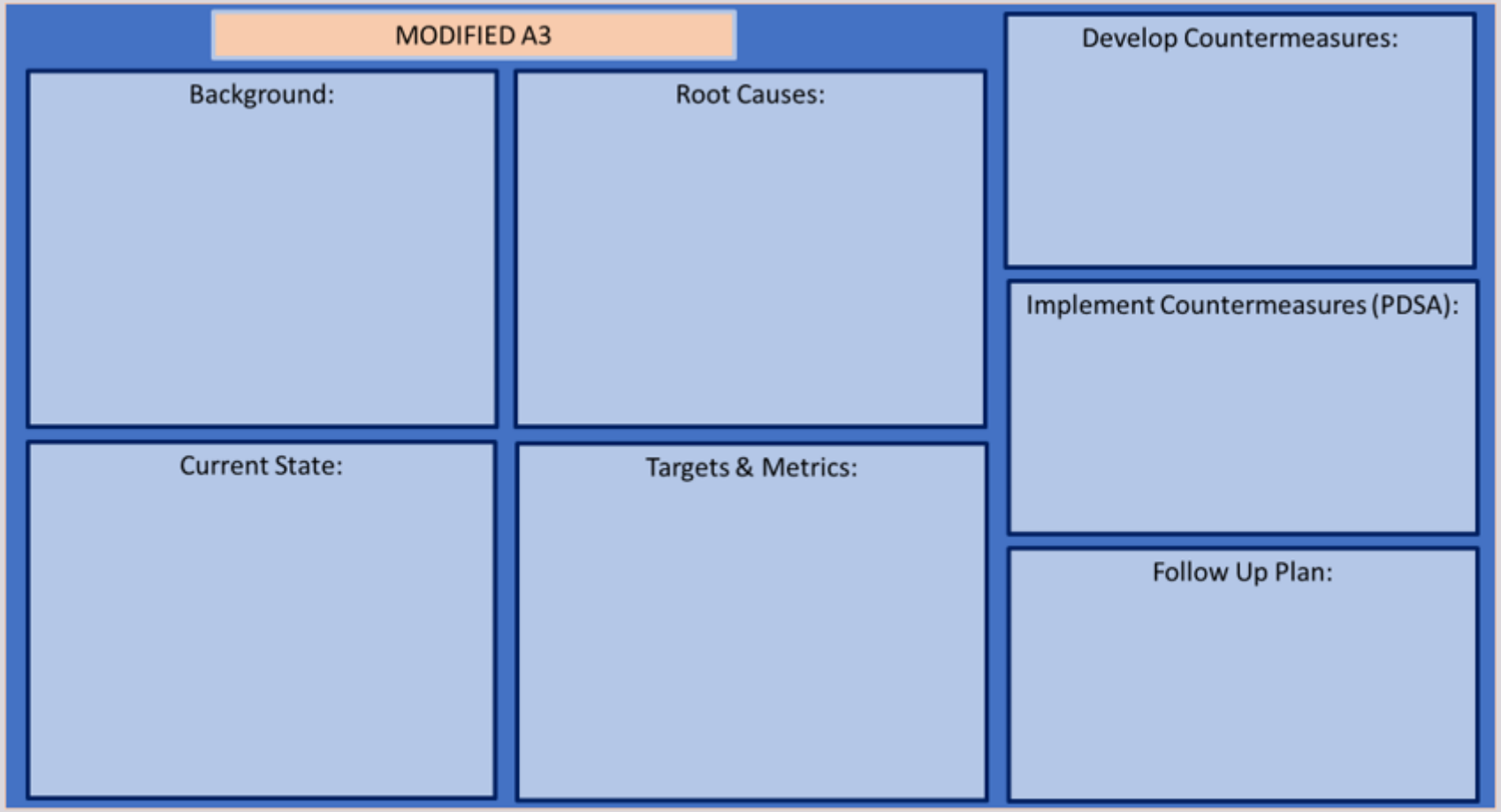
TEACHING IMPROVEMENT SCIENCE (TIS): WEEK 6

Today's Agenda

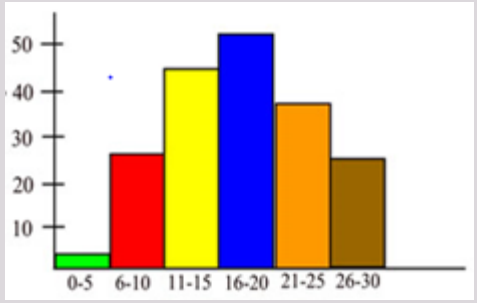
- Recap week 5
- System vs cognitive errors
- Cognitive bias
- Wrap up
- HSPs

TEACH
IMPROVEMENT
SCIENCE
HOME
CURRICULA
FAQ
CONTACT
SIMULATED HEALTH
SYSTEMS SCIENCE
CURRICULA

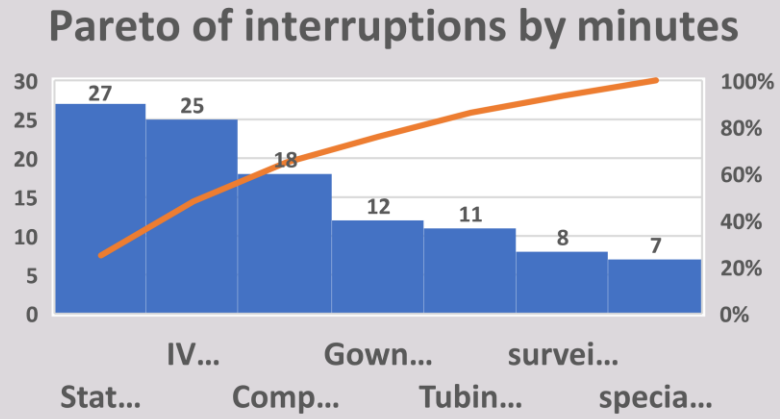

MODIFIED A3
Background:
Root Causes:
Develop Countermeasures:
Implement Countermeasures (PDSA):
Current State:
Targets & Metrics:
Follow Up Plan:

Ways to display data:

Histogram

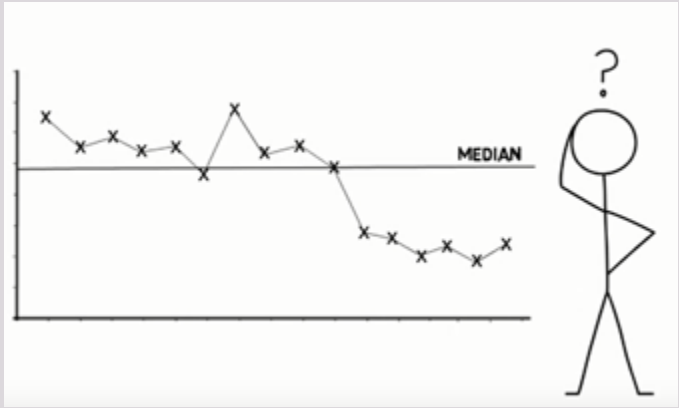


- *Depicts the distribution of a set of data*
- *Use it to see where the majority of values fall*



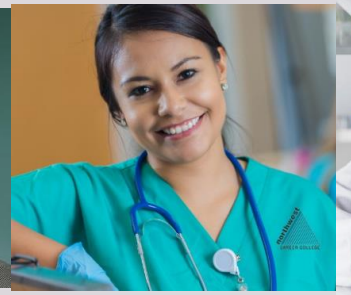
- *A sorted bar graph*
- *Use it when there are many problems or causes and you want to focus on the most significant*

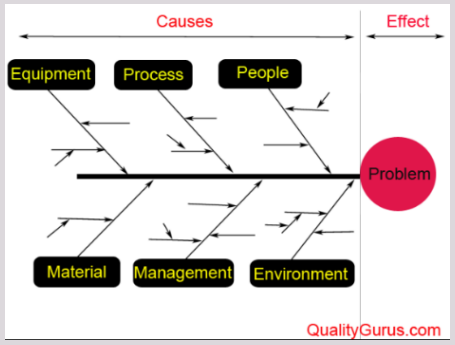
Run chart

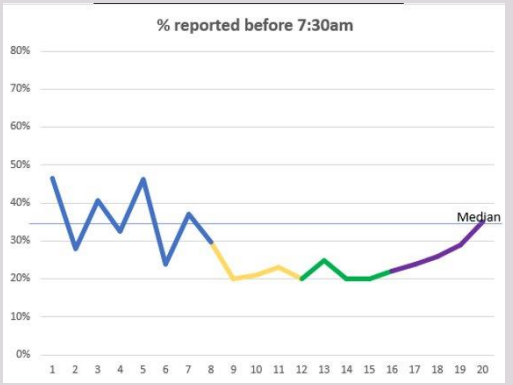


- *A line graph of data plotted over time.*
- *Use it to study observed data for trends or patterns over a specified period*

QI Project Basics







Week	1	2	3	4	5
Dates	8/10- 8/31	9/7- 9/28	10/5- 10/26	11/2-11/23	11/30-12/21
Topic	Systems 1: Intro & Clinical Efficiency	Systems 2: Microsystems & Tools for Improvement	Systems 3: Macrosystems & SDoH	Value-Based Care (+30 min)	Data Science (+30 min)

Week	6	7	8	9	10	11
Dates	1/11-2/1	2/8-3/1	3/8-3/29	4/5-4/26	5/3-5/24	5/31-6/21
Topic	Diagnostic Errors (+60 min)	Systems Errors (RCA) (+60 min)	Teamwork Simulation (+60 min)	Error Disclosure & Second Victim (+60 min)	Narrative Medicine (+60 min)	Present HSPs!

Health System Projects Will Be Completed Across Weeks 4-11

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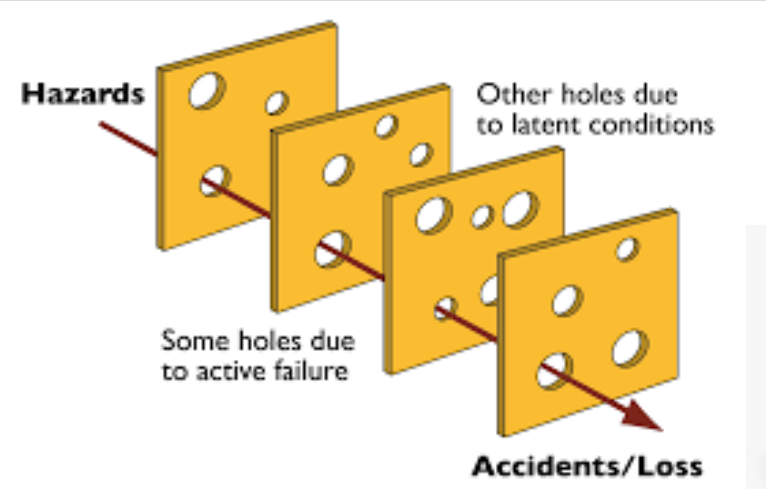
ERRORS

System Errors: Imperfect delivery of a well-chosen care plan



Cognitive Errors: Thinking flaws that lead to an error in diagnosis or treatment plan

No Fault Errors: Atypical presentations or outside the bounds of our collective medical knowledge

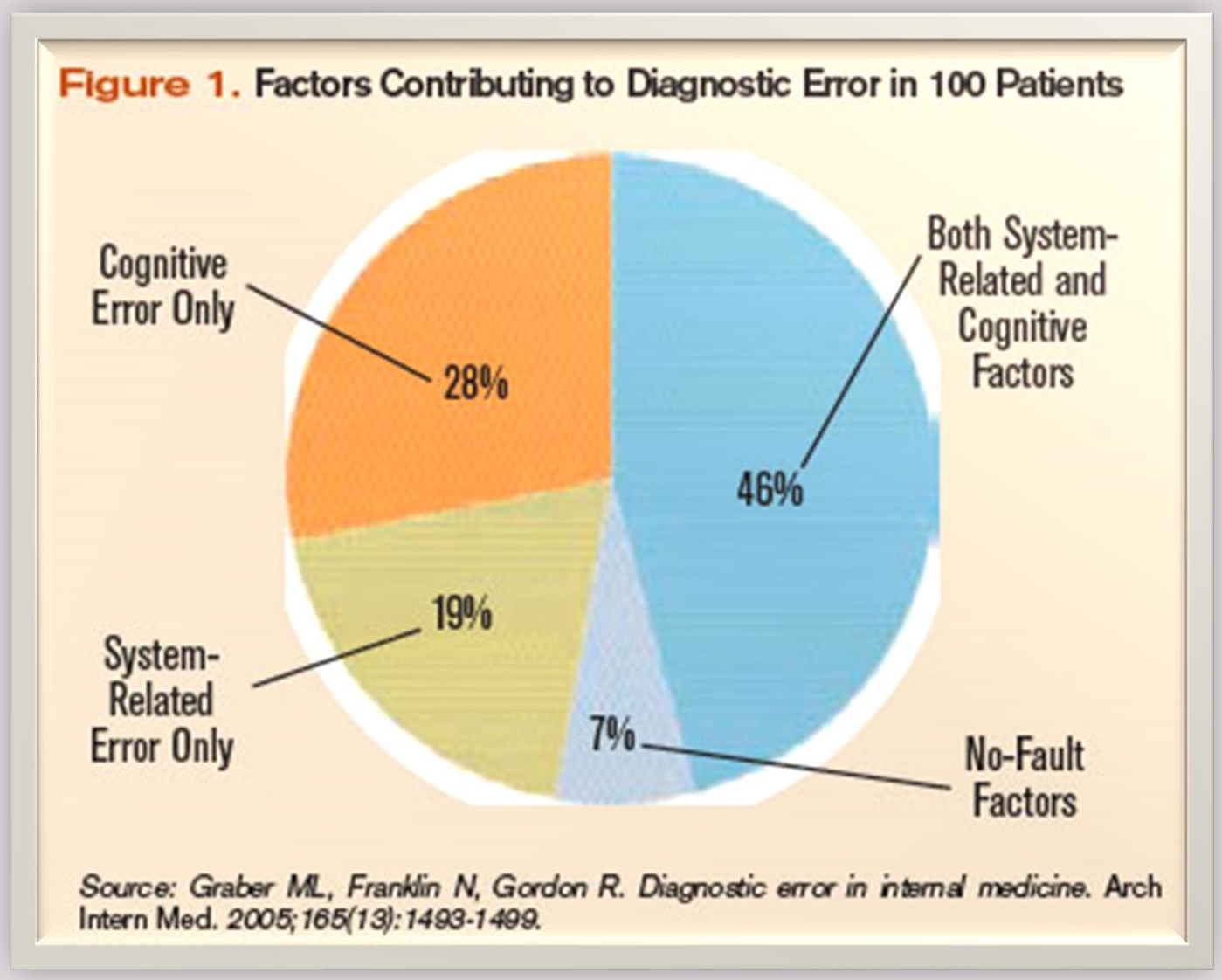


Figure 1. Factors Contributing to Diagnostic Error in 100 Patients
Cognitive Error Only
28%
Both System-Related and Cognitive Factors
46%
System-Related Error Only
19%
7%
No-Fault Factors
Source: Graber ML, Franklin N, Gordon R. Diagnostic error in internal medicine. Arch Intern Med. 2005;165(13):1493-1499.

Diagnostic error in medicine: analysis of 583 physician-reported errors

Comparative Study > Arch Intern Med. 2009 Nov 9;169(20):1881-7.

Types of Errors

- 44% Occur in testing phase
- 32% Clinician assessment
- 10% History taking
- 10% Physical examination
- 3% Referral or consultation errors and delays

Cognitive diagnostic error in internal medicine

Kees van den Berge [a] ✉ Sílvia Mamede [a, b]

European Journal of Internal Medicine

Volume 24, Issue 6, September 2013, Pages 525-529

Scope of diagnostic errors

- Up to 98,000 Americans die annually as a result of medical errors and cost between $17-29 billion annually

Sources of error

- 100 cases of diagnostic error reviewed, typically involved system-related (65%) and cognitive factors (74%)

How can we do better

- Reflective reasoning may counteract bias and seems to improve diagnostic accuracy in complex cases

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DISCLAIMER

- We use case examples for each cognitive bias.
- They are resident cases because they are relatable to you as trainees, and available to us as academic attendings.
- They are **NOT** meant to point blame.
- **Every one of us** has made several diagnostic errors at every stage of our careers (including as attendings).

Confirmation Bias

Cognitive Bias

Bias	Definition
Confirmation	
Authority	
Anchoring	
Availability	

Case: 90 y/o man with HFpEF, COPD on 2L home O2, Afib on warfarin, HTN, and TR who presented to night float c/o SOB. He is a poor historian and hard of hearing. He says he has been feeling SOB for months but worse in the past few days. Feels like he can't move without getting very SOB. He has kyphosis and always uses several pillows. He takes torsemide 80mg daily which was increased from 40mg daily 2 weeks ago and 20 mg daily 2 months ago. He doesn't regularly check his weight. He has been coughing more recently with whitish sputum.

Exam:

Gen: Elderly, frail man laying in bed
JVP: Upper 1/3 of neck
Cardiac: Irregularly irregular, soft SEM heard best at base
Lungs: Few scattered rhonchi, poor air movement
Abd: Soft, NTND
Extremities: 1+ edema to his ankles

Labs: Creatinine 2.5 (baseline 1.9), BUN 50 (baseline 30), K 3.3, Na 146

What do you suspect is going on?

Course Update:

- Night float starts him on 100mg IV Lasix for CHF exacerbation & 40mg prednisone for COPD exacerbation. Morning labs are similar to admission labs.

- Resident in the morning presents patient to the attending as a CHF exacerbation +/- maybe a soft call on a COPD exacerbation. Their plan is another 100mg IV Lasix.

- Attending sees the patient, cancels Lasix, orders a Cardiology consult for **unstable angina**.

Question: What happened?

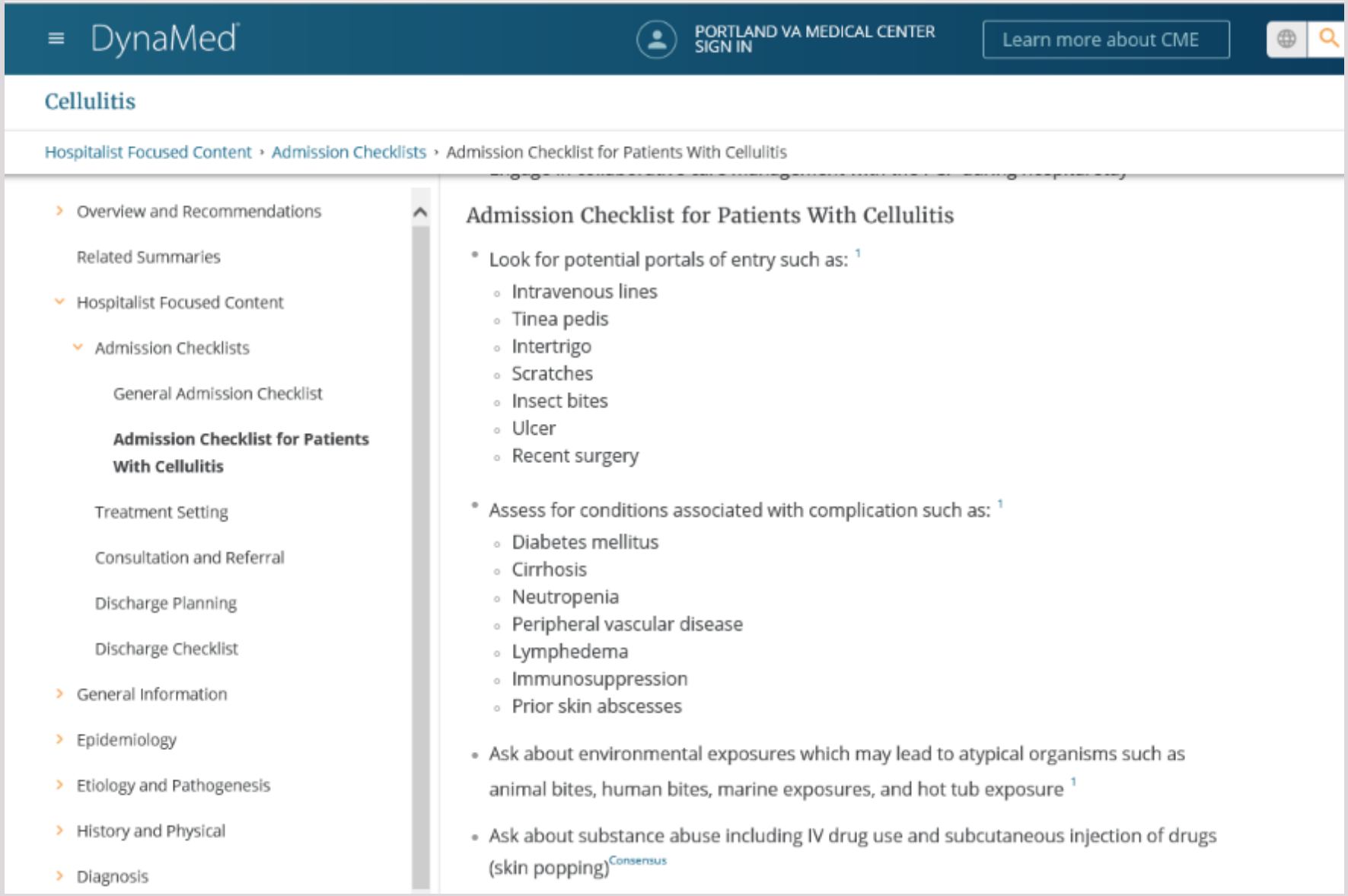
Provoking Situations & Factors for Confirmation Bias

- Pre-drawn conclusions based on sign out
- Lack of differential diagnosis
- Assuming the first diagnosis i e

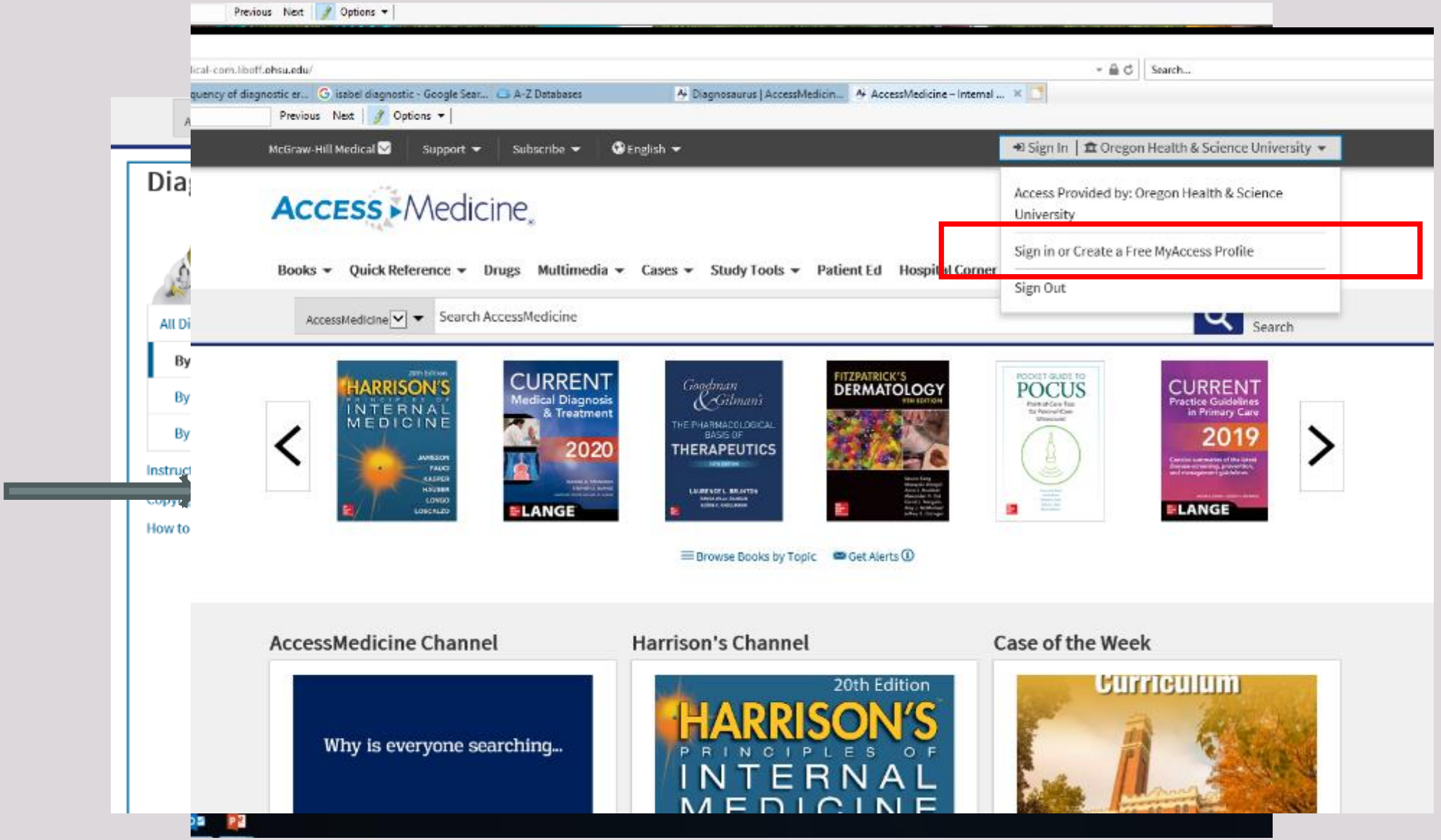
Mitigating Factors for Confirmation Bias

- Explore facts that don't fit into the picture
- Look for items that refute not just confirm a diagnosis
- Make your own differential diagnosis
- Use a diagnostic checklist and see if anything doesn't match

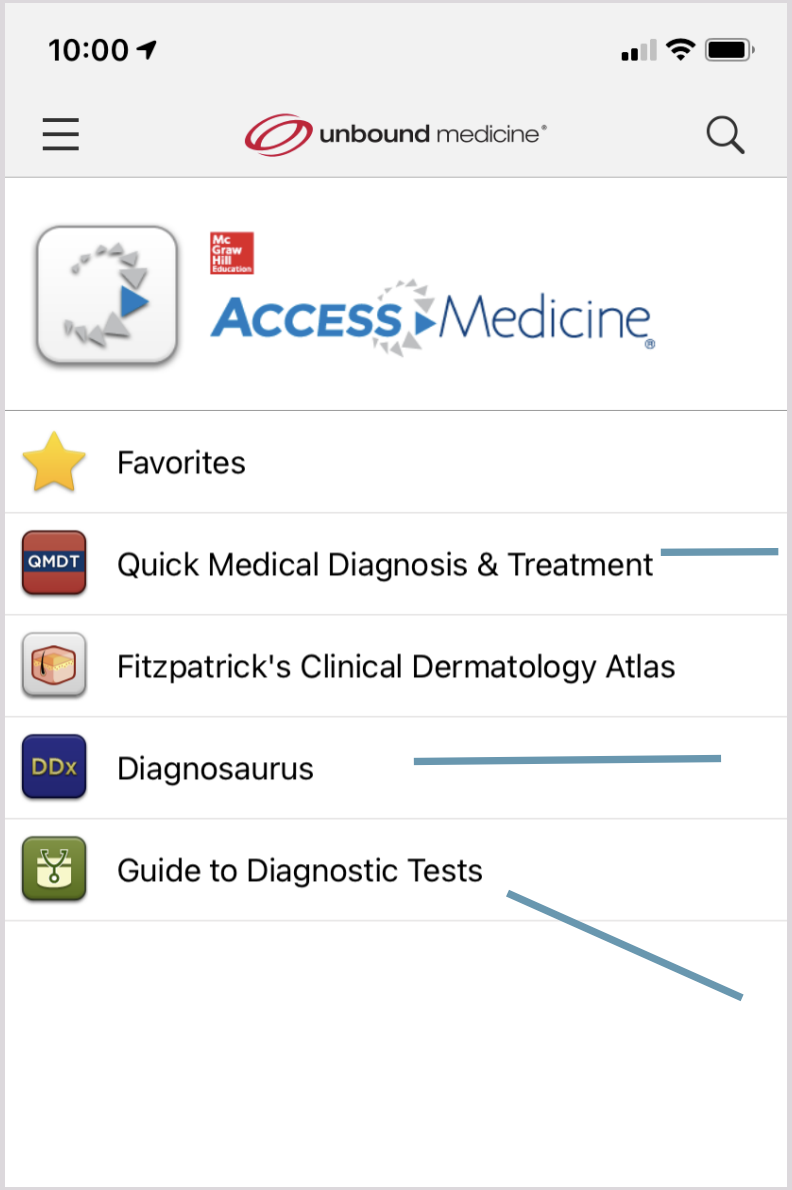
Dynamed Admission Checklist



Access Medicine - DDX Tool



Access Medicine - DDX Tool



Similar to UpToDate
(ie, general information search)

Ddx generator

Basic training and information
on diagnostic testing

Authority Bias

Cognitive Bias

Bias	Definition
Confirmation	Tendency to seek/focus on data to confirm, not refute, the hypothesis
Authority	
Anchoring	
Availability	

Case: 66 y/o woman w/tonsillar SCC on palliative chemotherapy with newly diagnosed mets to her left lung presents with cough, SOB and fever concerning for post-obstructive PNA. Bronchoscopy performed on hospital day 1 (HD1) showed exophytic infiltration into the L bronchus and distal L mainstem. Initially managed on amp/sulbactam, but on HD3 she becomes increasingly hypoxemic and spikes fever to 101.5 and Abx are broadened to Zosyn to include Enterobacter and Pseudomonas. Pt stabilizes and is narrowed to Augmentin on HD5 but spikes a fever that evening to 100.9 and is re-broadened to Zosyn by night team. You pick up the service on HD6.

Exam:

Gen: Elderly, appears old than stated age, breathing comfortably on RA
Cardiac: RRR no murmurs rub or gallops
Lungs: Course breath sounds with rhonchi and crackles in LUL.
Abd: Soft, NT, ND

Labs: WBC is 2.3 (ANC 1000) labs otherwise normal

Imaging: Worsening obstructive change of the left lung, now including portions of the lingula and left upper lobe with marked narrowing of the left mainstem bronchus caused by tumor invasion.

She has felt well for past 2 days despite a single fever on HD5, and she really wants to discharge. She has also been off supplemental oxygen X2 days.

- **Question:** What antibiotic do you cover her with on discharge?

Next Steps: As the resident you are convinced she needs Pseudomonal coverage (the fever spikes when antibiotics were narrowed were not coincidental). You read online and confirm that levofloxacin/ciprofloxacin have good Pseudomonal coverage, but moxifloxacin does *not*. You call the ID attending who says to discharge on Moxifloxacin if you want to cover Pseudomonas and anaerobes with a single drug.

It's time to round and your attending asks your plan… You swallow hard and say moxifloxacin, while cringing to yourself.

Provoking Situations & Factors for Authority Bias

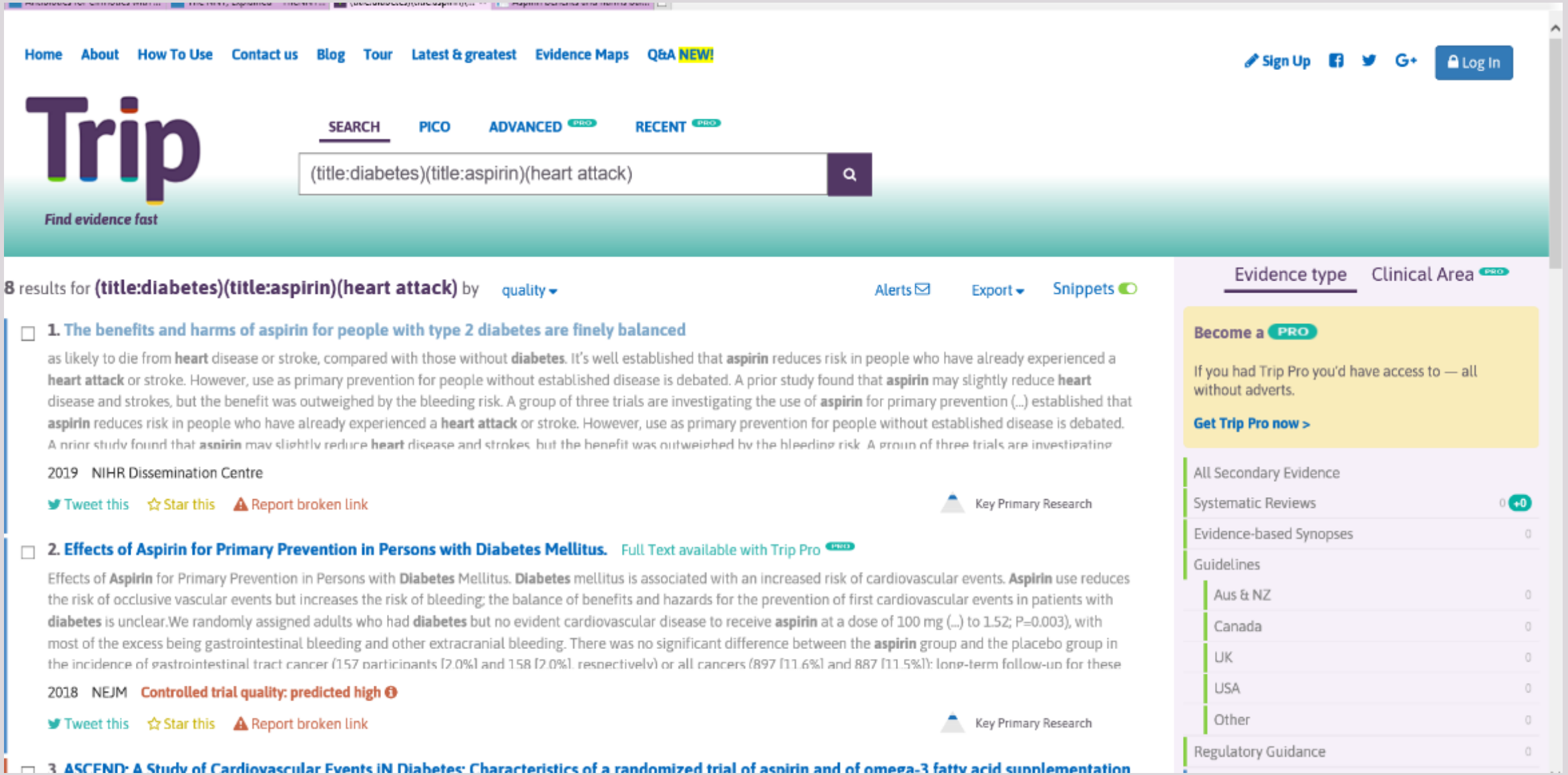
- Rare conditions
- Multiple consultants, attendings, etc.
- Perceived knowledge deficit co… …hority

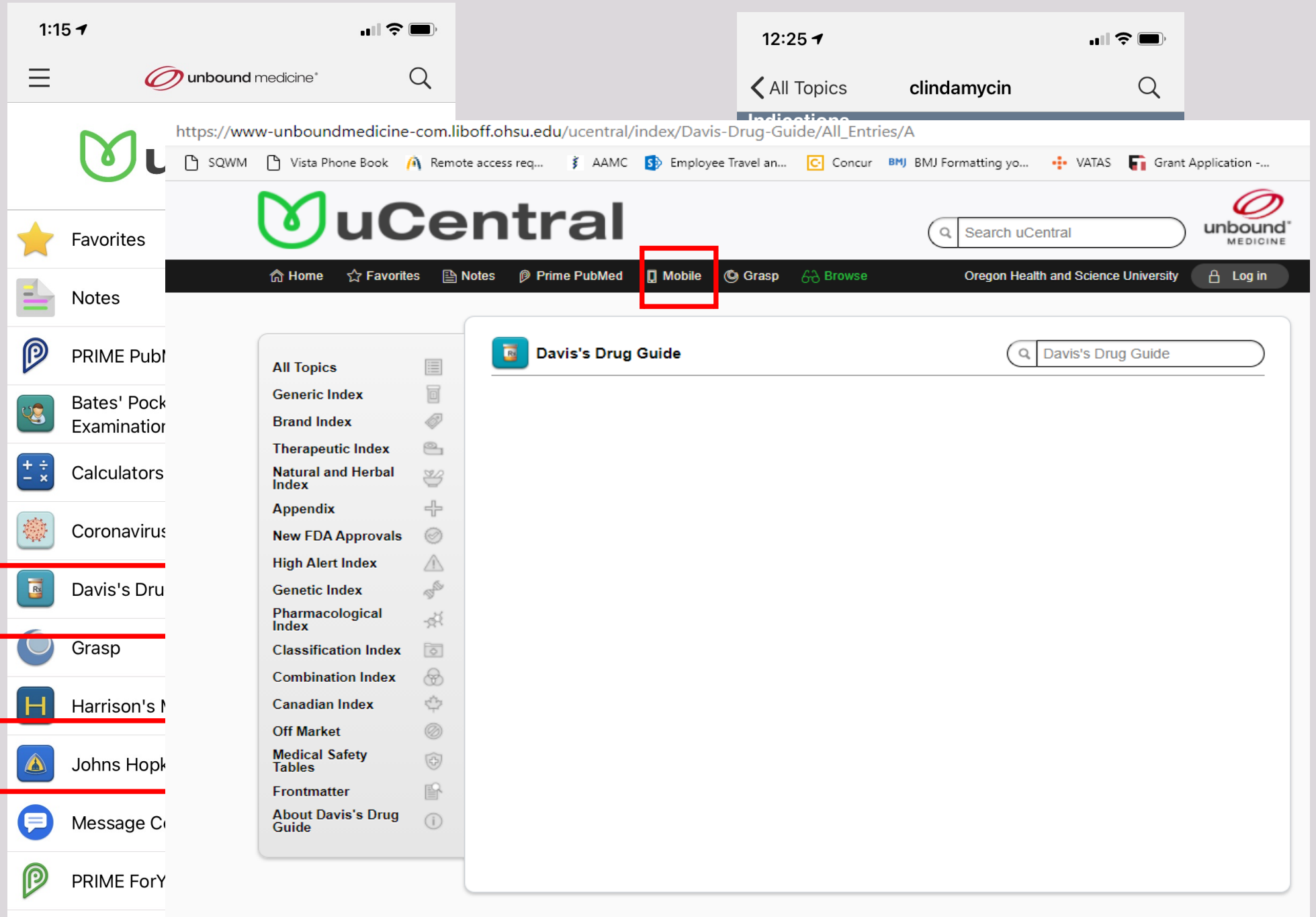
WHY??

Mitigating Factors for Authority Bias

- Independent or ‘in-parallel’ evaluation
- Face-to-face colloquy with consultants
- “I’m still worried about X, can you walk me through your thinking?”
- Gather your own treatment facts

Tripdatabase.com

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Remote access req...
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BMJ Formatting yo...
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Oregon Health and Science University
Log in
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New FDA Approvals
High Alert Index
Genetic Index
Pharmacological Index
Classification Index
Combination Index
Canadian Index
Off Market
Medical Safety Tables
Frontmatter
About Davis's Drug Guide
Davis's Drug Guide
Davis's Drug Guide

Stanford Antibiogram

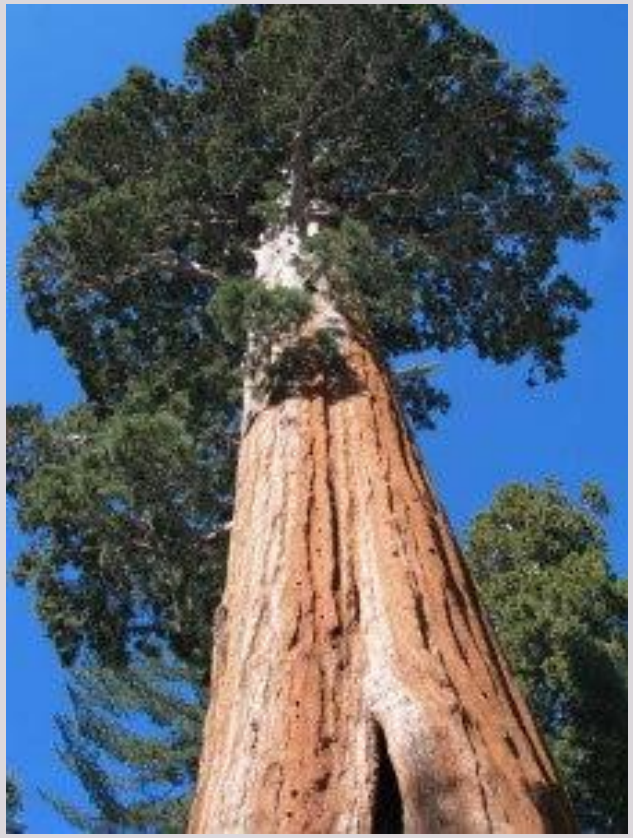
Step 2	Organism		Antimicrobial	
Select Organism Groups of Interest (Optional) elect Antimicrobial Subsets, e.g., "Oral Available"	☐ Gram Positive ☐ Gram Positive Cocci in Pairs / Chains ☐ Gram Positive Cocci in Clusters ☐ Gram Positive Cocci in Clusters, Coagulase Negative ☐ Gram Positive Rods ☐ Gram Negative ☐ Gram Negative (Diplo)Cocci ☐ Gram Negative Rods, Lactose Fermenting	☐ Gram Negative Rods, Non-Lactose Fermenting ☐ Gram Negative Rods, Non-Fermenting ☐ Atypical ☐ Anaerobe ☐ Fungal (Yeast) ☐ Fungal (Mold) ☐ Fungal (Dimorphic)	☐ Oral Available ☐ Penicillin ☐ Anti-Staphylococcal Penicillin ☐ Amino-Penicillin ☐ Anti-Pseudomonal Penicillin ☐ Carbapenem ☐ Monobactam ☐ Cephalosporin (IV) Gen 1 ☐ Cephalosporin (IV) Gen 2 ☐ Cephalosporin (IV) Gen 3+ ☐ Cephalosporin (PO) Gen 1 ☐ Cephalosporin (PO) Gen 2 ☐ Cephalosporin (PO) Gen 3	☐ Fluoroquinolone ☐ Aminoglycoside ☐ Protein Synthesis Inhibitor ☐ Macrolide ☐ Ketolide ☐ Doxycycline ☐ Glycylcycline ☐ Glycopeptide ☐ Anti-Metabolite ☐ Urinary Tract ☐ Miscellaneous ☐ Anti-Fungal

Step 3	Available		Selected (Clear)	Available		Selected (Clear)
(Optional) omize List of Selected Organisms and Antimicrobials	Proteus vulgaris Pseudomonas aeruginosa Pseudomonas aeruginosa CF mucoid Pseudomonas aeruginosa CF non-mucoid Salmonella Serratia marcescens Staphylococcus aureus (MRSA) Staphylococcus aureus (MSSA) Staphylococcus aureus (all) Staphylococcus lugdunensis Staphylococcus, Coagulase Negative (epid	(+) (-)	Pseudomonas aerugi	Amikacin Amphotericin B Ampicillin-Sulbactam Ampicillin/Amoxicillin Aztreonam Caspofungin Cefazolin Cefepime Ceftazidime Ceftolozane-Tazobactam	(+) (-)	Amikacin Amphotericin B Ampicillin-Sulbactam Ampicillin/Amoxicillin Aztreonam Caspofungin Cefazolin Cefepime Ceftazidime Ceftolozane-Tazobact

Step 4 Generate Table	Generate Sensitivity Table

Microbe	Isolates Tested	ALL DRUGS	Amikacin	Aztreonam	Cefepime	Ciprofloxacin	Gentamicin	Imipenem	Levofloxacin	Meropenem	Piperacillin-Tazobactam	Tobramycin
ALL BUGS	580	98	97	86	92	89	91	88	85	91	93	98
Pseudomonas aeruginosa	580	98	97	86	92	89	91	88	85	91	93	98

BREAK



TALLEST REDWOOD EXERCISE

Cognitive Bias

Bias	Definition
Confirmation	Tendency to seek/focus on data to confirm, not refute, the hypothesis
Authority	Tendency to stop thinking when confronted with authority (a person or an objective test)
Anchoring	
Availability	

Case: 70 y/o man with new Dx of HFrEF <30% (probable NICM) and COPD on 2L home O2 who is transferred from CCU for ongoing management of acute hypoxemic respiratory failure. He was previously at CLC following admitted for ADHF. While on the floor being diuresed, his platelets start to drop over a few days from 190 →70. He is on heparin for DVT prophylaxis.

What do you suspect is going on?

Course Update: The team is not initially sure that HIT is likely, but eventually decides to test for HIT. 2 days later his HIT Ab (ELISA) results positive. He is also transferred to the ICU with sepsis and PNA. He has no clinical signs or symptoms of clotting.

Now what do you suspect is going on?

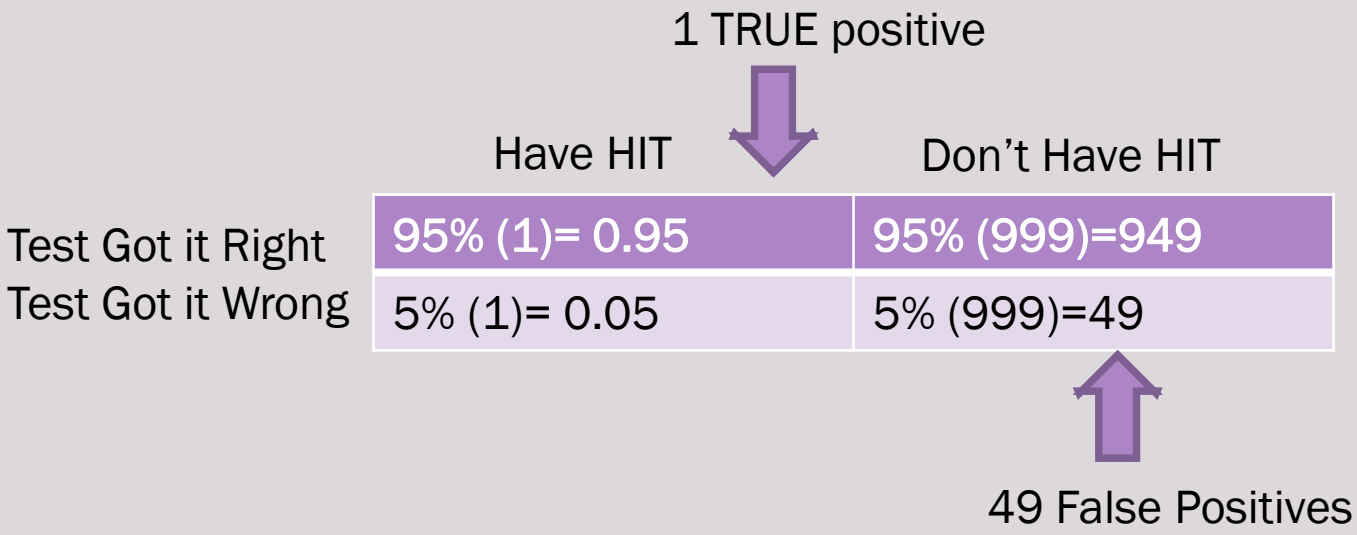
Question: Since the HIT Ab was positive, it has to be HIT, right? Should heparin be added to his allergy list? Does he need argatroban?

Test Characteristics:

- <0.1% base rate of HIT with heparin Ppx
- 95% sensitivity/specificity for the HIT Elisa

Population: 1000 patients on heparin Ppx

Question: How reliably will HIT Elisa diagnose HIT in this population?



Test Characteristics:

- 10% base rate of HIT if you have a Warkentin 4Ts = 4
- 95% sensitivity/specificity for the HIT Elisa.

Population: 1000 patients positive 4Ts

Question: How reliably will HIT Elisa diagnose HIT in this population?

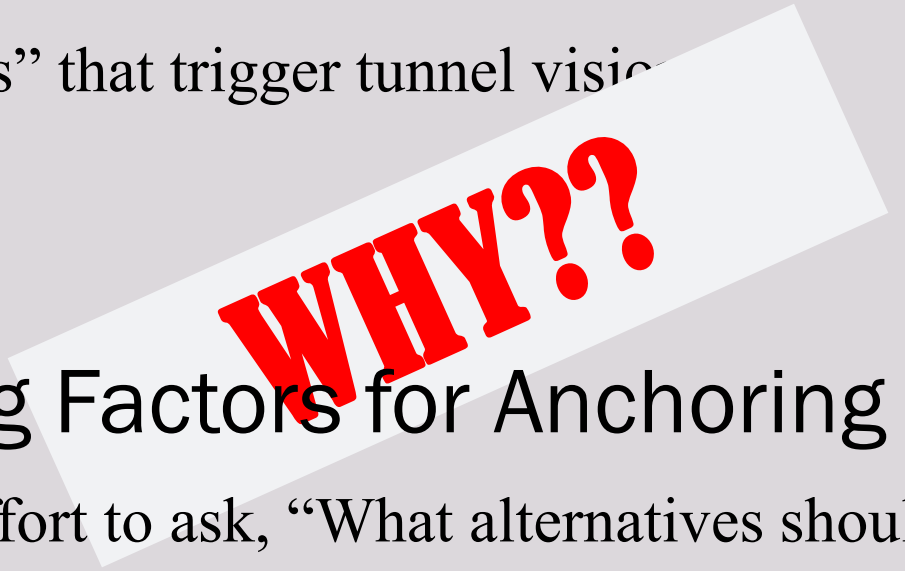
95 TRUE positive

	Have HIT	Don't Have HIT
Test Got it Right	95% (100) = 95	95% (900) = 855
Test Got it Wrong	5% (100) = 5	5% (900) = 45

45 False Positives

Provoking Situations & Factors for Anchoring

- Too little understanding of test operating characteristics
- Multiple admissions/visits for a particular problem
- Transfer patients with ‘known’ diagnoses
- “Key words” that trigger tunnel visi



Mitigating Factors for Anchoring

•Conscious effort to ask, “What alternatives should be considered?”

•Use a differential tool like “Access Medicine” available at OHSU

•Understand diagnostic test characteristics

Heparin-induced thrombocytopenia

View PDF

OVERVIEW	THEORY	DIAGNOSIS	MANAGEMENT	FOLLOW UP	RESOURCES
Summary	Epidemiology	Approach	Approach	Monitoring	Guidelines
	Etiology	History and exam	Treatment algorithm	Complications	Images and videos
	Case history	Investigations	Emerging	Prognosis	References
		Differentials	Prevention		Evidence
		Criteria	Patient discussions		
		Screening			

Investigations

1st investigations to order

VIEW ALL

CBC

Investigations to consider

VIEW ALL

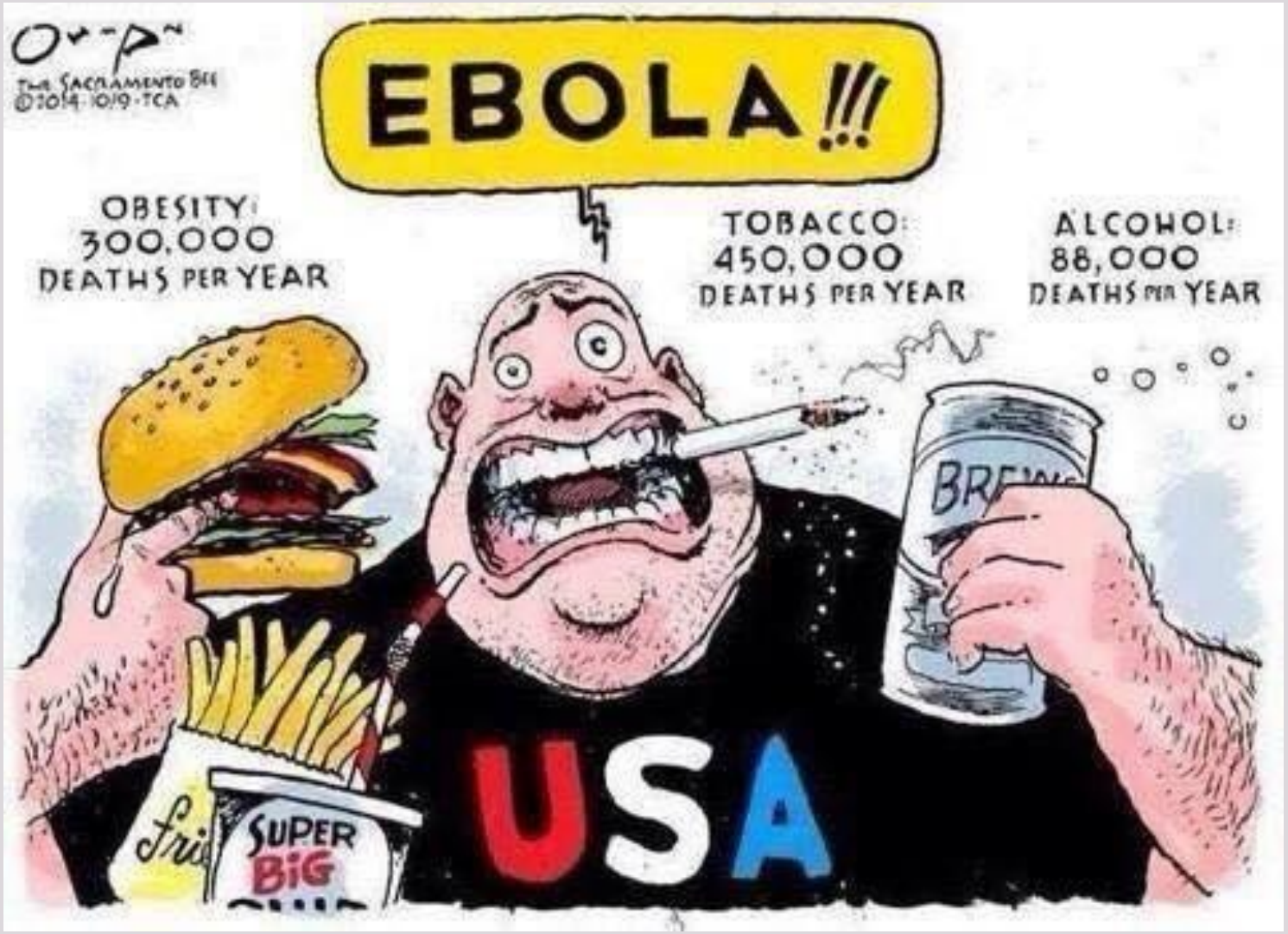
Warkentin (4Ts) Probability Scale

TEST	RESULT
The 4Ts score is commonly used to predict the clinical probability of HIT.[35][36] The American Society of Hematology recommends the 4Ts probability scale over other tools.[37]	score of 6-8 indicates high clinical suspicion for HIT; score of 4-5 indicates intermediate clinical suspicion for HIT; score of 0-3 indicates low clinical suspicion for HIT
Points from 0-2 are given for 4 categories: magnitude of Thrombocytopenia, Timing of onset of platelet fall (or other sequelae of	

Cognitive Bias

Bias	Definition
Confirmation	Tendency to seek/focus on data to confirm, not refute, the hypothesis
Authority	Tendency to stop thinking when confronted with authority (a person or an objective test)
Anchoring	Tendency to lock onto salient features in the initial presentation too early in the diagnostic process and failing to adjust later
Availability	

Availability Bias



Case: 67 y/o M with PMHX of BPH and LBP presents to VA clinic to establish care. During his visit he c/o 2 days of **chest pain**.

Have you ever encountered a patient at the VA where you were concerned about coronary artery disease?

Can someone tell me a brief story about one of their patients from the last 2-3 months? Especially if a diagnosis of CAD/ACS was delayed or missed?

Remember, our brains use a shortcut that if something can be recalled, it must be important. And we are inherently biased towards recently acquired information.

Case: 67 y/o M with PMHX of BPH and LBP presents to VA clinic to establish care. During his visit he c/o 2 days of **chest pain**, without radiation, that is "**sharp and stabby**" but also **burning in nature**. It has been waxing and waning over 2 days, it is not exertional, and started while watching the evening news after a spicy dinner. He notes some *mild nausea* associated. He *has not had a similar pain before and has no history of CAD*. He thinks he is having a heart attack.

Social hx: Never smoker, never drinker, lives with wife, worked as a mail man and just retired 3 months ago
Family hx: No family hx of CAD

Exam:

Vitals: BP 110/70 and *HR 70* without orthostatic changes, afebrile
Gen: Lying in bed in NAD, speaking full sentences, appears fit and healthy
Neck: JVP in clavicular fossa at 90 degrees
Cardiac: **RRR no m/r/g**
Lungs: CTAB
Abd: Soft abdomen, no organomegaly, + BS, **mild TTP in epigastrium**,
Extremities: Trace edema at ankles

Based on the focused information above, what might be going on?
Do you feel reassured, or do you think about your recent patient who had serious CAD?

Initial A/P from clinic:

Chest pain:

- No prior angio/stress test in our system
- EKG in clinic is unremarkable w/o e/o ischemia
- Refer to ED for further work up & admission for ACS work up

ED Course:

-Troponin x2 WNL

-EKG WNL

-CBC, BMP, BNP WNL

-Admitted for a stress test *(you argue to the ED that his HEART score is 2, purely driven by age > 65, so he has a ~1% risk of major adverse cardiac event, and in the HEART Score study this patient would be safe for early discharge.. But you lose.)*

Admission Course:

-CMP ordered shows AST/ALT in 200s, alk phos 215, tbili 5.7

-F/u RUQ US shows biliary dilation

Provoking Factors for Availability Bias

- Recent exposure to a disease (over diagnosis, e.g. CAD at the VA)
- No recent exposure to a disease (under diagnosis)
- Working in niche practices where [illegible] e "zebras"

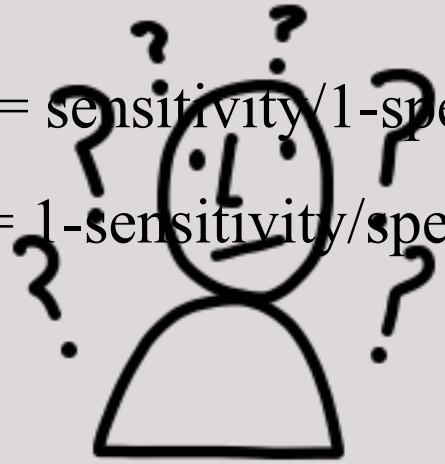
WHY??

Mitigating Factors for Availability Bias

- Know the predictive value of history & exam findings
- Question if you are seeing too many or too few zebras
- Applying Bayesian reasoning

Understanding the Likelihood Ratio

- Likelihood Ratio tell us…
  - How much a test alters our pre-test probability to generate the post-test probability (our updated prediction of likelihood of disease)



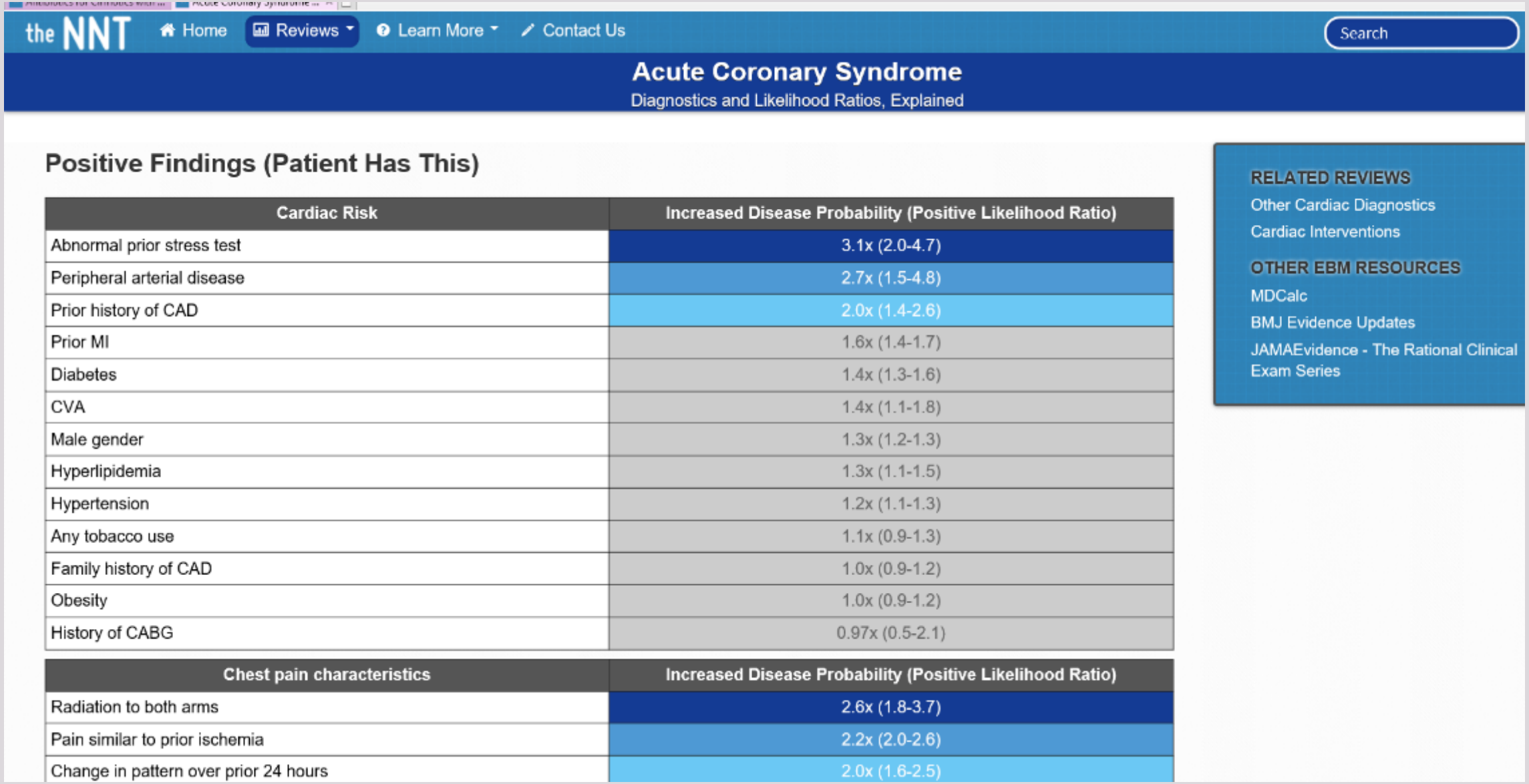
LR+ = sensitivity/1-specificity

LR- = 1-sensitivity/specificity

1. Inherent characteristic of the test itself
2. Does not change with population prevalence

https://www.uws.edu/wp-content/uploads/2013/10/Likelihood_Ratios.pdf

theNNT.com



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Acute Coronary Syndrome

Diagnostics and Likelihood Ratios, Explained

Positive Findings (Patient Has This)

Cardiac Risk	Increased Disease Probability (Positive Likelihood Ratio)
Abnormal prior stress test	3.1x (2.0-4.7)
Peripheral arterial disease	2.7x (1.5-4.8)
Prior history of CAD	2.0x (1.4-2.6)
Prior MI	1.6x (1.4-1.7)
Diabetes	1.4x (1.3-1.6)
CVA	1.4x (1.1-1.8)
Male gender	1.3x (1.2-1.3)
Hyperlipidemia	1.3x (1.1-1.5)
Hypertension	1.2x (1.1-1.3)
Any tobacco use	1.1x (0.9-1.3)
Family history of CAD	1.0x (0.9-1.2)
Obesity	1.0x (0.9-1.2)
History of CABG	0.97x (0.5-2.1)

Chest pain characteristics	Increased Disease Probability (Positive Likelihood Ratio)
Radiation to both arms	2.6x (1.8-3.7)
Pain similar to prior ischemia	2.2x (2.0-2.6)
Change in pattern over prior 24 hours	2.0x (1.6-2.5)

RELATED REVIEWS

Other Cardiac Diagnostics

Cardiac Interventions

OTHER EBM RESOURCES

MDCalc

BMJ Evidence Updates

JAMAEvidence - The Rational Clinical Exam Series

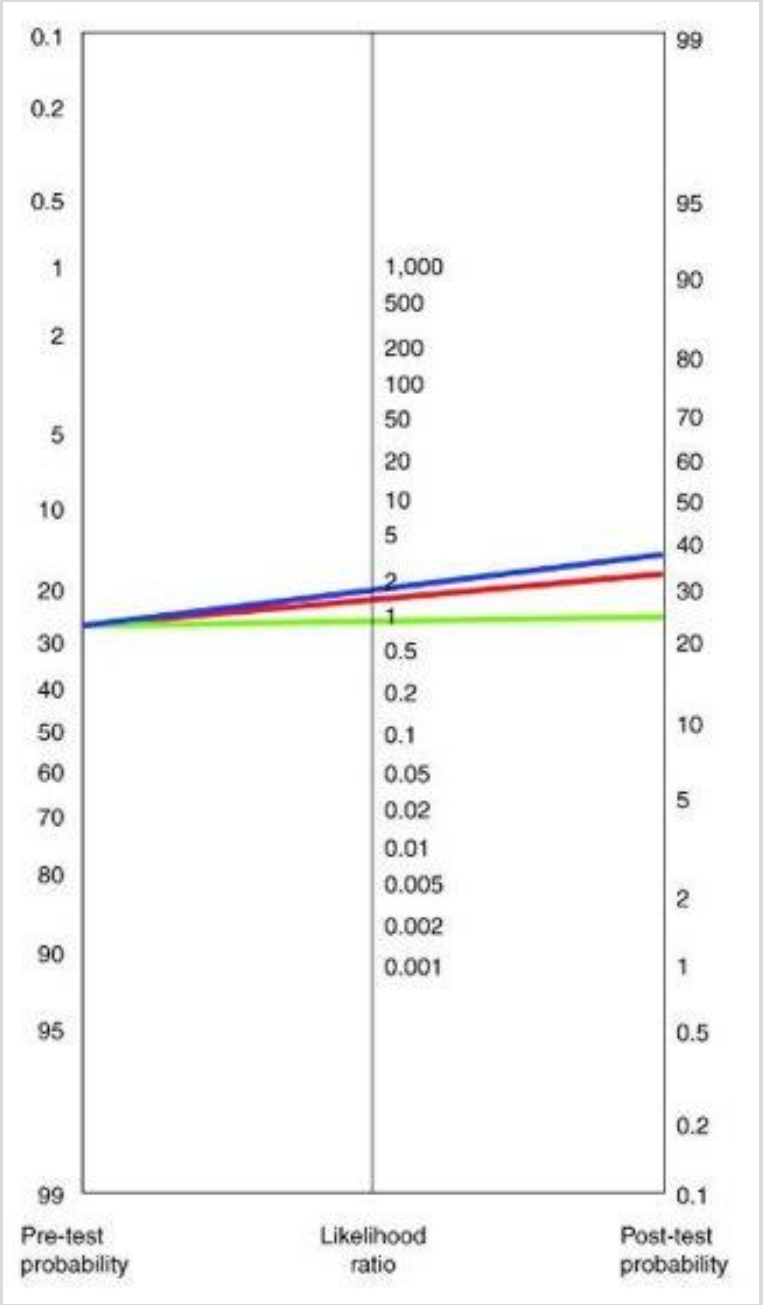
A relatively high likelihood ratio of **10** or greater will result in a large and significant increase in the probability of a disease, given a positive test.

A LR of **5** will moderately increase the probability of a disease, given a positive test.

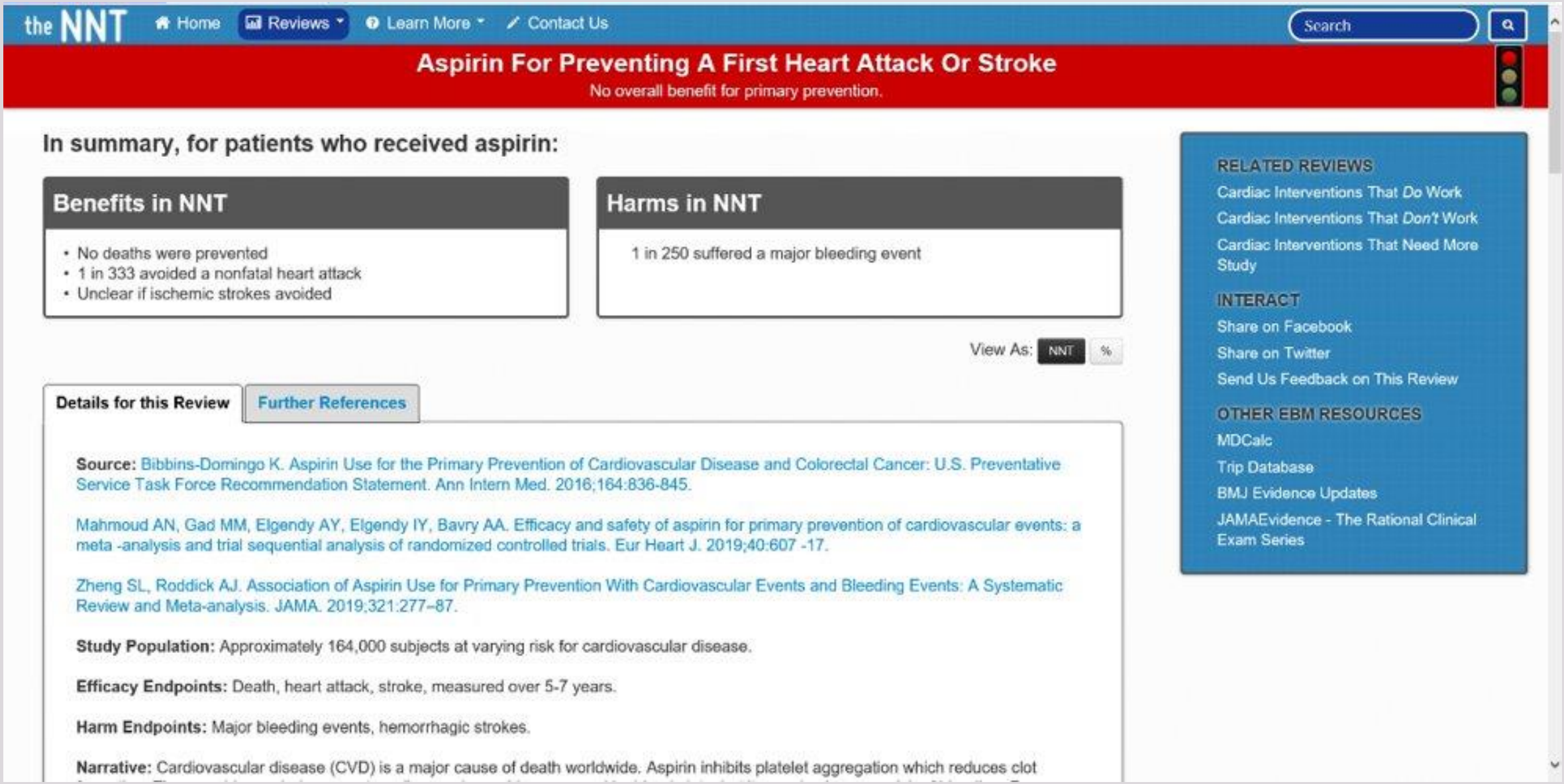
A LR of **2** only increases the probability a *small amount*.

A relatively low likelihood ratio (0.1) will significantly decrease the probability of a disease, given a negative test.

A LR of 1.0 means that the test is not capable of changing the post-test probability either up or down and so the test is not worth doing!



This is only true between 10-90% if you fall into the extreme of <10% of >90% this scale becomes inaccurate


the NNT
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Aspirin For Preventing A First Heart Attack Or Stroke
No overall benefit for primary prevention.
In summary, for patients who received aspirin:
Benefits in NNT
• No deaths were prevented
• 1 in 333 avoided a nonfatal heart attack
• Unclear if ischemic strokes avoided
Harms in NNT
1 in 250 suffered a major bleeding event
View As: NNT %
Details for this Review
Further References
Source: Bibbins-Domingo K. Aspirin Use for the Primary Prevention of Cardiovascular Disease and Colorectal Cancer: U.S. Preventative Service Task Force Recommendation Statement. Ann Intern Med. 2016;164:836-845.
Mahmoud AN, Gad MM, Elgendy AY, Elgendy IY, Bavry AA. Efficacy and safety of aspirin for primary prevention of cardiovascular events: a meta -analysis and trial sequential analysis of randomized controlled trials. Eur Heart J. 2019;40:607 -17.
Zheng SL, Roddick AJ. Association of Aspirin Use for Primary Prevention With Cardiovascular Events and Bleeding Events: A Systematic Review and Meta-analysis. JAMA. 2019;321:277–87.
Study Population: Approximately 164,000 subjects at varying risk for cardiovascular disease.
Efficacy Endpoints: Death, heart attack, stroke, measured over 5-7 years.
Harm Endpoints: Major bleeding events, hemorrhagic strokes.
Narrative: Cardiovascular disease (CVD) is a major cause of death worldwide. Aspirin inhibits platelet aggregation which reduces clot
RELATED REVIEWS
Cardiac Interventions That Do Work
Cardiac Interventions That Don't Work
Cardiac Interventions That Need More Study
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OTHER EBM RESOURCES
MDCalc
Trip Database
BMJ Evidence Updates
JAMAEvidence - The Rational Clinical Exam Series

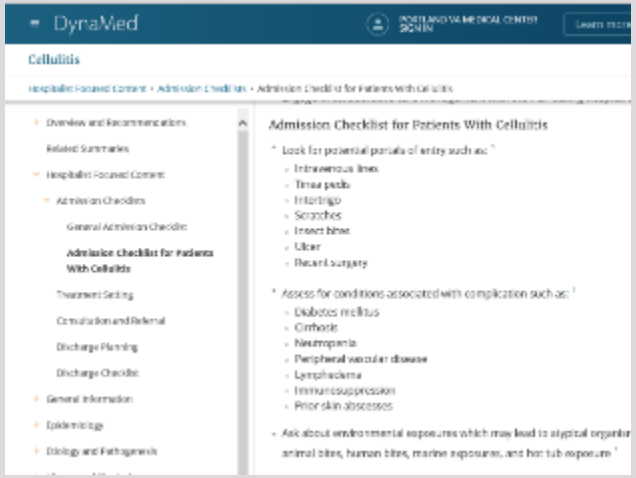
Today's Agenda

- Recap week 5
- System vs cognitive errors
- Cognitive bias
- **Wrap up**
- HSPs

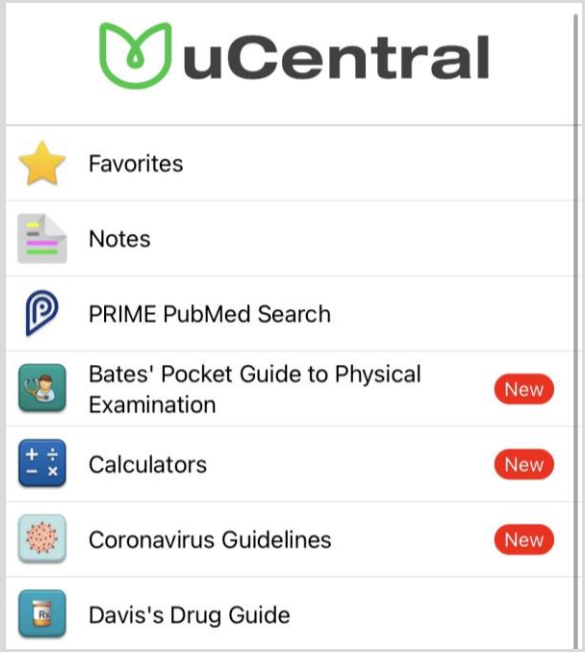
Tools

DDx Generator

Admission Checklist



Antibiotics



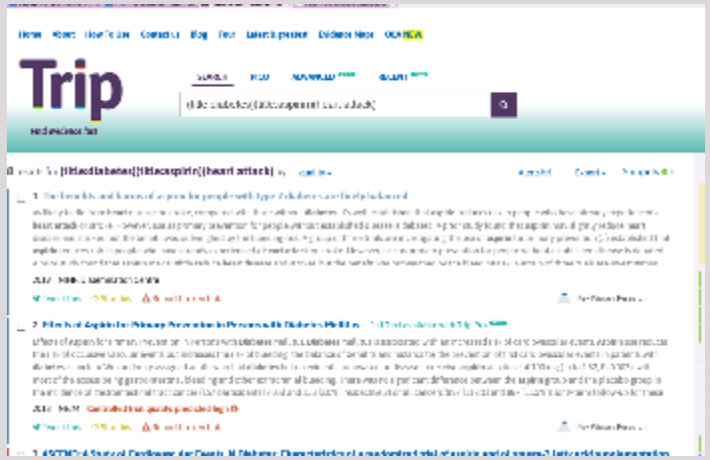
ts &

s who

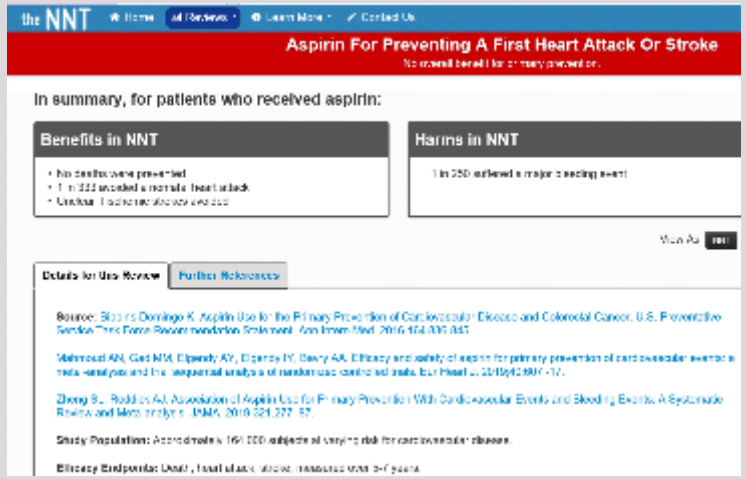
took over for patient care

- *What did they do different?*

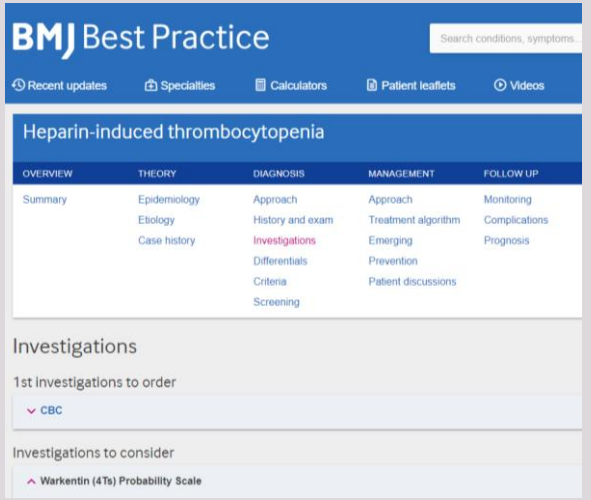
PICO Question



NNT & LR



Diagnostic Tests



FEEDBACK

bit.ly/WiscWK7FB

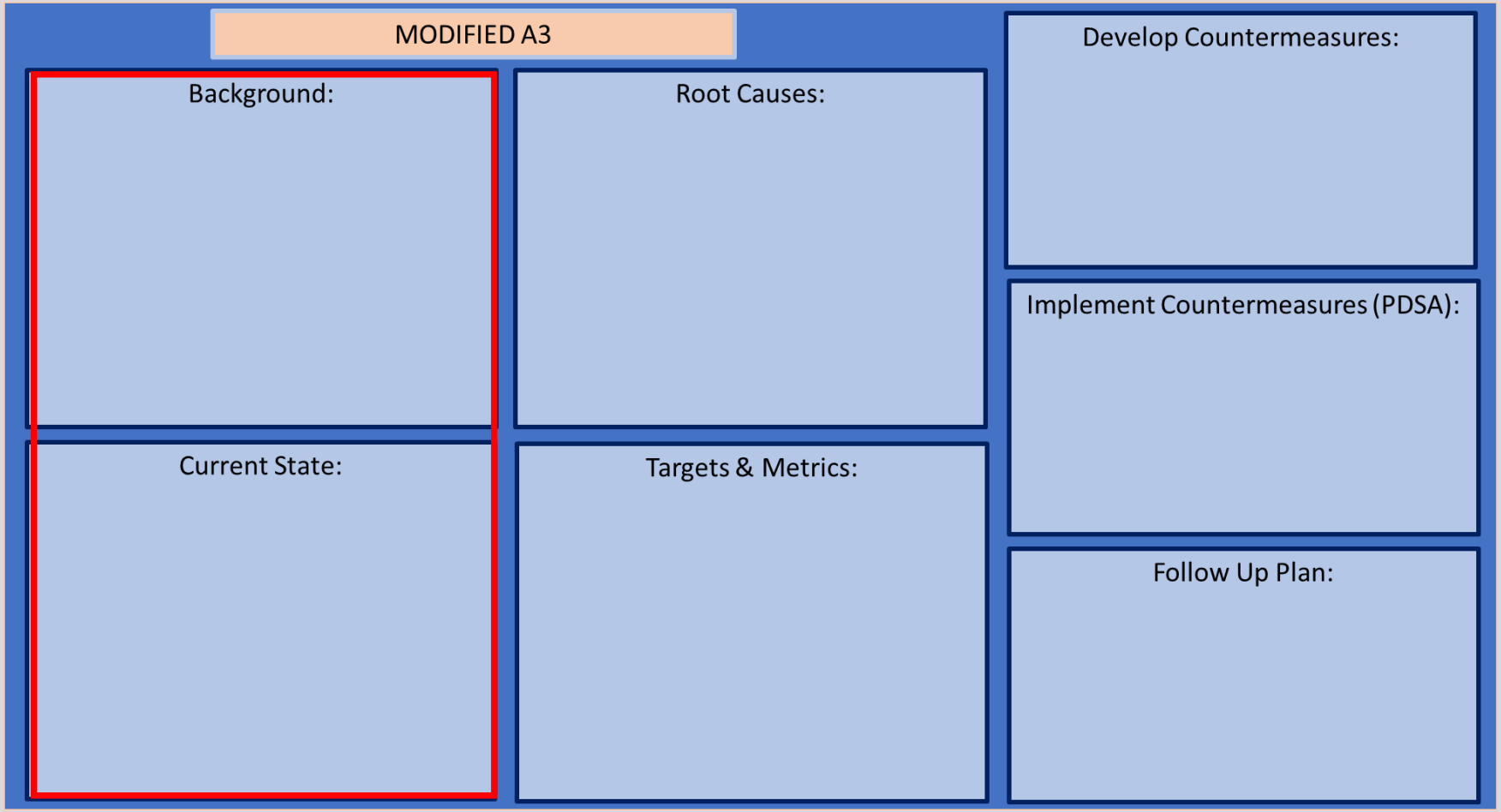
(case sensitive)

Today's Agenda

- Recap week 5
- Systems vs cognitive errors
- Cognitive bias
- Wrap up
- HSPs

Health System Project (HSP) Timeline:

11/2-11/23	11/30-12/21	1/11-2/1	2/8-3/1	3/8-3/29	4/5-4/26	5/3-5/24	5/31-6/21
Introduction to HSPs	Team & project selection, planning	Background & current state	Targets & metrics	Fishbone & root cause statements	Develop counter-measures	Finalizing PPT	Presentations!


MODIFIED A3
Background:
Root Causes:
Develop Countermeasures:
Implement Countermeasures (PDSA):
Current State:
Targets & Metrics:
Follow Up Plan:

Background Investigation

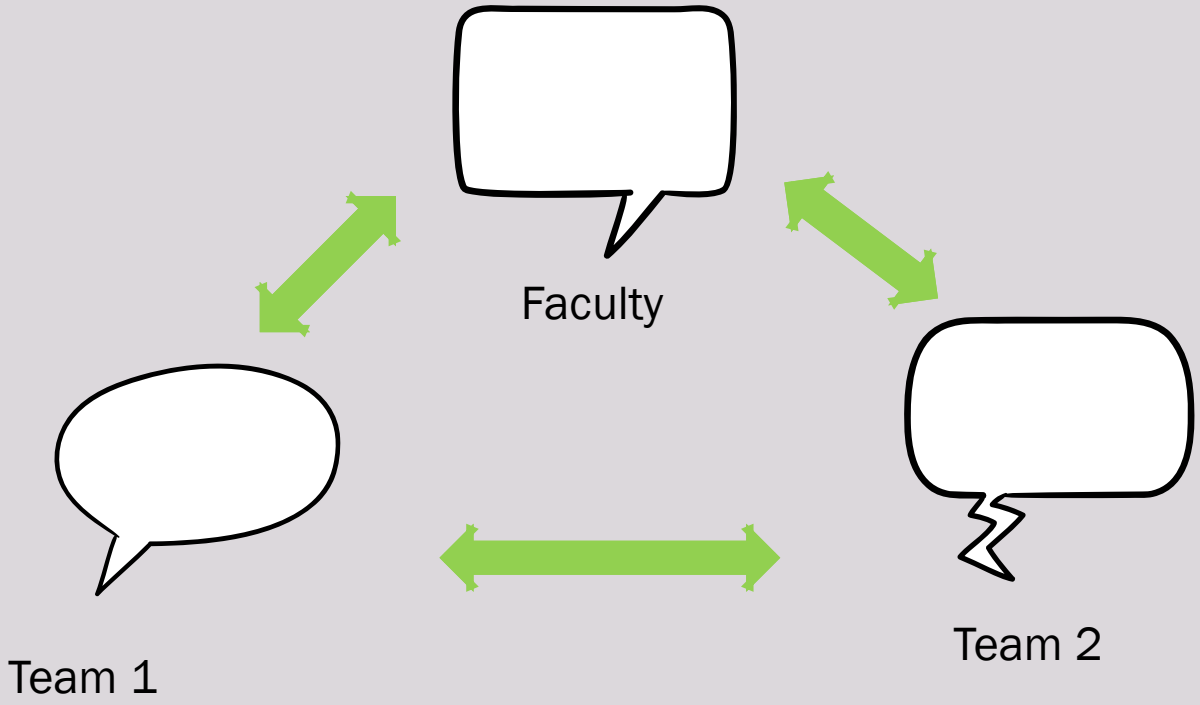
1. Is this a problem reported elsewhere?
2. How have others have solved this problem?
3. Is there alignment with local quality priorities?

Current State

1. Is there a problem?
   - Prove this with baseline data whenever possible
2. Characterize the problem
   - Interviews
   - Chart review
   - Data pull

Peer Learning

- Same groups every month
- Update: 3-5 minutes per team to describe the state of your project
- Next Steps: 5-7 minutes for group brainstorming of next steps



Peer Learning:

Background & Current State

- **Update: Describe your project–**
  - Topic of your project
  - Who is your Mentor
  - Location (inpatient/outpatient/specialty etc.)

- **Next Steps–**
  - Background: Is anyone aware of literature, institutional priorities or groups working on this?
  - Current State:
    - Who should we talk to?
    - Is there data we should collect?
    - What other points of view might be valuable?