

Nutrition, Lifestyle & the Heart– Brain Connection

Evidence from a Cardiovascular Perspective

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Disclosures

I have the following relevant financial relationship with a commercial interest to disclose:

Co-owner, Synergy Private Health

Learning Objectives

- Describe the bidirectional relationship between cardiovascular and psychological health.
- Identify dietary and lifestyle patterns associated with cardiovascular risk reduction.
- Apply practical, evidence-based prevention strategies in clinical practice.

Why a cardiologist at a nutritional psychiatry conference?

The overlap is biology, behavior, and prevention.

What is good for the heart is often good for the brain.

Vascular

BP, lipids, endothelial function

Metabolic

glucose, adiposity, insulin
resistance

Inflammatory / Autonomic

stress, sleep, immune activation

Shared levers: diet • movement • sleep • nicotine avoidance • stress regulation • social connection

Cardiovascular Disease Remains the World's Leading Killer

19.2M

**global CVD deaths
in 2023**

(up from 13.1M in 1990)

1 in 3

**US deaths are
attributable to CVD**

915,973

**US CVD deaths in
2023**

down from 941,652 in 2022

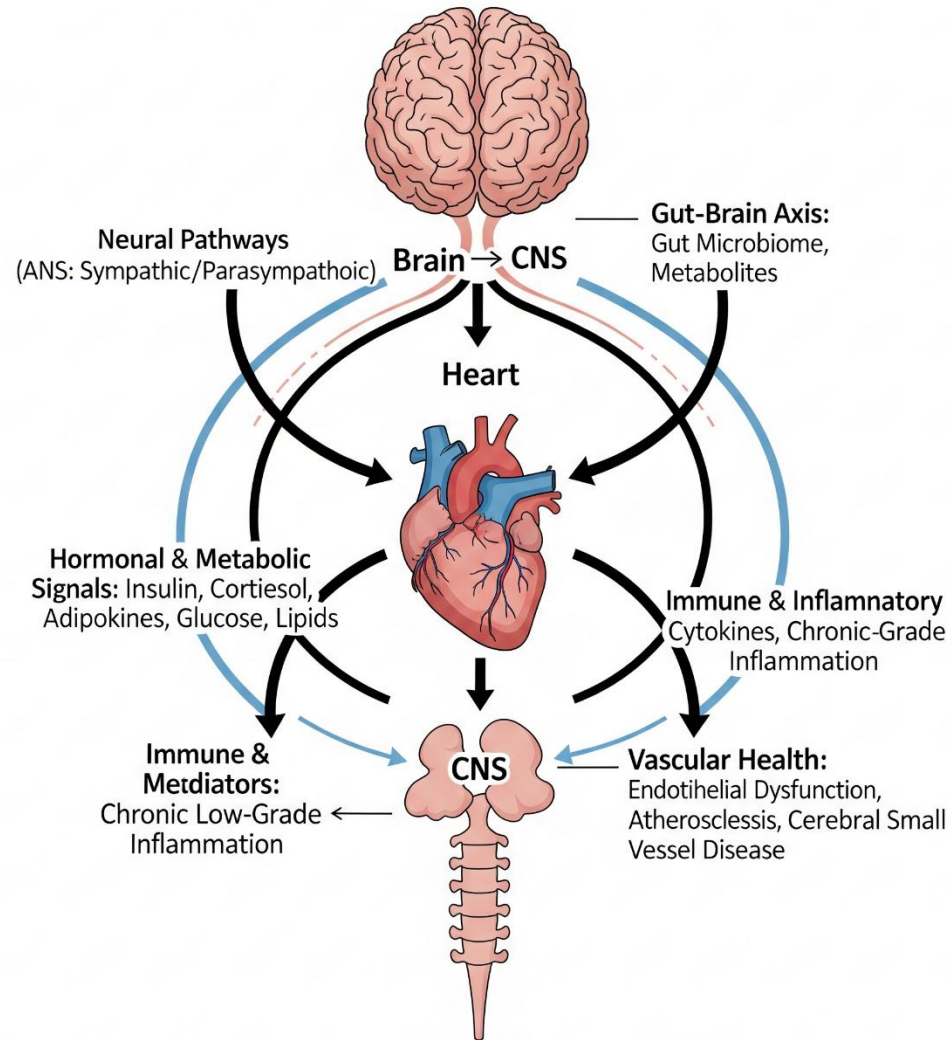
\$414.7B

US CVD cost, 2021–2022
(\$223.2B direct + \$191.5B
indirect)

**High burden + modifiable risk =
prevention opportunity**

Sources: GBD 2023 Cardiovascular Disease Collaborators. J Am Coll Cardiol. 2025 (global). Martin SS, et al. 2026 Heart Disease and Stroke Statistics Update. Circulation. 2026 (US).

The "Cardio-Metabolic-Brain Axis"



Overlap:
Lifestyle interventions that improve mental health
Improve cardiovascular health

The rising burden of both cardiovascular and neuropsychiatric diseases demands a unified, preventative approach.

Heart and mind: the relationship is bidirectional

CVD → psychological distress

Depression and anxiety more prevalent than in the general population

Stress of a chronic, life-threatening diagnosis; loss of independence

Post-MI depression, anxiety and PTSD

Hypoperfusion, microvascular disease and emboli
→ cognitive deficits



Psychological distress → CVD risk

Autonomic and HPA-axis activation

Systemic inflammation and sleep disruption

Lower adherence, smoking, diet, inactivity

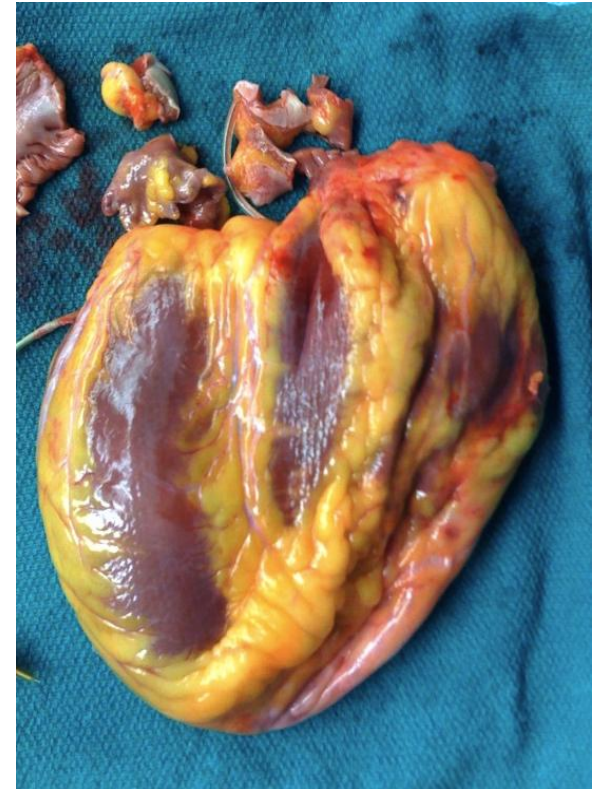
Beta-blocker–depression link is not supported by RCT-level evidence; sleep disruption is the more reproducible effect.

Case: stress-induced coronary vasospasm

49-year-old psychiatrist, type A personality

No medical conditions, no risk markers for CAD

Assault at age 38 → acute coronary vasospasm



The prevention paradox

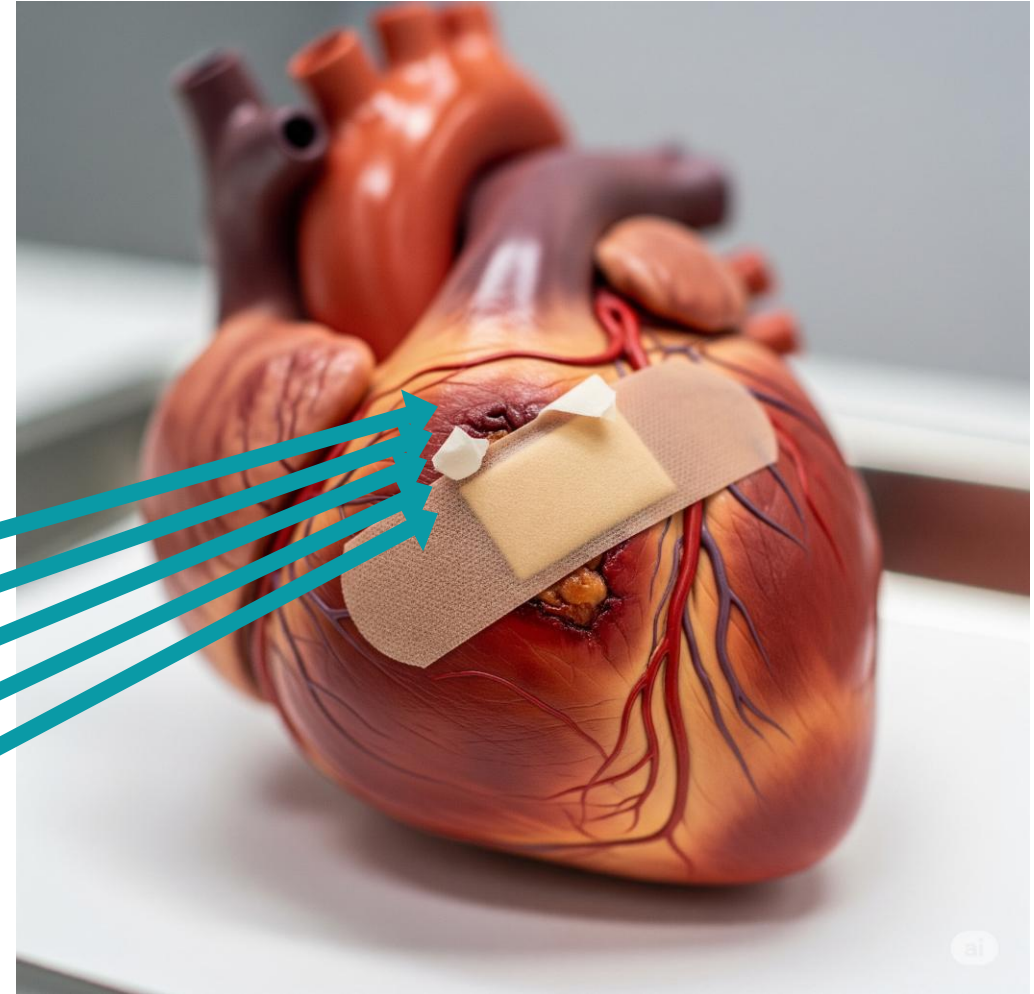
90%

of CVD is lifestyle-related and preventable

...yet CVD keeps rising globally

THE USUAL RESPONSE

- Beta blockers
- Antiplatelet agents
- ACEi / ARBs
- Stents / surgery
- Cholesterol-lowering agents



Investment Reality

Cardiovascular innovation attracts enormous capital — largely toward treatment after disease is established.

PHARMA

\$208B

**Projected global
cardiovascular
drug market by 2033**

\$1–3B average cost to develop an
approved drug

Innovation: PCSK9, SGLT2, novel
anticoagulants

DEVICES

\$121B

**Projected global
cardiovascular
device market**

High-value interventions include
stents,
transcatheter procedures and
mechanical support

CAPITAL FOCUS

Downstream

**Most investment targets
established
disease and intervention**

The opportunity: shift more
resources upstream
toward prevention and earlier risk
reduction

Substantial investment = excel at expensive, complex treatments for cardiovascular disease
We systematically underinvest in the prevention strategies that could eliminate 90% of disease burden entirely.

Prevention is inexpensive!

The 6 Pillars of Lifestyle Medicine



Cardiovascular health is measurable—and modifiable.

HEALTH BEHAVIORS



Diet

Vegetables, fruit, whole grains, lean protein



Activity

150 min/week moderate or 75 min vigorous activity



Nicotine

Avoid all smoking, vaping and secondhand smoke



Sleep

7–9 hours per night for most adults

HEALTH FACTORS



Weight

BMI under 25 kg/m²



Lipids

Non-HDL cholesterol under 130 mg/dL



Glucose

Fasting glucose or HbA1c in normal range



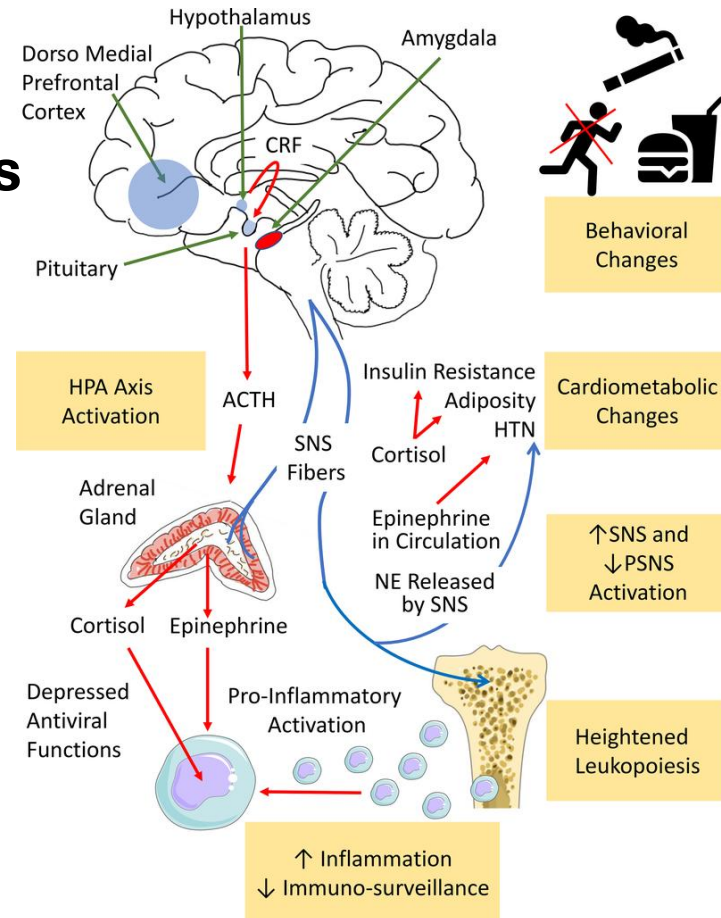
Blood pressure

Under 120/80 mm Hg, untreated

Psychological health and social determinants shape the ability to achieve these metrics.

Chronic stress is a cardiovascular risk modifier

- **Marital and Relationship Stress**
- **Work and Financial Strain**
- **Social Isolation**
- **Trauma/ Adverse childhood events**
- **Natural Disasters and Major Crises**



Not “just stress”

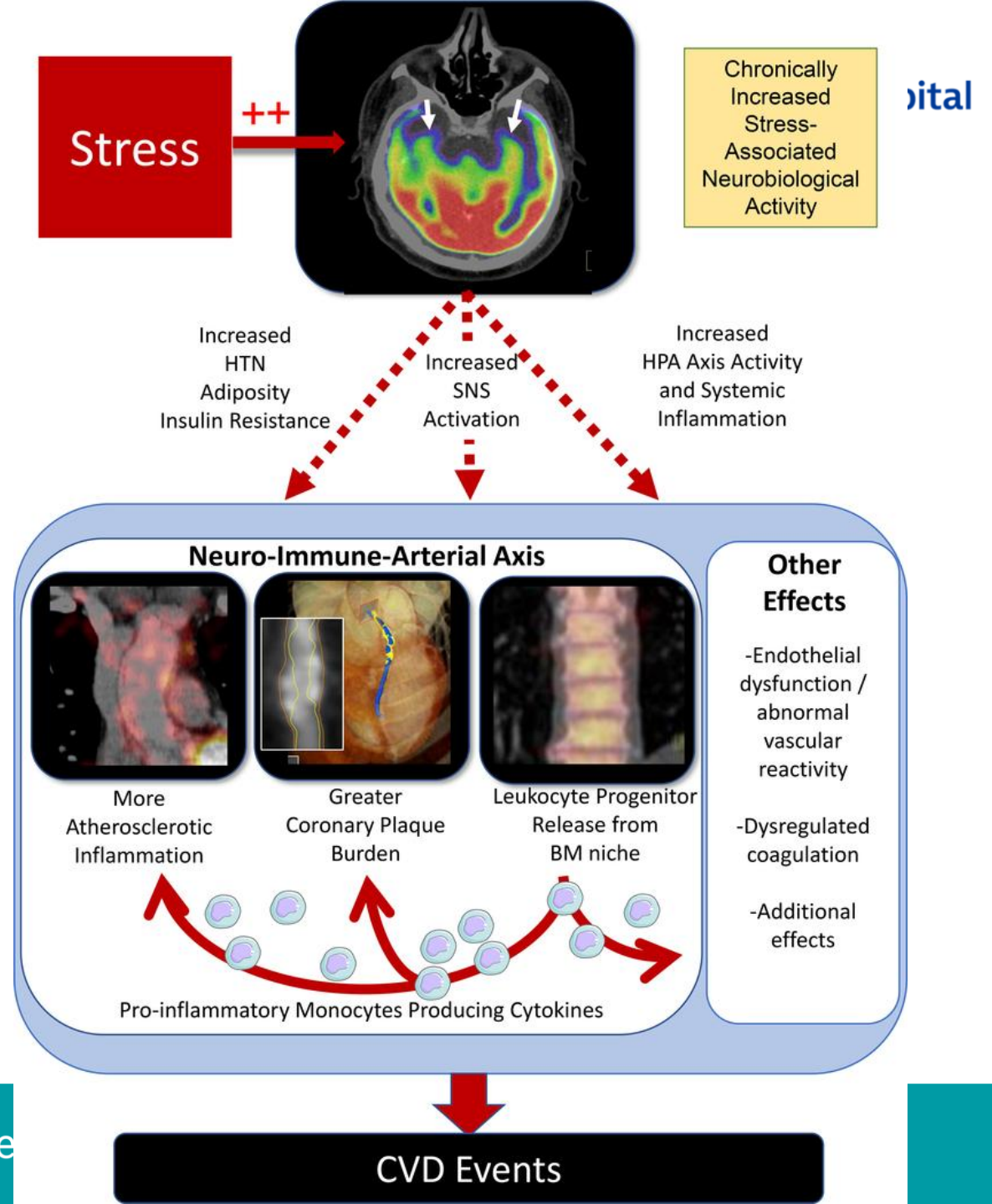
Stress can change cardiovascular biology and cardiovascular behaviors.

Human imaging connects stress biology to vascular risk

Resting elevated amygdalar activity was associated with:

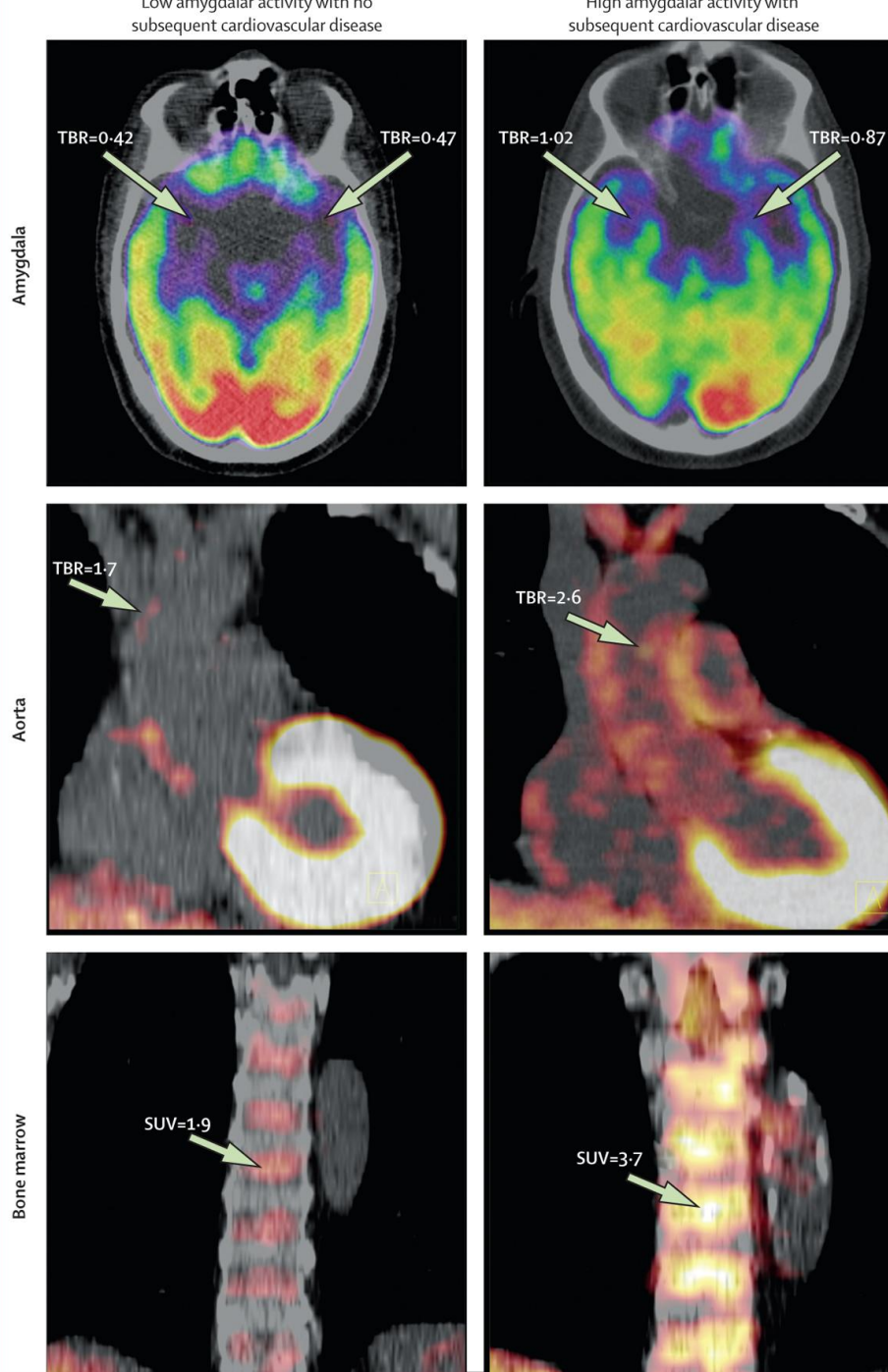
- Increased BM activity
- Increased levels of plaque burden and arterial inflammation
- Higher rates of CV Events

Recent studies show ↑ AmygA is present years before Takotsubo Syndrome onset



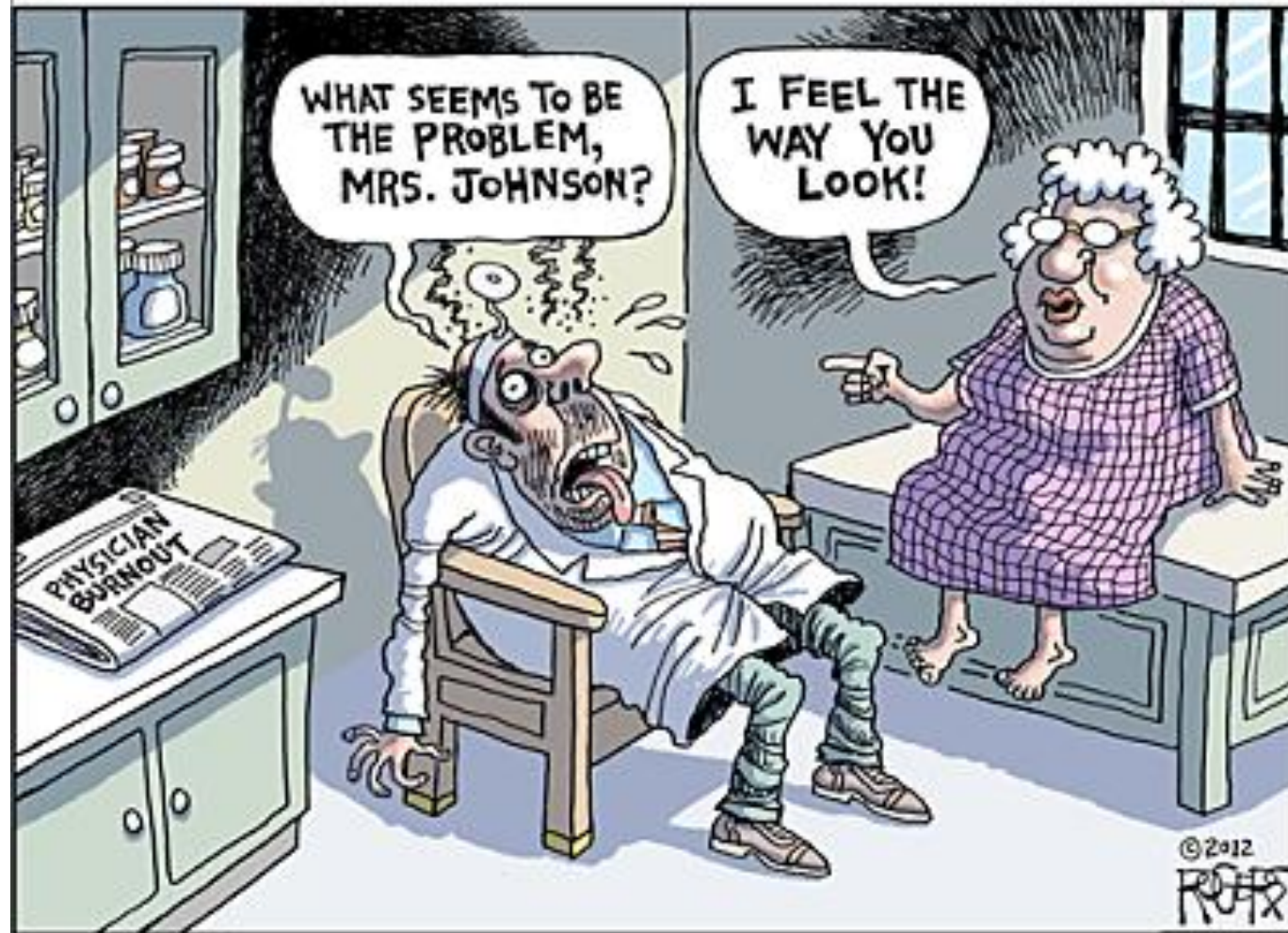
Amygdala Activity and Cardiovascular Events

- **Design:**
Prospective cohort study using PET/CT imaging to measure resting amygdalar activity in individuals without known cardiovascular disease.
- **Results:**
Higher baseline amygdala activity was independently associated with $\uparrow$ risk of subsequent MACE, including MI, stroke, and HF.
- **Mechanism:**
 $\uparrow$ amygdala activity predicted increased bone marrow activity and **arterial inflammation**, suggesting a brain–bone marrow–artery axis linking psychological stress to atherosclerosis and **CVD** events.



SECOND OPINION

BY ROB ROGERS



Nutritional considerations and CV health

Diet quality is a major modifiable risk factor

**A heart-healthy eating pattern is not one food.
It is the repeated pattern of choices over time.**

FOOD QUALITY AFFECTS

BP

LDL-C

Triglycerides

Glycemia

Weight

Inflammation

Endothelial function

Clinical counseling should focus on patterns patients can sustain — not single foods.

2026 AHA dietary guidance: the practical core



Vegetables & fruit



Whole grains



Healthy proteins



Unsaturated fats



Less sodium



Less added sugar



Minimize poor-quality UPFs



Limit/avoid alcohol



Healthy pattern across life

Different names. Similar cardiovascular architecture.

Mediterranean

Event reduction

30% ↓ CVD risk

DASH

BP reduction

8-14 mmHg ↓ BP

Healthful plant-forward

Risk factor improvement

40% ↓ heart disease risk

Common denominator

**Vegetables • fruit • legumes • whole grains • nuts/seeds • unsaturated fats •
minimally processed foods**

The label matters less than the food pattern.

Mediterranean pattern: primary prevention evidence

PREDIMED

Primary prevention RCT



7,447 adults at high cardiovascular risk



Mediterranean diet + EVOO (4 tbsp/day) or nuts (30g nuts) vs low-fat control



No calorie restriction; physical activity not promoted

PRIMARY OUTCOME

≈30%

relative reduction in major
cardiovascular events

Use as: strong dietary-pattern evidence, not a “magic olive oil” claim.

Mediterranean pattern: secondary prevention evidence

CORDIOPREV

Secondary prevention RCT



1,002 patients with established coronary heart disease



Mediterranean diet vs low-fat diet



Median follow-up $\approx$ 7 years

PRIMARY OUTCOME

HR 0.74

**for major cardiovascular events with
Mediterranean diet**

Primary + secondary prevention evidence supports a cardiovascular nutrition conversation.

Dietary Approaches to Stop Hypertension: strongest signal is blood pressure

DASH emphasizes:



vegetables and fruit



low-fat dairy or alternatives



whole grains, legumes, nuts



less sodium and fewer sweets

BP LOWERING WITH DASH

6–11 mmHg

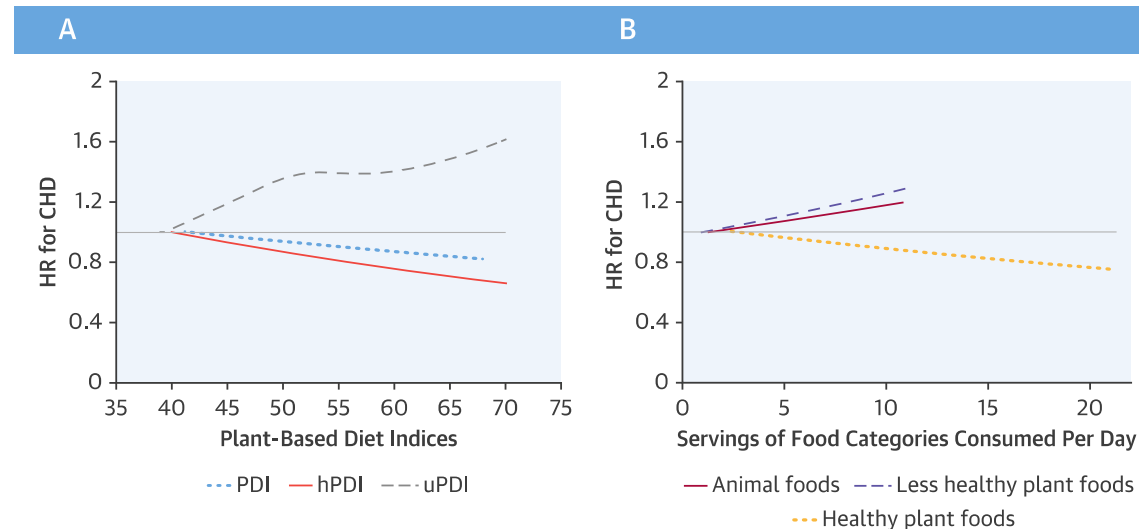
systolic BP decrease

3–6 mmHg

diastolic BP decrease

Healthful and Unhealthful Plant-Based Diets and the Risk of Coronary Heart Disease in U.S. Adults

CENTRAL ILLUSTRATION Dose-Response Relationship of Plant-Based Diet Indices and Animal, Healthy Plant, and Less Healthy Plant Foods With CHD Incidence



Satija, A. et al. *J Am Coll Cardiol.* 2017;70(4):411-22.

Analysis of the dose-response relationship of (A) the plant-based diet indices and (B) animal, healthy plant, and less healthy plant foods with CHD incidence was carried out after combining all 3 cohorts. Adjusted for age, smoking status, physical activity, alcohol intake, multivitamin use, aspirin use, family history of coronary heart disease (CHD), margarine intake, baseline hypertension, hypercholesterolemia, and diabetes, and updated body mass index. Also adjusted for post-menopausal hormone use in NHS (Nurses' Health Study) and NHS2 and for oral contraceptive use in NHS2. Energy intake was additionally adjusted when analyzing the plant-based diet indices. The 3 plant-based diet indices were examined in separate models. The 3 food categories (healthy and less healthy plant foods, and animal foods) were simultaneously included in the same model. For the unhealthful plant-based diet index (uPDI), p for test of curvature = 0.01 and p for nonlinear association is <0.001. The p values for test of curvature for overall plant-based diet index (PDI) = 0.25, for healthful plant-based diet index (hPDI) = 0.82, for animal foods = 0.58, for healthy plant foods = 0.99, and for less healthy plant foods = 0.74. The p values for linearity = 0.004 for animal foods, 0.001 for PDI, and <0.001 for hPDI, less healthy plant foods, and healthy plant foods. HR = hazard ratio.

WHAT THE FIGURE SHOWS

- Higher healthful plant-based index (hPDI): CHD incidence falls
- Higher unhealthful plant-based index (uPDI): CHD incidence rises
- More servings of animal foods and less healthy plant foods: risk rises
- Plant-based is not automatically heart-healthy — food quality decides

“Plant-based” does not automatically mean heart-healthy

Healthful plant foods

- vegetables, fruits
- legumes, whole grains
- nuts, seeds, unsaturated oils

Less-healthy plant foods

- refined grains
- sugar-sweetened beverages
- sweets and highly processed foods

Diet quality (not ideology) is the clinical message.

Emerging target: ultraprocessed foods

Higher UPF intake is consistently associated with adverse cardiometabolic outcomes.

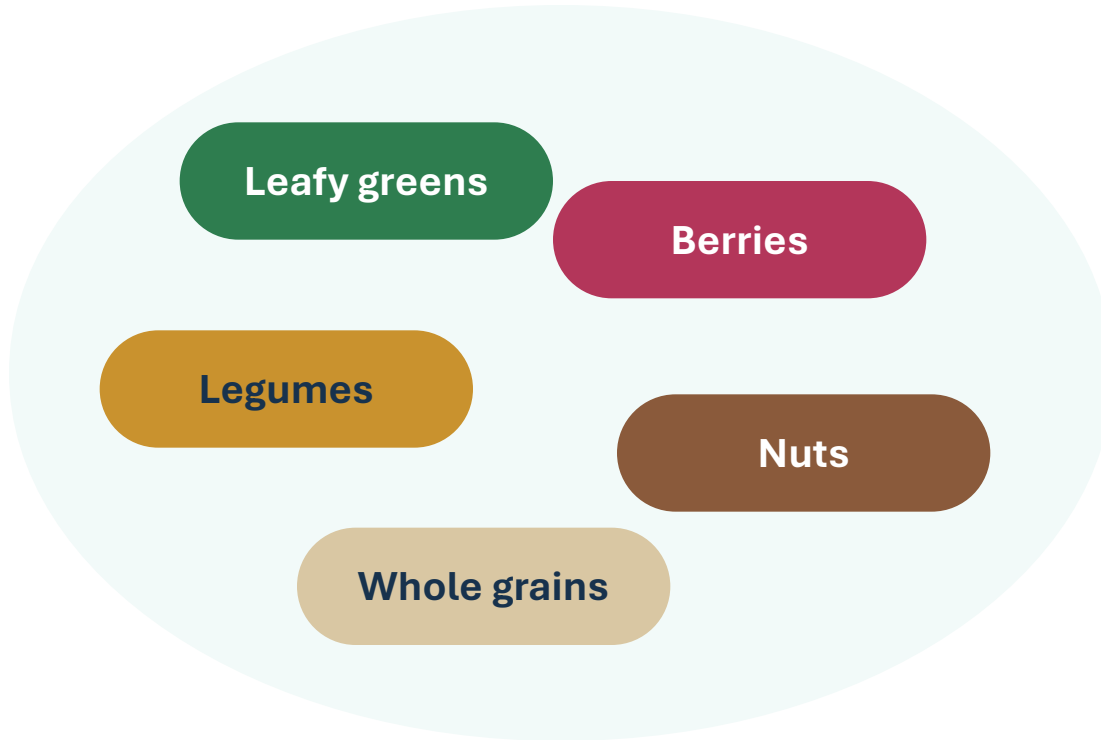
- 1** Most nutritionally poor UPFs are high in saturated fat, added sugar, sodium and calories.
- 2** Not every processed food is equivalent; nutrient quality and food access matter.
- 3** Practical counseling: replace the most harmful UPFs with minimally processed staples.

Nuance: processing ≠ automatically harmful; poor-quality UPF is the main target.

Think patterns, not superfoods

Mechanisms travel together:

- fiber
- polyphenols
- unsaturated fats
- potassium
- dietary nitrate



→ BP • LDL-C • glycemia • endothelial function • inflammation

Specific foods that promote CV health

Leafy greens

nitrate, potassium, fiber

Beets

dietary nitrate → nitric oxide biology

Berries

polyphenols and endothelial biomarkers

Nuts / legumes

fiber, unsaturated fats,
plant protein

Counsel the pattern; personalize the foods.

ARTICLE

The Effect of Fruit and Vegetable Intake on Risk for Coronary Heart Disease

Kaumudi J. Joshipura, ScD; Frank B. Hu, MD; JoAnn E. Manson, MD; Meir J. Stampfer, MD; Eric B. Rimm, ScD; Frank E. Speizer, MD; Graham Colditz, MD; Alberto Ascherio, MD; Bernard Rosner, PhD; Donna Spiegelman, ScD; and Walter C. Willett, MD

Background: Many constituents of fruits and vegetables may reduce the risk for coronary heart disease, but data on the relationship between fruit and vegetable consumption and risk for coronary heart disease are sparse.

Objective: To evaluate the association of fruit and vegetable consumption with risk for coronary heart disease.

Design: Prospective cohort study.

Setting: The Nurses' Health Study and the Health Professionals' Follow-Up Study.

Participants: 84 251 women 34 to 59 years of age who were followed for 14 years and 42 148 men 40 to 75 years who were followed for 8 years. All were free of diagnosed cardiovascular disease, cancer, and diabetes at baseline.

Measurements: The main outcome measure was incidence of nonfatal myocardial infarction or fatal coronary heart disease (1127 cases in women and 1063 cases in men). Diet was assessed by using food-frequency questionnaires.

Results: After adjustment for standard cardiovascular risk factors, persons in the highest quintile of fruit and vegetable intake had a relative risk for coronary heart disease of 0.80 (95% CI, 0.69 to 0.93) compared with those in the lowest quintile of intake. Each 1-serving/d increase in intake of fruits or vegetables was associated with a 4% lower risk for coronary heart disease (relative risk, 0.96 [CI, 0.94 to 0.99]; $P = 0.01$, test for trend). Green leafy vegetables (relative risk with 1-serving/d increase, 0.77 [CI, 0.64 to 0.93]), and vitamin C-rich fruits and vegetables (relative risk with 1-serving/d increase, 0.94 [CI, 0.88 to 0.99]) contributed most to the apparent protective effect of total fruit and vegetable intake.

Conclusions: Consumption of fruits and vegetables, particularly green leafy vegetables and vitamin C-rich fruits and vegetables, appears to have a protective effect against coronary heart disease.

Ann Intern Med. 2001;134:1106-1114. www.annals.org
For author affiliations, current addresses, and contributions, see end of text.



Joshipura KJ et al. *Ann Intern Med.* 2001;134:1106–1114.

23% lower CHD risk per ½-cup serving of dark green leafy vegetables

Dietary Nitrate and Hypertension

Dietary Nitrate Provides Sustained Blood Pressure Lowering in Hypertensive Patients

A Randomized, Phase 2, Double-Blind, Placebo-Controlled Study

Vikas Kapil, Rayomand S. Khambata, Amy Robertson, Mark J. Caulfield, Amrita Ahluwalia

Abstract—Single dose administration of dietary inorganic nitrate acutely reduces blood pressure (BP) in normotensive healthy volunteers, via bioconversion to the vasodilator nitric oxide. We assessed whether dietary nitrate might provide sustained BP lowering in patients with hypertension. We randomly assigned 68 patients with hypertension in a double-blind, placebo-controlled clinical trial to receive daily dietary supplementation for 4 weeks with either dietary nitrate (250 mL daily, as beetroot juice) or a placebo (250 mL daily, as nitrate-free beetroot juice) after a 2-week run-in period and followed by a 2-week washout. We performed stratified randomization of drug-naïve (n=34) and treated (n=34) patients with hypertension aged 18 to 85 years. The primary end point was change in clinic, ambulatory, and home BP compared with placebo. Daily supplementation with dietary nitrate was associated with reduction in BP measured by 3 different methods. Mean (95% confidence interval) reduction in clinic BP was 7.7/2.4 mmHg (3.6–11.8/0.0–4.9, $P<0.001$ and $P=0.050$). Twenty-four-hour ambulatory BP was reduced by 7.7/5.2 mmHg (4.1–11.2/2.7–7.7, $P<0.001$ for both). Home BP was reduced by 8.1/3.8 mmHg (3.8–12.4/0.7–6.9, $P<0.001$ and $P<0.01$) with no evidence of tachyphylaxis over the 4-week intervention period. Endothelial function improved by $\approx 20\%$ ($P<0.001$), and arterial stiffness was reduced by 0.59 m/s (0.24–0.93; $P<0.01$) after dietary nitrate consumption with no change after placebo. The intervention was well tolerated. This is the first evidence of durable BP reduction with dietary nitrate supplementation in a relevant patient group. These findings suggest a role for dietary nitrate as an affordable, readily-available, adjunctive treatment in the management of patients with hypertension (funded by The British Heart Foundation).

Clinical Trial Registration—URL: <http://www.clinicaltrials.gov>. Unique identifier: NCT01405898. (*Hypertension*. 2015;65:320-327. DOI: 10.1161/HYPERTENSIONAHA.114.04675.) • [Online Data Supplement](#)

Key Words: blood pressure ■ nitric oxide ■ nitrate ■ nitrites

1 cup beetroot juice/day × 4 weeks



↓ 8 / 2 mmHg
mean clinic BP reduction



Kapil V et al. *Hypertension*. 2015;65:320.

Nitrate-rich foods



Original Contribution

Physiological role for nitrate-reducing oral bacteria in blood pressure control

Vikas Kapil^a, Syed M.A. Haydar^a, Vanessa Pearl^a, Jon O. Lundberg^b, Eddie Weitzberg^b, Amrita Ahluwalia^{a,*}

^a Centre for Clinical Pharmacology, William Harvey Research Institute, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London EC1M 6BQ, UK

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ABSTRACT

Circulating nitrate (NO_3^-), derived from dietary sources or endogenous nitric oxide production, is extracted from blood by the salivary glands, accumulates in saliva, and is then reduced to nitrite (NO_2^-) by the oral microflora. This process has historically been viewed as harmful, because nitrite can promote formation of potentially carcinogenic *N*-nitrosamines. More recent research, however, suggests that nitrite can also serve as a precursor for systemic generation of vasodilatory nitric oxide, and exogenous administration of nitrate reduces blood pressure in humans. However, whether oral nitrate-reducing bacteria participate in “setting” blood pressure is unknown. We investigated whether suppression of the oral microflora affects systemic nitrite levels and hence blood pressure in healthy individuals. We measured blood pressure (clinic, home, and 24-h ambulatory) in 19 healthy volunteers during an initial 7-day control period followed by a 7-day treatment period with a chlorhexidine-based antiseptic mouthwash. Oral nitrate-reducing capacity and nitrite levels were measured after each study period. Antiseptic mouthwash treatment reduced oral nitrite production by 90% ($p < 0.001$) and plasma nitrite levels by 25% ($p = 0.001$) compared to the control period. Systolic and diastolic blood pressure increased by 2–3 .5 mm Hg, increases correlated to a decrease in circulating nitrite concentrations ($r^2 = 0.56$, $p = 0.002$). The blood pressure effect appeared within 1 day of disruption of the oral microflora and was sustained during the 7-day mouthwash intervention. These results suggest that the recycling of endogenous nitrate by oral bacteria plays an important role in determination of plasma nitrite levels and thereby in the physiological control of blood pressure.

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Bacteria in saliva convert nitrates to nitrites

Kapil V et al. Free Radic Biol Med. 2013;55:93.

Antiseptic mouthwash for 1 week inhibits this conversion.



Blueberries and cardiometabolic function



Blueberries improve biomarkers of cardiometabolic function in participants with metabolic syndrome—results from a 6-month, double-blind, randomized controlled trial

Peter J Curtis,¹ Vera van der Velpen,¹ Lindsey Berends,¹ Amy Jennings,¹ Martin Feelisch,² A Margot Umpleby,³ Mark Evans,⁴ Bernadette O Fernandez,⁵ Mia S Meiss,² Magdalena Minnion,² John Potter,¹ Anne-Marie Minihane,¹ Colin D Kay,¹ Eric B Rimm,³ and Aedin Cassidy¹

¹Department of Nutrition & Preventive Medicine, Norwich Medical School, University of East Anglia, Norwich, United Kingdom; ²Clinical and Experimental Sciences, Faculty of Medicine, University of Southampton and University Hospital Southampton NHS Foundation Trust, Southampton, United Kingdom; ³Department of Nutritional Sciences, University of Surrey, Guildford, United Kingdom; ⁴Wellcome Trust-MRC Institute of Metabolic Science, University of Cambridge, Cambridge, United Kingdom; and ⁵Departments of Epidemiology & Nutrition, Harvard TH Chan School of Public Health, and Channing Division of Network Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, MA

ABSTRACT

Background: Anthocyanin-rich blueberry intake is associated with reduced type 2 diabetes and cardiovascular disease (CVD) risk in prospective studies, although long-term randomized controlled trials (RCTs) have not been conducted in at-risk populations.

Objective: In the longest-duration RCT to date, we examined the effect of 6-mo blueberry intake on insulin resistance and cardiometabolic function in metabolic syndrome.

Conclusions: Despite insulin resistance remaining unchanged we show, to our knowledge, the first sustained improvements in vascular function, lipid status, and underlying NO bioactivity following 1 cup blueberries/d. With effect sizes predictive of 12–15% reductions in CVD risk, blueberries should be included in dietary strategies to reduce individual and population CVD risk. This study was registered at clinicaltrials.gov as NCT02035592. *Am J Clin Nutr* 2019;109:1535–1545.

1 cup blueberries/day for 6 months

- Improved endothelial function (FMD)
- Attenuated cGMP concentrations
- Increased HDL



What I avoid overclaiming

Nutrition does not replace statins, antihypertensives, antithrombotic therapy or revascularization when indicated.

Single “superfoods” rarely have outcomes-level evidence.

Dietary supplements are not a substitute for a cardioprotective eating pattern.

Association is not causation—especially for observational nutrition findings.

Our therapeutic toolbox should include both

Evidence-based medical therapy

statins / LDL-C lowering

antihypertensives

GLP-1RA / SGLT2i when indicated

antiplatelet / anticoagulation

revascularization when indicated

+

Evidence-based lifestyle therapy

dietary pattern

movement

sleep

nicotine avoidance

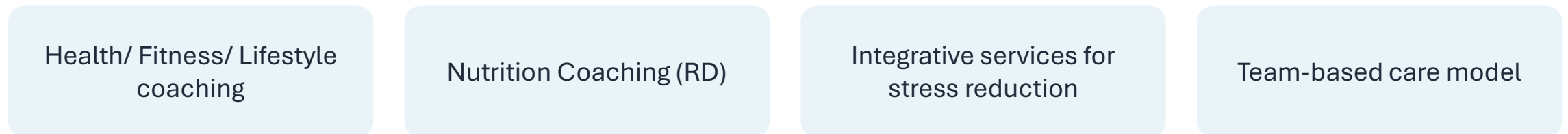
stress / psychological health

Addition, not substitution.

Turning evidence into clinical practice



DELIVERY SUPPORTS



“Would it be okay if we spend two minutes on how food is affecting your heart risk?”

1

Pick one target: sugary drinks, UPFs, vegetables, fiber, sodium, or saturated fat.

2

Make the next step concrete: what, when, where, and how often.

3

Follow with objective feedback: BP, LDL-C, TG, A1c, weight, symptoms, energy.

Prevention has to be realistic

Lifestyle change is not just willpower.

Food cost and availability

Time, caregiving burden, work schedules

Culture, family habits and preferences

Mental health, trauma and stress physiology

Neighborhood safety and access to movement

Better counseling = evidence + empathy + practical constraints.

Five take-home messages

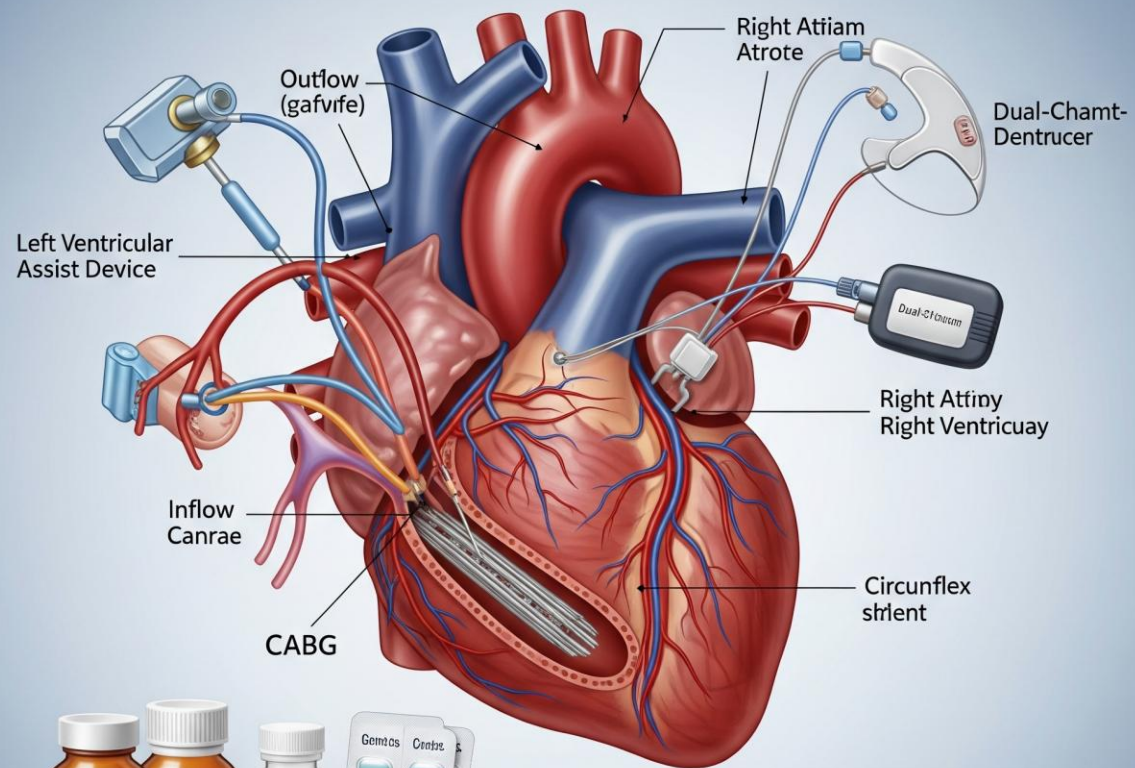
- 1 Heart and brain health are biologically and behaviorally interconnected.
- 2 Psychological stress is a meaningful cardiovascular risk modifier.
- 3 Dietary pattern matters more than individual “superfoods.”
- 4 Mediterranean, DASH and healthful plant-forward patterns share core architecture.
- 5 Lifestyle therapy complements—not replaces—evidence-based cardiovascular treatment.

Thank you

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Cardiac Interventions



NOVEL CARDIAC INTERVENTIONS



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