: <dbates@partners.org>.

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Although we strive to provide the best possible care, many studies within our own institution have identified gaps between optimal and actual practice. For example, in a study designed to assess the appropriateness of antiepileptic drug monitoring, only 27% of antiepileptic drug levels had an appropriate indication and, among these, half were drawn at an inappropriate time.¹⁰ Among digoxin levels, only 16% were appropriate in the inpatient setting, and 52% were appropriate in the outpatient setting.¹¹ Of clinical laboratory tests, 26% were ordered too early after a prior test of the same type to be clinically useful.¹² For evaluation of hypothyroidism or hyperthyroidism, the initial thyroid test performed was not the thyroid-stimulating hormone level in 52% of instances.¹² Only 17% of diabetics who needed eye examinations had them, even after visiting their primary care provider.¹³ The Centers for Disease Control and Prevention (CDC) guidelines for vancomycin use were not followed 68% of the time.¹⁴ Safety also is an issue: in one study, we identified 6.5 adverse drug events per 100 admissions, and 28% were preventable¹⁵; for example, many patients received medications to which they had a known allergy. Clearly, there are many opportunities for improvement.

We believe that decision support delivered using information systems, ideally with the electronic medical record as the platform, will finally provide decision makers with tools making it possible to achieve large gains in performance, narrow gaps between knowledge and practice, and improve safety.^{16,17} Recent reviews have suggested that decision support can improve performance, although it has not always been effective.^{18,19} These reviews have summarized the evidence that computerized decision support works, in part, based on evidence domain. While this perspective has been very useful and has suggested, for example, that decision support focusing on preventive reminders and drug doses has been more effective than decision support targeting assistance regarding diagnosis, it does not tell one how best to deliver it.

Challenges and Barriers to Clinical Decision Support (CDS) Design and Implementation Experienced in the Agency for Healthcare Research and Quality CDS Demonstrations

Prepared for:
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Prepared by:
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AHRQ Publication No. 10-0064-EF
March 2010



The Learning Health System Series

Optimizing Strategies for

CLINICAL DECISION SUPPORT

Summary of a Meeting Series

James E. Tcheng; Suzanne Bakken; David W. Bates; Hugh Bonner III;
Tejal K. Gandhi; Meredith Josephs; Kensaku Kawamoto; Edwin A. Lomotan;
Erin Mackay; Blackford Middleton; Jonathan M. Teich; Scott Weingarten;
Marianne Hamilton Lopez, *Editors*

 NATIONAL ACADEMY OF MEDICINE

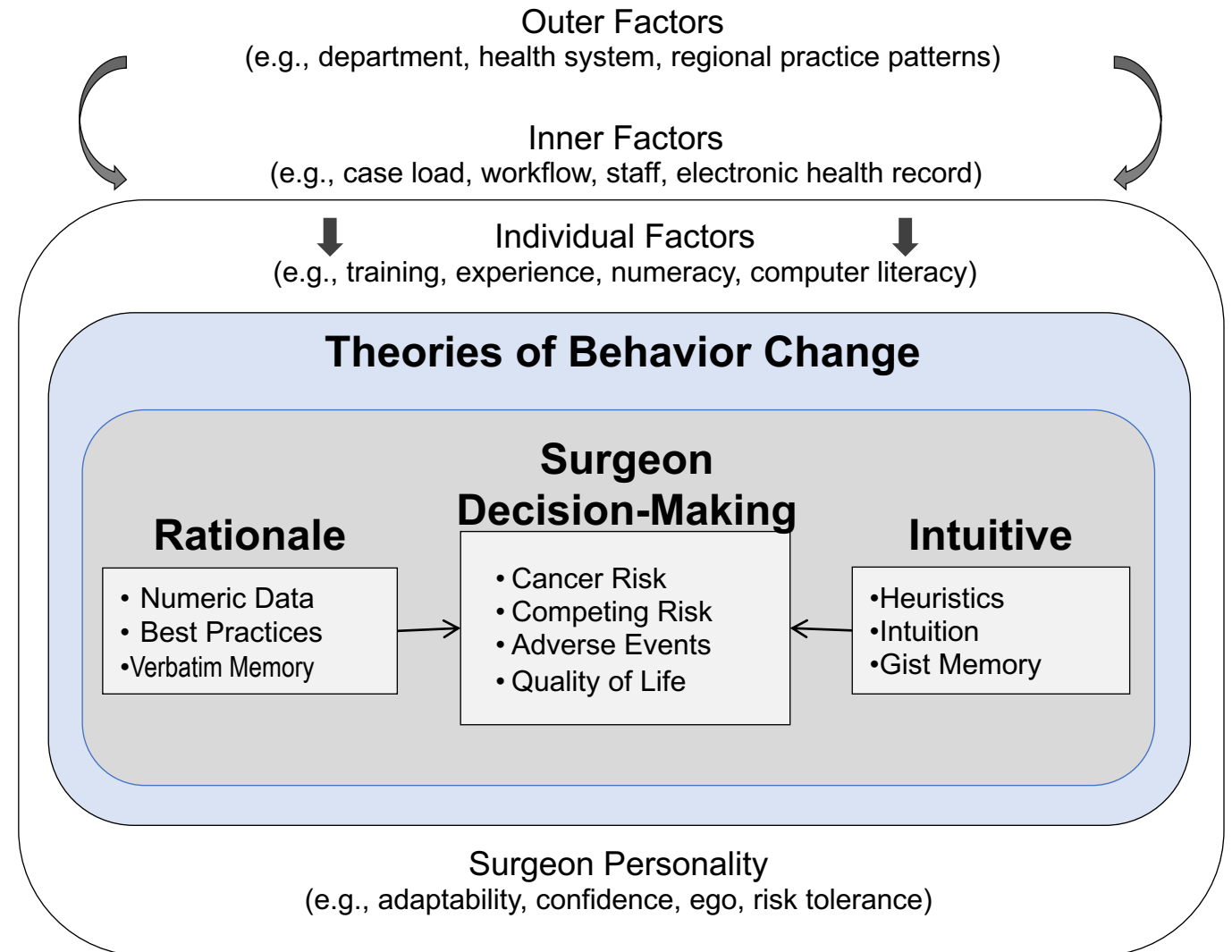
WASHINGTON, DC
NAM.EDU



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Implementation Frameworks

“In the case of CDS, issues around design and implementation of the system are often interconnected.”



Research Program – Guiding Question

- How can we provide information to enhance cancer surgery decision-making?



Deep Dive into User Perspectives + Barriers



How do urologists use the EHR?

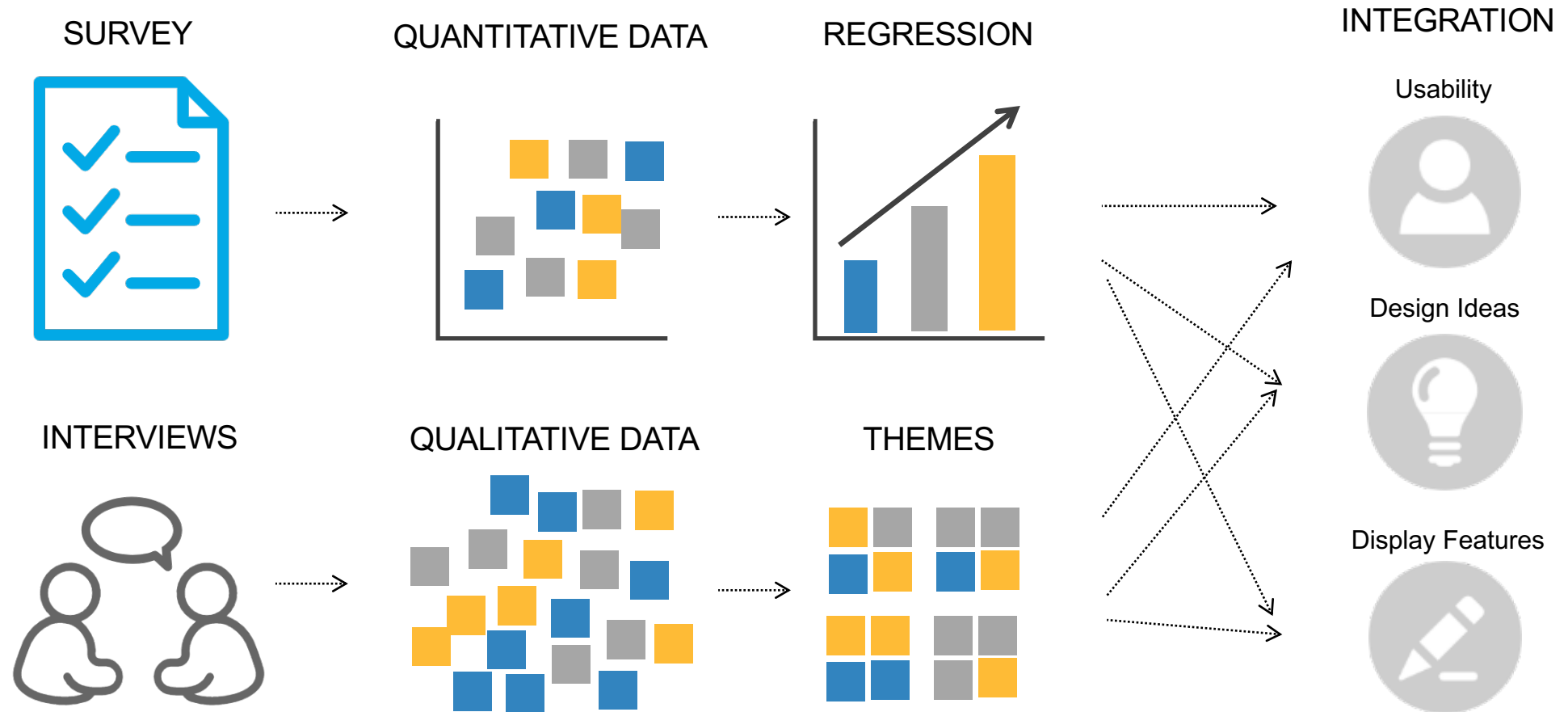


How do urologists make decisions?



How do urologists make use of RPTs?

Mixed Methods Approach



Study Cohort

Characteristics	Surveys (N=12,366)	Interviews (N=25)
Years in Practice	19.4 (7.7-32.0)	15 (6-21)
Male	89.7 (88.4-91.1)	64%
Female	10.3 (8.9-11.7)	36%
White	79.4 (77.4-81.4)	80%
All Other Races	20.7 (18.7-22.7)	20%
North Central	18.6 (16.7-20.6)	16%
South Central	14.0 (12.3-15.7)	4%
Mid Atlantic	10.2 (8.7-11.7)	20%
Northeastern	3.7 (2.8-4.5)	8%
New England	5.7 (4.6-6.7)	4%
Western	18.8 (16.8-20.7)	16%
Southeast	21.3 (19.4-23.3)	32%
New York	7.8 (6.4-9.2)	0%
Metro	90.0 (88.5-91.5)	92%
Rural	10.0 (8.5-11.5)	8%

Characteristics	Surveys (N=12,366)	Interviews (N=25)
Fellowship	39.5 (37.1-41.8)	56%
No Fellowship	60.5 (58.2-62.9)	44%
General	58.3 (55.9-60.7)	48%
Specialty	41.7 (39.3-44.1)	52%
Employed	61.7 (59.3-64.1)	72%
Owner – Any	38.3 (36.0-40.7)	28%
Academic	28.7 (26.5-30.9)	36%
Multispecialty	14.4 (12.8-16.1)	12%
Private Hospital	8.0 (6.6-9.4)	8%
Urology Group	30.0 (27.8-32.2)	20%
Solo Practice	7.0 (5.6-8.3)	8%
Public	8.6 (7.1-10.0)	8%
Other	3.4 (2.5-4.4)	8%
Major cases/mo	4.5 (1.3-9.6)	6 (3-16)
Patient visits/wk	69.5 (48.6-99.1)	70 (40-90)



Deep Dive into User Perspectives + Barriers



How do urologists use the EHR?

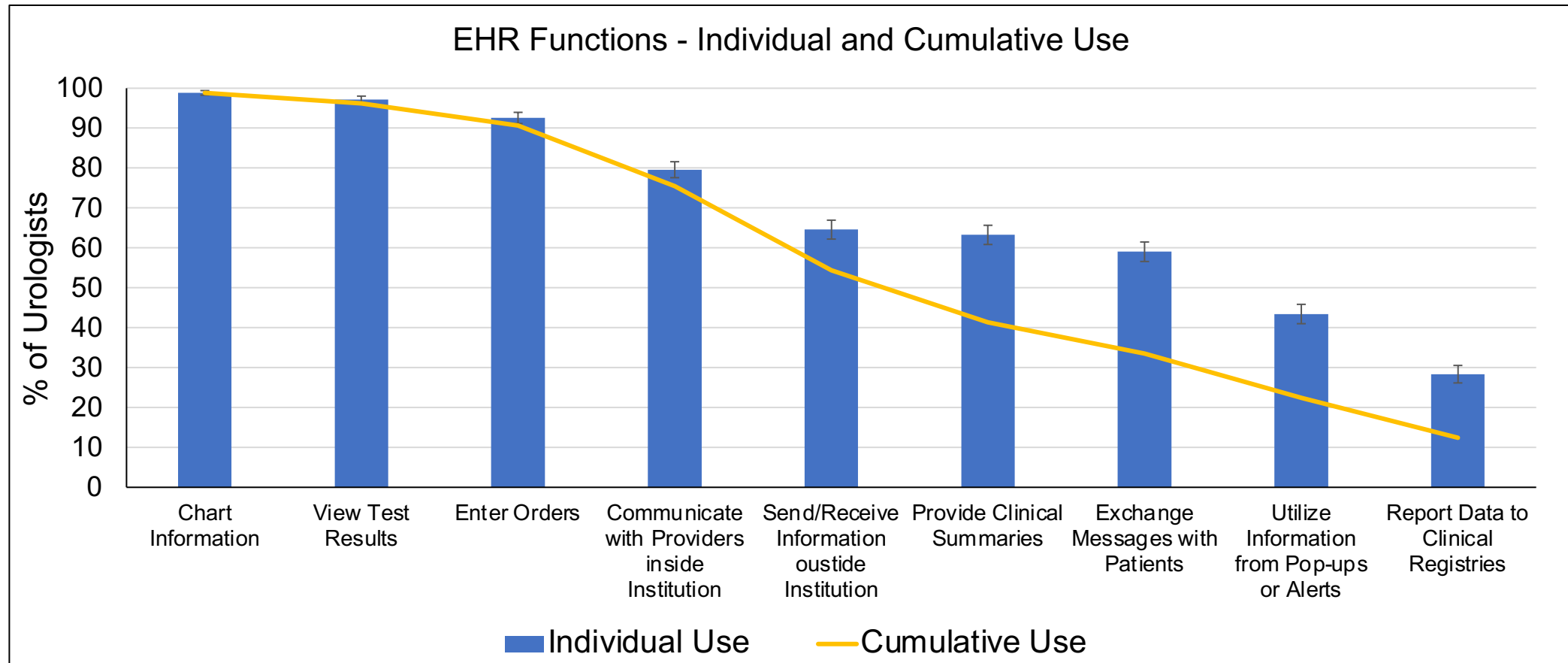


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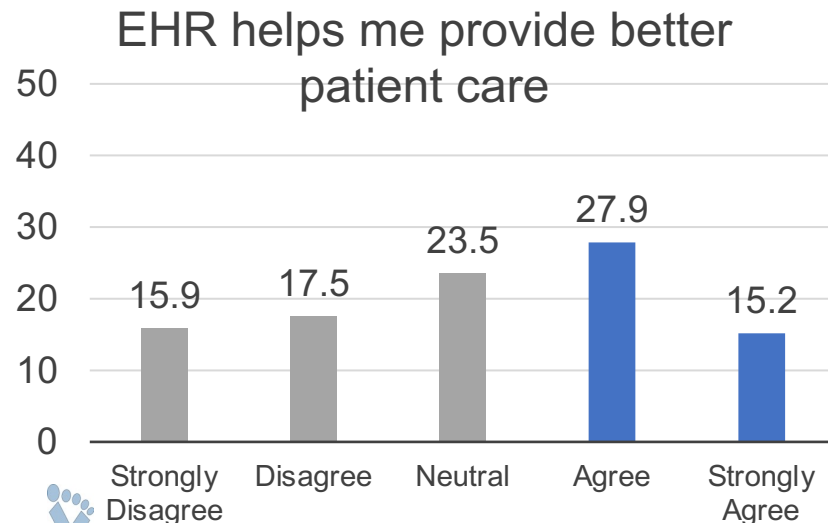
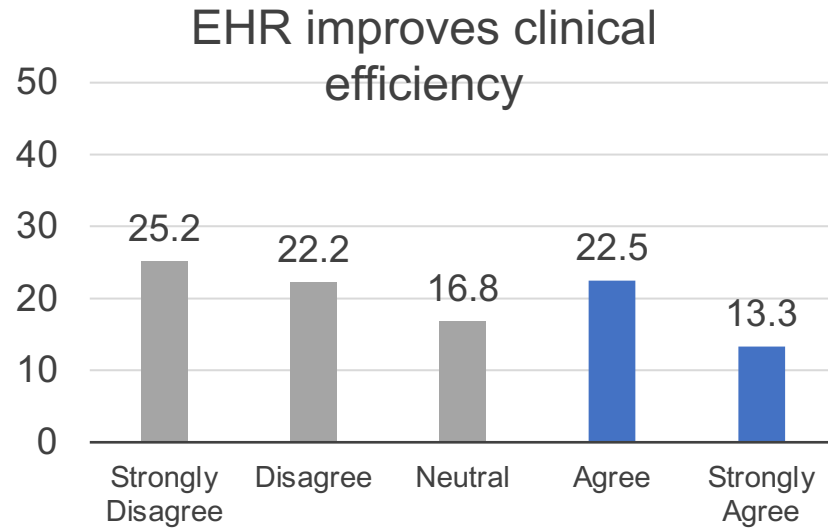
Use of the EHR



Use of 7 or more associated with ownership and practice setting ($p < 0.05$)



User Experience with the EHR



Access to Data - *"You can see records from a long time ago, and so I think that's a positive...We have it all there at our fingertips. I can see more records from outside hospitals, which is also great."*

Information Overload - *"You've got like 1,000 notes. You can't read all thousand notes. You got to figure out where is the information that you actually require in here. That can be really difficult to find."*

Administrative Burden - *"I spend way too much time [on] unimportant things...I have to spend time either after hours, between patients, making sure that my computer chart is correct."*

Patient Safety - *"I hate it, but then again, the occasional pop-up that says, 'Oh, this patient is deathly allergic to the drug you're trying to write for 'em.' It's like, 'I'm glad I got this electronic policeman here.' It has its benefits."*

Clerical Tasks - *"It impacts patient care because we're clicking on things that make no difference as far as the outcome for the patient...we treat the chart more than the patient."*

Less Patient Interaction - *"I look at our nurse's station and our doctor's dictation room. They're all full of people doing computer work and very little actual time at the bed with the patient."*



Key Use and Experience Drivers

Key Characteristics		Perceived Benefit		Themes with Exemplar Quotes (Qualitative)
		Clinical Efficiency	Patient Care	
Overall		-11.6%	+9.7%	Early Exposure “VA had one EHR, clinical setting had Epic, [hospital] had Cerner. To me, I’ve always had to use a bunch. I’m not stressed out about it. My partners hate it. All the younger ones can handle...” Mid/Late Adoption “I’d just say I remember when EHRs first came out, there was a little bit of pushback. I mean, there were docs who refused...and they would fight it for years and years, and they got left behind.”
Years in Practice	≤10	+7.5%	+29.9%	
	11–20	-11.2%	+12.3%	
	21–30	-28.0%	-7.5%	
	>30	-20.8%	-1.8%	



Key Use and Experience Drivers

Key Characteristics		Perceived Benefit		Themes with Exemplar Quotes (Qualitative)
		Clinical Efficiency	Patient Care	
Overall		-11.6%	+9.7%	Infrastructure “We literally had seven computer systems we had to go through. There was one for in-patient care and one for out-patient care and one for labs and two for radiology. It was a nightmare trying to coordinate all that stuff.” Support/Resources “Epic requires the use of scribes in our clinics. I would say it’s significantly decreased our efficiency and increased our overhead...If it was stand-alone, we would never use that product. It’s just not cost-effective for a private practice.”
Practice Size	<5 urologists	-16.4%	+0.3%	
	≥5 urologists	-8.6%	+15.5%	
Practice Type	Academic	-9.5%	+22.7%	
	Multispecialty	-6.5%	+16.0%	
	Public	-2.4%	+20.6%	
	Private Hospital	-18.7%	-0.1%	
	Urology Group	-19.7%	-5.5%	
	Solo Practice	-11.2%	-4.7%	
Rurality	Urban	-9.2%	+11.8%	
	Rural	-33.1%	-9.4%	



Implications for CDS

- EHRs continue to evoke negative/mixed feelings
- Use/perception will improve as the workforce turns over
- Urologists in private practice need to be engaged



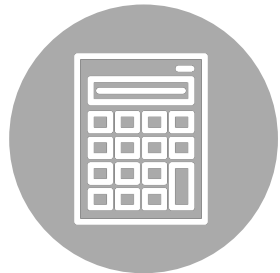
Deep Dive into User Perspectives + Barriers



How do urologists use the EHR?



How do urologists make decisions?



How do urologists make use of RPTs?

Surgical Decision-Making Process

“A lot of things I don't even consciously think about. My brain does it. A lot of it is just years of experience and getting a sense...after doing this for a while, you kind of learn to judge where they are on that continuum.”

Patient
Factors

External
Factors

Processes

Assessing the Patient

Disease Severity

- Pathology
- Imaging
- Tests
- Genomics
- Prognosis

Overall Health

- Functional Status
- Nutrition
- Medications
- Comorbidities

Desired Outcomes

- Cure
- Quality of Life

Assessing Treatments

- Approach
- Relative risks/benefits
- Feasibility/Availability

Matching Options to the Patient

- Internal to surgeon
- External to patient
- Maximizing benefit / minimizing harm

Reconciliation & Collaboration

- Communicating info
- Setting expectations
- Aligning goals
- Achieving buy-in

Surgeon
Factors

Work
Factors



Risk Assessment – Key Sources

Visual

“Just being able to get up by yourself and walk 10 feet, turn around, and sit back down comfortably gives you a lot of information about someone's overall status, at least, for what I do. There are little things like that that we do.”

Verbal

“Where do they come from? Do they live alone? Do they live with family? Are they able to care for themselves?...Gettin’ a sense of how they deal with their daily activities.”

Written

“It’s really a deep dive into their medical history. Looking at their comorbidities. Like I said before, most of our patients do carry something, so a quick check in the medicine list usually is a simple way to figure out where they’re at.”



Heuristics



Representativeness
(21/25)



Affect/Visceral
(20/25)



Anchoring
(16/25)



Framing
(15/25)



Loss Aversion
(14/25)



Commission/Omission
(14/25)



Tally
(12/25)



Confirmation
(11/25)



Availability
(8/25)



Implications for CDS

- Decision-making process is comprehensive and complex
- Multiple heuristics and subject to externalities
- Considering these aspects may be helpful to developing interventions targeting decision-making



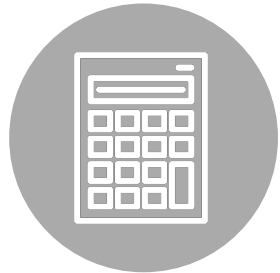
Deep Dive into User Perspectives + Barriers



How do urologists use the EHR?



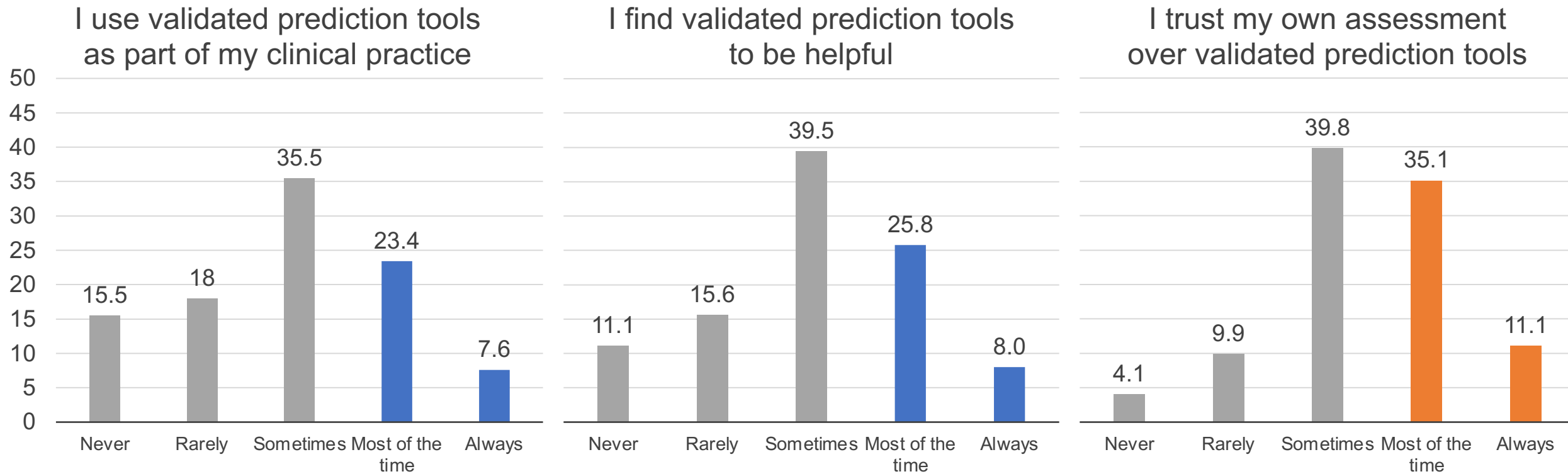
How do urologists make decisions?



How do urologists make use of RPTs?



RPT Use, Helpfulness, and Trust



Years in practice associated with use, helpfulness, & trust ($p < 0.001$)

Use & helpfulness also related to specialty & practice volume ($p < 0.05$)



RPTs – Current State

Surgical Risk Evaluation

Surgeons rely on their gestalt formed by their intuition, honed by experience

“A lot of things I don't even consciously think about. My brain does it. A lot of it is just years of experience and getting a sense...after doing this for a while, you learn to judge where they are on that continuum.”

Surgeons use simple rules-based representations (gist) to gauge risk

“She looked much older than her stated age. She came to clinic in a wheelchair. She didn't want the surgery herself. Sometimes patients know better than we do...those are some things that I often maybe subconsciously think about and look at.”

Surgeons retrieve exact numerical data based on clinical context and preferences

“These engineer types that are coming in, and they can really digest this. Half my patients are not—they don't understand that.”

Current Role for RPTs

Surgeons use RPTs for objective information to complement their gestalt

“I tend to use a surgical risk calculator. I wouldn't say it probably changes much, but it does give us a nice way in maybe an objective form...just helpful from an objective standpoint for the patients.”

Surgeons use RPT estimates to calibrate their gist/gestalt

“I did use it for a while for prostate cancer...I think after a while I got an idea of what life expectancy was gonna be. I think they're useful, but then after a while you get a pretty good gestalt.”

Surgeons use RPTs to help communicate risks/benefits to their patients

“I think it's helpful, more for patient education sometimes than anything else. I know that there's a risk for a prostatectomy infection. I know that's a risk, but it's nice to be able to show the patient...”

Challenges for RPTs

Surgeons lack the time, technology, resources, or incentive to use

“The private practice surgeon isn't reimbursed any more or given extra kudos. It's only more time added to the EMR, the calculation, the afterhours, the burden on the practitioner's family life, to add stupid numbers for the same answers. It's useless in my eyes.”

RPTs lack key variables, nuance, or specificity to individual cases

“I think it's mostly an accuracy issue. One thing that I find really limiting is the lack of robust geriatric variables...maybe they've fallen several times in the last six months, or they've lost a bunch of weight...”

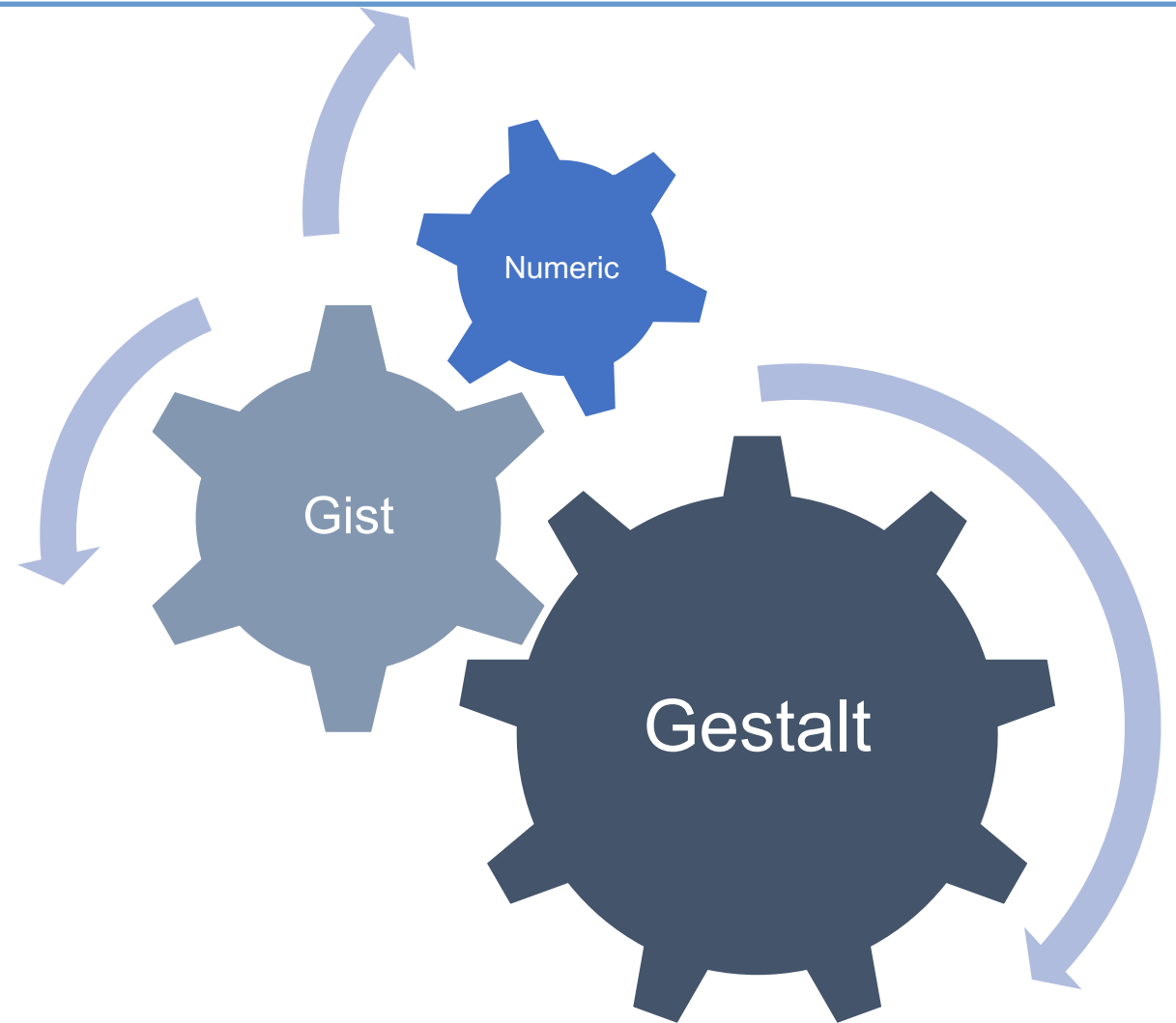
In cases of uncertainty, surgeons rely on their intuition and experience

“At the end of the day, despite the numbers saying one thing, you have to take a step back and treat each patient as an individual with their own desires and background. That's why I still fall back on my gestalt.”




Risk Perception Continuum

“At the end of the day, despite the numbers saying one thing or another, you have to take a step back and treat each patient as an individual with their own desires and background. That's probably why I still fall back on my gestalt and what I get to know these people.”



Implications for CDS

- Experience  gestalt and limits “need” for RPTs
- Confirmation, Calibration, and Communication
- Further limited by operational and methodological issues

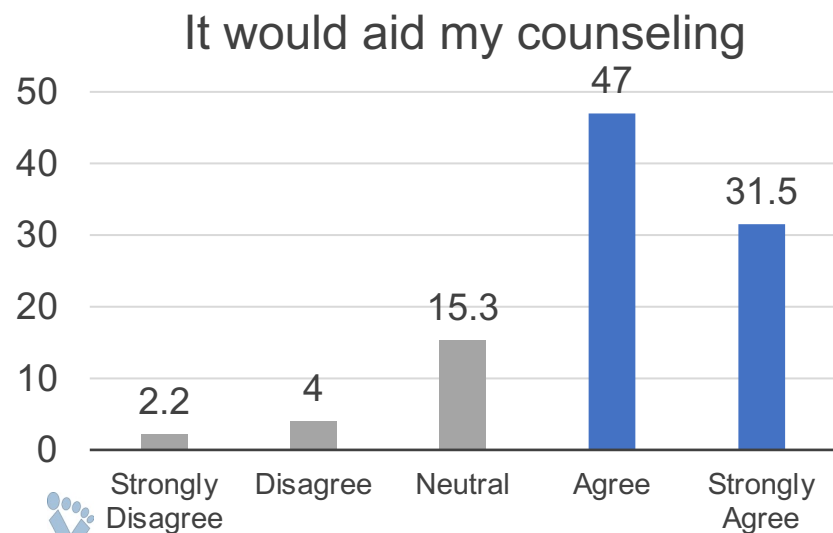
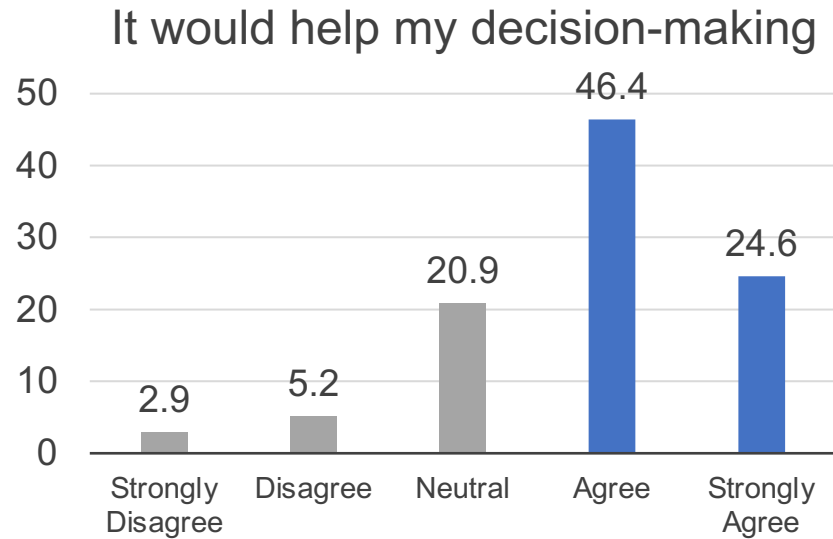


Exploring CDS + User Needs

- To gauge receptiveness to a proposed CDS



Favorable Attitudes toward CDS



Adding Objectivity to the Process - “It also gives me objective risk information to make a clinical decision.”

Optimizing Treatment Selection - “It’ll help deter the wrong surgery or it will help [show] the other possibilities”

Highlighting Less Considered Issues - “[It] may bring up some or make me a little more aware of potential issues that I may have not realized”

Guiding Patient Conversations - “Might help the discussion go more efficiently and be a little more scientific...more concrete, finite guidance.”

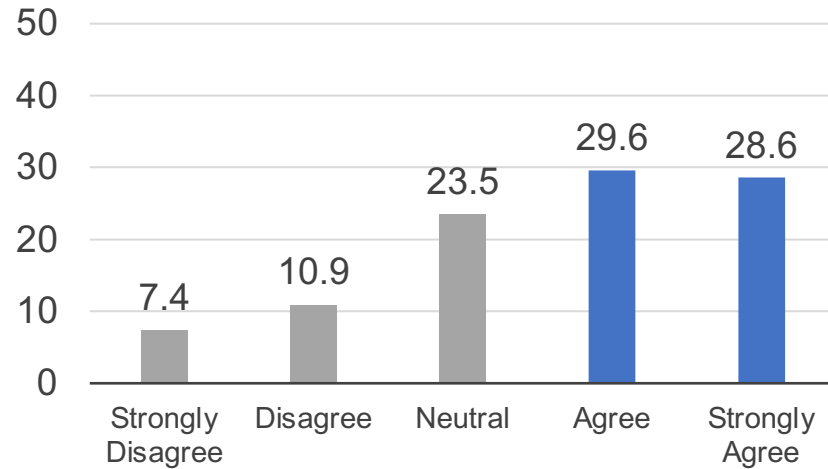
Supporting Recommendations with Data - “I think patients are more apt to believe numbers as opposed to just telling [them they] have a high risk or something.”

Providing Reassurance/Alleviating Anxiety and Fear - “Gives patients more confidence in the fact that what you’re deciding to do is backed up by other objective data.”

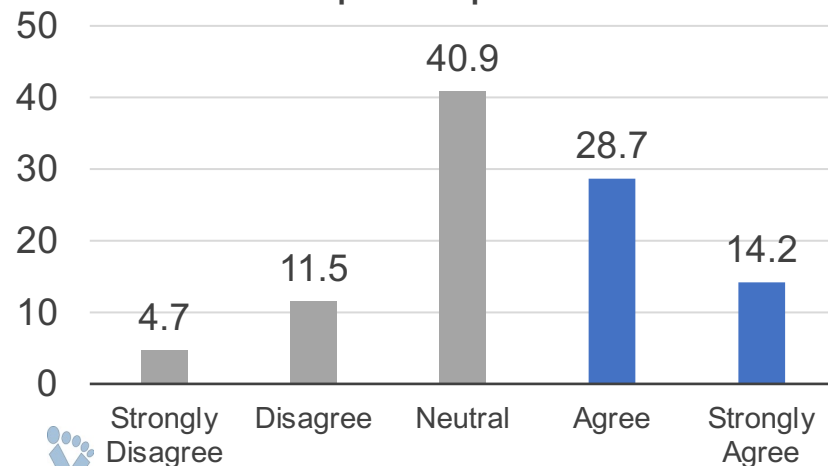


Favorable Attitudes toward CDS

It would save me time



It would improve patient outcomes



Reducing Cognitive/Work Load - “If you’ve got it at your fingertips, it actually saves time... I would focus my energy on managing other health issues.”

Extending the Reach of Surgeons - “If [APPs] have the surgical tool that can predict what—if it's straightforward, maybe they don't need to run it by us.”

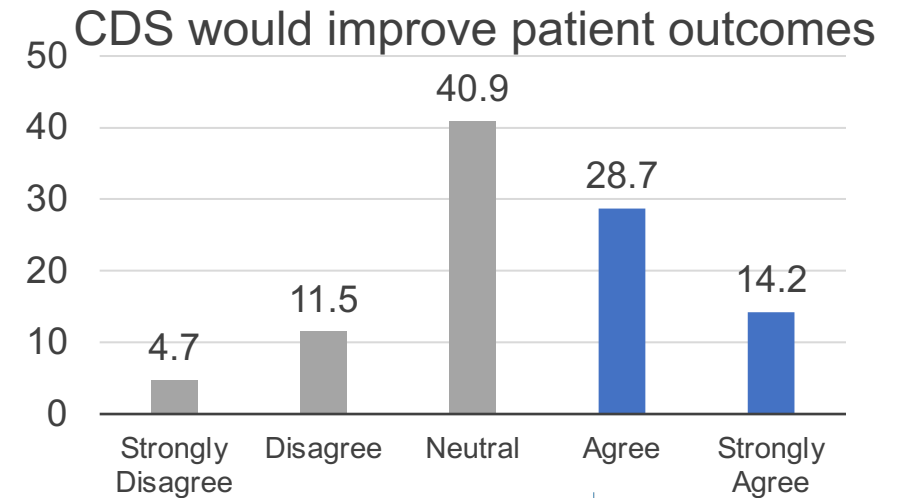
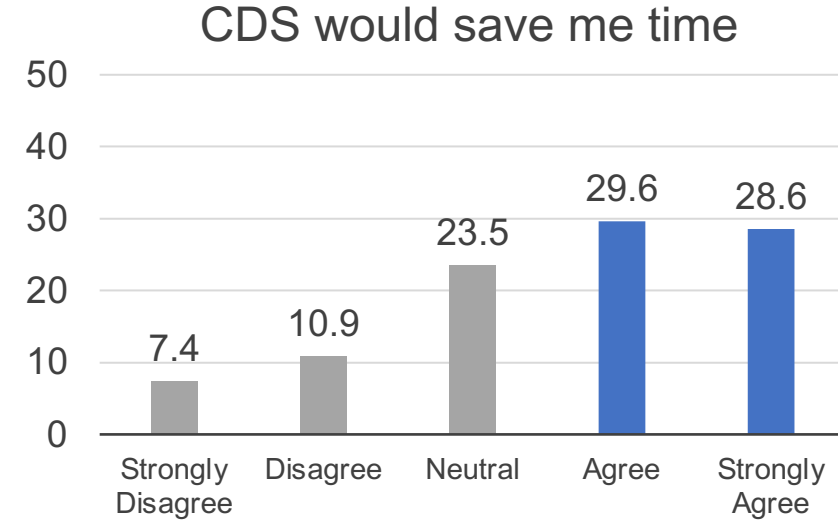
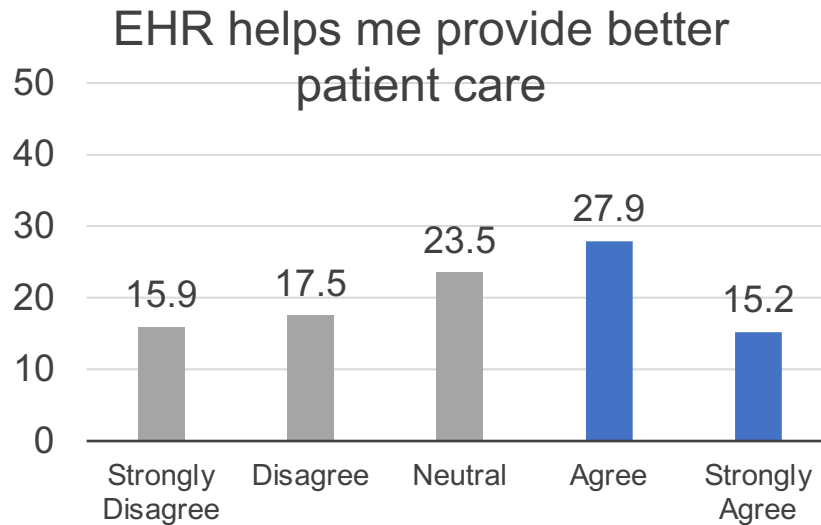
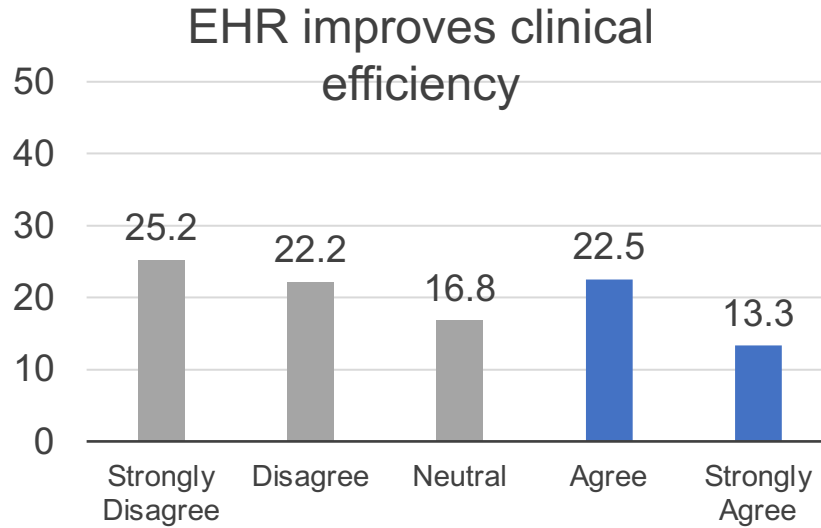
Optimizing Resource Utilization - “If they seem to be healthier than I thought, then I might not err on the side of presenting someone at tumor board”

Safeguarding Patient Safety - “It could improve patient safety. I like to think that I pick up on all the important things, sometimes [I] don't.”

Enhancing the Patient Experience - “[It's] going to enhance the patient experience...gives more realistic expectations for the outcomes.”

Ensuring Equitable Patient Care - “Every patient gets the same exact quality of care...whether I’m seeing 1 or 50...that would be a really big value add.”

Physician Attitudes are Movable



Optimism Conditioned on Design (Format)

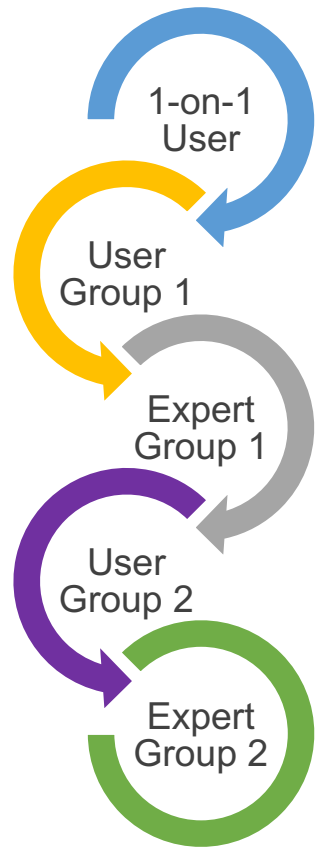
Visual	<ul style="list-style-type: none"> ▪ Single Snapshot, Multi-Dimensional ▪ Infographics and Charts ▪ Gauges, Dials, Icons ▪ Color-Coded Information ▪ Familiarity/Mimics Existing Tools 	
Form/ Function	<u>Usefulness</u> <ul style="list-style-type: none"> ▪ Surgery Specific ▪ Customizable ▪ Finetune/Adjust ▪ Patient-Facing ▪ Depict Trends ▪ Hypothetical Results 	<u>Ease of Use</u> <ul style="list-style-type: none"> ▪ Embedded into EHR ▪ Easy to Locate ▪ Automated ▪ One or Two Clicks ▪ Simple/Intuitive ▪ Interoperability
	<u>General</u> <ul style="list-style-type: none"> ▪ Mortality, Survival, Life Expectancy ▪ Complications ▪ Readmission/Dispo ▪ Functional Status 	<u>Specific</u> <ul style="list-style-type: none"> ▪ Renal Function ▪ Margin Status ▪ Cardiovascular Risk ▪ Key Drivers of Risk



So what's next?

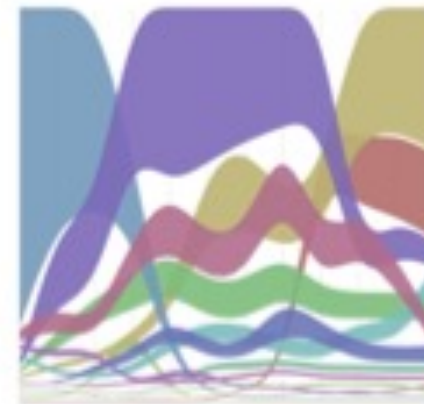
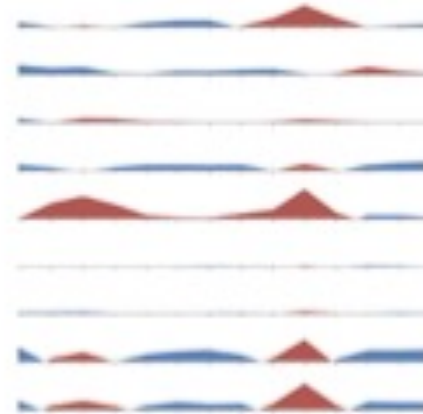
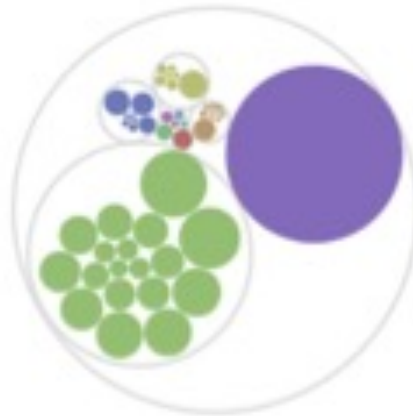
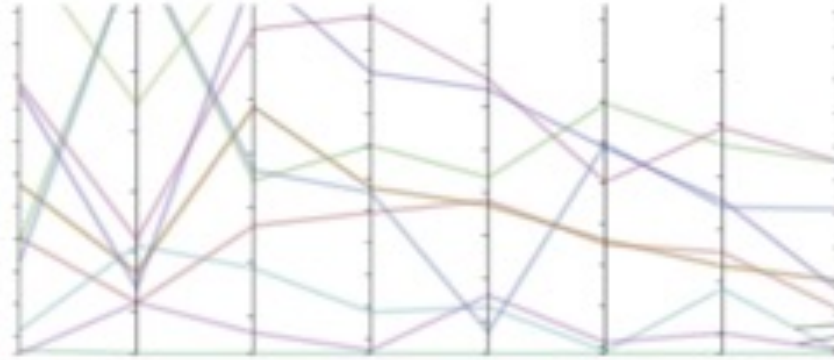
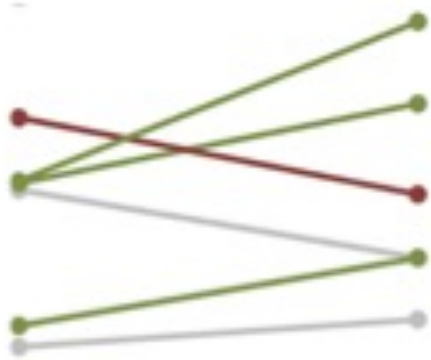
User - Centered - Design

- Iterative
- Systematic
- Consensus
- Diversity



Users as Designers

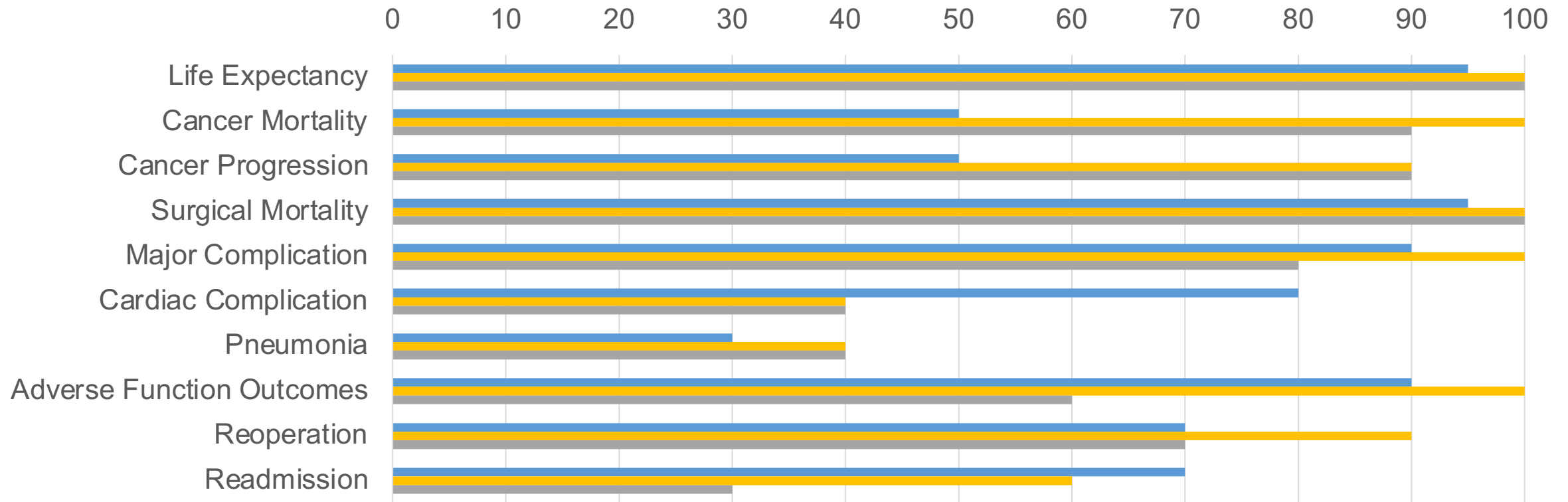
Inspiration - Prioritization - Ideation



Users as Designers

Inspiration - Prioritization - Ideation

On a scale from 0-100, how important is it to include in the visual risk display?

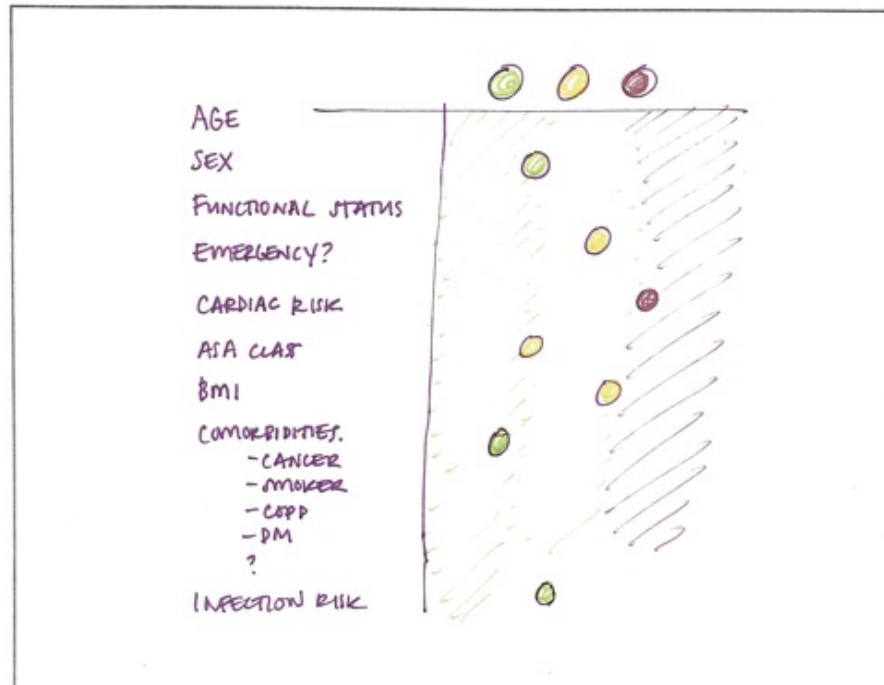


Users as Designers

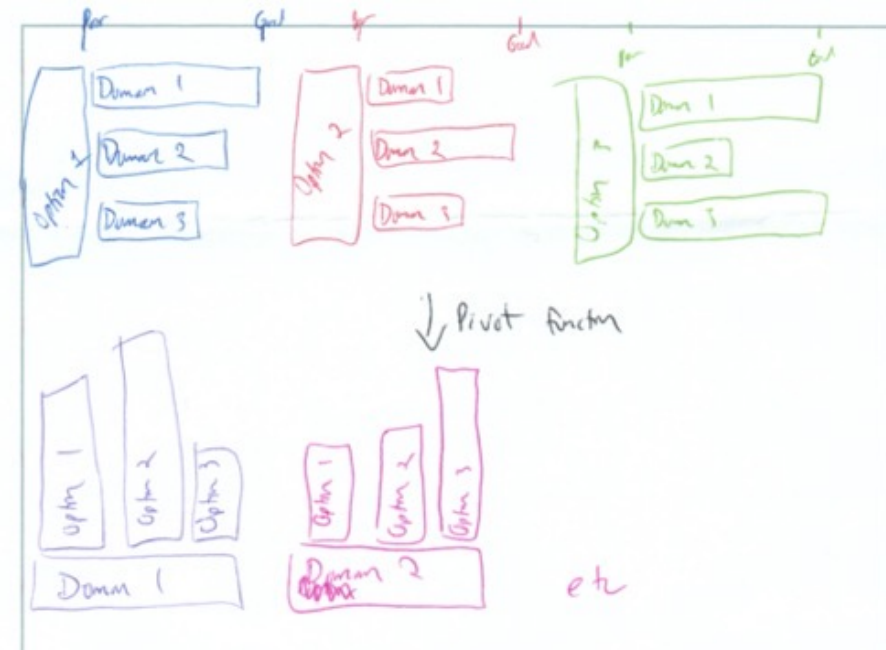
Inspiration - Prioritization - Ideation



USING THE SPACE ON THIS PAPER, DRAW OR WRITE OUT WHAT YOU WOULD LIKE TO SEE IN A VISUAL RISK DISPLAY THAT WOULD HELP YOU MAKE A DECISION ABOUT SURGERY



USING THE SPACE ON THIS PAPER, DRAW OUT A VISUAL TOOL OR DISPLAY THAT WOULD HELP YOU WHEN MAKING A DECISION ABOUT SURGERY



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