Leveraging AI

2024 Winter Scientific Seminar
Friday | December 13, 2024

Chicago, IL

Kayur V. Patel, MD, MRO, FACP, FACPE, FACHE, FACEP

High Reliability Organization
Culture of Safety
Errors.

"..... "It's the system more than the individuals that is to blame," Makary said. The U.S. patient-care study, which was released in 2016, explored death-rate data for eight consecutive years. The researchers discovered that based on a total of *35,416,020 hospitalizations,* there was a pooled incidence rate *9.5 % of all deaths stemmed from medical error.*

https://www.hopkinsmedicine.org/news/media/releases/study_suggests_medical_errors_now_third_leading_cause_of_death_in_the_us

"…The original research article was published July 17 by *BMJ Quality & Safety*. Results of the new analysis of national data found that across all clinical settings, including hospital and clinic-based care, an estimated *795,000 Americans die or are permanently disabled by diagnostic error* each year, confirming the pressing nature of the public health problem….July 2023, John Hopkins

https://qualitysafety.bmj.com/content/qhc/33/2/109.full.pdf
https://www.hopkinsmedicine.org/news/newsroom/news-releases/2023/07/report-highlights-public-health-impact-of-serious-harms-from-diagnostic-error-in-us


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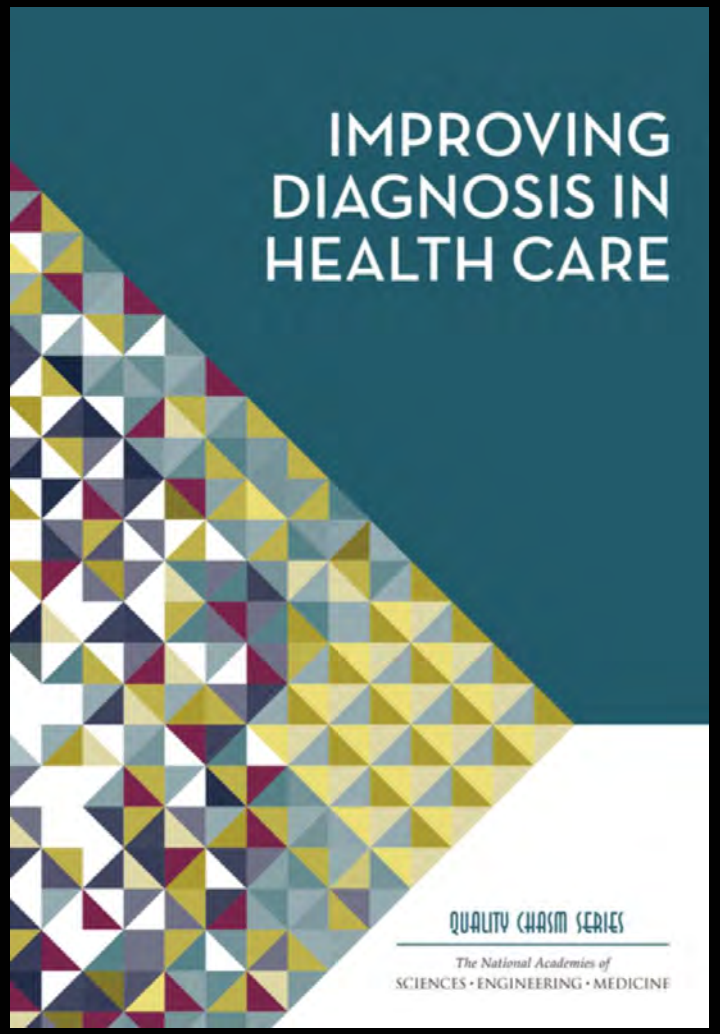
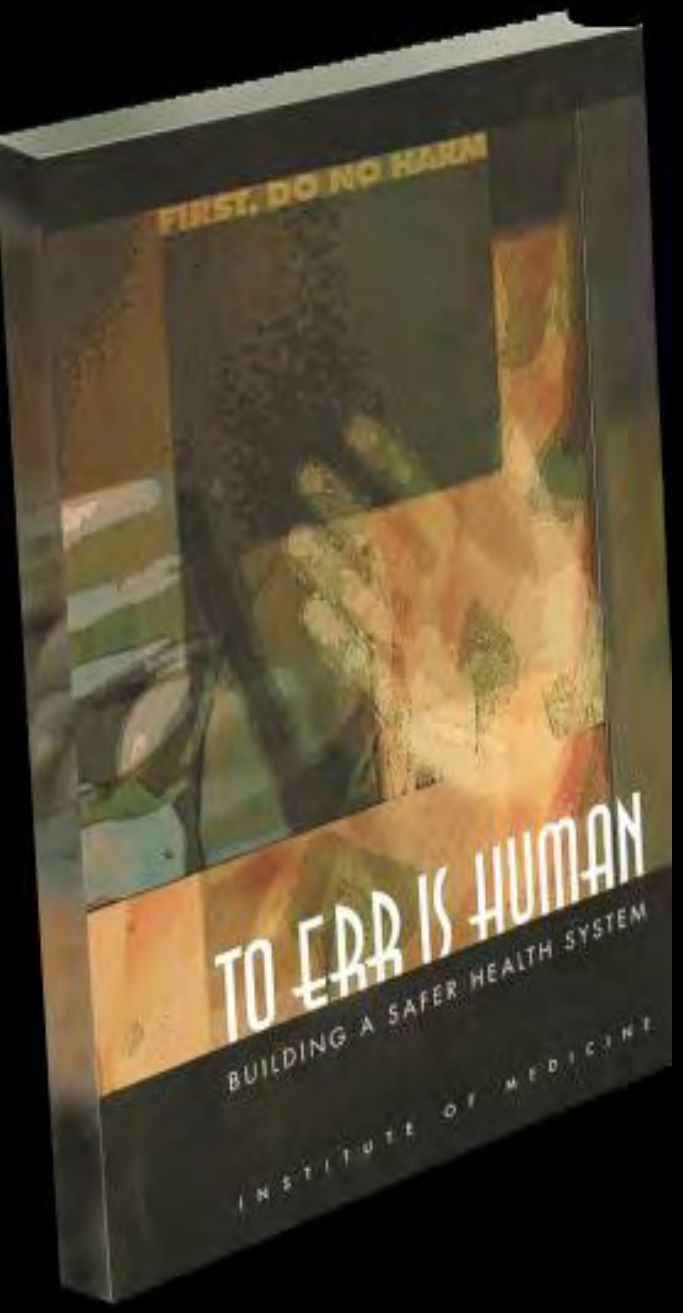
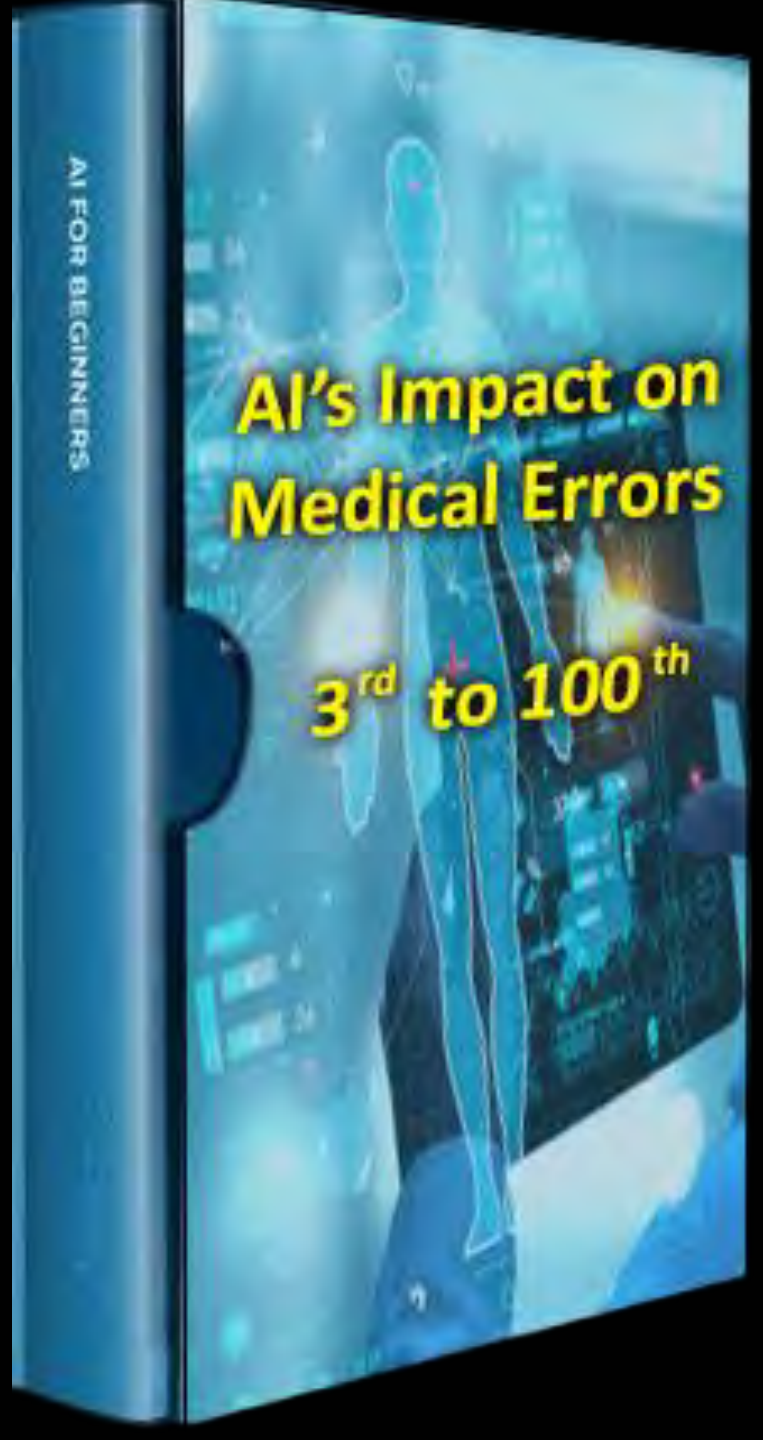


"Getting the right diagnosis is a key aspect of health care - it provides an explanation of a patient's health problem and informs subsequent health care decisions. The diagnostic process is a complex, collaborative activity that involves clinical reasoning and information gathering to determine a patient's health problem. According to Improving Diagnosis in Health Care, diagnostic errors-inaccurate or delayed diagnoses-persist throughout all settings of care and continue to harm an unacceptable number of patients. *It is likely that most people will experience at least one diagnostic error in their lifetime*, sometimes with devastating consequences. Diagnostic errors may cause harm to patients by preventing or delaying appropriate treatment, providing unnecessary or harmful treatment, or resulting in psychological or financial repercussions. The committee concluded that improving the diagnostic process is not only possible, but also represents a moral, professional, and public health imperative."…National Academy of Medicine, 2015



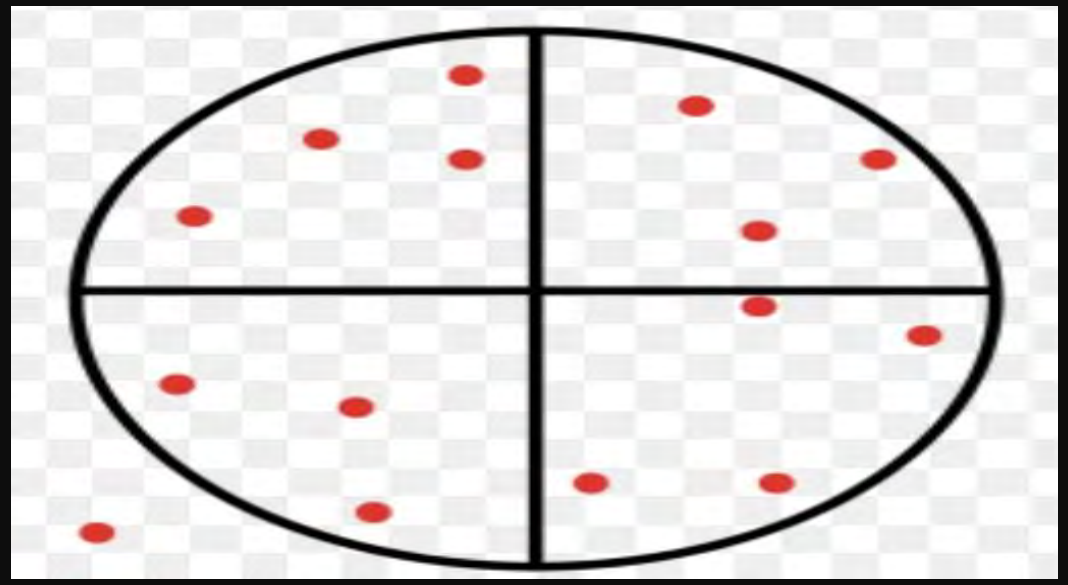
"....*To Err Is Human* asserts that the ***problem is not bad people in health care rather it is that good people are working in bad systems*** that need to be made safer. A realization that most errors are out of the clinician's control. Hospitals are obligated to facilitate, identify and establish root cause analysis of healthcare related errors. Disclosure of medical errors is considered an ethical duty and is required by JCAHO. Institutions must make sure that patients harmed by adverse events do not face additional financial burdens; conduct a root cause analysis; and develop an action plan if necessary. If an actual error transpired, the appropriate institutional representative should apologize to the patient. Institutions should also adopt policies that encourage smooth transitions to new technologies, and foster communication as the key to improving patient safety. Despite all efforts current study from John Hopkins revealed number of healthcare related errors have not changed from first reported in 1999 by Institute of Medicine (IOM). This accounts for our third leading cause of death in the US..

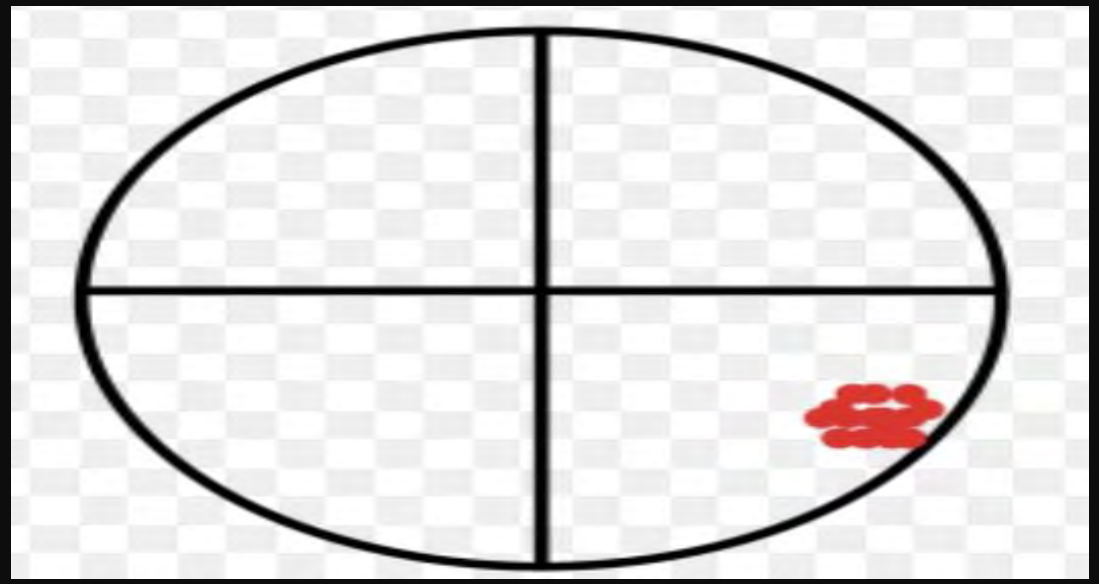

AI FOR BEGINNERS
AI's Impact on Medical Errors
3rd to 100th

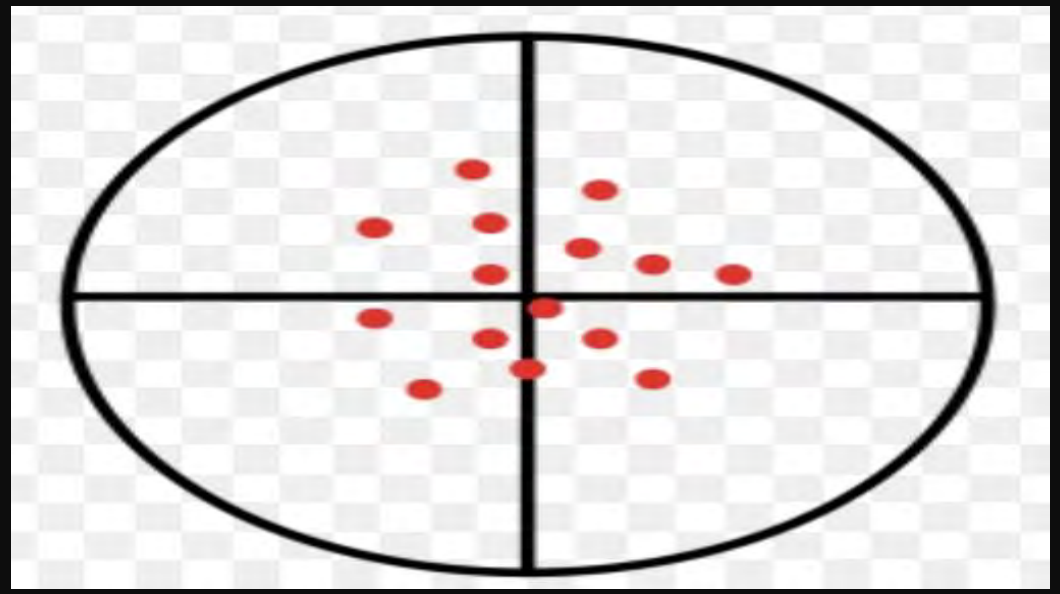

Physician | Patient


Kayur Patel


Precision | Accuracy





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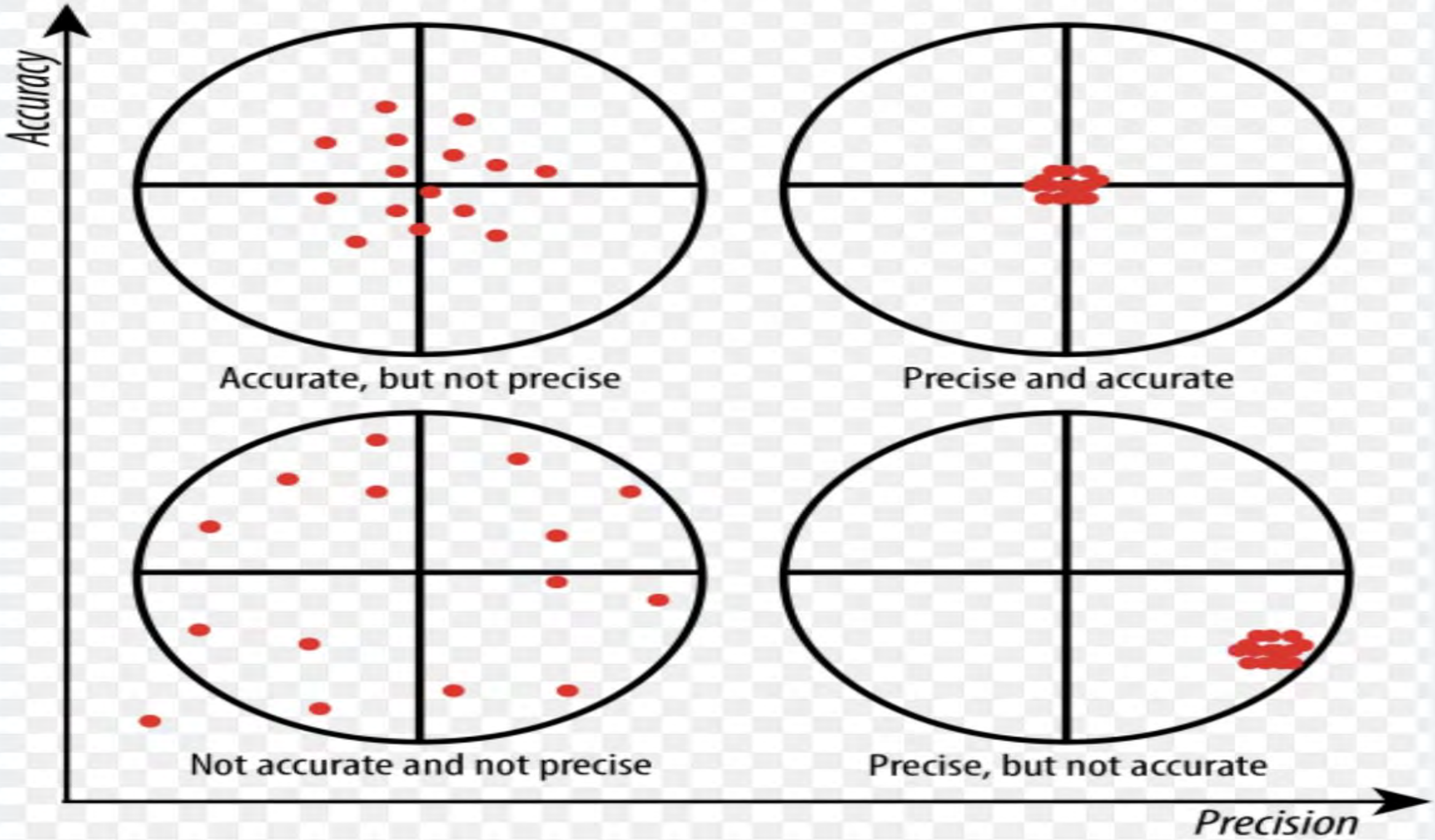
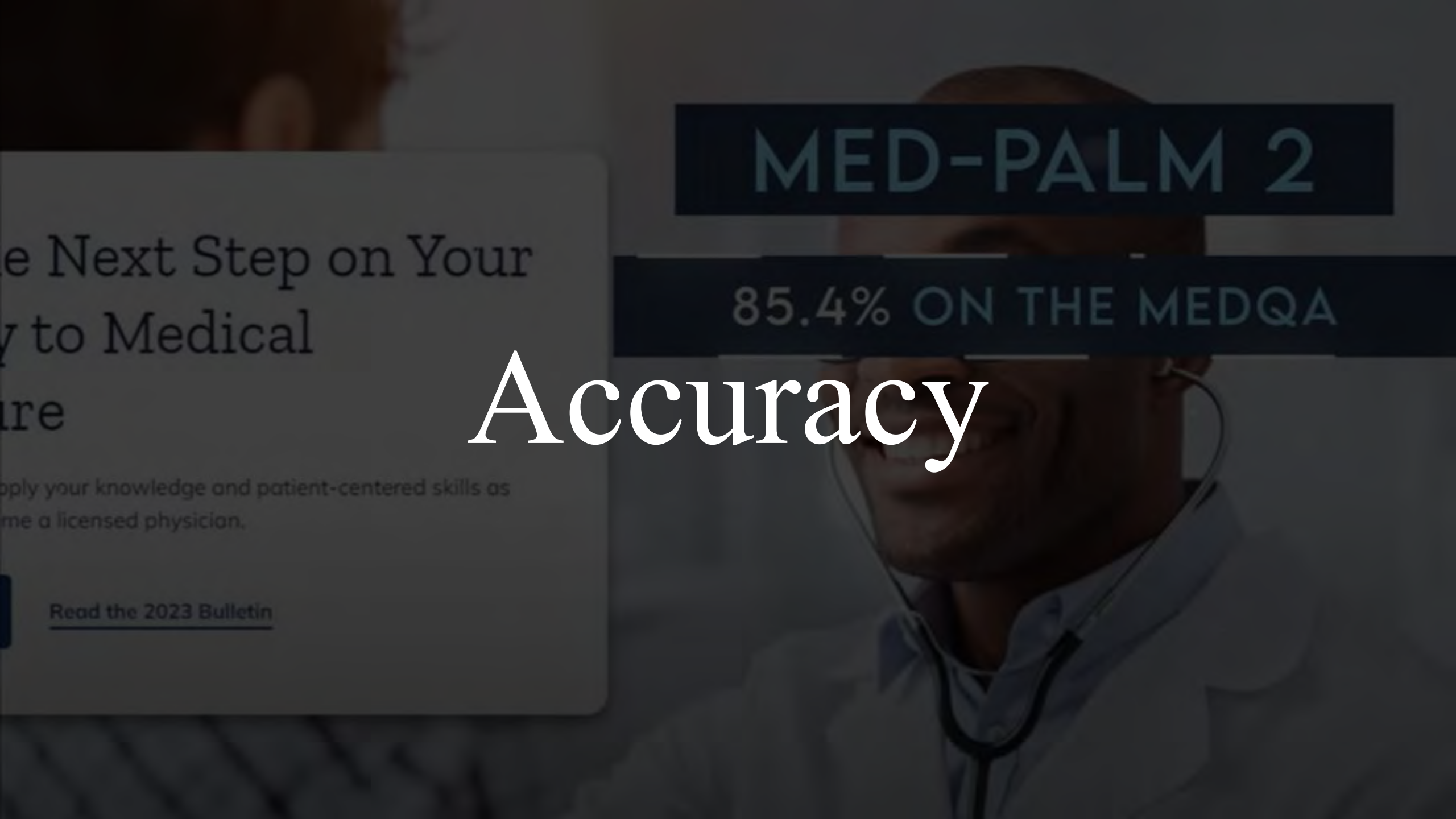
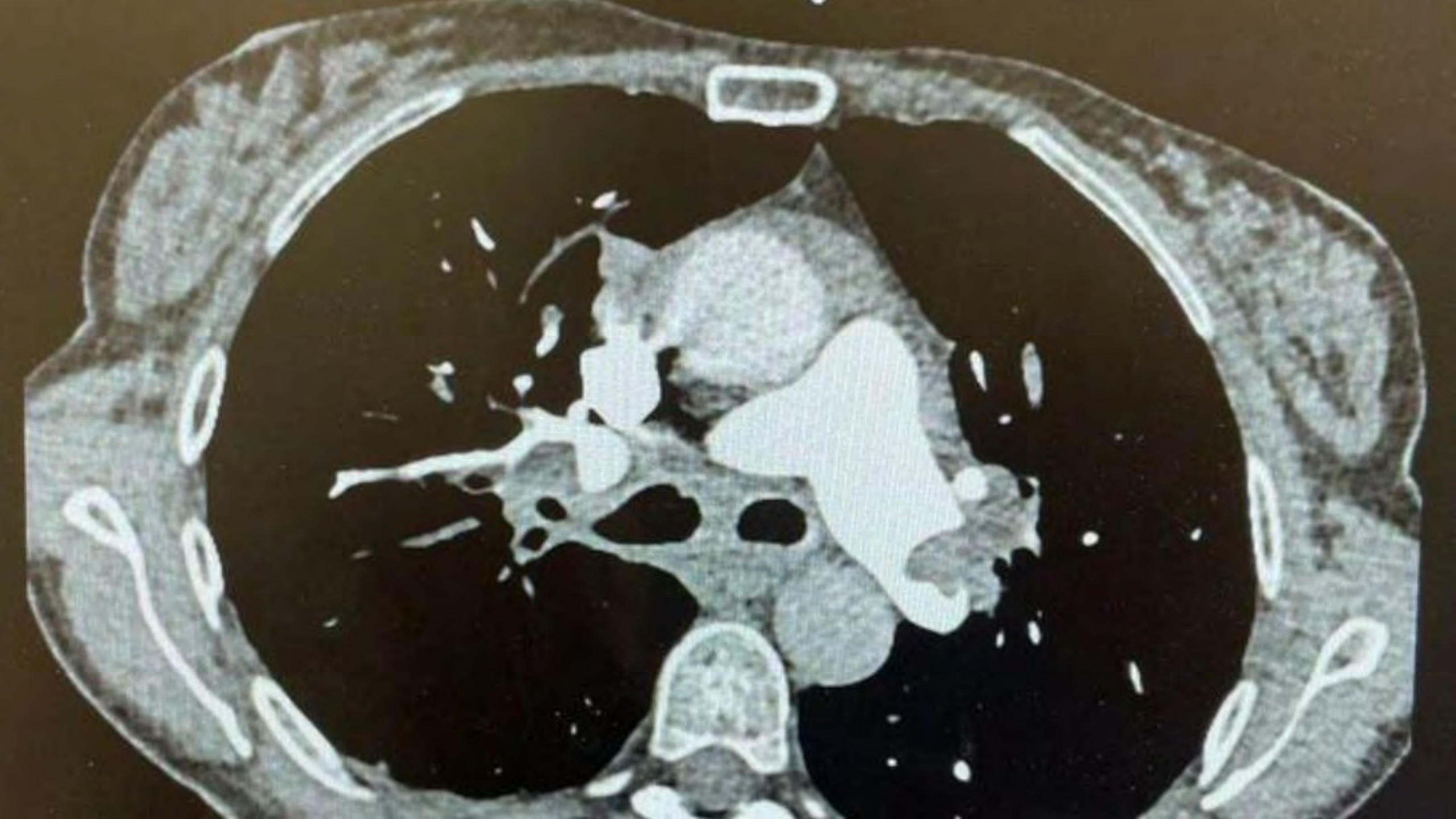

Accuracy
Accurate, but not precise
Precise and accurate
Not accurate and not precise
Precise, but not accurate
Precision

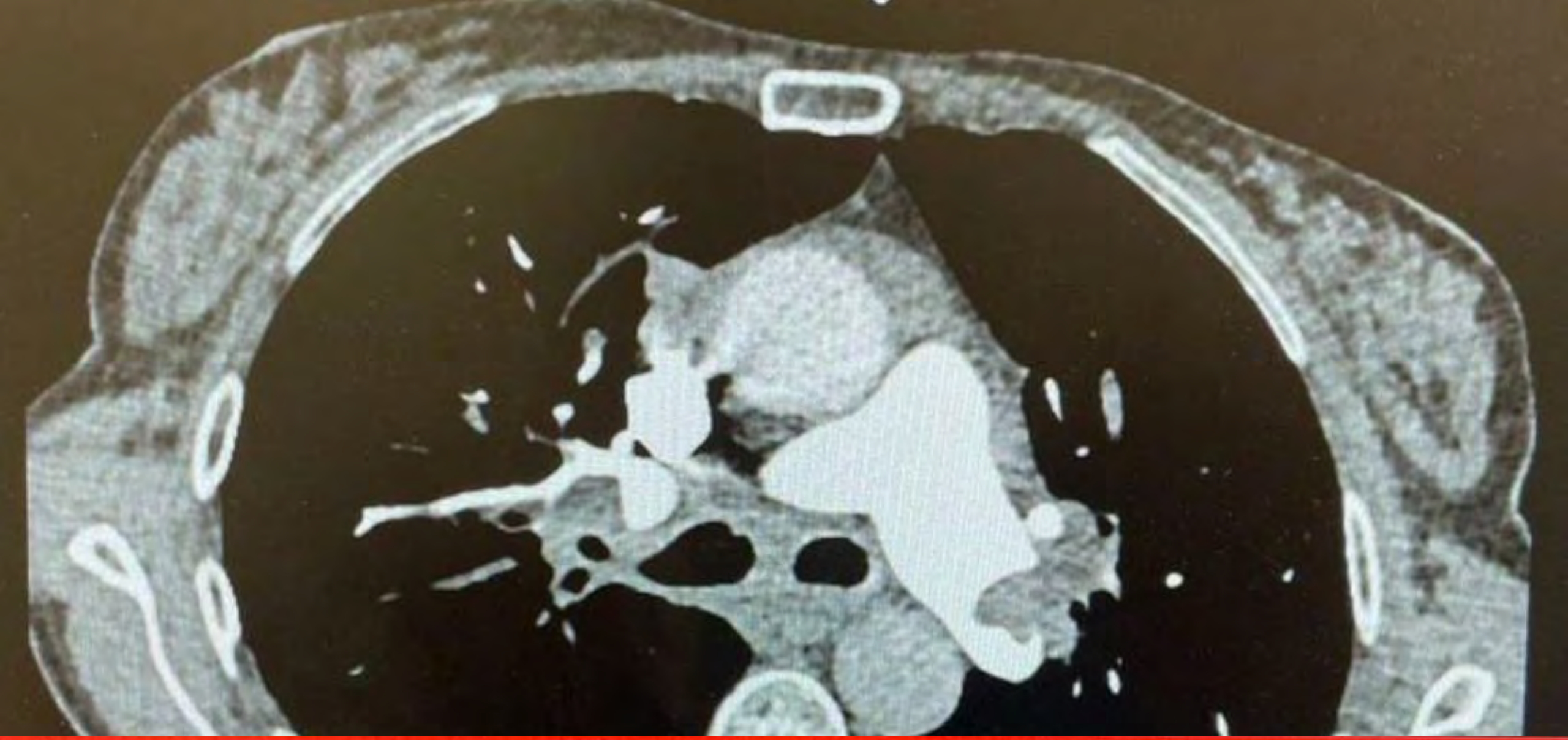

MED-PALM 2
85.4% ON THE MEDQA
e Next Step on Your
y to Medical
ıre
pply your knowledge and patient-centered skills as
me a licensed physician.
Read the 2023 Bulletin

Accuracy

Med-PaLM2

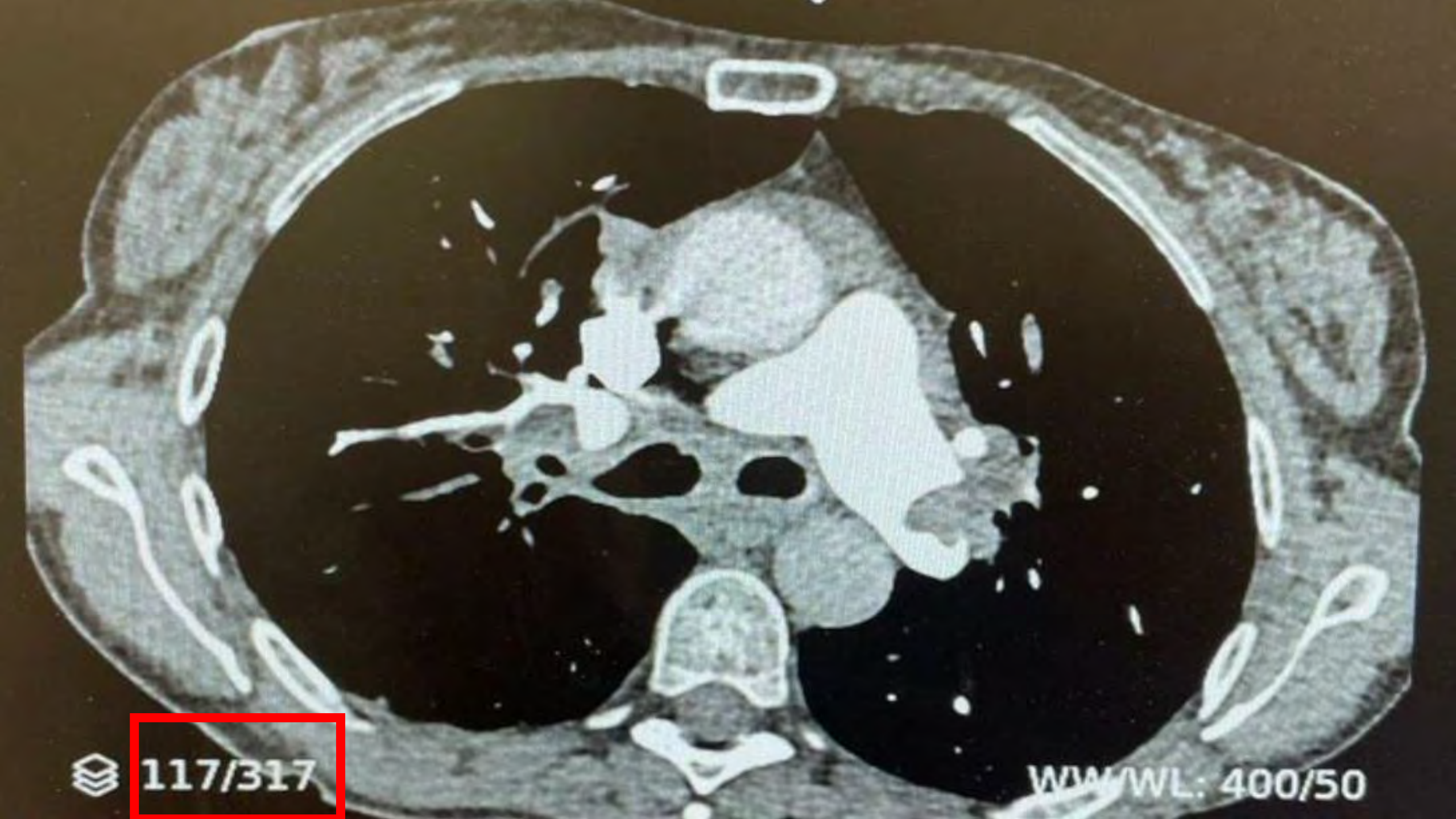
61-year-old with SOB and CP
LLE swelling
Hypoxic.

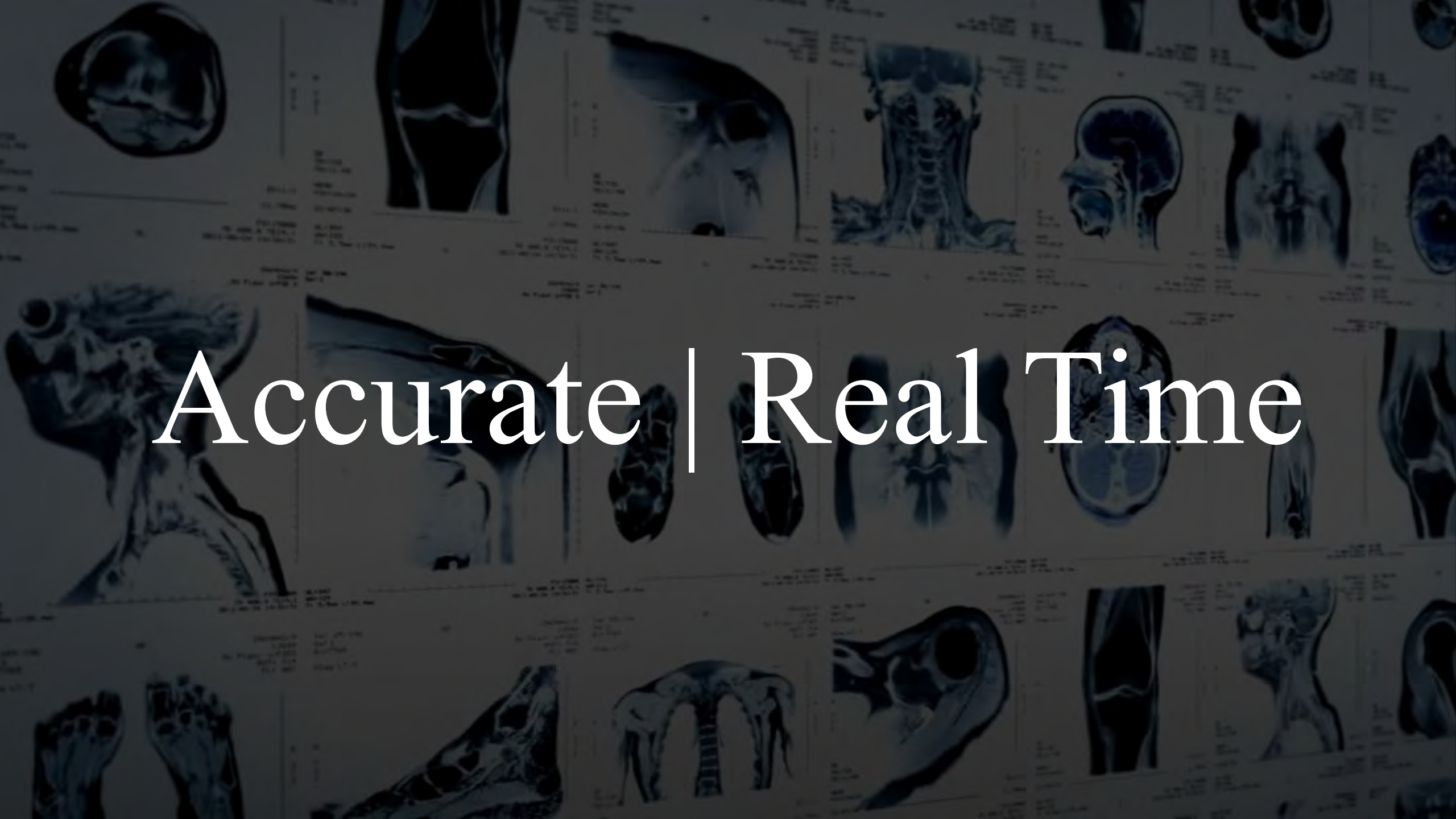




Suspected PE

RECORD. INFORMATIONAL PURPOSES ONLY. NOT FOR DIAGNOSTIC USE.

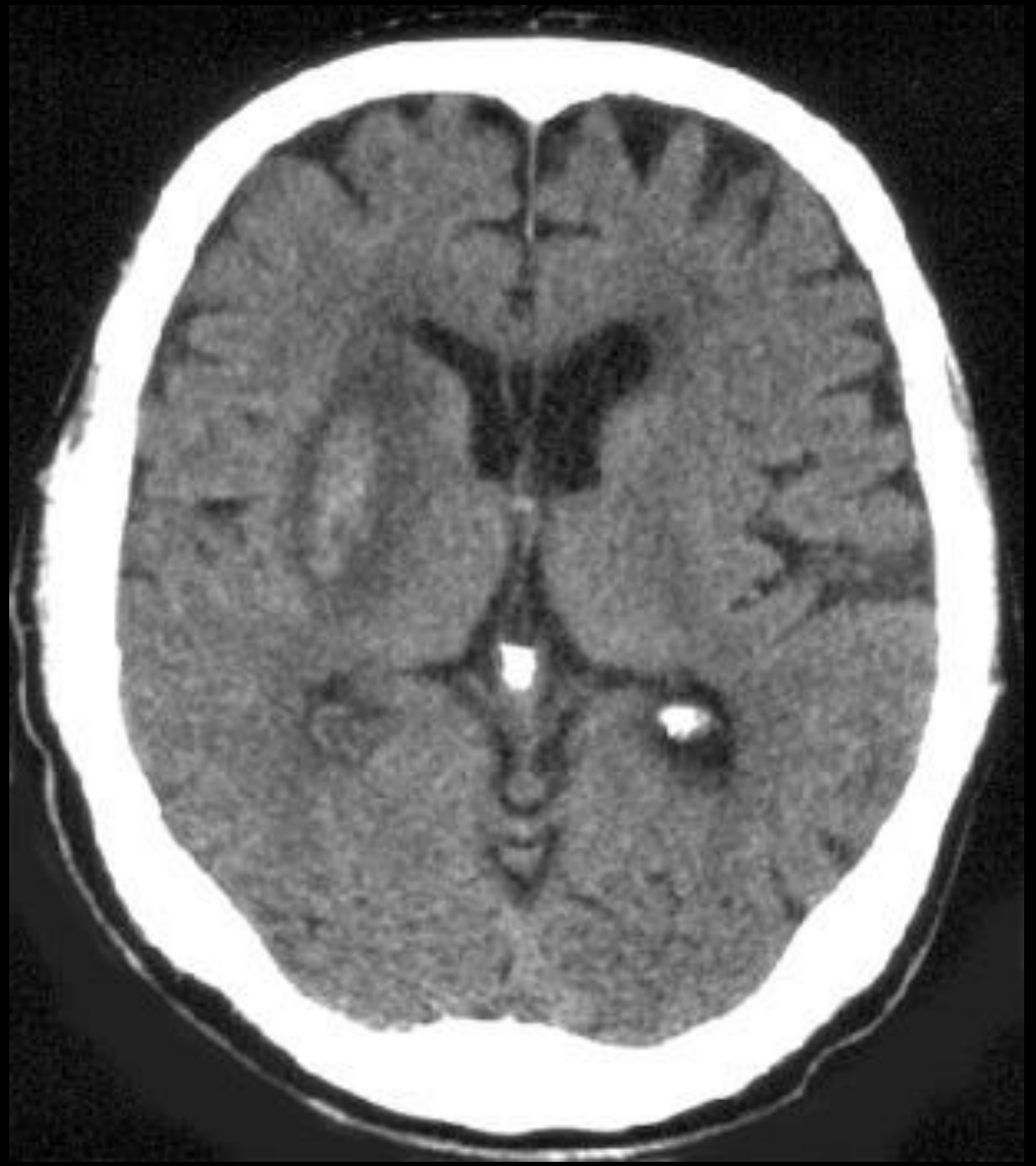

117/317
WW/WL: 400/50

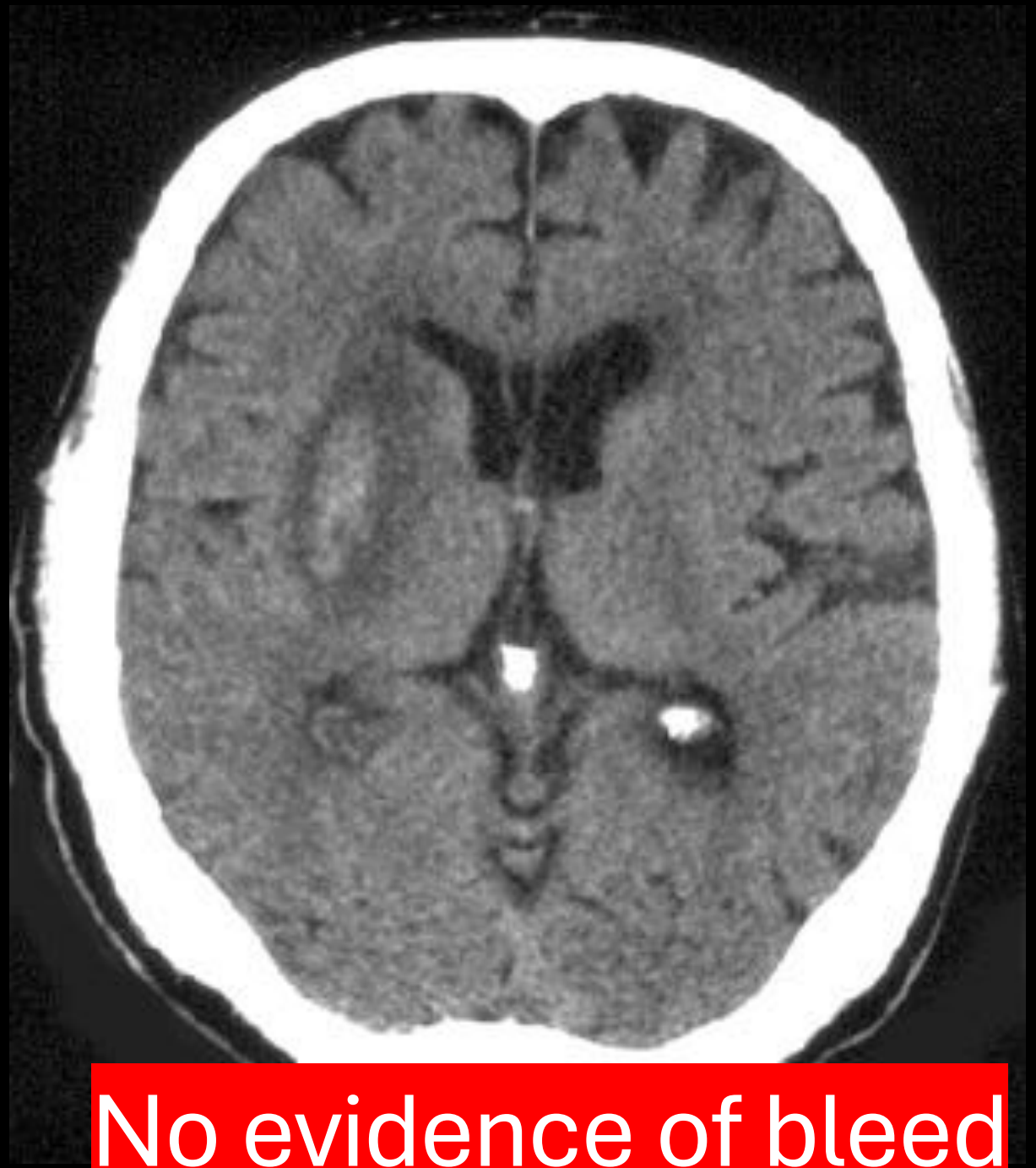

Accurate | Real Time

Impacts Outcomes


lass General Brigham

62-year-old with left side weakness 3 hours ago.




No evidence of bleed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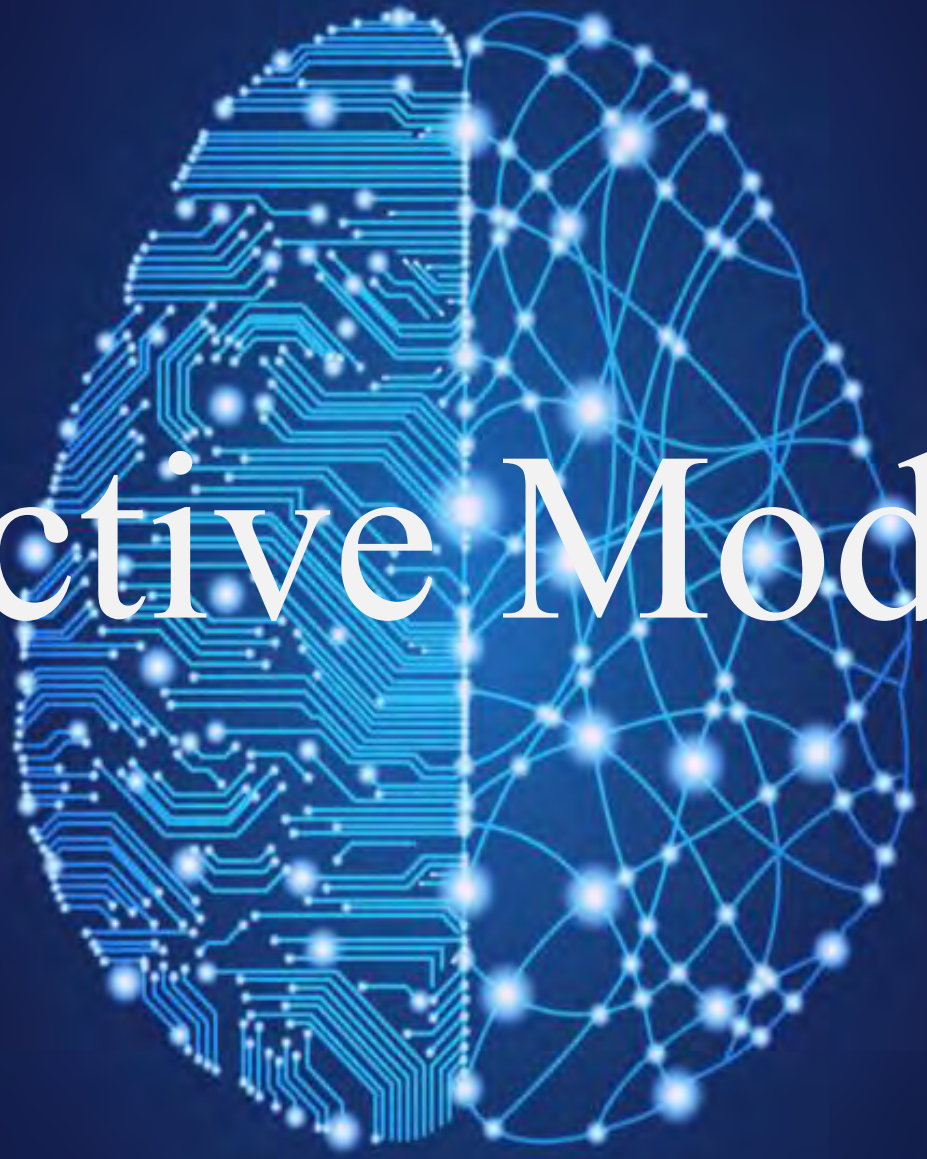
FASTER
42%
FASTER

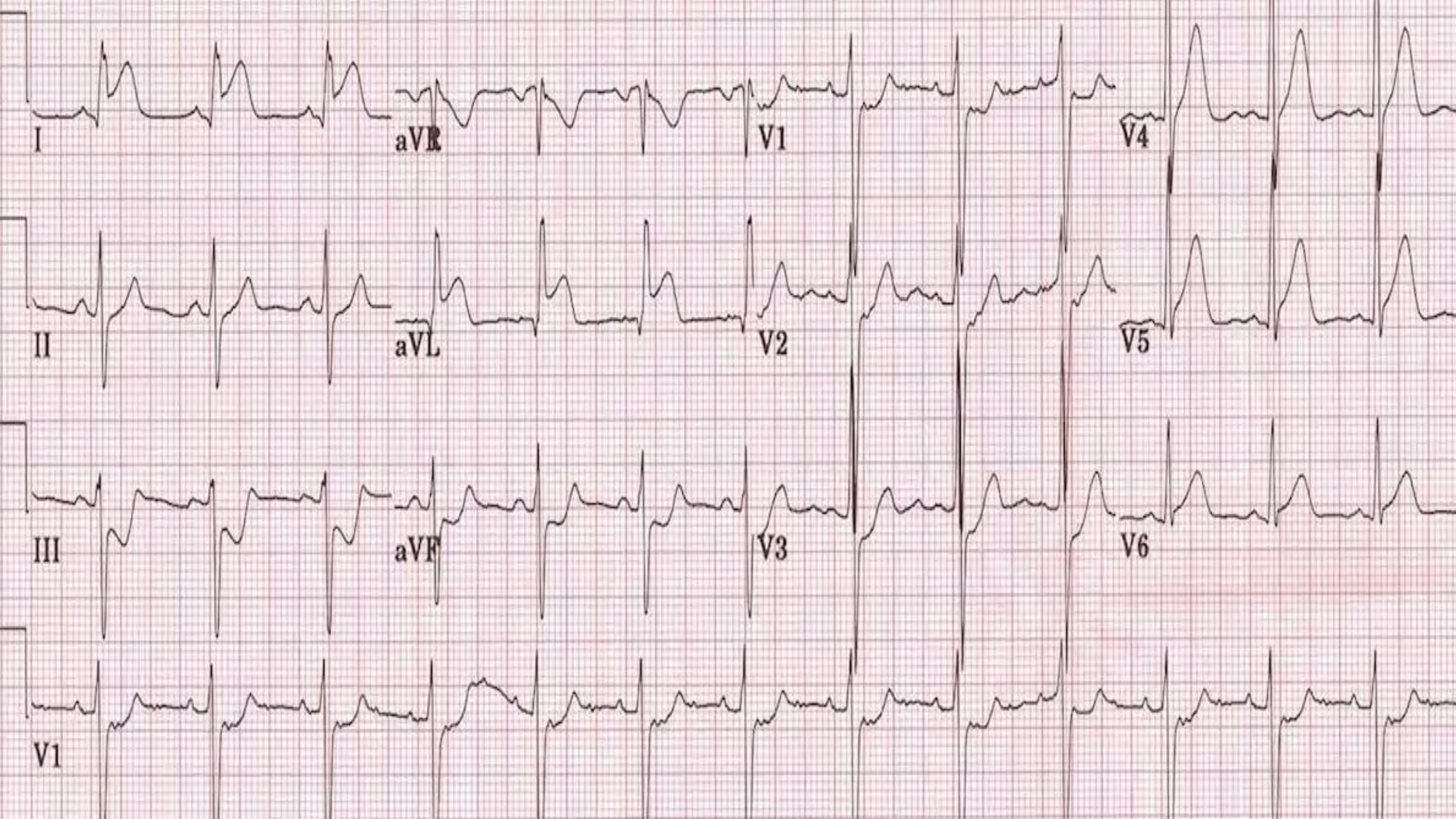

9:41
Monday, June 3

Predictive Modelling



Algorithms

59-year-old with left side CP
1 hour ago.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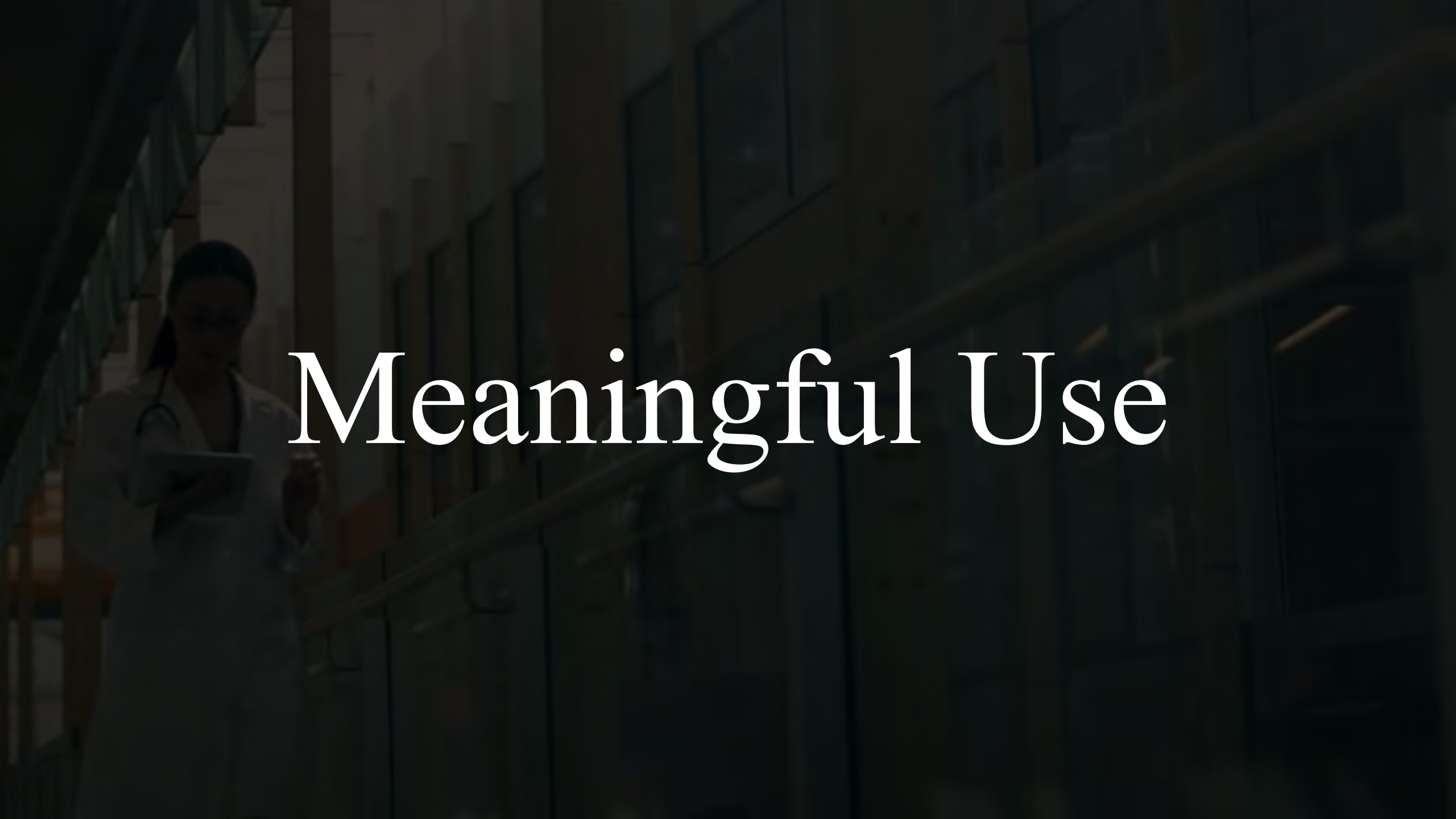
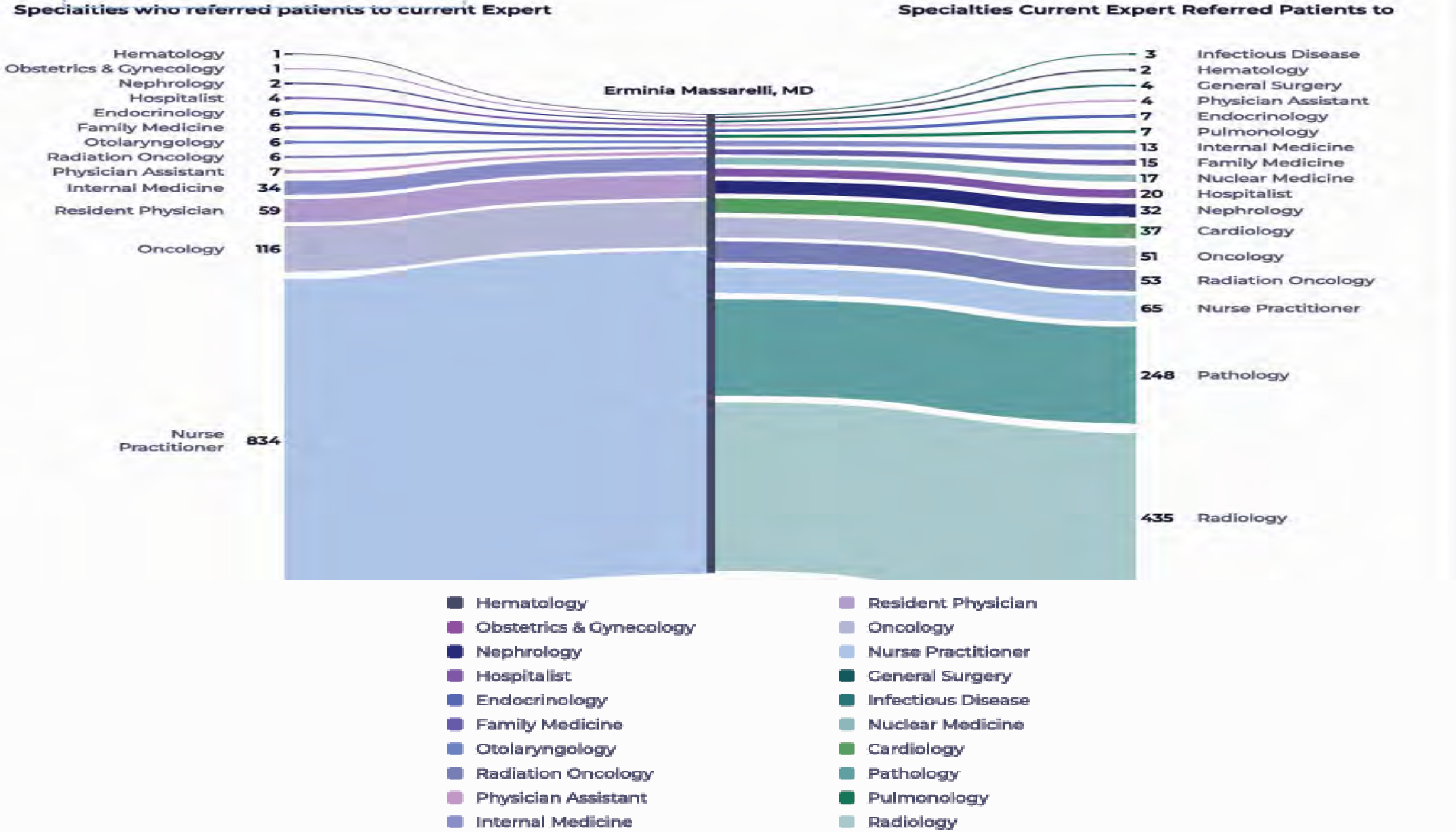
Workflow | Efficiency | Outcome

Harvest Data



Meaningful Use


Specialties who referred patients to current Expert
Specialties Current Expert Referred Patients to
Erminia Massarelli, MD
Hematology 1
Obstetrics & Gynecology 1
Nephrology 2
Hospitalist 4
Endocrinology 6
Family Medicine 6
Otolaryngology 6
Radiation Oncology 6
Physician Assistant 7
Internal Medicine 34
Resident Physician 59
Oncology 116
Nurse Practitioner 834
3 Infectious Disease
2 Hematology
4 General Surgery
4 Physician Assistant
7 Endocrinology
7 Pulmonology
13 Internal Medicine
15 Family Medicine
17 Nuclear Medicine
20 Hospitalist
32 Nephrology
37 Cardiology
51 Oncology
53 Radiation Oncology
65 Nurse Practitioner
248 Pathology
435 Radiology
Hematology
Obstetrics & Gynecology
Nephrology
Hospitalist
Endocrinology
Family Medicine
Otolaryngology
Radiation Oncology
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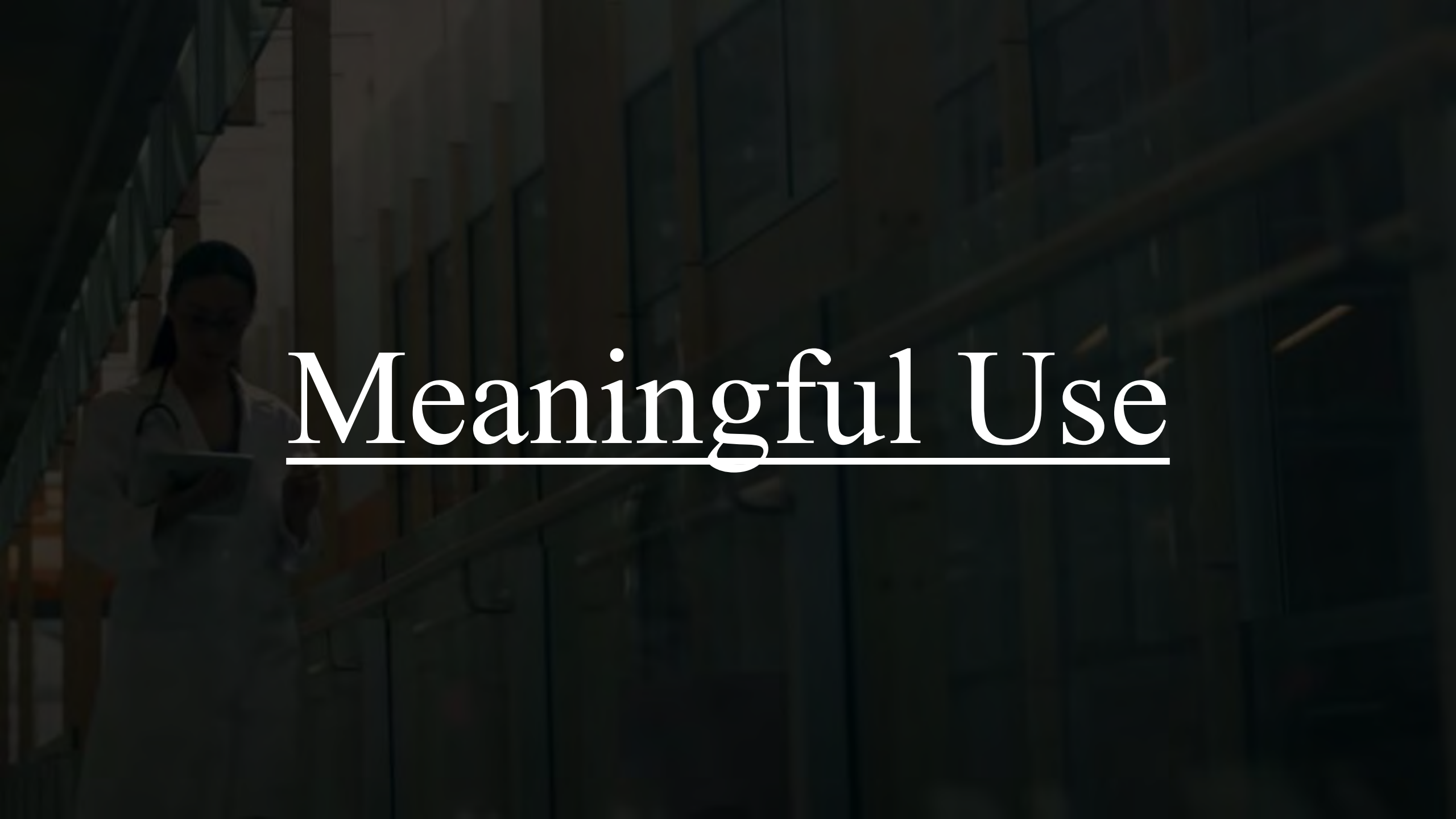

Meaningful Use


New Vital Signs

Med-PaLM2


Home | Hospital

Medical Errors

Quality Bar

Supply | Demand

50

Ethical

Consistant | Realiable | Safe

99.99

”When stakes are high….Culture of Tolerance approaches zero”

Marginal Gains

Culture of Zero Tolerance

53


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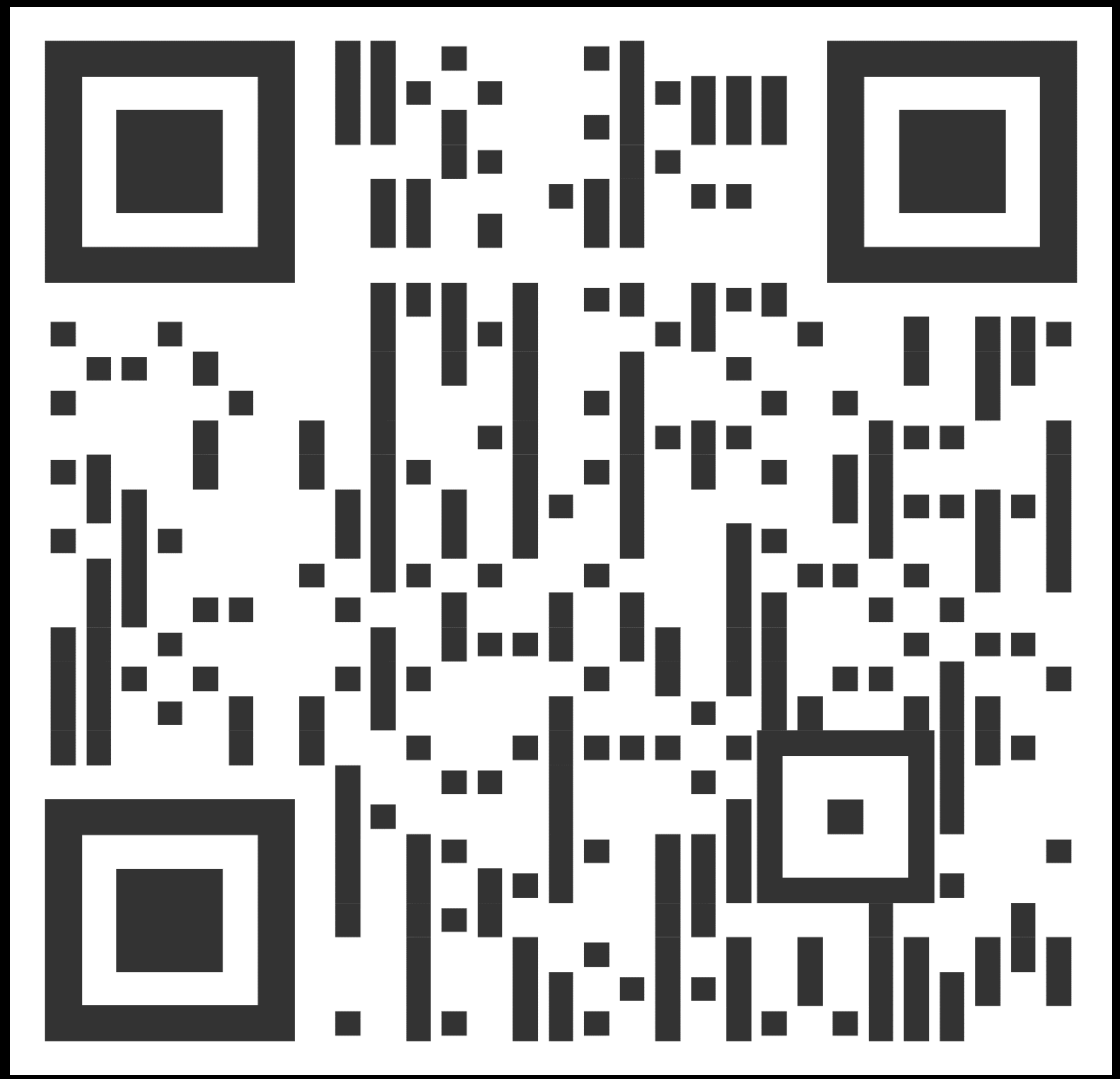
KayurPatel@MDExperts.MD



317-285-8062

Heart Failure with Preserved EF

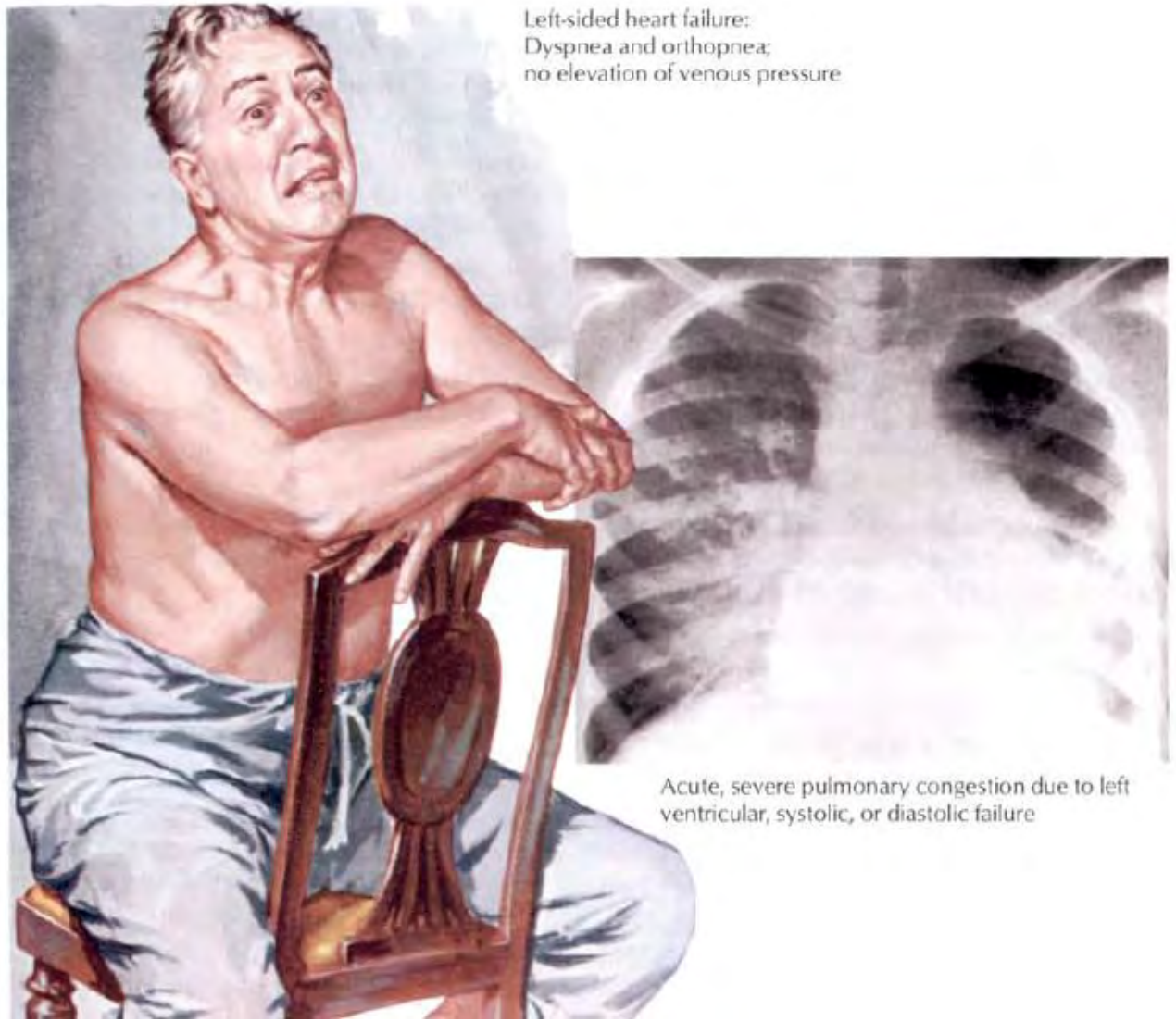
December 13, 2024

Charu Gupta, MD

Advanced Heart Failure

Disclosures

- None



Left-sided heart failure:
Dyspnea and orthopnea;
no elevation of venous pressure

Acute, severe pulmonary congestion due to left ventricular, systolic, or diastolic failure

Left-Sided Heart Failure and Pulmonary Congestion

Definition

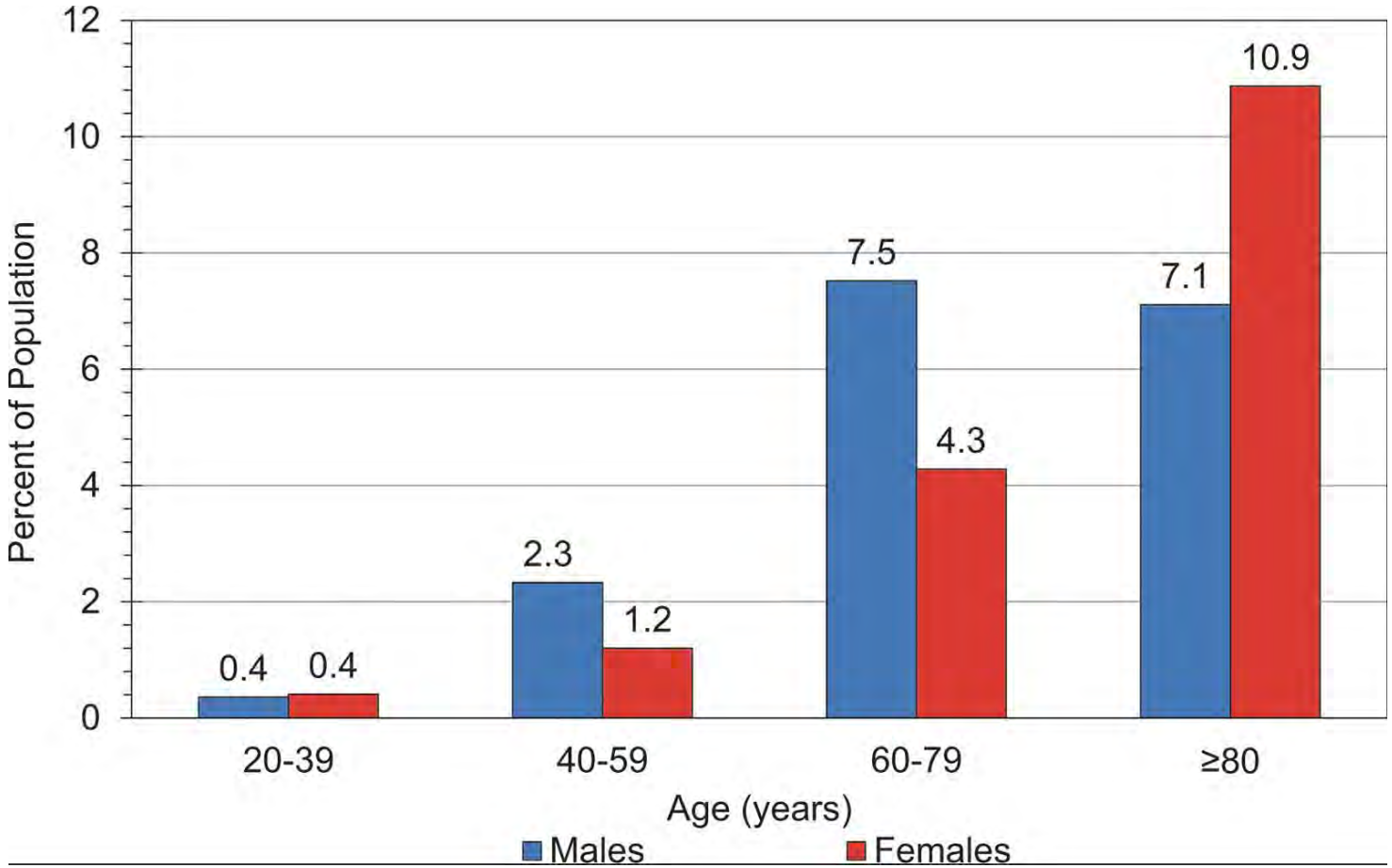
- Heart failure is a clinical syndrome:
  - Results from any structural or functional impairment of ventricular filling or ejection of blood
  - Manifestations of HF are dyspnea and fatigue:
    - » Limited exercise tolerance
    - » Fluid retention (leading to pulmonary and/or splanchnic congestion and/or peripheral edema)
  - Some patients have exercise intolerance but little evidence of fluid retention
  - There is no single diagnostic test for HF
- Largely a clinical diagnosis based on a careful history and physical examination.

Heart Disease and Stroke Statistics—2023 Update A Report From the American Heart Association

- On the basis of data from NHANES 2017 to 2020, ≈6.7 million Americans ≥20 years of age had HF, which is increased from ≈6.0 million according to NHANES 2015 to 2018.
- The lifetime risk of HF at 50 years of age increased among participants of the FHS (Framingham Heart Study) when comparing two 25-year epochs (1965–1989 versus 1990–2014) from 18.9% to 22.6% in females and 19.1% to 25.3% in males.

- Some data suggest that improvements in survival in individuals with HF could be leveling off over time. Data from the Rochester Epidemiology Project in Olmsted County, Minnesota, showed improved survival after HF diagnosis between 1979 and 2000; however, estimated 5-year mortality for those with HF did not decline from 2000 to 2010 and remained high (52.6% overall; 24.4% for those 60 years of age; and 54.4% for those 80 years of age).

Heart Disease and Stroke Statistics—2023 Update A Report From the American Heart Association: Prevalence of CHF



Prevalence of HF among US adults ≥20 years of age by sex and age (NHANES, 2017–2020).. Source: Unpublished National Heart, Lung, and Blood Institute tabulation using NHANES.40

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Katherine A.A. Clark et al. Trends in Heart Failure Hospitalizations in the US from 2008 to 2018, Journal of Cardiac Failure; Volume 28: Issue 2, 2022: 171-180.

Key Trends in Heart Failure Admissions Stats over the past decade 2008-2018			
	Overall Heart Failure	HFrEF	HFpEF
Number of Hospitalizations	↑	↑	↑
Demographics	More diverse	More diverse	More diverse
Total hospital costs	↓	↓	↓
Inpatient Mortality	↓	=	↓

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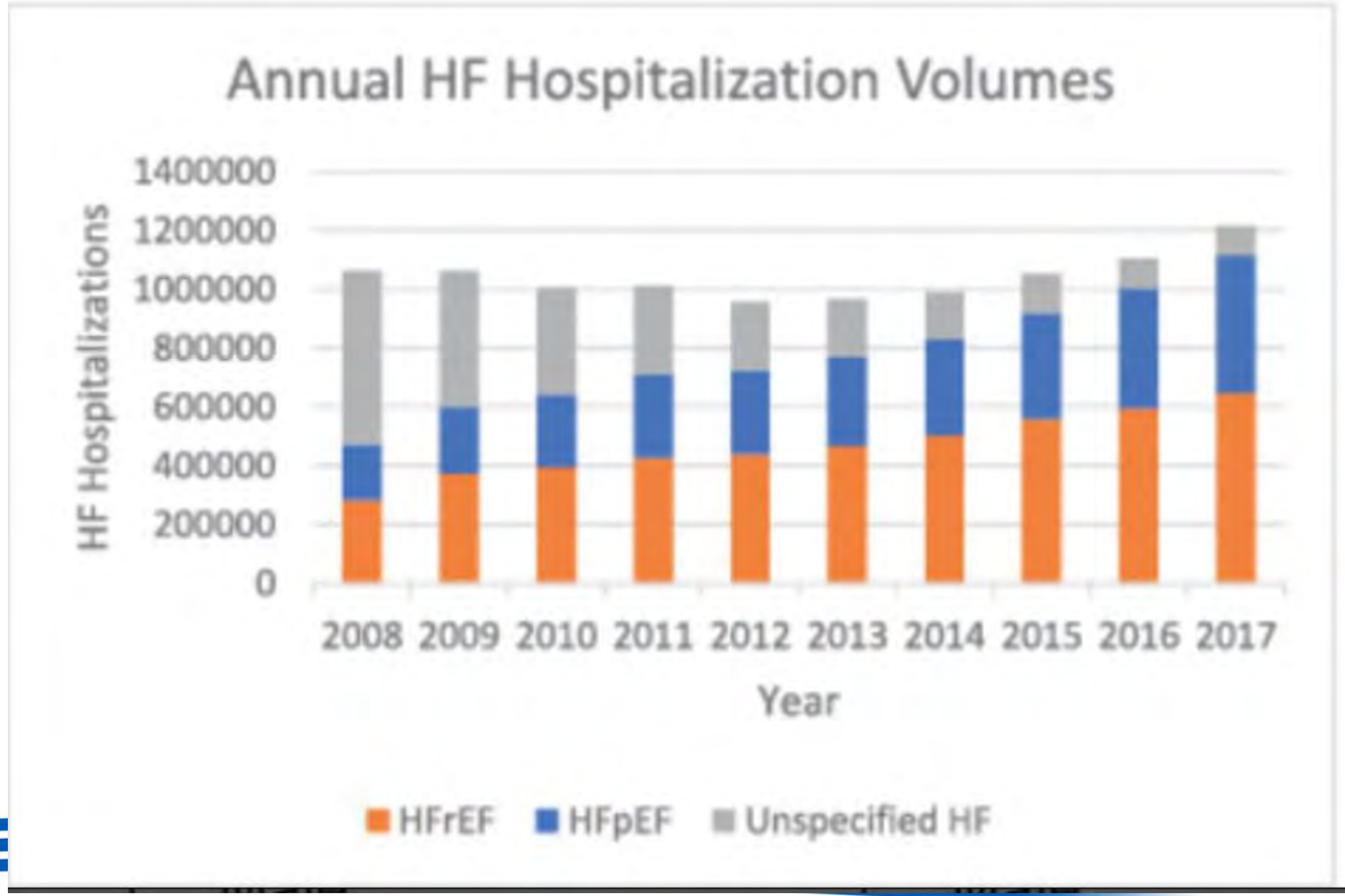
Katherine A.A. Clark et al. Trends in Heart Failure Hospitalizations in the US from 2008 to 2018, Journal of Cardiac Failure; Volume 28: Issue 2, 2022: 171-180.



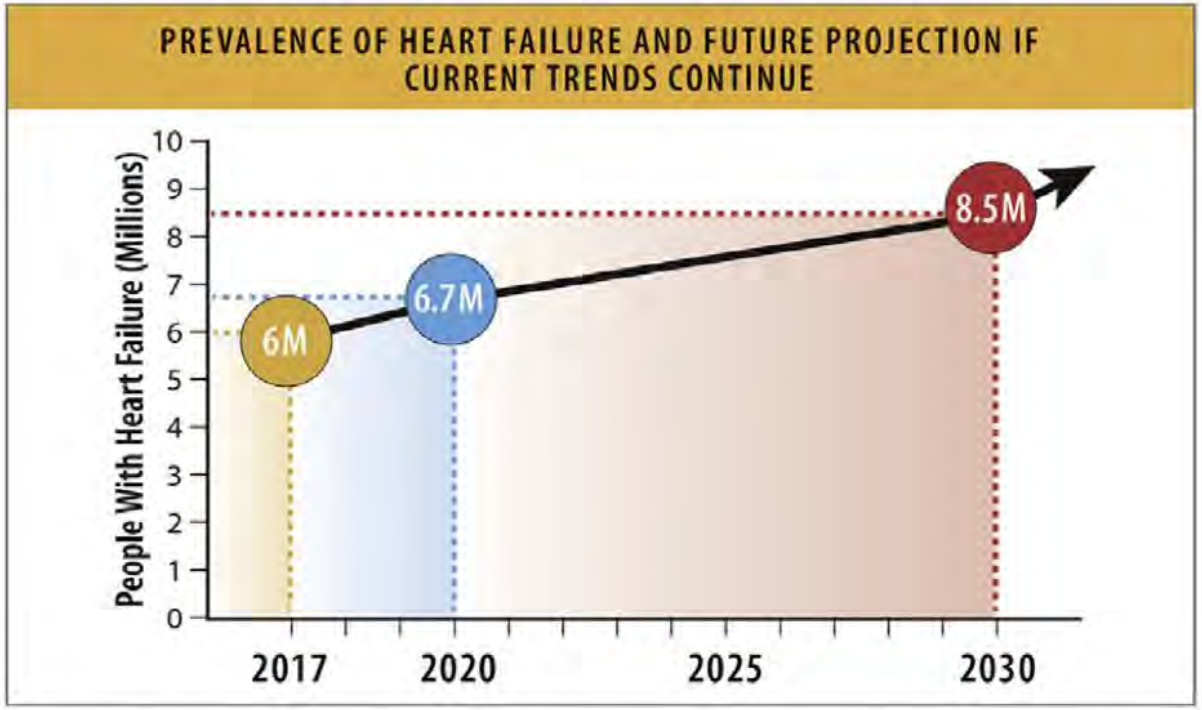
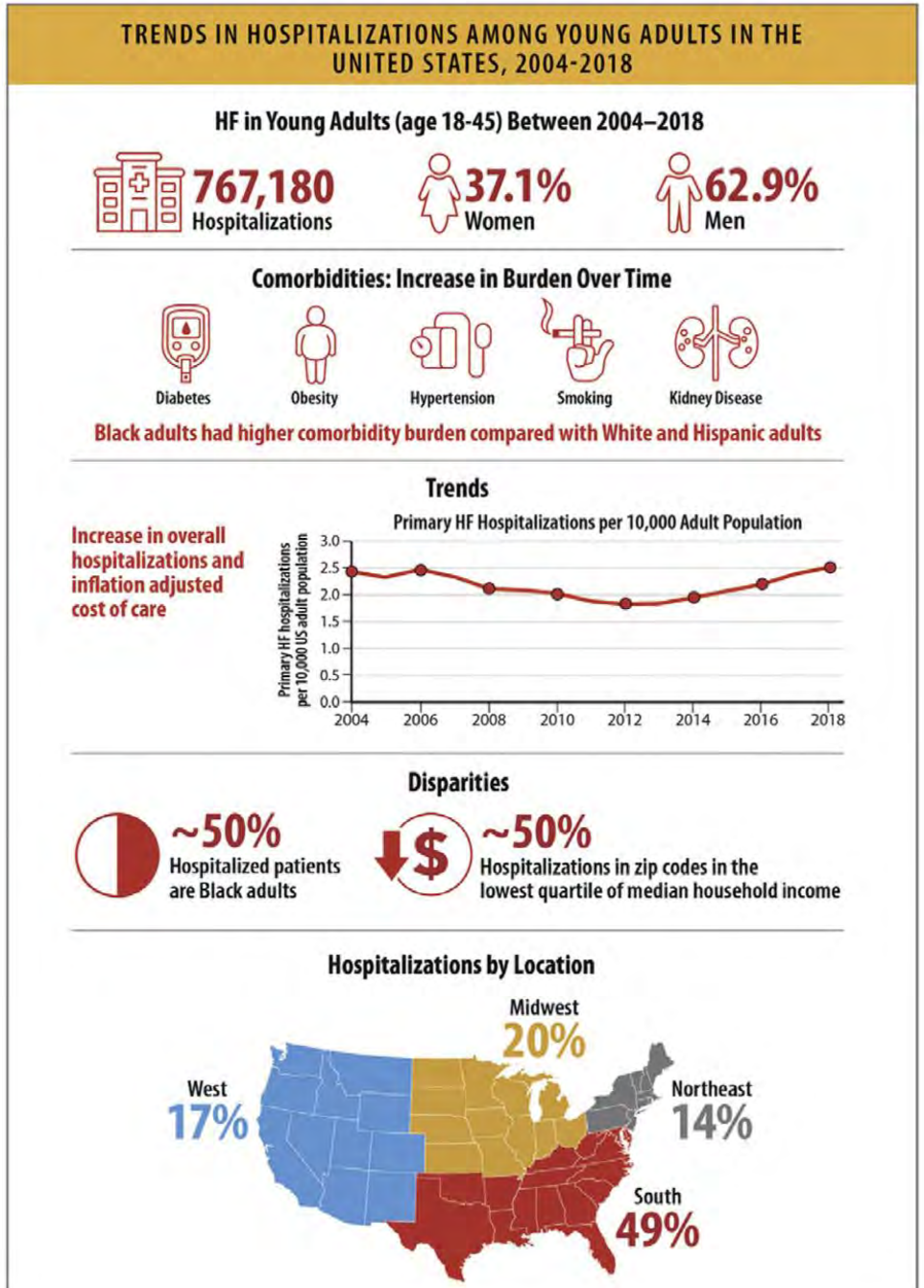


Fig. 3. Prevalence of HF and future projection if current trends continue. HF = heart failure. Modified from Van Nuys KE, Xie Z, Tysinger B, Hlatky MA, Goldman DP. Innovation in heart failure treatment: life expectancy, disability, and health disparities. JACC Heart Fail 2018;6:401–9 and Heidenreich PA, Albert NM, Allen LA, Bluemke DA, Butler J, Fonarow GC, et al. Forecasting the impact of heart failure in the United States: a policy statement from the American Heart Association. Circ Heart Fail 2013;6:606–19.



Trends in hospitalizations among young adults in the United States, 20042018. APC=annual percentage change; HF=heart failure; US=United States. Modified from Jain V, Minhas AMK, Khan SU, Greene SJ, Pandey A, Van Spall HGC, et al. Trends in HF hospitalizations among young adults in the United States From 2004 to 2018. JACC Heart Fail 2022;10:35062.

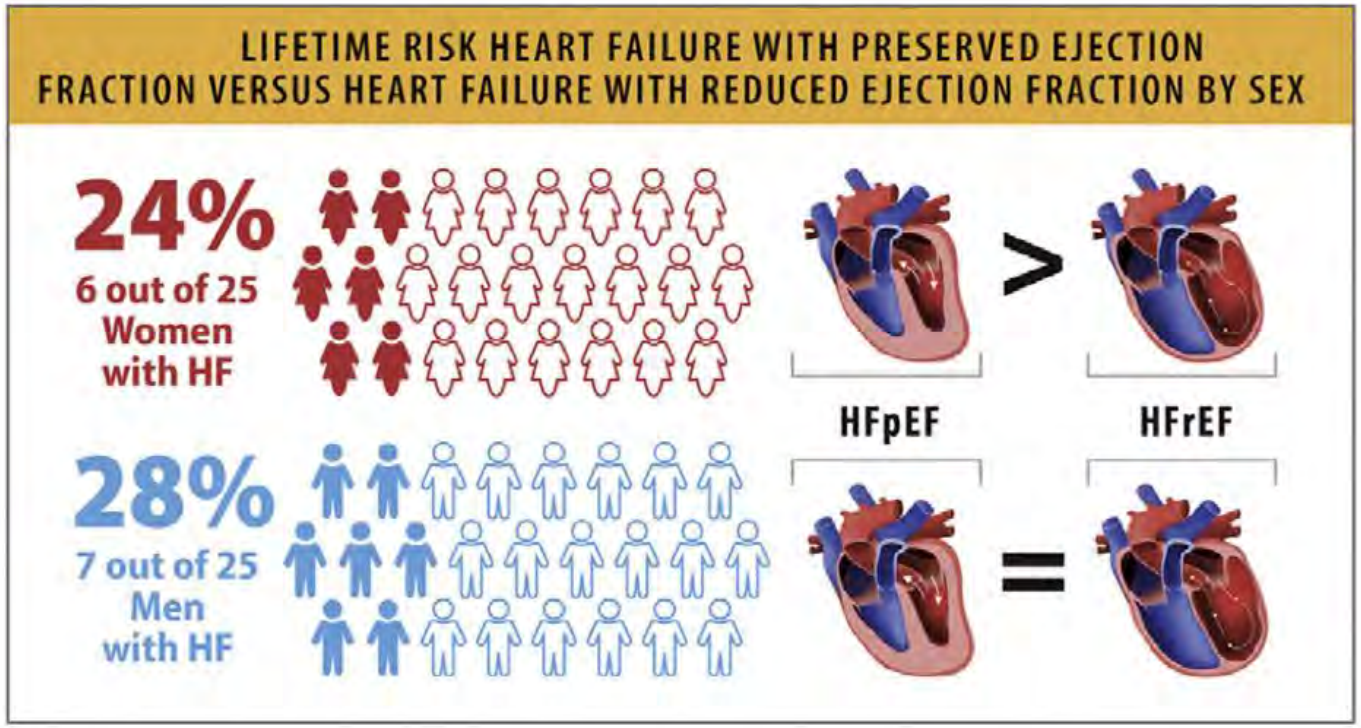
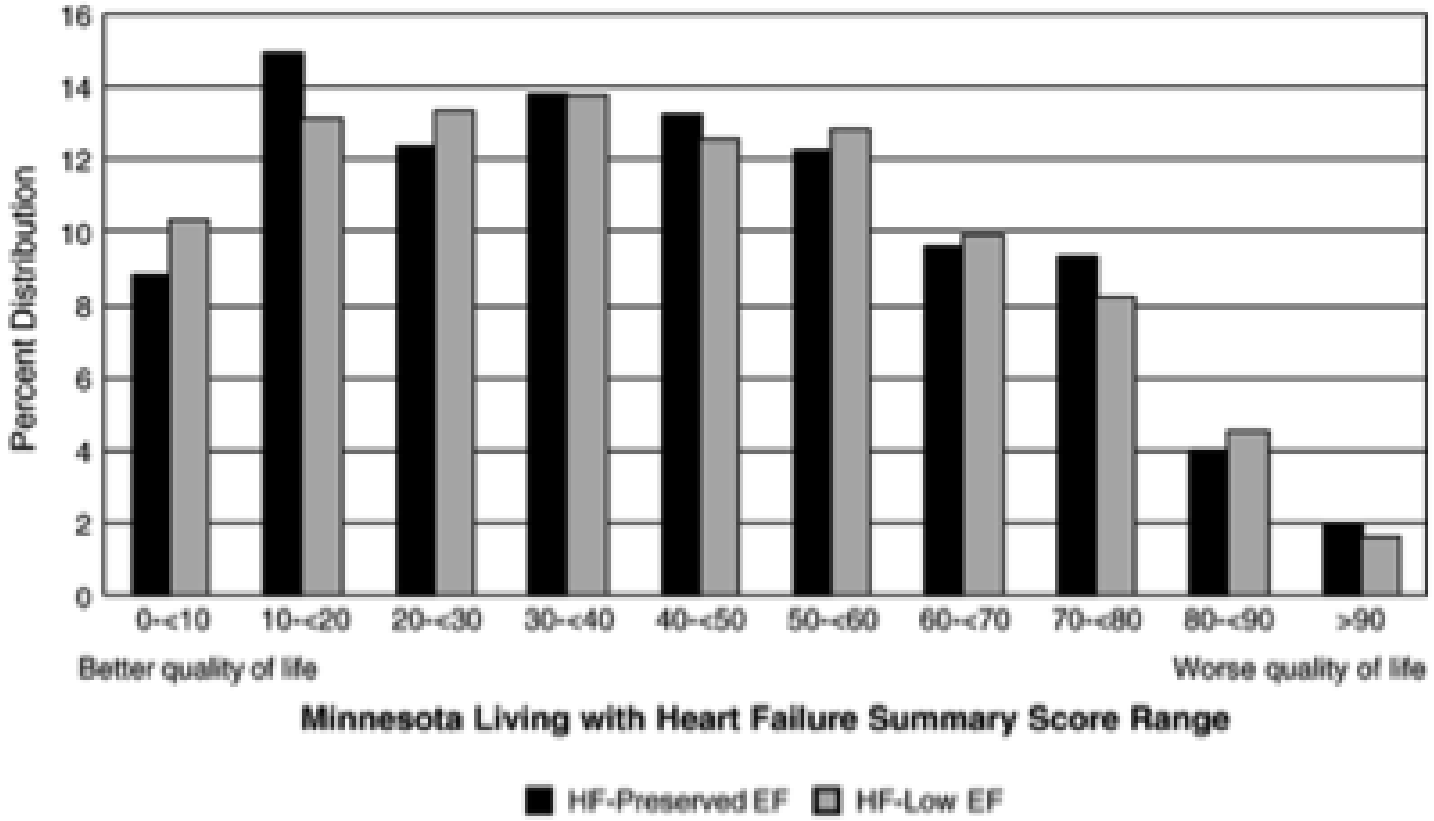


Fig. 2. Lifetime risk of HFpEF vs HFrEF by sex. HF = heart failure; HFpEF = heart failure with preserved ejection fraction; HFrEF = heart failure with reduced ejection fraction. Modified from Pandey A, Omar W, Ayers C, LaMonte M, Klein L, Allen NB, et al. Sex and race differences in lifetime risk of heart failure with preserved ejection fraction and heart failure with reduced ejection fraction. Circulation 2018;137:1814–23.



Better QOL

Worse QOL

European Journal of Heart Failure
Volume 9, Issue 1, pages 83-91, 14 JAN 2007 DOI: 10.1016/j.ejheart.2006.10.012
http://onlinelibrary.wiley.com/doi/10.1016/j.ejheart.2006.10.012/full#ejhf2006-10-012-fig-0001

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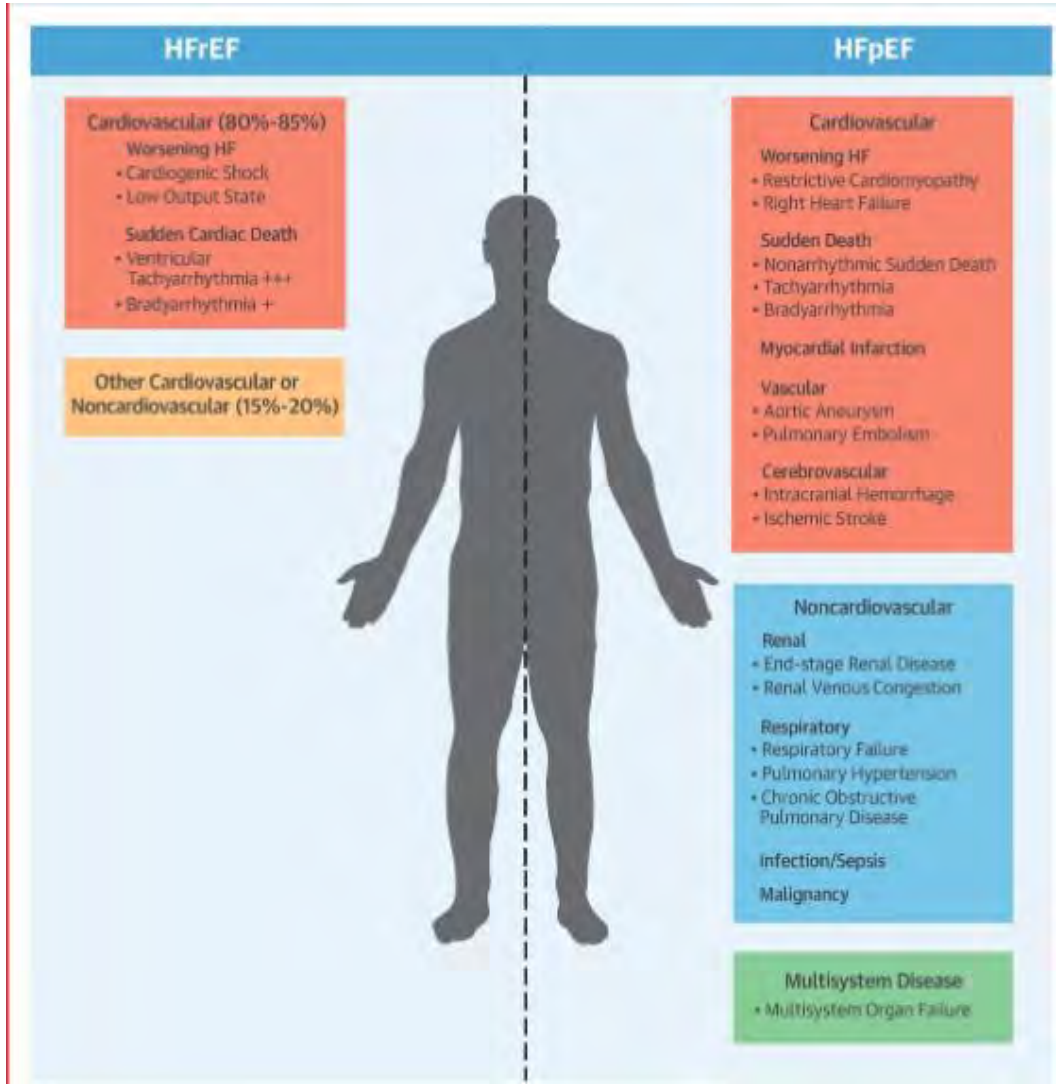
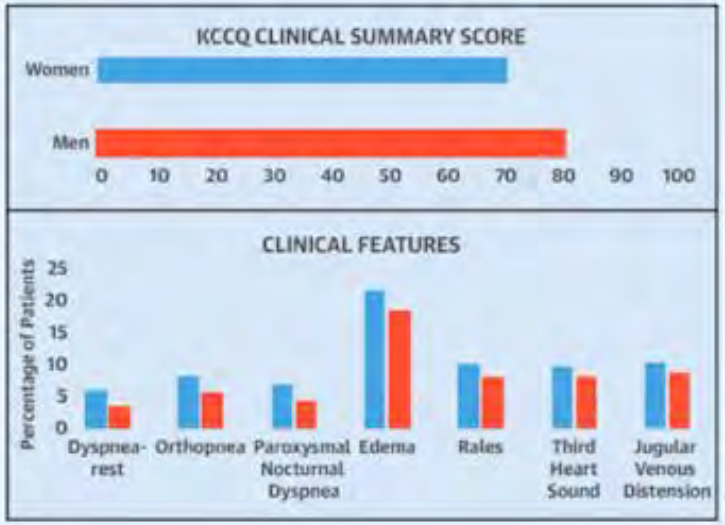
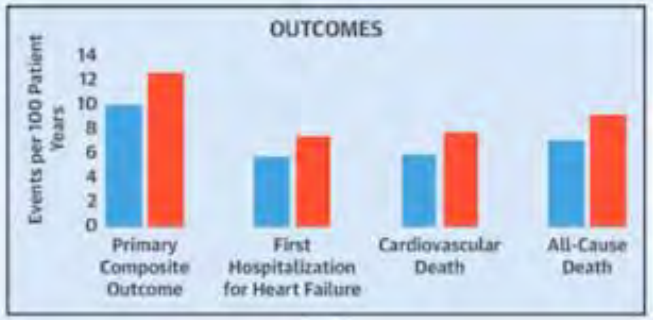


Vaduganathan M et al. JACC 2017;69 (5):556-69.

Women with Heart Failure*

- Older
- Predominant non-ischemic etiology
- Worse renal function
- More anxiety/depression
- Relative underuse of diuretics/ overuse of digoxin
  Underuse of anticoagulants and devices





Dewan, P. et al. J Am Coll Cardiol. 2019;73(1):29-40.

*Heart failure and reduced ejection fraction.
All compared to men
Women Men

RECOMMENDATIONS:
-Tailored therapeutic strategies for women
-Increased referral to cardiac rehabilitation programs
-More psychosocial support

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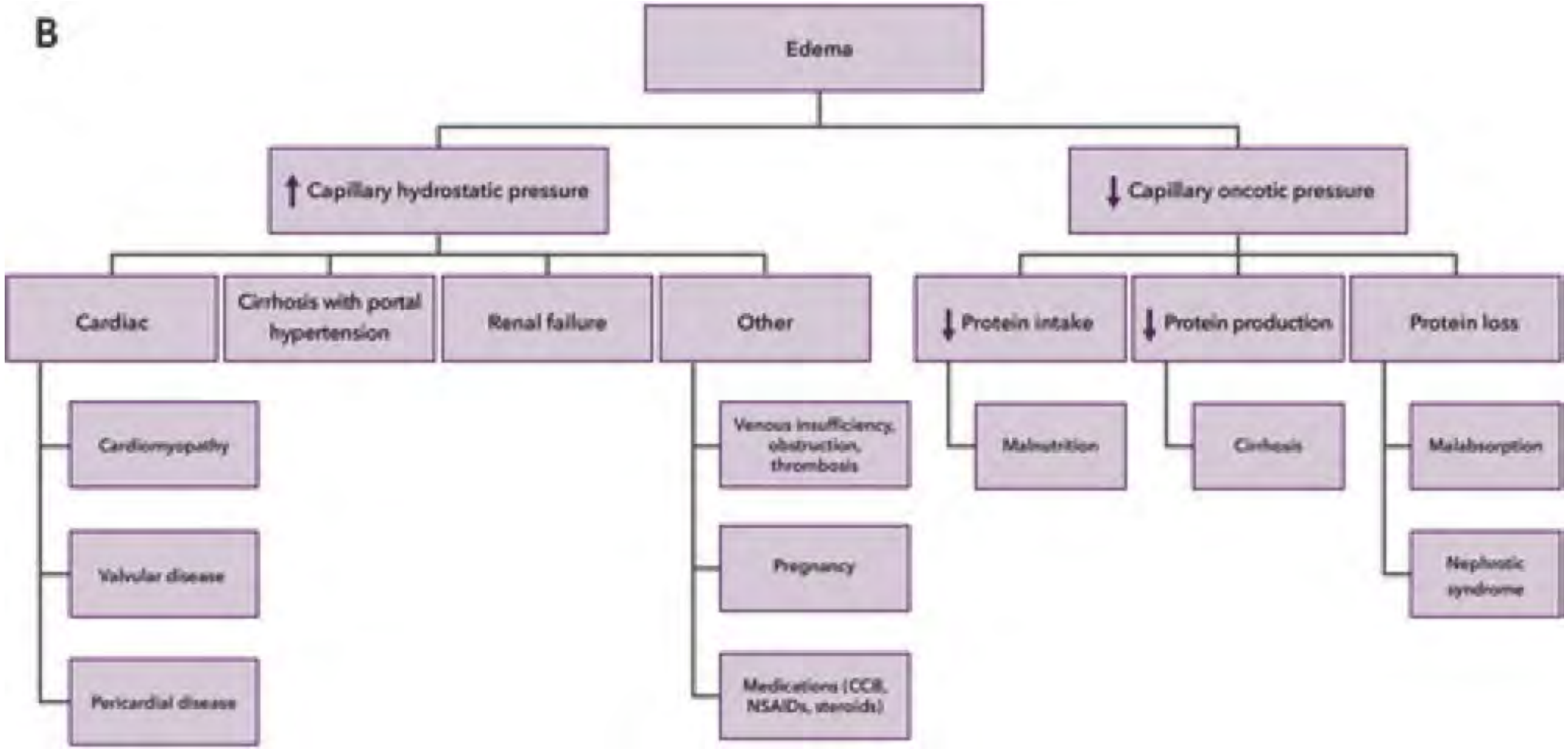
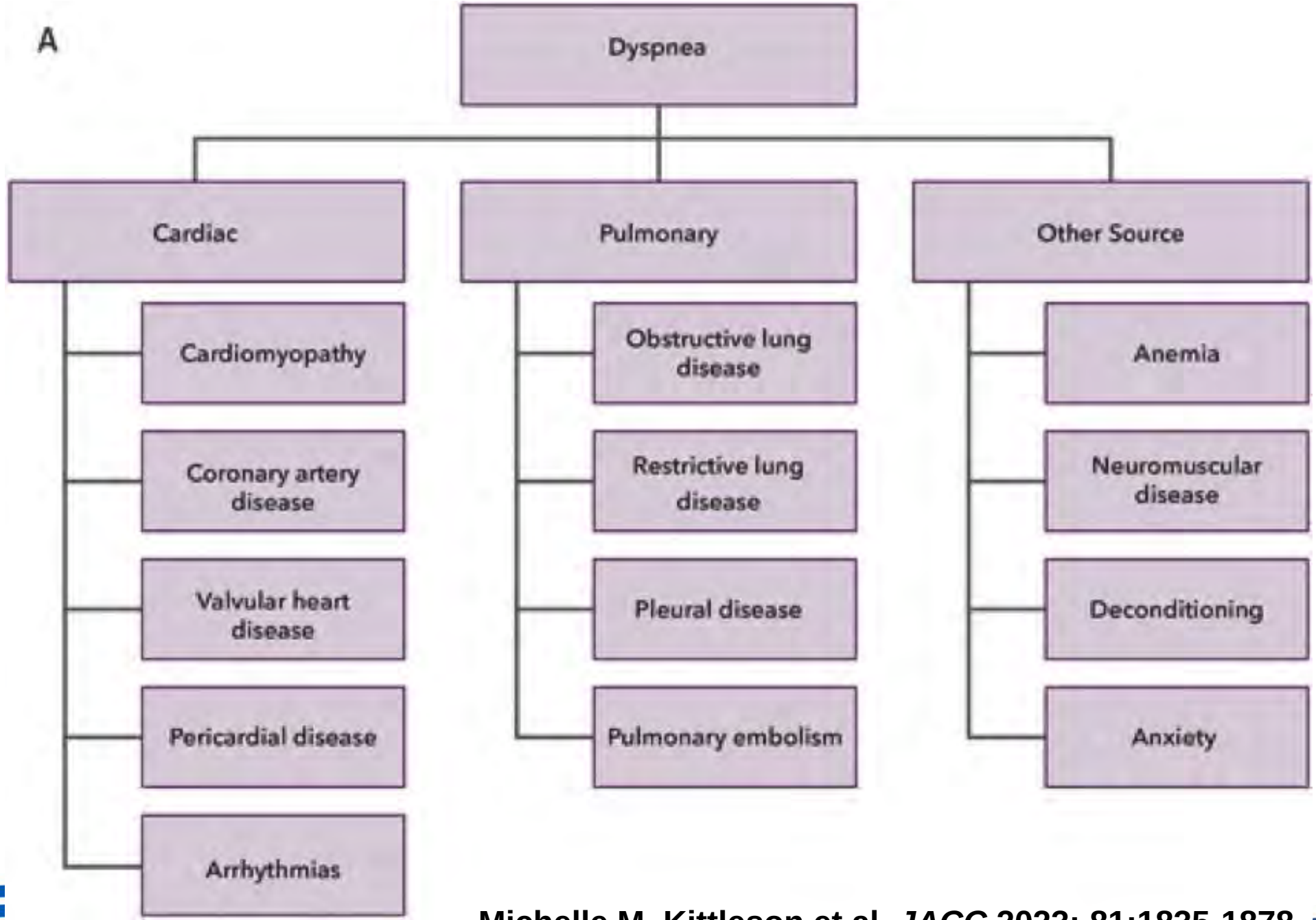


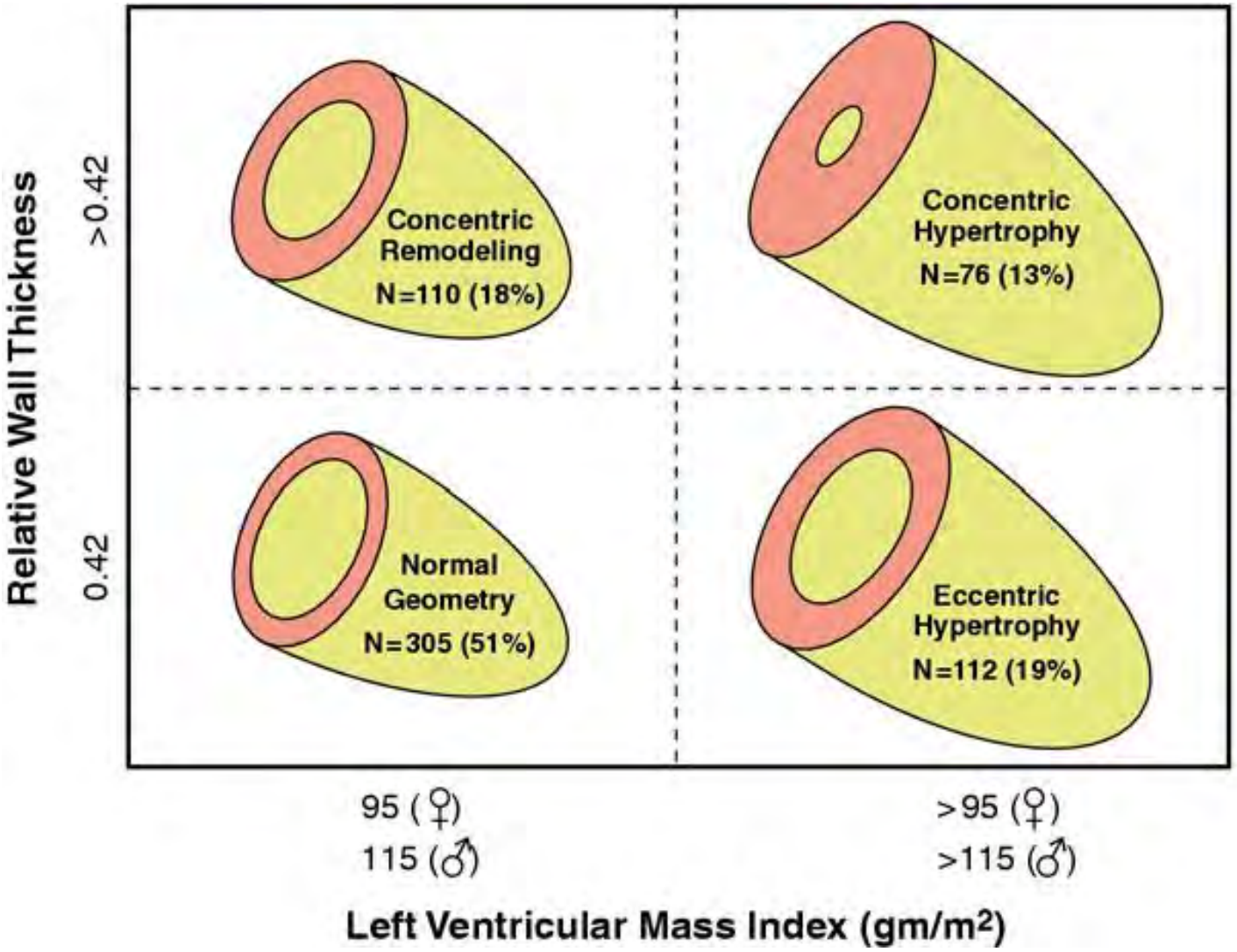
Michelle M. Kittleson et al. *JACC* 2023; 81:1835-1878.

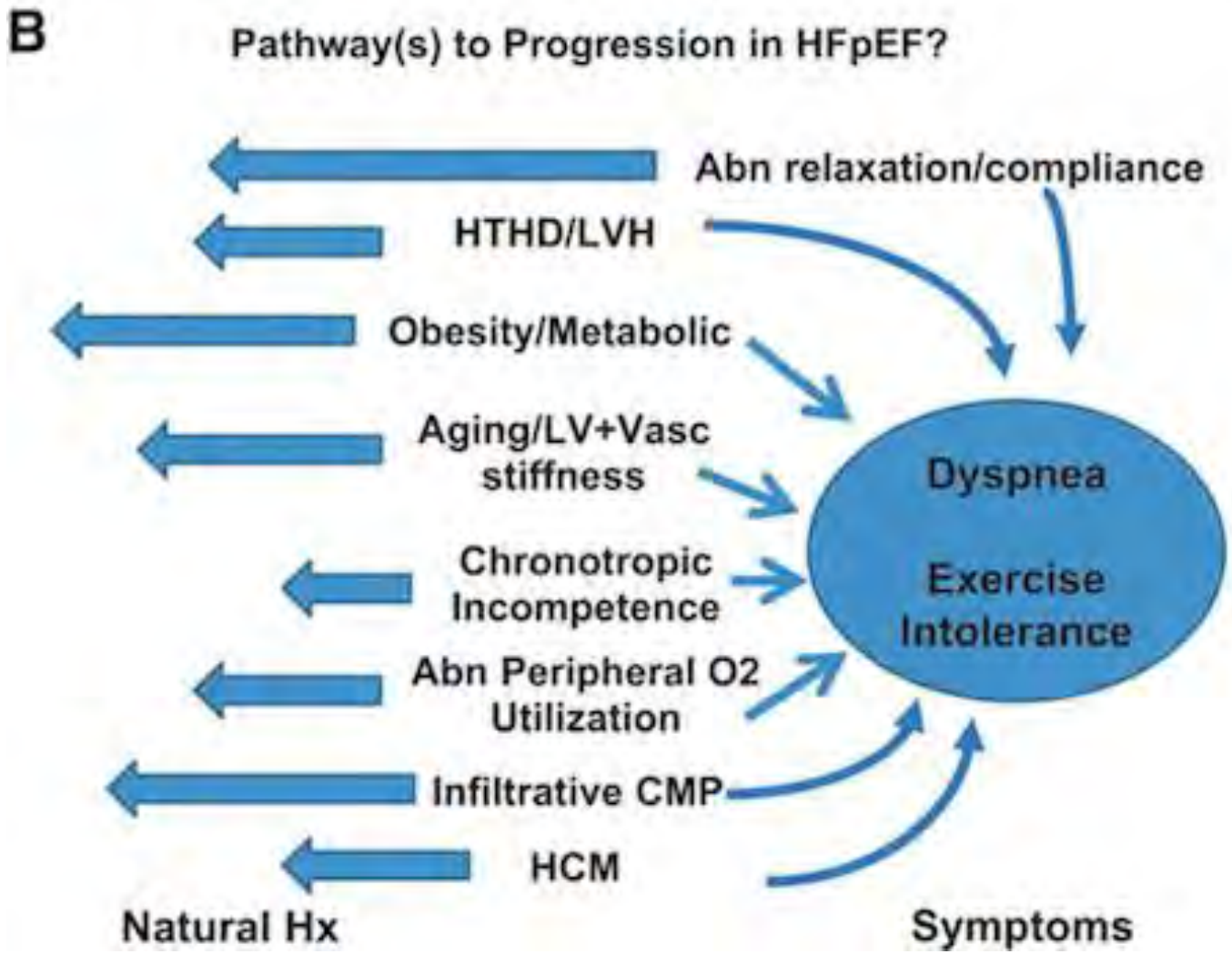


Michelle M. Kittleson et al. *JACC* 2023; 81:1835-1878.

LV Remodeling and Heart Failure

Konstam et al, JACC Imaging 2011;4:98-108

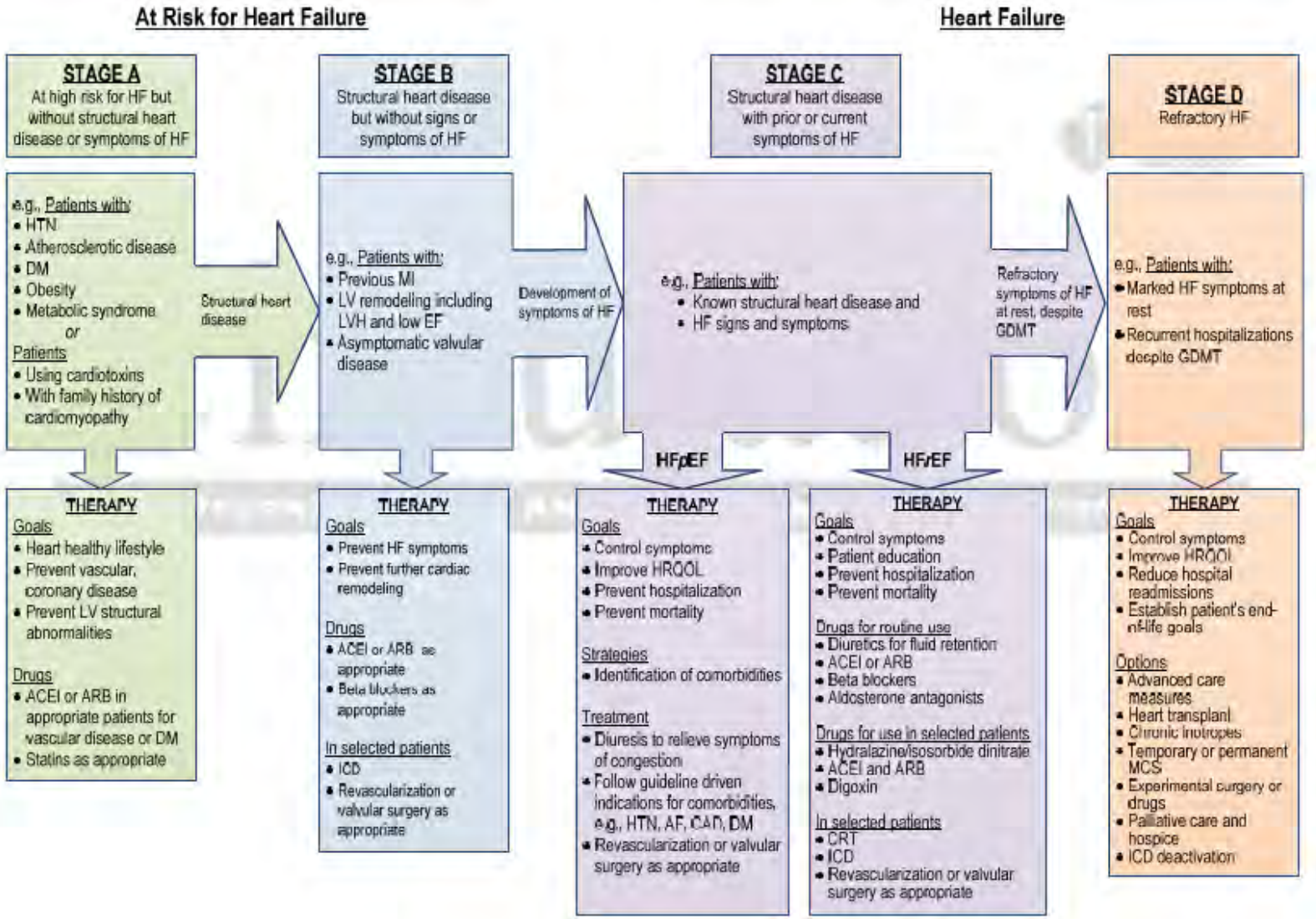




Udelson J, Stevenson LW Circ 2016

2013 ACCF/AHA Guideline for the Management of Heart Failure : A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines

Yancy et al Circulation. 2013;128:000–000



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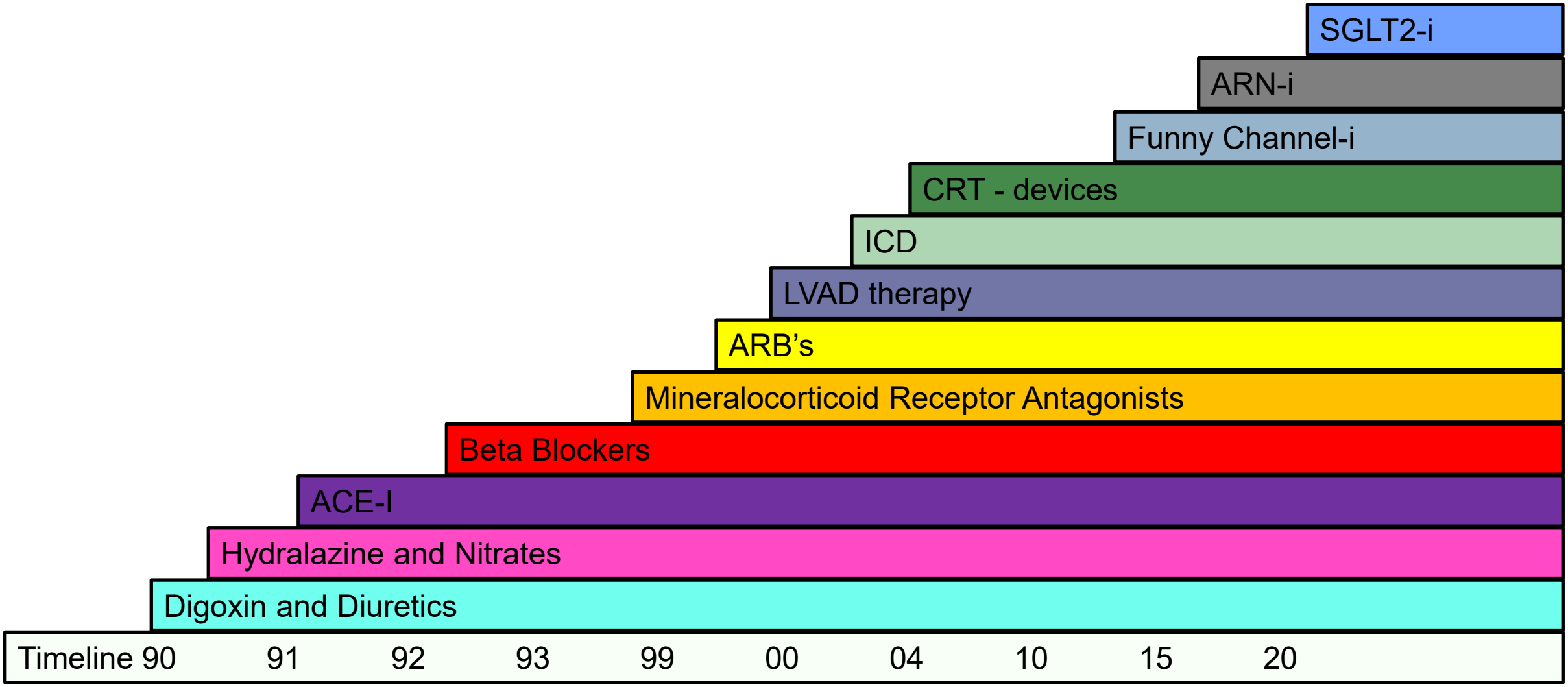
Evolution of Heart Failure Therapy



Case Presentation

- 83 yo female with DOE
- History of “atrial tachycardia”, hypertension, questionable lung disease, DM2, OSA on CPAP
- Seen in pulmonary clinic and referred to CHF – lung disease was not believed to be primary problem
- Exam: mildly hypertensive, obese, +S4 with elevated JVD and +HJR, and bilateral lower extremity edema
- Meds: Metoprolol, intermittent low dose lasix, valsartan, amlodipine, potassium

Case Presentation

- Workup
- ECG normal sinus rhythm
- Stress test negative for ischemia
- Echo suggested grade 1 diastolic dysfunction and normal LA size, elevated estimated PA pressure
- Patient has some memory issues: difficulty remembering her symptoms, severity of symptoms, change in symptoms, or whether she feels better or worse with diuretics

ACC/AHA Guidelines

Recommendations for Treatment of HF*p*EF

Recommendations	COR	LOE
Systolic and diastolic blood pressure should be controlled according to published clinical practice guidelines	I	B[67,80]
Diuretics should be used for relief of symptoms due to volume overload.	I	C
Coronary revascularization for patients with CAD in whom angina or demonstrable myocardial ischemia is present despite GDMT	IIa	C
Management of AF according to published clinical practice guidelines for HF*p*EF to improve symptomatic HF	IIa	C
Use of beta-blocking agents, ACE inhibitors, and ARBs for hypertension in HF*p*EF	IIa	C
ARBs might be considered to decrease hospitalizations in HF*p*EF	IIb	B[67,81]
Nutritional supplementation is not recommended in HF*p*EF	III: No Benefit	C

ACE indicates angiotensin-converting enzyme; AF, atrial fibrillation; ARBs, angiotensin-receptor blockers; CAD, coronary artery disease; COR, Class of Recommendation; GDMT, guideline-directed medical therapy; HF, heart failure; HF*p*EF, heart failure with preserved ejection fraction; and LOE, Level of Evidence.

TABLE 2 Common Factors That Can Contribute to Worsening Heart Failure

Acute myocardial ischemia
Uncontrolled hypertension
Atrial fibrillation and other arrhythmias
Nonadherence with medication regimen, sodium, or fluid restriction
Medications with negative inotropic effect
Medications that increase sodium retention (NSAIDs, thiazolidinediones, steroids)
Excessive alcohol intake or illicit drug use
Anemia
Hyper or hypothyroidism
Acute infections (upper respiratory infection, pneumonia, urinary tract infections)
Additional acute cardiovascular diagnoses (aortic valve disease, endocarditis, myopericarditis)

Adapted from Yancy, et al. 2013 ACCF/AHA Guideline for the Management of Heart Failure (15).

ACCF = American College of Cardiology Foundation; AHA = American Heart Association; NSAIDs = nonsteroidal anti-inflammatory drugs.

TABLE 3 Clinical Evidence of Congestion

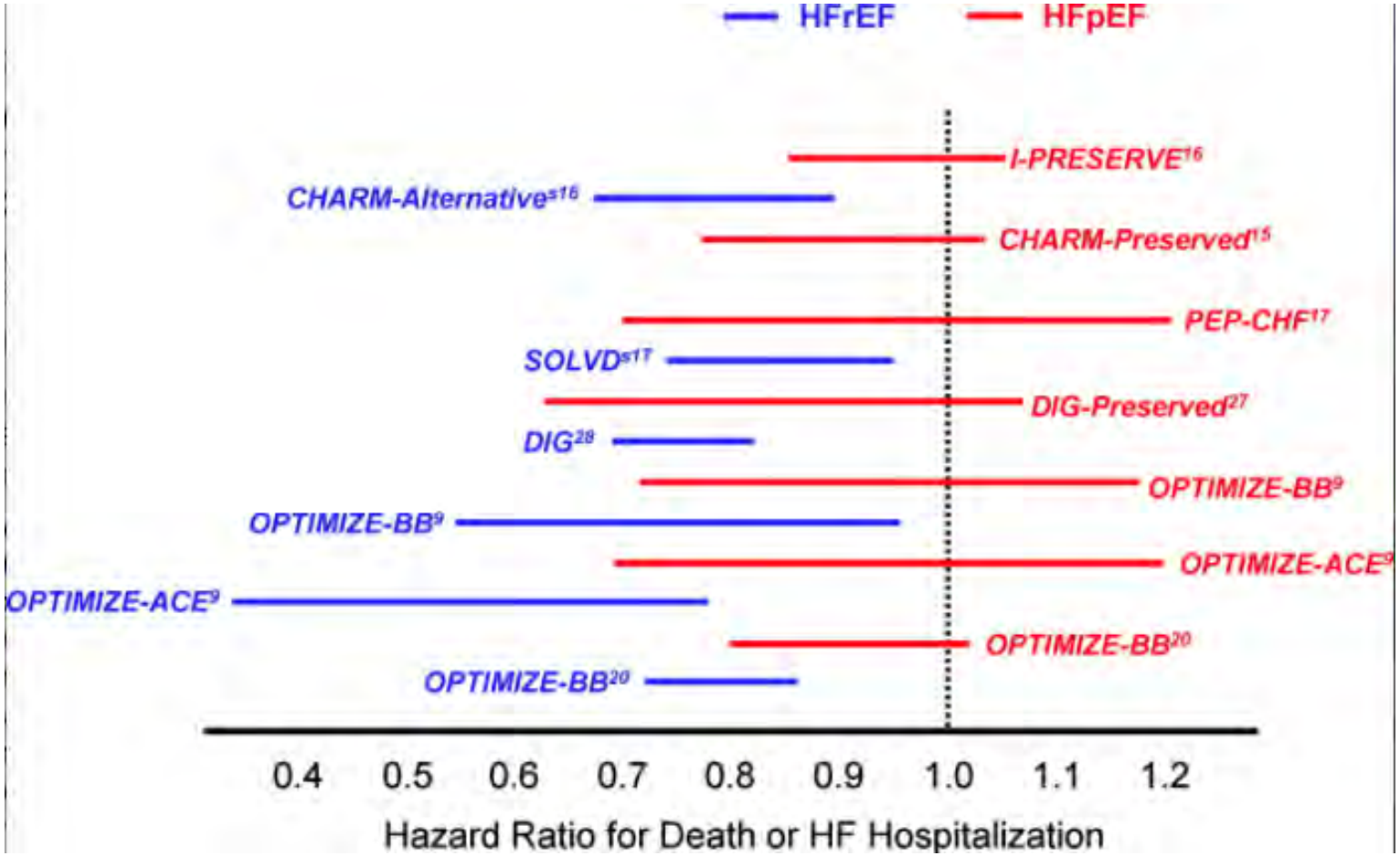
Symptoms
Orthopnea
Dyspnea on minimal exertion
Paroxysmal nocturnal dyspnea
Nocturnal cough*
Bendopnea
Abdominal swelling
Early satiety
Anorexia, nausea
Right upper quadrant pain
Peripheral swelling
Rapid weight gain
Signs†
Elevated jugular venous pressure
Rales‡
Pleural effusion‡
Increased intensity of pulmonary component of second sound
Third heart sound
Murmurs of mitral and/or tricuspid regurgitation
Pulsatile hepatomegaly
Ascites§
Pre-sacral, scrotal, or peroneal edema
Peripheral edema

*Often when supine.
†JVP is the most sensitive sign. Rales may not always be present.
‡Not common in chronic HF.
§May be difficult to distinguish from central adiposity.

HF = heart failure; JVP = jugular venous pressure.

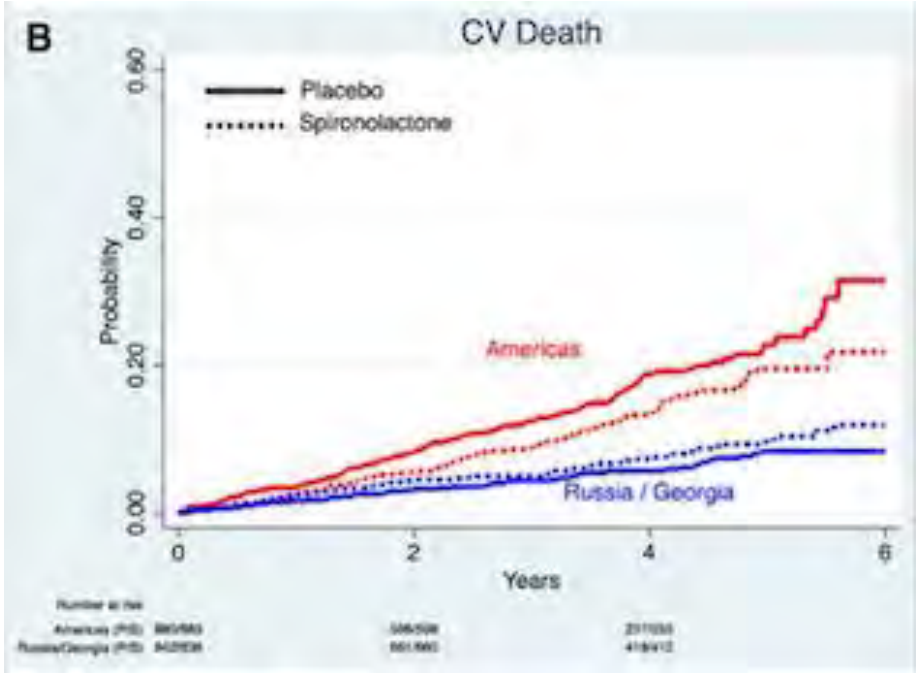
Hollenberg SM, Warner Stevenson L, Ahmad T, Amin VJ, Bozkurt B, Butler J, Davis LL, Drazner MH, Kirkpatrick JN, Peterson PN, Reed BN, Roy CL, Storrow AB. 2019 ACC Expert Consensus Decision Pathway on Risk Assessment, Management, and Clinical Trajectory of Patients Hospitalized With Heart Failure: A Report of the American College of Cardiology Solution Set Oversight Committee. J Am Coll Cardiol. 2019 Oct 15;74(15):1966-2011. doi: 10.1016/j.jacc.2019.08.001. Epub 2019 Sep 13. Erratum in: J Am Coll Cardiol. 2020 Jan 7;75(1):132.

Cause for concern

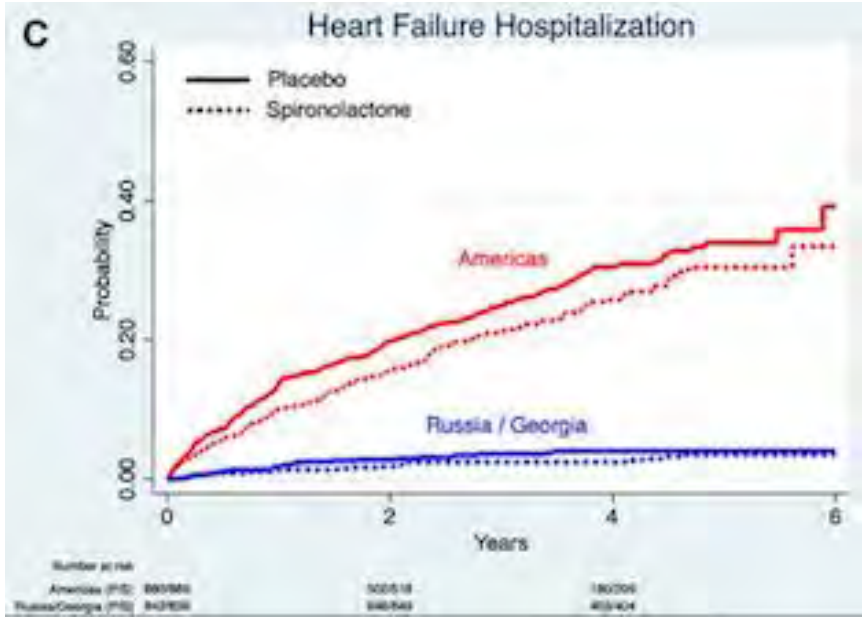


Borlaug, Barry A Circ May 2011; 123:2006-2014

TOPCAT Ad-HOC ANALYSIS



Spironolactone in HFpEF



Pfeffer. TOPCAT Ad-hoc. Circ 2015

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Empagliflozin in Heart Failure with a Preserved Ejection Fraction

Anker, SD et al, NEJM 2021

N = 5988
45% Female
76% White
NYHA Classification

- 80% Class II
- 18% Class III
- < 1% Class IV

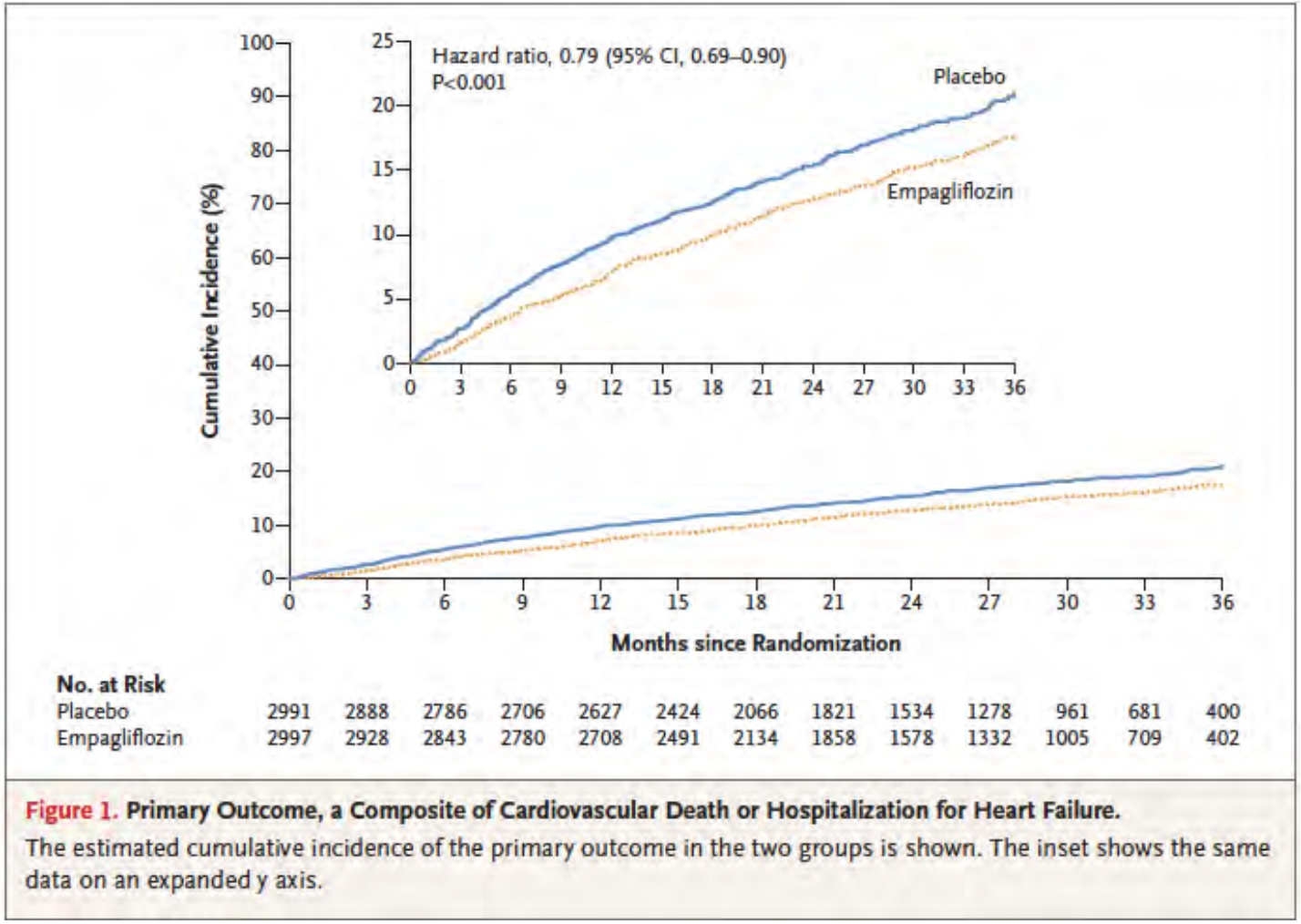

Figure 1. Primary Outcome, a Composite of Cardiovascular Death or Hospitalization for Heart Failure.
The estimated cumulative incidence of the primary outcome in the two groups is shown. The inset shows the same data on an expanded y axis.

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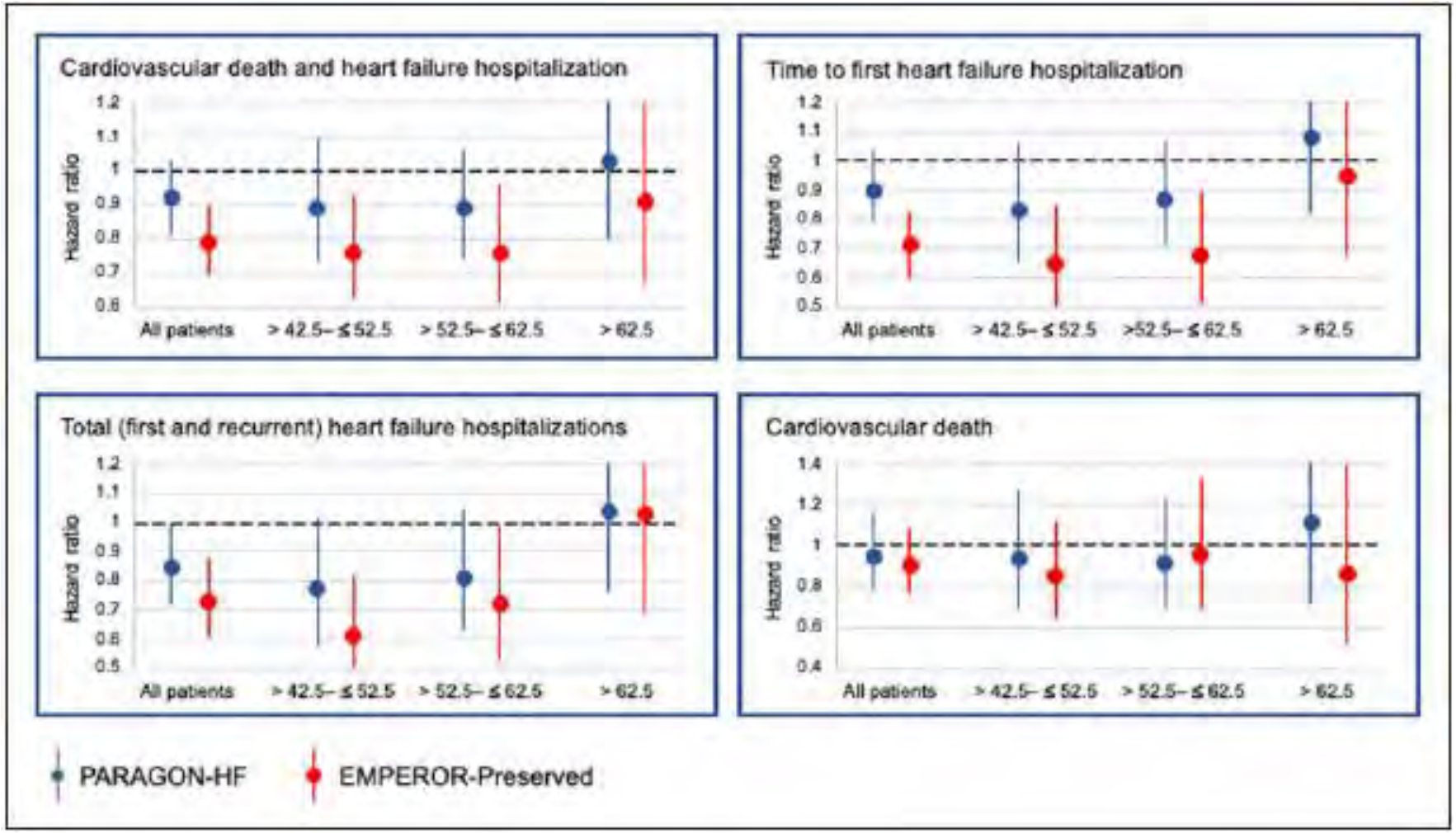
Heart Failure and a Preserved Ejection Fraction A Side-by-Side Examination of the PARAGON-HF and EMPEROR-Preserved Trials

Packer, M et al, Circulation. 2021;144:00–00

Magnitude of reduction in the risk of serious heart failure outcomes appears to be greater with the SGLT2-I than with neprilysin inhibition for most patients with HFpEF



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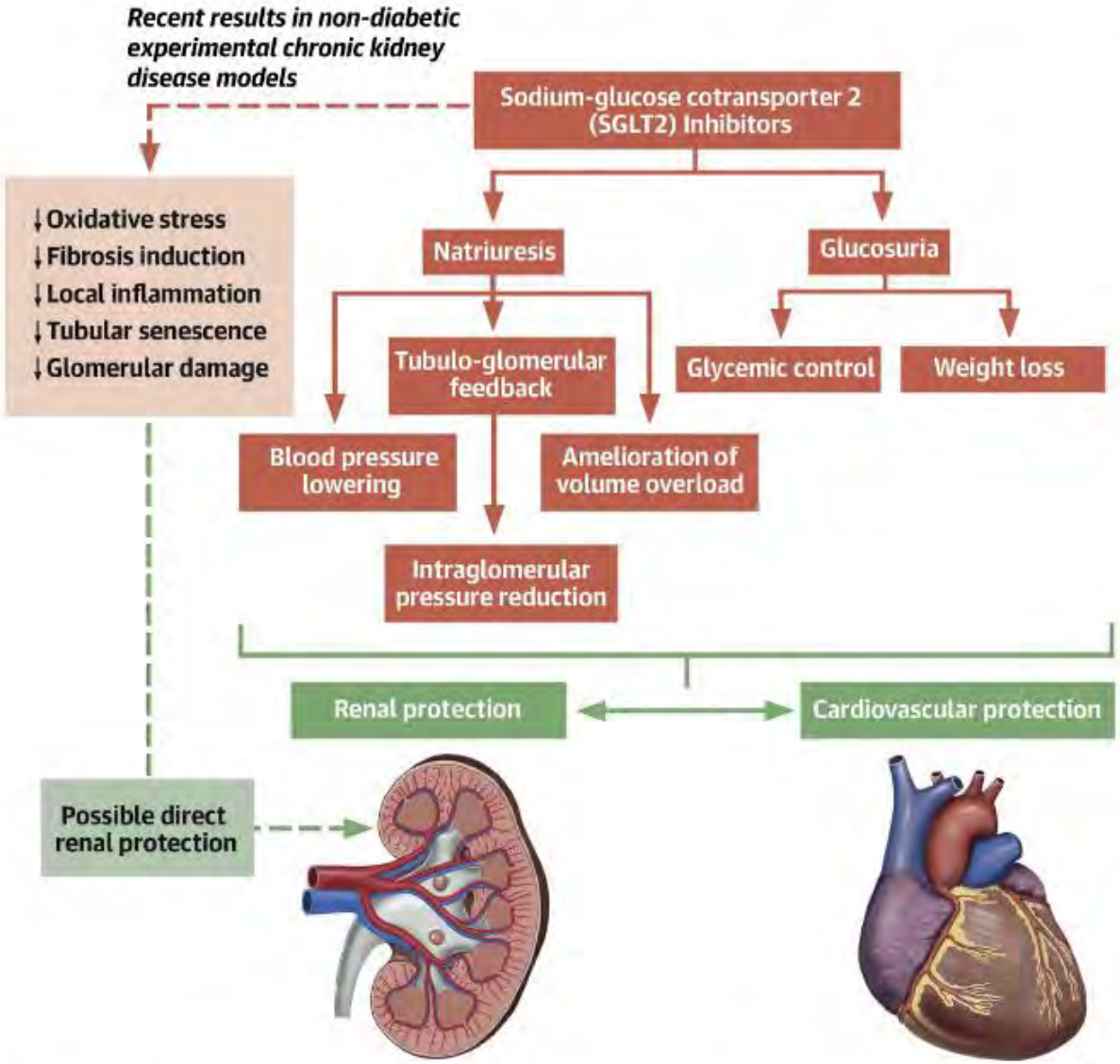
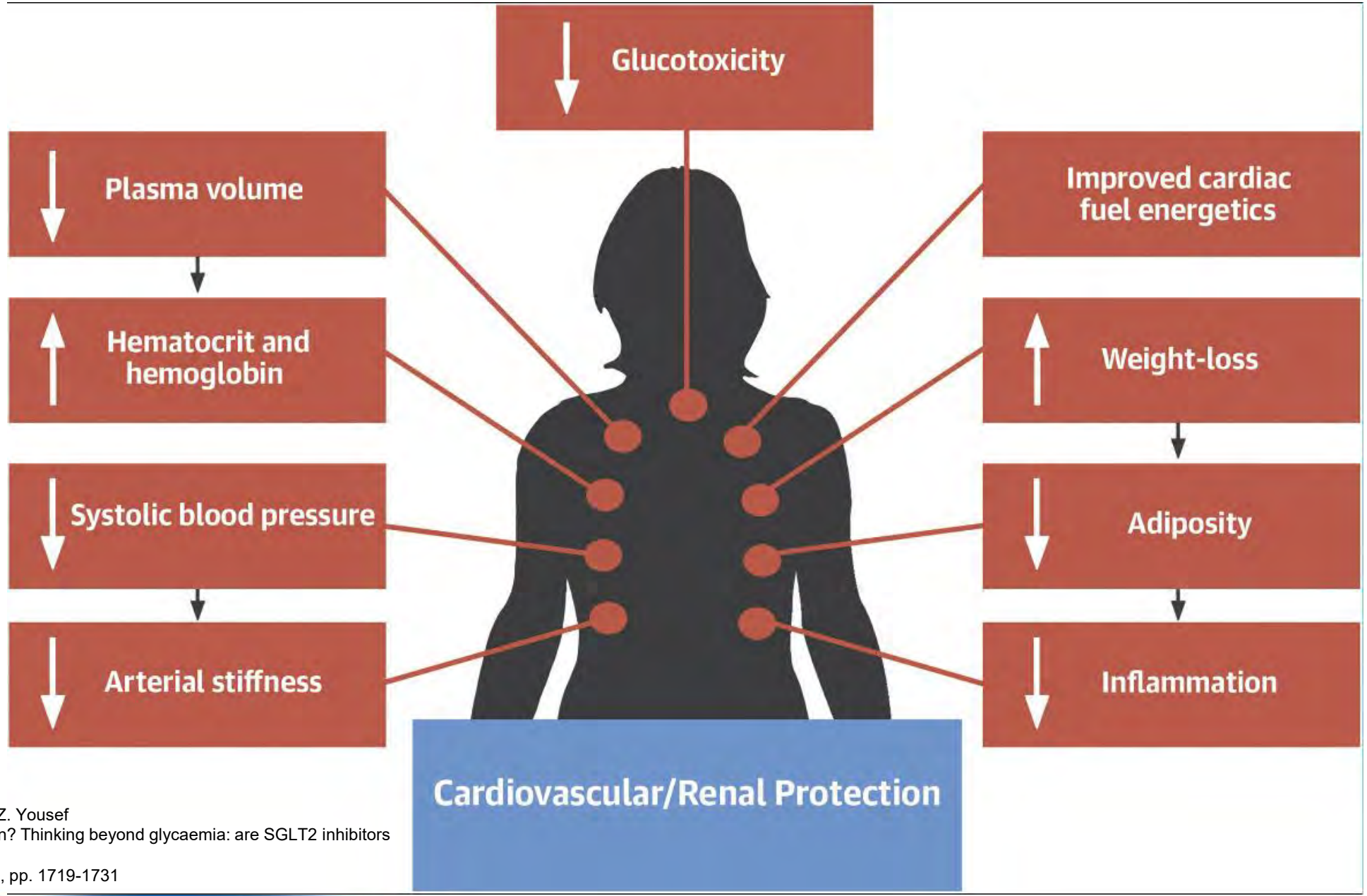
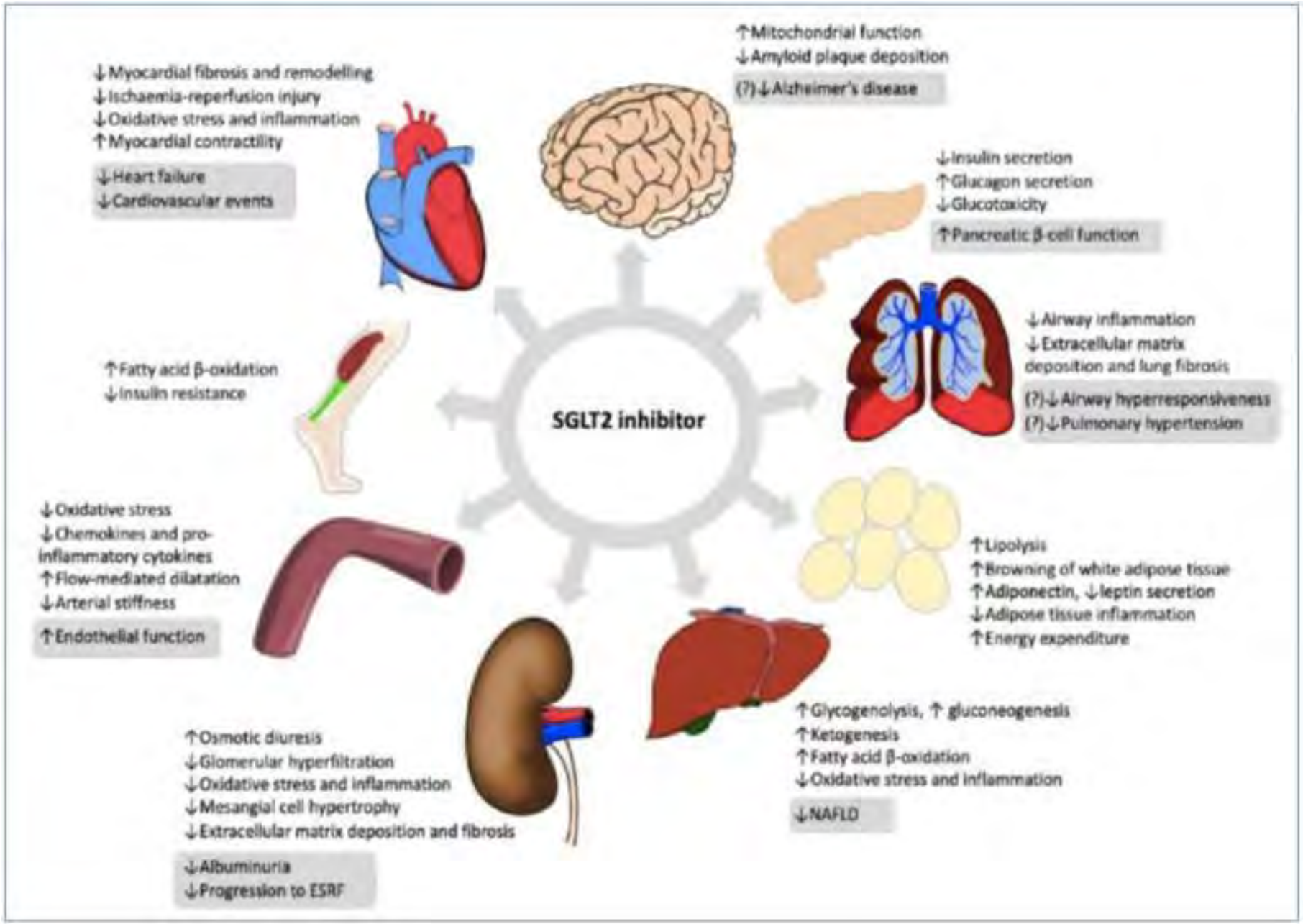
CENTRAL ILLUSTRATION: Sodium-Glucose Cotransporter 2 Inhibitor Cardiorenal Protection Mechanistic Overview



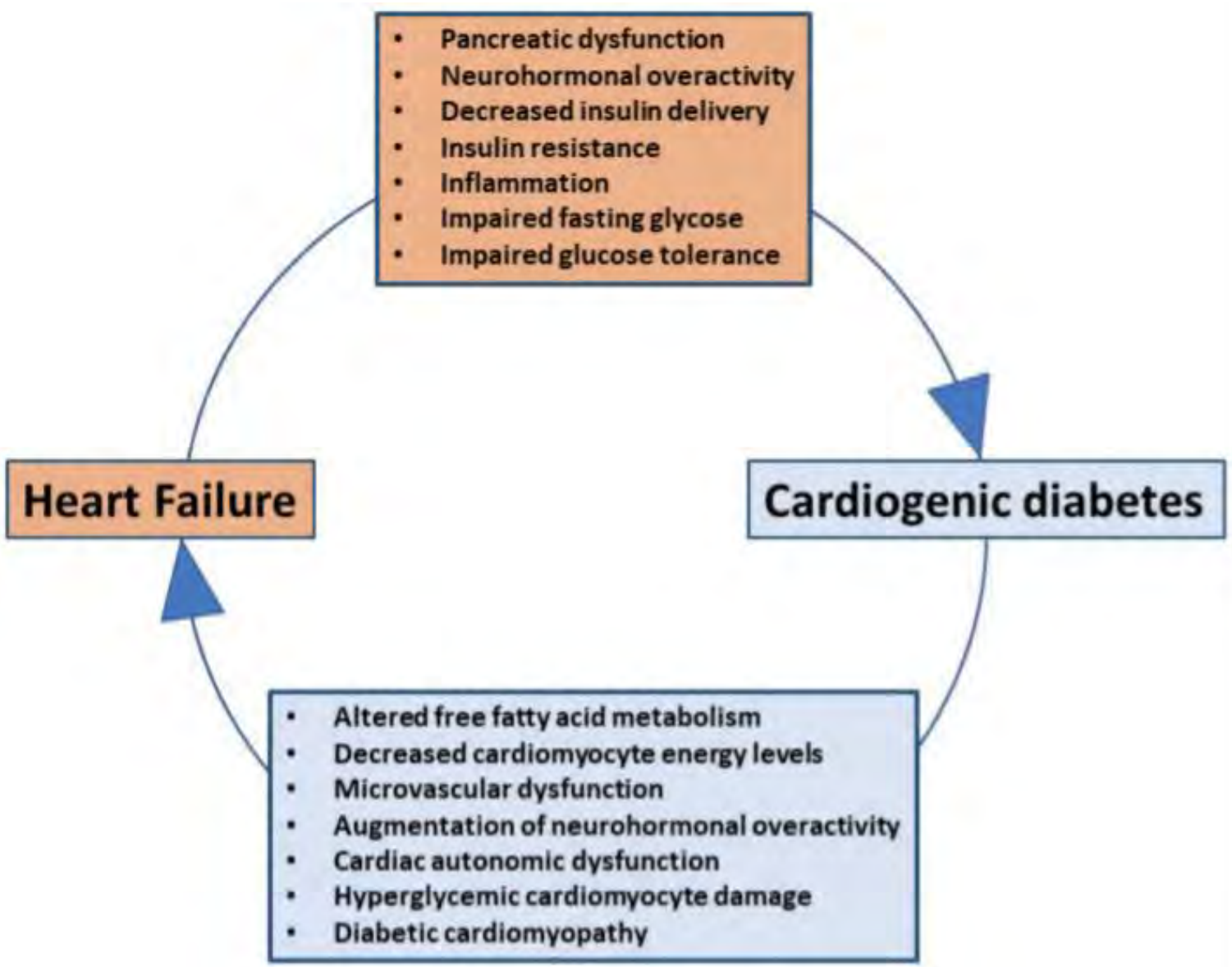
Zelniker, T.A. et al. J Am Coll Cardiol. 2020;75(4):422-34.



M. Evans, A.R. Morgan, Z. Yousef
What next after metformin? Thinking beyond glycaemia: are SGLT2 inhibitors the answer?
Diabetes Ther, 10 (2019), pp. 1719-1731



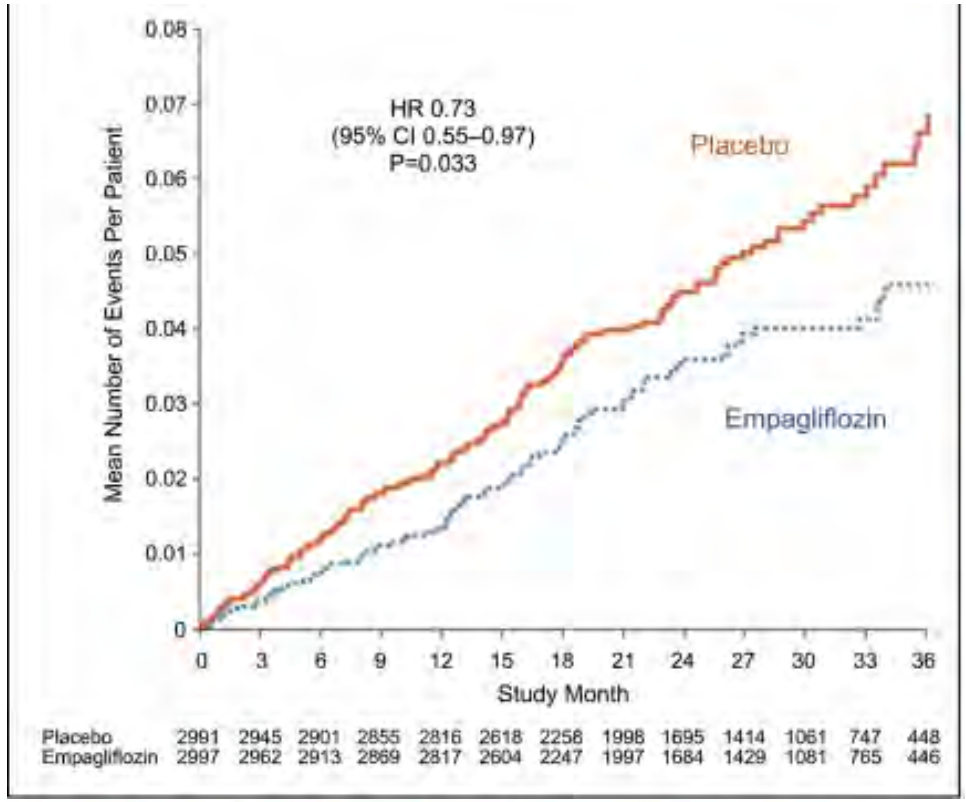
97. Hoong C.W.S., Chua M.W.J. SGLT2 inhibitors as calorie restriction-mimetics: Insights on longevity pathways and age-related diseases. *Endocrinology.* 2021;162:bqab079. doi: 10.1210/endocr/bqab079.

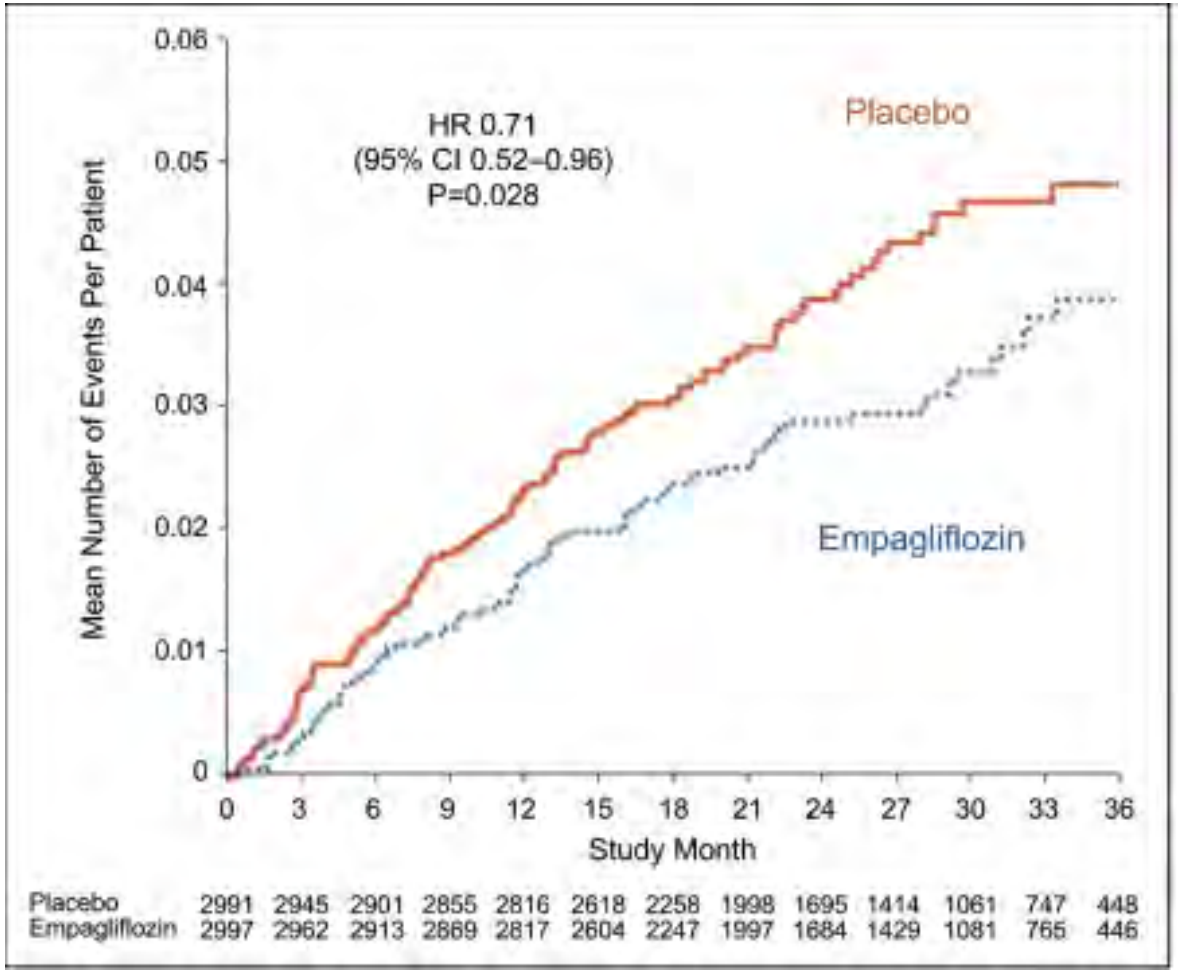


J Clin Med. 2021 Aug; 10(16): 3682.

EMPEROR-preserved

- 29% lower risk of hospitalization for HF
- Reduced risk of outpatient events





Packer, Milton et al. “Effect of Empagliflozin on Worsening Heart Failure Events in Patients With Heart Failure and Preserved Ejection Fraction: EMPEROR-Preserved Trial.” Circulation vol. 144,16 (2021): 1284-1294

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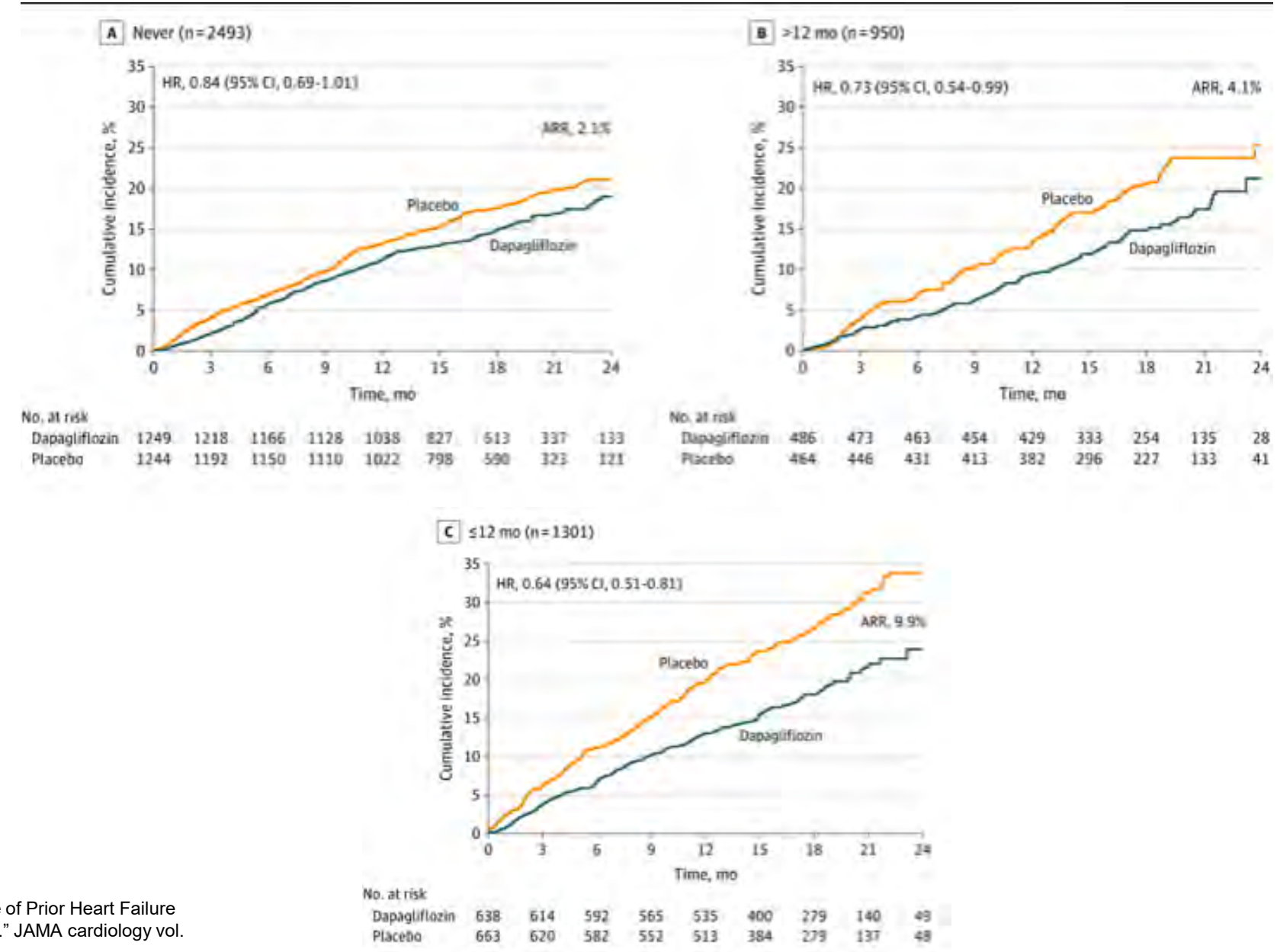
Dapagliflozin

Reduced EF, sub analysis

- Statistically significant benefit by 28 days
- Reduced risk of primary outcome by 16% (never), 27% (>12m), and 36% (<12m)
- More recent HF hospitalization experienced greater absolute risk reduction
- Difference persisted for 2 years



Berg, David D et al. “Time to Clinical Benefit of Dapagliflozin and Significance of Prior Heart Failure Hospitalization in Patients With Heart Failure With Reduced Ejection Fraction.” JAMA cardiology vol. 6,5 (2021): 499-507.

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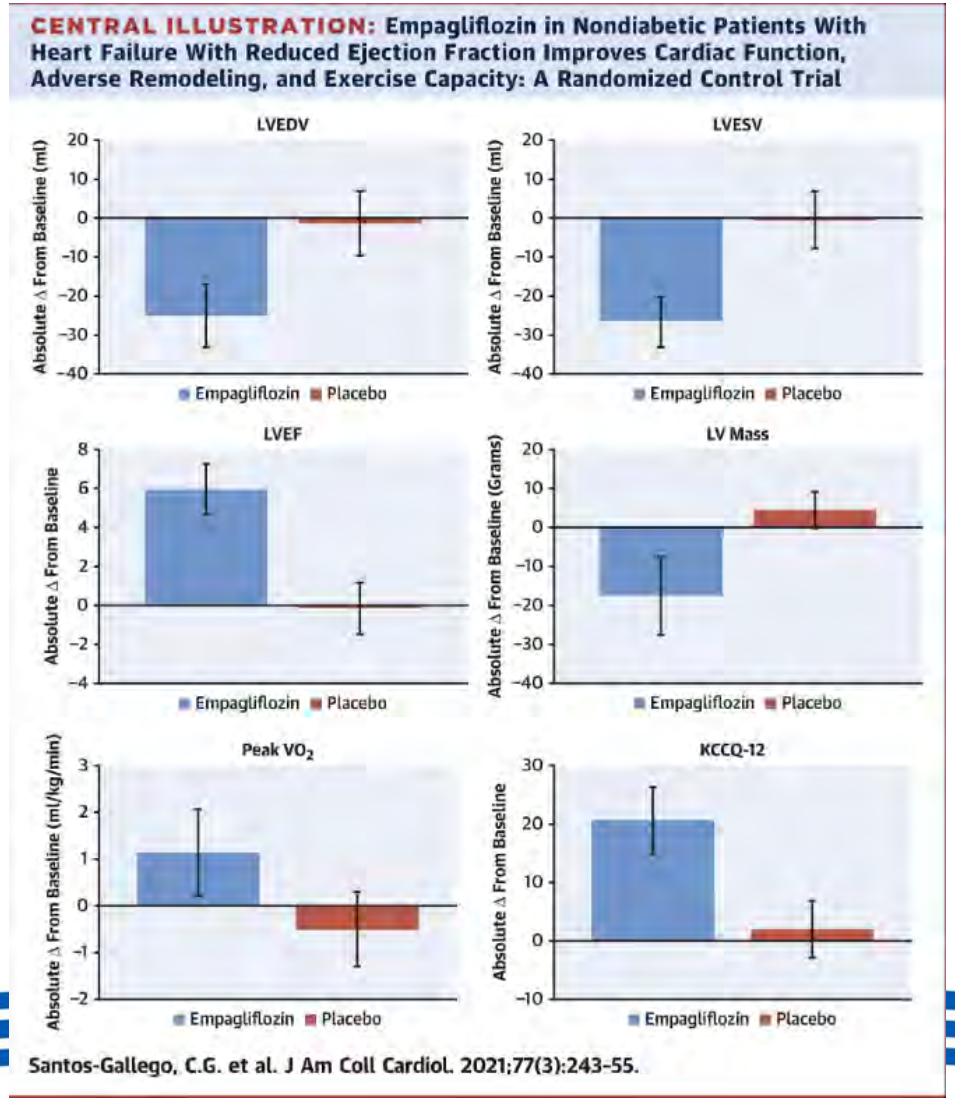
EMPULSE

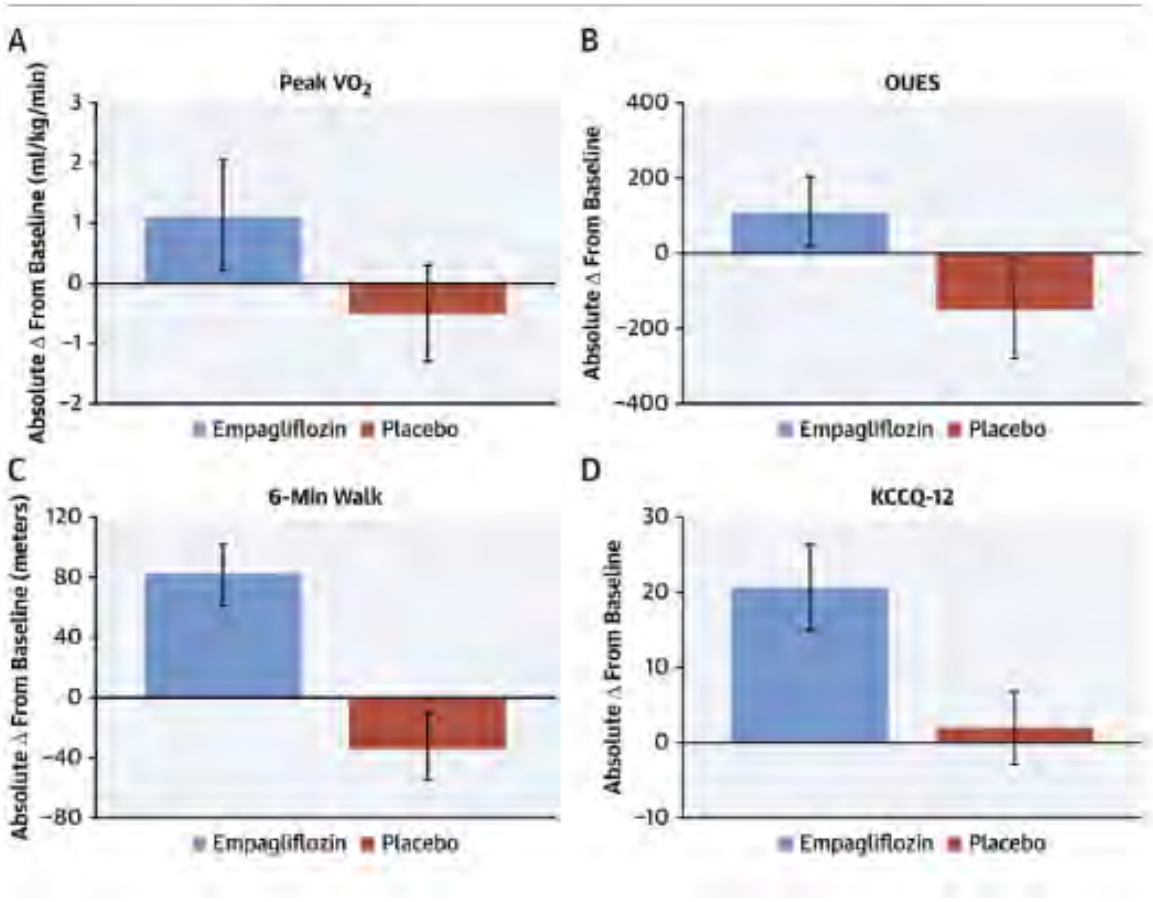
Empagliflozin - inpatient

- Double blind trial
- 530 patients with HF hospitalization (regardless of EF) initiated on empagliflozin 10 mg or placebo when clinically stable
- Median time to randomization 3 days
- Benefit in patients with and without diabetes
- Death from any cause, # HF events, time to first HF event, and improved QOL
- At end of 90 days, incidence of CV death or HFE was 12.8% in treatment group and 18.5% in the placebo group (HR 0.69)

EMPA-TROPISM

Nondiabetics, assess LV mass changes, 6 met, KCCQ





Santos-Gallego, C.G. et al. J Am Coll Cardiol. 2021;77(3):243-55.

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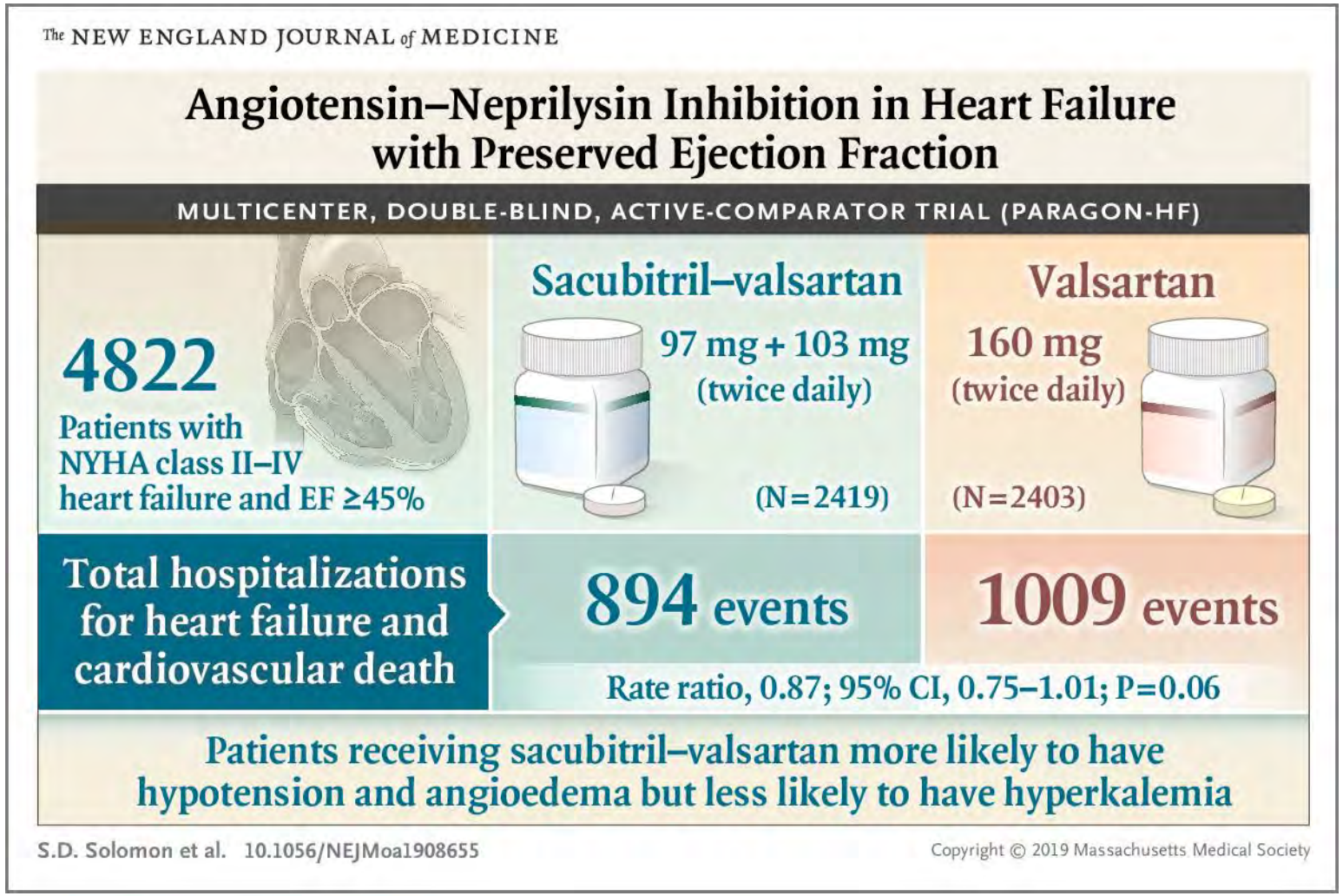
Angiotensin-Neprilysin Inhibition in Heart Failure with Preserved Ejection Fraction - PARAGON-HF Investigators

Solomon, S et al. N Engl J Med. 2019 Oct 24;381(17):1609-1620



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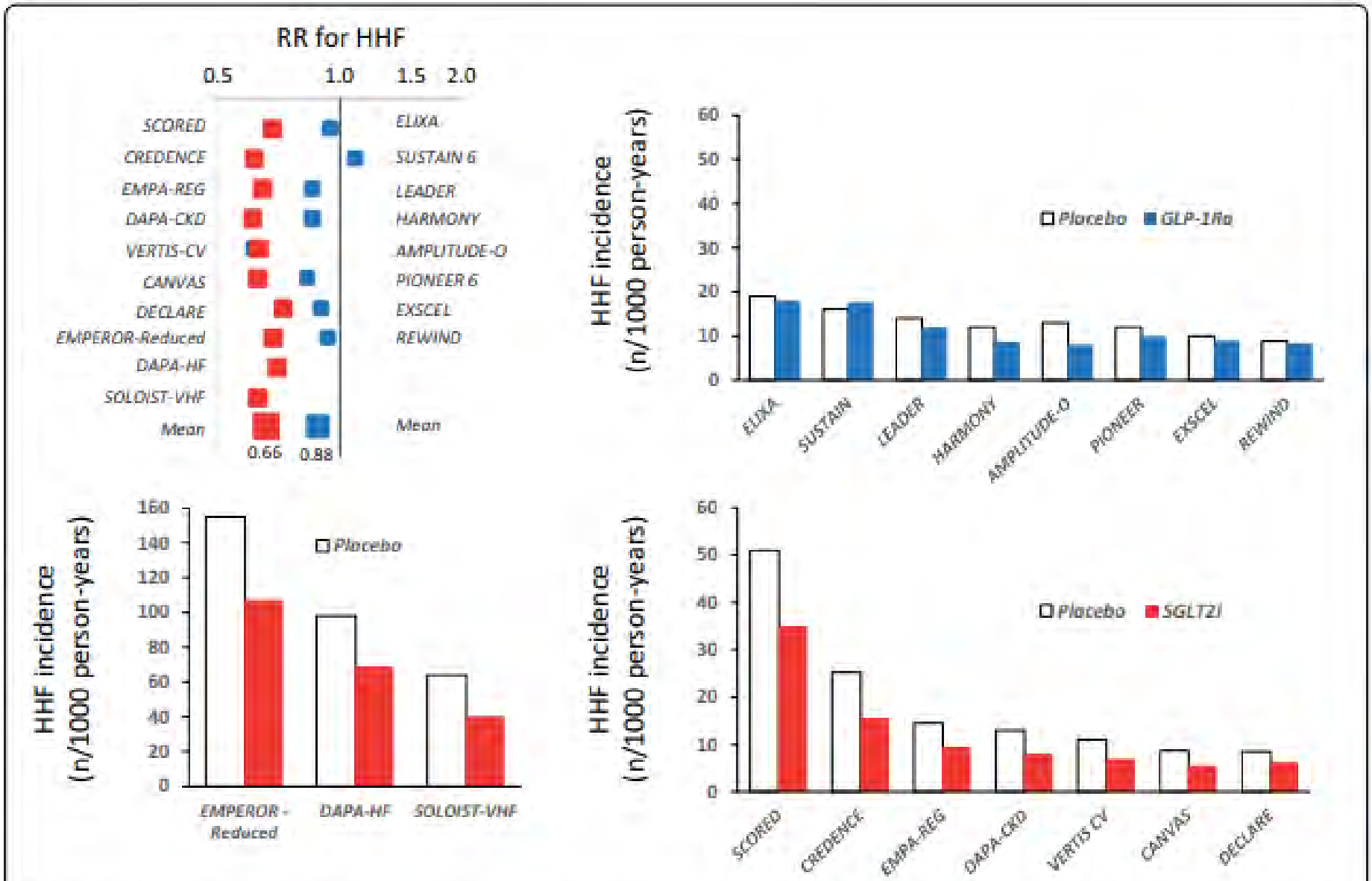
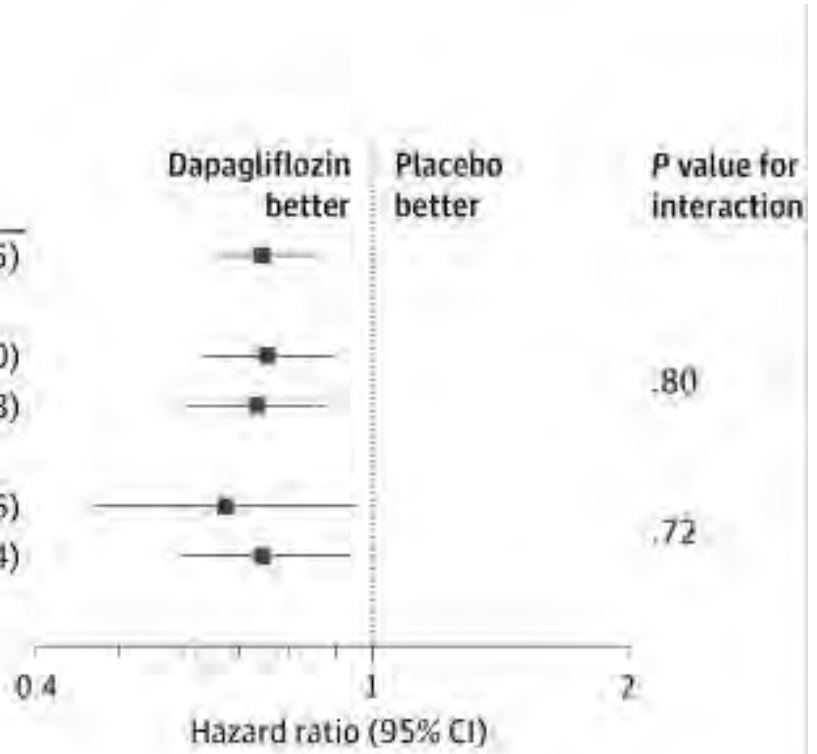


Fig. 1 Unadjusted RR and absolute incidence rates of HHF (per 1000 pts-year) in the major CV outcome trials with GLP-1Ra (blue) and SGLT-2i (red)

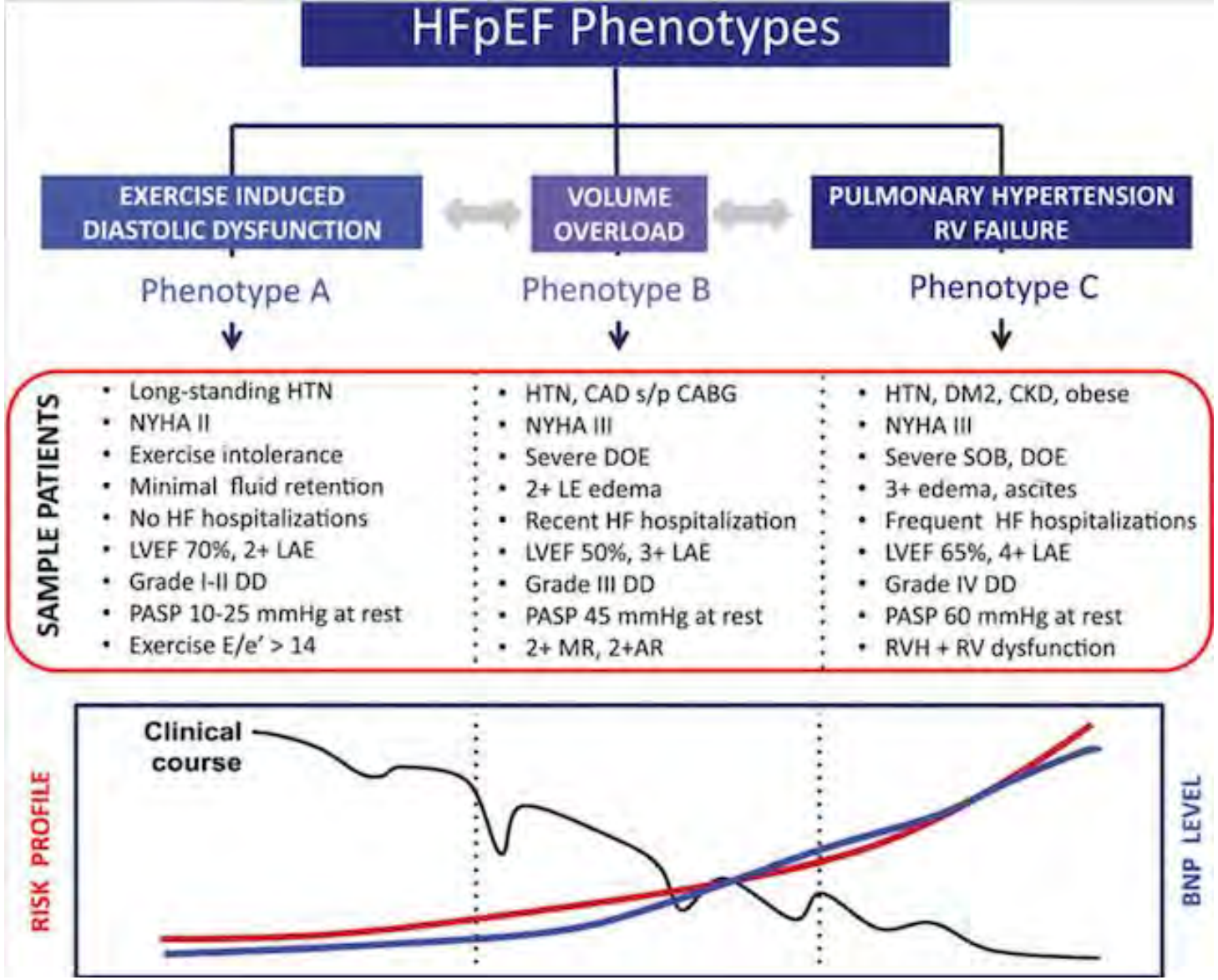
Decreased DM incidence

A Patients without diabetes

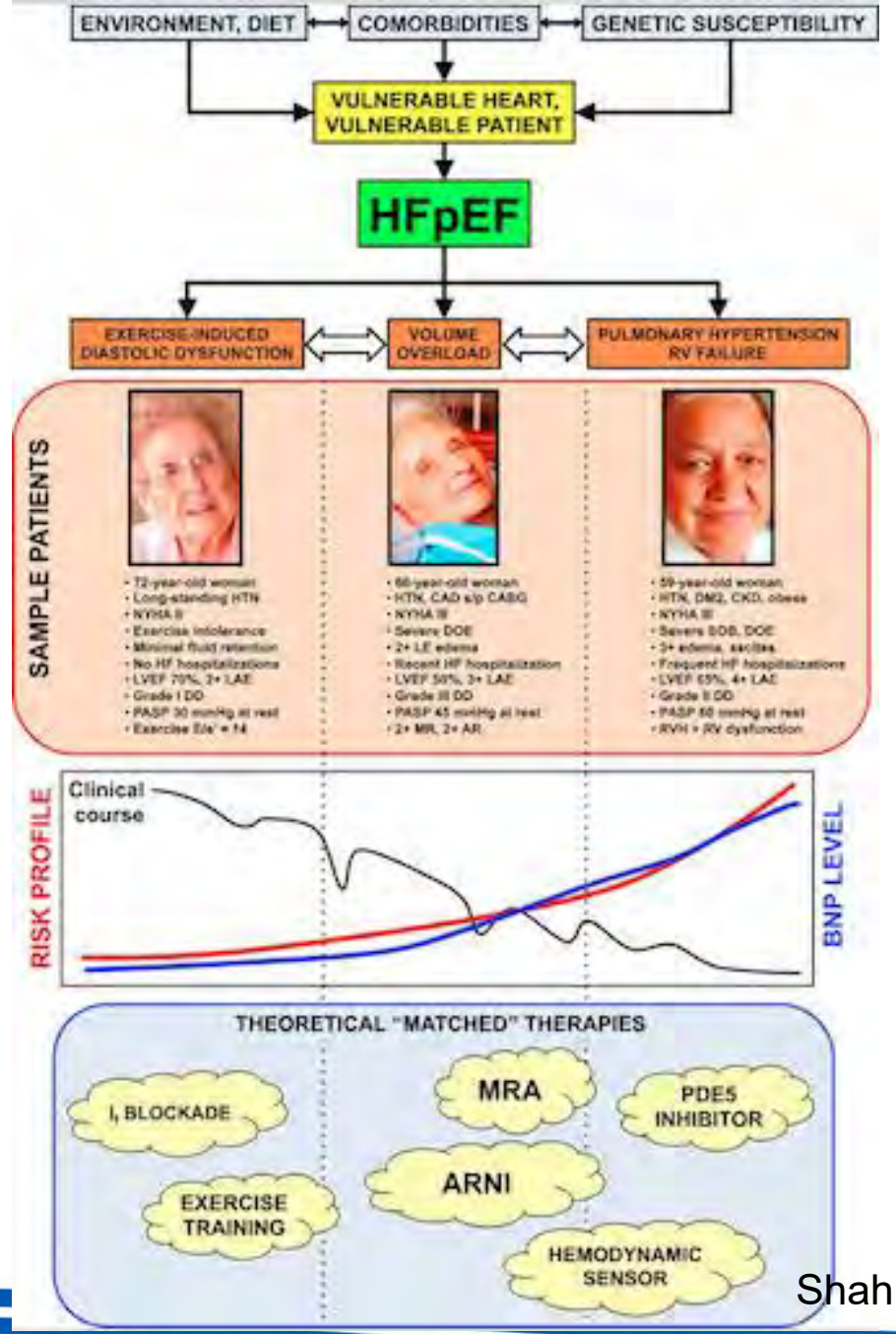
Primary composite outcome	No. of patients/total No. (%) Dapagliflozin	Placebo	Absolute risk reduction (95% CI), %	Hazard ratio (95% CI)	P value for interaction
Overall effect	386/2373 (16.3)	502/2371 (21.2)	4.9 (2.7 to 7.1)	0.74 (0.65 to 0.85)	
Type 2 diabetes at baseline[a]					
Yes	215/1075 (20.0)	271/1064 (25.5)	5.5 (1.9 to 9.0)	0.75 (0.63 to 0.90)	.80
No	171/1298 (13.2)	231/1307 (17.7)	4.5 (1.7 to 7.3)	0.73 (0.60 to 0.88)	
Patients without type 2 diabetes at baseline					
Normoglycaemic	53/438 (12.1)	71/419 (16.9)	4.8 (0.1 to 9.6)	0.67 (0.47 to 0.96)	.72
Prediabetes	118/860 (13.7)	160/888 (18.0)	4.3 (0.9 to 7.7)	0.74 (0.59 to 0.94)	



Petrie MC, Verma S, Docherty KF, et al. Effect of Dapagliflozin on Worsening Heart Failure and Cardiovascular Death in Patients With Heart Failure With and Without Diabetes [published correction appears in JAMA. 2021 Apr 6;325(13):



Shah SJ. JACC. 2013; 62:1339-1342.



Shah SJ. JACC. Oct 2013; 62:15

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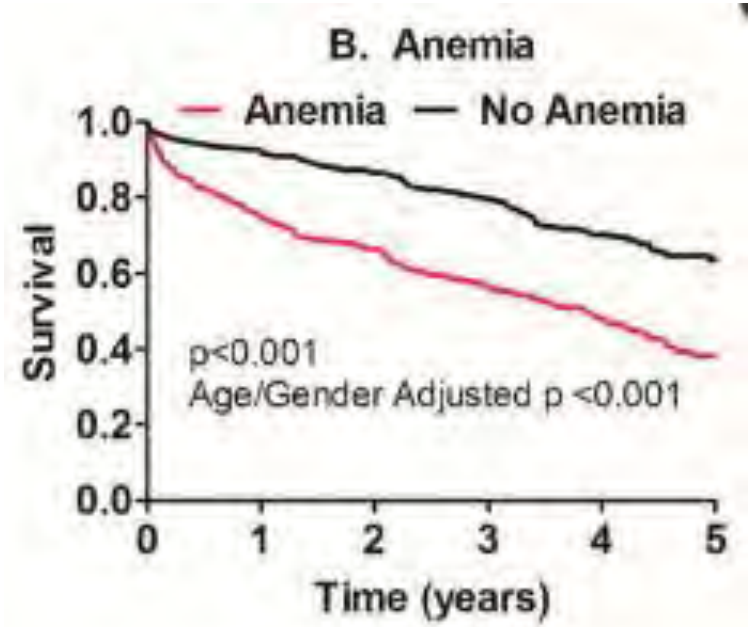
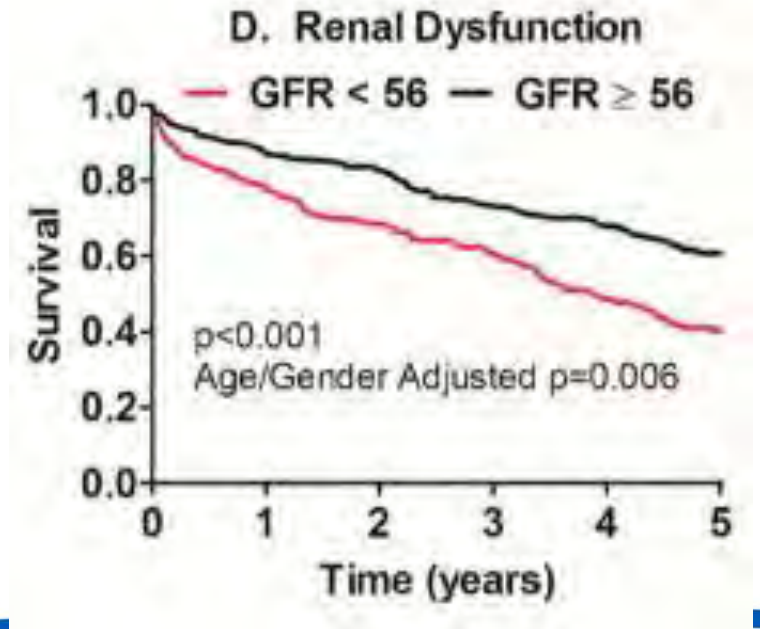
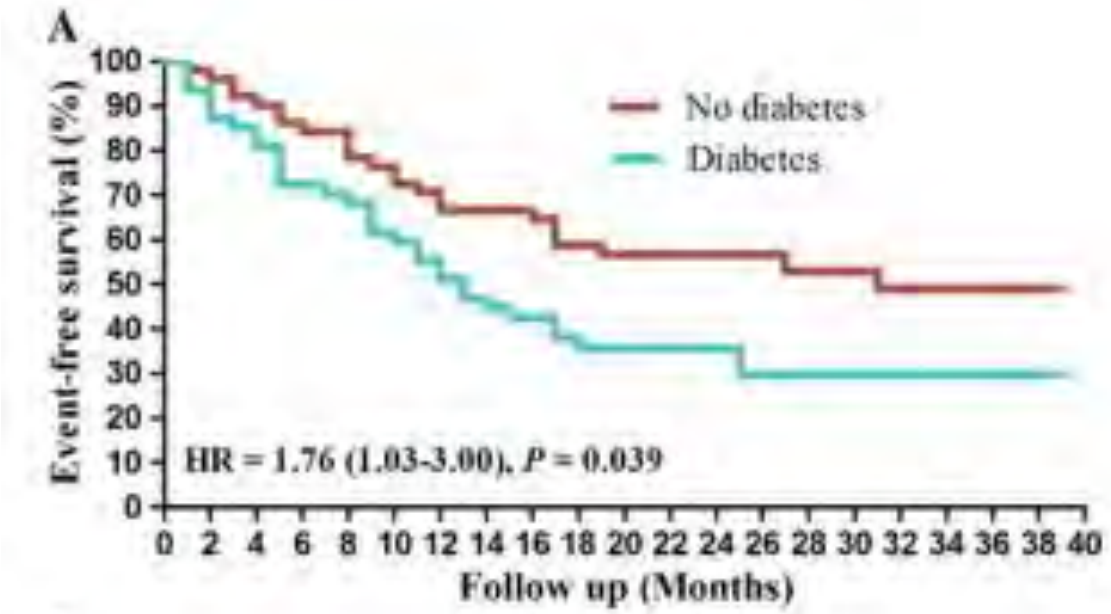
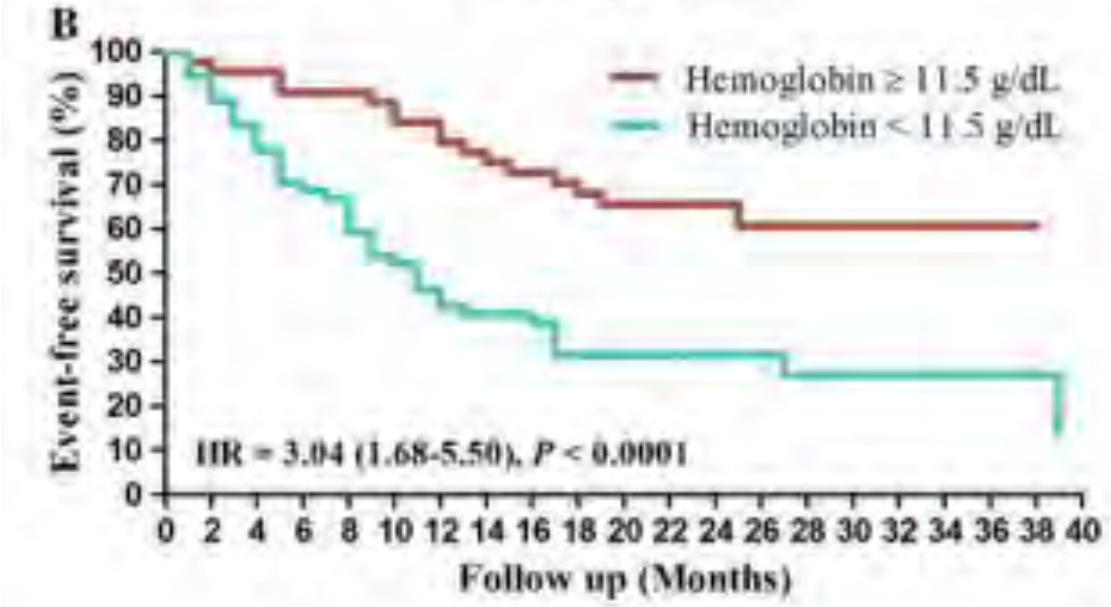
Anemia





Mohammed SF et al. Circ Heart Fail. 2012





Marechaux S et al. Heart Vessels (2011)

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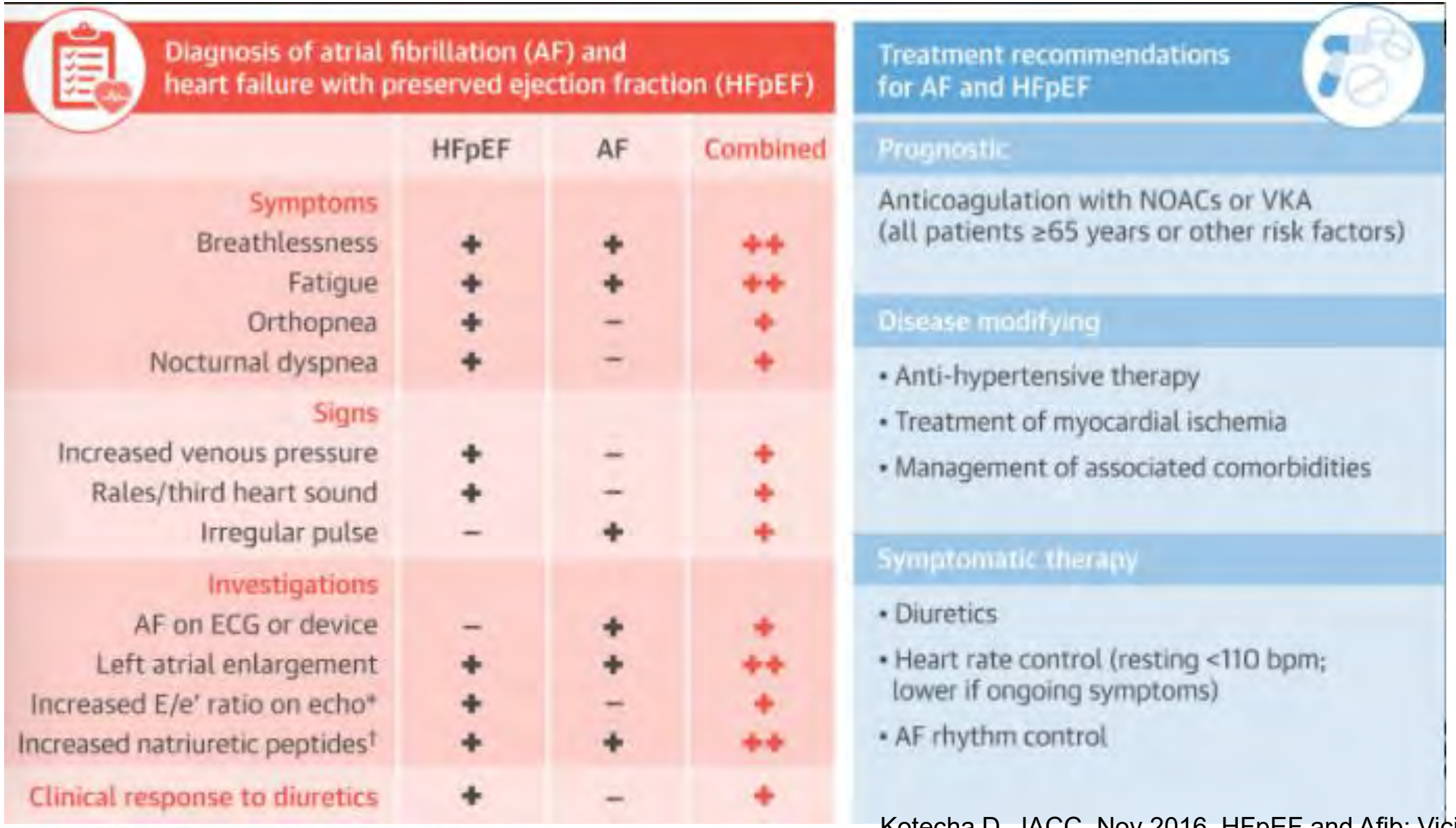
Atrial Fibrillation



Diagnosis of atrial fibrillation (AF) and heart failure with preserved ejection fraction (HFpEF)

	HFpEF	AF	Combined
Symptoms			
Breathlessness	+	+	++
Fatigue	+	+	++
Orthopnea	+	–	+
Nocturnal dyspnea	+	–	+
Signs			
Increased venous pressure	+	–	+
Rales/third heart sound	+	–	+
Irregular pulse	–	+	+
Investigations			
AF on ECG or device	–	+	+
Left atrial enlargement	+	+	++
Increased E/e' ratio on echo*	+	–	+
Increased natriuretic peptides†	+	+	++
Clinical response to diuretics	+	–	+

Treatment recommendations for AF and HFpEF

Prognostic

Anticoagulation with NOACs or VKA (all patients ≥65 years or other risk factors)

Disease modifying

- Anti-hypertensive therapy
- Treatment of myocardial ischemia
- Management of associated comorbidities

Symptomatic therapy

- Diuretics
- Heart rate control (resting <110 bpm; lower if ongoing symptoms)
- AF rhythm control

Kotecha D, JACC. Nov 2016. HFpEF and Afib: Vicious Twins.

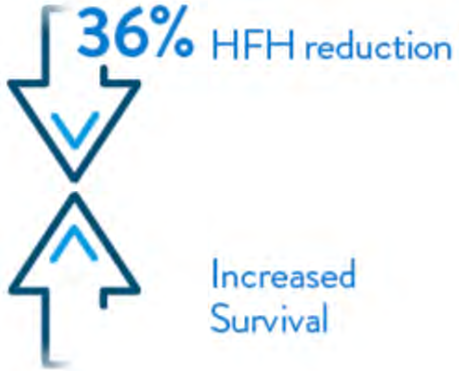
Cardiomems

Sensor inserted via right heart catheterization

Patients take daily sensor reading from the comfort of their home

Data wirelessly transmitted to clinician's secure website

Clinician reviews data and contacts patient as necessary



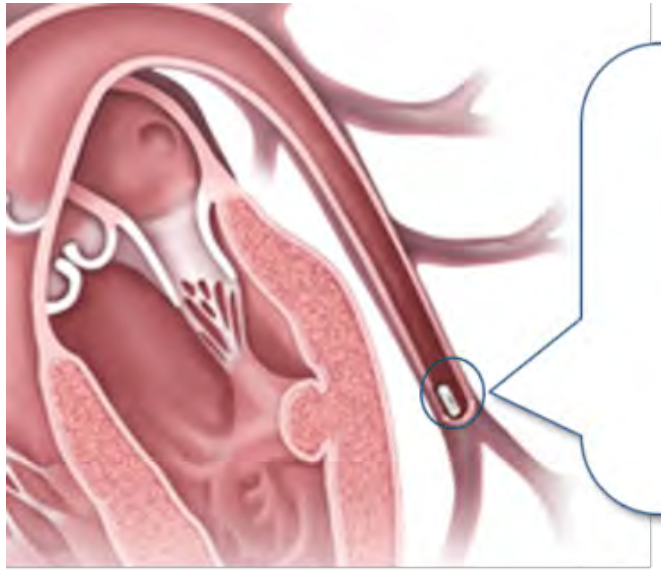
2023

Meta-Analysis of HFrEF Patients in CHAMPION,GUIDE-HF, and LAPTOP-HF

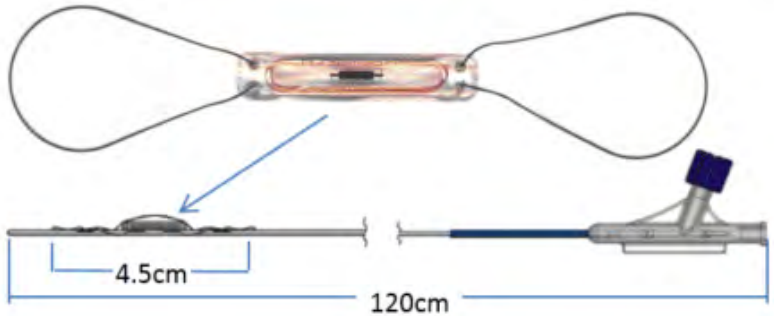
Lindenfeld et al.

This patient-level meta-analysis includes 1,350 HFrEF patients from CHAMPION, GUIDE-HF, and LAPTOP-HF studies to assess the impact on heart failure hospitalizations over 12 months, and survival over the full follow-up across trials. This combined patient population confirmed previous findings of decreased heart failure hospitalizations and improved survival with the use of devices such as the CardioMEMS HF System.[10]

Cardiomems



PA Sensor and Delivery System



Patient Electronics System

PA Pressure Database

Physician Access Via Secure Website

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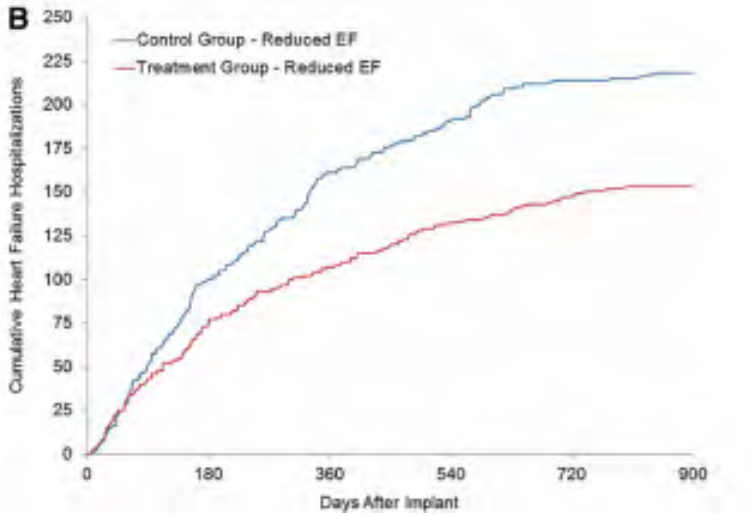
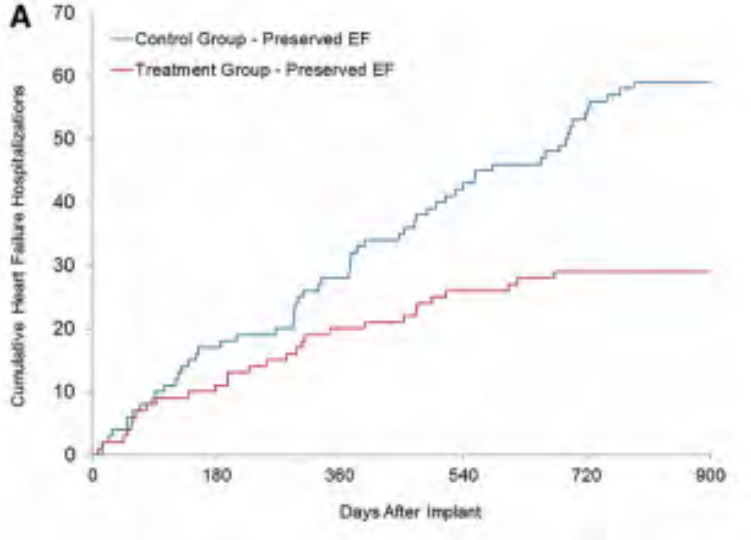
PA Pressure Monitor





Adamson PB. Circ HF. Nov 2014;7:935-944.

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HFpEF Predisposition Phenotypes	HFpEF Clinical Presentation Phenotypes					
		Lung Congestion	+Chronotropic Incompetence	+Pulmonary Hypertension (CpcPH)	+Skeletal muscle weakness	+Atrial Fibrillation
	Overweight/obesity/ metabolic syndrome/ type 2 DM	• **Diuretics (loop diuretic in DM)** • **Caloric restriction** • Statins • Inorganic nitrite/nitrate • Sacubitril • Spironolactone	+Rate adaptive atrial pacing	+Pulmonary vasodilators (e.g. PDE5I)	**+Exercise training program**	+Cardioversion + Rate Control **+Anticoagulation**
	+Arterial hypertension	+ACEI/ARB	+ACEI/ARB +Rate adaptive atrial pacing	+ACEI/ARB +Pulmonary vasodilators (e.g. PDE5I)	+ACEI/ARB **+Exercise training program**	+ACEI/ARB +Cardioversion + Rate Control **+Anticoagulation**
	+Renal dysfunction	+Ultrafiltration if needed	+Ultrafiltration if needed +Rate adaptive atrial pacing	+Ultrafiltration if needed +Pulmonary vasodilators (e.g. PDE5I)	+Ultrafiltration if needed **+Exercise training program**	+Ultrafiltration if needed +Cardioversion + Rate Control **+Anticoagulation**
	+CAD	+ACEI +Revascularization	+ACEI +Revascularization +Rate adaptive atrial pacing	+ACEI +Revascularization +Pulmonary vasodilators (e.g. PDE5I)	+ACEI +Revascularization **+Exercise training program**	+ACEI +Revascularization +Cardioversion + Rate Control **+Anticoagulation**

Case Follow Up

- 83 yo female with DOE
- Initiated spironolactone 12.5 mg and daily lasix with sliding scale for weight gain and higher daily dose, weight log, symptom log
- No anemia, no atrial arrhythmia identified
- RHC: RA (7), PA 57/20 (33), PCW 24

consistent with secondary pulmonary hypertension

- CPEST: Heart rate increase had early plateau exercised to 96% of age-predicted pkVO2

Case Follow Up

- Decreased metoprolol to 50 mg daily, stopped amlodipine, added vasodilating agents
- Stopped supplemental oxygen
- Advised regular exercise program (no reimbursement for cardiac rehab in HFpEF)
- Ongoing assessment of functional capacity every 6 months – 1 year with repeat CPEST
- Consider REDUCE-LAP trial down the road

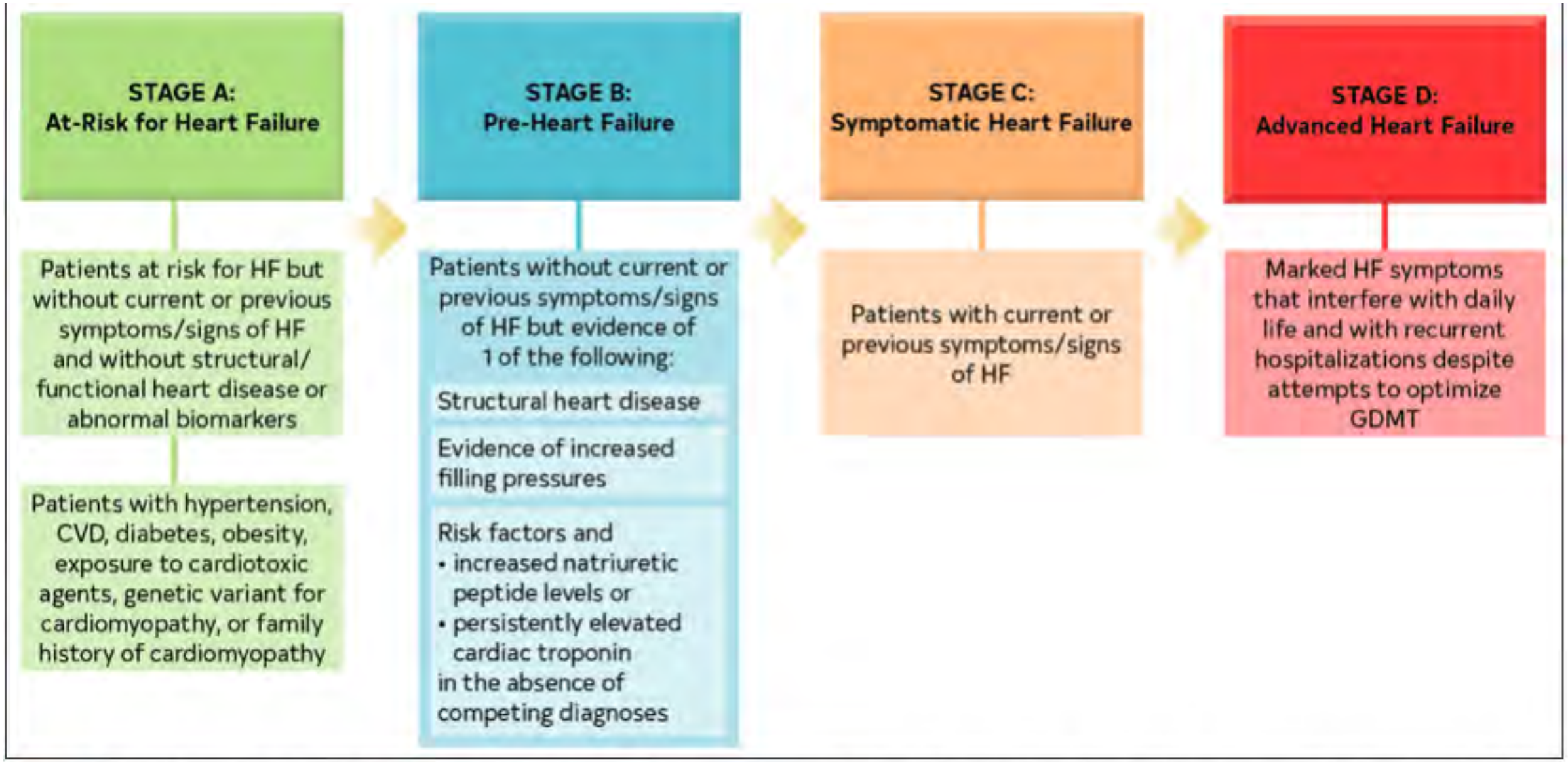
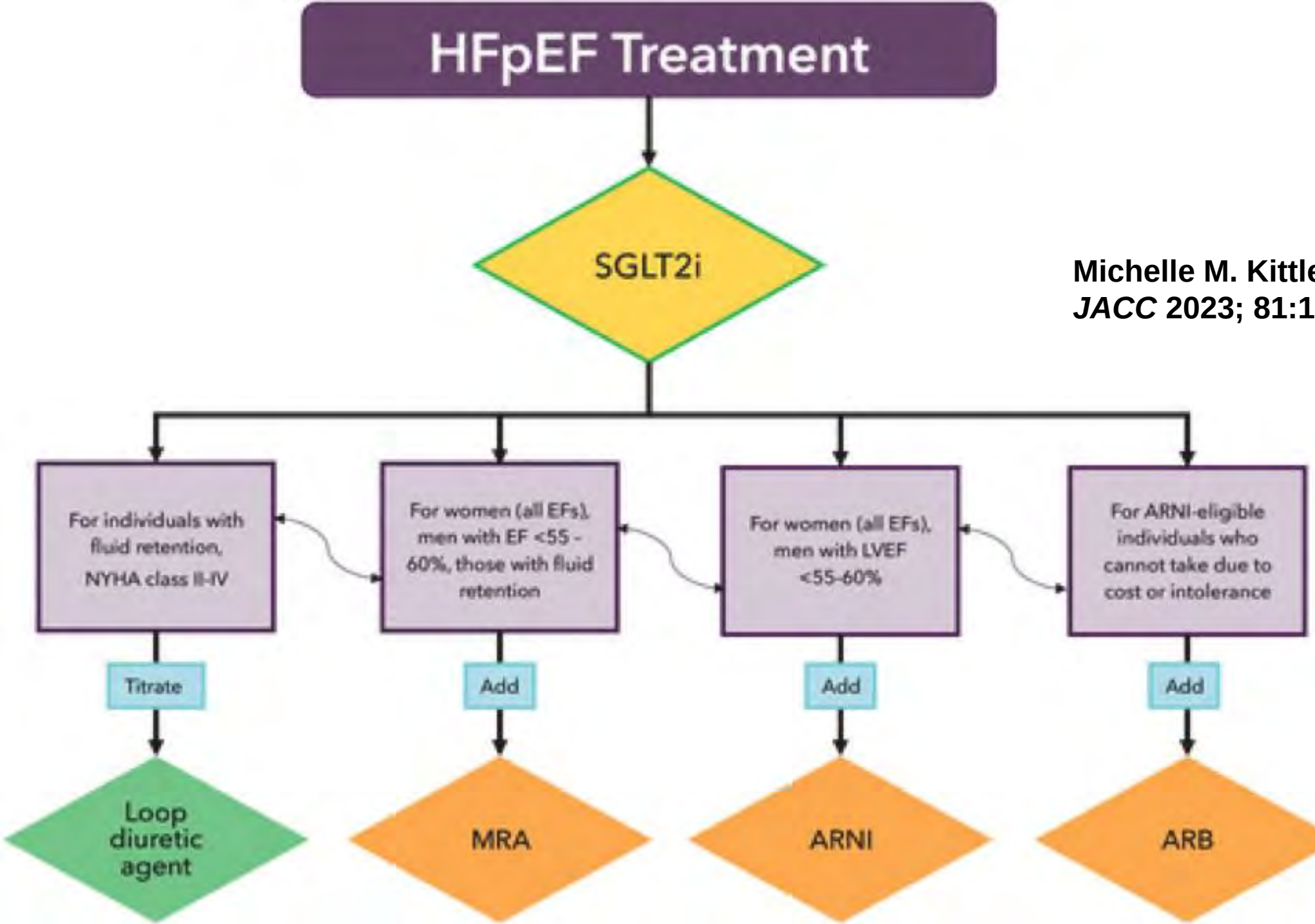
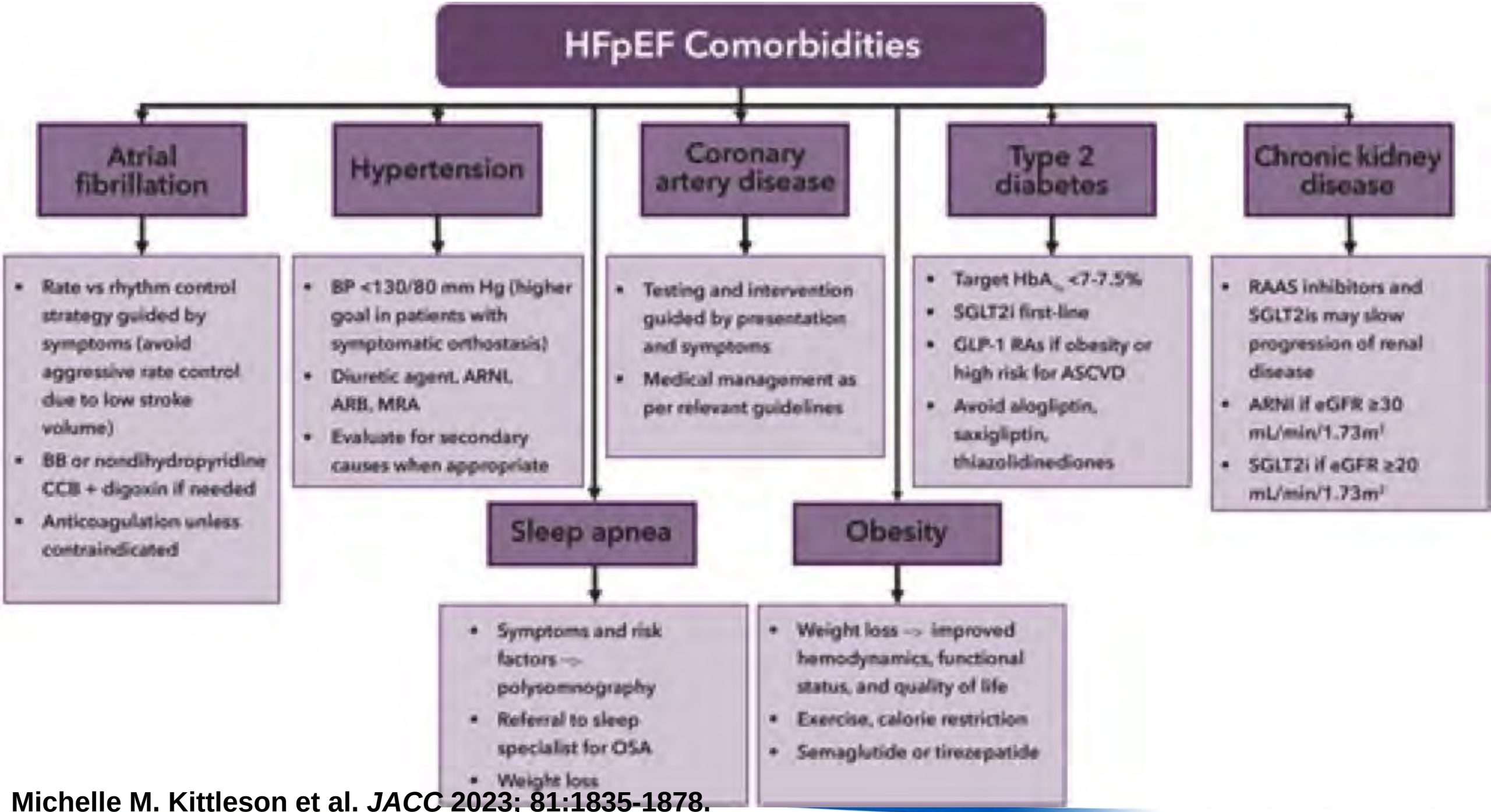


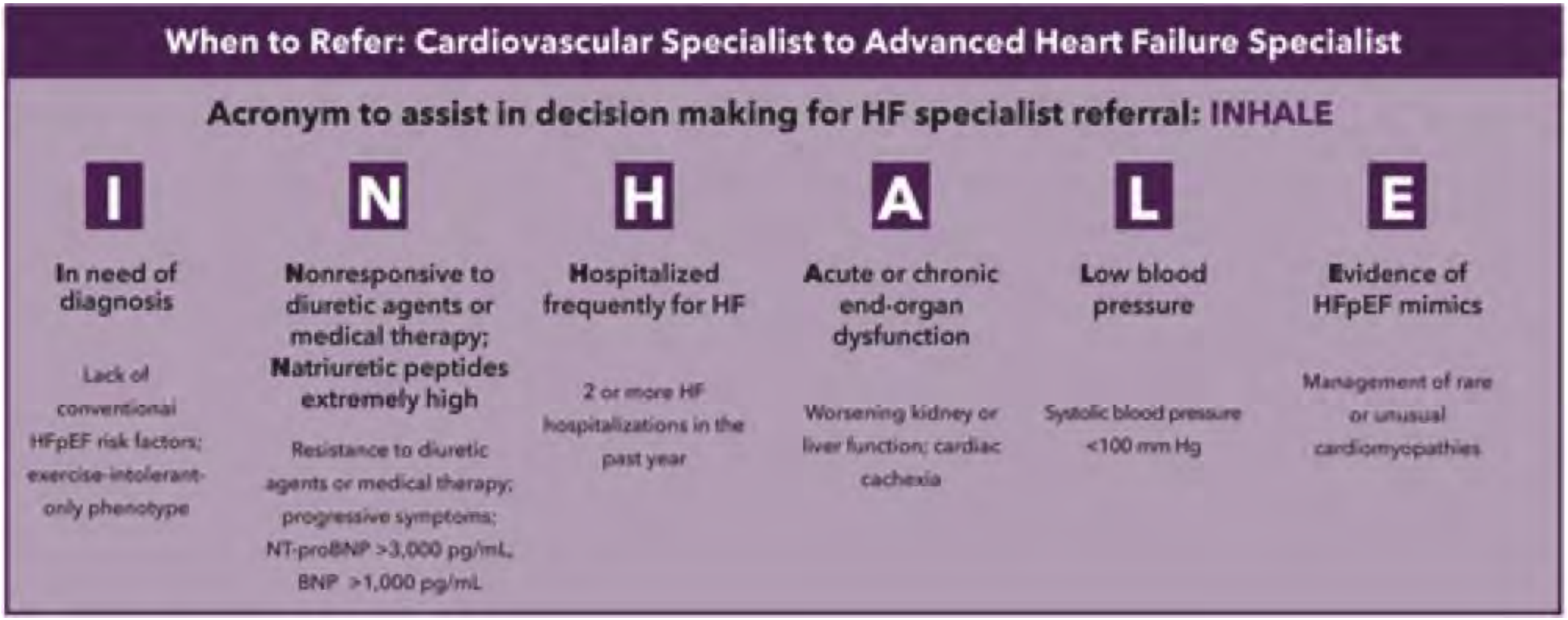
Figure 1. ACC/AHA Stages of HF. The ACC/AHA stages of HF are shown. ACC indicates American College of Cardiology; AHA, American Heart Association; CVD, cardiovascular disease; GDMT, guideline-directed medical therapy; and HF, heart failure.



Michelle M. Kittleson et al.
JACC 2023; 81:1835-1878.



Michelle M. Kittleson et al. *JACC* 2023; 81:1835-1878.



Michelle M. Kittleson et al. *JACC* 2023; 81:1835-1878.

The End!


PAST TRAUMA
BAD NEWS
PANDEMIC
STRESS
PAST TRAUMA
PANDEMIC
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PAST TRAUMA
MINOR INCONVENIENCE
I think you're overreacting
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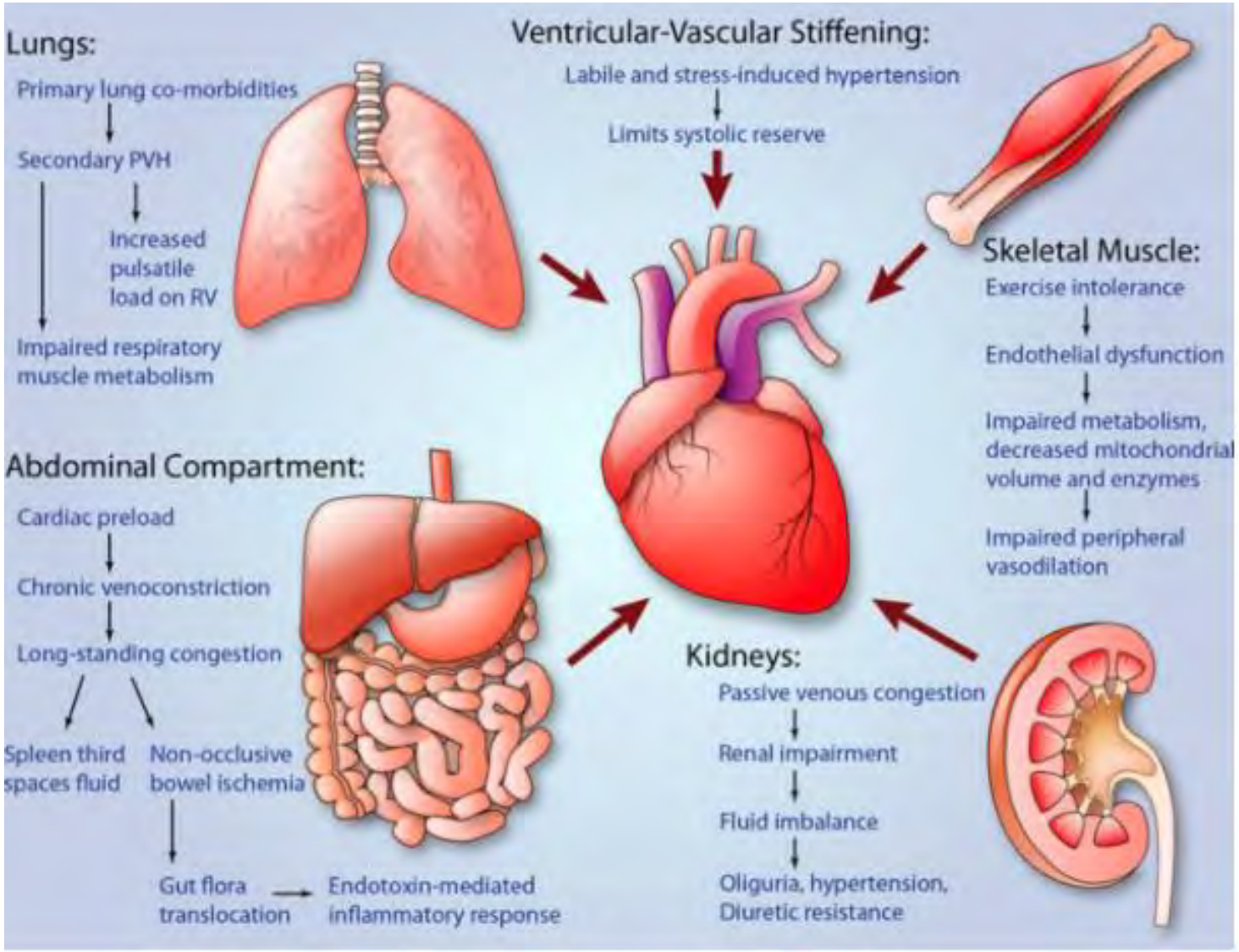

Sharma K and Kass D. Circ Research. June 2014; 115:79-96.

Osteopathic Considerations and Treatment for Headaches in Pregnancy

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Chair Osteopathic Manipulative Medicine
Illinois COM (proposed) at The Chicago School

IOMS Winter Scientific Seminar
Lombard, IL
December 12-15, 2024

The Proposed
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Disclosures

None

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Objectives

1

1. Review the common headache types and relevant anatomy

2

2. Learn how to screen for common somatic dysfunctions seen in pregnancy

3

3. Describe practical techniques for the treatment of headaches in pregnancy

4

4. Explore the evidence for application of OMT in the care of pregnant patients

Classification of Headaches: International Headache Society

Primary

1. Migraine
2. Tension-type headache (TTH)
3. Trigeminal autonomic cephalgias (TACs)
4. Other primary headache disorders

Secondary

5. Trauma or injury to the head and/or neck
6. Cranial and/or cervical vascular disorder
7. Non-vascular intracranial disorder
8. Substance or its withdrawal
9. Infection
10. Disorder of homeostasis
11. Headache or facial pain attributed to disorder of the cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cervical structure
12. Psychiatric disorder

Classification of Headaches: International Headache Society

Neuropathies, Facial Pains and Other Headaches

1. Painful lesions of the cranial nerves and other facial pain
2. Other headache disorders

Headaches Overview

- #1 Neurological complaint seen in primary care setting
- More prevalent in assigned female at birth (AFAB) compared to assigned male at birth (AMAB)
- Hormonal influence

Migraine Headaches

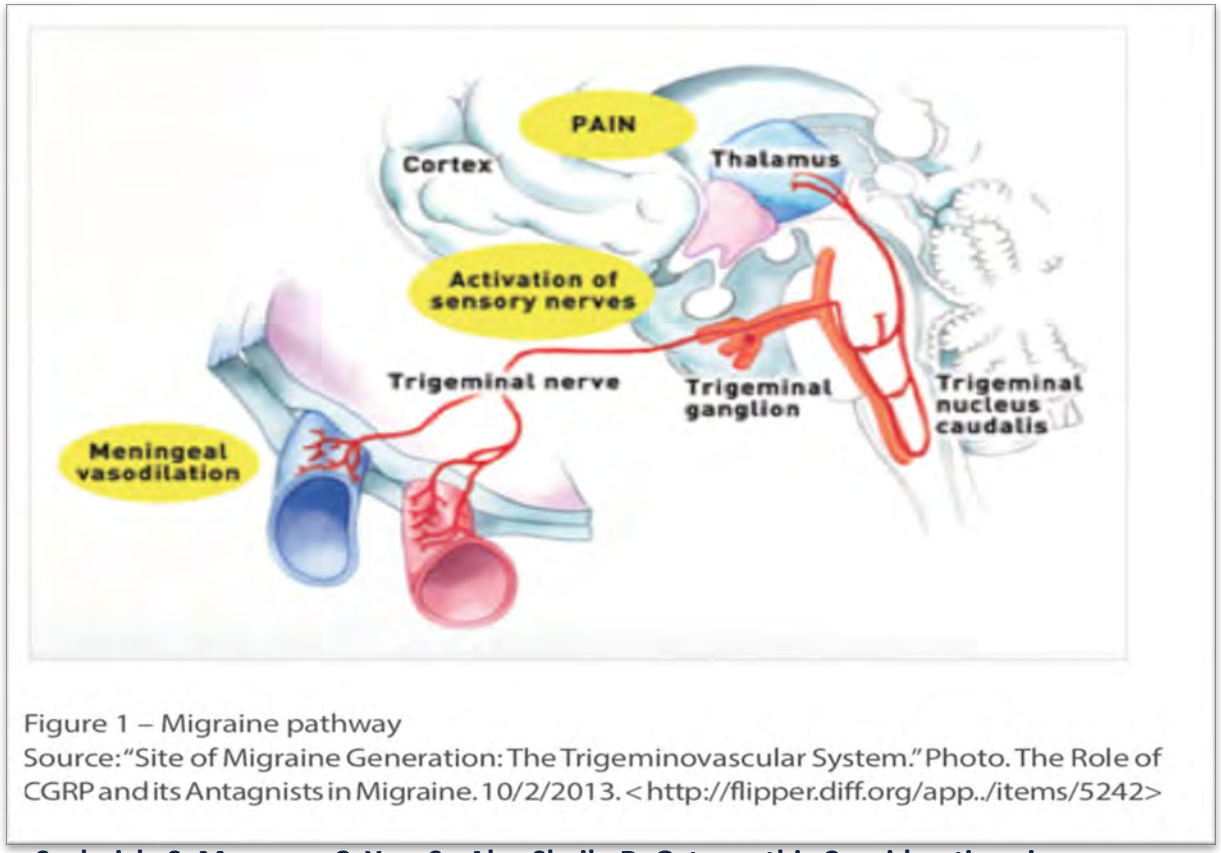


Figure 1 – Migraine pathway
Source: "Site of Migraine Generation: The Trigeminovascular System." Photo. The Role of CGRP and its Antagnists in Migraine. 10/2/2013. <http://flipper.diff.org/app../items/5242>

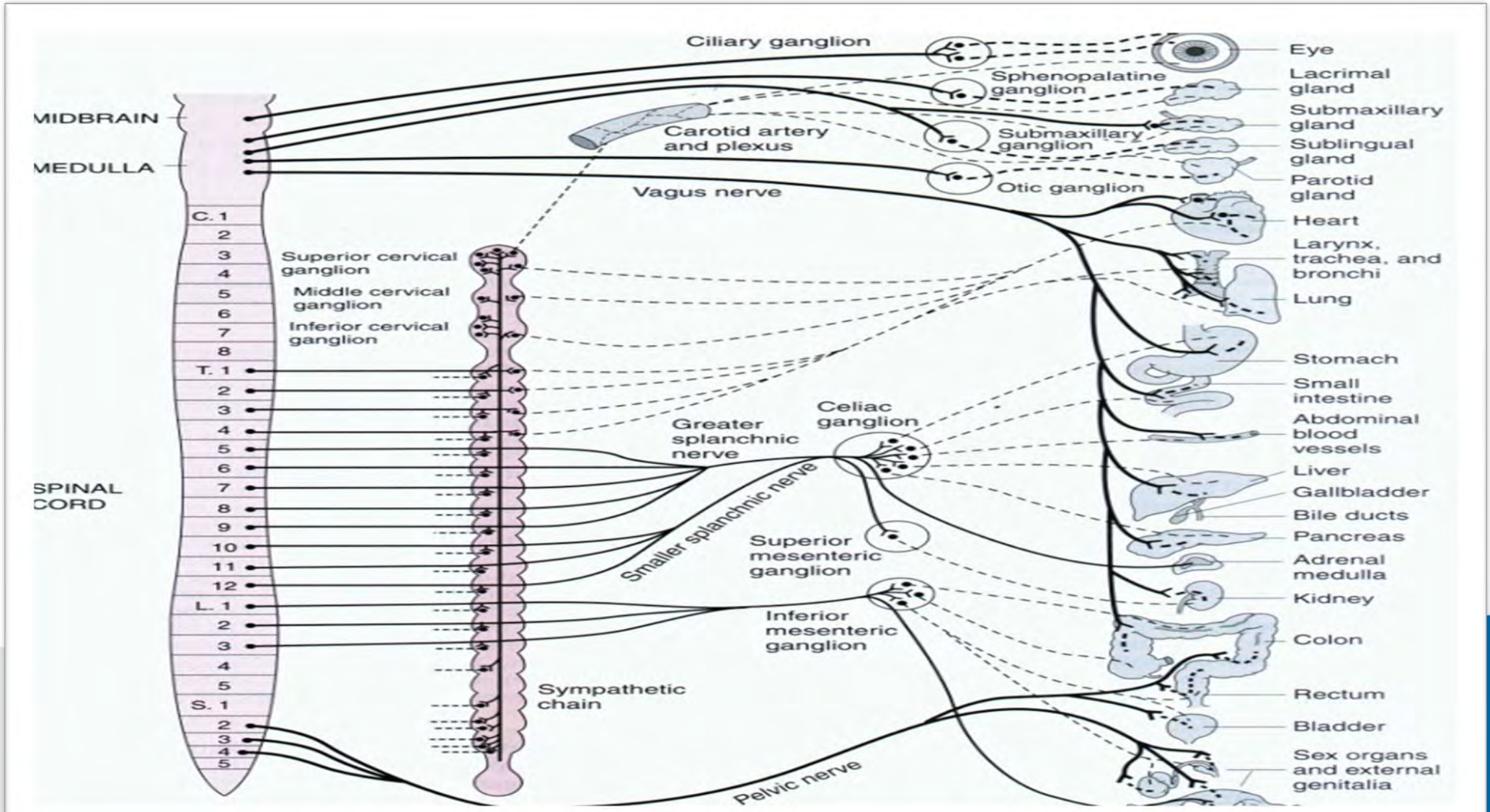
- Responsible for ~60% of headaches in pregnancy
- Trigeminal nerve plays a large role
- Generally, improve during pregnancy in those with pre-conception migraines
- Many pharmacologic options not recommended during pregnancy
- Non-invasive modalities are preferred treatment option

Soshnick, S. Mezzone, C, Yao, S., Abu-Sbaih, R. Osteopathic Considerations in the Management of Migraine in Pregnancy. Osteopathic Family Physician. 2015 March/April; (7) 2:19-23.

Anatomic and Biomechanical Considerations

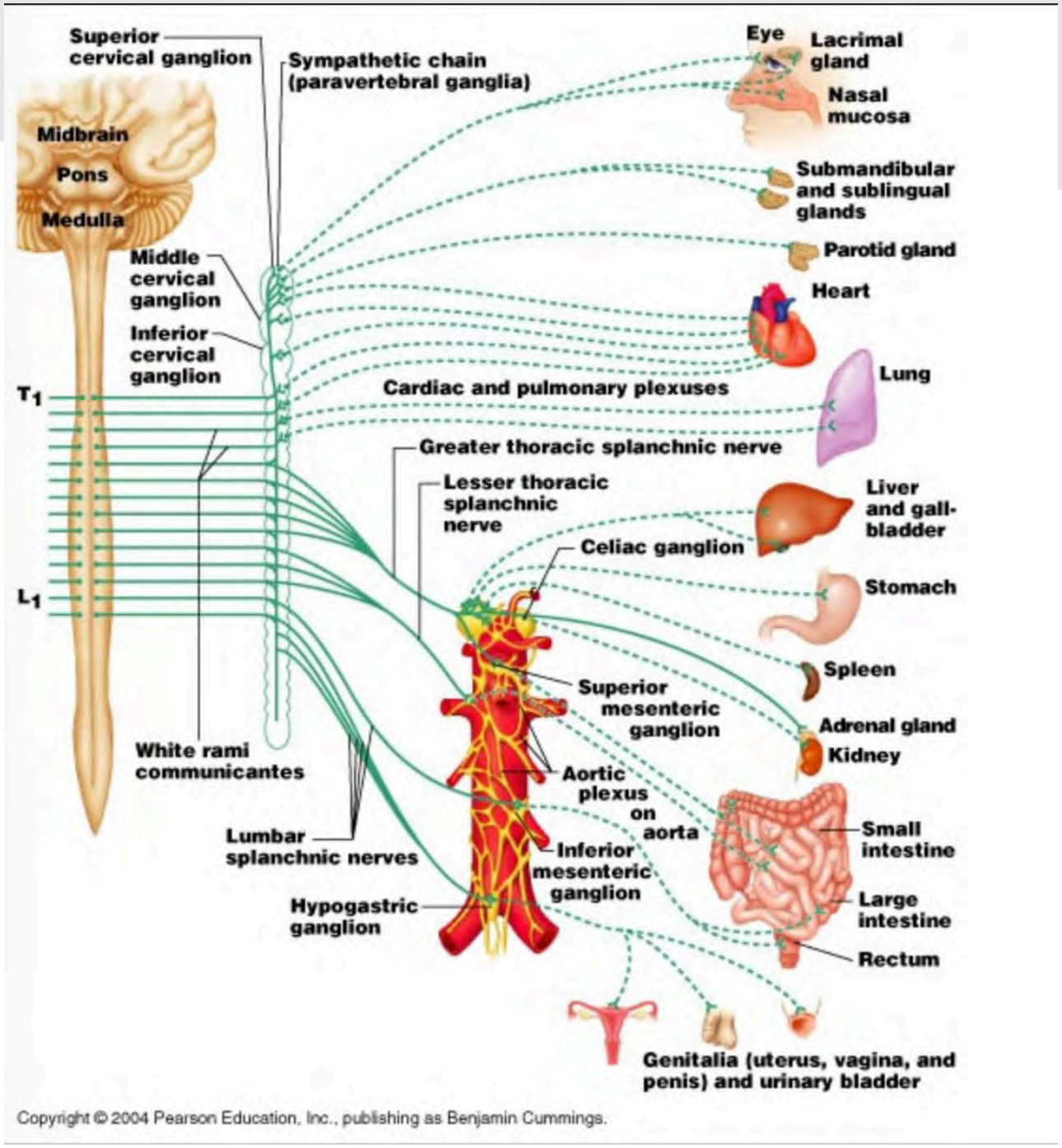
Soshnick, S. Mezzone, C, Yao, S., Abu-Sbaih, R. Osteopathic Considerations in the Management of Migraine in Pregnancy. Osteopathic Family Physician. 2015 March/April; (7) 2:19-23.

Autonomic Nervous System



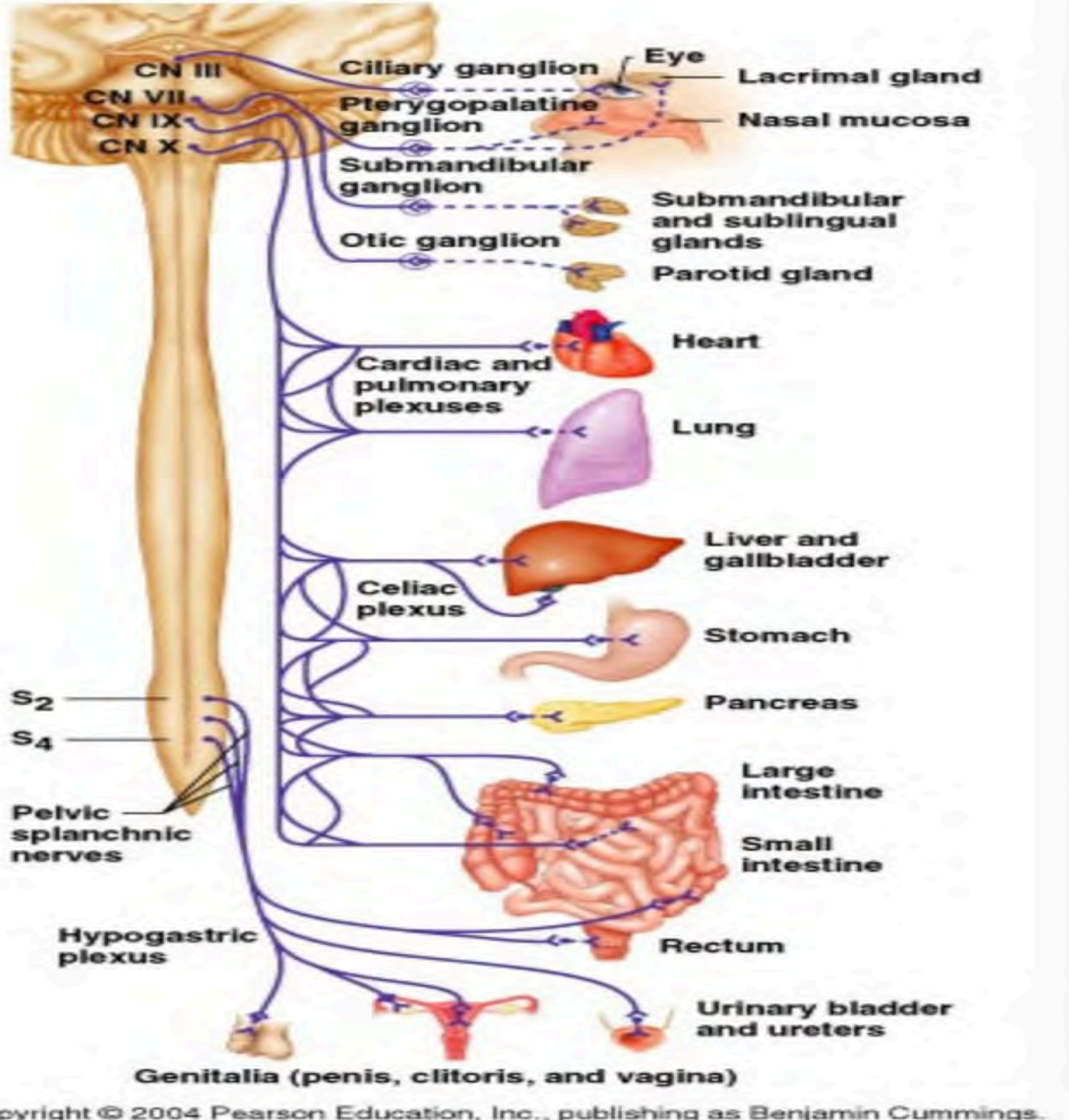
Sympathetic Nervous System

- The upper thoracic region provides sympathetic tone to head and neck

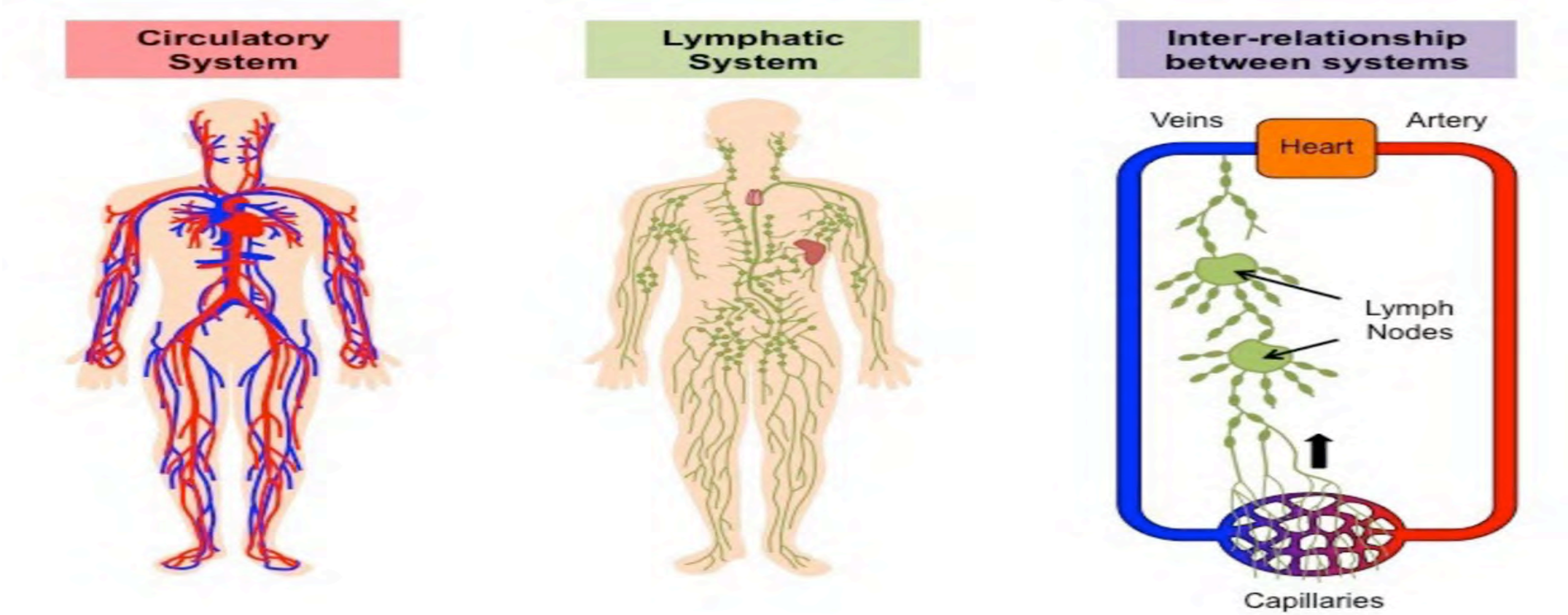


Parasympathetic Nervous System

- Head Region
- Sacral Region
- Vagus nerve (CN X)

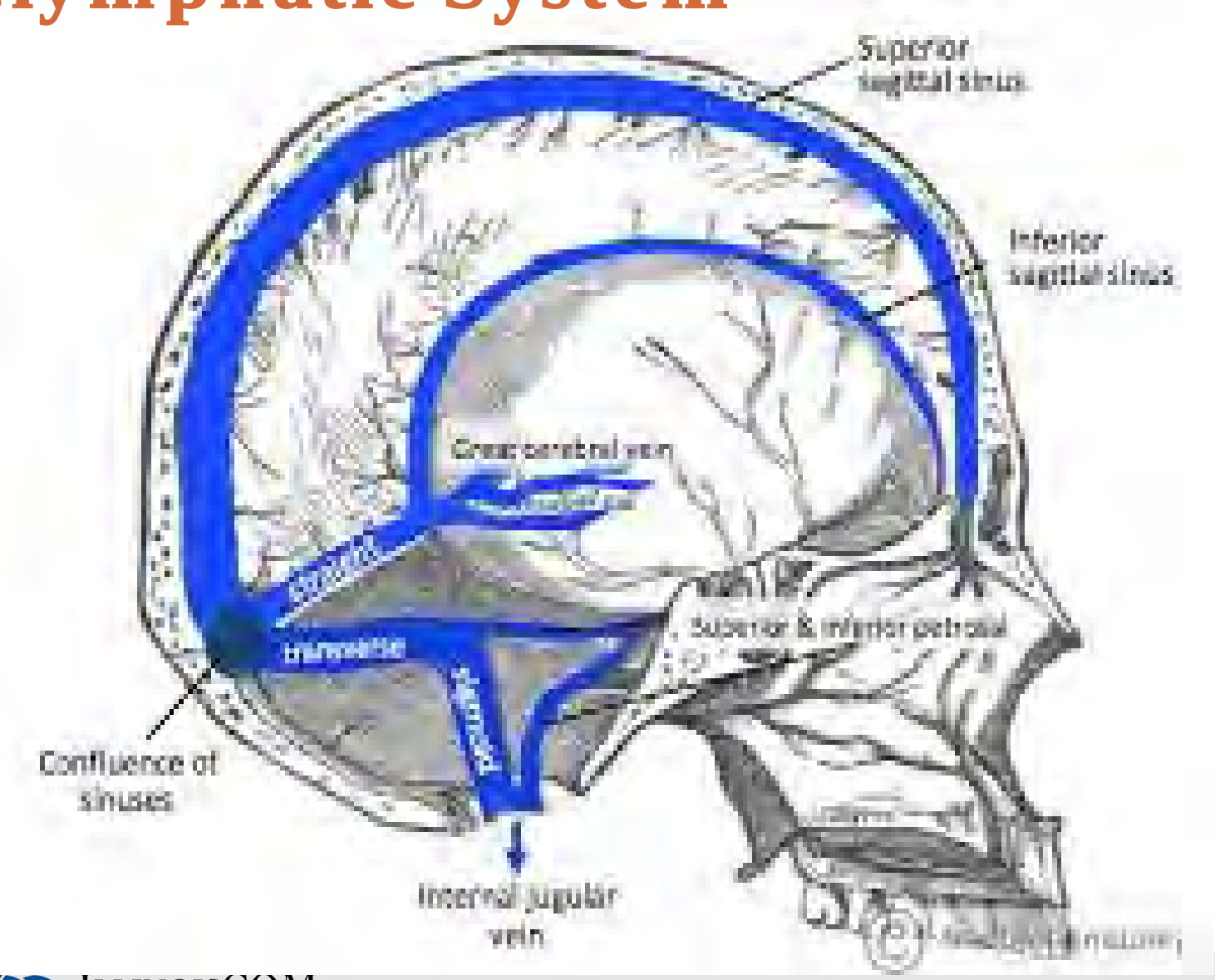


Lymphatic System



- Adequate clearance is essential for overall homeostasis

Glymphatic System



- Located between the layers of dura mater
- Superior sagittal sinus, Inferior sagittal sinus and straight sinus drain into confluence of sinuses → right and left transverse sinuses → Sigmoid sinus → Internal jugular vein

- **Right Thoracic Duct:**

  - Right head, face and neck

  - Right upper trunk

  - Right upper extremity

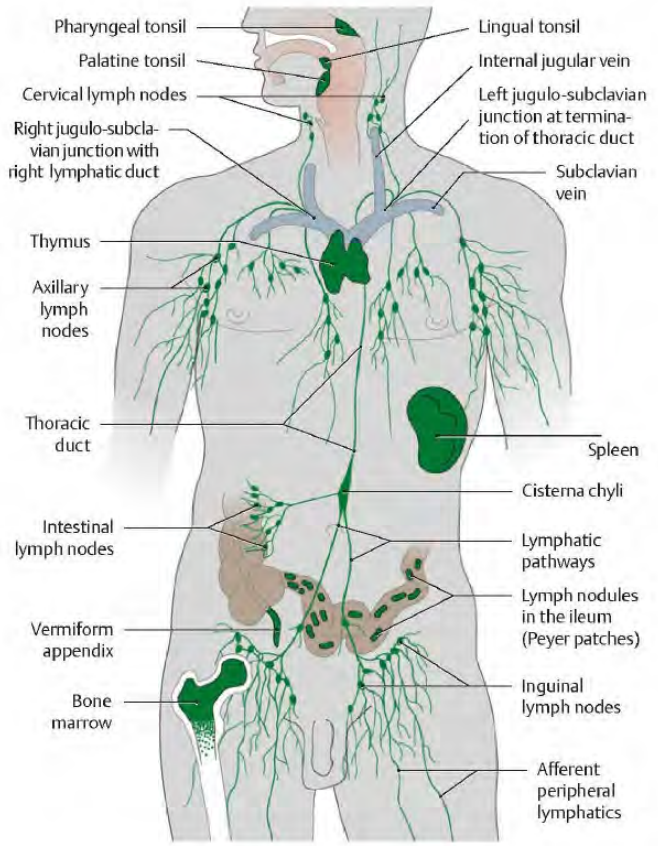
- **Left Thoracic Duct:**

  - Left head, face and neck

  - Left upper extremity

  - Remainder of trunk

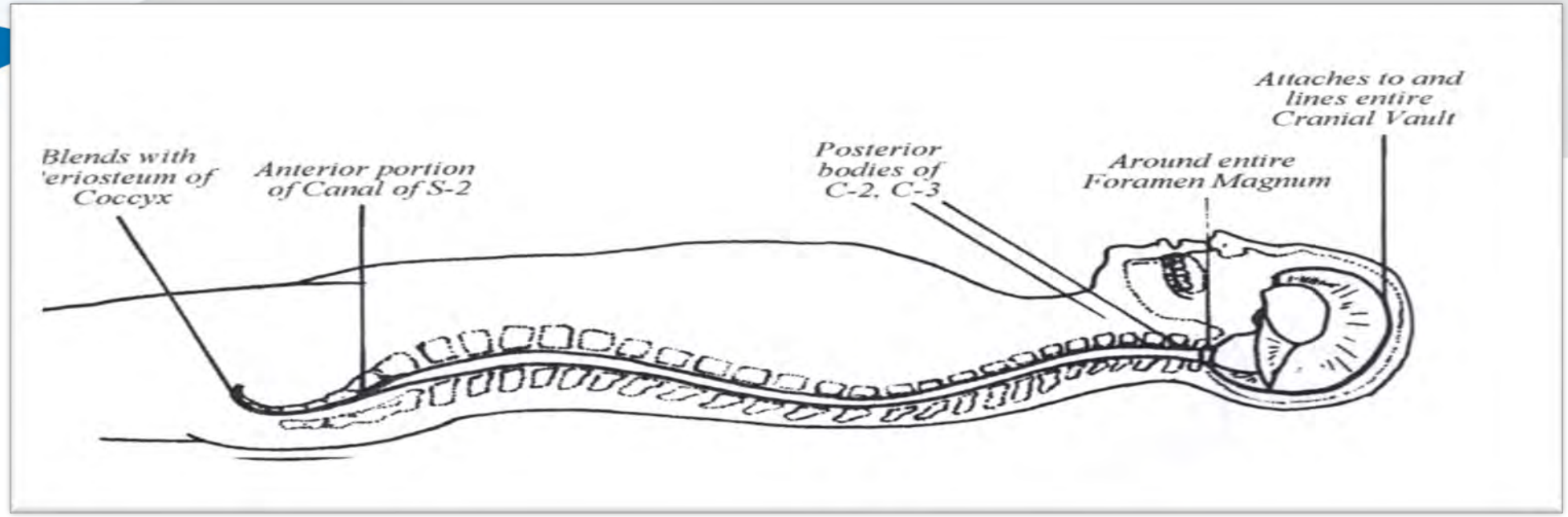
  - Bilateral lower extremities



A The human lymphatic system

Illustrator: Markus Voll pp. 50-51

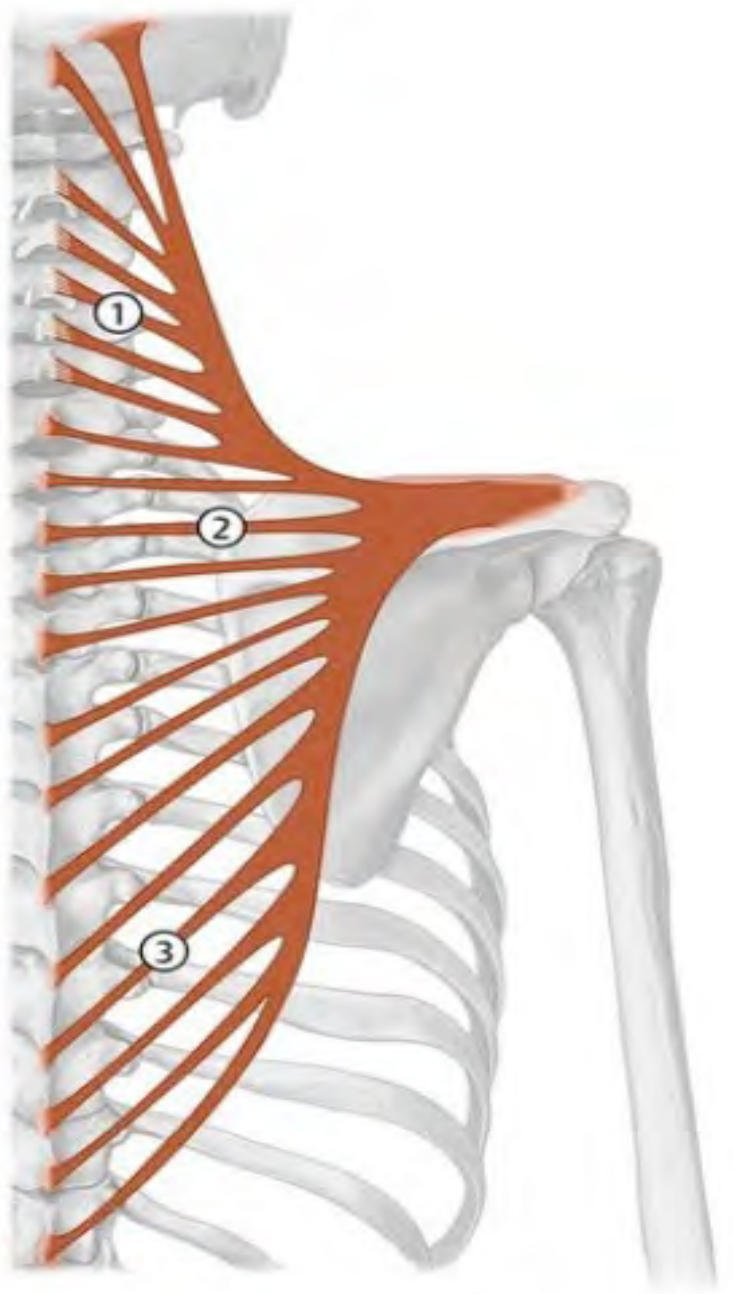
Dura

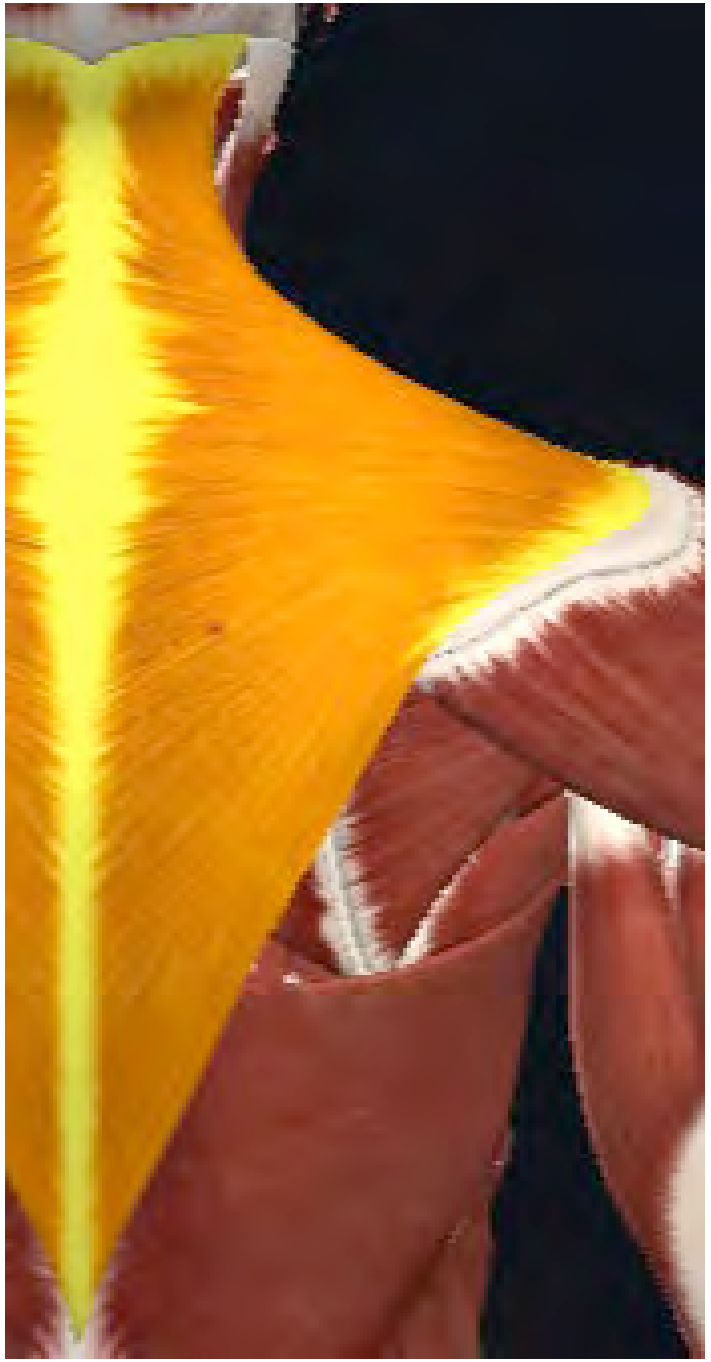


- One of 3 meningeal layers to surround and protect the CNS
- Main attachments at C2, C3 and S2
- 2 layers within the cranium
- Spine changes and sacral nutation in pregnancy cause added strain and stress to the dura

Trapezius

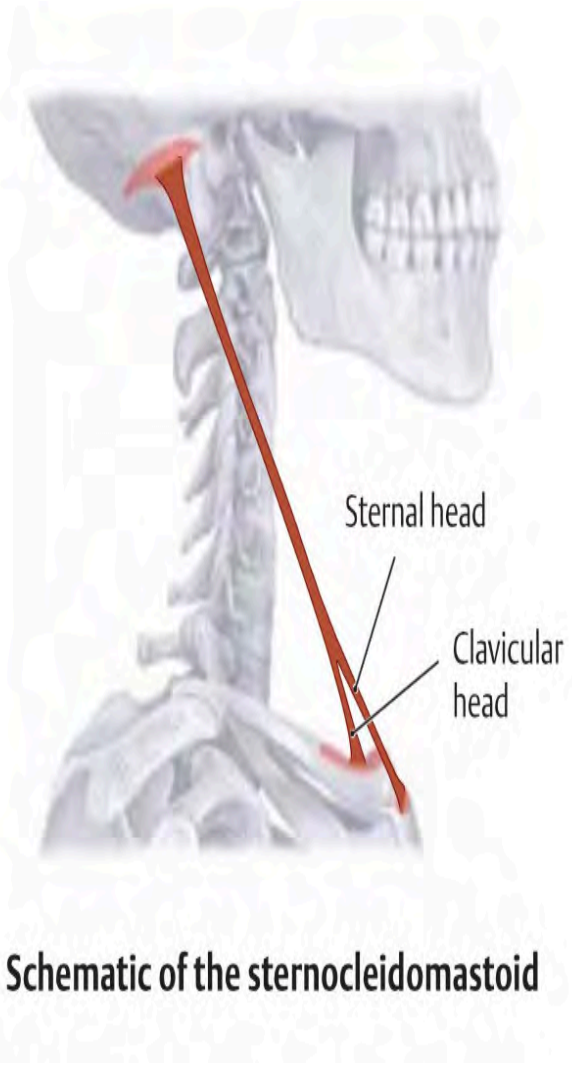
- 3 major segments
- Innervation:
  Accesory nerve (CN XI), C3-4
- Function: Elevation, depression, retraction and superior rotation of scapula



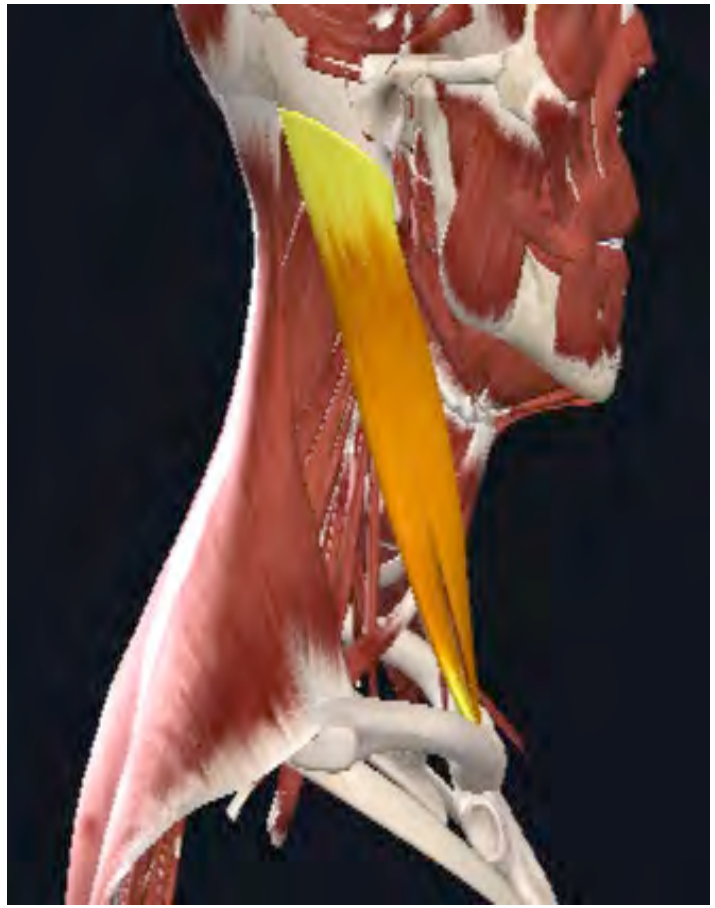


Sternocleidomastoid

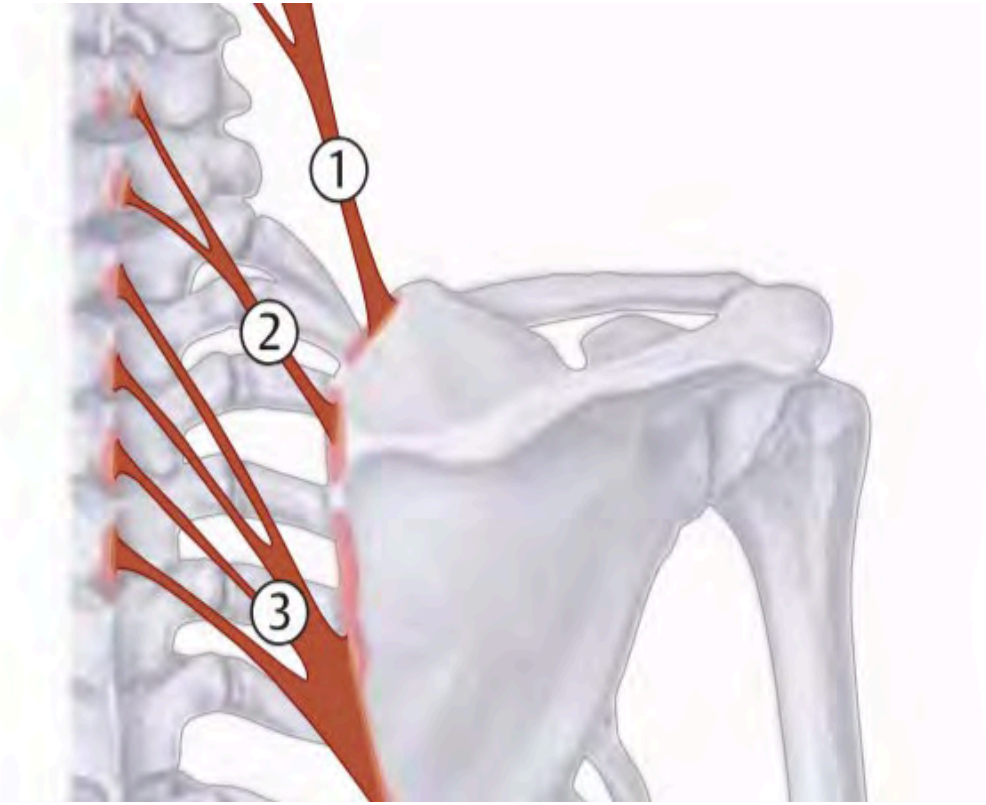
- 3 sites of attachment
- Innervation:
  CN XI
  C1-C2
- Function:
  Sidebending, rotation and extension of the head

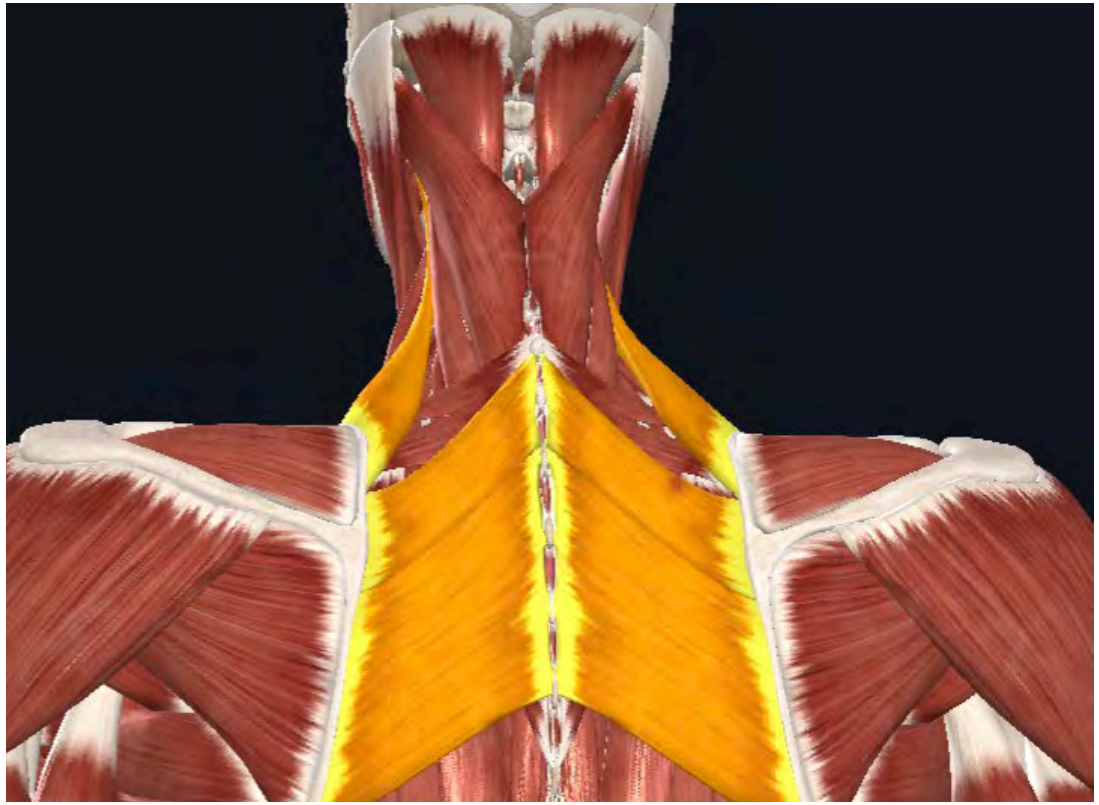


B Schematic of the sternocleidomastoid

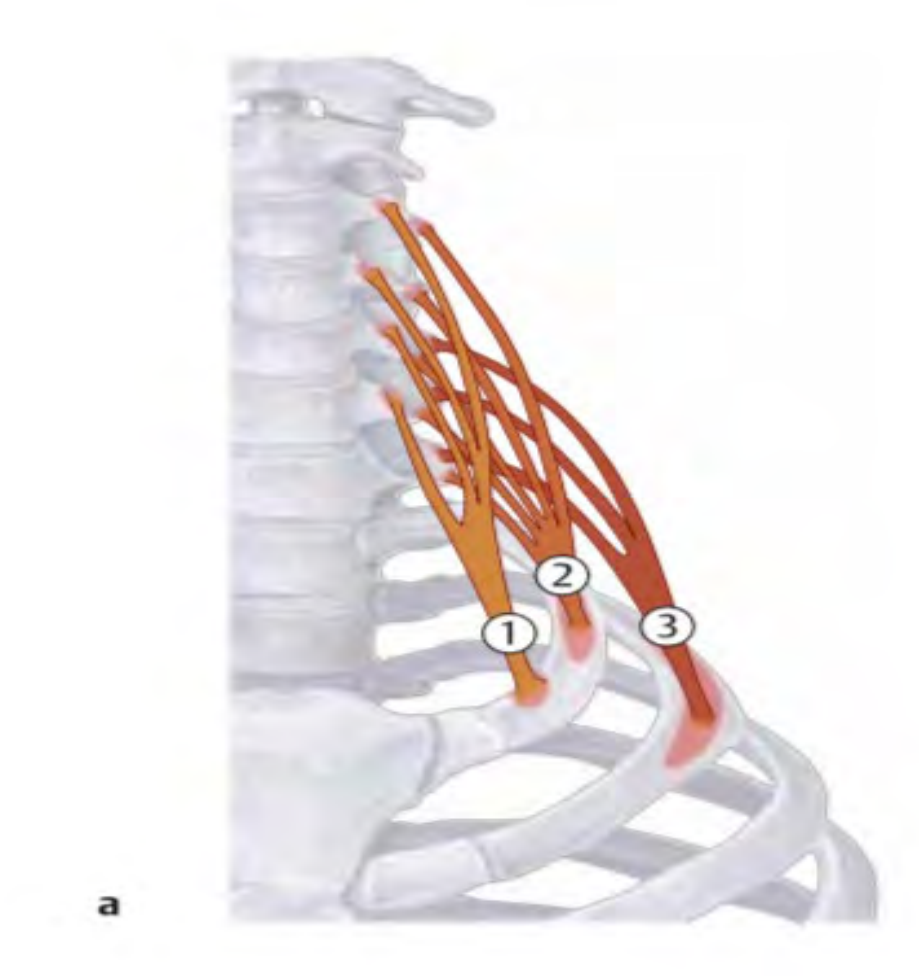


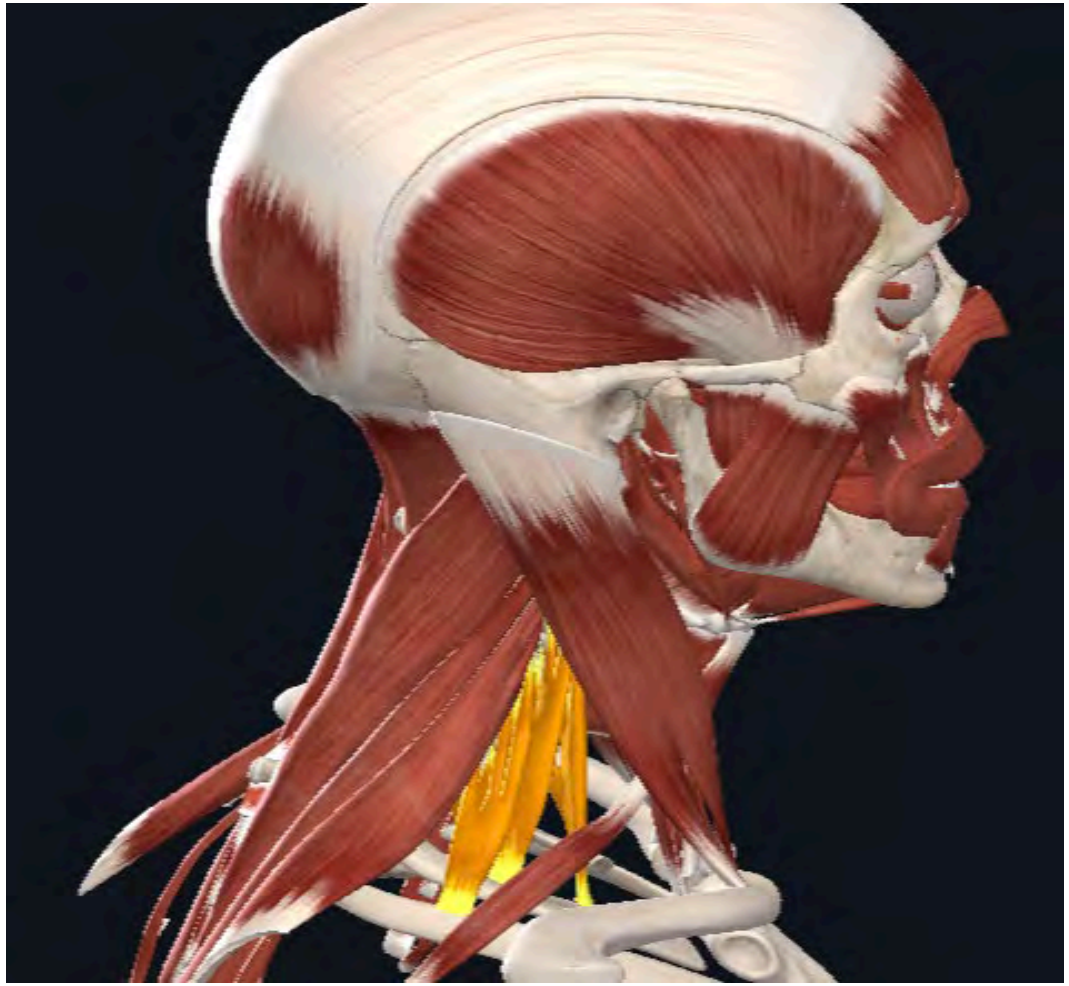
Levator Scapulae and Rhomboids



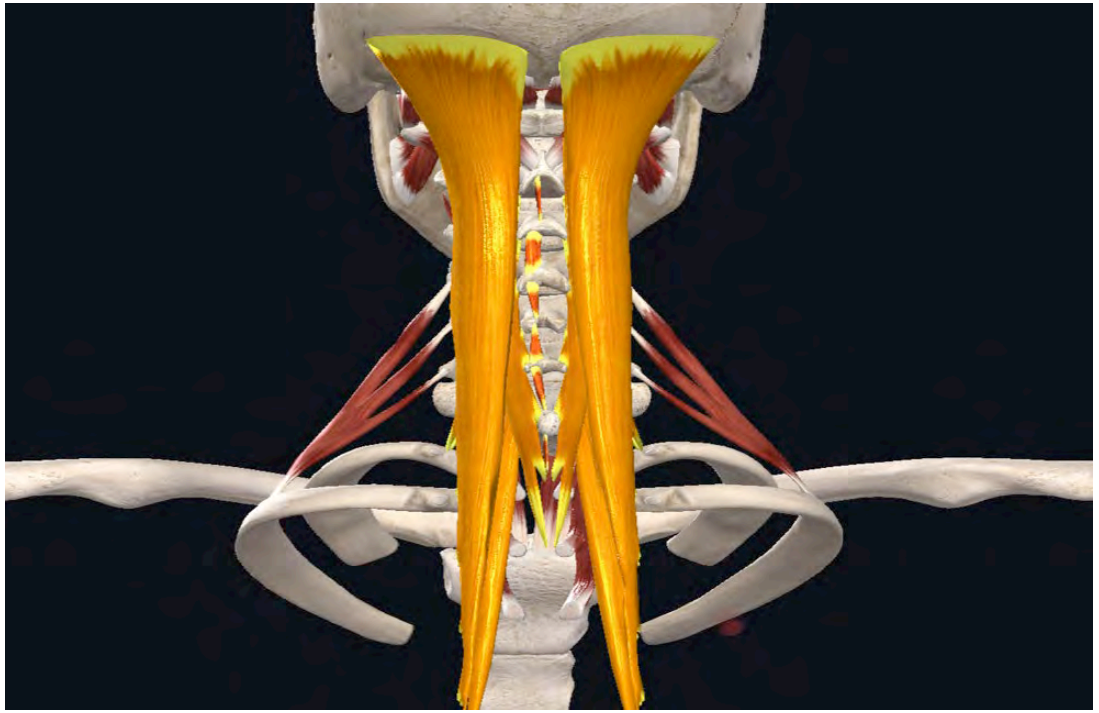


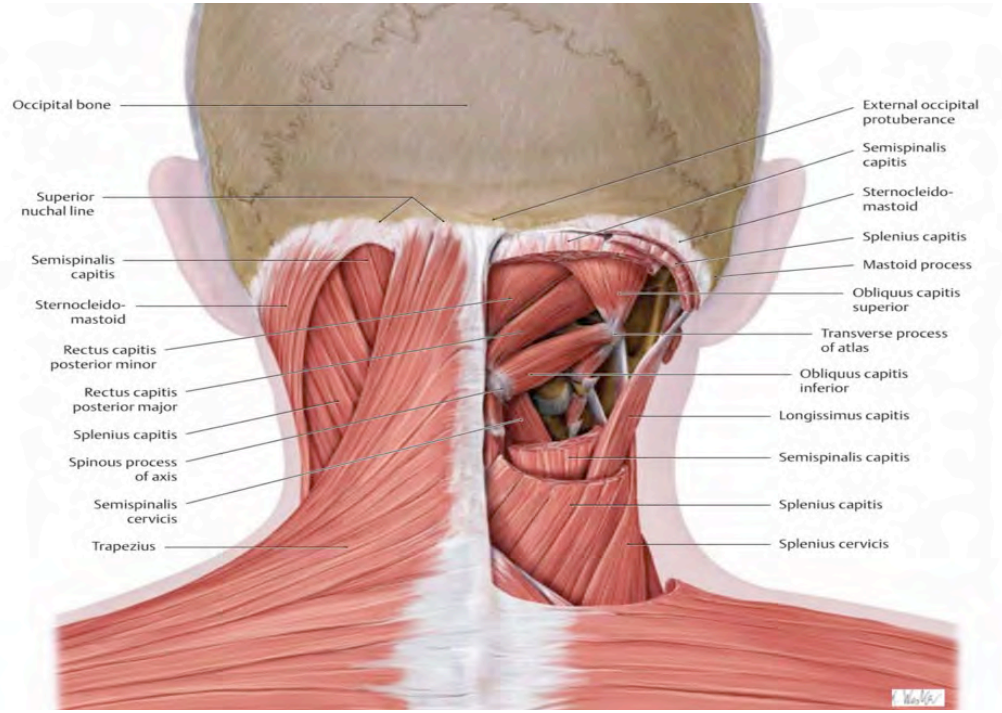
Scalenes



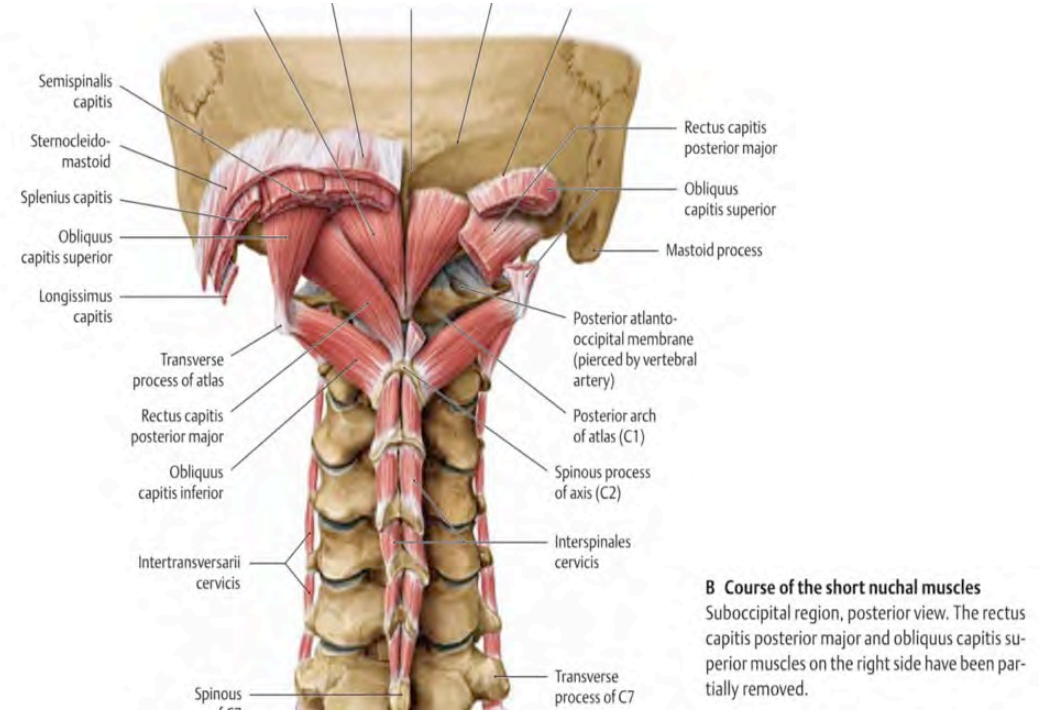


Long Nuchal Musculature

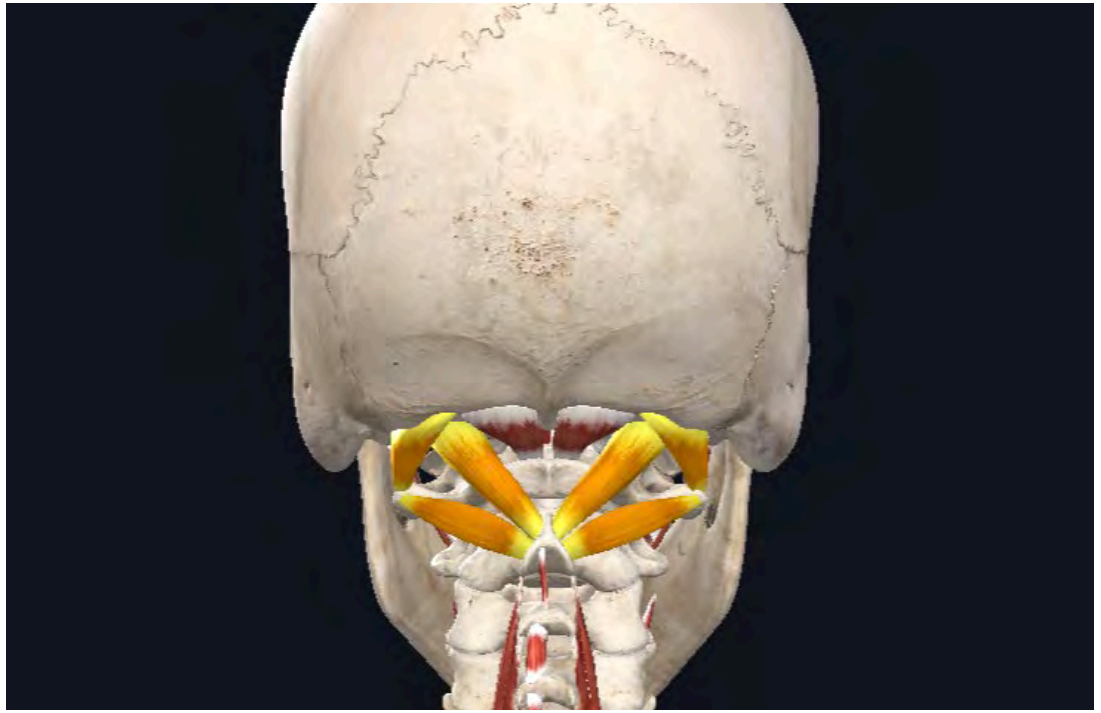




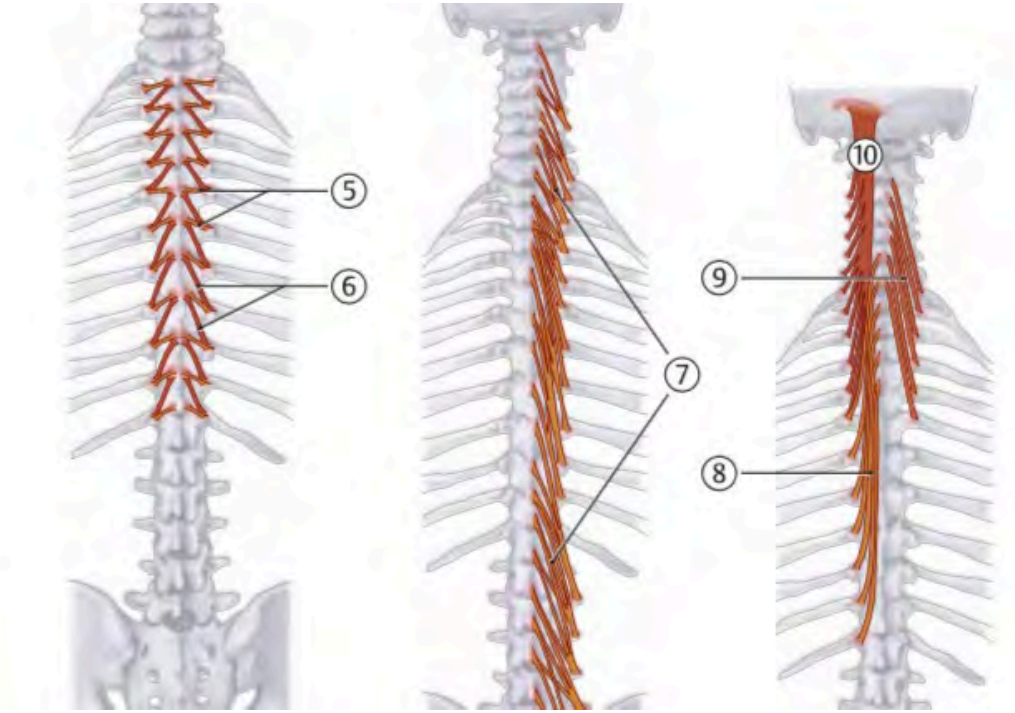
Short Nuchal Musculature

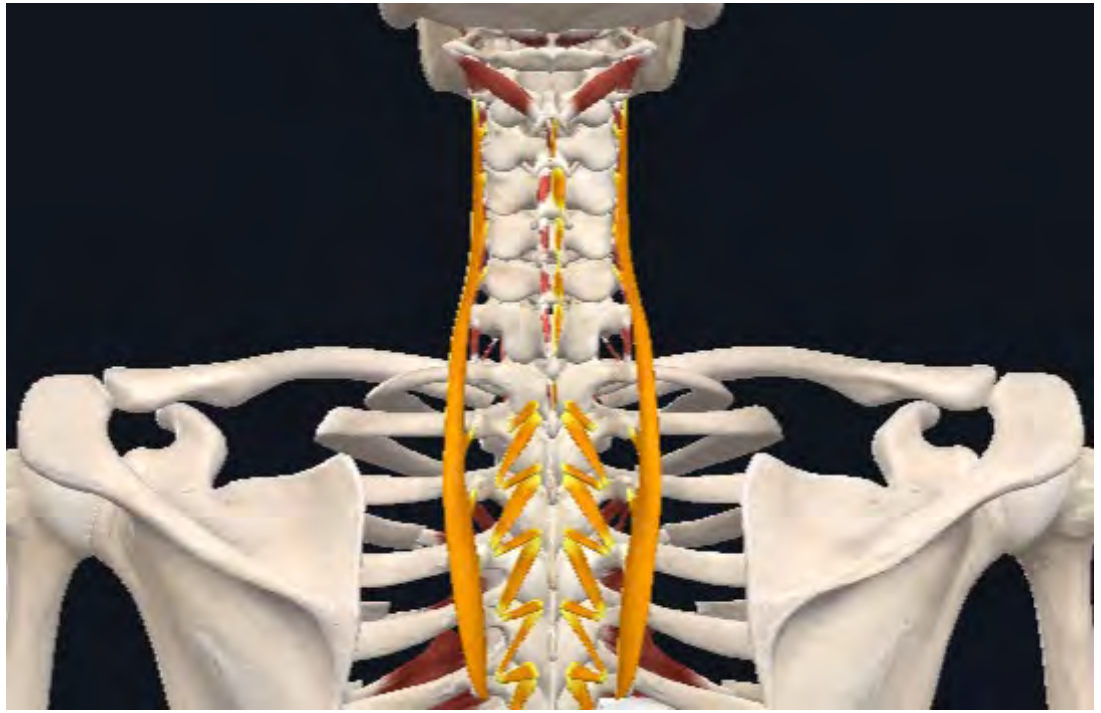


B Course of the short nuchal muscles
Suboccipital region, posterior view. The rectus capitis posterior major and obliquus capitis superior muscles on the right side have been partially removed.

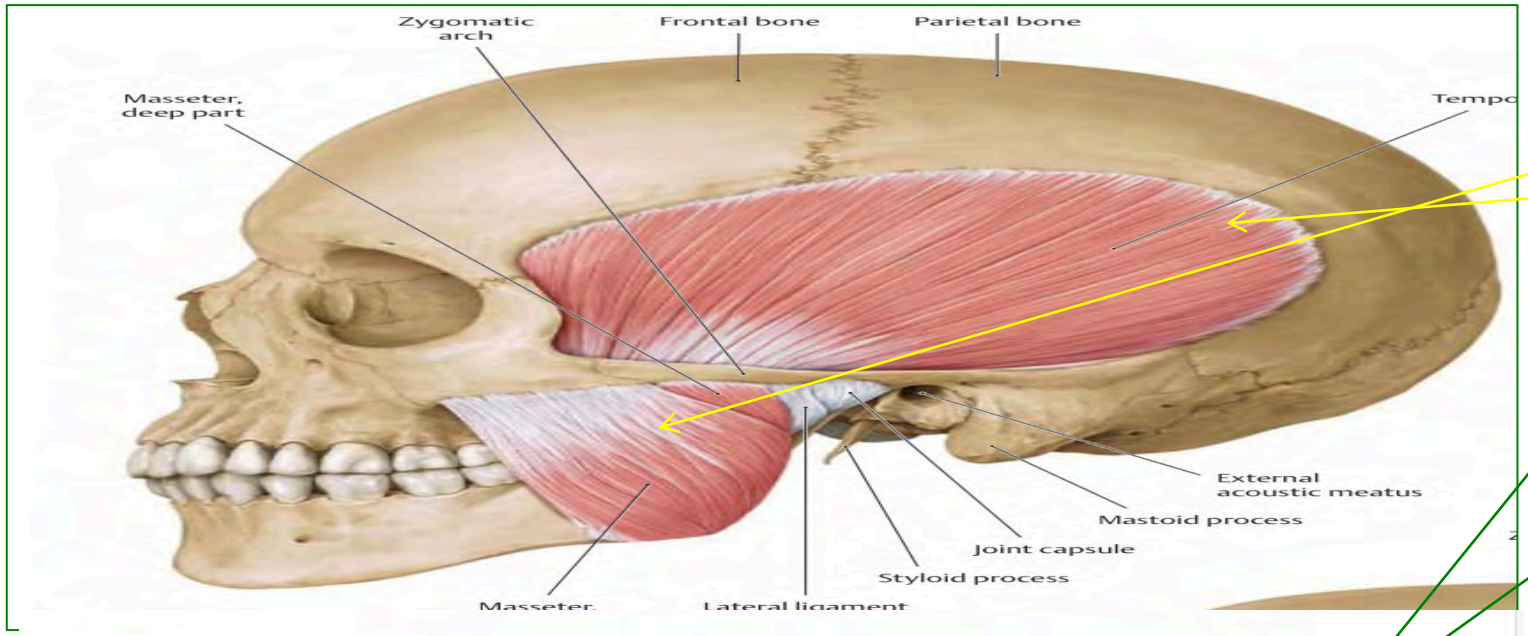


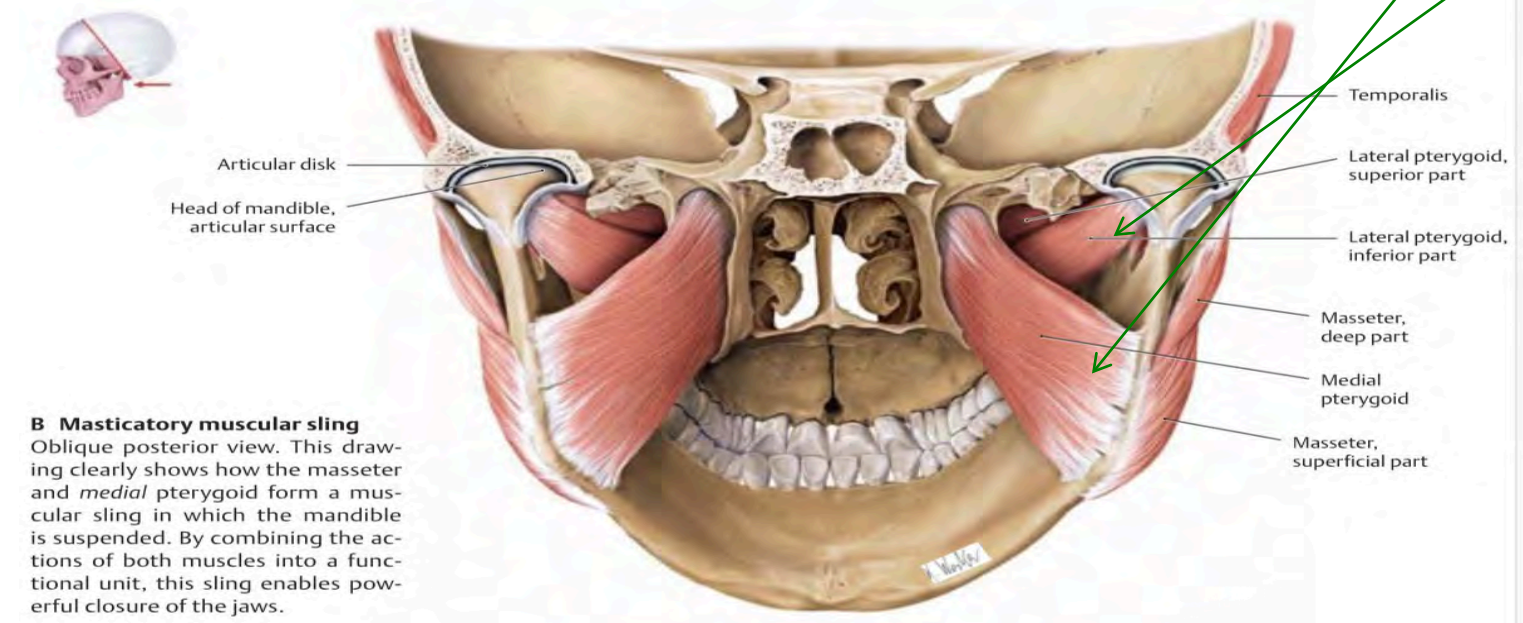
Intrinsic Back Muscles





Temporomandibular Joint





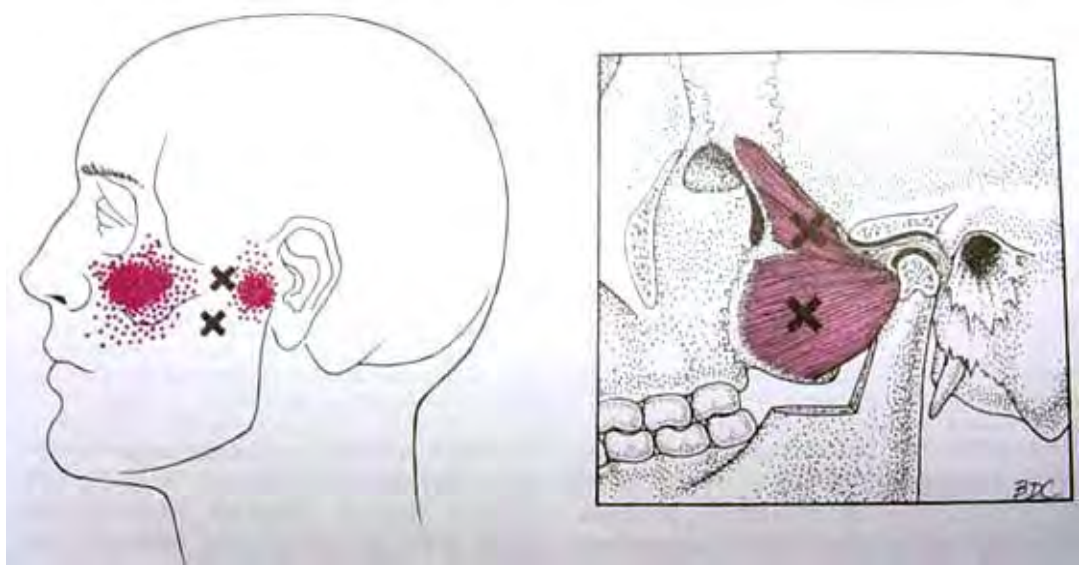
B Masticatory muscular sling
Oblique posterior view. This drawing clearly shows how the masseter and *medial* pterygoid form a muscular sling in which the mandible is suspended. By combining the actions of both muscles into a functional unit, this sling enables powerful closure of the jaws.

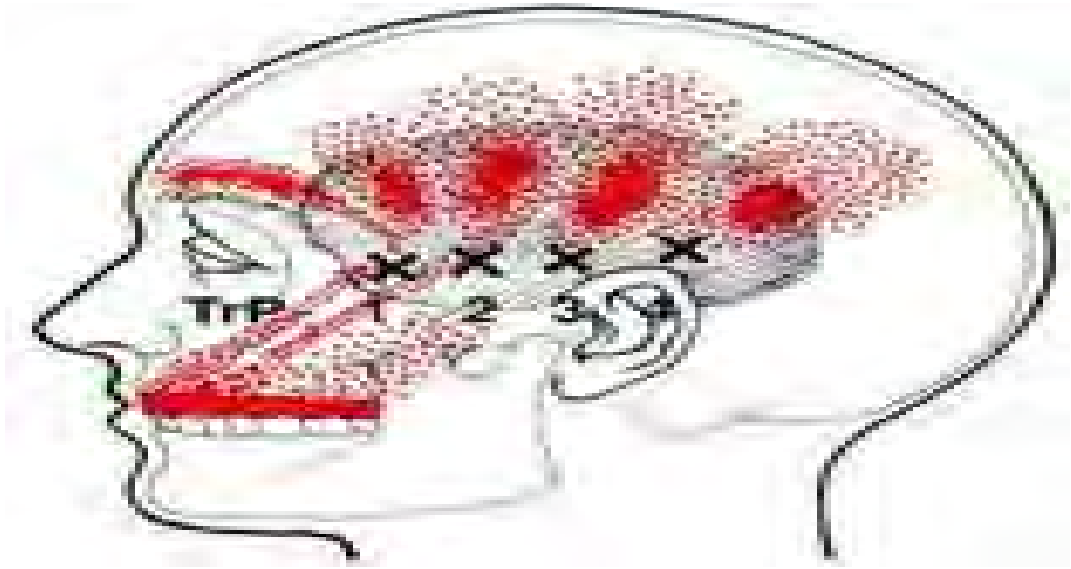
Closing
- Masseter
- Temporalis
- Medial pterygoid

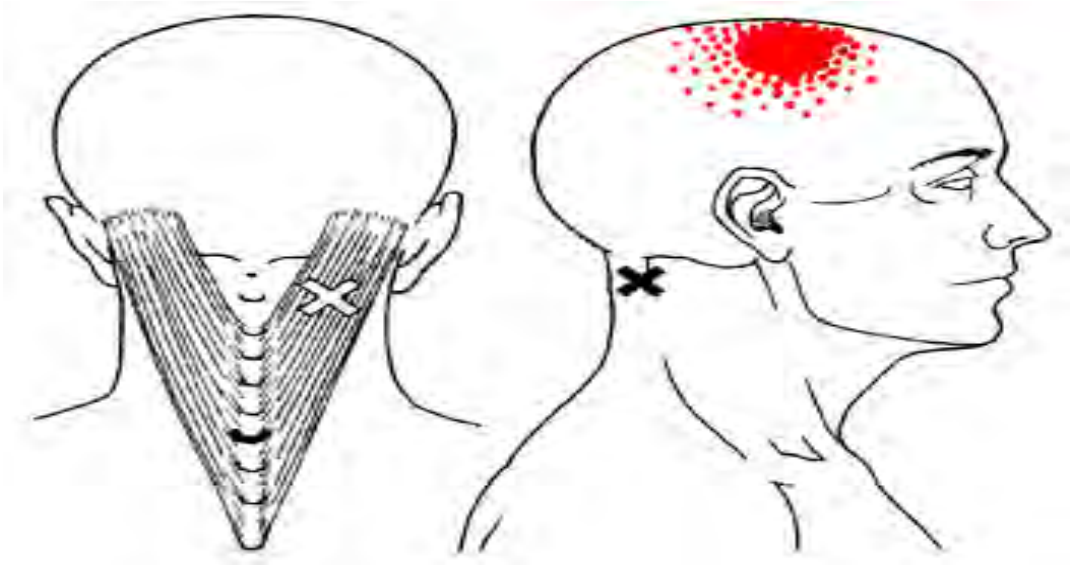
Translation
- Lateral pterygoid

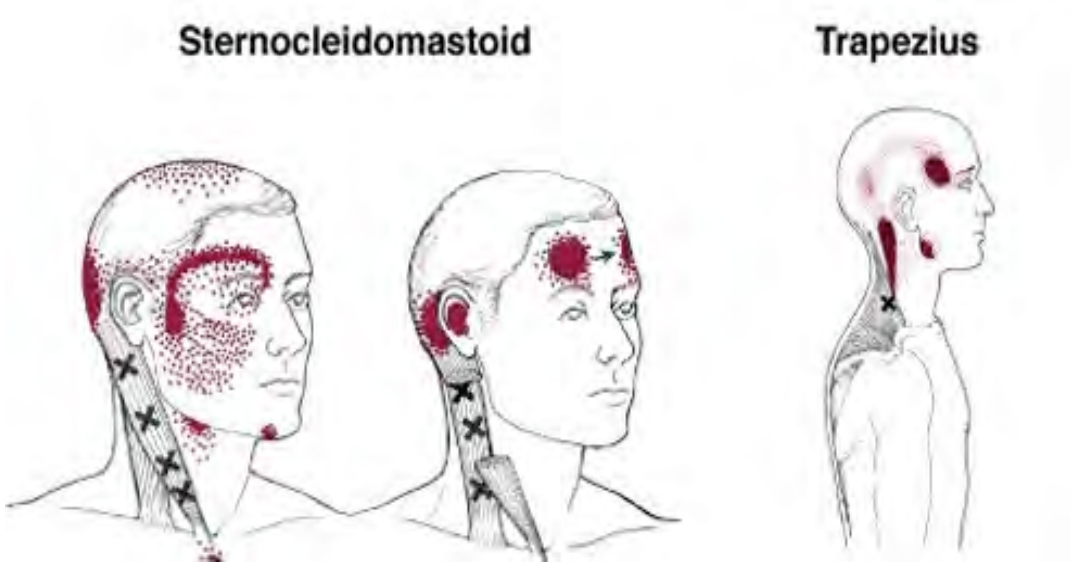
Opening
- Strap Muscles
- Digastric
- Mylohyoid
- Geniohyoid
- Sternohyoid
- Omohyoid
- Thyrohyoid

Trigger Point Patterns

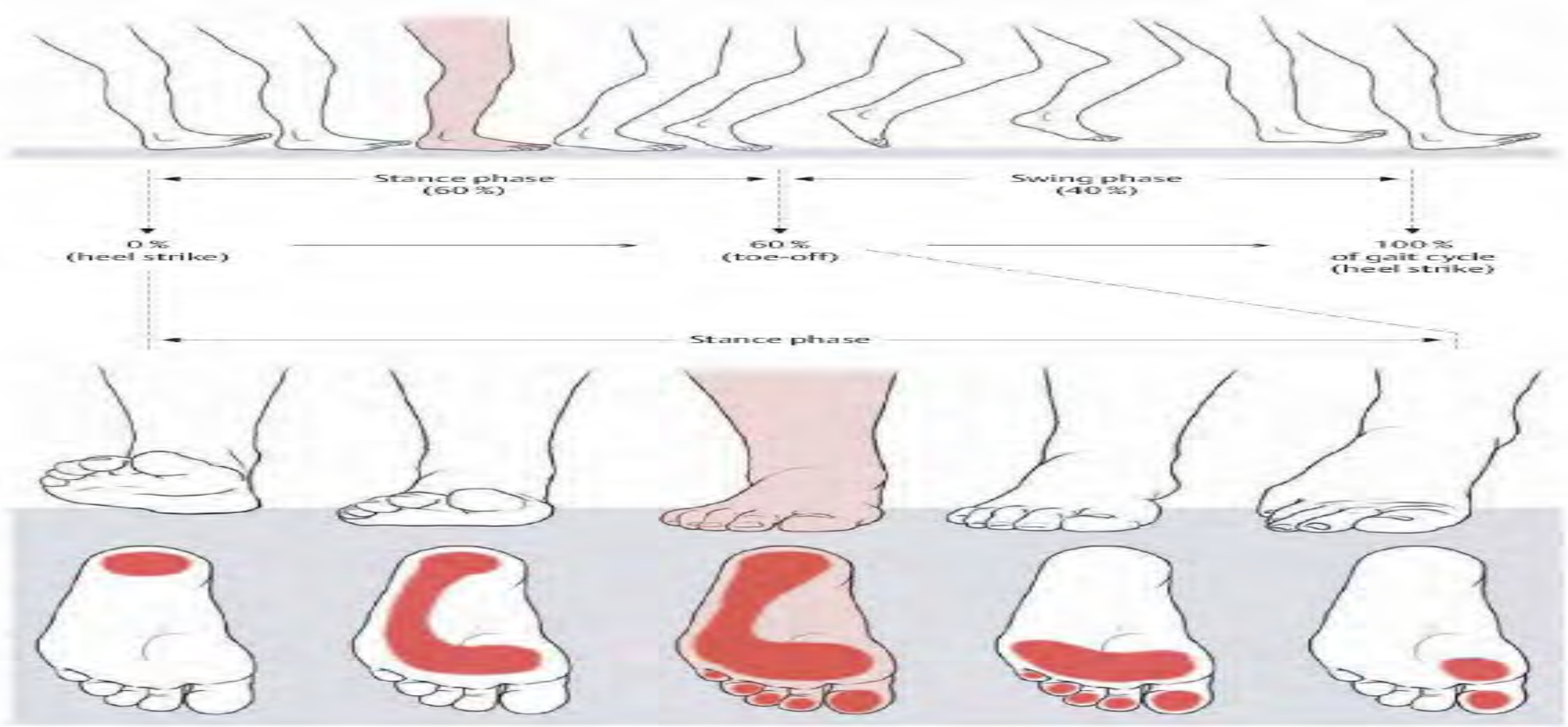








Don’t Forget the FEET!!!



D Movements of the leg during one gait cycle

Rationale for use of OMT

1. Decrease pain
2. Decrease intensity and frequency of headache symptoms
3. Limit medication use
4. Restore homeostasis
5. Improve quality of life and patient satisfaction

Focused Structural Exam

- Head/TMJ
- Cervical
- Thoracic
- Ribs
- Upper Extremity

Overall Goals of Treatment

Restore	Restore balance to the autonomic nervous system
Correct	Correct somatic dysfunction of articular spine and associated musculature
Optimize	Optimize diaphragmatic function
Address	Address circulation via restoration of venous and lymphatic flow
Decrease	Decrease tension within soft tissue and fascia
Help	Help patient identify and come up with strategies to help mitigate additional stressors

Techniques for the Office Visit

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Descriptors	Relevance in Pregnancy	Sample Treatment
Head (Occipito-cervical)	Autonomic- Parasympathetic Mechanical pain/ Major Diaphragm/Venous drainage	OA release (MFR) Sagittal Suture Release (MFR)
Cervical (Cervical-thoracic)	Mechanical pain	Cervical soft tissue release (MFR)
Thoracic (Thoraco-lumbar)	Autonomic- Sympathetic Mechanical pain/ Major Diaphragm	Seated Thoracic Mobilization (Articulatory) Doming of Respiratory diaphragm (MFR)
Upper Extremities (Acromioclavicular/ sternoclavicular regions)	Autonomic- Sympathetic Mechanical pain/ Major Diaphragm	Direct Inhibition for Trapezius Thoracic Inlet Release (MFR/lymph)
Rib Cage (costochondral, costovertebral, sternochondral)	Autonomic- Sympathetic Mechanical pain/ Major Diaphragm	Rib Raising (Soft tissue/Lymph)
Sacrum	Autonomic-Parasympathetic	Sacral rocking (Articulatory)

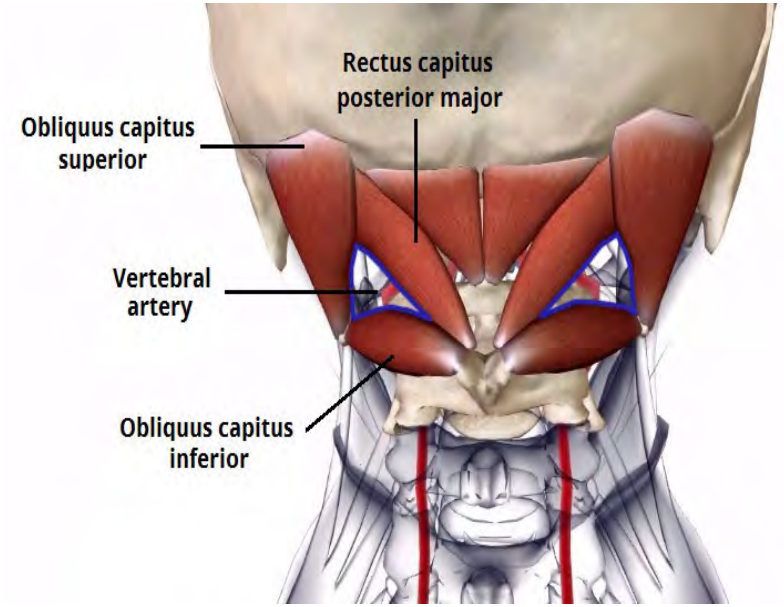
OA Release

Modulates parasympathetic nervous system

Patient position: Supine

Hand placement: Palms up with finger tips at 90 degrees to the suboccipital space.

Technique: Hold until release of muscle/fascial tension is appreciated



Sagittal Suture Release

- Relieves tension from dural membrane of cranium and encourages venous drainage
- Patient position: Supine
- Hand Placement: Palms contact parietal bones with thumbs crossed and pads contacting adjacent sides of suture.
- Technique: Apply simultaneous pressure perpendicular to suture from lambda to bregma in intervals until release

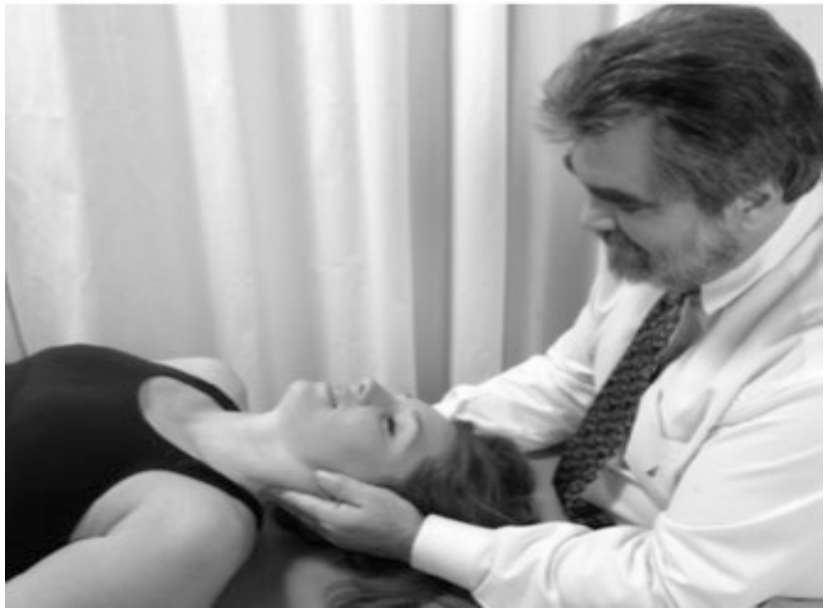
Cervical Soft Tissue MFR

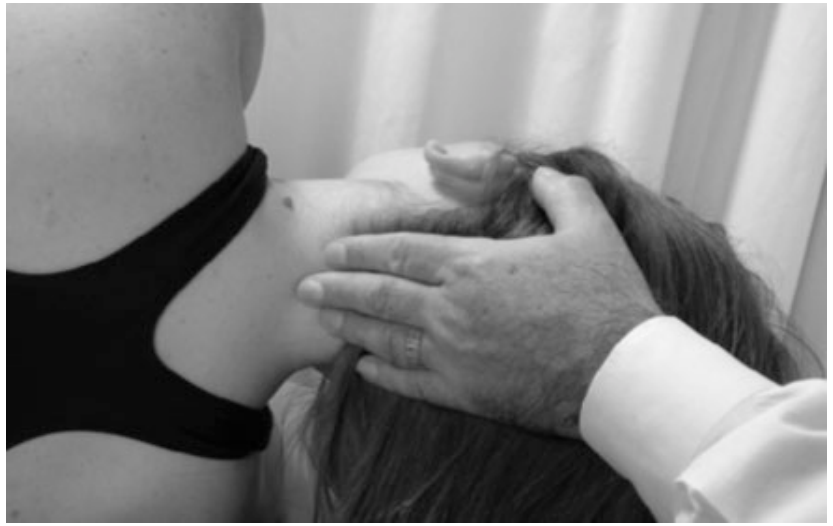
Decrease muscle tension and increase ROM

Patient position: supine

Hand position: Place fingers pads on bilateral paravertebral muscles just lateral to the spinous processes

Technique: Apply pressure anteriorly, superiorly and laterally, knead and release paravertebral muscles in segmental fashion along length of cervical spine





https://www.researchgate.net/publication/6218053_Avian_influenza_An_osteopathic_component_to_treatment

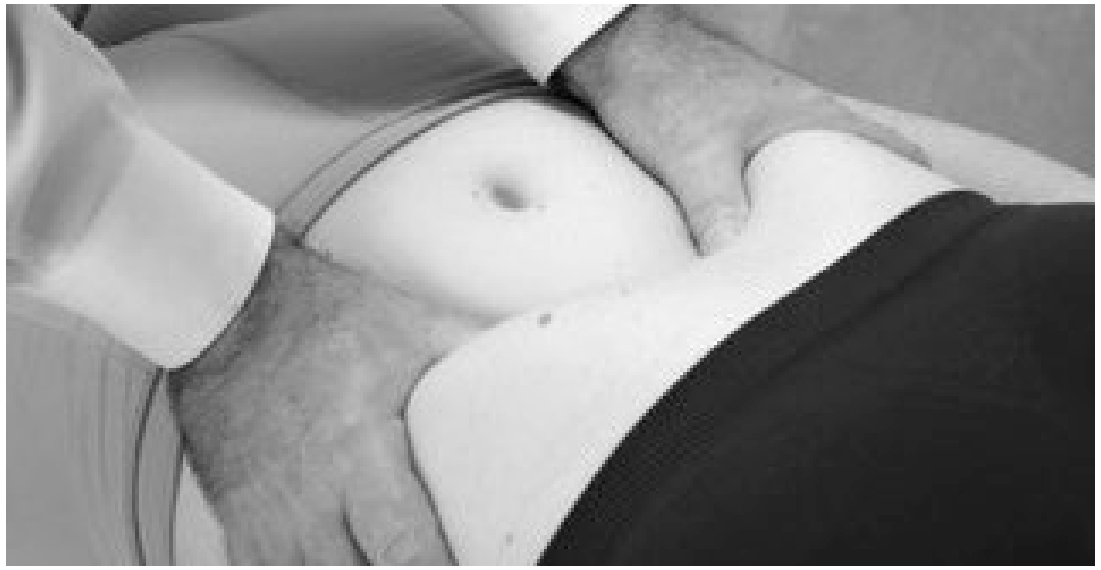
Thoracic Mobilization

https://www.researchgate.net/figure/Rib-raising-technique-method-1_fig12_6218053

- Increase motion within the thoracic spine
- Patient position: Seated with arms resting over physician's shoulder and rests head on their arms
- Hand position: Under patient's arms with finger pads fanned across the bilateral transverse processes as a fulcrum for thoracic extension
- Technique: Apply anterior-lateral traction to the transverse processes and provide a springing motion by shifting center of gravity posteriorly, pulling patient forward towards you until engagement of the restrictive barrier is achieved. Return patient to neutral and repeat several times addressing all restricted segments of thoracic spine.

Doming of Respiratory Diaphragm

- Encourage lymphatic drainage by increasing mobility; decrease discomfort
- Position: Seated or Supine
- Hand position: lower part of rib cage with thenar eminences beneath coastal margins
- Technique: engage restrictive barrier while having patient inhale and follow diaphragm and rib cage motion to exaggerate



https://www.researchgate.net/figure/Supine-doming-of-the-diaphragm_fig20_6218053

Trapezius Inhibition

Nicholas, A. S., & Nicholas, E. A. (2008). Atlas of osteopathic techniques. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

- Direct inhibition of trapezius muscles to decrease hypertonicity
- Patient position: supine
- Hand position: Over trapezius with thumb pads on anterior aspect and remaining fingers on posterior aspect
- Technique: Apply squeezing force (as patient tolerates) to the trapezius between thumbs and fingers until tissue texture softening

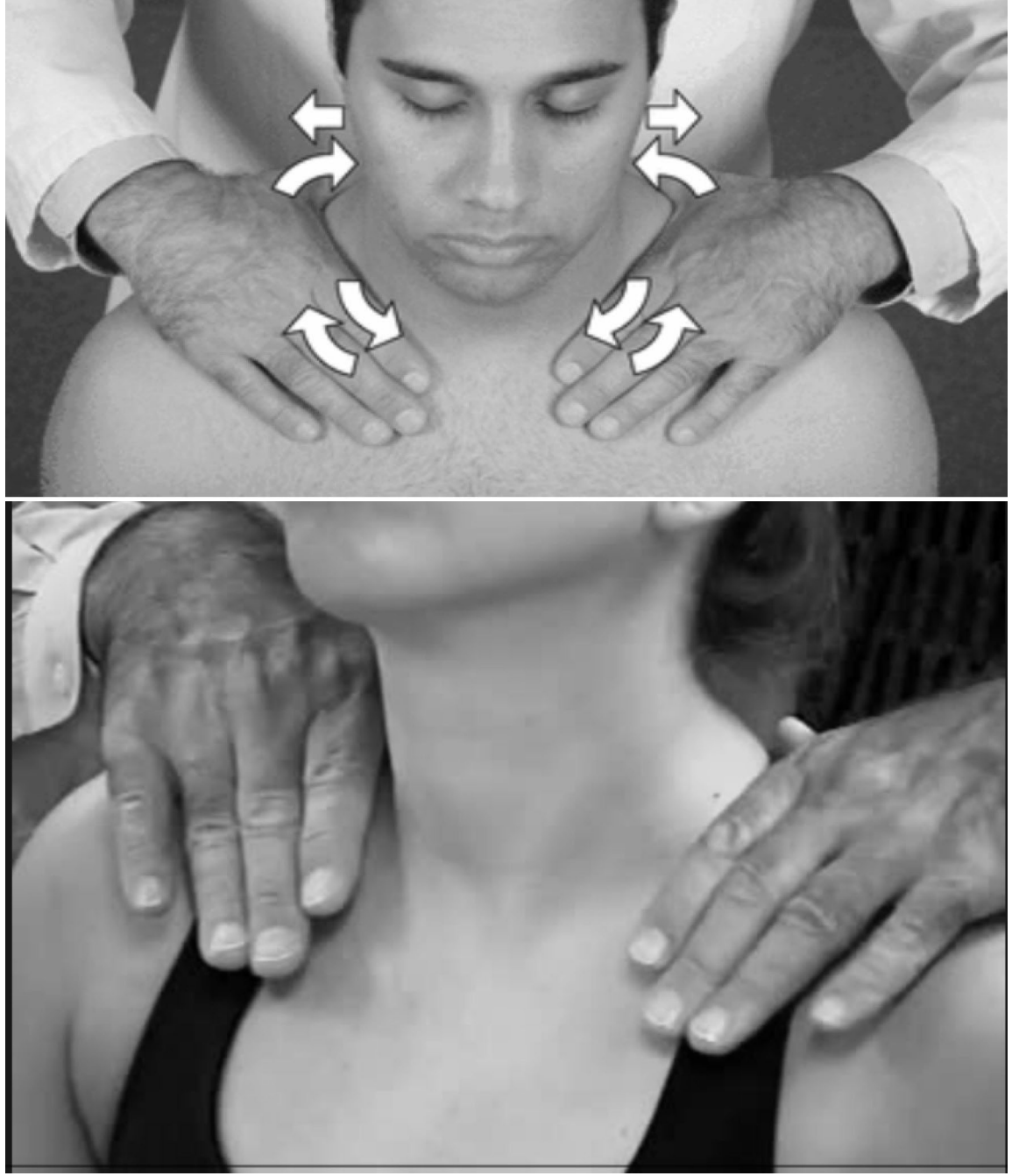
Thoracic Inlet MFR

Promote lymphatic drainage through release of fascial restrictions

Patient position: Seated or supine

Hand Position: 2nd and 3rd digits joint below SC joint and rest hands so thumbs are over trapezius region

Technique: “Steering wheel” direct or indirect toward to restriction.



Nicholas, A. S., & Nicholas, E. A. (2008). Atlas of osteopathic techniques. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

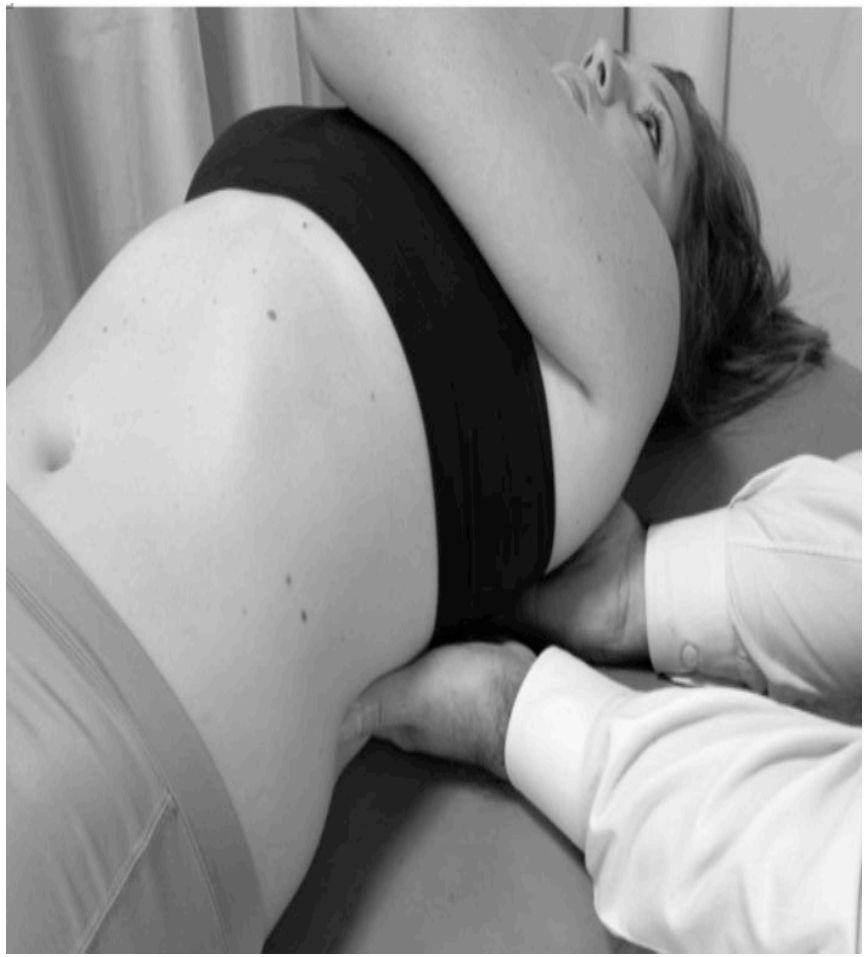
Rib Raising

Decrease sympathetic facilitation of muscle tension and increase ROM

Patient position: Supine or seated

Hand position (supine): contact rib angles with finger pads on side of restriction.

Technique: Apply anterolateral traction to the respective rib angles to engage costal joints in repetitive rhythmic fashion until restriction of motion is freed



https://www.researchgate.net/figure/Rib-raising-technique-method-2_fig13_6218053

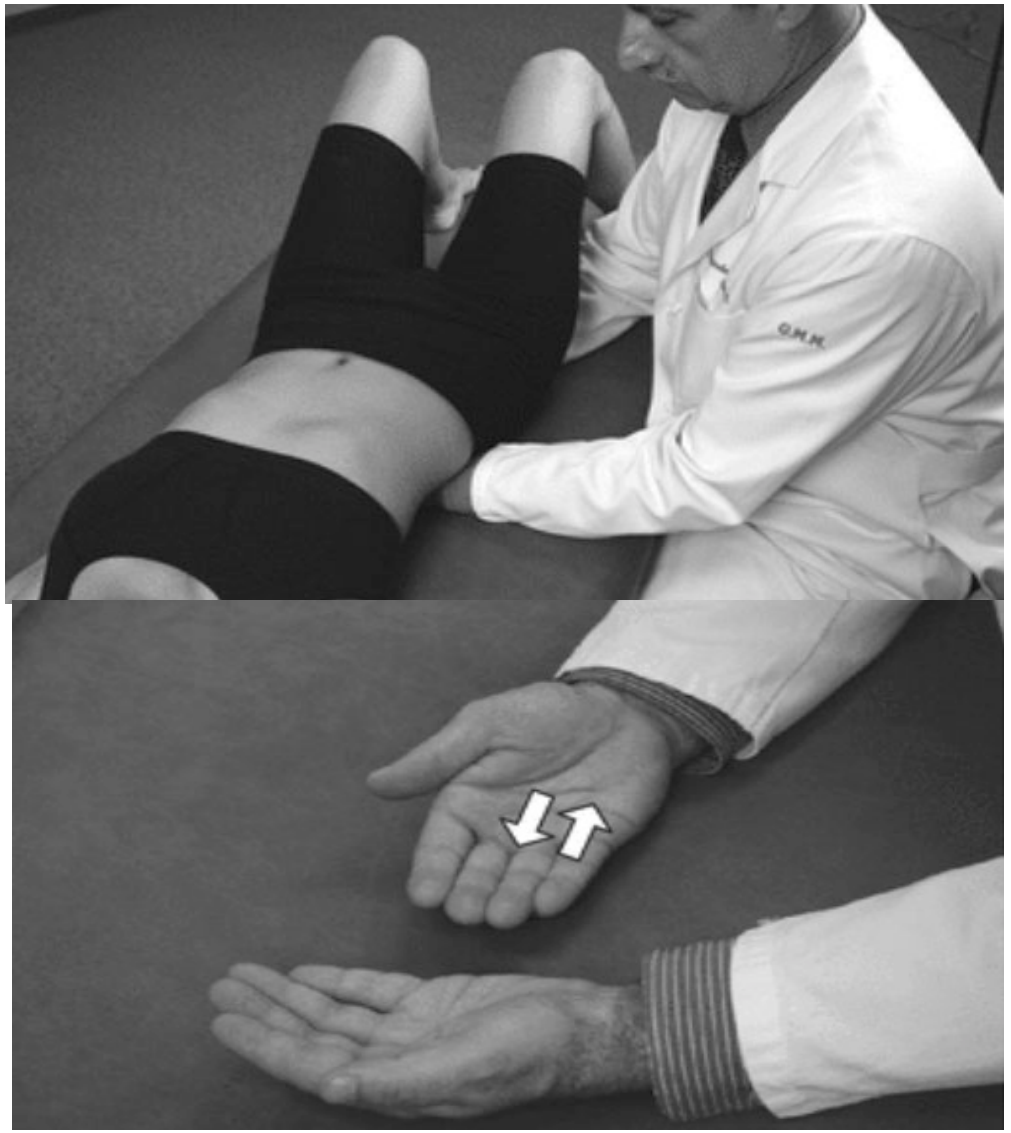
Sacral Rocking

Improve sacral mobility and decrease dural tension

Patient position: Supine

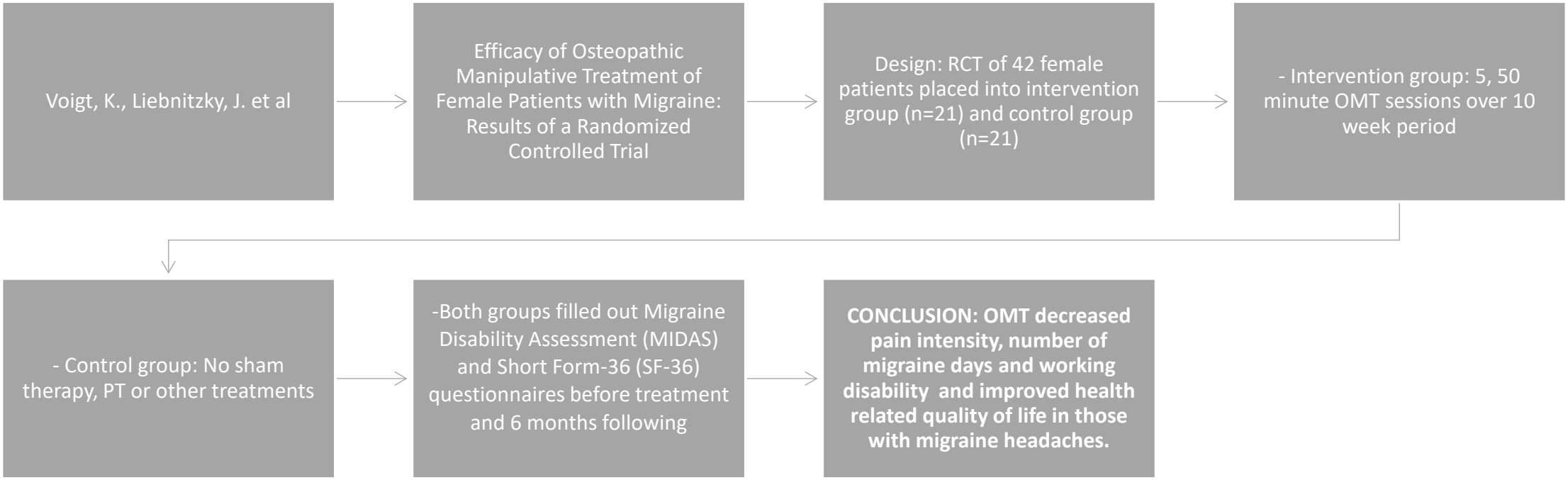
Hand position: Cephalad hand at lumbosacral junction and caudad hand under body of sacrum

Technique: Apply gentle caudad traction with caudad hand and follow sacral motion exaggerating flexion and extension until sacrum moves freely



Nicholas, A. S., & Nicholas, E. A. (2008). Atlas of osteopathic techniques. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Evidence in Brief



Evidence in Brief

Liddle SD, Pennick V.

Interventions for preventing and treating low-back and pelvic pain during pregnancy. Cochrane Database of Systematic Reviews 2015, Issue 9.

- Randomized controlled trials (RCTs) of any treatment, or combination of treatments, to prevent or reduce the incidence or severity of low-back pain, pelvic pain or both, related functional disability, sick leave and adverse effects during pregnancy
- 15 RCTs examined women with low-back pain (participants = 1847); 6 examined pelvic pain (participants = 889); and 13 examined women with both low-back and pelvic pain (participants = 2385)

CONCLUSION:

Evidence from single studies suggests that acupuncture or craniosacral treatment improves pregnancy-related pelvic pain, and osteopathic manipulative treatment or a multimodal intervention intervention (manual therapy, exercise and education) may also be of benefit

Evidence in Brief

J. Licciardone, S. Buchanan, K. Hensel, H. King, K. Fulda, S. Stoll

Osteopathic manipulative treatment of back pain and related symptoms during pregnancy: a randomized controlled trial American Journal of Obstetrics and Gynecology, 202 (2010), pp. 43.e1-43.e8

DESIGN

- 144 subjects, randomized, placebo-controlled trial
  - Usual obstetric care **only**
  - Usual obstetric care **and osteopathic manipulative treatment**
  - Usual obstetric care **and sham ultrasound treatment**

Evidence in Brief

J. Licciardone, S. Buchanan, K. Hensel, H. King, K. Fulda, S. Stoll

Osteopathic manipulative treatment of back pain and related symptoms during pregnancy: a randomized controlled trial Am J Obstet Gynecol, 202 (2010), pp. 43.e1-43.e8

RESULTS

Usual **obstetric care and osteopathic manipulative treatment** group

- **Significantly less deterioration of back-specific functioning**
- (effect size, 0.72; 95% confidence interval, 0.31-1.14; p = .001 vs usual obstetric care only; and effect size, 0.35; 95% confidence interval, -0.06 to 0.76; p = .09 vs usual obstetric care and sham ultrasound treatment)

Usual obstetric care and sham ultrasound treatment group

- Back pain remained unchanged

Usual obstetric care only group,

- Back Pain Increased (no between-group difference achieved statistical significance)

CONCLUSION

Osteopathic manipulative treatment slows or halts the deterioration of back-specific functioning during the third trimester of pregnancy.

Evidence in Brief: PROMOTE Study

Hensel KL, Buchanan S, Brown SK, et al.

Pregnancy Research on Osteopathic Manipulation Optimizing Treatment Effects: the PROMOTE study Am J Obstet Gynecol 2015;212:108.e1-9.

DESIGN

- 400 women in their third trimester.
- Assigned randomly to
  - Usual care **only (UCO)** n=133
  - Usual care **plus OMT (OMT)** n=136
  - Usual care **plus placebo ultrasound treatment (PUT)** n=131
- 7 treatments over 9 weeks
- Outcomes Measures
  - Self-report measures for pain and back-related functioning and
  - Medical records for delivery outcomes.

Evidence in Brief: PROMOTE Study

Hensel KL, Buchanan S, Brown SK, et al.

Pregnancy Research on Osteopathic Manipulation Optimizing Treatment Effects: the PROMOTE study Am J Obstet Gynecol 2015;212:108.e1-9.

RESULTS

- OMT group similar to that of the PUT group:
    - Significant treatment effects for pain and back-related functioning ($P < .001$ for both groups),
    - Significantly improved compared with the UCO group.

CONCLUSION

OMT is a safe, effective adjunctive modality to improve pain and functioning during the third trimester.

Summary

Headaches are a common condition in pregnant women as well as the general population

Multiple factors, including anatomic and biomechanical, predispose women to headaches in pregnancy

A quick structural screen and OMT can be easily incorporated into an office visit to provide relief from headaches and other somatic dysfunction

Evidence supports that Osteopathic manipulative treatment can be safely and effectively used during pregnancy

Pregnant women can receive OMT treatment throughout their pregnancy to mitigate symptoms from structural changes and compensatory patterns

Let's Not Forget....

- Person is a unit of body, mind and spirit
- The body is capable of self-regulation, healing and maintenance
- Structure and function are reciprocally interrelated
- Rational treatment is based upon the understanding of the above

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Soshnick, S. Mezzone, C, Yao, S., Abu-Sbaih, R. Osteopathic Considerations in the Management of Migraine in Pregnancy. Osteopathic Family Physician. 2015 March/April; (7) 2:19-23.

THANK YOU!!

The Proposed
ILLINOISCOM
at The Chicago School

Cardiovascular Disease in Women: A Continuum of Care

Charu Gupta, MD

NorthShore University HealthSystem

Learning Objectives

- Review the burden of cardiovascular disease in women
- Review the impact of cardiovascular disease on maternal morbidity and mortality in the United States
- Understand the influence of pregnancy-related conditions on women's lifelong cardiovascular health

Facts about women and heart disease

American Heart Association/ goredforwomen.org

- **Cardiovascular disease kills more women than all forms of cancer combined**
- Only 44% of women recognize that cardiovascular disease is their greatest health threat
- Among females 20 years and older, nearly 45% are living with some form of cardiovascular disease and **less than 50% of women entering pregnancy in the United States have good heart health.**
- **Cardiovascular disease is the No. 1 killer of new moms and accounts for over one-third of maternal deaths.**
- Black women have some of the highest maternal mortality rates.
- **Overall, 10% to 20% of women will have a health issue during pregnancy, and high blood pressure, preeclampsia and gestational diabetes during pregnancy greatly increase a women's risk for developing cardiovascular disease later in life.**
- 51.9% of high blood pressure deaths, otherwise known as hypertension or the "silent killer," are in women, and out of all women, 57.6% of Black females have hypertension — more than any other race or ethnicity.
- Furthermore, only 38% of participants in clinical cardiovascular trials are women.

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WOMEN'S HEART DISEASE FACTS

Heart disease is the No. 1 killer of women.

Heart disease causes **1 in 3** women's deaths each year.

Yet, only **1 in 5** women believe heart disease is her greatest health threat.

9 in 10 women have one or more risk factors for developing heart disease.

80% of the deaths are preventable.

Circulation
Volume 147, Issue 8, 21 February 2023; Pages e93-e621

Case 1

- 38 yo G3P1 at 34+2 weeks with IVF pregnancy with SOB
- Obstetric History
  - 39 wk vaginal delivery
  - First trimester miscarriage
- PMHx
  - Morbid obesity (BMI ~45)
  - Borderline chronic HTN

Case 1

- Prenatal course:
  - Single elevated BP at 13 wks, on baby ASA for prevention of preeclampsia
  - Normal fetal growth ultrasounds
- Hospital course
  - Severe range BP (171/116), ↑protein:creatinine
  - Tachycardic and tachypneic, crackles on exam
  - Initiated induction of labor for severe preeclampsia
  - Vaginal delivery, baby boy

Case 1

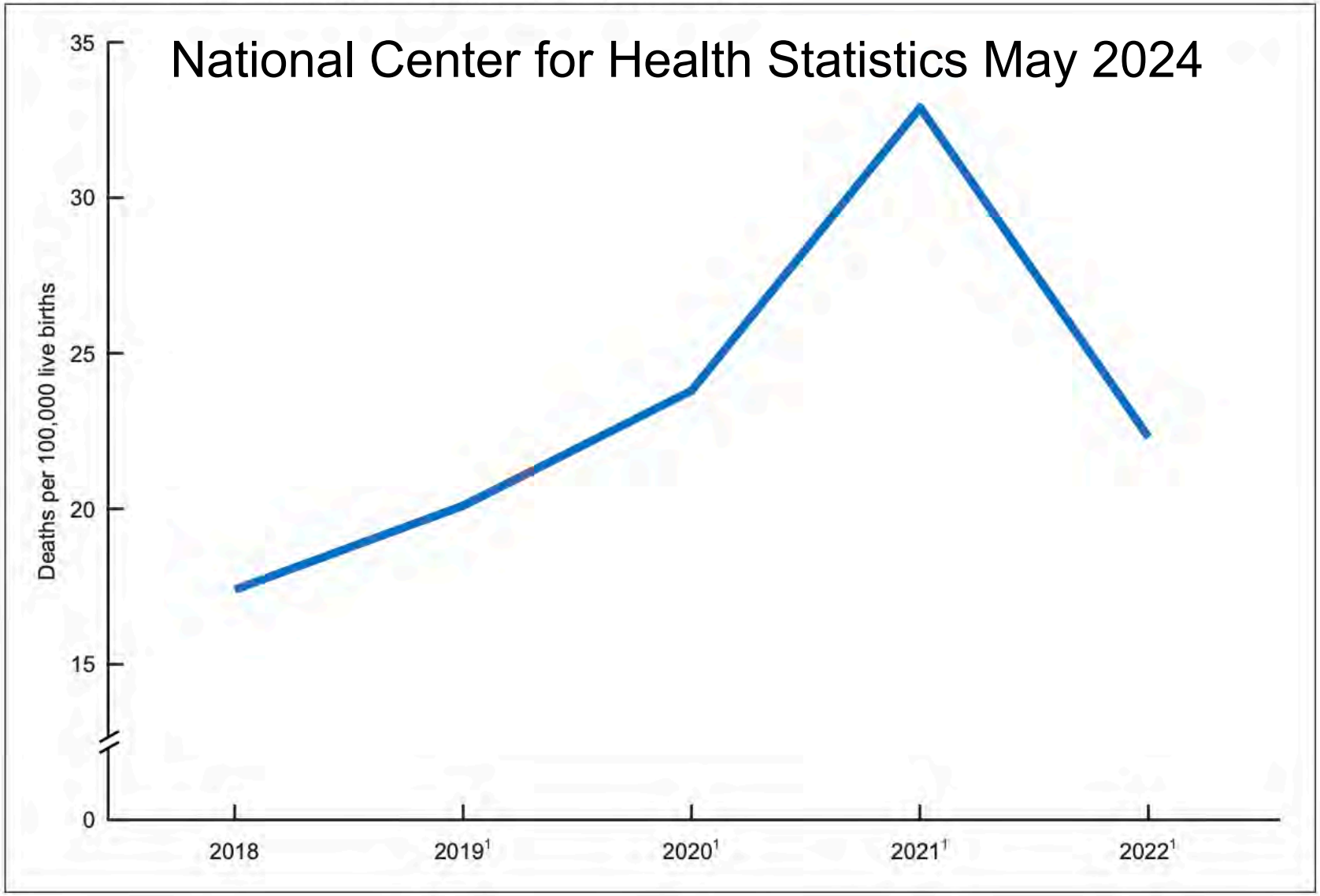
- Required IV Lasix, labetalol, and given verapamil. On PPD #0 echo showed 45-50% with elevated pro-BNP, troponin.
- Seen by general cardiology and started on IV Lasix and metoprolol 25 BID
- Worsening of tachycardia, worsening pulmonary edema, and echo with EF 25%
- Heart failure cardiology/ cardio-ob on call consulted and patient admitted to medical floor

Case 1

- CHF/ Cardio OB consult:
  - Transitioned from lasix to bumex, added spironolactone given history of PCOS, and entresto given reduced EF
  - No plan to breastfeed at this point, and no plan for additional pregnancies
- Returns to CHF clinic and now doing well, no exercise limitation, EF improved to 40 - 50%
- Started beta blocker after 1-2 months when euvolemic and compensated
- Diagnosed with genetic cardiomyopathy (TITIN myopathy), no ICD needed currently

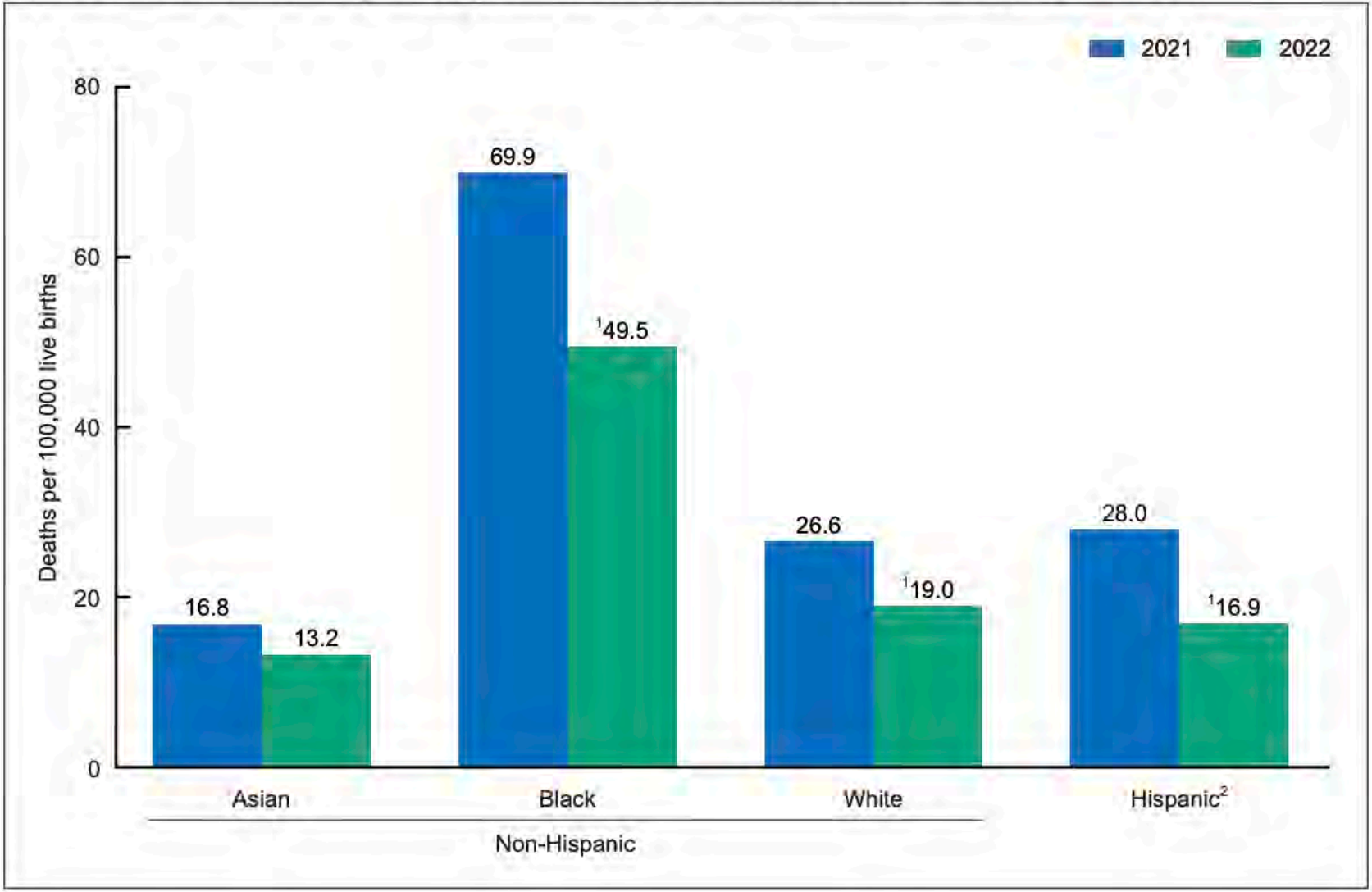
Circulation
Volume 147, Issue 8, 21 February 2023; Pages e93-e621

Figure 1. Maternal mortality rate: United States, 2018–2022



National Center for Health Statistics May 2024

Figure 2. Maternal mortality rate, by race and Hispanic origin: United States, 2021 and 2022



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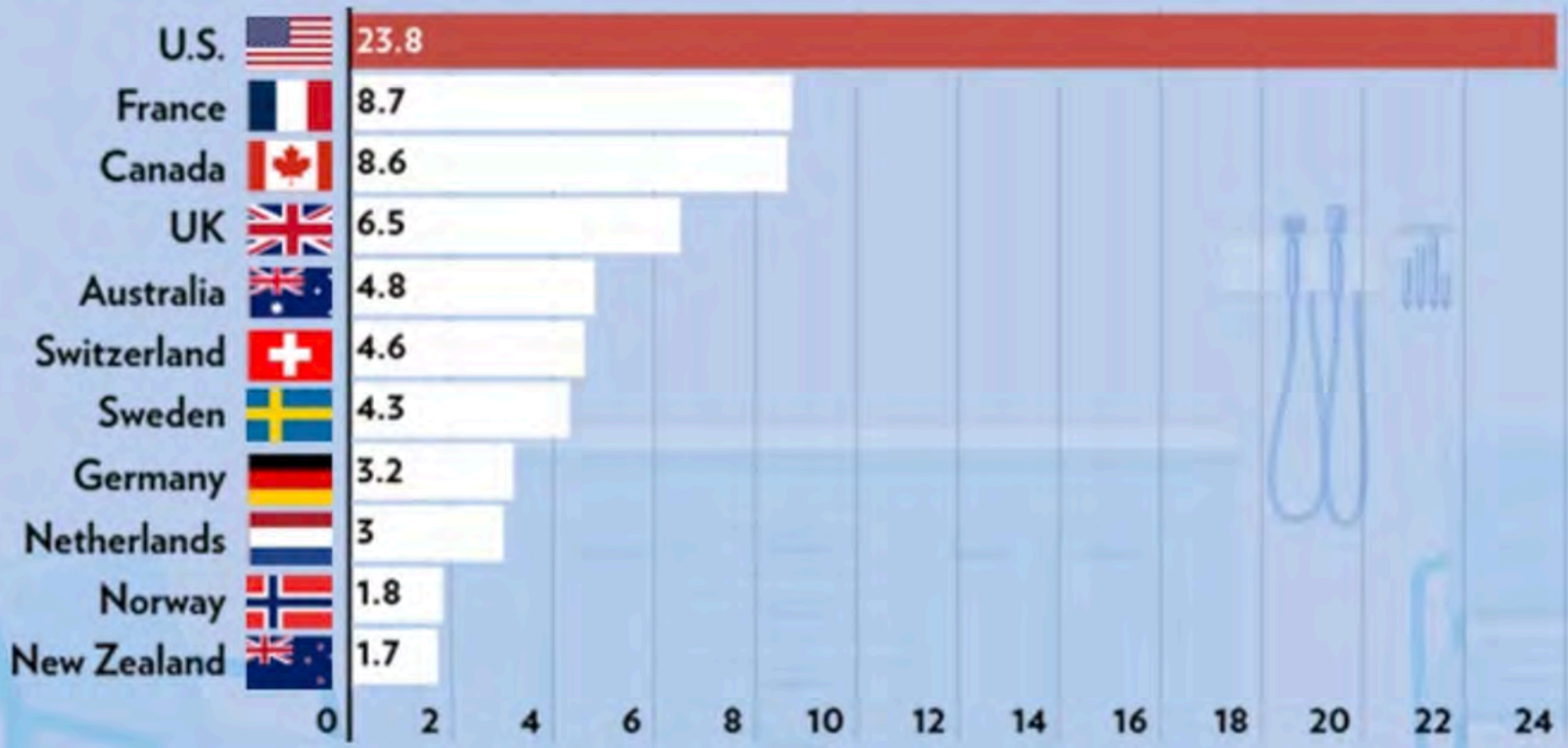
Maternal Mortality in the U.S. Far Outstrips That of Other Industrialized Nations



Source: https://www.cdc.gov/nchs/data/hestat/maternal-mortality/2020/maternal-mortality-rates-2020.htm

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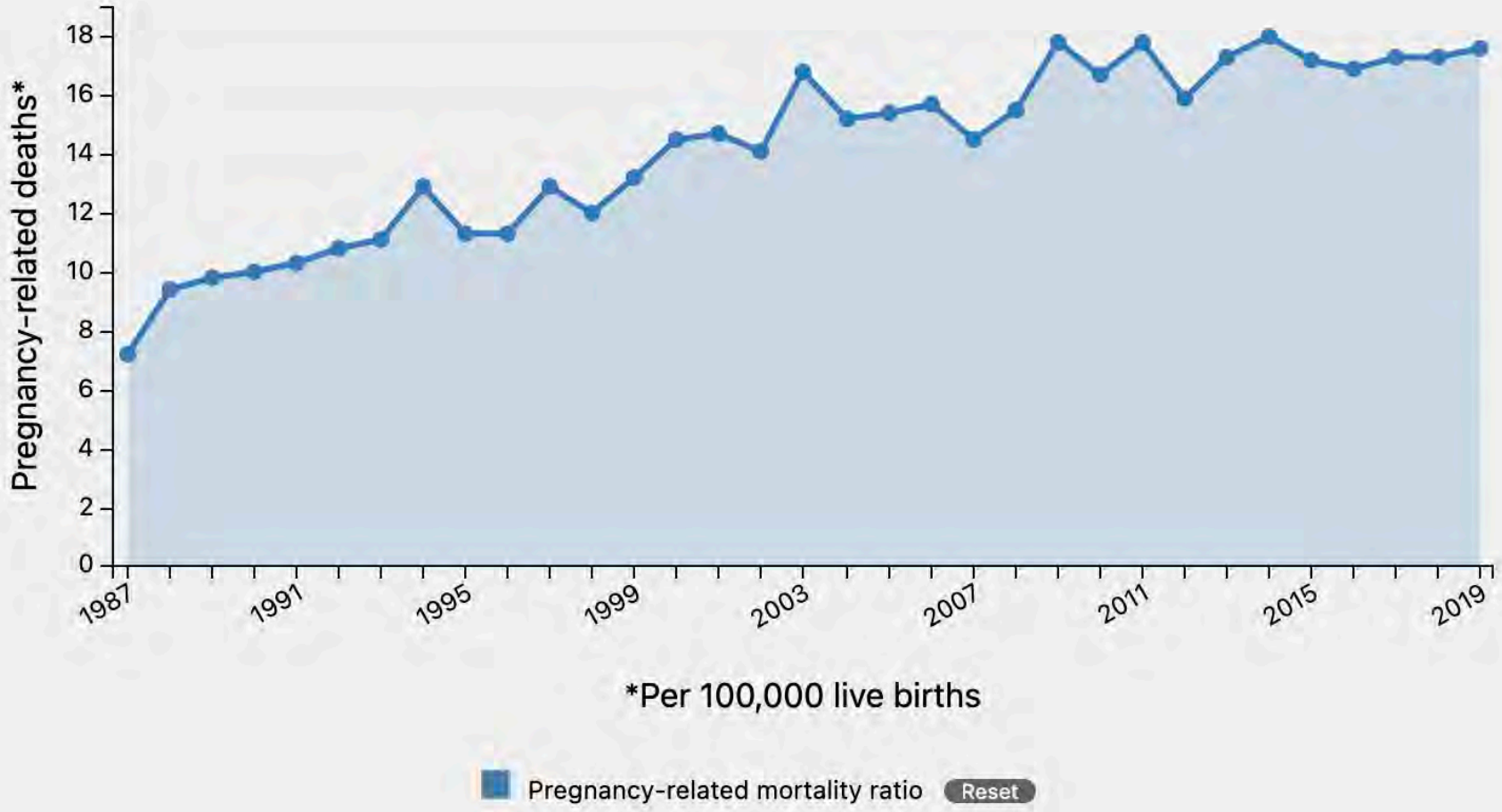
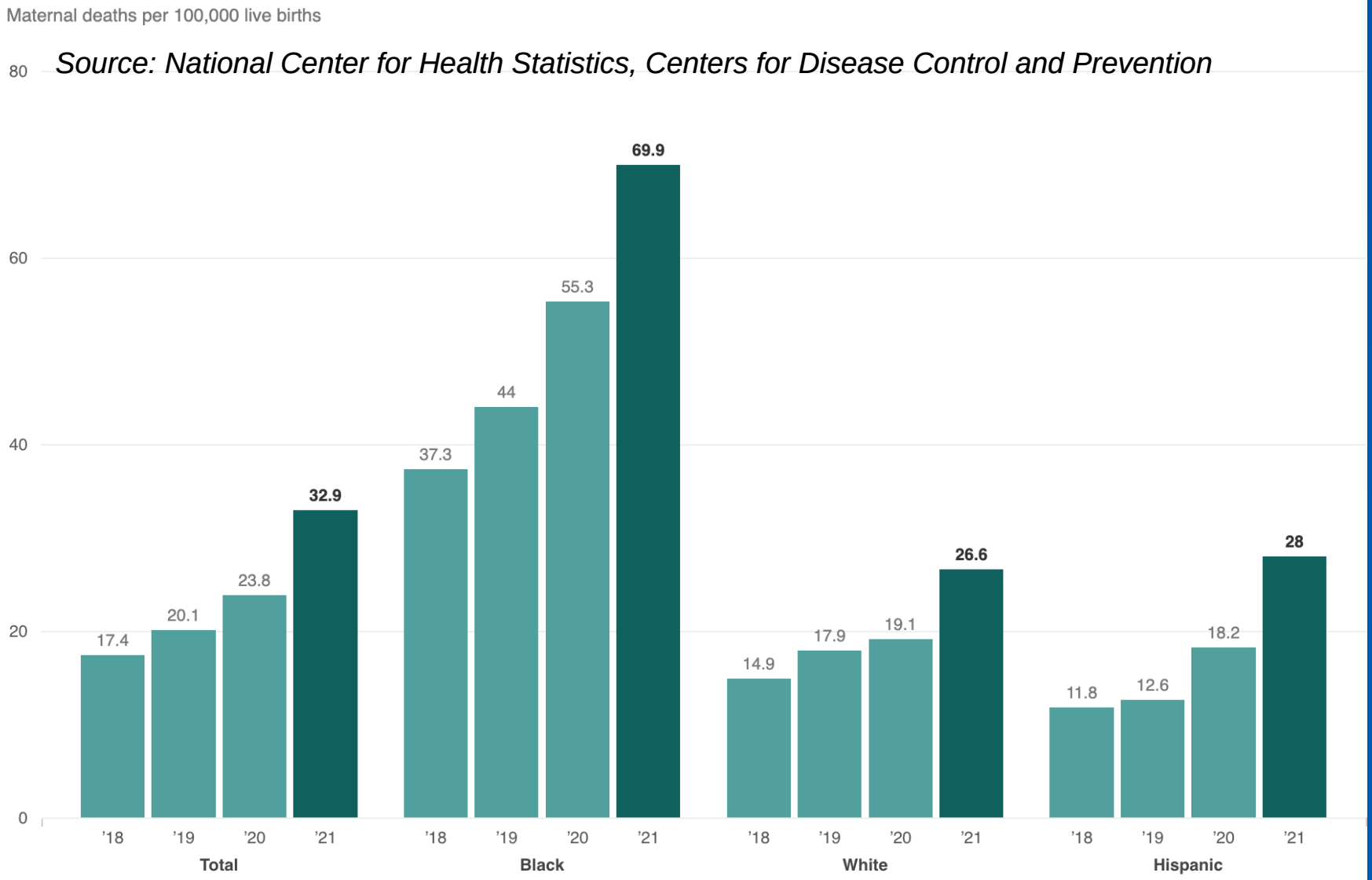
Trends in pregnancy-related mortality ratios in the United States: 1987-2019



U.S. maternal mortality rates rise between 2018 and 2021



Source: National Center for Health Statistics, Centers for Disease Control and Prevention

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State of Illinois
Illinois Department of Public Health

Maternal Mortality in Illinois

What is Maternal Mortality?

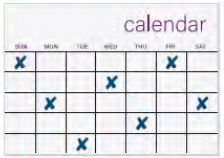
- ***Pregnancy-Associated Death*** -- Death of a woman while pregnant or within one year of pregnancy from any cause.
- ***Pregnancy-Related Death*** -- Death of a woman while pregnant or within one year of pregnancy from a cause related to pregnancy.

The Illinois Department of Public Health supports two Maternal Mortality Review Committees, which:

- Identify cause of death
- Determine if the death was pregnancy-related
- Determine if the death was preventable
- Develop recommendations to prevent deaths

An average of **75 women** die each year while pregnant or within one year of pregnancy.

That is **1 death every 5 days**



More than **4 out of 5** pregnancy-related deaths were preventable.

About **1 in 3** pregnancy-associated deaths were **pregnancy-related**.

Black women are most likely to die from pregnancy-related causes.

3X Black women are about **three times** as likely to die from a pregnancy-related condition as White women.

Mental health conditions, including substance use disorder, were the leading cause of pregnancy-related deaths.

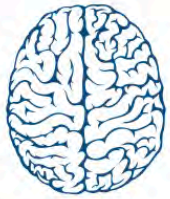
Black women were more likely to die from pregnancy-related **medical** conditions.

Timing among pregnancy-related deaths

1 in 3 women died **while pregnant**

1 in 3 women died during the **first 2 months postpartum**

1 in 3 women died **2 or more months postpartum**

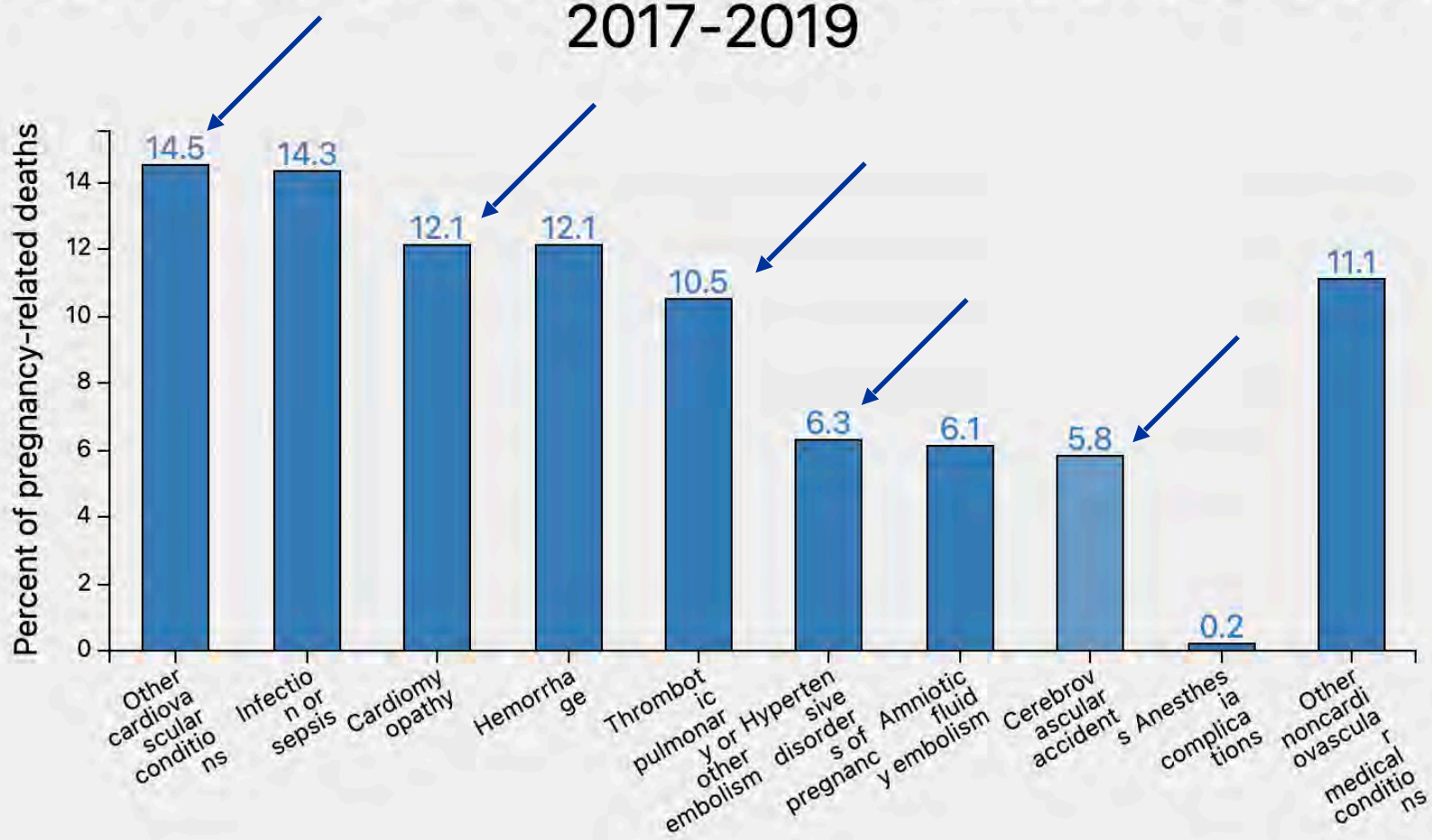


White women were more likely to die from pregnancy-related **mental health** conditions.

IDPH
Illinois Department of Public Health

NorthShore University HealthSystem

Causes of pregnancy-related death in the United States: 2017-2019



CDC Pregnancy Mortality Surveillance System

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Illinois DPH Maternal Morbidity and Mortality Report

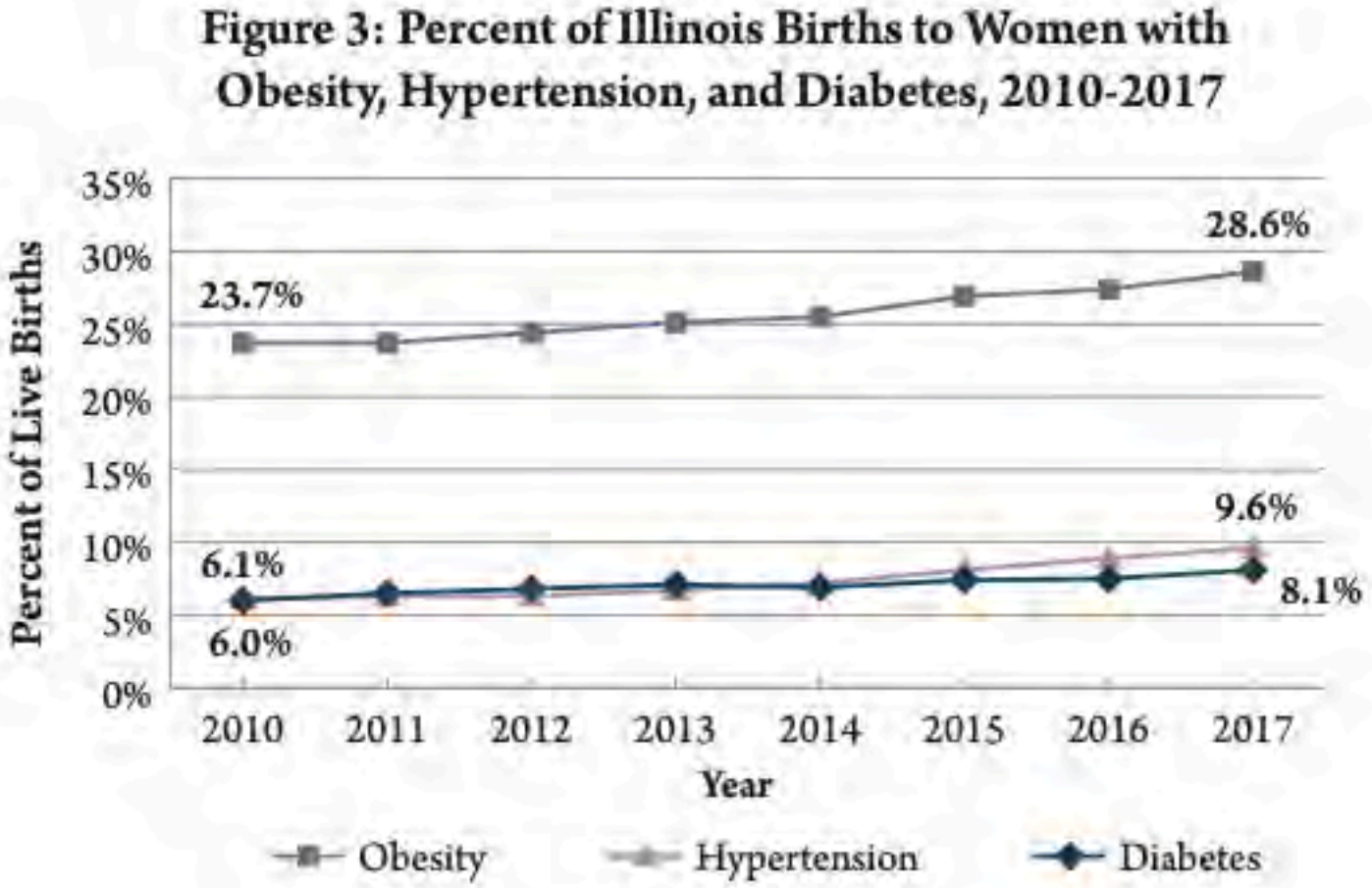

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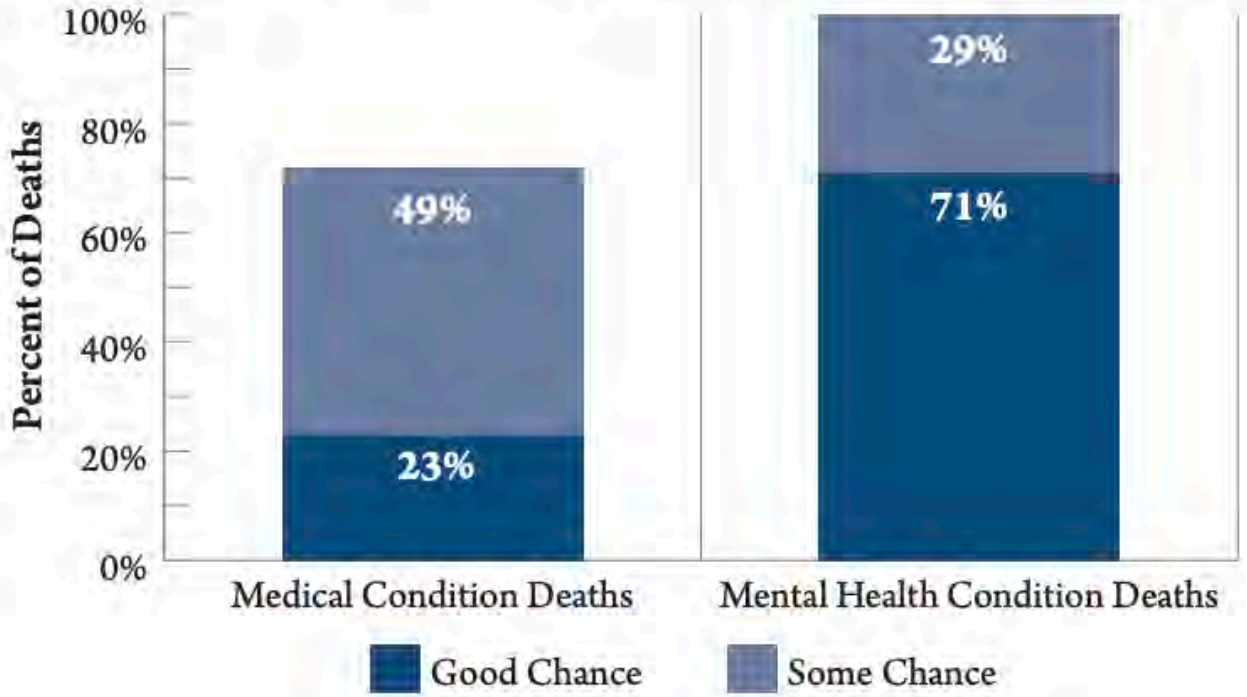
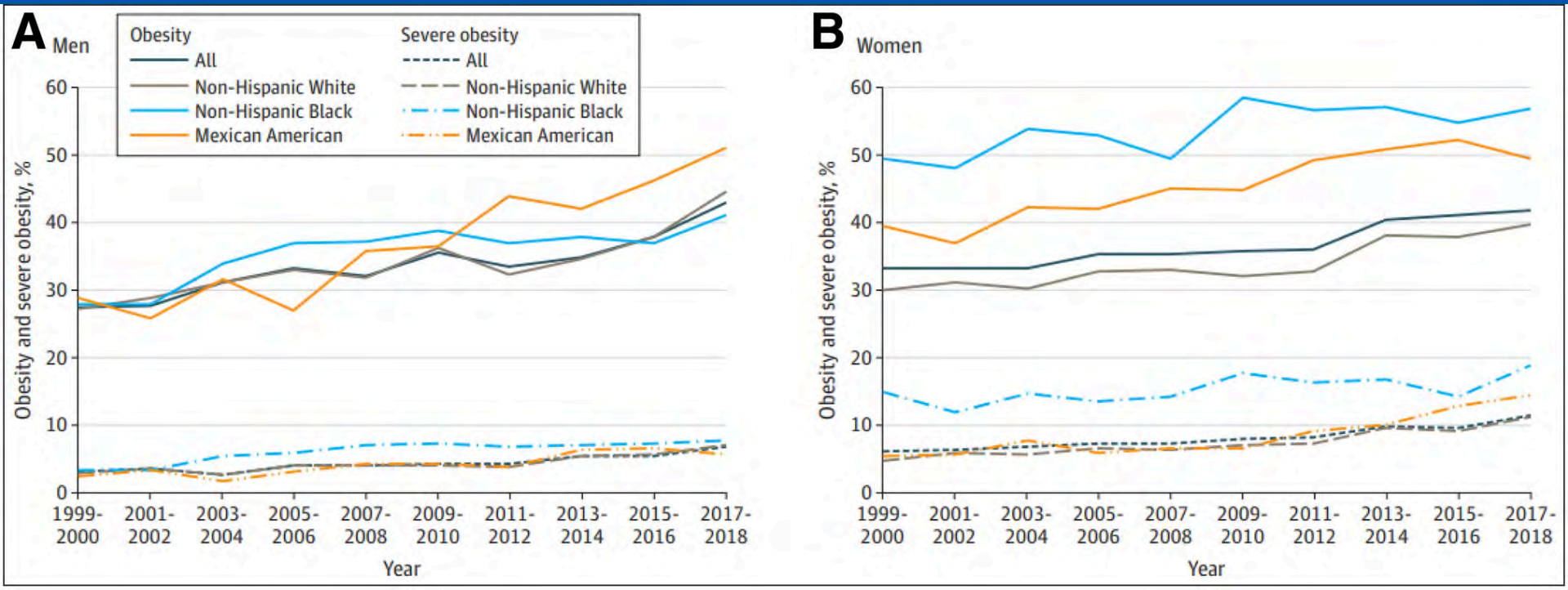
Figure 22. Percent of Pregnancy-Related Deaths That Were Preventable, By Underlying Cause of Death, Illinois 2016-2017



Illinois Maternal Morbidity and Mortality Report, 2016-2017, Illinois Department of Public Health. (April 2021).

Heart Disease and Stroke Statistics: 2023 Update



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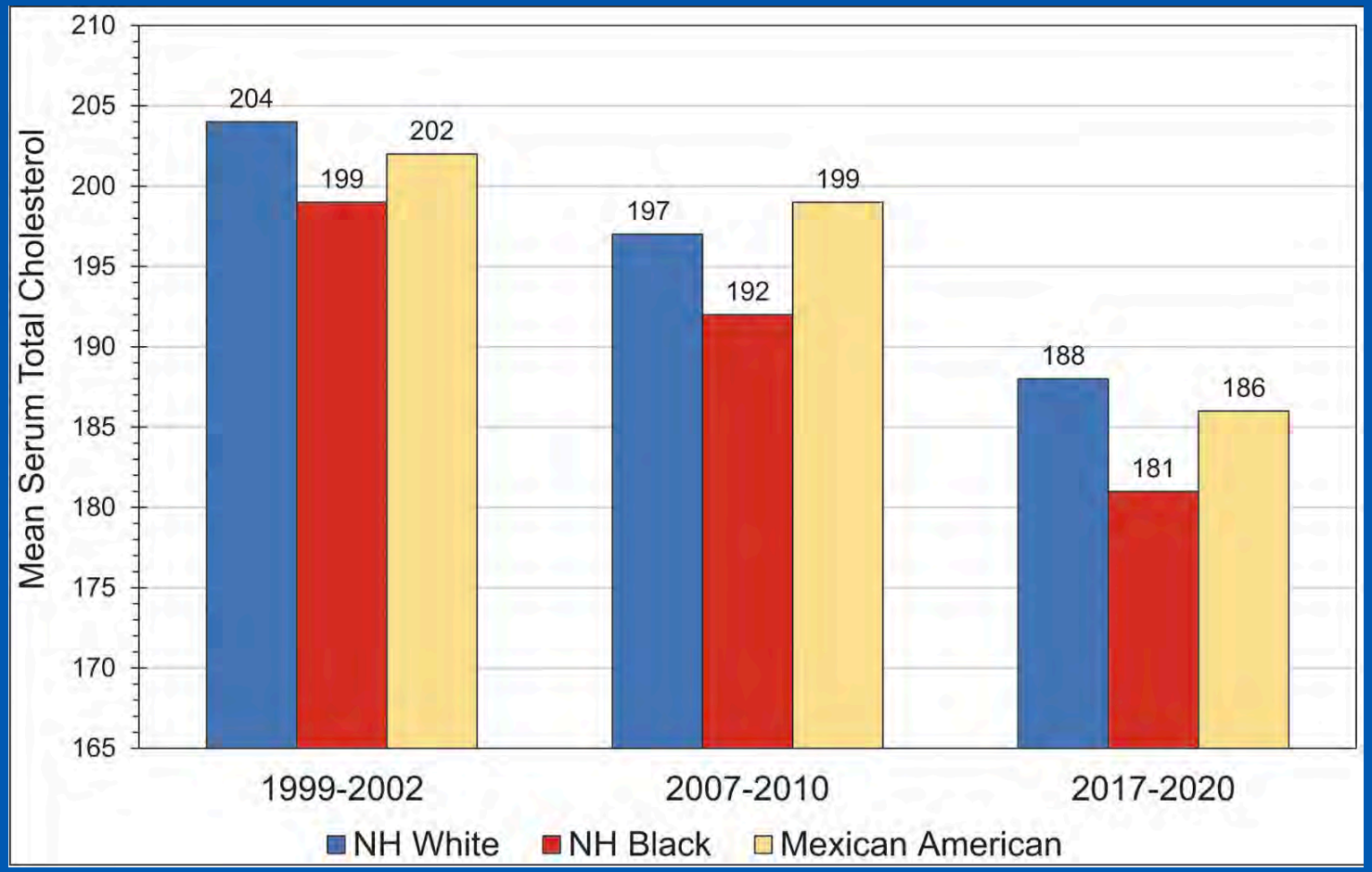
Total Serum Cholesterol



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Preeclampsia.org

5% to 8%

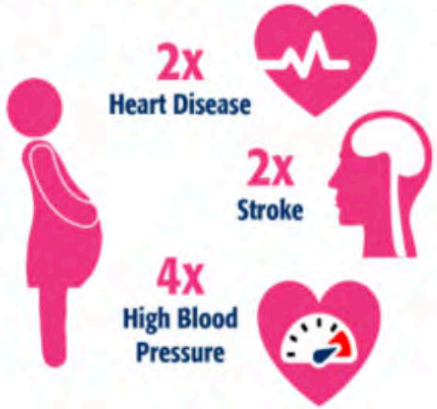
One in Every 12 Pregnancies

Preeclampsia (including eclampsia and HELLP syndrome) impacts 5% to 8% of all pregnancies

2x to 4x

Know Your High Risks

Preeclampsia doubles your risk of heart disease and stroke, and quadruples your risk of high blood pressure later in life



2 out of 3

women who experience preeclampsia will die from cardiovascular disease

At higher risk...

If you have had preeclampsia and:

- ✓ delivered pre-term
- ✓ had low-birth weight babies
- ✓ suffered from severe preeclampsia more than once

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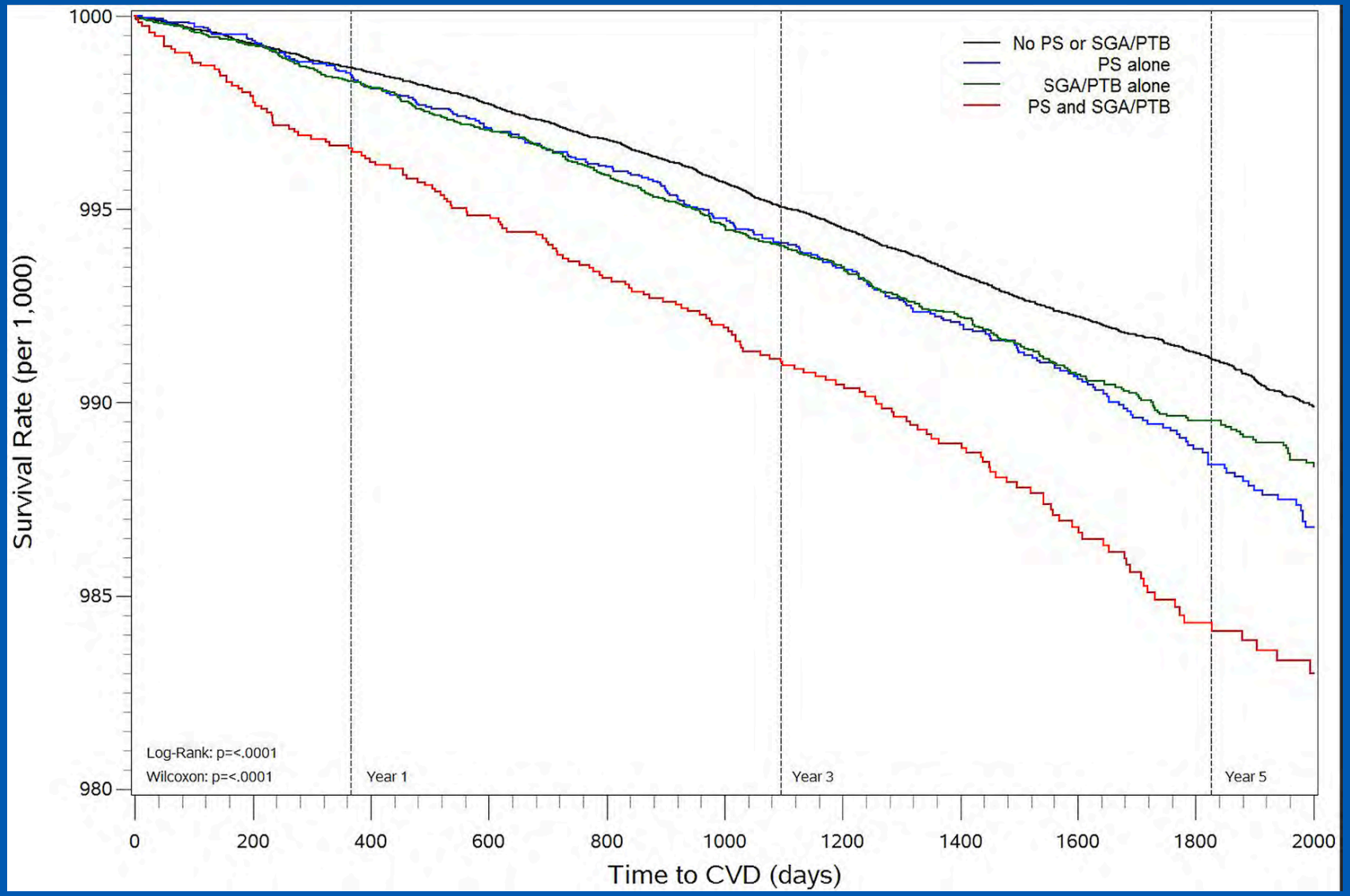

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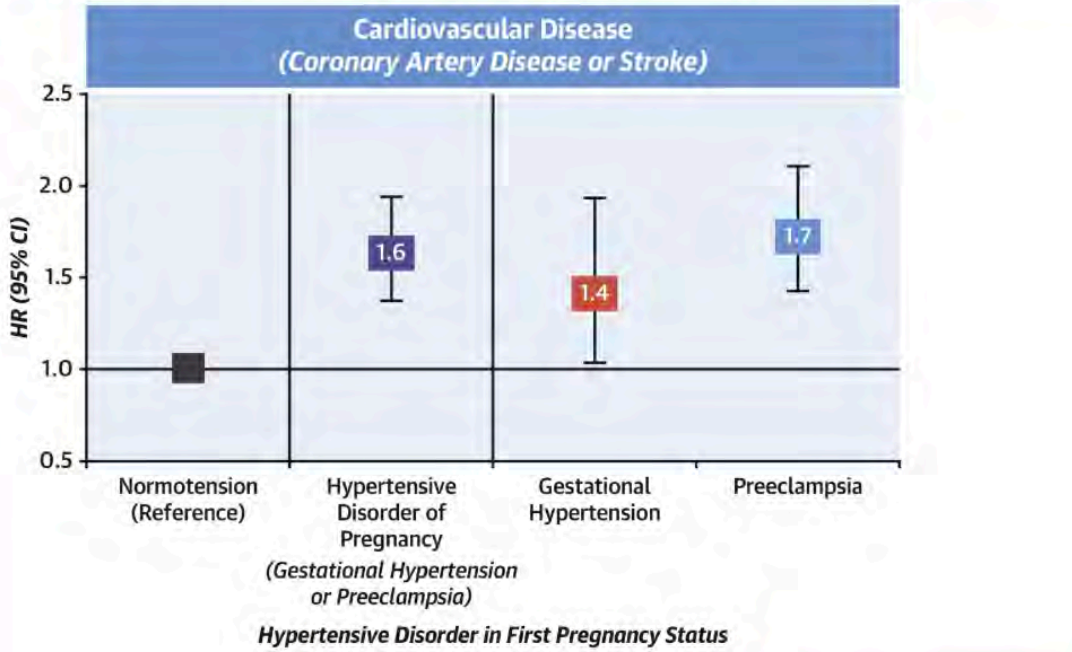
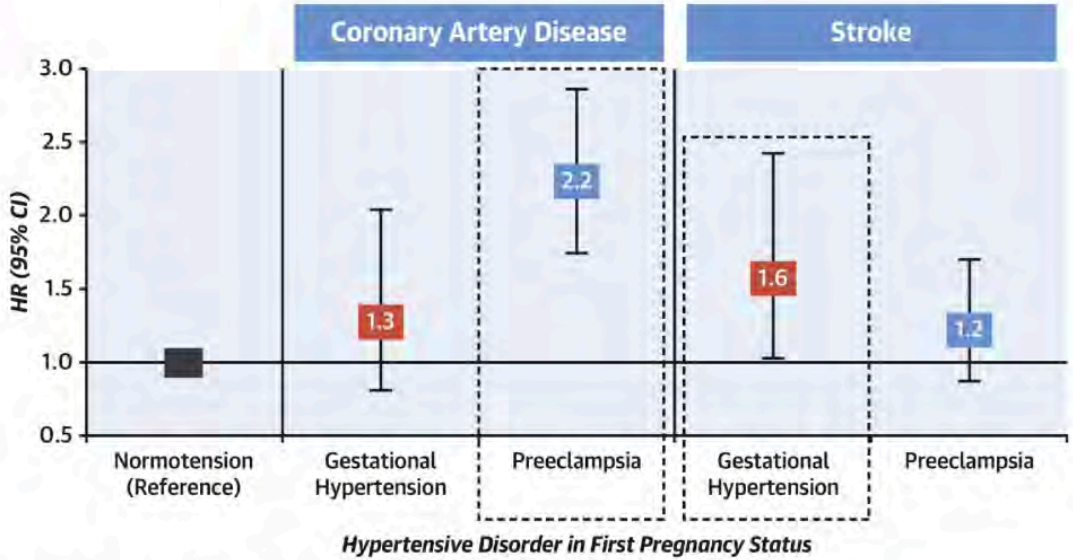
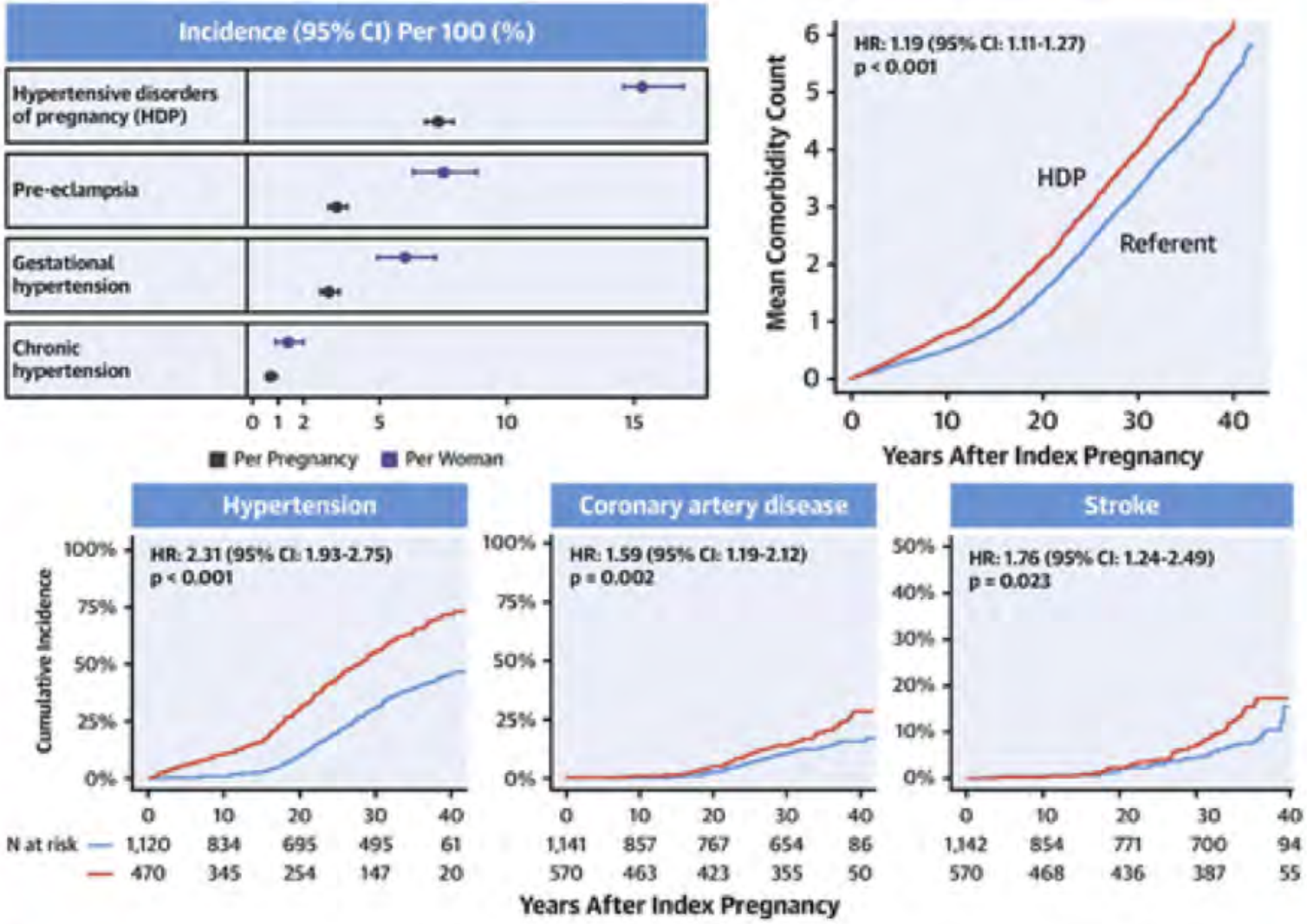
CENTRAL ILLUSTRATION: Differential Associations by Hypertensive Disorder of Pregnancy and Cardiovascular Disease Subtypes





Stuart JJ, et al. J Am Coll Cardiol. 2022;79(19):1901-1913.

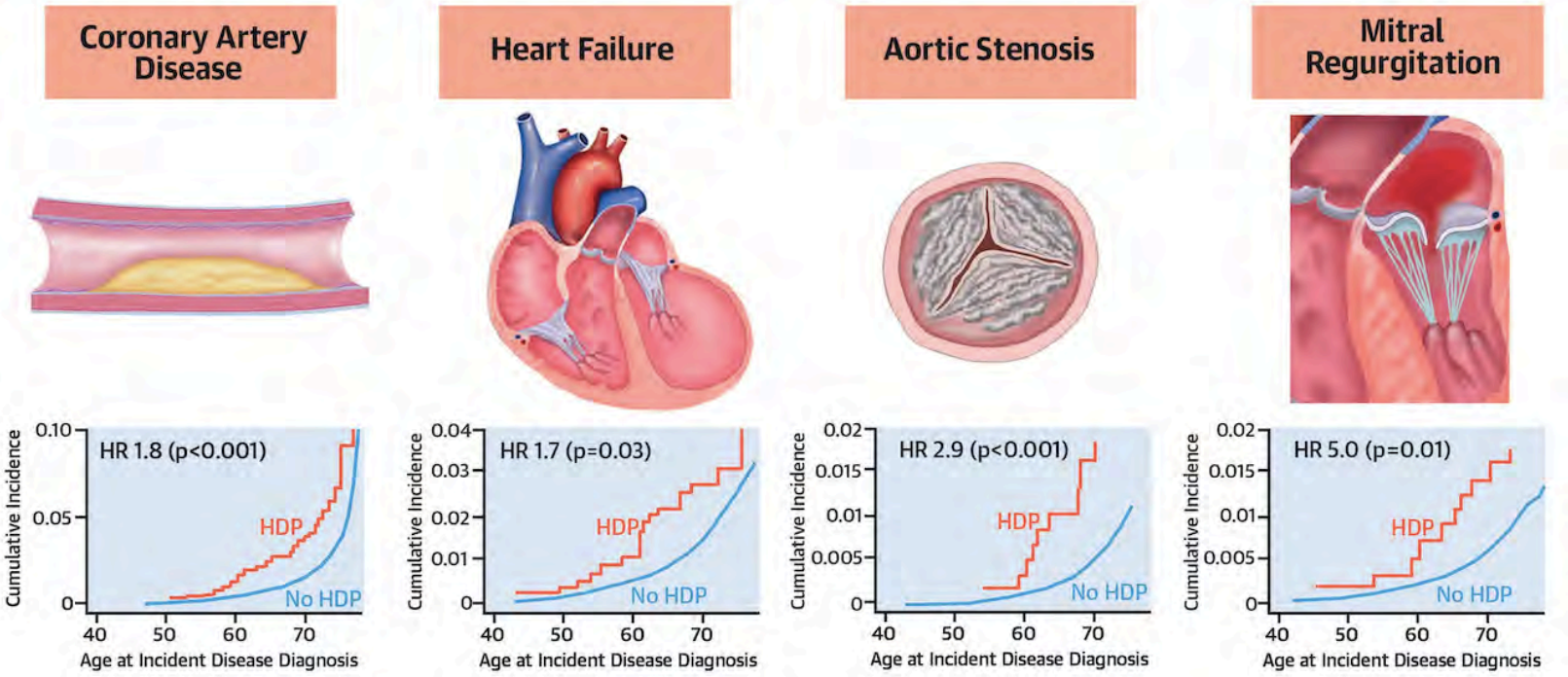
CENTRAL ILLUSTRATION: Hypertension in Pregnancy: Incidence Per-Pregnancy and Per-Woman, Outcomes and Multimorbidity Later in Life



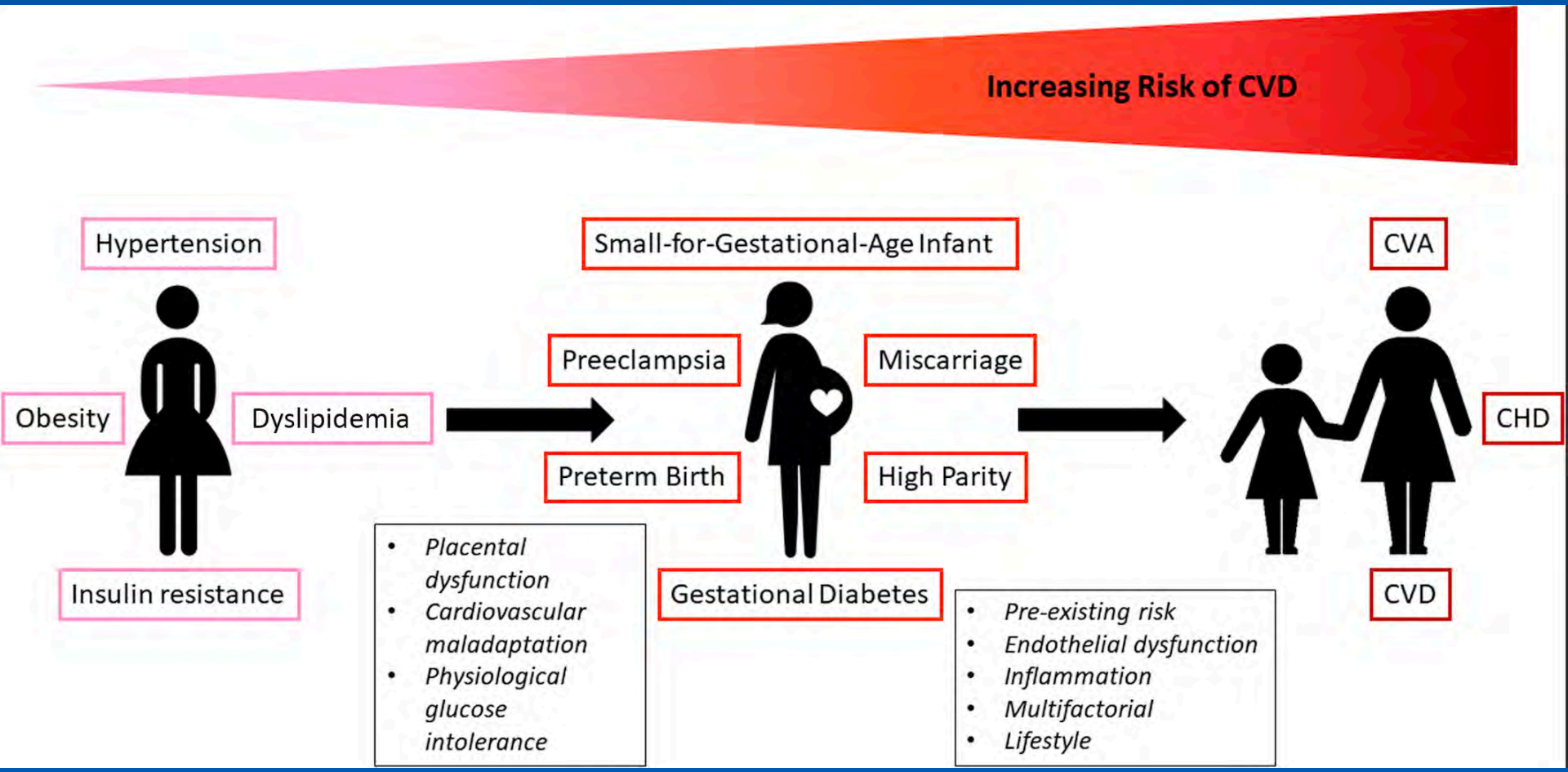
Garovic, V.D. et al. J Am Coll Cardiol. 2020;75(18):2323-34.

Consequences

CENTRAL ILLUSTRATION: Hypertensive Disorders of Pregnancy Are Associated With Long-Term Risk of Diverse Cardiovascular Diseases



Honigberg, M.C. et al. J Am Coll Cardiol. 2019;74(22):2743-54.



Ki Park et al. J Am Coll Cardiol Case Rep 2020; 2:161-163.

Identifying Risk in Pregnant Women

23-year-old G1P0
37 weeks gestation

- ☑ dyspnea
- ☑ HR 110 beats/min
- ☑ BMI 35 kg/m^2

45-year-old G4P3
20 weeks gestation

- ☑ diabetic
- ☑ hypertension
- ☑ chest pain
- ☑ BP 145/95 mm Hg

38-year-old G2P1
14 weeks gestation

- ☑ dyspnea
- ☑ palpitations
- ☑ HR 120 beats/min
- ☑ bibasilar crackles

1. If Abnormal exam consult MFM and Primary Care/Cardiology
2. If ≥ 1 symptom+ ≥ 1 abnormal vital signs + ≥ 1 risk factor OR any combination adding to ≥ 4 prompts further evaluation with ECG and BNP, echocardiogram +/- CXR if heart failure or valve disease suspected or if BNP elevated, Holter monitor if arrhythmia suspected, referral to cardiologist for ischemic testing if suspected or results abnormal

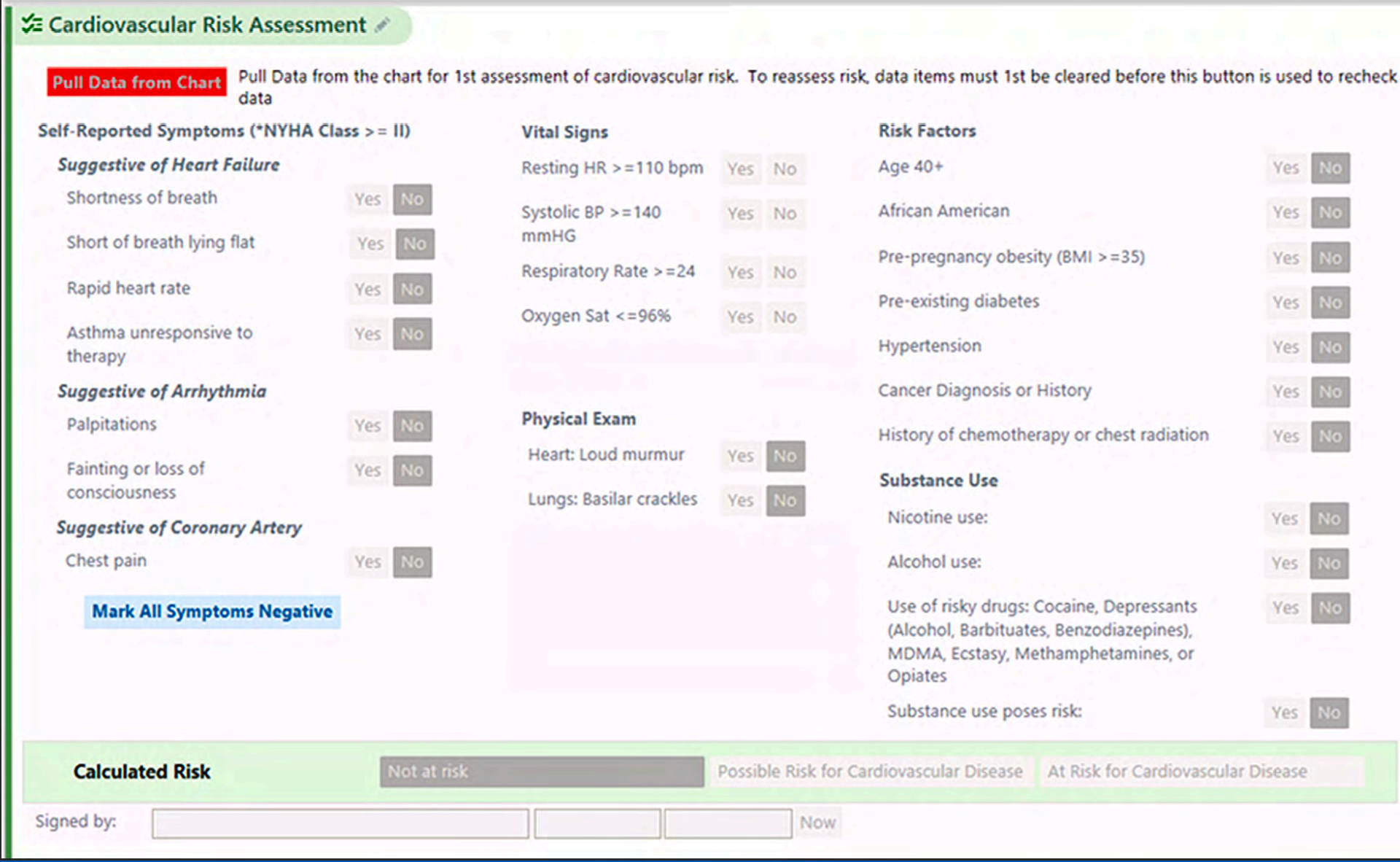
Positive Screen with workup revealing:

Elevated BNP > echo
LV EF 35%
New diagnosis PPCM

Abnormal ECG > cardiology consult
> Elevated hs TN > coronary angiogram
> PCI right coronary artery

ECG – sinus tachycardia > Echo moderate rheumatic mitral stenosis > Cardio-Obstetric team consult to manage pregnancy, labor and delivery with goal of optimizing maternal and fetal outcomes

Scott NS et al. Bridging the Gap in Maternal Card iovascular Risk: Identifying Patients at Elevated Risk*, JACC: Advances; Volume 2, Issue 1, 2023.



Hameed A, Tarsa M, Graves C, et al. Cardiovascular Risk Assessment as a Quality Measure in the Pregnancy and Postpartum Period. *JACC Adv.* 2023 Jan, 2 (1) .

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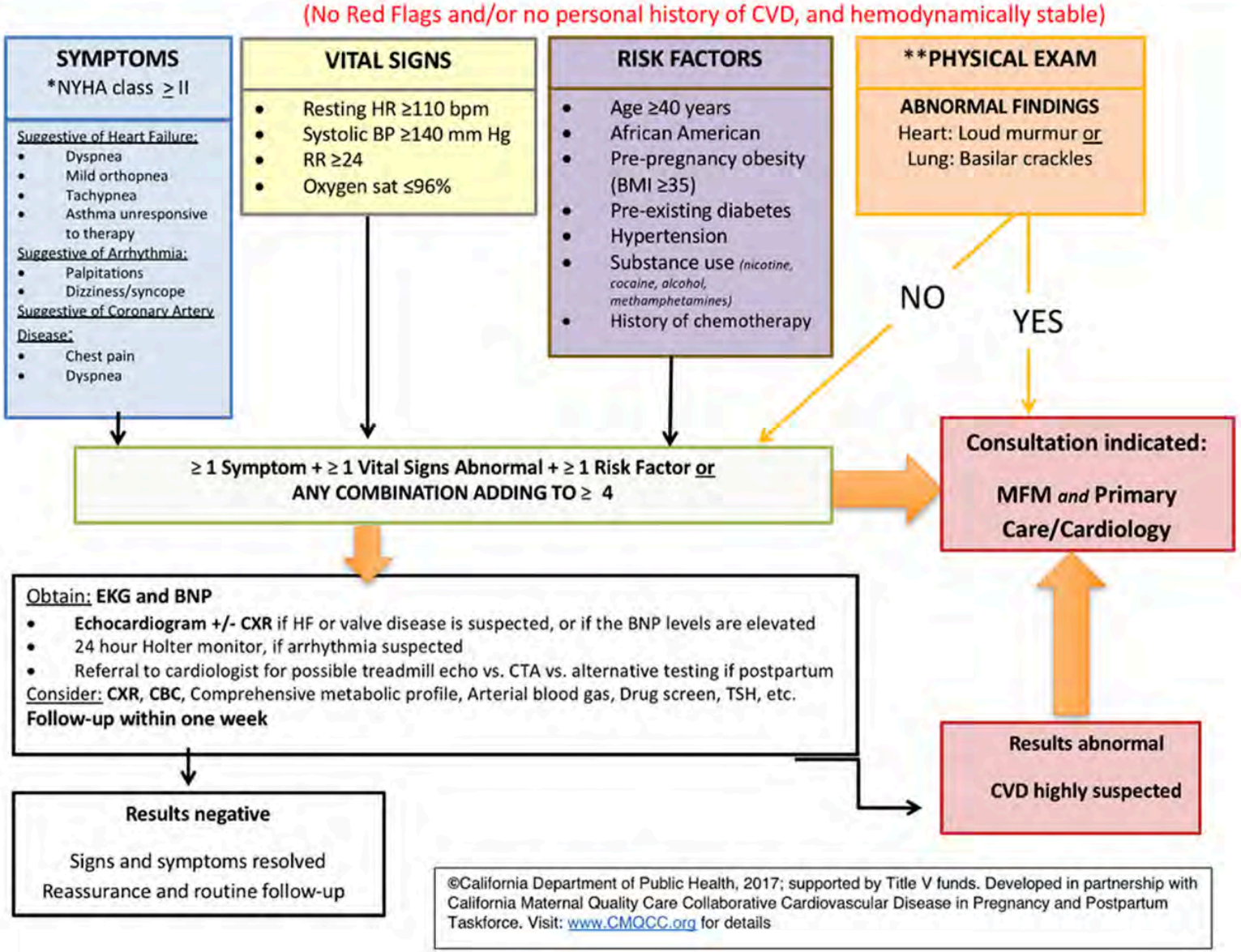
FIGURE 2 Cardiovascular Disease Algorithm Risk Assessment Toolkit



CENTRAL ILLUSTRATION: The Cardio-Obstetrics Model of Care

Preconception
- Contraception advice
- Optimize medical status
- Medication adjustment
- Risk assessment:
  - mWHO
  - CARPREG II
  - ZAHARA

Pregnancy
- Team-based care with patient
- Serial monitoring
- Delivery planning balancing maternal/ fetal risks

Labor/Delivery
- Mode: Vaginal delivery usually preferred
- Regional anesthesia
- Monitoring: consider pulse oximetry, telemetry if indicated

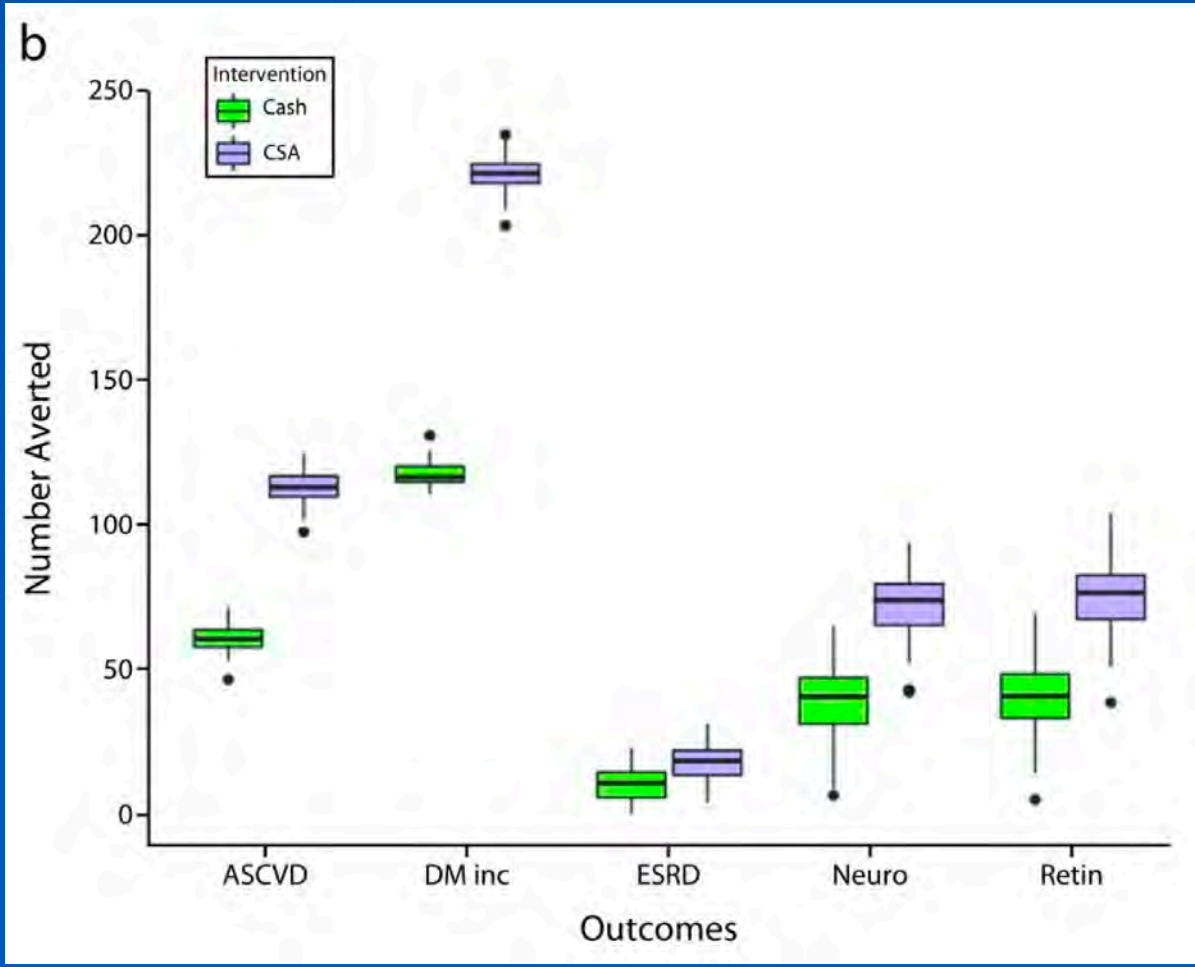
Postpartum
- Monitoring: minimum 48 hours
- Assess and treat cardiovascular complications
- Patient counseling on symptoms of complications

Fourth Trimester
- 3-7 days follow-up post-discharge
- Comprehensive evaluation within 6 weeks
- Consider addition of telehealth visits
- Contraception

Long-Term
- Identify women with APO (preeclampsia and hypertensive disorders, gestational diabetes, preterm delivery, small for gestational age)
- CVD risk screening

Davis, M.B. et al. J Am Coll Cardiol. 2021;77(14):1763-77.

Cash v. CSA : Lifetime Benefits



Basu S, O'Neill J, Sayer E, Petrie M, Bellin R, Berkowitz SA. Population Health Impact and Cost-Effectiveness of Community-Supported Agriculture Among Low-Income US Adults: A Microsimulation Analysis. Am J Public Health. 2020 Jan;110(1):119-126.

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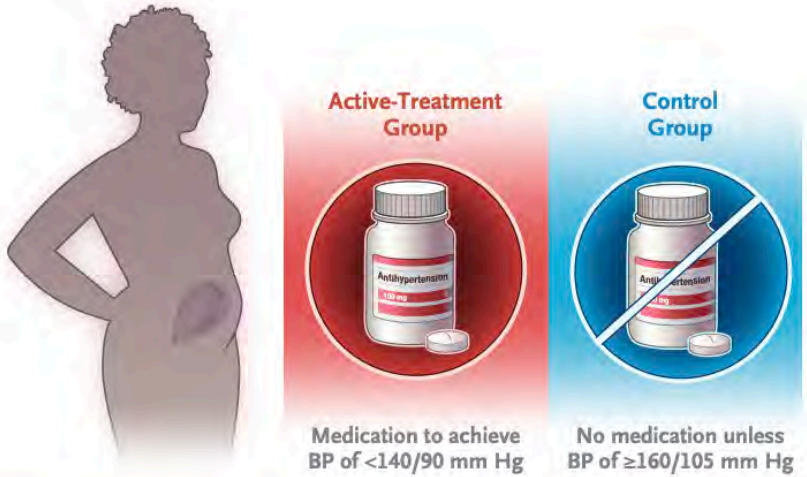

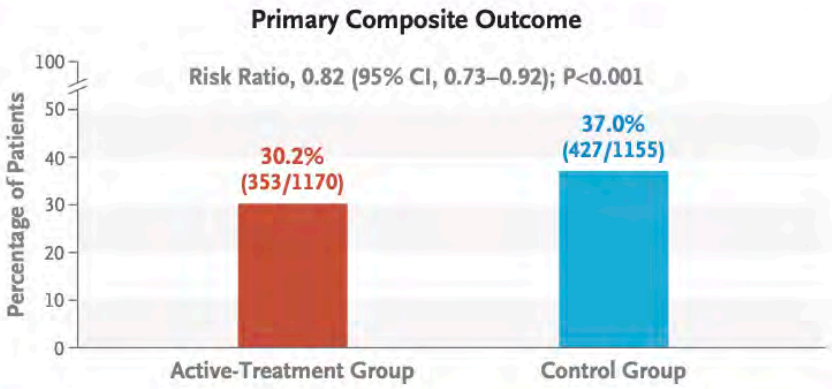

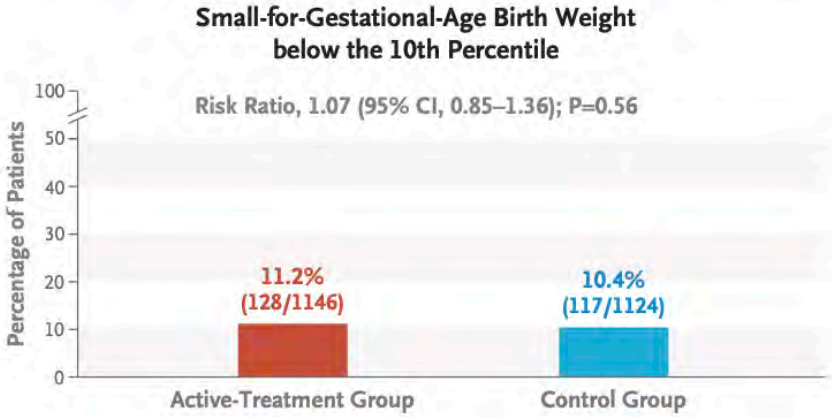

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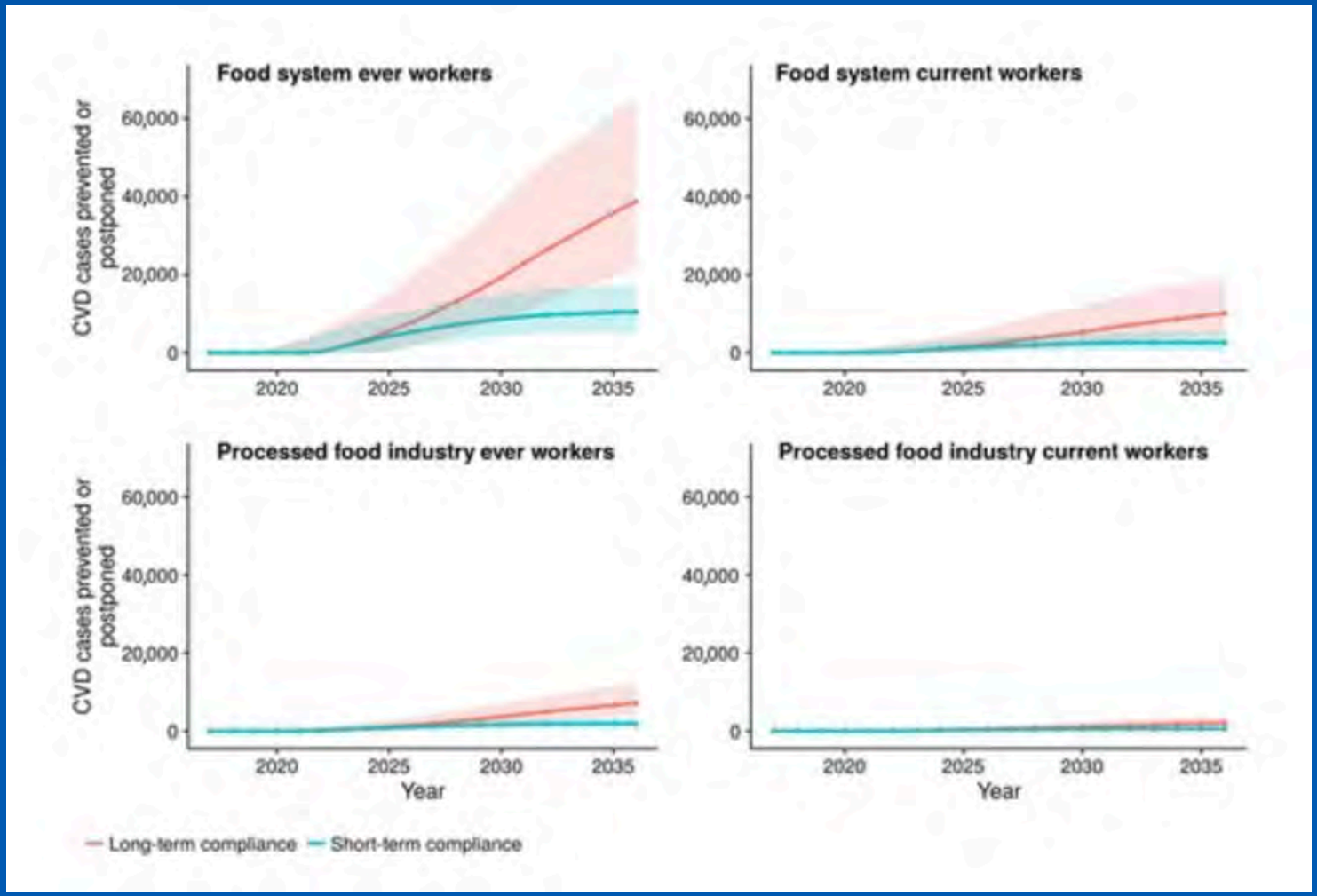
Sodium Reduction- Potential benefits



Milbank Q. 2019 Sep; 97(3): 858–880.

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Physical Activity

'Moderate' to 'high'-quality evidence from randomised controlled trials revealed that exercise-only interventions, but not exercise+cointerventions, reduced odds of GDM (n=6934; OR 0.62, 95% CI 0.52 to 0.75), GH (n=5316; OR 0.61, 95% CI 0.43 to 0.85) and PE (n=3322; OR 0.59, 95% CI 0.37 to 0.9) compared with no exercise. To achieve at least a 25% reduction in the odds of developing GDM, PE and GH, pregnant women need to accumulate at least 600 MET-min/week of moderate-intensity exercise (eg, 140 min of brisk walking, water aerobics, stationary cycling or resistance training).

Davenport, Margie H et al. “Prenatal exercise for the prevention of gestational diabetes mellitus and hypertensive disorders of pregnancy: a systematic review and meta-analysis.” British journal of sports medicine vol. 52,21 (2018): 1367-1375.

Environment

In a subsample of 528 females and males 45 to 84 years of age who did not have hypertension at baseline from the Chicago, IL, MESA field center, higher levels of **self-reported neighborhood safety** were associated with lower levels of SBP (1.54 mm Hg per 1-SD increase [95% CI, 0.25–2.83]) in both sexes and lower levels of DBP (1.24 mm Hg [95% CI, 0.37–2.12]) among females only

Mayne SL, Moore KA, Powell-Wiley TM, Evenson KR, Block R, Kershaw KN. Longitudinal Associations of Neighborhood Crime and Perceived Safety With Blood Pressure: The Multi-Ethnic Study of Atherosclerosis (MESA). Am J Hypertens. 2018 Aug 3;31(9):1024-1032.

Participants with aTRH had lower social network scores (that is, fewer sources of regular social contact) compared with participants without aTRH ($P<0.01$). No other psychosocial factors differed between groups. Social network was also the only psychosocial factor that was associated with aTRH prevalence in regression analyses. In age-, sex-adjusted and fully adjusted models, one additional unique source of social contact was associated with a 19% (PR=0.81; 95% confidence interval (CI): 0.68–0.94, $P=0.001$) and a 13% (PR=0.87; 95% CI 0.74–1.0, $P=0.041$) lower prevalence of aTRH, respectively.

Shallcross, A., Butler, M., Tanner, R. *et al.* Psychosocial correlates of apparent treatment-resistant hypertension in the Jackson Heart Study. *J Hum Hypertens* **31**, 474–478 (2017).

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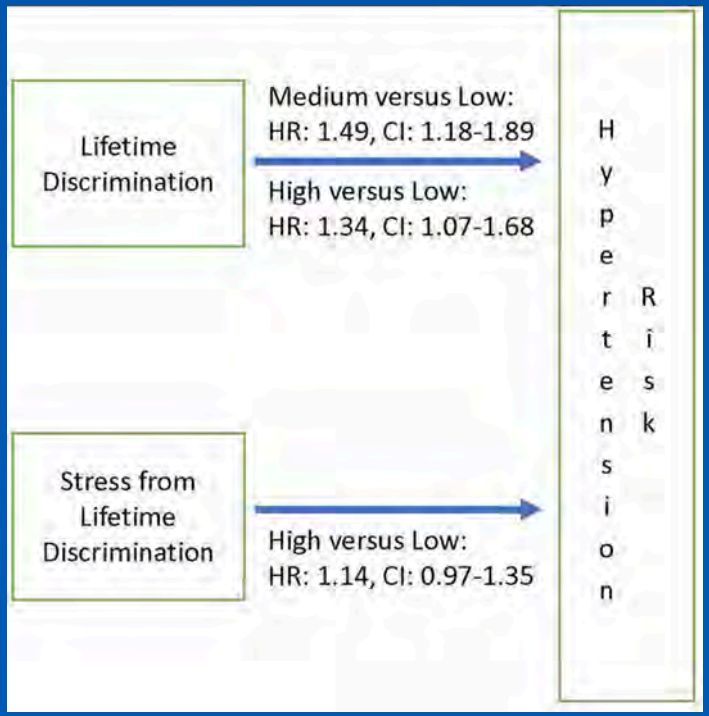

Hypertension
Volume 76, Issue 3, September 2020; Pages 715-723

In a geographically diverse sample of black adults followed up for more than 25 years, we found that increases in neighborhood-level racial residential segregation were associated with small but statistically significant increases in systolic but not diastolic blood pressure. In addition, among those living in high-segregation neighborhoods at baseline, reductions in exposure to neighborhood segregation were associated with decreases in systolic blood pressure of more than 1 mm Hg.

Kershaw KN, Robinson WR, Gordon-Larsen P, Hicken MT, Goff DC Jr, Carnethon MR, Kiefe CI, Sidney S, Diez Roux AV. Association of Changes in Neighborhood-Level Racial Residential Segregation With Changes in Blood Pressure Among Black Adults: The CARDIA Study. JAMA Intern Med. 2017 Jul 1;177(7):996-1002.

Discrimination

Women who perceived greater discrimination had an increased risk of developing gestational diabetes mellitus. Results from the mediation analysis indicate that more than 20% of the association between discrimination and gestational diabetes mellitus operates via a pathway that includes obesity.

MacGregor C, Freedman A, Keenan-Devlin L, Grobman W, Wadhwa P, Simhan HN, Buss C, Borders A. Maternal perceived discrimination and association with gestational diabetes. Am J Obstet Gynecol MFM. 2020 Nov;2(4):100222.

Adults who felt they had experienced a high level of discrimination at work were 54 percent more likely to develop high blood pressure (hypertension) than were those who reported little or no workplace discrimination, according to research published in the Journal of the American Heart Association.

The Washington Post
May 14, 2023


PUBLIC HEALTH

How poverty and racism 'weather' the body, accelerating aging and disease

March 28, 2023 · 2:00 PM ET

Heard on Fresh Air

By Dave Davies

NorthShore University HealthSystem

You were right — traffic noise is indeed pushing up your blood pressure

By Amy Woodyatt, CNN

Published 2:00 PM EDT, Wed March 22, 2023

- In a meta-analysis of 10 studies, air pollution (particulate matter [PM2.5]) exposure during pregnancy was associated with higher risk for HDP (OR, 1.52 [95% CI, 1.24–1.87] per 10 μg/m^3).[32]

Medicaid Expansion Improved Health Equity for Redlined Areas

Uninsurance rates were worse in historically redlined areas in the seven states that have not adopted Medicaid expansion, leading to a lack of health equity.

By Kelsey Waddill

healthpayerintelligence.com

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Additional Risk Factors

"Our results demonstrate a relationship between short sleep duration and later sleep midpoint with gestational diabetes."

Facco, Francesca L et al. "Objectively measured short sleep duration and later sleep midpoint in pregnancy are associated with a higher risk of gestational diabetes." American journal of obstetrics and gynecology vol. 217,4 (2017): 447.e1-447.e13.

This systematic review showed that there is a relationship between intestinal microbiota and GDM. Gut microbiota could be a biomarker for early detection of GDM and could be considered a potential target for modification to reduce the risk of GDM.

Medici Dualib P, Ogassavara J, Mattar R, Mariko Koga da Silva E, Atala Dib S, de Almeida Pititto B. Gut microbiota and gestational Diabetes Mellitus: A systematic review. Diabetes Res Clin Pract. 2021 Oct;180:109078.

Pediatrics

“newborn–physician racial concordance is associated with a significant improvement in mortality for Black infants. Results further suggest that these benefits manifest during more challenging births and in hospitals that deliver more Black babies. We find no significant improvement in maternal mortality when birthing mothers share race with their physician”

RESEARCH ARTICLE

Physician–patient racial concordance and disparities in birthing mortality for newborns

Brad N. Greenwood, Rachel R. Hardeman, Laura Huang, and Aaron Sojourner

PNAS September 1, 2020 117 (35) 21194-21200; first published August 17, 2020;
https://doi.org/10.1073/pnas.1913405117

Doctor-Patient Race Concordance

- Annals of internal medicine - Published in Dec 2003 (Cooper, LA et al)
  - Race concordant visits were longer and had higher ratings of patient pos-time affect compared to race-discordant visits
  - More satisfied, rated physicians as more participatory
  - 362 patients in urban primary card practices

- Journal of Health and Social Behavior - Sep 2002 (LaVeist TA)
  - Race-concordant reported greater satisfaction with their physicians

- Archives of Internal Medicine - May 1999 (Saha, S)
  - Blacks with racially concordant physicians were more likely than non-concordant to report receiving preventative care and “always” receiving needed medical care

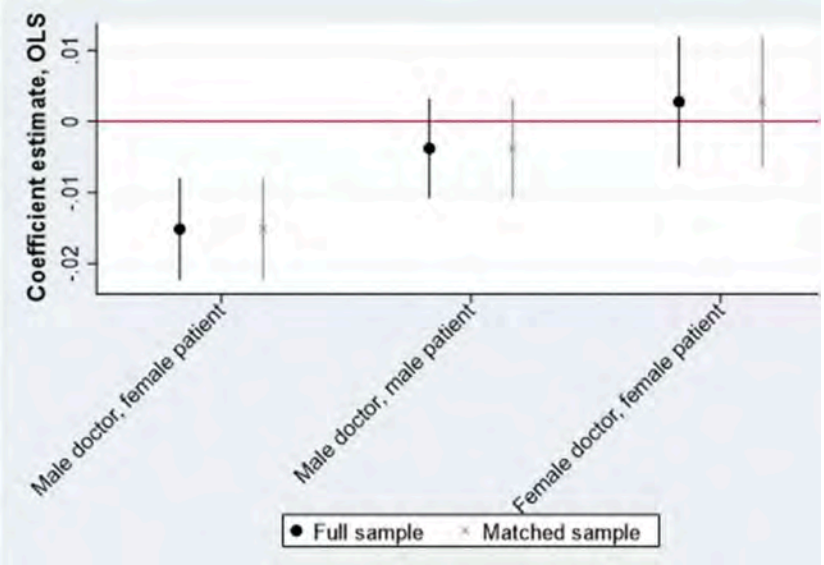
May 10, 1999

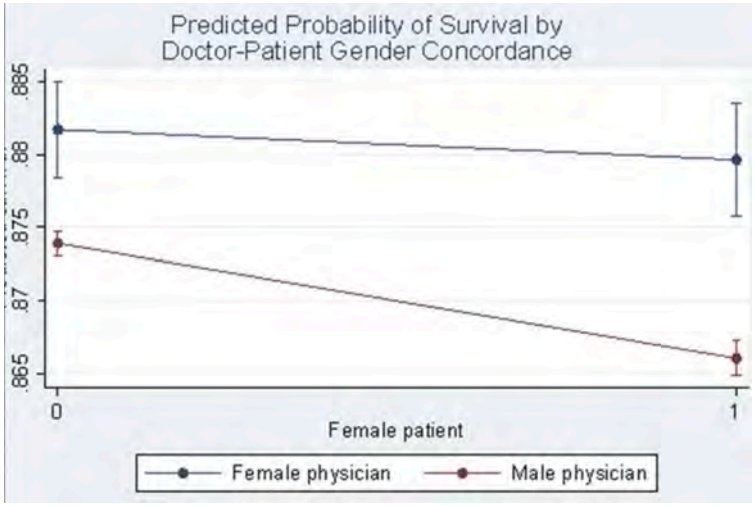
Patient-Physician Racial Concordance and the Perceived Quality and Use of Health Care

Somnath Saha, MD, MPH; Miriam Komaromy, MD; Thomas D. Koepsell, MD, MPH; et alAndrew B. Bindman, MD

Author Affiliations Article Information *Arch Intern Med.* 1999;159(9):997-1004. doi:10.1001/archinte.159.9.997

Patient-physician gender concordance





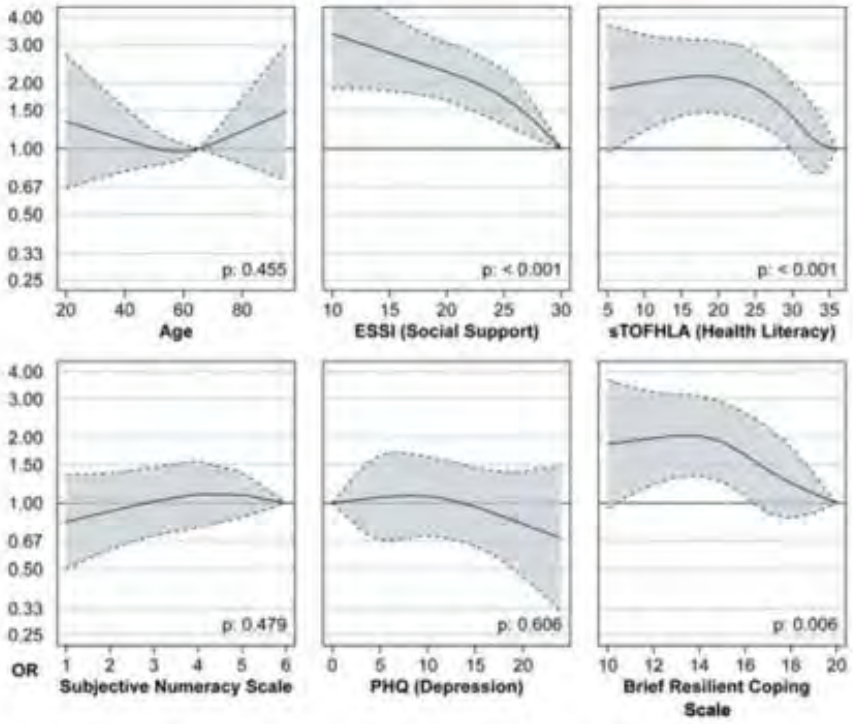
This asymmetry was particularly notable for female patients, who are less likely to survive an AMI when treated by a male physician. We also found that male physicians are more effective at treating female AMI patients when they work with more female colleagues and when they have treated more female patients in the past.

Greenwood BN, Carnahan S, Huang L. Patient-physician gender concordance and increased mortality among female heart attack patients. Proc Natl Acad Sci U S A. 2018 Aug 21;115(34):8569-8574.

J Health Commun. Author manuscript; available in PMC 2015 Feb 5.
PMCID: PMC4318514
Published in final edited form as:
NIHMSID: NIHMS659409
J Health Commun. 2014; 19(0 2): 44–60.
PMID: 25315583
doi: 10.1080/10810730.2014.934936

Predictors of Healthcare System and Physician Distrust In Hospitalized Cardiac Patients

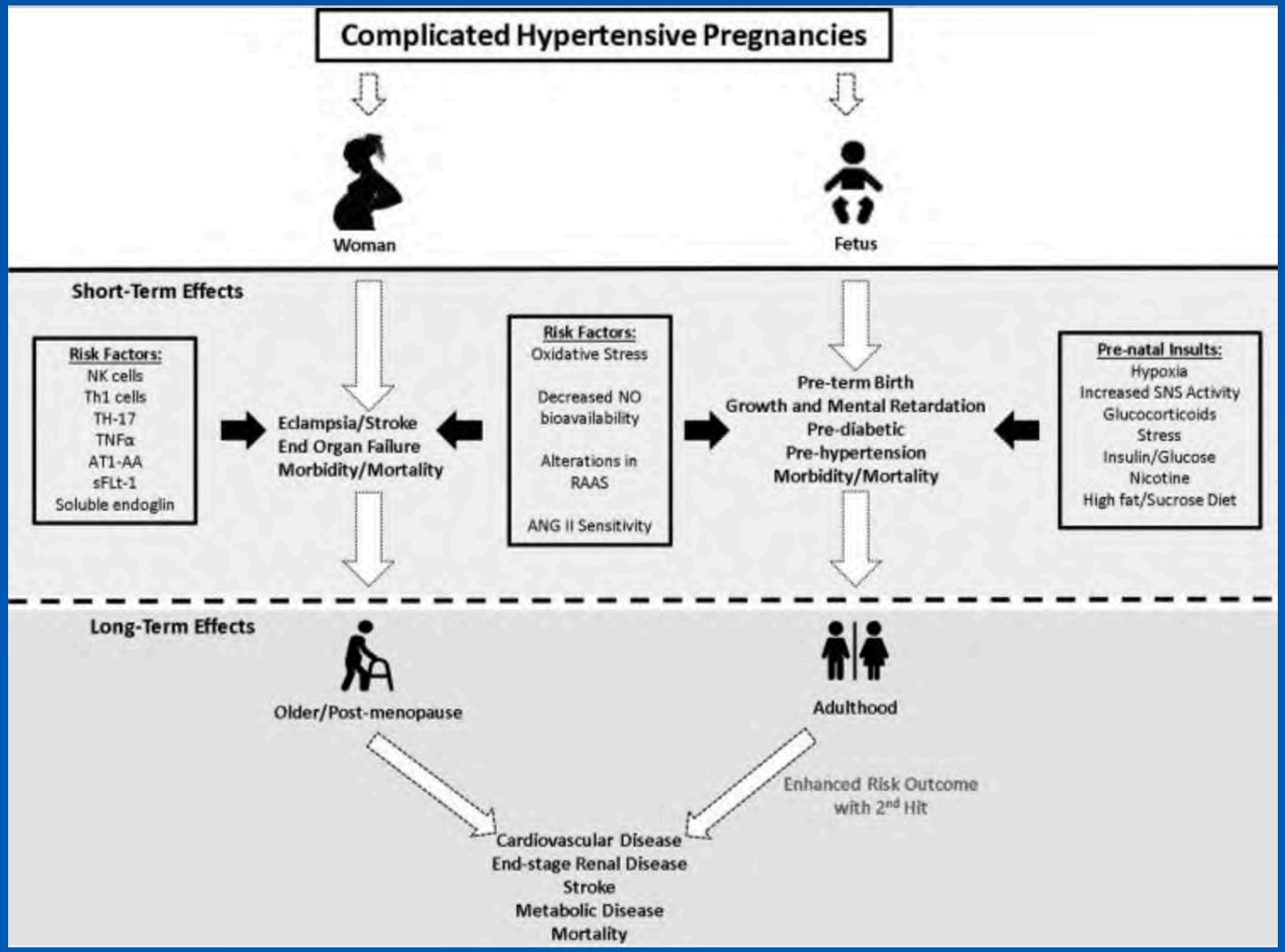
Charu Gupta,[a] Susan P. Bell,[b] Jonathan S. Schildcrout,[c] Sarah Fletcher,[c] Kathryn M. Goggins,[d] and Sunil Kripalani[e], for the Vanderbilt Inpatient Cohort Study (VICS)[f]



- Distrust of physicians
- Distrust of healthcare systems
- Health literacy
- Depression
- Social Support
- Prior research focused on predictors of self-care including perceived self-efficacy

Contributing factors

- Different types of disease between men and women
- Different symptoms and presentations
- Tests may not be similarly effective
- Implicit bias in suspecting CVD or ordering tests
- Physician patient concordance/ discordance (gender and race)
- Cognitive stressors and impact on implicit bias (providers)
- Trust and Distrust (healthcare system, individual physicians, pharmaceutical companies)
- Social determinants of health
  Environmental factors
- Mental Health/ depression
- Health literacy
- Overburdened healthcare system



Cunningham MW Jr, LaMarca B. Risk of cardiovascular disease, end-stage renal disease, and stroke in postpartum women and their fetuses after a hypertensive pregnancy. Am J Physiol Regul Integr Comp Physiol. 2018 Sep 1;315(3):R521-R528.

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Effect of maternal health on offspring

A meta-analysis of 40 studies showed that offspring (at <10 years of age) of mothers with preeclampsia had increased SBP (mean difference, 2.2 mm Hg [95% CI, 1.28–3.12]) and DBP (mean difference, 1.41 mm Hg [95% CI, 0.3–2.52]) compared with control subjects

Hoodbhoy Z, Mohammed N, Nathani KR, Sattar S, Chowdhury D, Maskatia S, Tierney S, Hasan B, Das JK. The impact of maternal preeclampsia and hyperglycemia on the cardiovascular health of the offspring: a systematic review and meta-analysis [published online May 3, 2021]. Am J Perinatol. doi: 10.1055/s-0041-1728823.

Can having gestational diabetes in pregnancy cause long-term complications for the baby?

Infants of parents with gestational diabetes have an increased chance of developing diabetes later in life. This is thought to be caused by both genetics and diabetes management (glucose control) during pregnancy. Some studies suggest that poorly-controlled diabetes during pregnancy could affect development of the central nervous system (CNS), which can increase the chance of problems with learning, behavior, and development. However, data from these studies are limited.

MotherToBaby | FACT SHEET

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Modifying Future CV Risk

- Education
  - Consider group classes and community outreach
  - Early risk assessment using standardized tools and pathway
  - Provider awareness of women and CV disease
  - Provider education about implicit bias

- Lifestyle changes
  - Exercise
  - Weight loss (Microbiome diversity?)
  - Diet/DASH (Cash or CSA?)
  - Stop smoking
  - Neighborhood safety
  - Sleep quality/ Noise pollution
  - Transportation vouchers

- Monitoring
  - BP management
  - Lipid panel, Hgb A1C
  - Mental Health, stress, depression, and perceived discrimination

- Special evaluations or counseling for high risk patients? Longer healthcare benefits?
- Optimizing appropriate medications when patient is out of the peripartum timeframe (what would I put this person on in the future?)
- Increased diversity of providers (gender and race)
- More cohesive and consistent relationships between patients and specific teams or providers
- Access to preconception counseling
- Mandatory MMM reviews

Case 2

- 44 yo G3P3 presents to cardiology clinic after hypertension noted during screening colonoscopy
- Previously seen by primary gynecologist and reported no issues during her pregnancies
- After additional questioning, she admits to gestational hypertension and induction of labor at 37 weeks with her first pregnancy – off and on antihypertensive medications since that time

Case 2

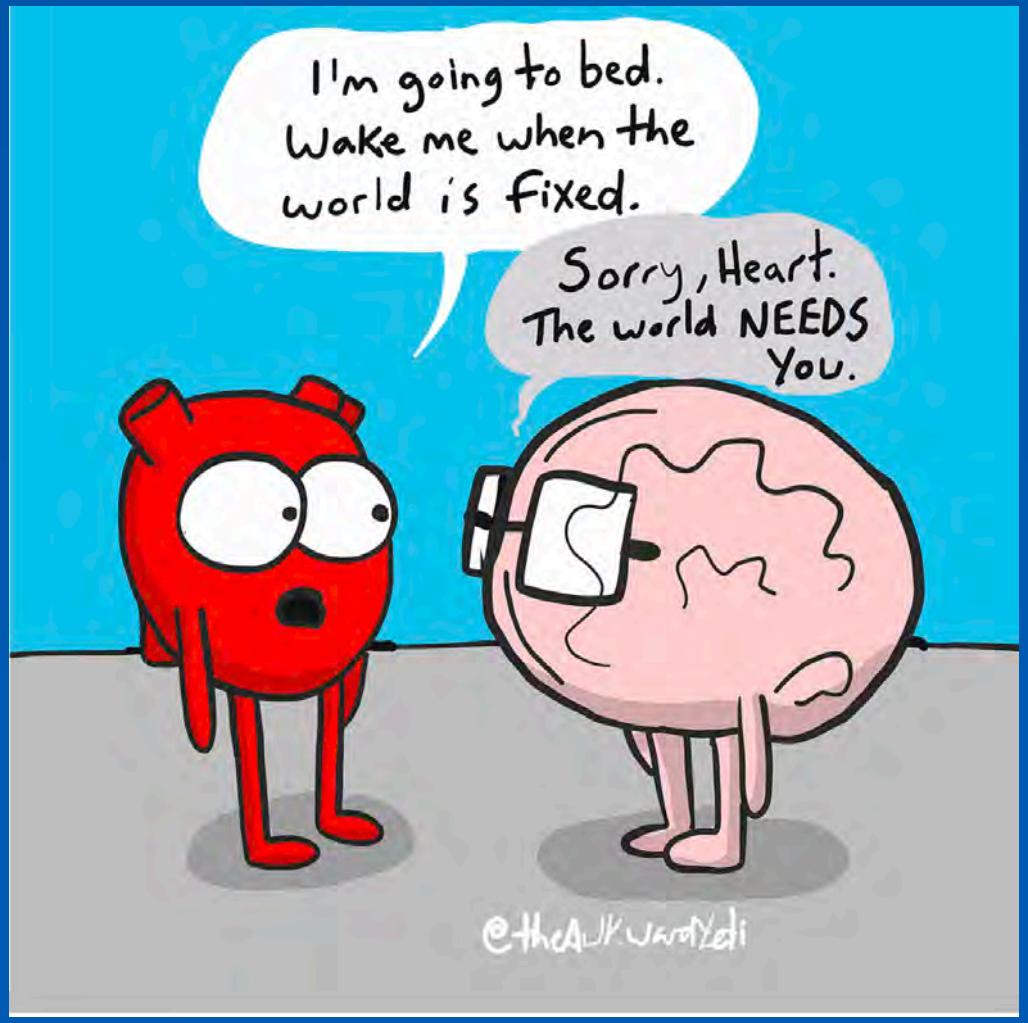
- Echo: mitral valve prolapse with mild mitral regurgitation, mildly reduced LV diastolic function, no left ventricular hypertrophy
- Moderate dilatation of the aortic root and ascending aorta
- Cardiology consultation: reports increased stress and anxiety over the last year, tolerating amlodipine, is mildly hypertensive and tachycardic at her first visit
  - Medications changed to beta blocker with plan for ACE-inhibitor due to aortic root abnormality
  - Sleep study ordered

Case 2

- Sleep study: moderate-severe obstructive sleep apnea
- Follow up visit: getting treatment for her sleep apnea and BP significantly improved
- Re-image her aortic root and ascending aorta at 3-6 months.
- Encouraged regular exercise and stress reduction.

Summary

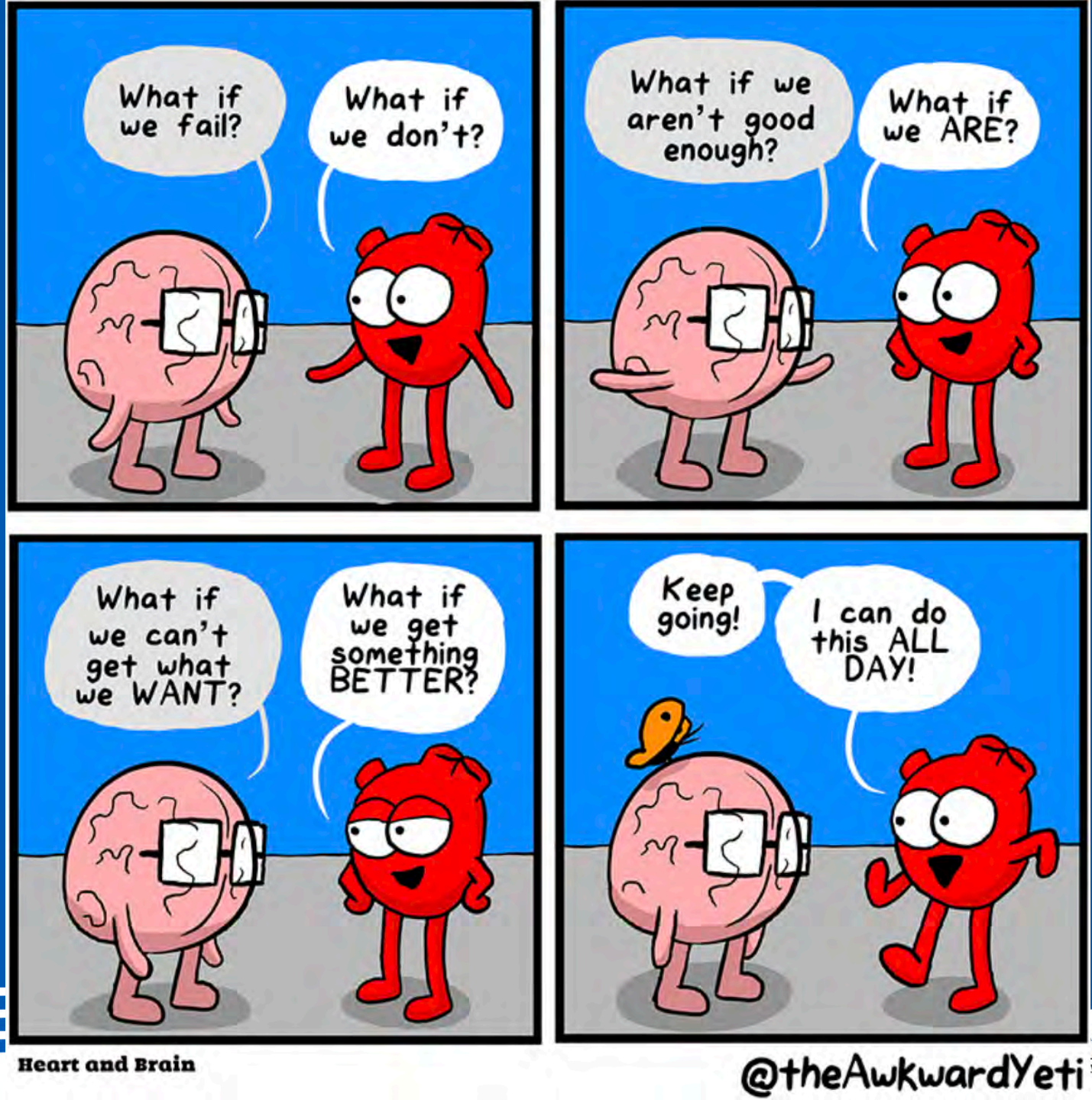
- High burden of CV disease in women
- CV disease in women is unique
- High rates of CV-related mortality in pregnant women
- Gestational DM, low and high birthweight babies, preterm delivery, and hypertensive disorders of pregnancy are independent CVD risk factors
- Obstetric history is medical history
- Collaboration across specialties is the model for improving outcomes
- Maternal health reflects public health



Thank you!

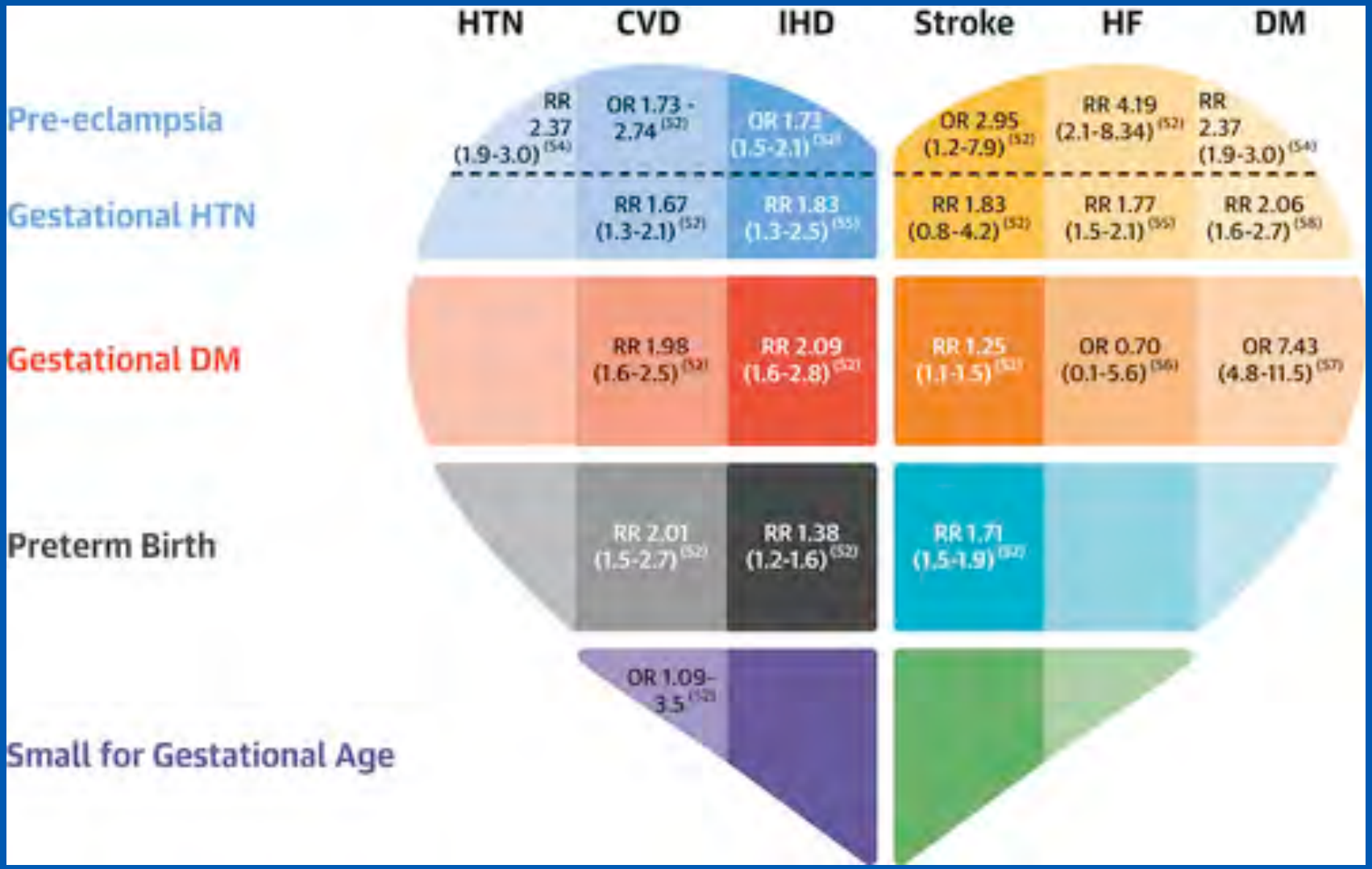
Dr. Charu Gupta

Contact me at cgupta@northshore.org with any questions or feedback.

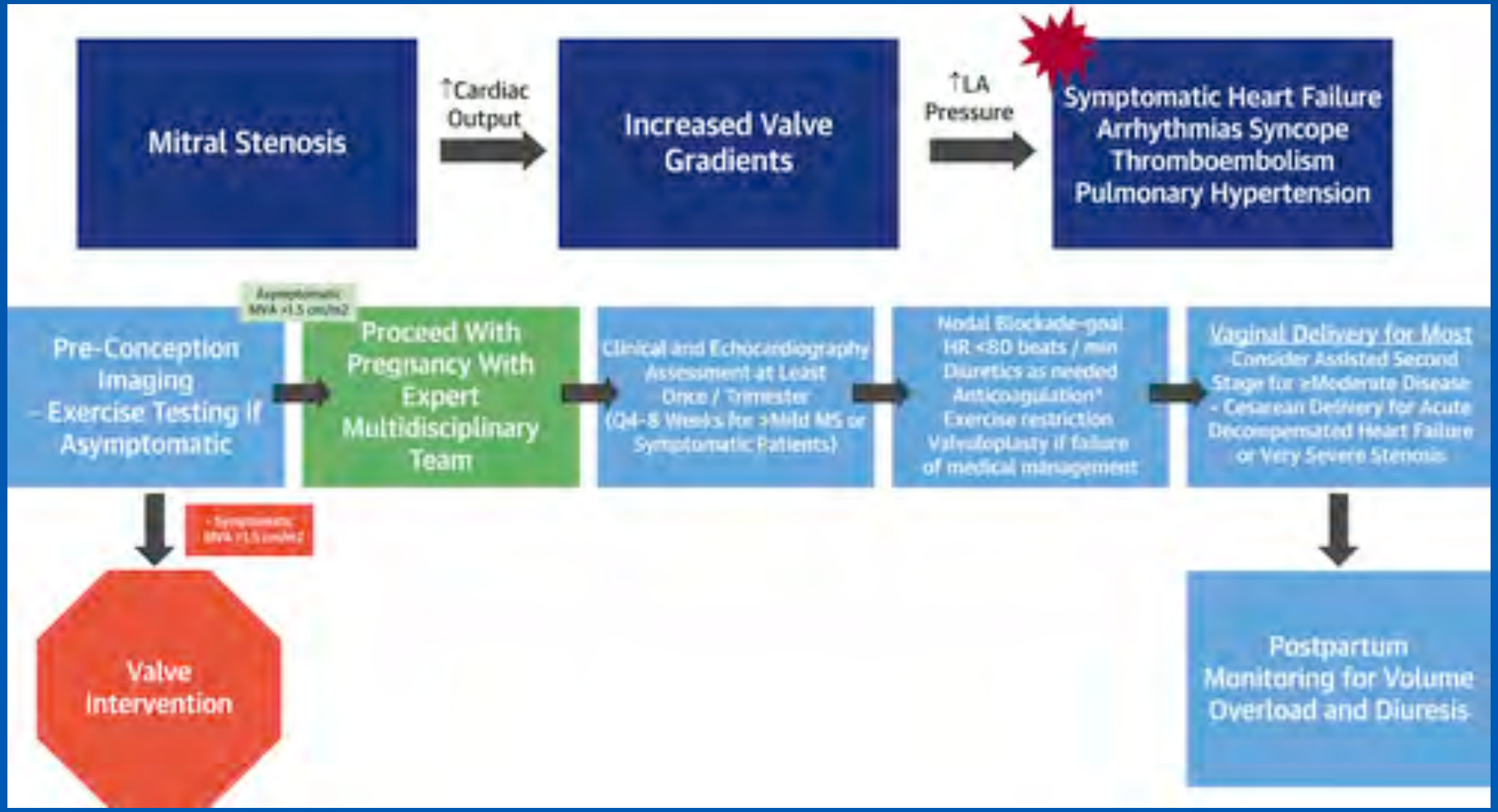


Heart and Brain

@theAwkwardYeti



Melinda B. Davis et al. *J Am Coll Cardiol* 2021; 77:1763-1777.



Kathryn J. Lindley et al. *J Am Coll Cardiol* 2021; 77:1778-1798.

Johnson, TJ SAEM Jan 2016

- 68 ER residents, tested IAT (Implicit association test) before and after shifts
- The busier the shift, the more there was a change in pre- and post-IAT scores
- ED overcrowding was associated with larger postshift bias
- Implicit bias more than three times greater than explicit bias

"Our hypotheses were based on research showing that decisions become more difficult as more decisions must be made and that such decision fatigue increases the brain's reliance on heuristics.52 They were also based on psychological research showing that experimentally increasing cognitive stress produces increased levels of implicit bias and more stereotyping behavior."

Primary Care Rapid Renal Review
IOMS 2024 Winter Scientific Seminar

Harald Lausen, DO, MA, FACOFP dist.

Chief Medical Officer, South Central Hospital Alliance of Illinois

Family Physician, Carlinville Area Hospital & Clinics

Faculty Disclosure

- I have no conflicts or disclosures

Topics

- Chronic Kidney Disease
- Acute Kidney Injury
- Nephrolithiasis
- Diabetic Nephropathy
- OMT Considerations
- Bonus - PKD

55y/o Hypertensive Male

- Tobacco: 1 PPD x 30 years
- ETOH: 4-6 beers per week
- BMI: 32
- PMHx: HTN
- Meds: 20 mg Lisinopril bid, 25 mg HCTZ daily,
  40 mg Pravastatin daily
- Previous 12 months BPs: 170/80, 185/90
- Today's BP: 180/95
- Labs 9 months ago: Cr 1.5, GFR 65, LDL 140, Gluc 110
- Labs 1 month ago: Cr 1.8, GFR 50, LDL 145, Gluc 115

Questions?

What is the Definition of Chronic Kidney Disease?

At what Stage of Chronic Kidney Disease is the Diagnosis typically made?

CKD – Definition

- **Abnormal Kidney Function and a Progressive Decline in Glomerular Filtration Rate**
- **Kidney Damage for 3 or more months**
- GFR <90 mL/min
  - Normal young adult >90 mL/min (125mL/min)
- Albuminuria >30 mg/day
  - Normal young adult < 3-30 mg/day
- GFR and Albuminuria predict Risk of Progression to CKD

CKD – GFR Staging

- Stage G1 – GFR > 90 mL/min (normal - mild)
- Stage G2 – GFR 60-89 mL/min (mild)
- Stage G3a – GFR 45-59 mL/min (mild-mod)
- Stage G3b – GFR 30-44 mL/min (mod-sev)
- Stage 4 – GFR 15-29 mL/min (severe)
- Stage 5 – GFR < 15 mL/min (failure)

CKD – Albuminuria Staging

- Stage A1 - < 30 mg/day (normal to mild)
- Stage A2 - 30-300 mg/day (moderate)
- Stage A3 - > 300 mg/day (severe)

Prognosis of CKD by GFR and albuminuria categories: KDIGO 2012

GFR categories (ml/min/1.73 m²) description and range				Persistent albuminuria categories description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	<15			

Legend:

Kidney Disease Improving Global Outcome (KDIGO) classification of chronic kidney disease (CKD). Gradation of color from green to red corresponds to increasing risk and progression of CKD. GFR, glomerular filtration rate. (Reproduced with permission from Kidney Int Suppl 3:5-14, 2013.)

CKD - Epidemiology

- About 6% US adults (stages 1-2)
- About 4.5% US adults (stages 3-4)
- Nearly 50% have albuminuria w/o < GFR
- 85% with albuminuria have microalbuminuria
- Risk Factors (obesity, smoking, low birth wt)
- Predisposition (age, family hx, gender, race)
  - Females > Males
  - AA > Caucasian advance to ESRD

CKD - Etiology

- Mostly Secondary – Top 5 (90% globally)
- Diabetes / Diabetic Nephropathy
- Hypertension / Vascular Disease
- Glomerulonephritis
- AD Polycystic Kidney Disease
- Other Cystic and Tubulointerstitial Nephropathy

CKD – Signs / Symptoms

- **Usually asymptomatic (1&2) until advanced**
- **Diagnosis typically occurs at Stage 3**
- Anemia
- Fatigue
- Blood pressure
- Decreased Appetite / Malnutrition
- Edema
- Lab Findings
  - Elevated Creatinine, Decreased GFR, Anemia, Hyponatremia, Hyperkalemia, Hypocalcemia, Hyperphosphatemia, Acidemia, Vit D, PTH, CRP

CKD - Management

- Treat reversible causes
  - Perfusion, obstruction, drugs
- Prevent / slow disease progression
  - BP, Lipids, Glucose, Weight, ACE/ARB, SGLT2, Smoking
- Treat complications
  - Volume, Electrolytes, Anemia, Nutrition
- Preparation for dialysis or transplant
  - Renal (GFR<30), Vascular, Transplant

Tidbits

- Hyperkalemic Hyperchloremic Metabolic Acidosis is common in early CKD
- Cr and Urea are not the main causes of uremia symptoms – hundreds of toxins
- Loop Diuretics plus Metolazone may help with diuresis resistance and salt excretion
- Increased PTH levels occur in CKD secondary to Hyperphosphatemia due to decreased GFR
- CVD (cardio, cerebro) is the leading cause of morbidity and mortality in every stage of CKD.

75y/o Female w/ Dehydration

- Tobacco: 1 PPD x 20 years; quit 30 years ago
- ETOH: none for 30 years
- PMHx: HTN, HLD, DM
- Meds: 20 mg Lisinopril bid, 25 mg HCTZ daily,
  40 mg Pravastatin daily, Metformin 500 mg bid
- Previous BP: 125/80, 120/75
- Today's BP: 105/55
- Labs previous: Cr 1.3, GFR 85, Na 135, K 3.6, A1c 7.5
- Labs today: Cr 2.8, GFR 40, Na 145, K 4.8, Gluc 115

Questions?

What is the Definition of Acute Kidney Injury?

What are the 3 major Categorical Etiologies of Acute Kidney Injury?

Acute Kidney Injury (AKI) - Definition

- Previously known as acute renal failure (ARF)
- Heterogeneous group of conditions
- Increase BUN and/or SCr concentration
- Often associated w/ reduction in urine volume
- **Rise of at least 0.3 mg/dL or 50% higher Cr than baseline within a 24–48-hours period**
- **Or a reduction in urine output to 0.5 mL/kg per hour for longer than 6 hours**

AKI – RIFLE Criteria

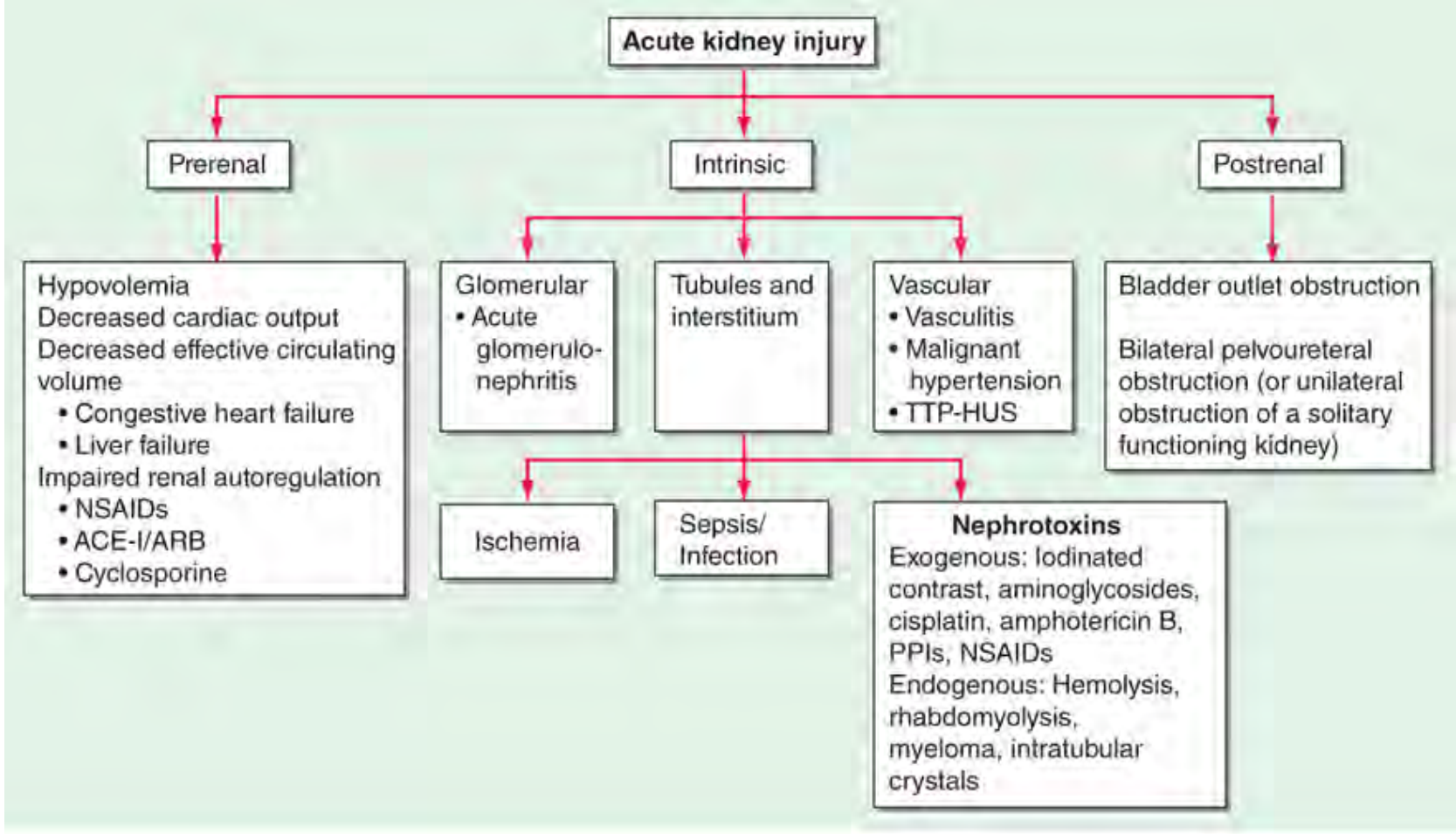
- Risk
  - 1.5 fold increase SCr OR GFR decrease 25% OR <0.5 mL/kg/hr for 6 hrs
- **Injury**
  - **2 fold increase SCr OR GFR decrease 50% OR <0.5 mL/kg/hr for 12 hrs**
- Failure
  - 3 fold increase SCr OR GFR decrease 75% OR <0.5 mL/kg/hr for 24 hrs OR anuria for 12 hrs
- Loss - Complete loss of Kidney Function >4 weeks
- ESRD - Complete loss of Kidney Function >3 months

AKI- Epidemiology

- Complicates 5–7% of hospital admissions
- 30% of admissions to the ICU
- estimated yearly incidence of 500 / 100,000
- Increased risk of death in hospitalized pts
  - ICU mortality rates may exceed 50%.
- Increases risk for developing / worsening CKD

AKI - Etiology

- **Pre-Renal (most common cause of AKI)**
  - **hypovolemia**, decreased cardiac output, and medications (NSAIDs, ACE/ARB)
- **Renal**
  - sepsis, ischemia, and nephrotoxins
- **Post-Renal**
  - **obstruction** of both kidneys unless only one kidney is functional



Classification of the major causes of acute kidney injury. ACE-I, angiotensin-converting enzyme inhibitor-I; ARB, angiotensin receptor blocker; NSAIDs, nonsteroidal anti-inflammatory drugs; PPI, proton pump inhibitors; TTP-HUS, thrombotic thrombocytopenic purpura–hemolytic-uremic syndrome.

AKI – Signs / Symptoms

- Typically an elevation in SCr concentration
- H&P may assist with etiology
- Decreased urinary output (sometimes)
- Urinalysis may be helpful (FeNa)
- Lab Findings
  - Elevated Creatinine, Decreased GFR
  - Possible Hyperkalemia, Hyperphosphatemia, Hypocalcemia
  - Related Anemia, Elevated CK, Elevated ESR, etc

AKI - Management

- Metabolic Acidosis
- Cardiac Issues
- Uremia
- Volume Status
- Potassium
- Sodium
- Calcium
- Phosphate

Question?

What are the Indications for Dialysis in Acute Kidney Injury or Chronic Kidney Dz?

CKD & AKI - Dialysis Indications

- Uremia
  - (pericarditis, encephalopathy, neuropathy, pleuritis, bleeding diathesis, nausea, vomiting, malnutrition)
- Refractory metabolic disturbance
  - (hyperkalemia, hypercalcemia, hypocalcemia, hyperphosphatemia)
- Refractory fluid overload
- Metabolic acidosis (pH <7.1)
- Refractory hypertension

Tidbits

- Renal U/S is the most useful imaging modality
- Pre-Renal AKI with hypervolemia can be seen in HepatoRenal Syndrome and Cirrhosis
- AKI complicates more than 50% Severe Sepsis
- Kidneys account for 20% of Cardiac Output
- AKI with Marked Hyperphosphatemia and Hypocalcemia consider Rhabdomyolysis

35y/o Male w/ Flank Pain

- Tobacco: Non-smoker
- ETOH: 4-6 beers per week
- Occup: Construction worker
- PMHx: HTN, Gout
- Meds: 20 mg Lisinopril daily, 25 mg HCTZ daily
- Previous BP: 125/80
- Today's BP: 120/75
- Labs previous: All within normal range
- Labs today: Urine dip shows 3+ hematuria
- Xray today: Normal, No visible stones

Questions?

What type of Kidney Stone is Second Most Common?

What type of Kidney Stone does Not Show on X-Ray?

Nephrolithiasis - Diagnosis

- Urinary Sx, Renal Colic, Flank Pain, Hematuria
- Helical CT scanning without contrast
- Ultrasound is not as sensitive as CT
- Abdominal x-rays may be used to monitor for formation and growth of kidney stones
- **Calcium, cystine, and struvite stones are all radiopaque on standard x-rays, whereas uric acid stones are radiolucent**

Nephrolithiasis - Epidemiology

- One of the most common urologic problems
- 19% of men and 9% of women (lifetime)
- Calcium stones are more common in men
- Average age onset is third to fourth decade
- 50% of people who form a single calcium stone form another within the next 10 years
- Average rate of new stone formation in recurrent formers is about one every 3 years

Nephrolithiasis - Etiology

- **Calcium oxalate and Calcium phosphate stones make up 75–90% of the total**
- **Uric acid stones account for 5–10% of stones and are more common in men**
- Struvite stones account for 1% of stones
- Cystine stones account for 1% of stones

Nephrolithiasis – Risk Factors

- Previous stone
- Race (White), Age (30-40), Gender (M) and FHx
- Hydration
- Bowel absorption – Bypass, Crohns
- Hypertension and Diabetes
- CKD
- Gout
- Recurrent UTIs
- Diet (high protein, high sodium, low calcium)

Nephrolithiasis – Signs / Symptoms

- Asymptomatic stones may be discovered during the course of radiographic studies
- Common cause of isolated hematuria
- Symptoms occur when they enter the ureter or occlude the ureteropelvic junction.
- Passage usually produces pain and bleeding
- Stone in the ureter within the bladder wall causes frequency, urgency, and dysuria
- Majority of ureteral stones <0.5 cm in diameter pass spontaneously

Nephrolithiasis – Evaluation

- Composition of kidney stones
- 24-h urine collection
- Serum and urine calcium, uric acid, electrolytes, and creatinine
- Urine pH, volume, oxalate, and citrate

Nephrolithiasis – Management

- Water hydration, Pain control
- Infection, Bleeding
- Alpha adrenergic blocker
- Nutrition / Diet
- Treatment / Medications (94% stones)
  - Hyperparathyroidism
  - Citrate supplements (also uric acid)
  - Calcium; thiazides
  - Uric Acid; allopurinol
- Destruction / Extraction - extracorporeal lithotripsy, percutaneous nephrolithotomy, ureteroscopy

Tidbits

- Low Calcium Diet increases recurrence of calcium stones
- Uric Acid stones result from persistently acidic urine that may be caused by metabolic syndromes, chronic diarrhea, or gout
- Cystinuria occurs due to an inherited disorder (autosomal recessive and dominant)
- Struvite stones are typically the result of Proteus species UTI

45y/o Female w/ Diabetes (Adult)

- Tobacco: 1 PPD x 30 years
- ETOH: 2-4 beers per week
- BMI: 34
- PMHx: HTN and HLD x 15 years, DM x 5 years
- Meds: 20 mg Lisinopril bid, 25 mg HCTZ daily, 40 mg Pravastatin daily, Metformin 500 mg bid
- Today's BP: 150/85
- Labs recent: Cr 1.4, GFR 85, A1c 8.0, LDL 110, Microalbumin 100

Questions?

What is the Definition of Diabetic Nephropathy?

How Long after the Onset of Diabetes does Microalbuminuria Typically Appear?

Diabetic Nephropathy - Definition

- Occurs in both type 1 and type 2 diabetics
- **Microalbuminuria (30-300 mg/day)**
- 3 major histologic changes in the glomeruli:
  - mesangial expansion
  - glomerular basement membrane thickening
  - glomerular sclerosis

Diabetic Nephropathy - Epidemiology

- Most common cause of chronic renal failure in the United States
- 45% of patients receiving renal replacement therapy
- 40% of patients with type 1 (10% of) or type 2 (90% of) diabetes develop nephropathy

Diabetic Nephropathy - Etiology

- Hyperglycemia
- Hypertension
- Dyslipidemia
- Metabolic syndrome / Obesity
- Smoking
- Family history of diabetic nephropathy
- Age
- Race

Diabetic Nephropathy
Signs / Symptoms

- **Asymptomatic; microalbuminuria typically appears 5–10 years after the onset of diabetes**
- Microalbuminuria (30-300mg/24 hr)
- Proteinuria (500mg-25g/24 hr)
- Cardiovascular Disease
- After onset of proteinuria, 50% of patients reach renal failure over another 5–10 years

Diabetic Nephropathy - Management

- Disease Progression - including ACE / ARB, SGLT2
- Hypertension – including ACE / ARB
- Glucose – Medication and Diet
- Proteinuria – ACE / ARB
- Hypercholesterolemia - Statin
- Edema – Diuretics
- Smoking Cessation
- Diabetic Retinopathy

Tidbits

- Minimal Change Disease causes 70-90% of nephrotic syndromes in *childhood*
- Membranous Glomerulonephritis is the most common cause of nephrotic syndromes in the *elderly*; 30% of cases in all adults
- Focal Segmental Glomerulosclerosis accounts for 50% of nephrotic syndromes in *AA pts* and 33% of all adult cases

36 y/o Female w/ Pyelonephritis

Where would you palpate / treat the Viscerosomatic Reflexes for the Kidney?

Paravertebral Viscerosomatic Reflexes Urinary Tract

System / Organ	Sympathetic	Parasympathetic
Kidney	**T9-L1 Ipsilateral**	**Occiput, C1, C2**
Proximal Ureter	T11-L3 Ipsilateral	Occiput, C1, C2
Distal Ureter	T11-L3 Ipsilateral	S2 – S4
Bladder	T11-L3 bilateral	S2 – S4
Urethra	T11-L2 bilateral	----------

Basic OMT – Urinary System

- Parasympathetic Component
  - Occipitoatlantal Myofascial Release
  - Cervical (Upper) Paravertebral Soft Tissue
  - Sacral Inhibitory Pressure / Sacral Rock
- Sympathetic Component
  - Thoracic/Lumbar Paravertebral Soft Tissue

Tidbits

- Fever is the main distinguishing feature between cystitis and pyelonephritis
- Bacteremia develops in 20-30% of cases of pyelonephritis
- Predisposition to cystitis and pyelonephritis include frequent intercourse, new partner, UTI in previous 12 months, maternal hx of UTI, diabetes and incontinence
- Common organisms are E. Coli, Staph, Klebsiella, Pseudomonas, and Proteus

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Questions?

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"Your kidney stone test came back.
You didn't pass."

Bonus Material – Polycystic Kidney

Questions?

How is Polycystic Kidney Disease Inherited?

What Percentage of Adults with ESRD have Polycystic Kidney Disease?

PKD

- **Autosomal Dominant (ADPKD) mostly in Adults**
- **Autosomal Recessive mostly in Children (ARPKD)**
- Among the Most Common Life-Threatening Inherited Diseases Worldwide (12 million)
- **Autosomal Dominant Form accounts for about 4% of ESRD in the United States**

ADPKD

- Occurs in 1:400-1:1000 individuals worldwide
- Equally prevalent in all ethnic groups
- Over 90% are inherited cases
- Phenotypic Heterogeneity is a hallmark (family members have a different clinical course)
- Often asymptomatic until 4th or 5th decade
- Diagnosis is frequently made before onset of symptoms

ADPKD - continued

- Renal function declines progressively over 10-20 years after diagnosis
- 60% of patients by age 70 have ESRD
- Diagnosis is typically made by family screening and imaging studies
- Multiple cysts in one or more kidney
- No treatment
- Treat HTN (ACE or ARB may be beneficial)

ARPKD

- Incidence is 1:20,000 Births
- Kidneys are enlarged with small cysts limited to the collecting tubules
- Up to 50% of Affected Neonates Die of Pulmonary Hypoplasia
- About 80% of those who survive neonatal period will live another 10 years, but 33% will have ESRD

ARPKD - continued

- Diagnosis is typically made by Ultrasound
- Diagnosis can be made after 24 weeks in utero
- Cysts are Generally Not Visible until After Birth
- No treatment
- BP management, Dialysis, Kidney Transplantation extends Life Expectancy
- Hepatic Fibrosis may be a Complication

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Thank You!

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