

So You Think You Know What “Diagnosis” Means?

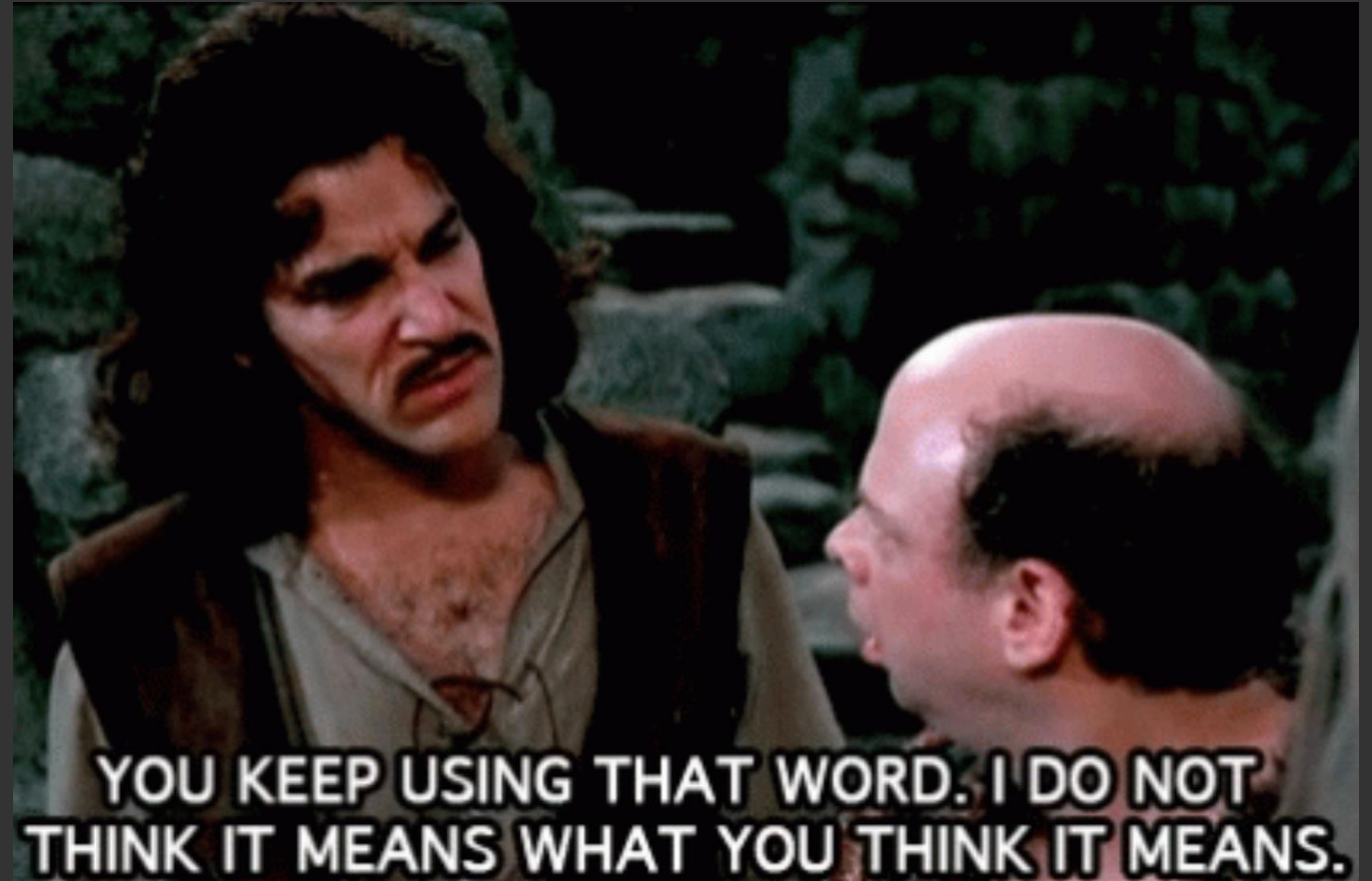
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“Diagnosis”



Main Ideas for Today

- Diagnosis is far more important – and complex -- than it gets credit for
 - Diagnosis drives everything in patient care
- The clinical laboratory community has a lot to teach the healthcare world about doing diagnosis right
 - Especially given the emergence of AI

Every year:

- 1 in 20 US adults experiences a diagnostic error
- 800,000 Americans suffer serious harm due to a diagnostic error
- Most of these are related to diagnostic testing
 - Pre-analytic: Wrong test, specimen problems, etc.
 - Post-analytic: Miscommunication of results

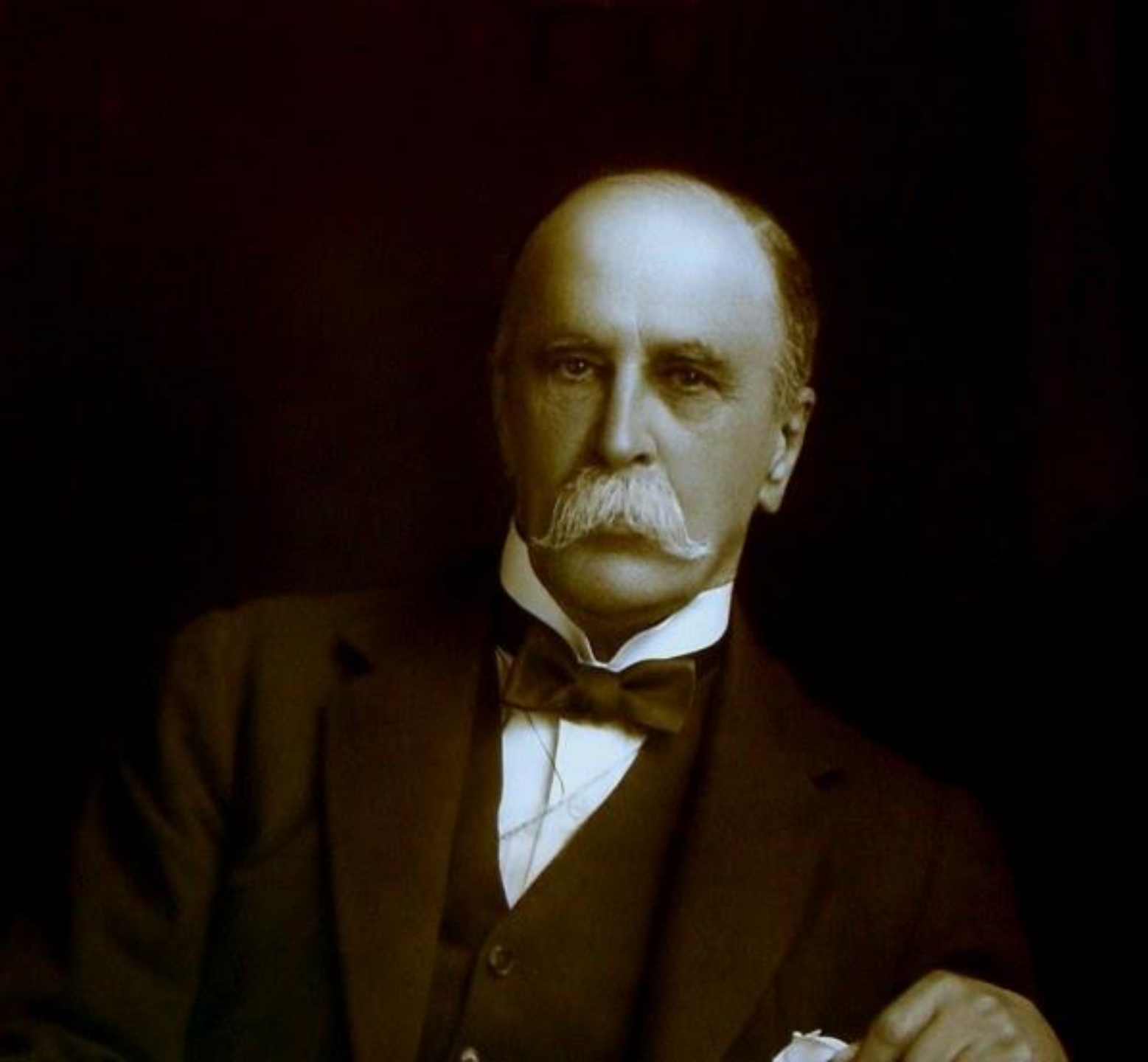
Source: ECRI

The US healthcare industry treats diagnostic testing as a commodity that supports the “real” value of therapy.

In reality, diagnosis is the central value driver in healthcare.

What “Diagnosis” Really Means

- Understanding the patient in enough detail to know what they need – and what they don't need
- A process that takes place throughout the patient journey, not just at the beginning.



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“The good physician treats the disease. The great physician treats the patient who has the disease.”

Dr. William Osler



How the US Healthcare Industry Corrupts Diagnosis

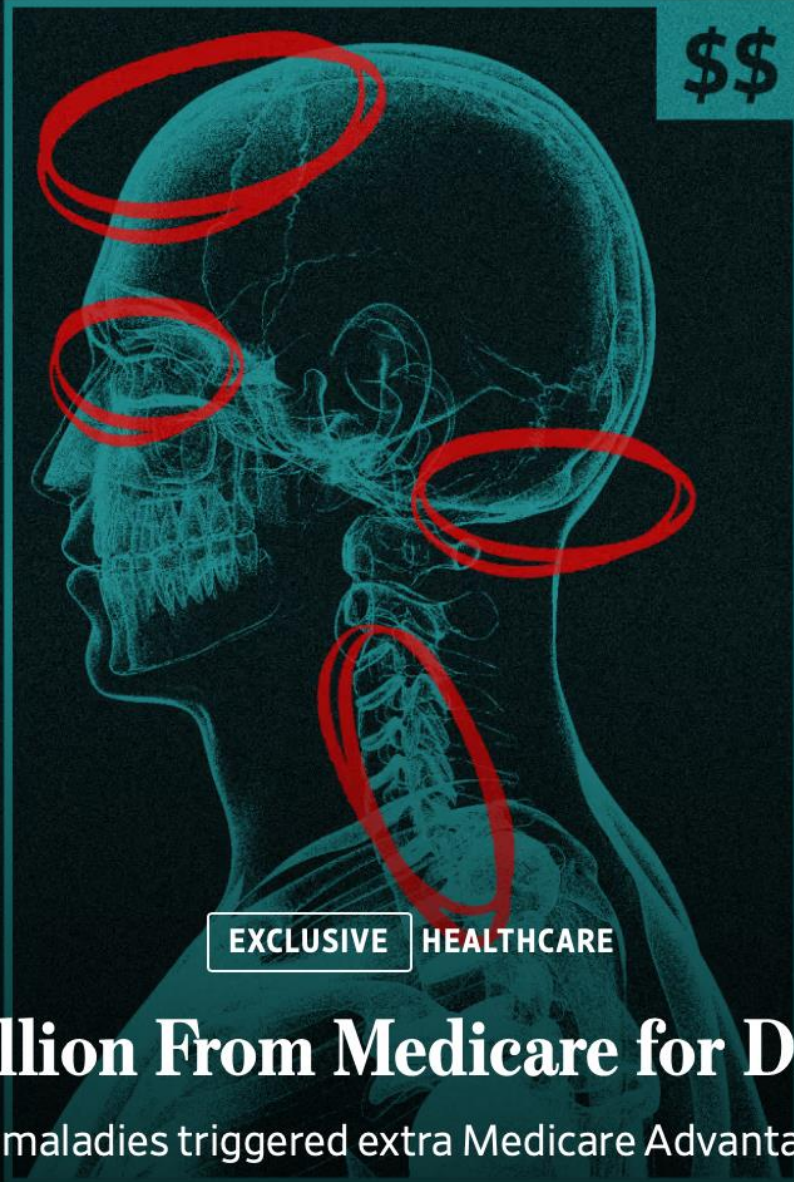
Hospitals and Insurers

- Diagnosis = ICD codes
- ICD codes determine what hospitals get paid
 - For procedures
 - For hospitals stays
 - For capitated care, e.g. Medicare Advantage

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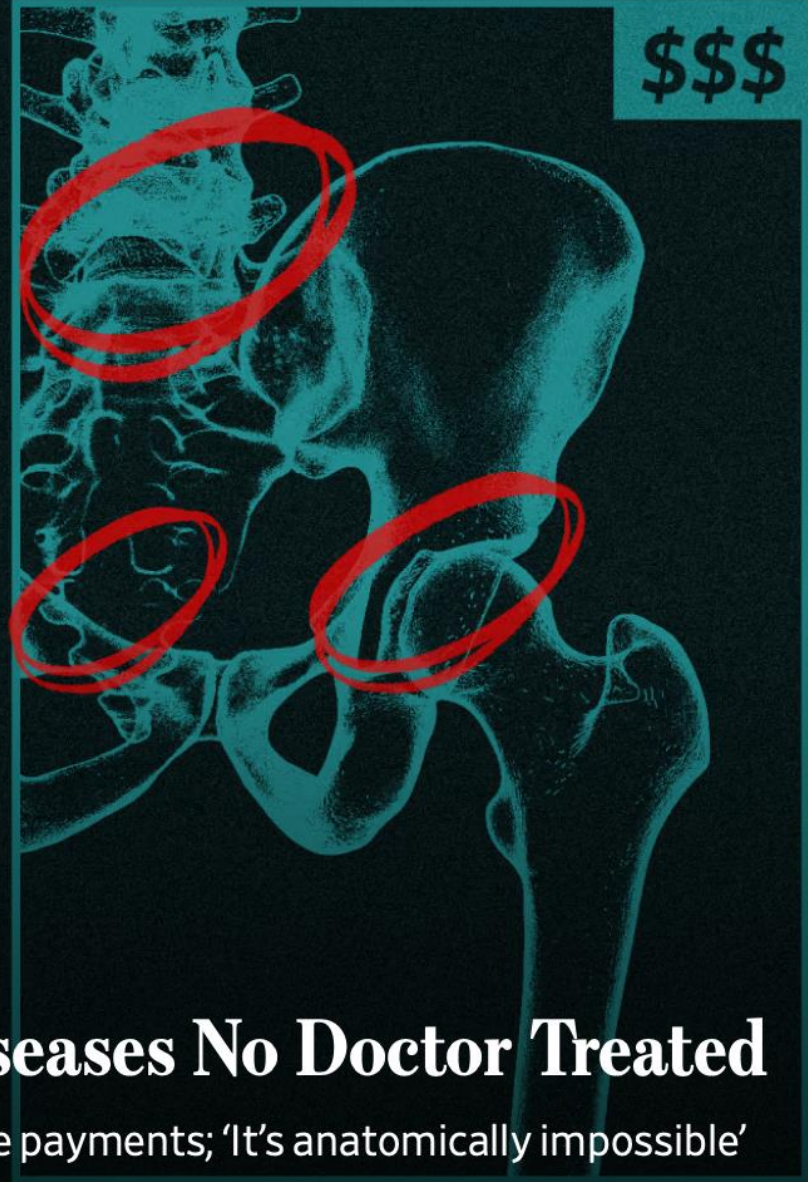


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EXCLUSIVE HEALTHCARE

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Insurers Pocketed \$50 Billion From Medicare for Diseases No Doctor Treated

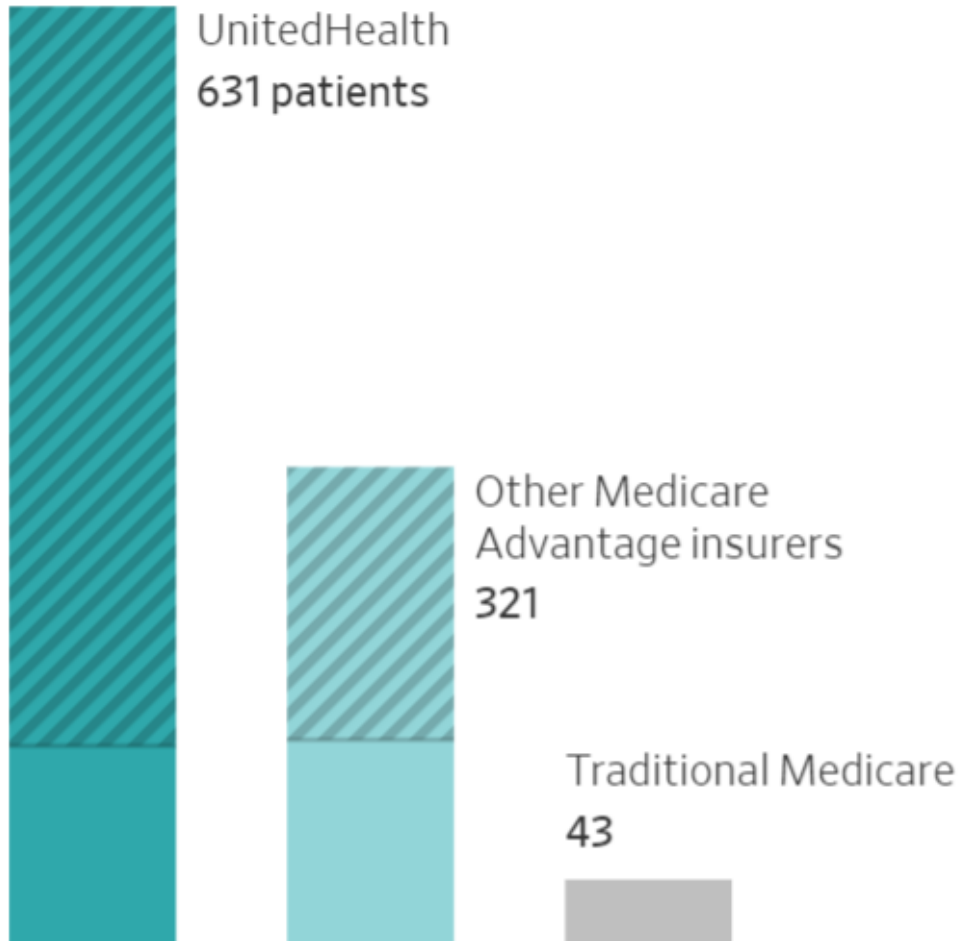
Questionable diagnoses of HIV and other maladies triggered extra Medicare Advantage payments; 'It's anatomically impossible'

Gaming Medicare Advantage through Overdiagnosis

- More diagnosis codes = more “risk adjustment” i.e. \$\$
- Software “recommends” extra diagnosis codes to doctors.
 - Accepting the codes only required one click
 - Rejecting any codes required providing an explanation

Patients diagnosed with diabetic cataracts per 10,000 beneficiaries

▨ Insurer diagnosed



By [Christopher Weaver](#),
[Tom McGinty](#), [Anna Wilde Mathews](#) and [Mark Maremont](#)
Graphics by [Andrew Mollica](#)





Updated July 8, 2024 at 12:08 am ET

A STAT INVESTIGATION

Health Care's *Colossus*

How UnitedHealth turned a questionable artery-screening program into a gold mine



By [Casey Ross](#) , [Lizzy Lawrence](#) , [Bob Herman](#) , and [Tara Bannow](#)  Aug. 7, 2024



[Reprints](#)

Quantaflo Device

- United Healthcare sent nurses to patients' homes with this device to document as many cases of peripheral vascular disease as they could.
- For billing purposes only; doctors and patients weren't told about the "diagnoses"



Pharma's Perspective

- The goal of diagnosis is to get patients onto a drug
 - Recruitment into clinical trials
 - Eligibility for treatment

Why Are These Ads Showing Up on Facebook?



Lp(a) Advertising Campaign

- Ads take you to www.myfreehearttest.com
- Free testing, including Lp(a), LDL, HbA1c, eGFR
- Goal: recruiting for clinical trials
- Funding: not disclosed on the website
 - But it's almost certainly funded by a pharma with a drug that lowers Lp(a)

The Toxic Effects of US Healthcare Payment Models

- “Value” is defined as whatever brings revenue, namely doing more “stuff” to the patient
- Diagnosis is only valued to the extent that it brings revenue
 - Justifying a procedure or drug
 - Risk-adjusting



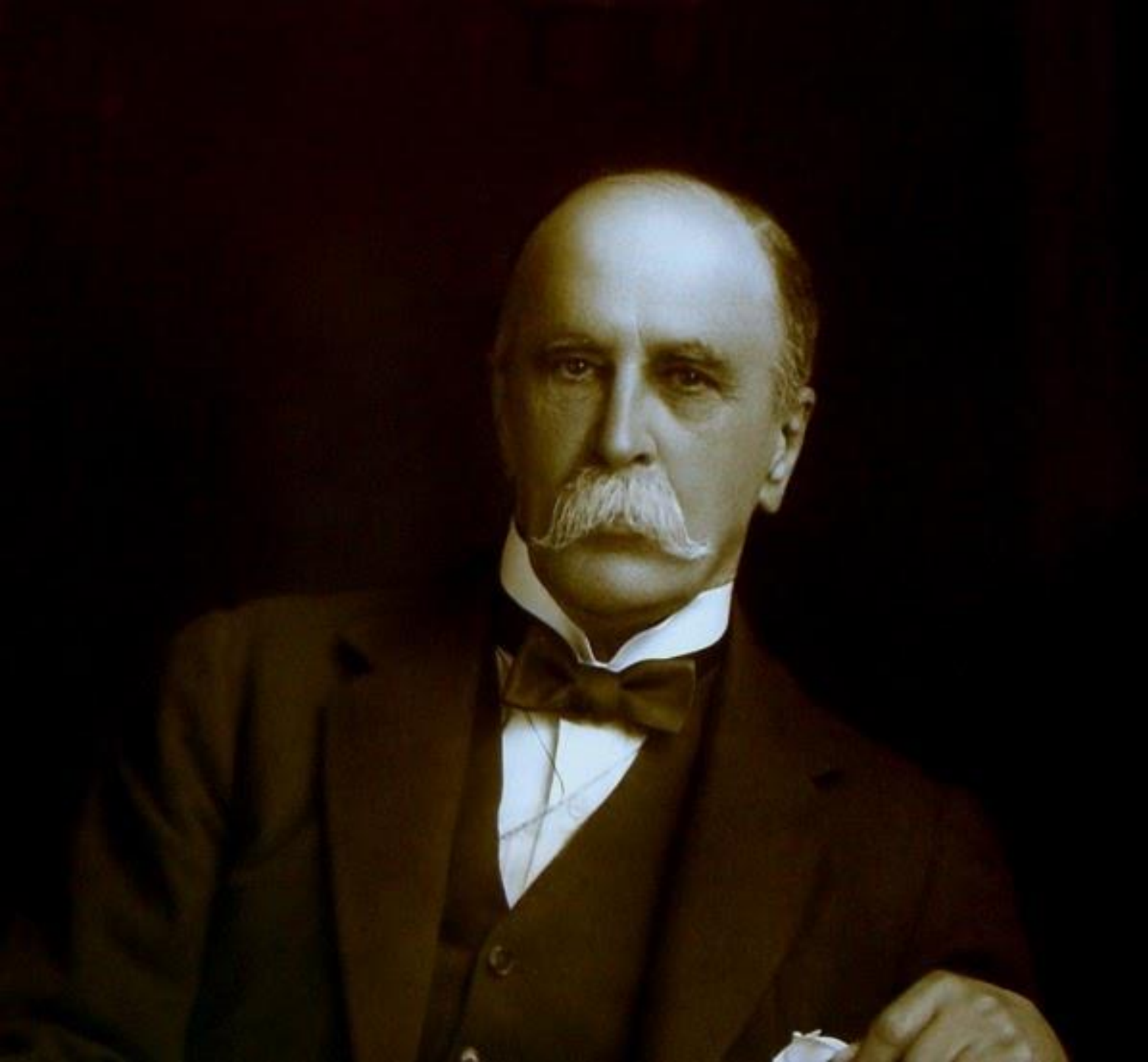
—

“We should do as much as possible for the patient, and as little as possible to the patient.”

Dr. Bernard Lown

Patient Perspective

- The purpose of diagnosis is to gain more detailed understanding of an individual patient
- Determine not just what treatments they need, but also what treatments they *don't* need.



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“One of the first duties of a physician is to educate the masses not to take medicine.”

Dr. William Osler

What Does All This Mean for Test Development?

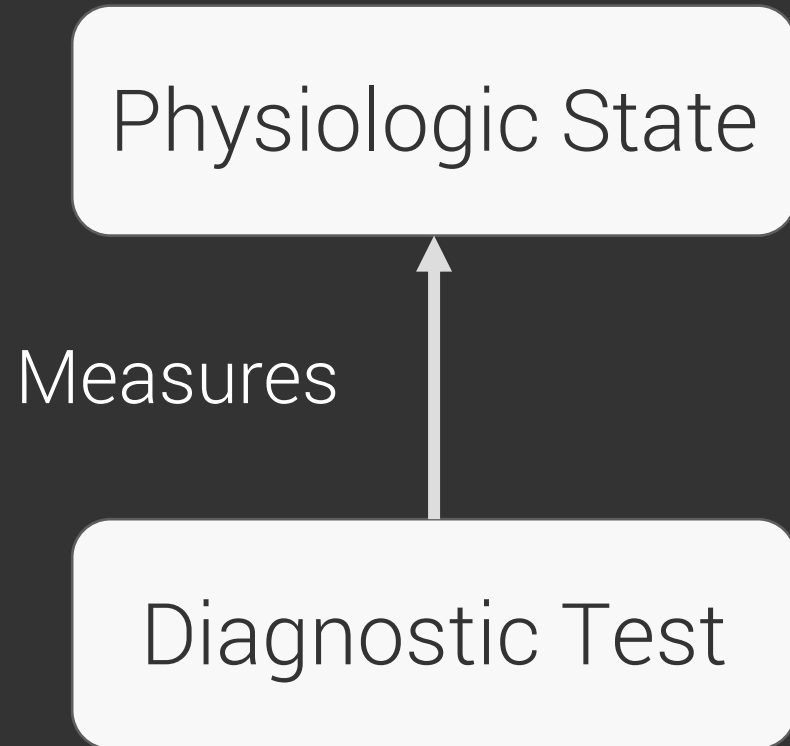
The Wrong Way to Develop Tests

- Find something you can bill for
 - Therapy
 - Risk adjustment
- Devise a test that justifies that charge
- Release it into the wild with minimal oversight

The Right Way to Develop Tests

- Start with an unmet patient need
- Devise a test that helps doctors make decisions
- Deploy with robust feedback loops
 - Quality management systems
 - Longitudinal science

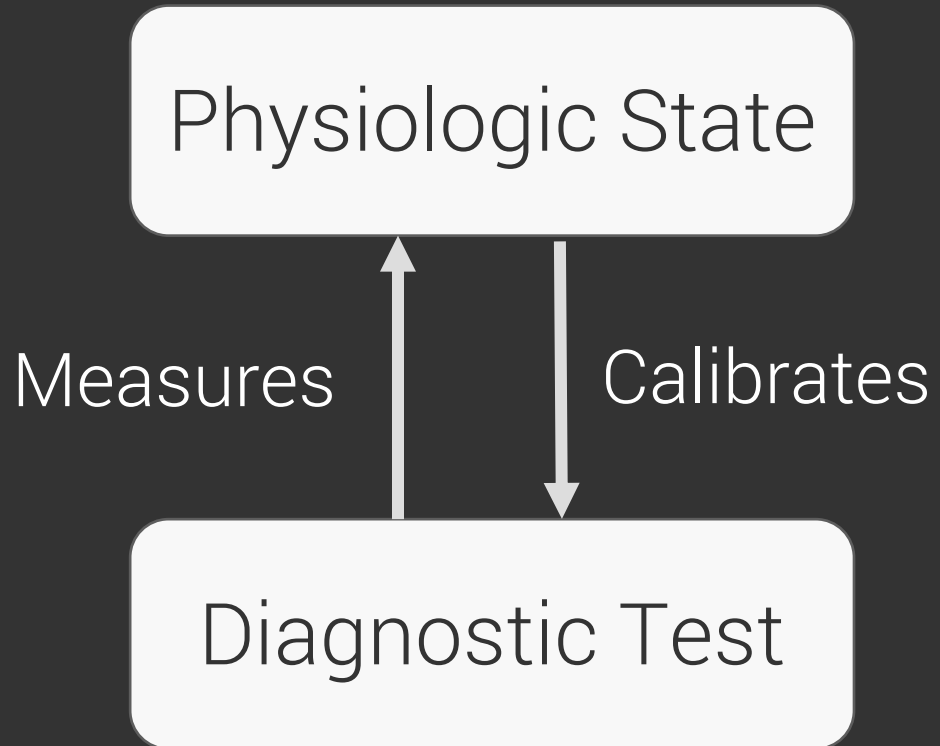
Diagnostic Test



How do we ensure test accuracy?

- Feedback loops that compare the test against what it's trying to measure
 - Validation
 - Quality control
 - Proficiency testing
 - Calibration

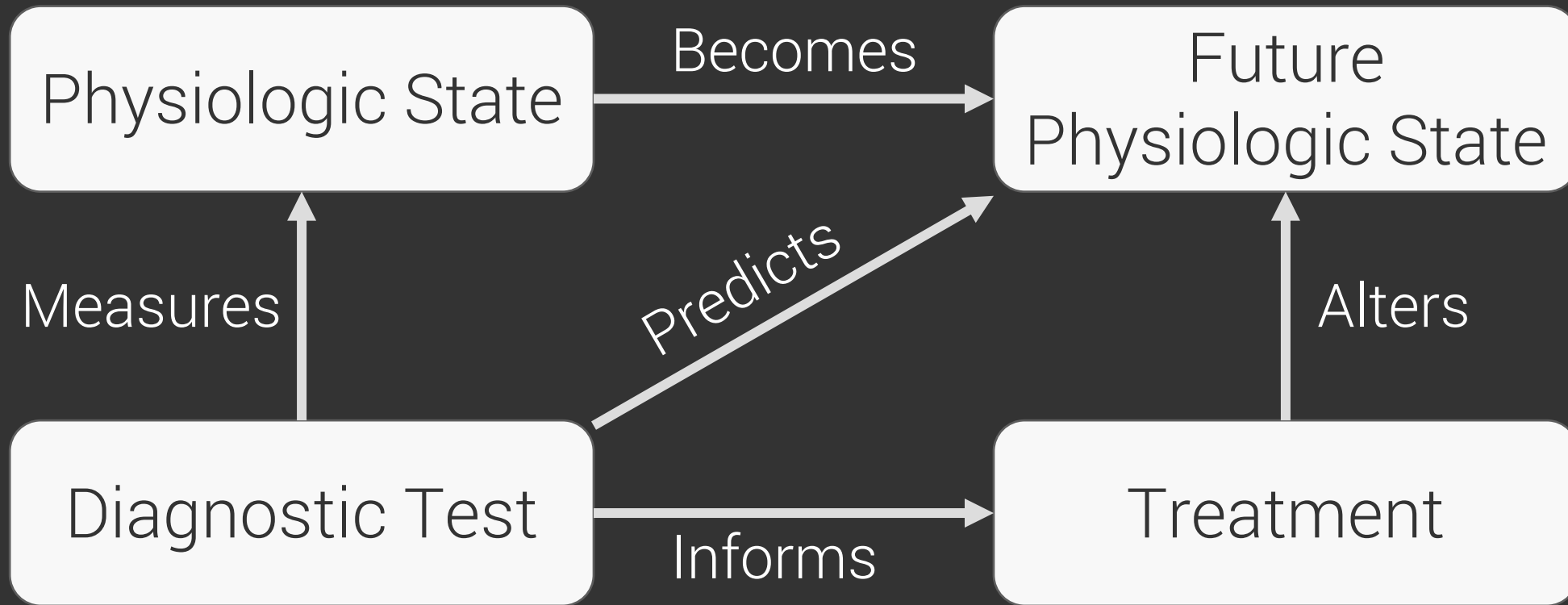
Diagnostic Test



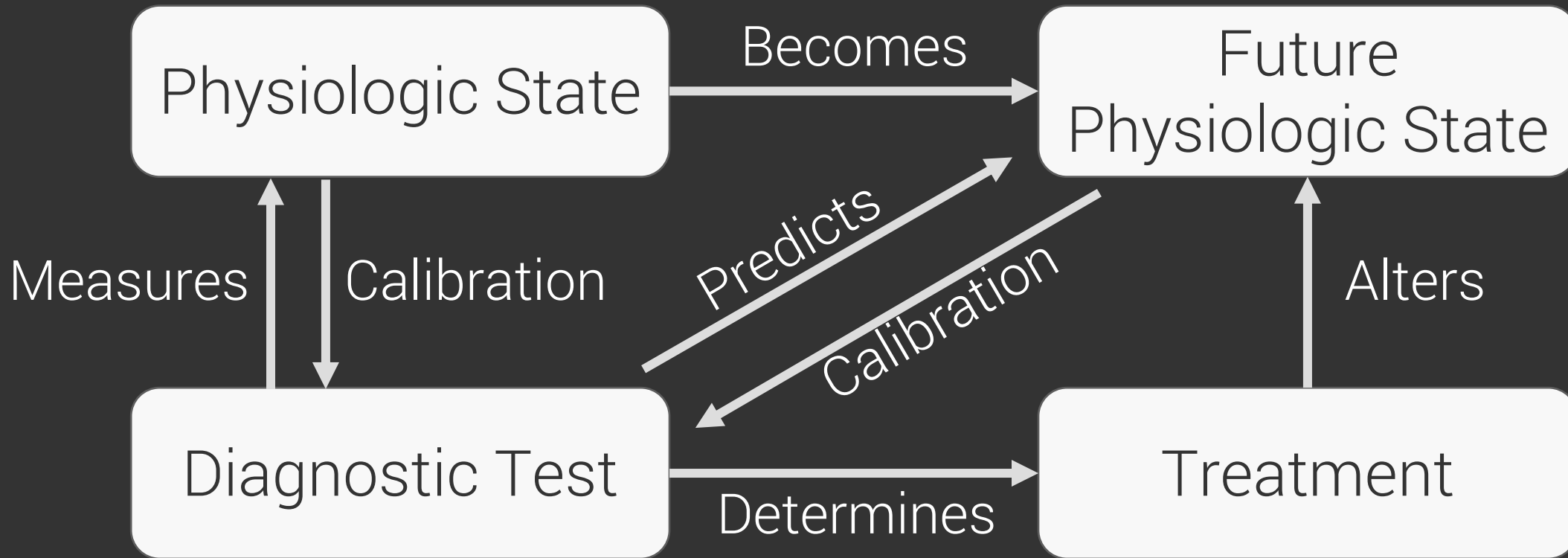
Diagnosis

- What we can measure: Current physiologic state
- What we actually care about: Future physiologic state
 - So that we can make informed decisions

Diagnosis



Reliable Diagnosis



How do you calibrate a test against future physiologic states?

- Diagnostic criteria (disease definitions) are based largely on future states
 - Natural history
 - Prognosis given available therapies
- Periodically recalibrated using longitudinal data
- Criteria are published in peer-reviewed journals

This is a slow process!

When Diagnostic Testing Goes Wrong

When Diagnostic Testing Goes Wrong

- Inadequate quality systems
- Inadequate long-term science

Ductal breast carcinoma: Immunohistochemistry for ER/PR receptors

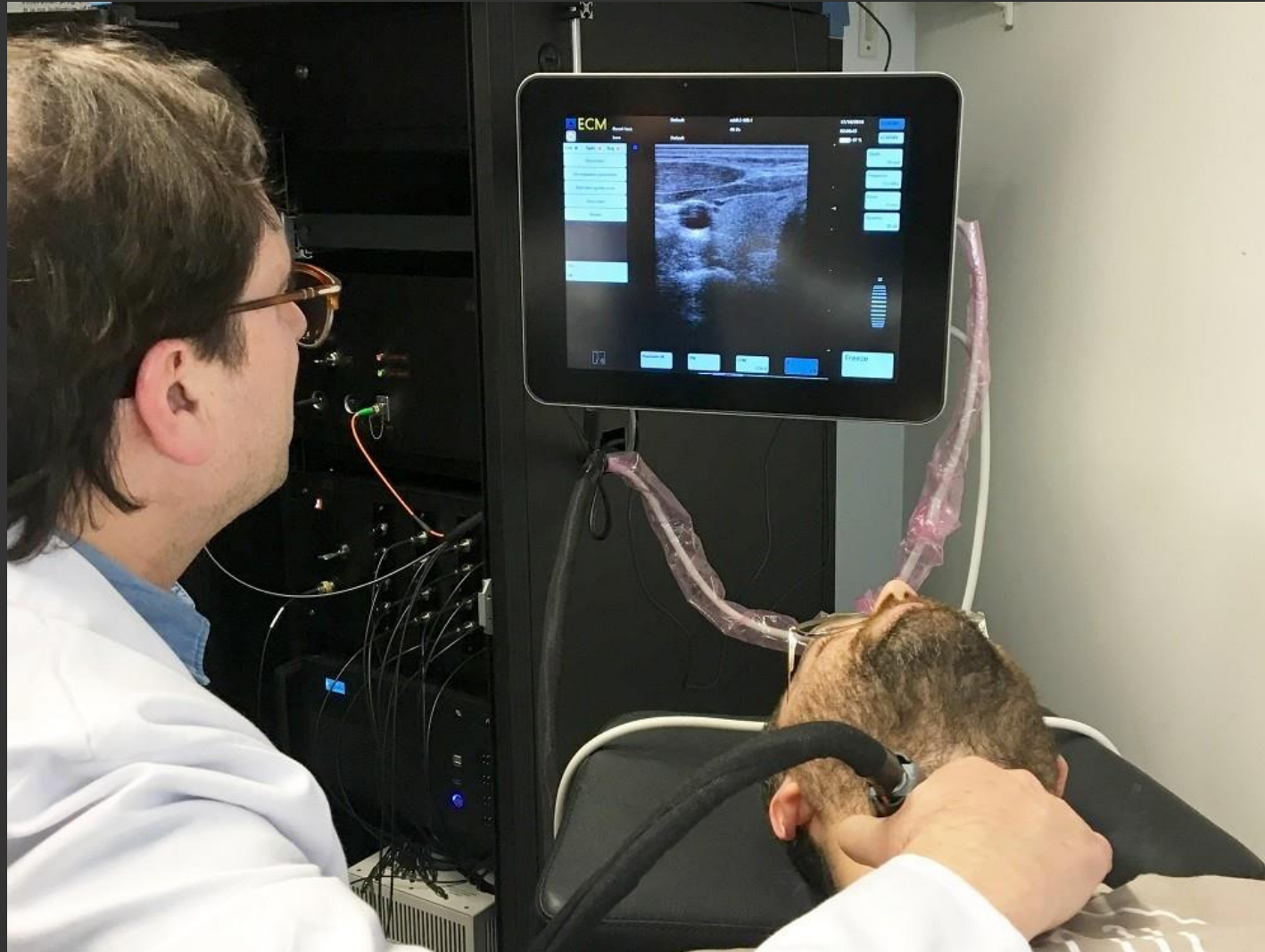
- Tests performed well in FDA-overseen clinical trials
- When de-centralized, some IHC tests gave false negatives
 - Variable tissue fixation
 - Variable cutoff between positive and negative
- Results:
 - Many women who would have benefitted from hormone-based cancer therapy in early 2000s didn't receive it.

Hammond ME et al. J Clin Oncol. 2010 Jun 1;28(16):2784-95. doi: 10.1200/JCO.2009.25.6529. Epub 2010 Apr 19.

IHC for ER/PR: Lessons Learned

- FDA approval doesn't guarantee success in the real world
- Pre-analytic issues are huge, but often invisible
- Proficiency testing is critical

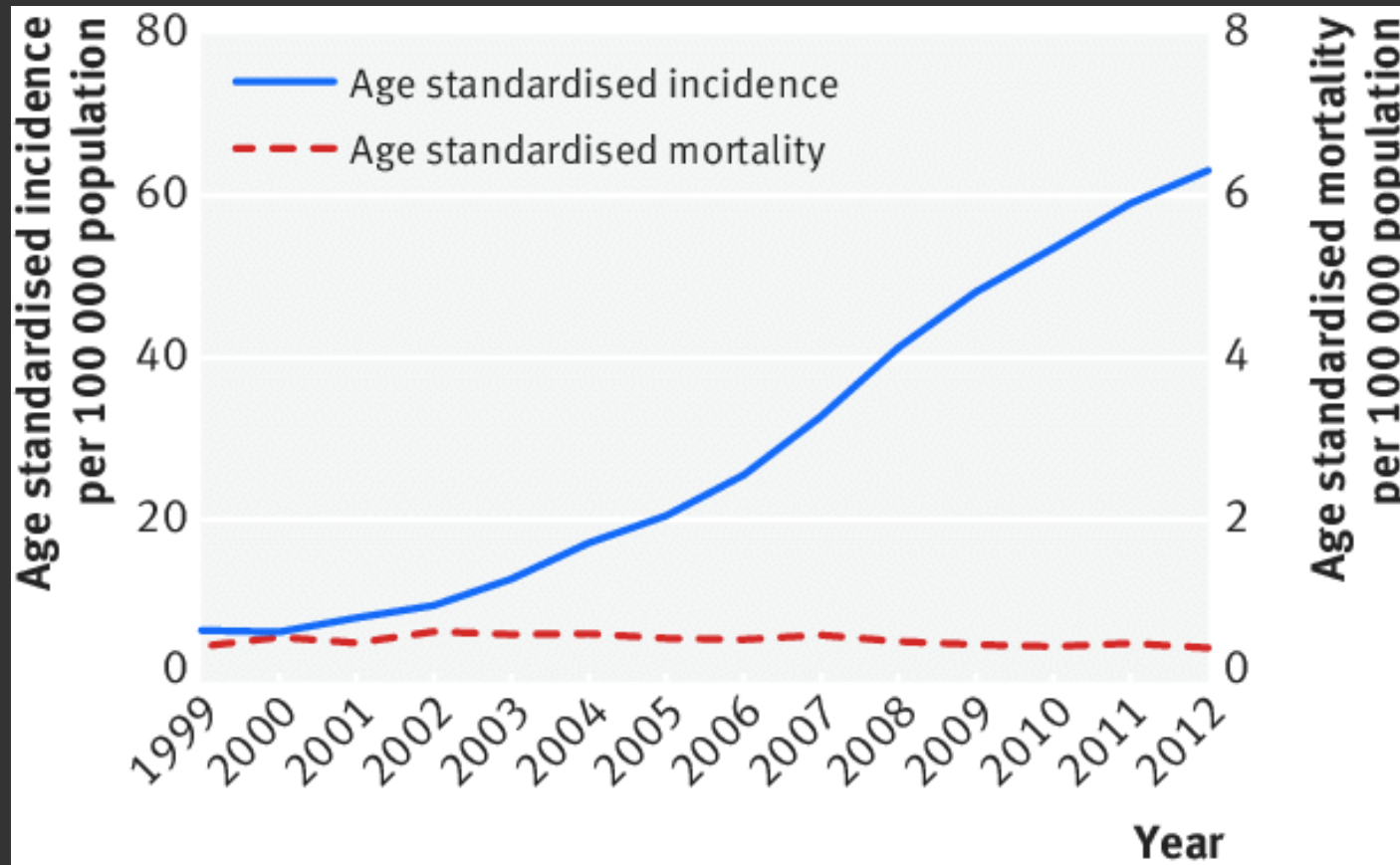
Ultrasound Screening for Thyroid Nodules



Ultrasound for Thyroid CA Screening

- In 1990s, GE pushed miniaturization of medical ultrasound
- Handheld ultrasound can detect small (<1cm) thyroid nodules
- High popularity of thyroid screening in South Korea in early 2000s led to thousands of (over)diagnoses of thyroid cancer
 - Unnecessary thyroidectomy/ablation
 - Lifelong thyroid replacement therapy

Overdiagnosis of Thyroid Cancer in South Korea, 1999-2012



Thyroid Ultrasound: Lessons Learned

- Even when a test seems intuitively beneficial, the benefits must still be proven
- When companies push premature adoption of a test before there's evidence of benefit, patients suffer

Science Matters



Diagnostic tests require careful
calibration against both
current and future reality

What about AI and Algorithms?

How AI Is Improving Diagnostics, Decision-Making and Care

🏠 / [Data & Insights](#) / [AHA Center for Health Innovation Market Scan](#)





AI sometimes performs uncannily well...

...And sometimes surprisingly badly

...And we don't yet have robust systems to ensure that medical AI performs as expected

Concerns with AI for Diagnosis

- Automation bias
- Algorithm bias

Automation Bias

- The propensity of humans to favor suggestions coming from automated decisionmaking systems.

Anthropomorphism

- The illusion that AI is “human-like”
- AI developers exploit this to make their products more appealing
 - Elon Musk developing humanoid robots
 - ChatGPT delivering results one character at a time

AI Bias

- Not just (or even primarily) about social categories such as race
- AI is naturally biased against any subgroup that is not well-represented in the training data.

A STAT INVESTIGATION

[EMBEDDED BIAS]

How race became ubiquitous in medical decision-making tools



By [Usha Lee McFarling](#)  and [Katie Palmer](#)  Sept. 4, 2024



ELSEVIER

Artificial Intelligence in Medicine 9 (1997) 107–138

Artificial
Intelligence
in Medicine

An evaluation of machine-learning methods for predicting pneumonia mortality

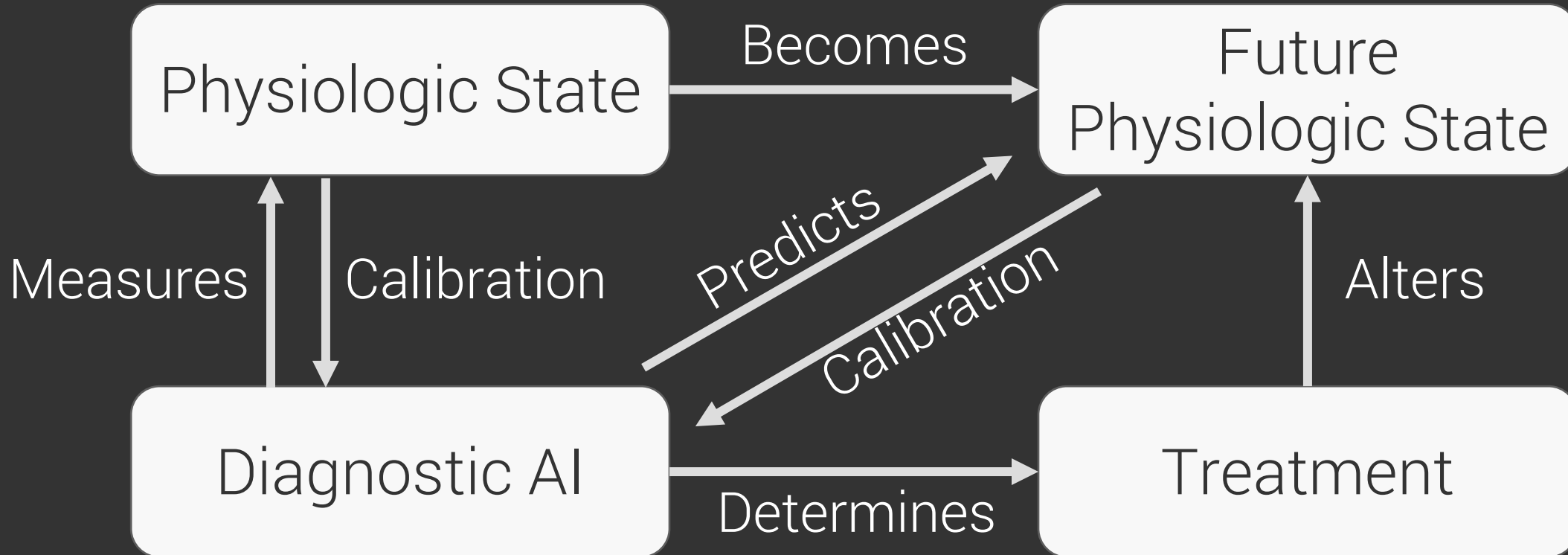
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Explainability

- It's safer to be predictably wrong
- than unpredictably wrong.

How can we ensure safe,
reliable
AI-based diagnosis?

Reliable Dx (Minimizing Bias)



Clinical Laboratory Testing

- Performance characteristics well-studied and understood
- Robust quality management systems
- Robust accountability (CLIA)

Artificial Intelligence

- Performance characteristics (explainability) hard to study
- Primitive quality management
- Accountability is vague and diffuse



Epic Sepsis Algorithm

Original Investigation

June 21, 2021

External Validation of a Widely Implemented Proprietary Sepsis Prediction Model in Hospitalized Patients

Andrew Wong, MD¹; Erkin Otles, MEng^{2,3}; John P. Donnelly, PhD⁴; [et al](#)

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

JAMA Intern Med. 2021;181(8):1065-1070. doi:10.1001/jamainternmed.2021.2626

Epic Failures (With the Sepsis Algorithm)

- Wrong accuracy goal
- No local validation
- No ongoing calibration
- No cross-institutional validation
 - (No proficiency testing)

Summary

Diagnostic tests have high stakes

Diagnostic tests require calibration against current biologic reality

Diagnostic tests require calibration against future biologic reality

Summary, Cont.

AI will require even more layers of quality management than clinical laboratories have

But very little of this is currently in place

When corporations put profits ahead of quality and science and patients, bad things happen.



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