Aggressive detection and reversal of heart disease

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Kahn Center for Cardiac Longevity

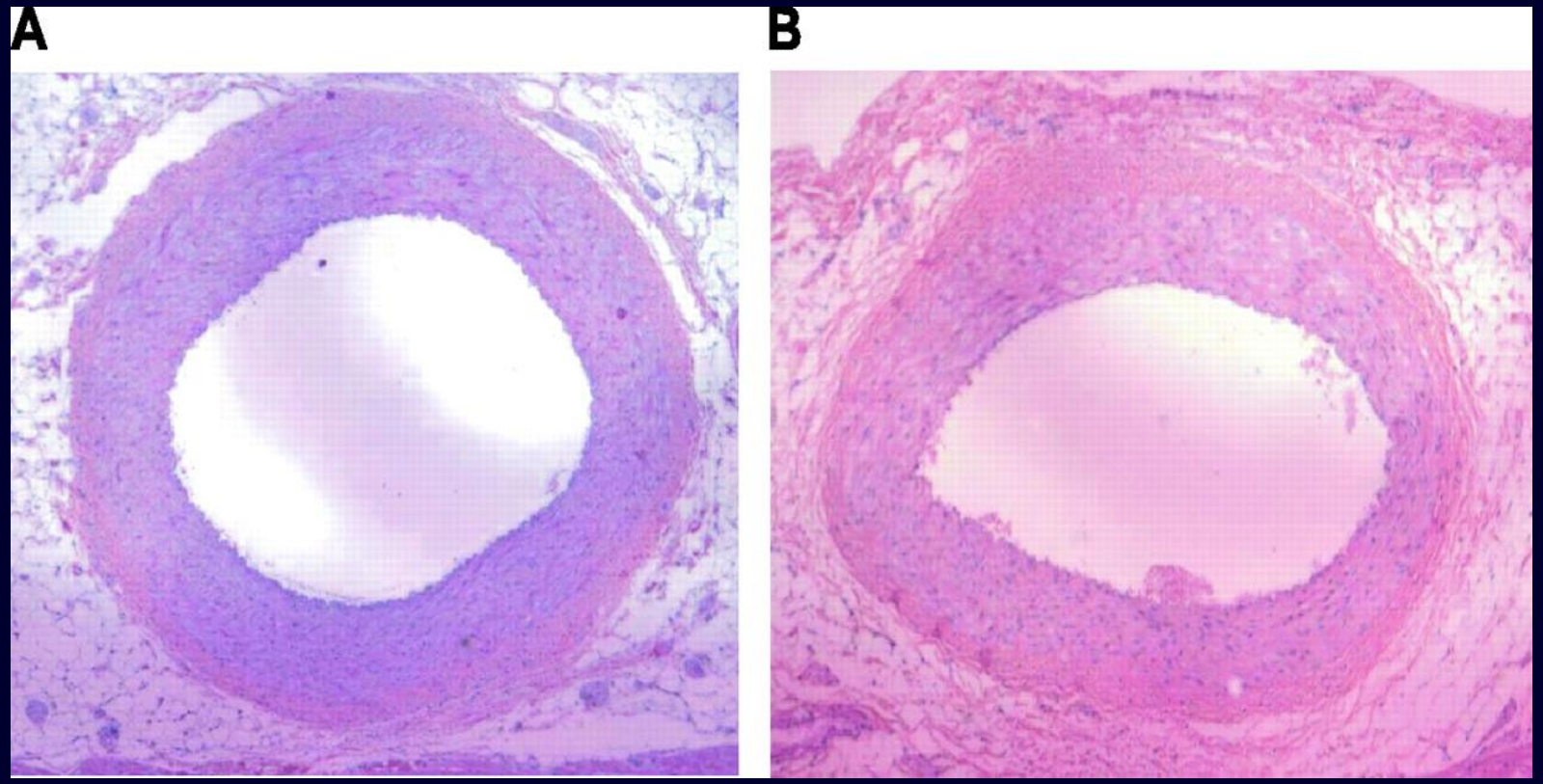
Disclosures

- Speaker – Quest/Cleveland HeartLab

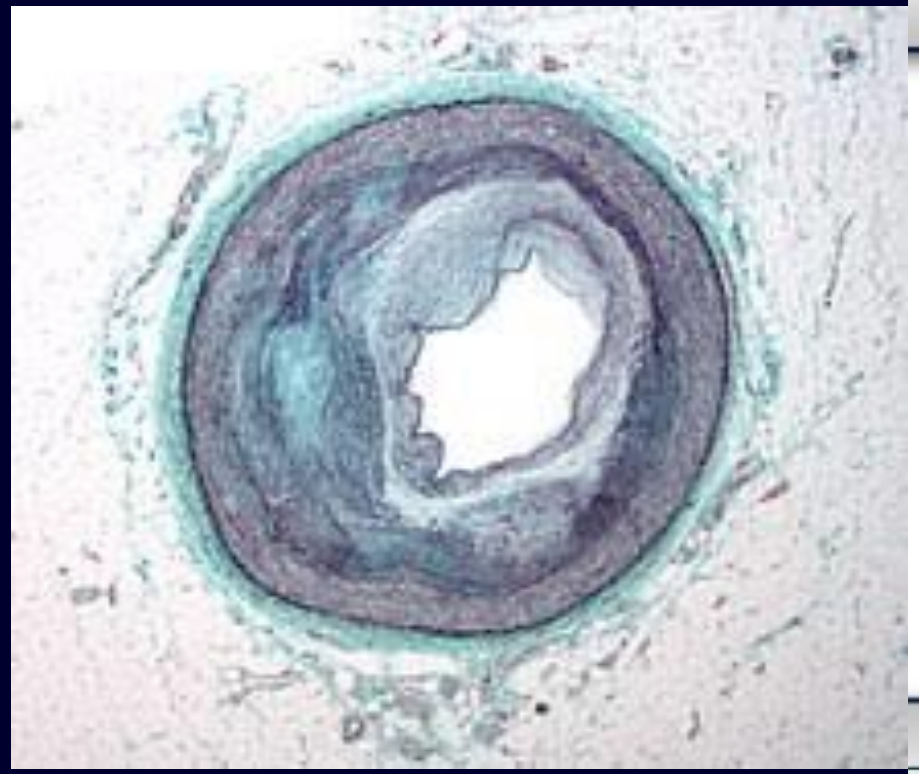
"A Man is as Old as His Arteries"

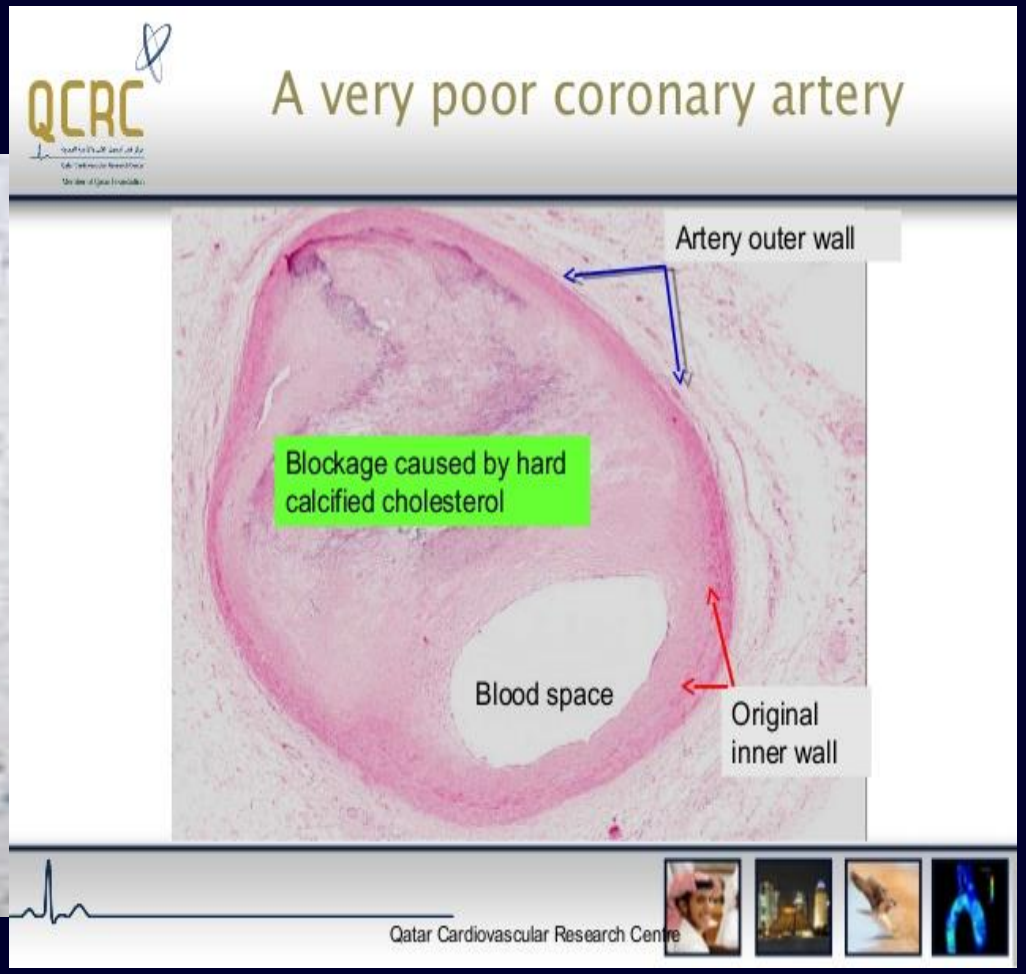
Dr Thomas Sydenham (1624-89)

Normal arteries

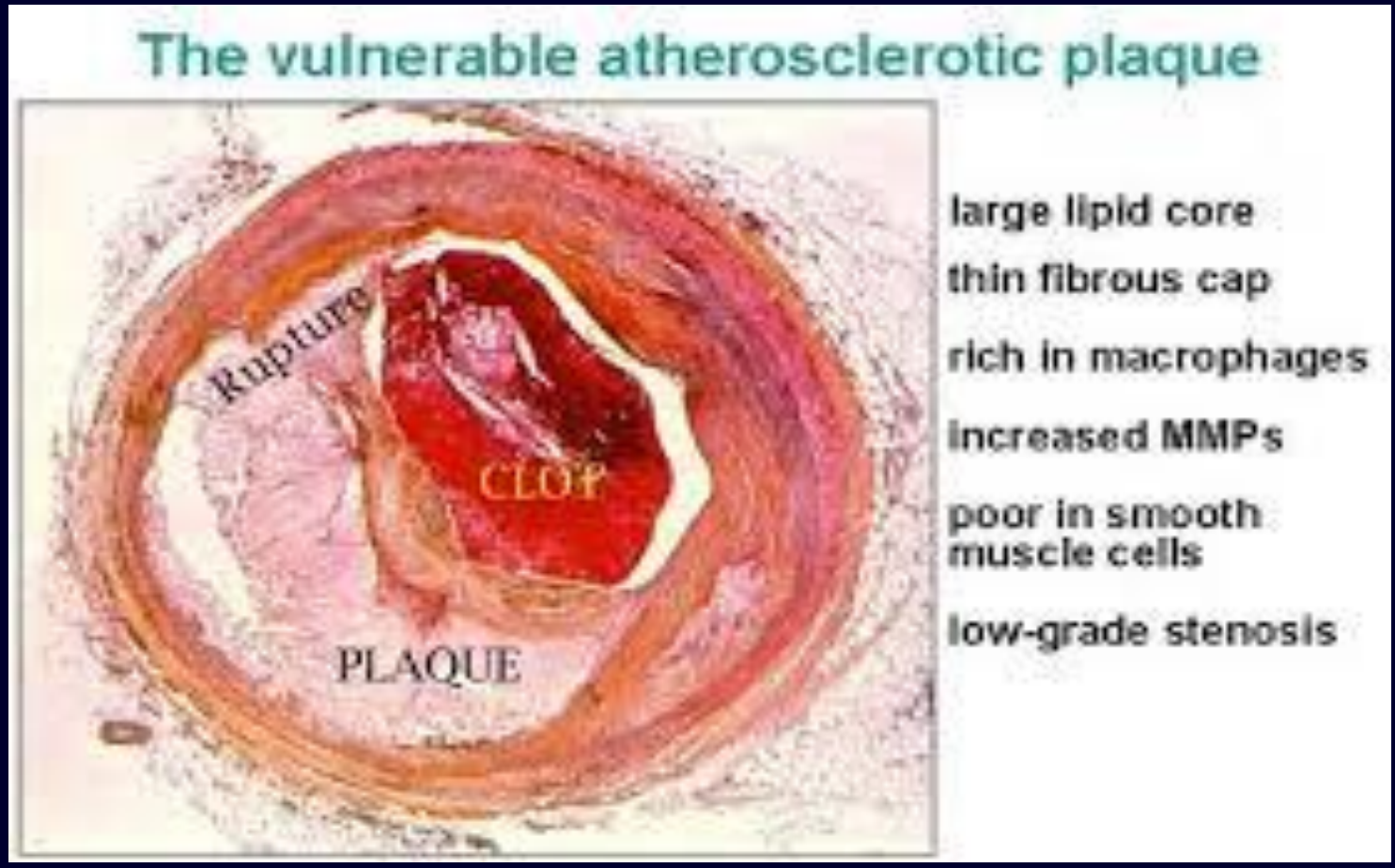


Stenosed coronary arteries

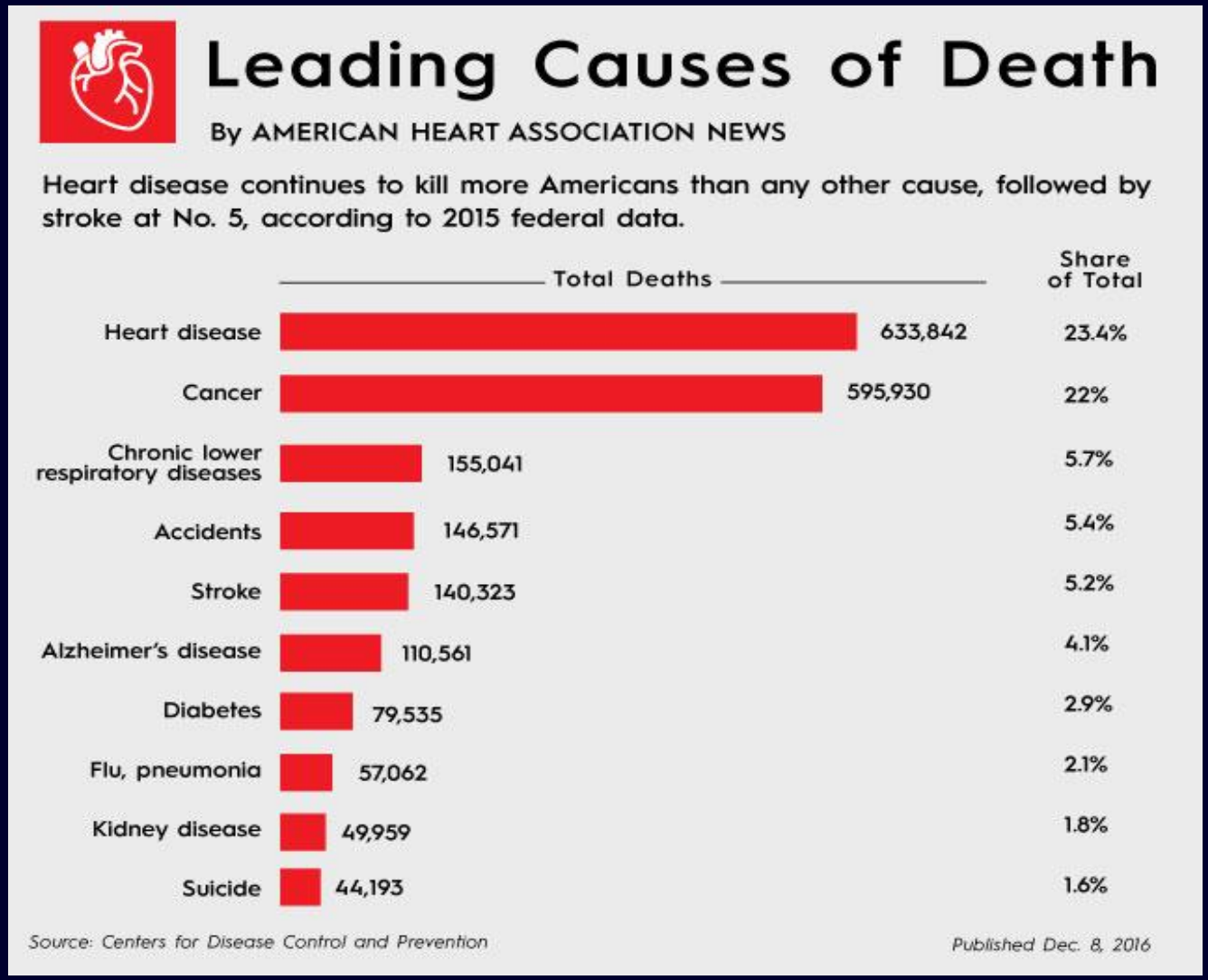




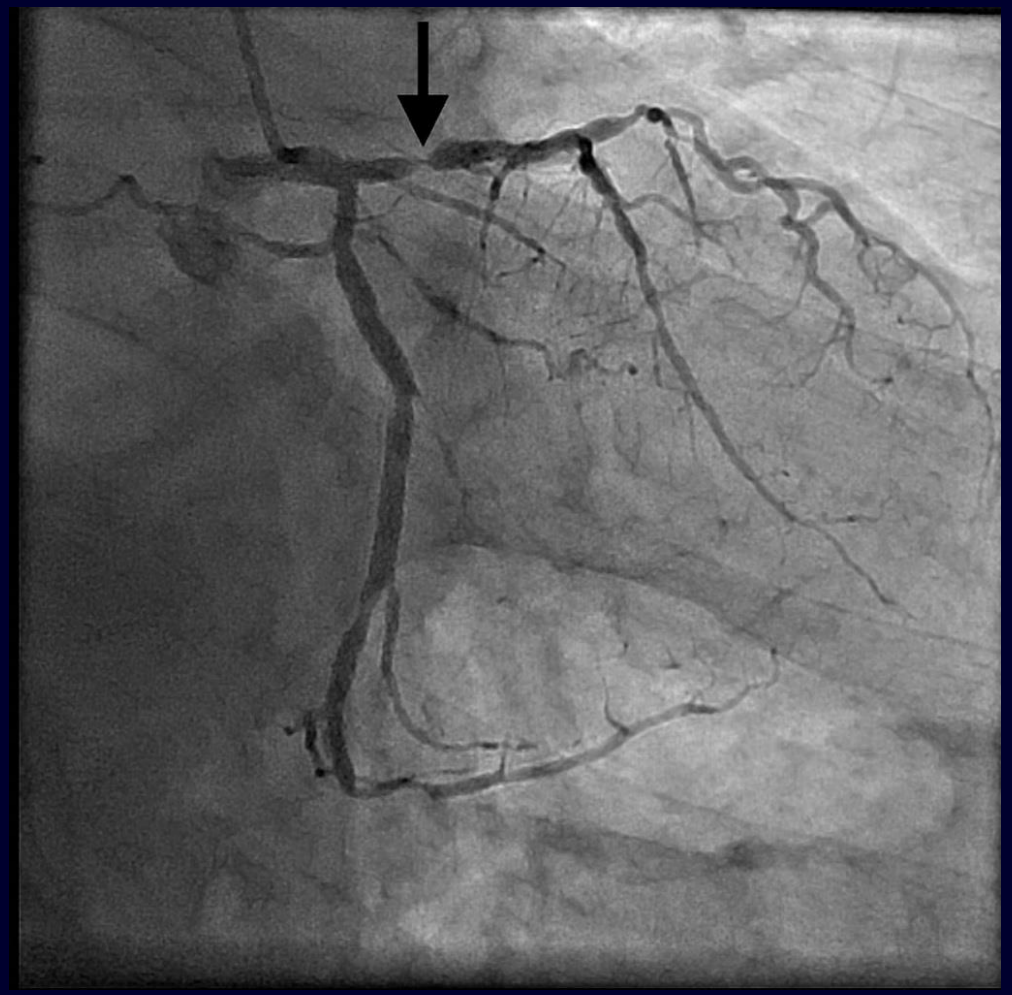
Robs us of life, love, laughter



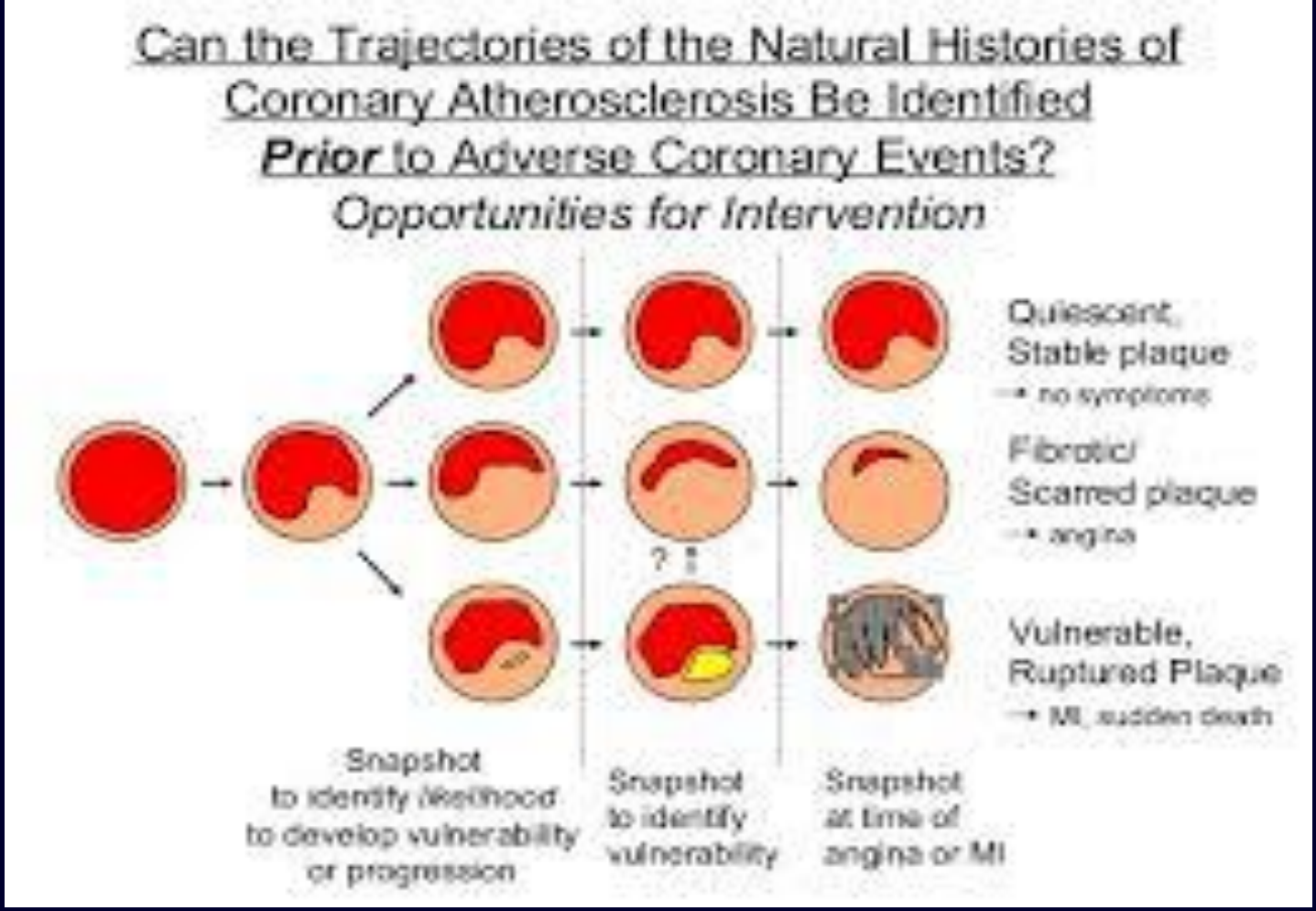
Heart disease deaths



Do you have this problem?
Early Detection

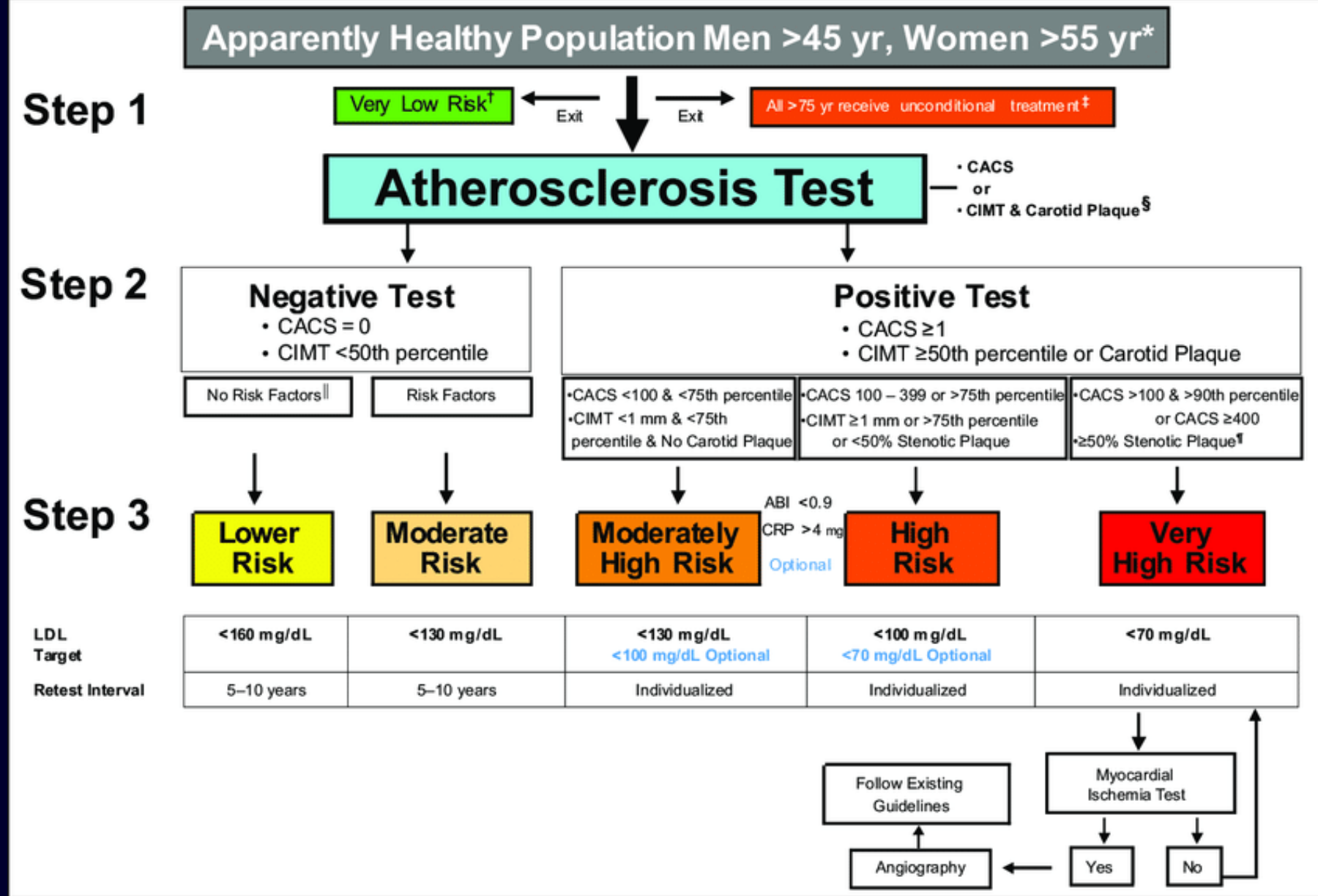


Natural early:
early detection

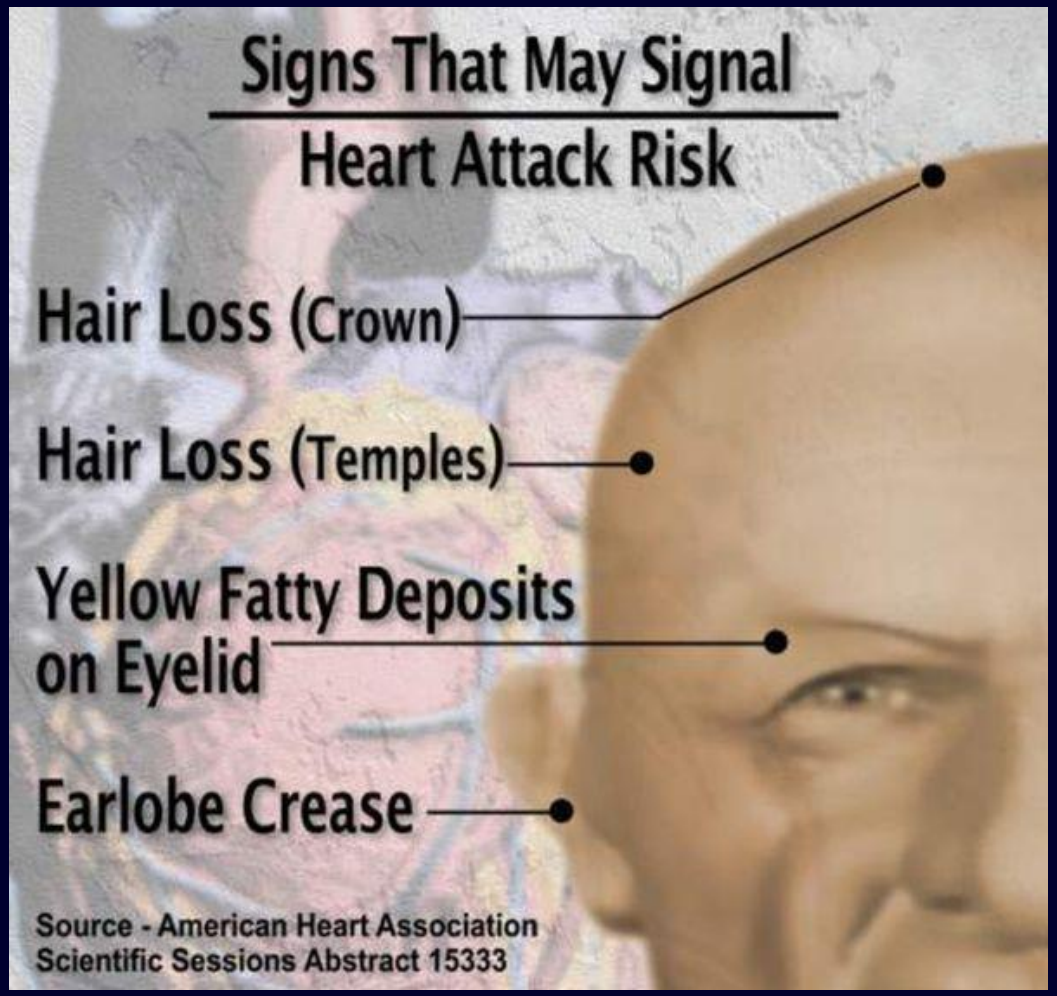


The 1st SHAPE Guideline

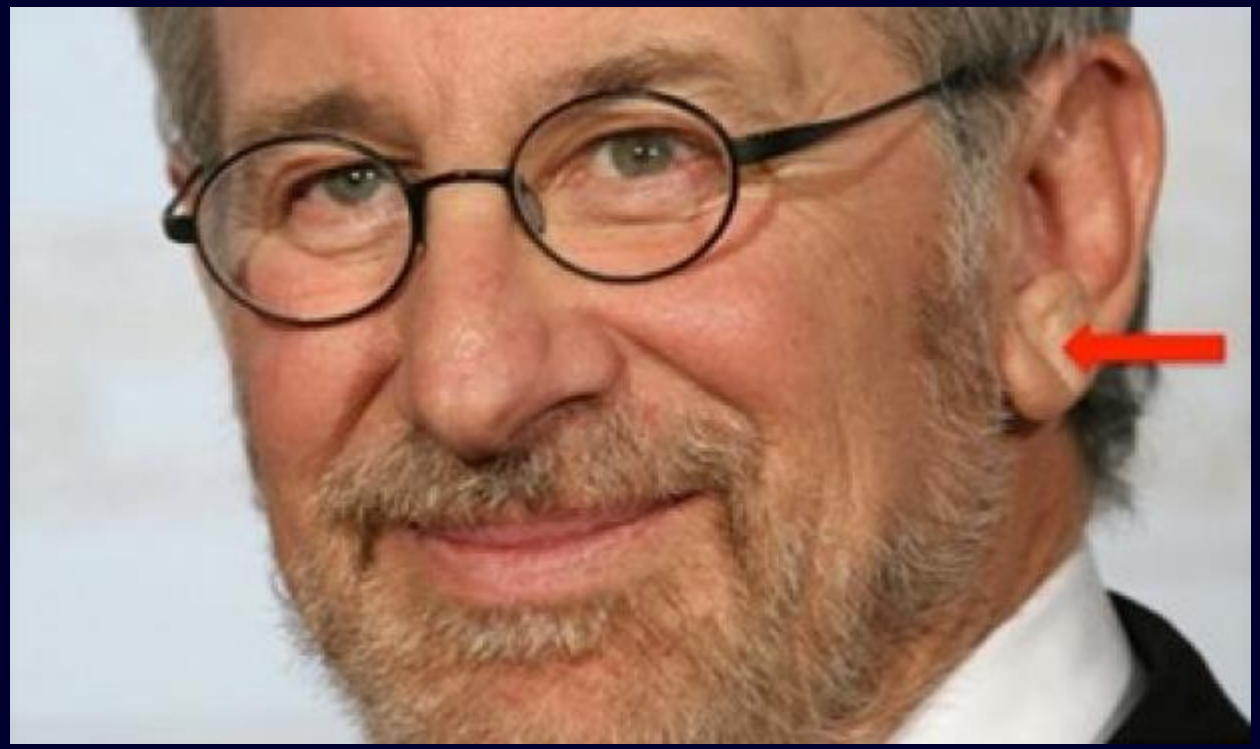
Toward the National Screening for Heart Attack Prevention and Education (SHAPE) Program



Clinical pearls for early detection



Clinical pearl
diagonal earlobe crease



Diagonal earlobe crease: Association with medical ailments

- Out of **6638** participants, 179 had DELC. The prevalence of bilateral DELC was 2.7%. The prevalence was significantly high among males (4%) and in the 51-60 years age group (5%). There were **408** (6.15%) participants who gave a history of **CAD**, 827 (12.46%) of **DM**, and 670 (10.09%) **HTN.**
- Significantly high association observed between **DELC** and **CAD, DM, and HTN.**
- Conclusions: The prevalence of bilateral DELC was 3% and is significantly associated with CAD, DM, and HTN

Kadam YR, Shah YM, and Kore P. Diagonal earlobe crease: Prevalence and association with medical ailments. *J Clin and Prev Cardiol*. 2018;7(2):49-53.

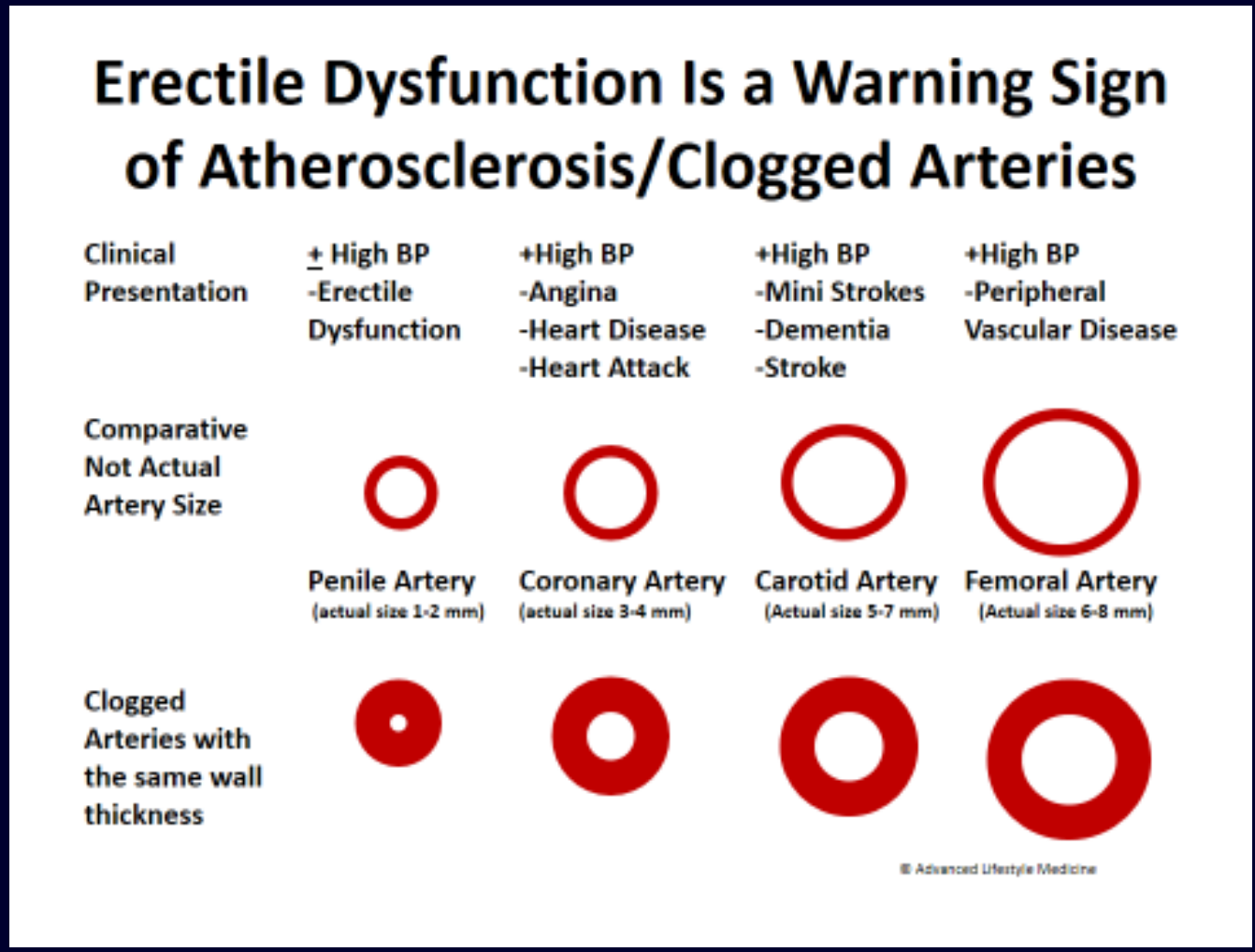
Diagonal earlobe crease: Association with medical ailments

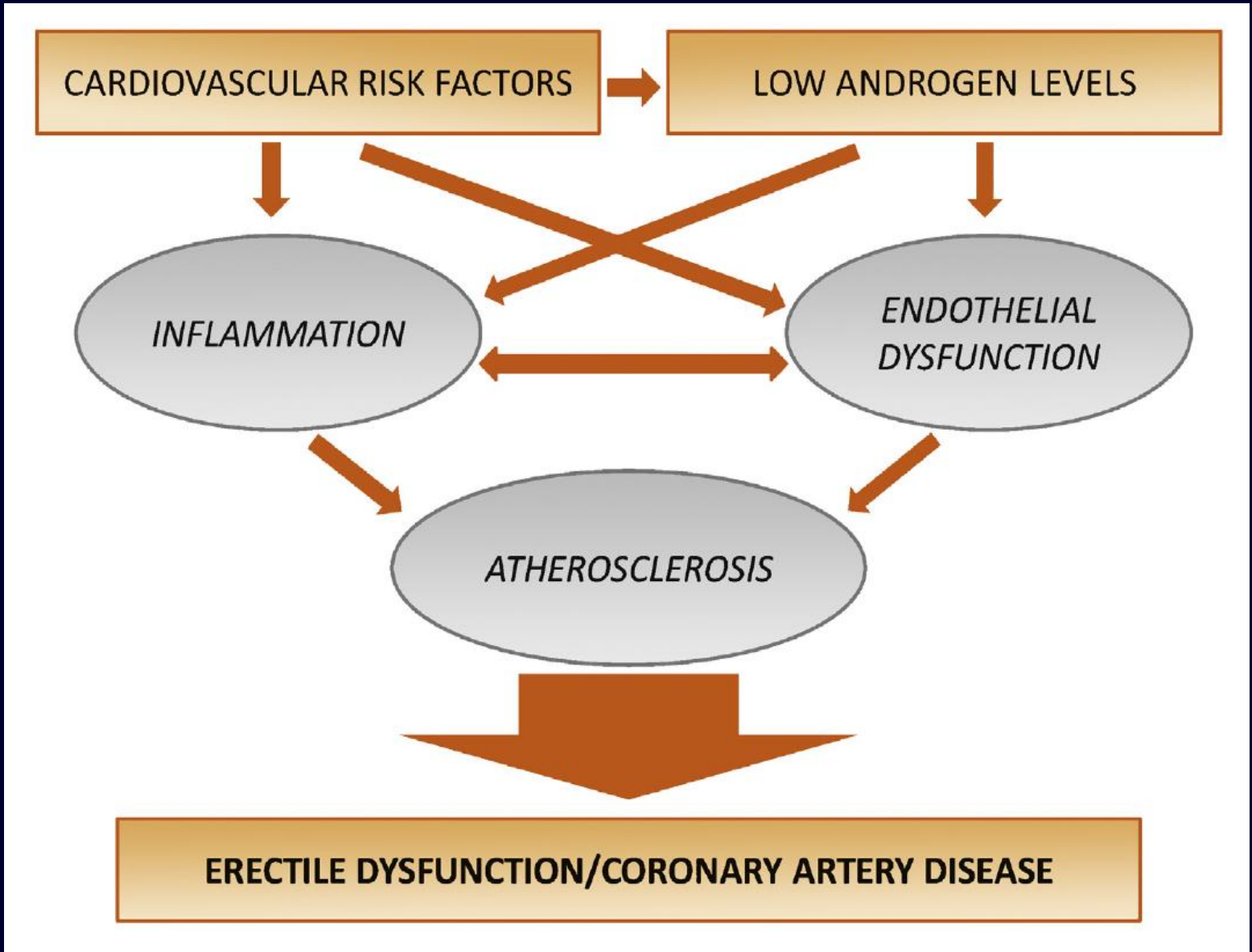
Association between DELC and CAD				
DELC	CAD		Total	Significance
	Yes, *n* (%)	No, *n* (%)		
Yes	36 (8.82)	143 (2.30)	179 (2.70)	χ^2=62.19
No	372 (91.18)	6087 (97.70)	6459 (97.30)	*P*=0.00
Total	408 (100.00)	6230 (100.00)	6638 (100.00)	
Association between DELC and DM				
DELC	DM		Total	Significance
	Yes, *n* (%)	No, *n* (%)		
Yes	34 (4.11)	145 (2.50)	179 (2.70)	χ^2=7.20
No	793 (95.89)	5666 (97.50)	6459 (97.30)	*P*=0.00
Total	827 (100.00)	5811 (100.00)	6638 (100.00)	
Association between DELC and HTN				
DELC	HTN		Total	Significance
	Yes, *n* (%)	No, *n* (%)		
Yes	42 (6.27)	137 (2.30)	179 (2.70)	χ^2=36.23
No	628 (93.73)	5831 (97.70)	6459 (97.30)	*P*=0.00
Total	670 (100.00)	5968 (100.00)	6638 (100.00)	

DELC=Diagonal earlobe crease, DM=Diabetes mellitus, HTN=Hypertension, CAD=Coronary artery disease

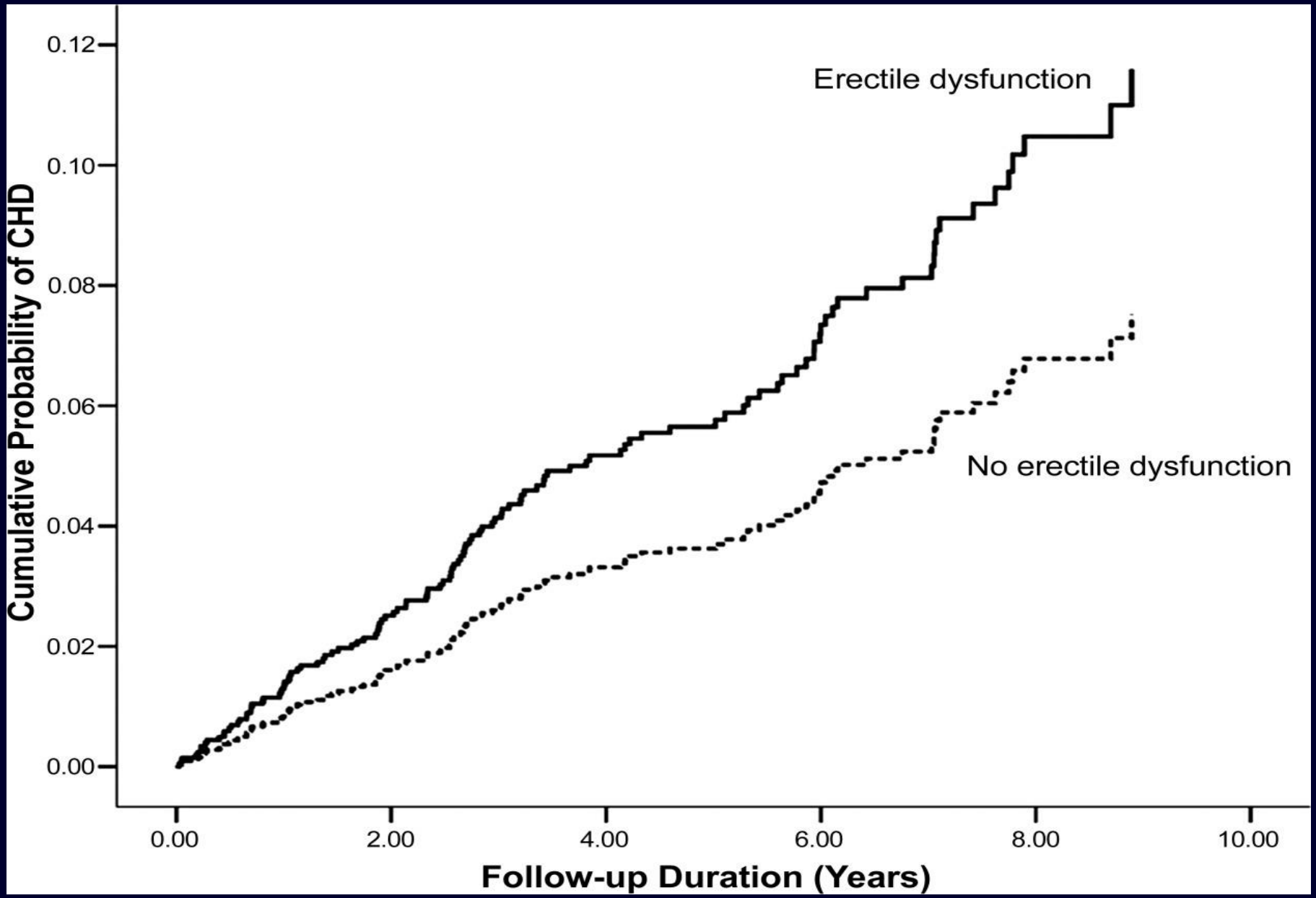
Kadam YR, Shah YM, and Kore P. Diagonal earlobe crease: Prevalence and association with medical ailments. *J Clin and Prev Cardiol*. 2018;7(2):49-53.

Canary in the coal mine



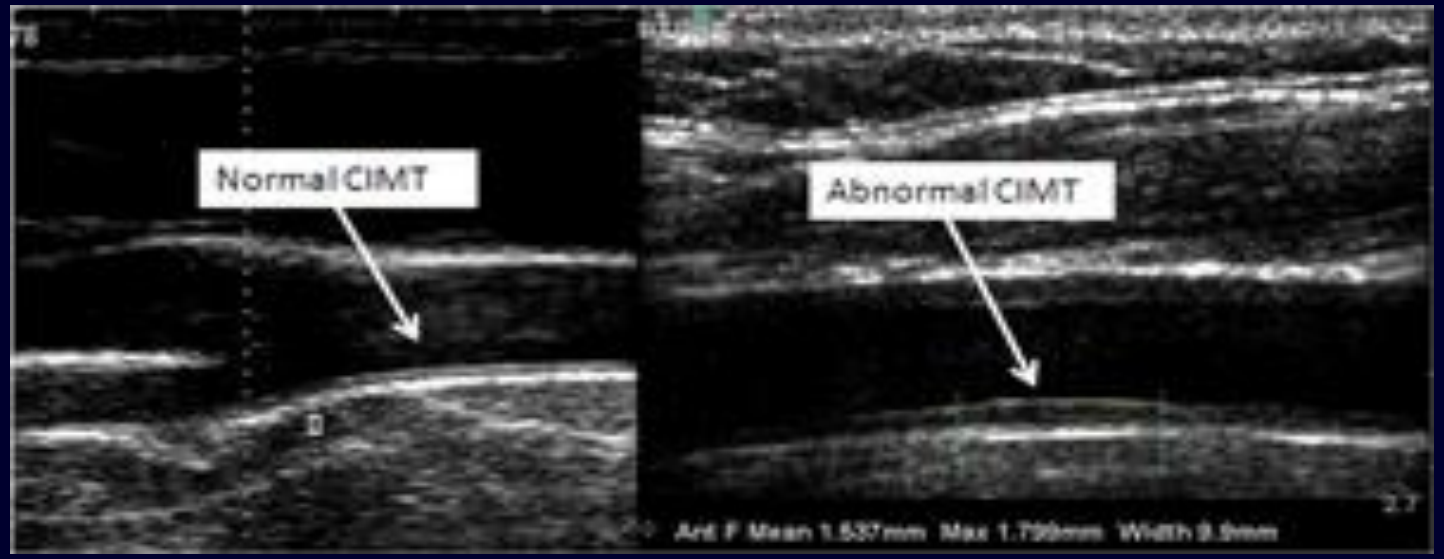


Gandaglia G, Briganti A, Jackson G, et al. A systematic review of the association between erectile dysfunction and cardiovascular disease. Eur Urol. 2014;65(5):968-78.



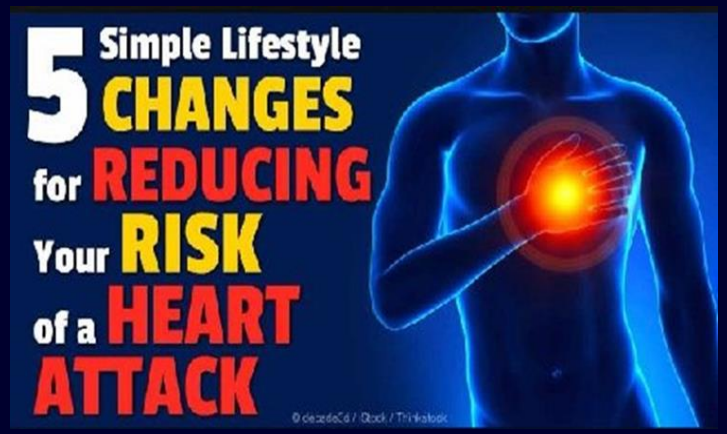
Ma RC, So WY, Yang X, et al. Erectile dysfunction predicts coronary heart disease in type 2 diabetes. J Am Coll Cardiol. 2008;51(21):2045-50.

Radical steps:
Prevent
Detect
Reverse



Lifestyle habits to prevent 85% of heart attacks

- Don’t smoke
- Walk 30-40 minutes daily/ thin waist
- Eat >5 servings of fruit/veg a day
- Sleep 7-8 hours a night
- Enjoy a few alcoholic beverages a week



Morgen Study 2013 Netherlands: 17,887 men and women

Karolinska Study 2014 Sweden 20,721 men

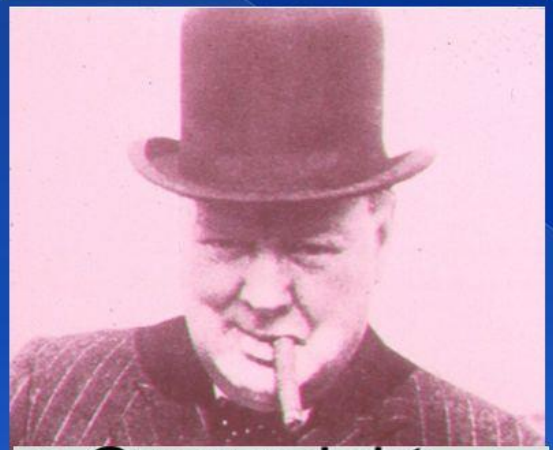
Hoevenaar-blom MP, Spijkerman AM, Kromhout D, Verschuren WM. Sufficient sleep duration contributes to lower cardiovascular disease risk in addition to four traditional lifestyle factors: the MORGEN study. Eur J Prev Cardiol. 2014;21(11):1367-75.

2. Early detection of America's #1 killer

SHAPE
Society for Heart Attack Prevention and Eradication

Support HEART ATTACK ERADICATION Campaign

Sir Winston Churchill, 91 ✝

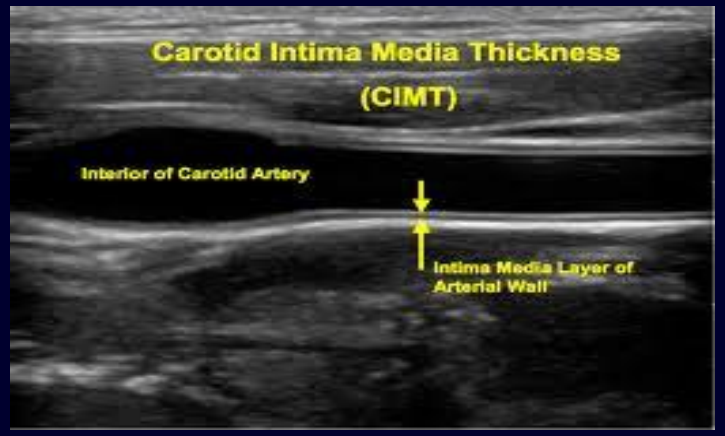


- Overweight
- Not Fit
- Heavy Smoker

Jim Fixx, 53 ✝♥

- Not Overweight
- Very Fit
- Non-Smoker

Tools of the heart attack prevention specialist



Do you know your Coronary Artery Calcium Score (CACS)?

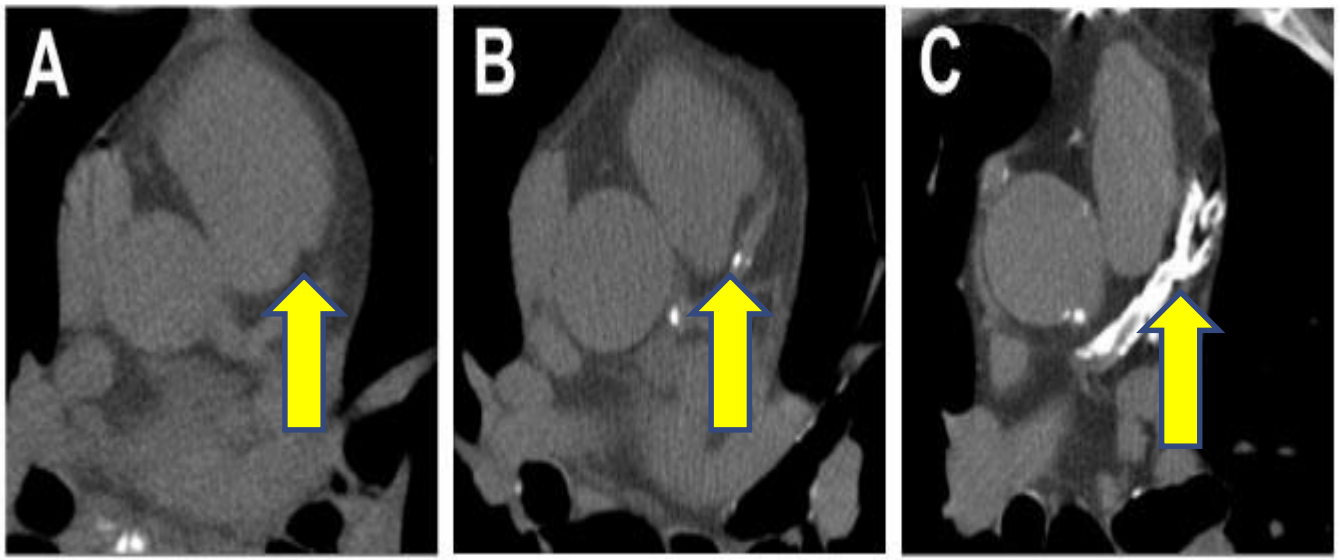
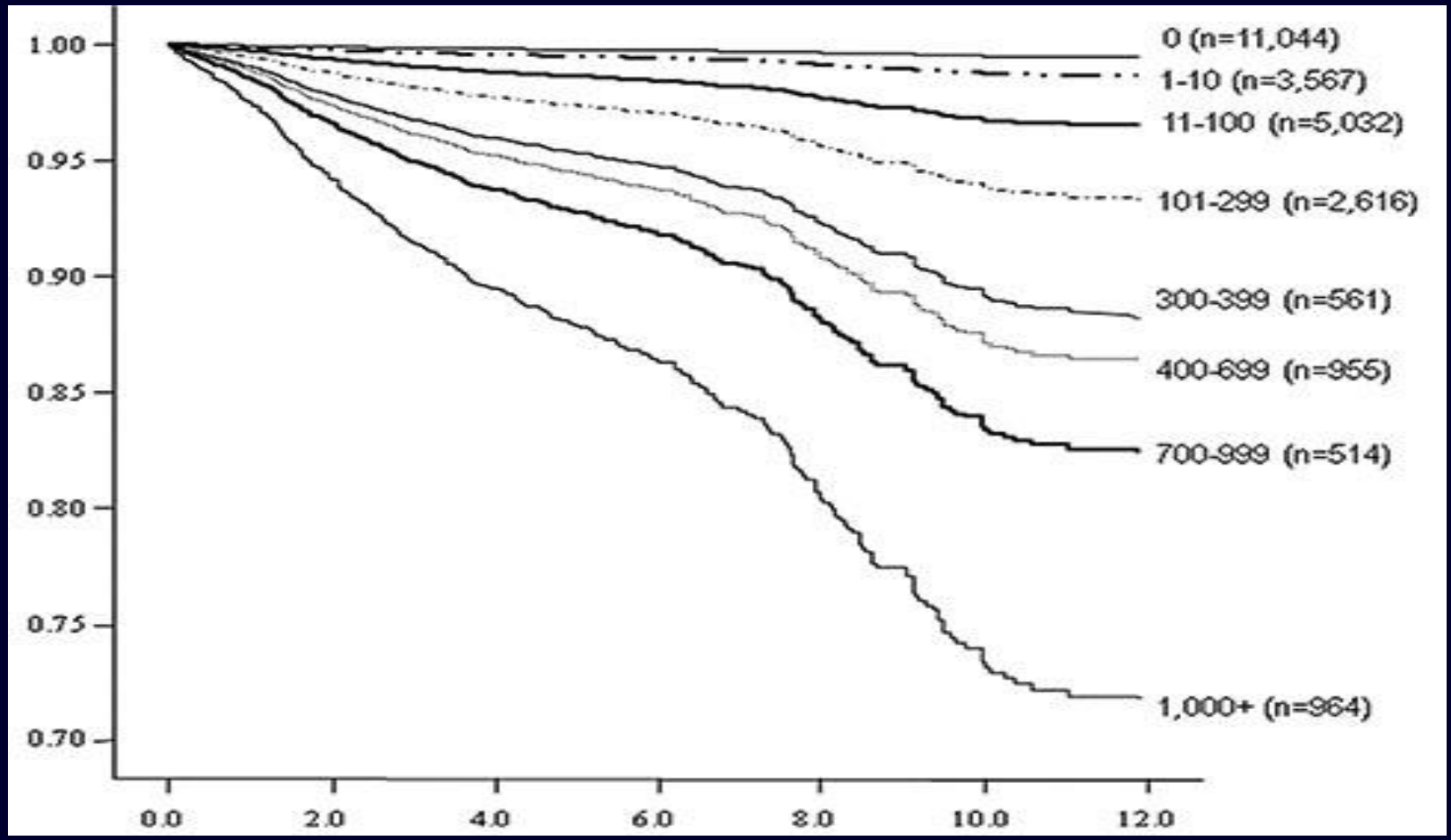


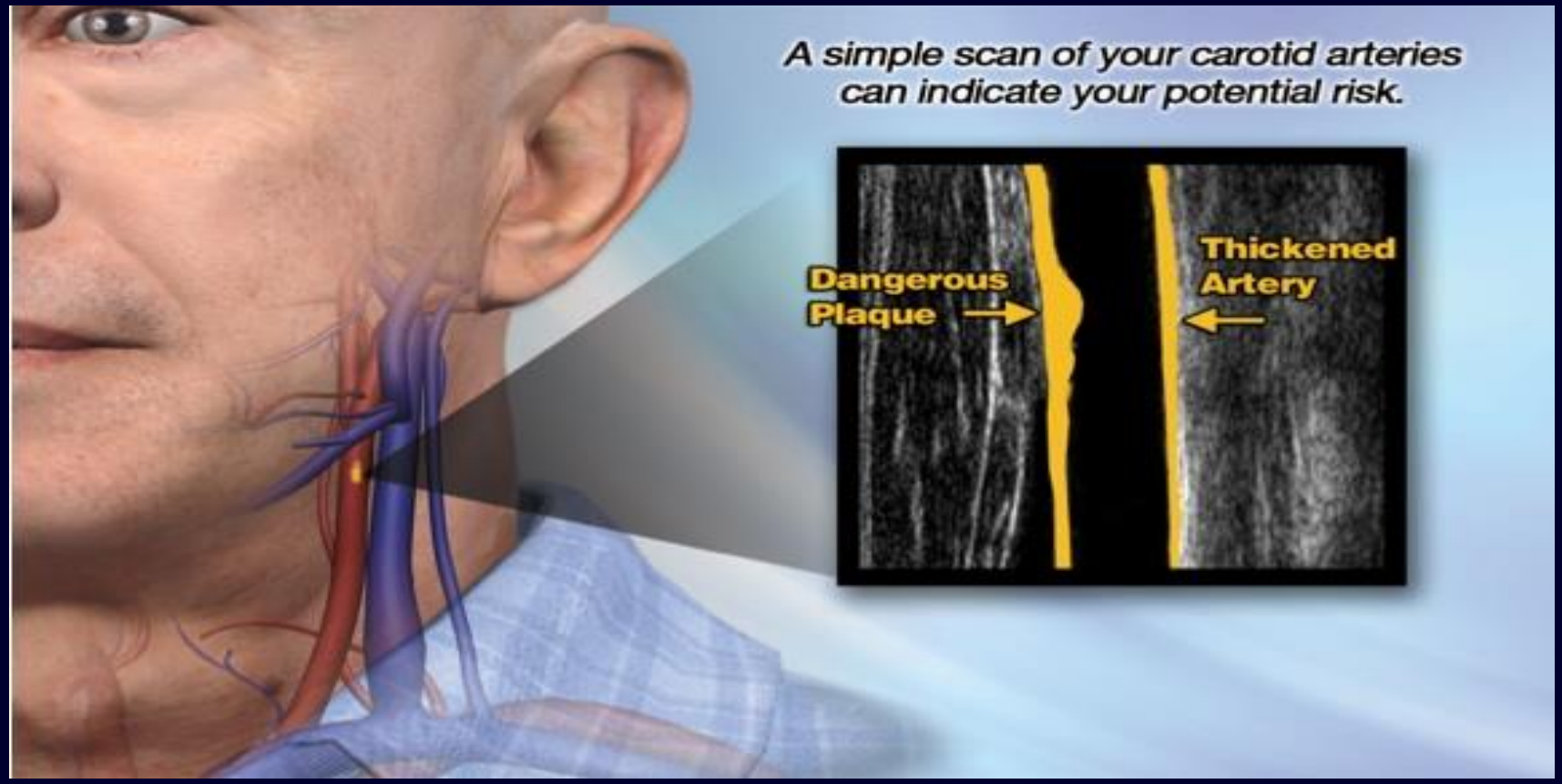
Figure 1 - *Images illustrating the coronary artery calcium score of three patients with increasing calcification grades in the territory of the anterior descending artery: A. no calcification; B. mild calcification; C. severe calcification.*

Prognosis by CACS: 12 Years



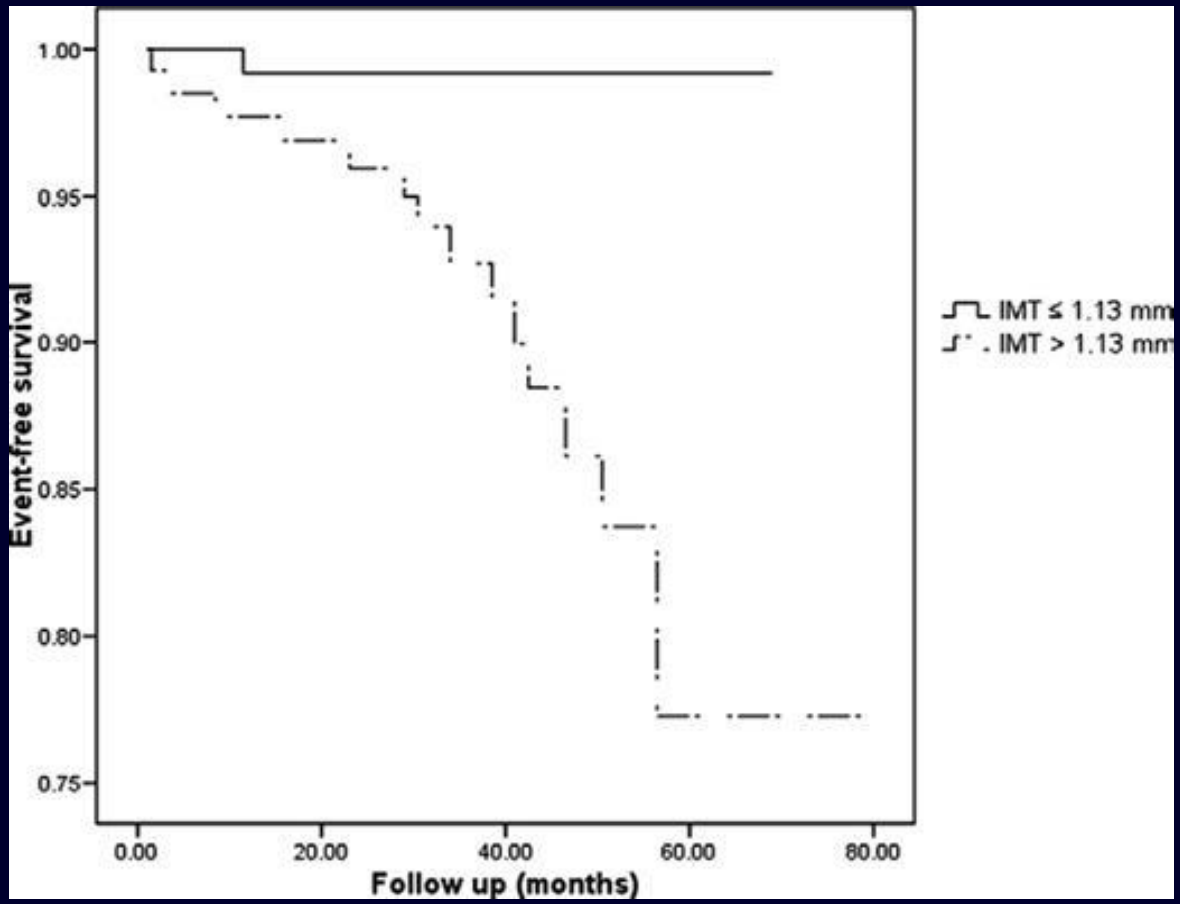
Adapted from Budoff MJ, Shaw LJ, Liu ST et al. Long-term prognosis associated with coronary calcification: observations from a registry of 25,253 patients. J Am Coll Cardiol. 2007; 49:1860-870

CIMT: Carotid Intimal medial thickening



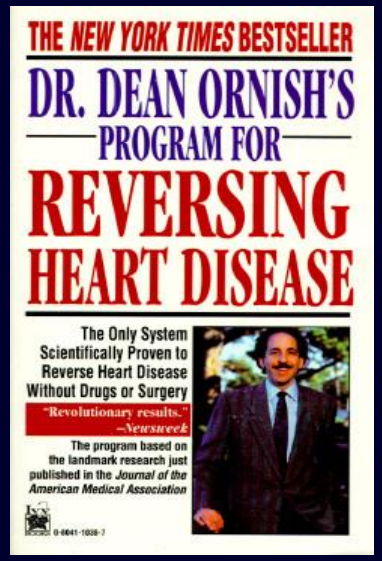
CIMT: Prognosis

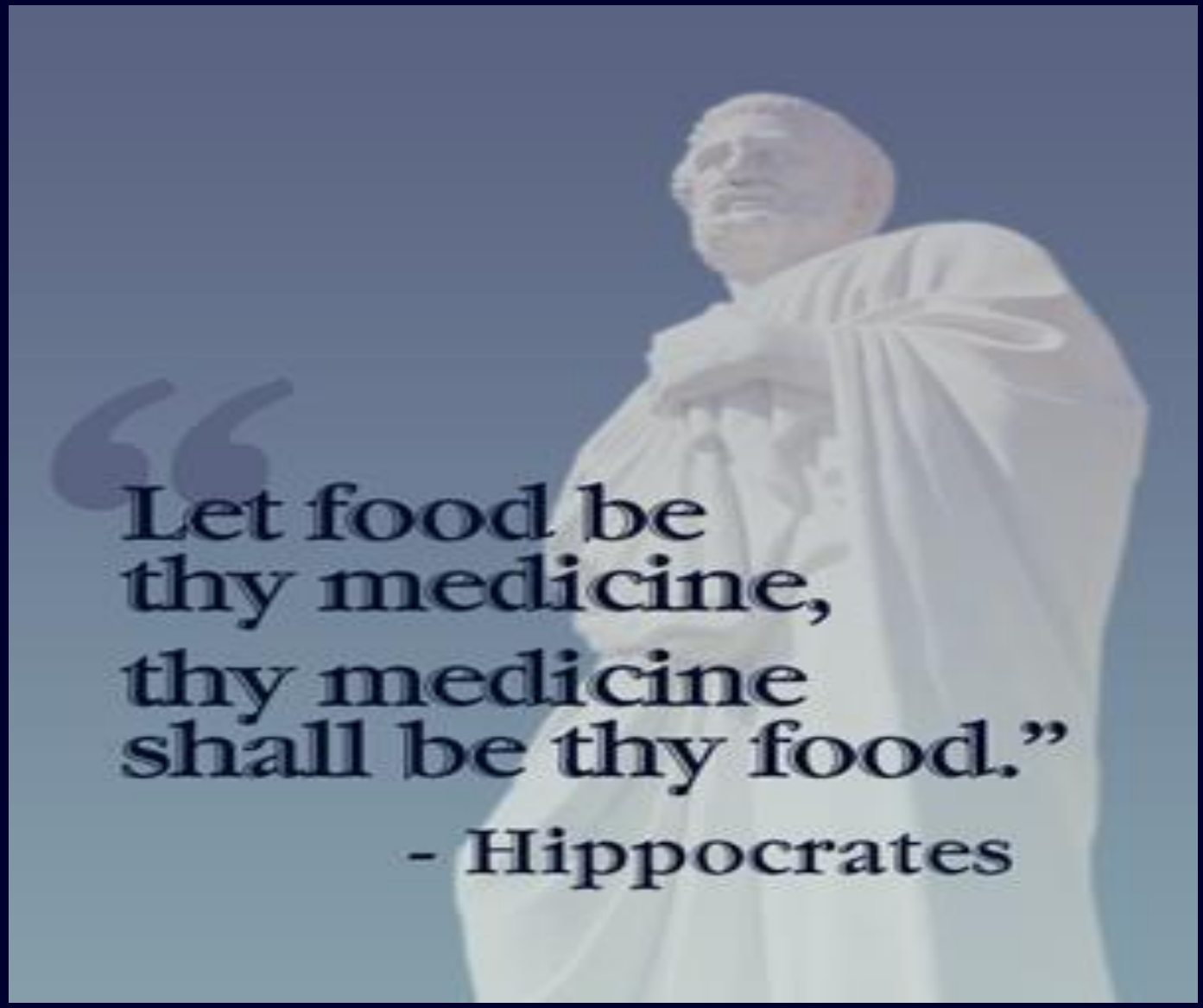
- Intima-media thickness of the carotid arteries is a strong and independent predictor of death and serious cardiovascular events in hypertensive patients with CAD referred for coronary angiography.



Zielinski T, Dzielinska Z, Januszewicz A, et al. Carotid intima-media thickness as a marker of cardiovascular risk in hypertensive patients with coronary artery disease. Am J Hypertens. 2007;20(10):1058-64.

3. Heart disease is reversible




“Let food be
thy medicine,
thy medicine
shall be thy food.”
- Hippocrates

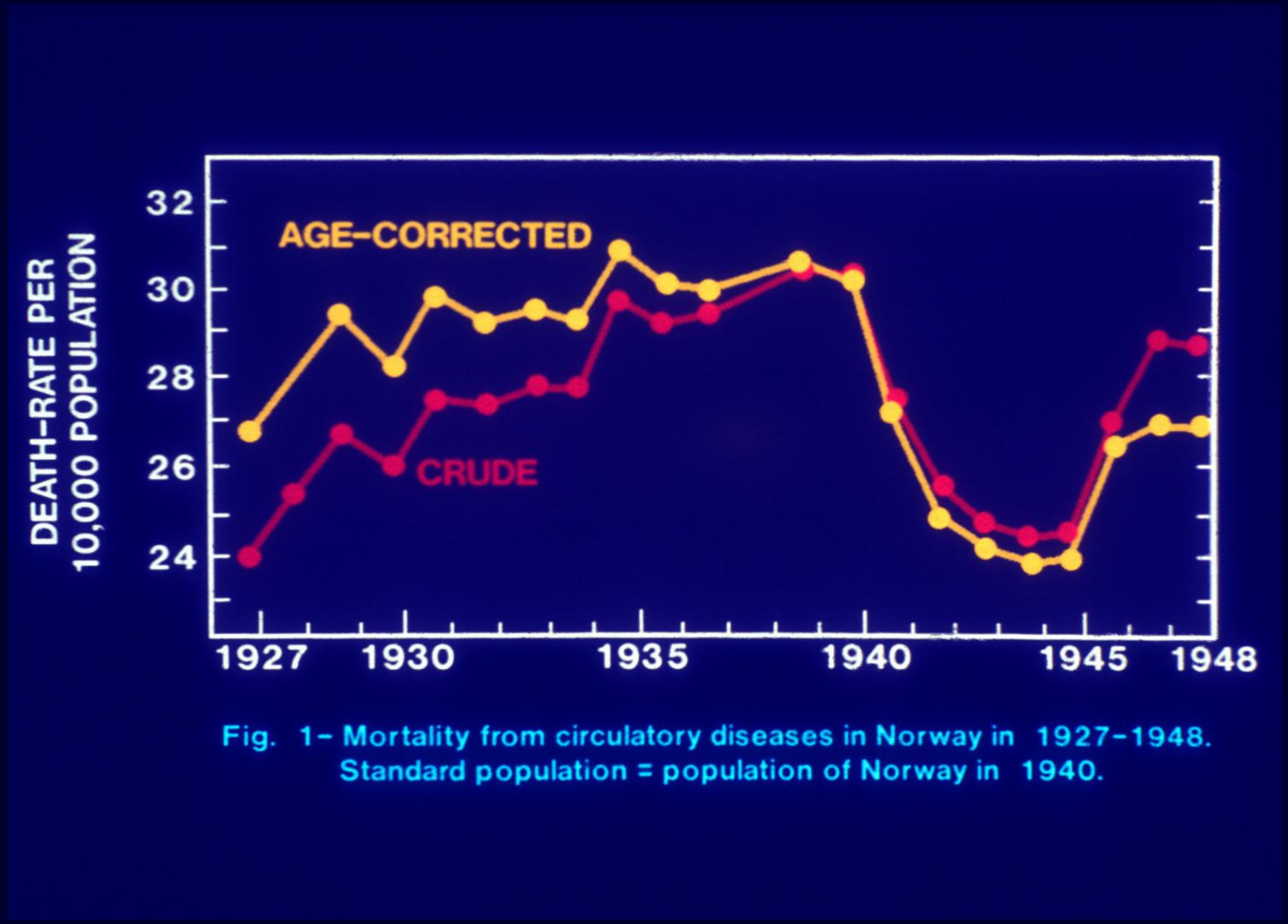


Fig. 1- Mortality from circulatory diseases in Norway in 1927-1948.
Standard population = population of Norway in 1940.

Strom A, Jensen RA. Mortality from Circulatory Diseases in Norway 1940-1945. *The Lancet*. 1951; 1(3): 126-129.

- sfsdfs

REDUCTION OF MORTALITY RATE IN CORONARY DISEASE BY A LOW CHOLESTEROL-LOW FAT DIET.

(1951) AM. HEART J. 42: 538-545.

- 100 Cases within 6 months post-infarction to either a low-cholesterol, low-fat diet or alternatively to a control not intervened upon
- After three years the test group reduced **166** lbs. in men and **141** lbs. in women to **145** lbs. and **124** lbs and cholesterol fell from 312 mg % to 220 in the diet group
- A sense of optimism, feelings of well-being and good spirits, increased exercise tolerance, increased working capacity, and decreased anginal symptoms

Lester Morrison, MD

Foods To Be Avoided

SOUPS: Cream Soups.

MEATS: All glandular organs, as liver, brains, kidney, sweetbreads; pork and very fat meats, fat fish, fish roe.

MILK AND MILK PRODUCTS: Whole milk, cream, cheddar, Swiss and all rich cheese and cheese spreads; excessive butter and butter substitutes.

EGGS: Egg yolks.

BREADS: Hot breads, pancakes, waffles, coffee cakes, muffins, doughnuts.

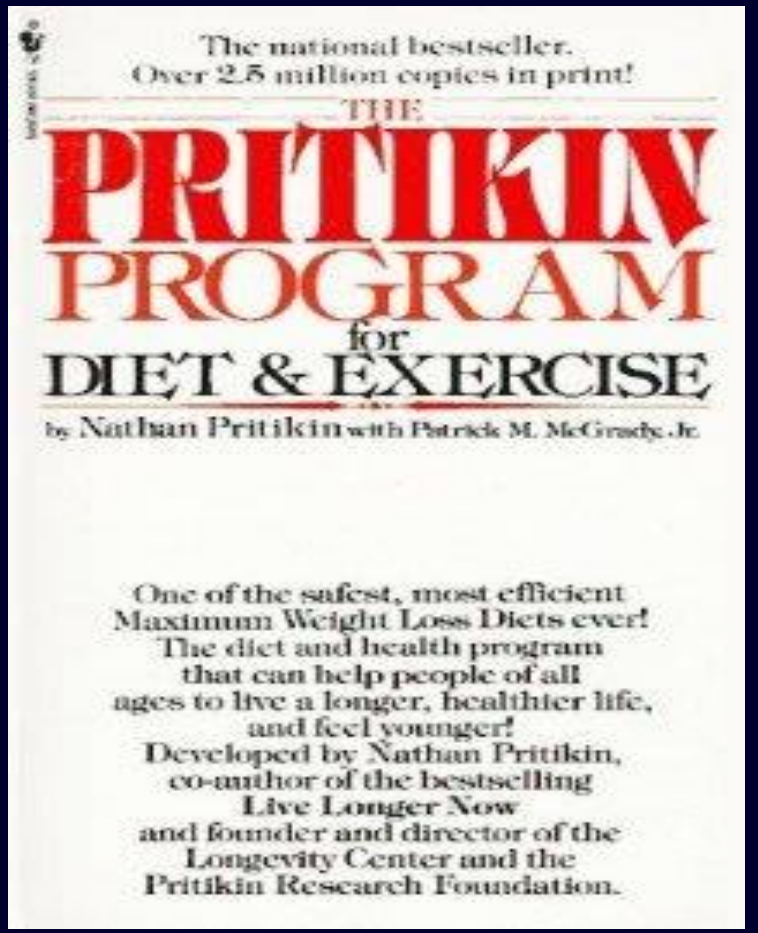
DESSERTS: Any made with cream and egg yolks; pies, frozen creams, rich cakes and cookies.

CONCENTRATED FATS: The excessive use of fats in any form, as salad dressings, olive or vegetable oils, suet, chicken or pork fat.

MISCELLANEOUS: Rich gravies, olives, nuts and avocados.

Morrison low-fat diet results

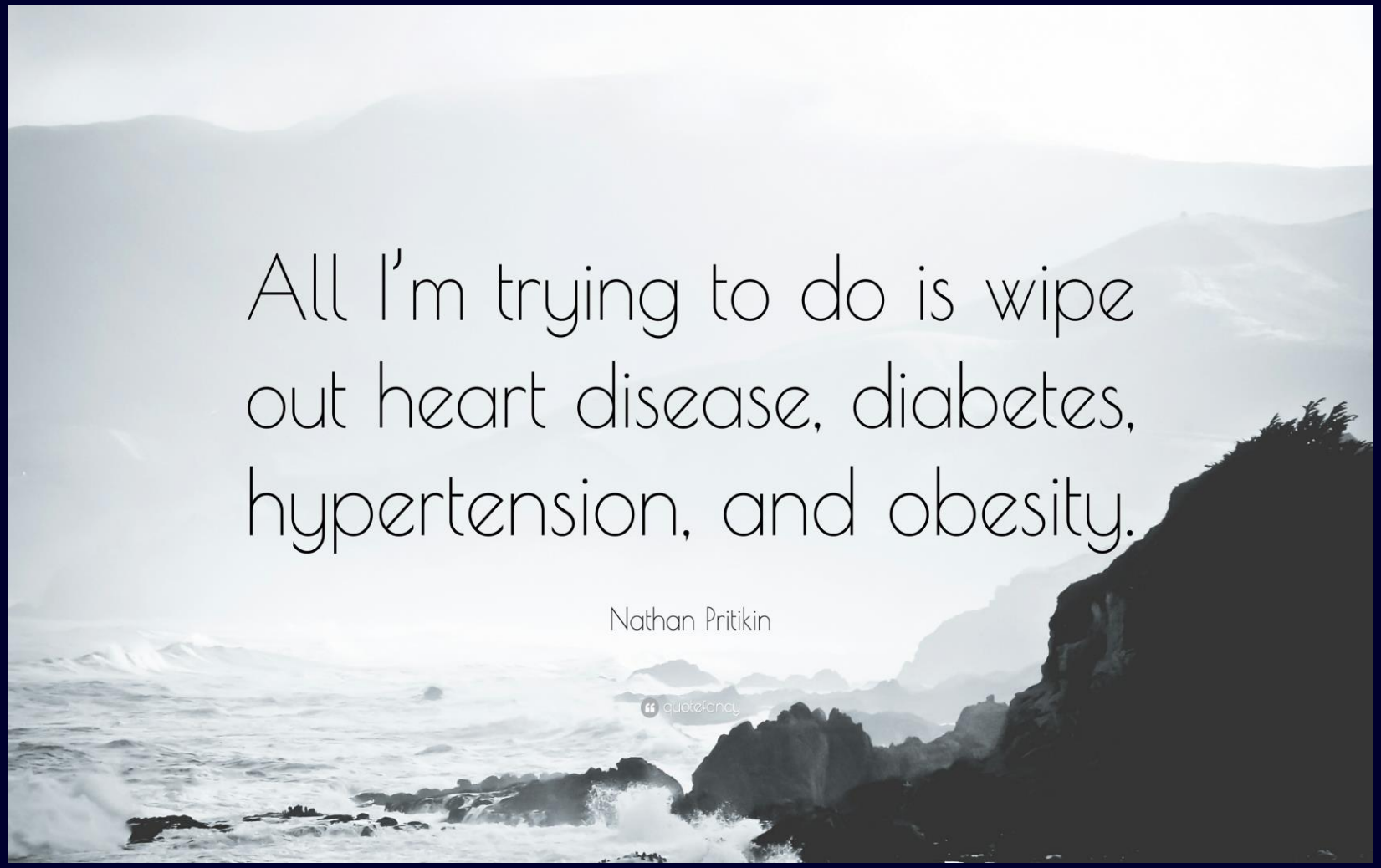
Nathan Pritikin



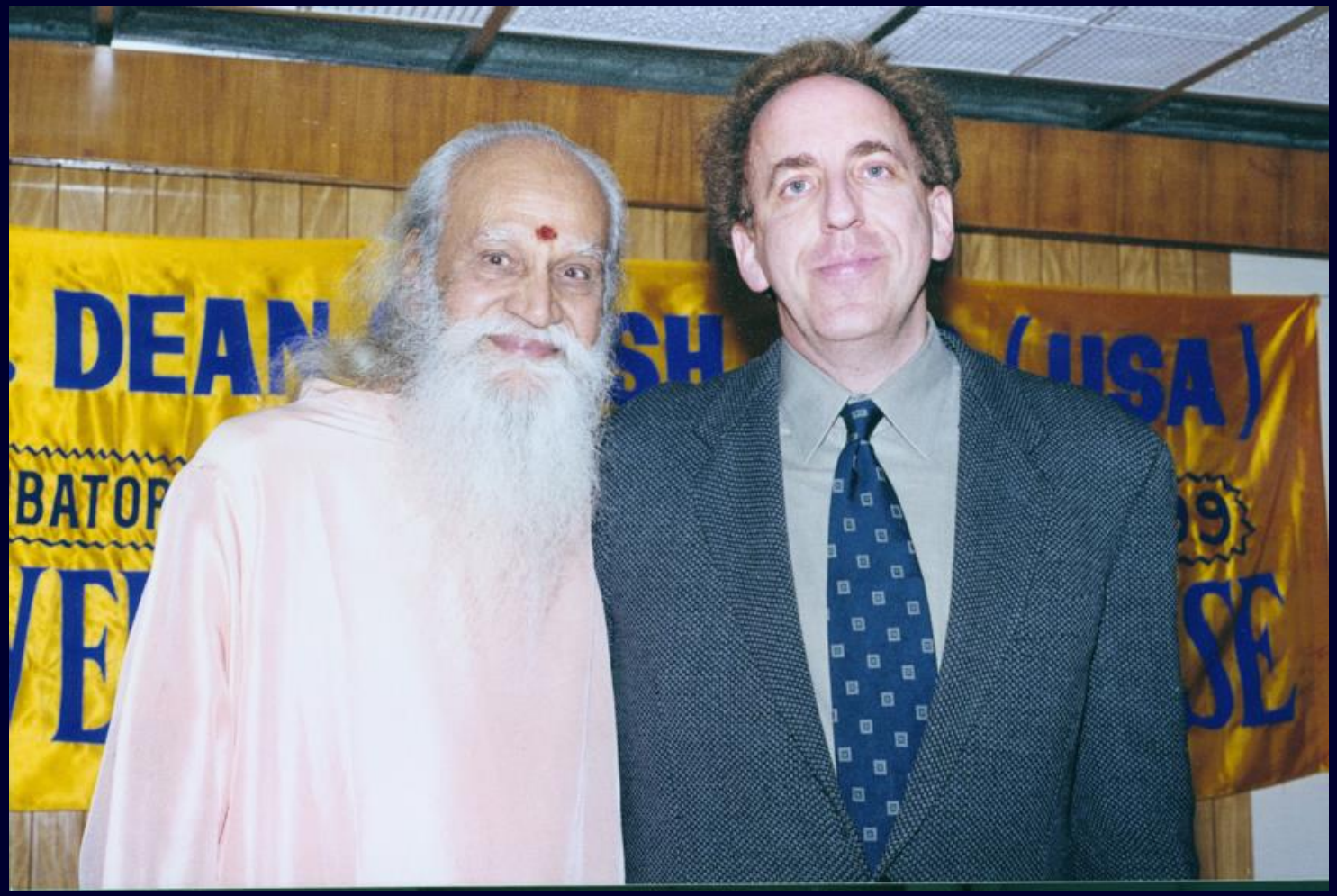
Pritkin lifestyle program

- 3-week residential program with exercise and ad libitum low fat (<10% of calories) plant based diet
- 4566 men and women
- Mean LDL-C reduction 25% in men and 20% in women
- Significant reductions in TG and HDL-C
- Significant 3.2% reduction in body weight

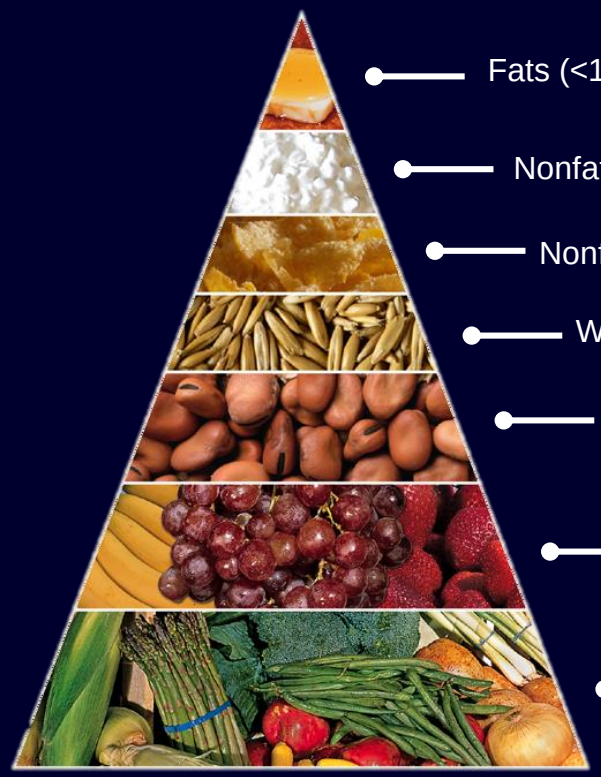
Barnard et al. *Arch Intern Med* 1991;151:1389-1394.


All I'm trying to do is wipe out heart disease, diabetes, hypertension, and obesity.
Nathan Pritikin
quotefancy

The doctor and the guru



Original Ornish Plan



Fats (<10%)

Nonfat dairy products – yogurt, cheese, egg whites

Nonfat products – cereal, soups, tofu, crackers, egg beaters

Whole grain – corn, rice, oats, wheat, etc.

Beans and legumes

Fruits

Vegetables

No calorie restriction

2) Moderate exercise
3) Stress reduction
4) Smoking cessation

<u>Excluded</u>
All oils
All meats
Olives
Avocados
Nuts – seeds
High or low fat products
Sugar – syrup – honey
Alcohol

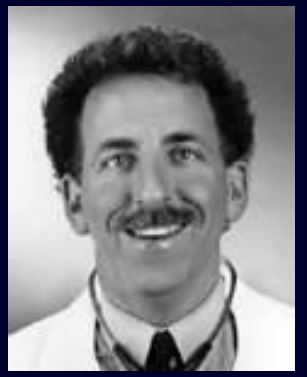
The Lancet
21 July 1990, Vol.336(8708):129–133,
doi:10.1016/0140-6736(90)91656-U
Originally published as Volume 336, Issue 8708

MEDICAL SCIENCE

Can lifestyle changes reverse coronary heart disease?

The Lifestyle Heart Trial

D. Ornish MD [a,b], S.E. Brown MD [a,b], J.H. Billings PhD [a,b], L.W. Scherwitz PhD [c], W.T. Armstrong MD [d], T.A. Ports MD [e], S.M. McLanahan MD [f], R.L. Kirkeeide PhD [g], K.L. Gould MD [g] (Prof), R.J. Brand PhD [h] (Prof)



Intensive Lifestyle Changes for Reversal of Coronary Heart Disease

Dean Ornish, MD; Larry W. Scherwitz, PhD; James H. Billings, PhD, MPH; K. Lance Gould, MD; Terri A. Merritt, MS; Stephen Sparler, MA; William T. Armstrong, MD; Thomas A. Ports, MD; Richard L. Kirkeeide, PhD; Charissa Hogeboom, PhD; Richard J. Brand, PhD

Context.—The Lifestyle Heart Trial demonstrated that intensive lifestyle changes may lead to regression of coronary atherosclerosis after 1 year.

Objectives.—To determine the feasibility of patients to sustain intensive lifestyle changes for a total of 5 years and the effects of these lifestyle changes (without lipid-lowering drugs) on coronary heart disease.

Design.—Randomized controlled trial conducted from 1986 to 1992 using a randomized invitational design.

Patients.—Forty-eight patients with moderate to severe coronary heart disease were randomized to an intensive lifestyle change group or to a usual-care control group, and 35 completed the 5-year follow-up quantitative coronary arteriography.

Setting.—Two tertiary care university medical centers.

Intervention.—Intensive lifestyle changes (10% fat whole foods vegetarian diet, aerobic exercise, stress management training, smoking cessation, group psychosocial support) for 5 years.

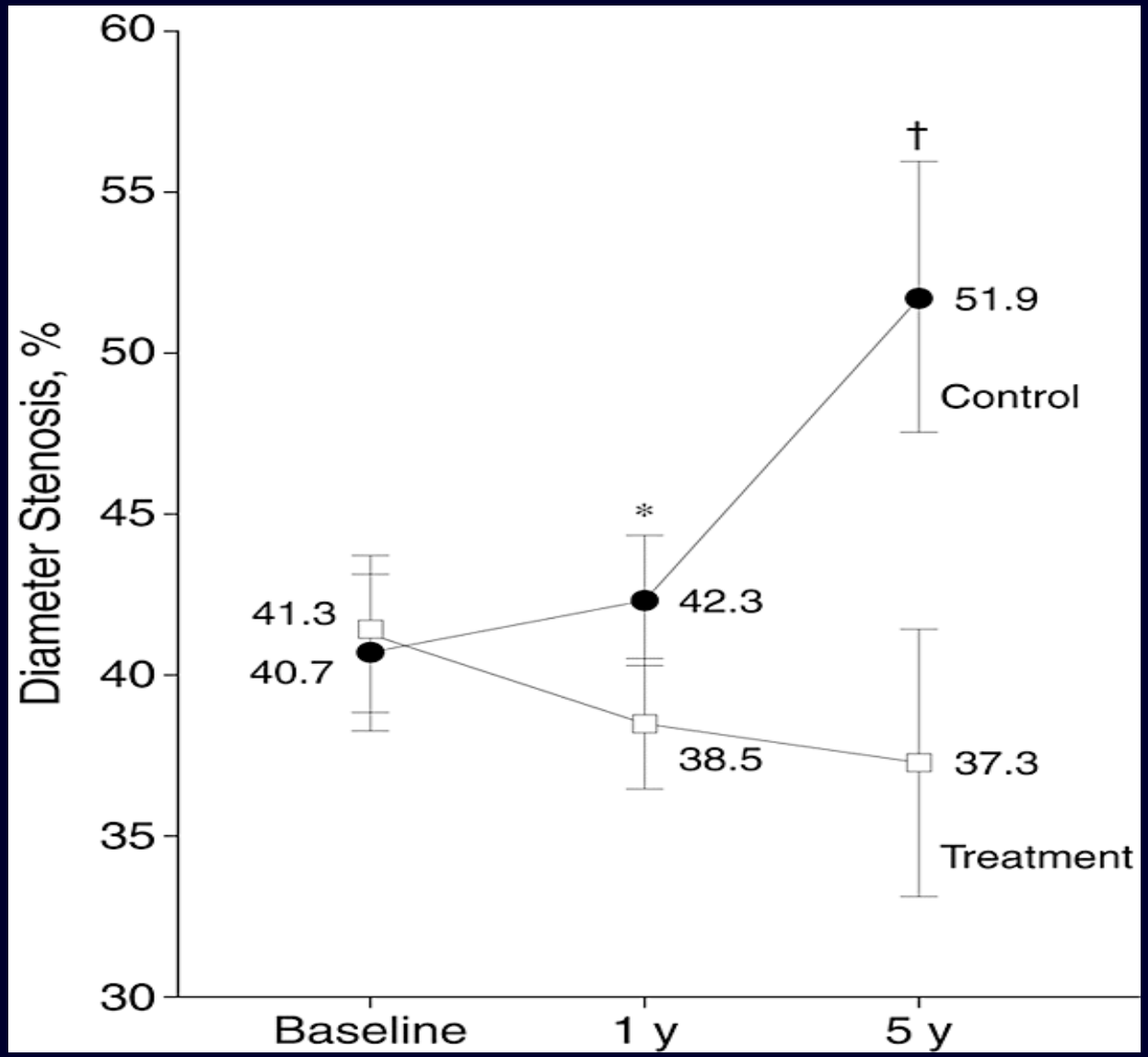
Main Outcome Measures.—Adherence to intensive lifestyle changes, changes in coronary artery percent diameter stenosis, and cardiac events.

THE LIFESTYLE Heart Trial was the first randomized clinical trial to investigate whether ambulatory patients could be motivated to make and sustain comprehensive lifestyle changes and, if so, whether the progression of coronary atherosclerosis could be stopped or reversed without using lipid-lowering drugs as measured by computer-assisted quantitative coronary arteriography. This study derived from earlier studies that used noninvasive measures.[1,2]

After 1 year, we found that experimental group participants were able to make and maintain intensive lifestyle changes and had a 37.2% reduction in low-density lipoprotein (LDL) choles-

Ornish, D. et al. (1998). JAMA, 280, 2001–2007

Lifestyle Heart Trial: 5 Year QCA Data



Ornish and Pritikin Programs Approved by CMS

In August 2010, the Centers for Medicare and Medicaid Services (CMS) approved the Ornish Program for Reversing Heart Disease and the Pritikin Program for inclusion in the list of approved intensive cardiac rehabilitation (ICR) programs for Medicaid and Medicare reimbursement.

The Ornish Program for Reversing Heart Disease (also known as the Multisite Cardiac Lifestyle Intervention Program, Multicenter Cardiac Lifestyle Intervention Program, and the Lifestyle Heart Trial program) was initially described in the 1970s and incorporates comprehensive lifestyle modifications, including exercise, a low-fat diet, smoking cessation, stress management training, and group support sessions. Extensive research has continued over the past 30 years, although the focus of the intervention (lifestyle modifications) did not change.

The Pritikin Program (also known as the Pritikin Longevity Program) originated in the 1950s and is a comprehensive program that is provided in a physician's office and incorporates a specific diet (10-15 percent of calories from fat, 15-20 percent from protein, 65-75 percent from complex carbohydrates), exercise, and counseling lasting 21-26 days. An optional residential component is also available for participants.

To qualify for reimbursement, the Ornish and Pritikin programs had to meet the ICR program requirements set forth by Congress in the Social Security Act and in CMS regulations. As required by the Social Security Act, an ICR program must show, in peer-reviewed published research, that it improves patients' cardiovascular disease through specific outcomes. The program must also demonstrate through peer-reviewed, published research that it has accomplished one or more of the following for its patients: (1) positively affected the progression of coronary heart disease, (2) reduced the need for coronary bypass surgery, and (3) reduced the need for percutaneous coronary interventions. Additionally, the program must show that it accomplished a statistically significant reduction in five or more of the following measures for patients from their levels before cardiac rehabilitation services to after cardiac rehabilitation services: (1) low density lipoprotein, (2) triglycerides, (3) body mass index, (4) systolic blood pressure, (5) diastolic blood pressure, and (6) the need for cholesterol, blood pressure, and diabetes medications. Intensive cardiac rehabilitation programs must be approved through the NCD process to ensure that they demonstrate these accomplishments; ICR sessions are limited to 72 one-hour sessions, up to six sessions per day, over a period of up to 18 weeks.

CMS staff reviewed six studies of the Pritikin program and nine on the Ornish version appearing in peer-reviewed publications. Ornish's most recent study—"The Effectiveness and Efficacy of an Intensive Cardiac Rehabilitation Program in 24 Sites"—was published in the March/April issue of *The Science of Health Promotion*. This study summarizes the experience of almost 3,000 patients who went through 24 different hospital programs that the Preventive Medicine Research Institute trained in various parts of the country. In brief, the investigators found significant improvements in all metrics and that these were sustained for at least one year.

Individual hospitals and clinics wishing to provide the Ornish program for the Medicare and Medicaid patients should go tohttp://www.pmri.org/certified_programs.html for further information. Additional information and the official CMS approval is listed at: http://www.cms.gov/MedicareApprovedFacilitie/07_ICR.asp#TopOfPage.

Bravewell Seeks Best Practices

The Bravewell Collaborative has launched a new program to recognize and highlight best practices from integrative medicine centers and programs throughout the United States. The submission process is open to anyone. Best practices are reviewed by a committee of experts and, if approved, posted on the Bravewell Web site to share with the field.

"By documenting best practices and making them easily available to those working within health care, we hope to bring attention to how integrative medicine can improve patient care," said Teresa Bonner, vice president of programs for the Bravewell Collaborative.

Best practices should be submitted to: info@bravewell.org. Please put "Best Practices" in the subject line.

Criteria

To be considered a best practice, the model, program, or intervention must have been in use for the more than three years and be based on documented patient outcomes. Please include information on the following in the submission:

- name and contact information of author
- name and description of clinic, center, or hospital where the practice is in use
- what health challenge is being treated
- a complete description of the model of care, program, or practice
- what type of healthcare providers deliver the best practice and how they are credentialed
- how patients are recruited or selected for the practice
- patient intake and assessment forms used
- patient outcomes data
- any cost-effectiveness data
- a description of how the program or practice interfaces with the larger organization

George Family Foundation Integrative Nursing Fellowship

The George Family Foundation recently awarded a grant of $556,000 to the Center for Spirituality & Healing at the University of Minnesota to create a fellowship and cocurricular program that will prepare nurse leaders in integrative health and healing.

Over the next six years, the fellowship program will provide unprecedented clin-

A STRATEGY TO ARREST AND REVERSE CORONARY ARTERY DISEASE: A 12-YEAR LONGITUDINAL STUDY OF A SINGLE PHYSICIAN'S PRACTICE

Caldwell B. Esselstyn, Jr., MD

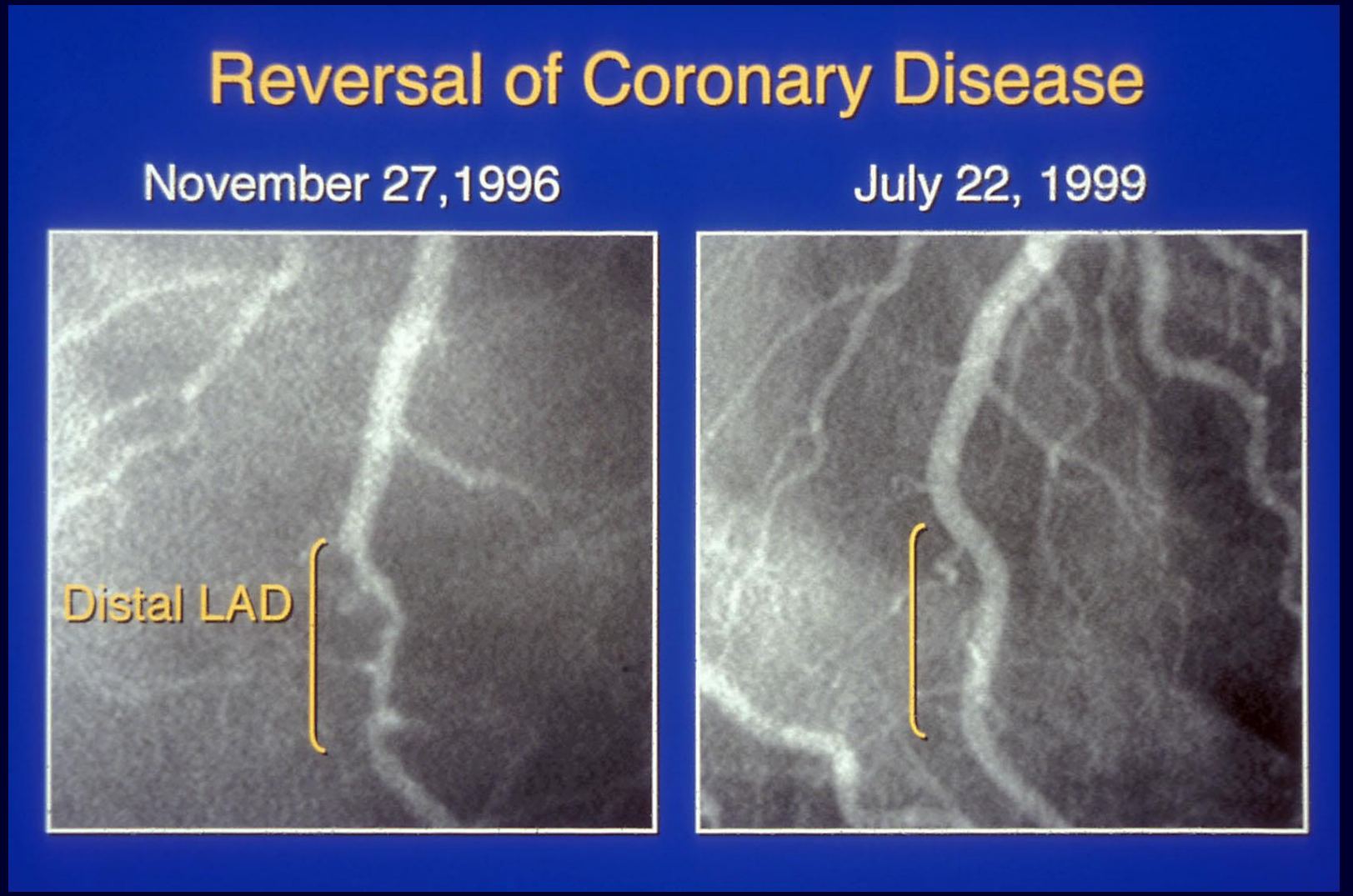
Foods to be included

- Whole grains
- Legumes, lentils
- Vegetables
- Fruit

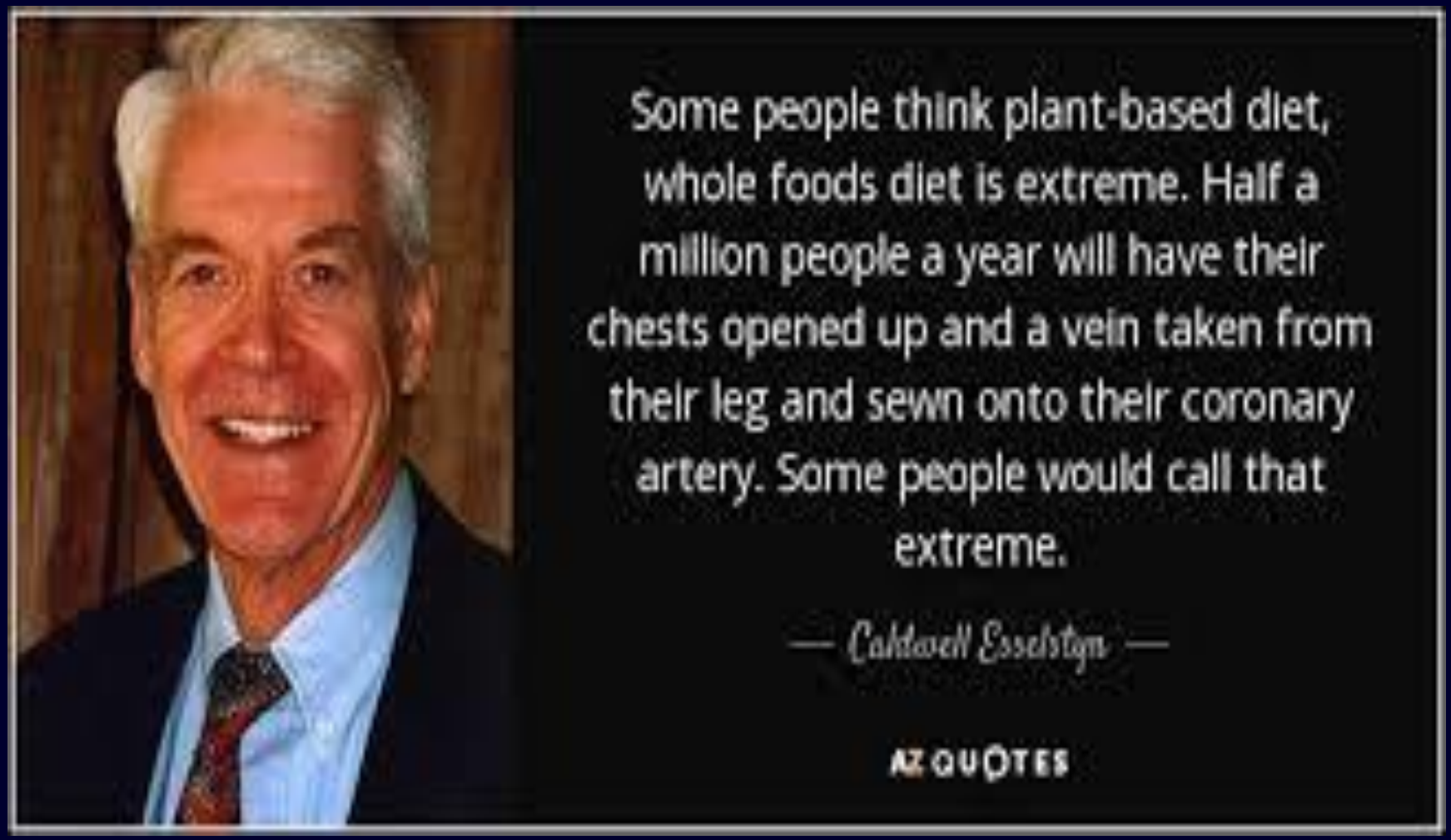
Foods to be excluded

- Added oils
- Fish
- Fowl
- Meat
- All dairy

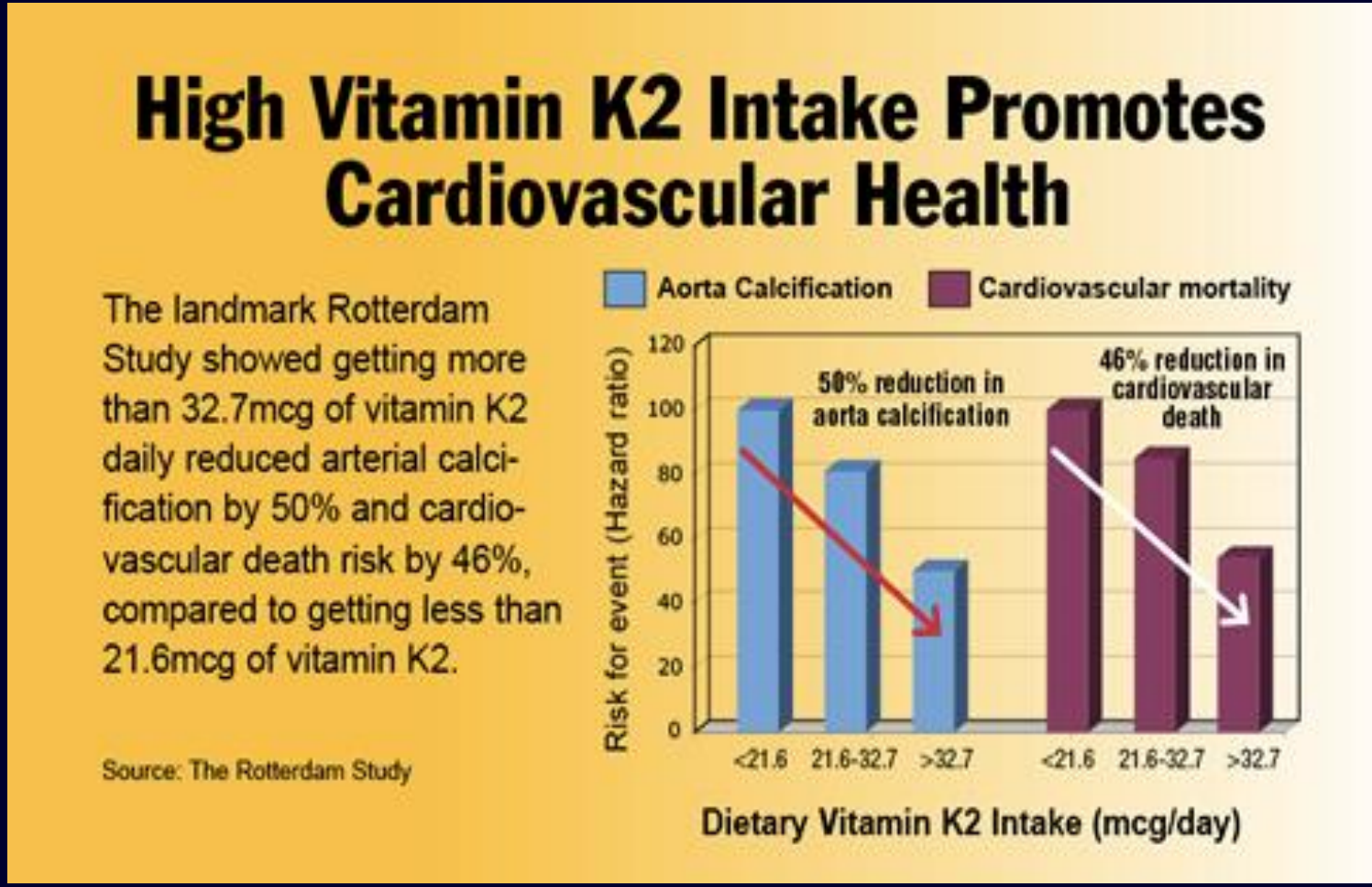
Diet – 11% fat – plant based
Cholesterol lowering medication
Unstructured exercise



Esselstyn CB, Gendy G, Doyle J, Golubic M, Roizen MF. A way to reverse CAD?. J Fam Pract. 2014;63(7):356-364b.

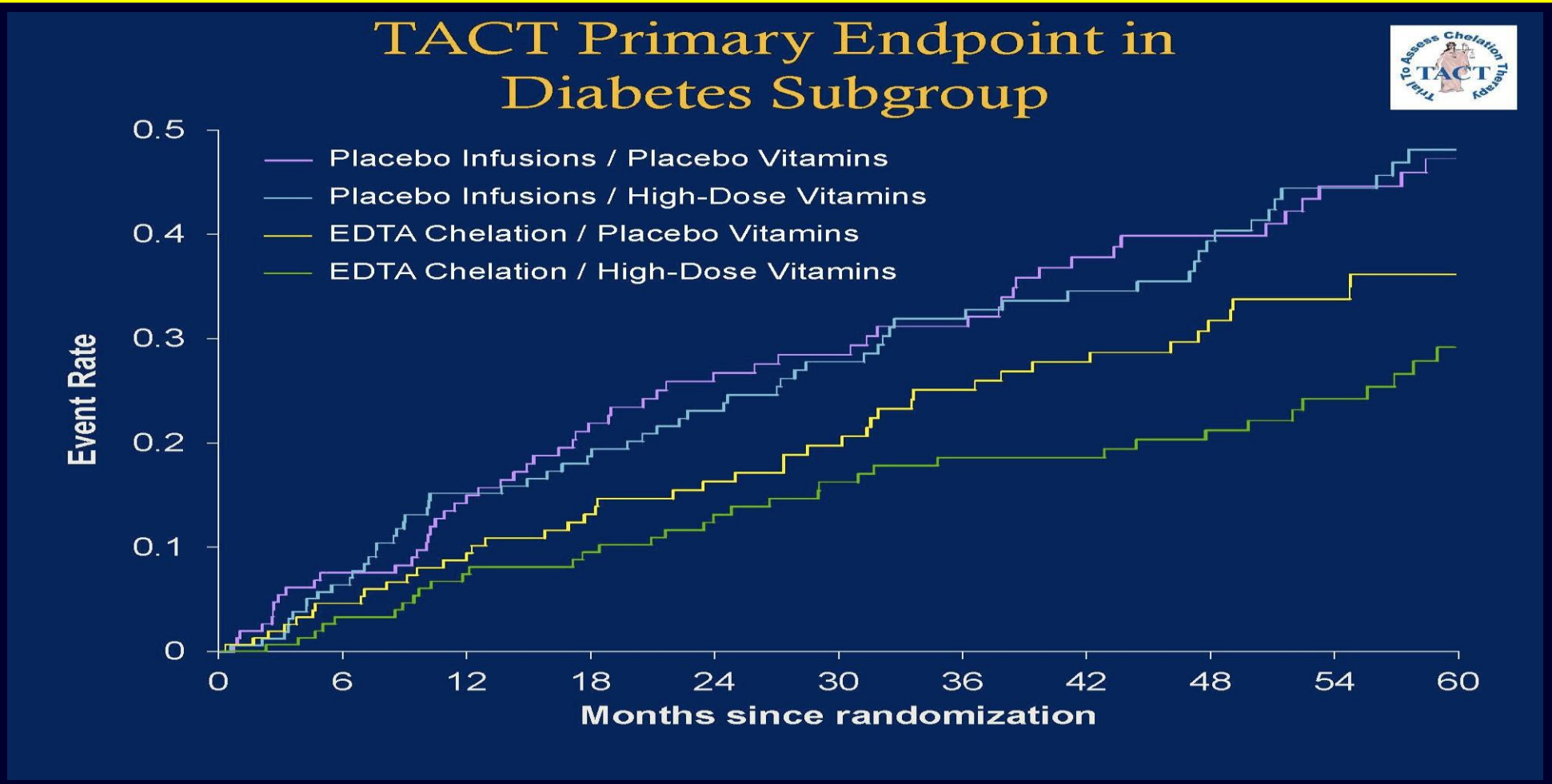

Some people think plant-based diet, whole foods diet is extreme. Half a million people a year will have their chests opened up and a vein taken from their leg and sewn onto their coronary artery. Some people would call that extreme.
— Caldwell Esselstyn —
AZ QUOTES

Additional Reversal Strategies



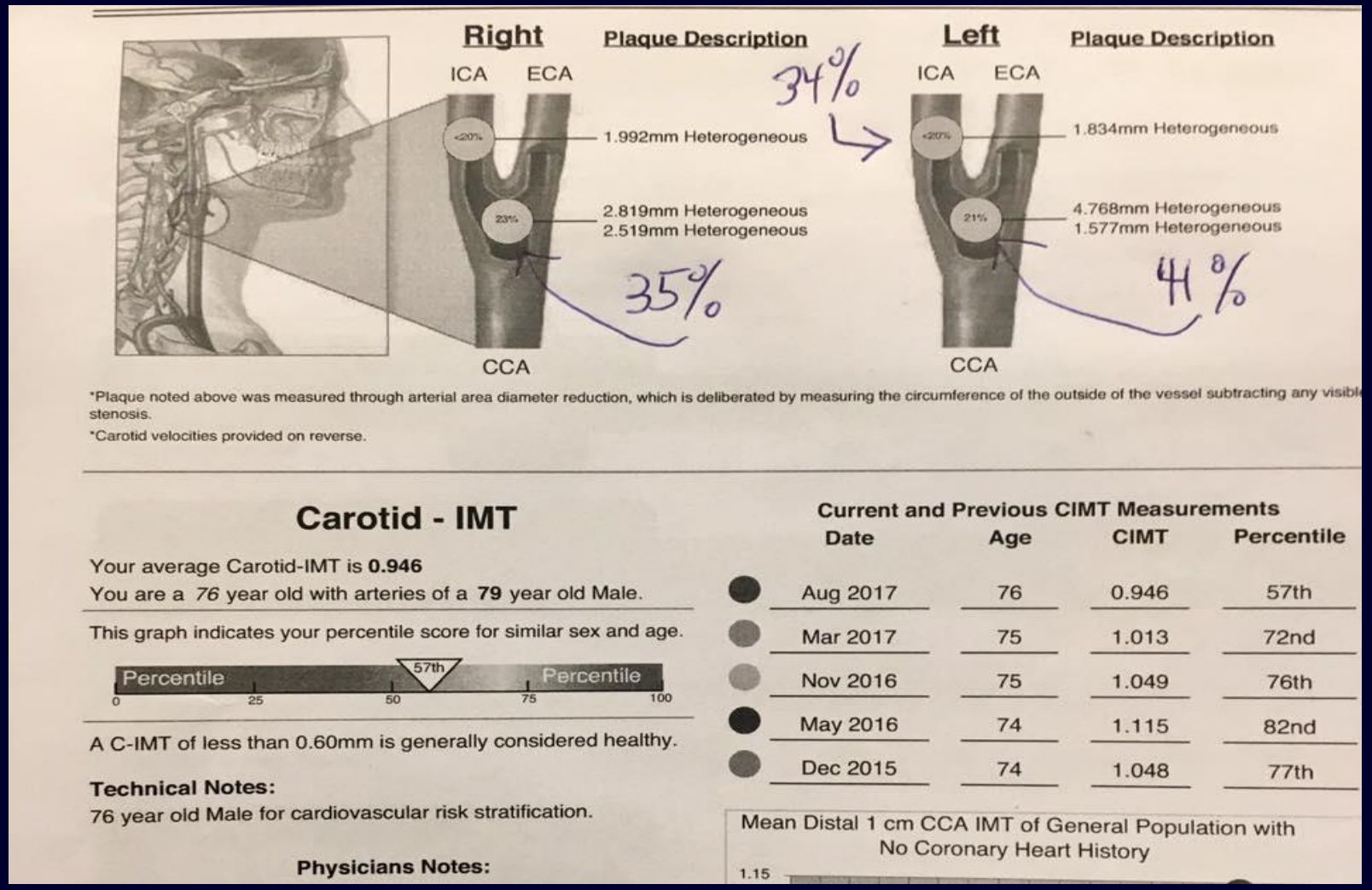
Geleijnse JM, Vermeer C, Grobbee DE, et al. Dietary intake of menaquinone is associated with a reduced risk of coronary heart disease: the Rotterdam Study. J Nutr. 2004;134(11):3100-5.

Chelation and vitamins



Lamas GA, Goertz C, Boineau R, et al. Effect of disodium EDTA chelation regimen on cardiovascular events in patients with previous myocardial infarction: the TACT randomized trial. JAMA. 2013;309(12):1241-50.

CIMT to document reversal



Right — **Plaque Description**

ICA ECA

34%

1.992mm Heterogeneous

2.819mm Heterogeneous
2.519mm Heterogeneous

35%

CCA

Left — **Plaque Description**

ICA ECA

1.834mm Heterogeneous

4.768mm Heterogeneous
1.577mm Heterogeneous

41%

CCA

*Plaque noted above was measured through arterial area diameter reduction, which is deliberated by measuring the circumference of the outside of the vessel subtracting any visibl stenosis.

*Carotid velocities provided on reverse.

Carotid - IMT

Your average Carotid-IMT is **0.946**

You are a *76* year old with arteries of a **79** year old Male.

This graph indicates your percentile score for similar sex and age.

A C-IMT of less than 0.60mm is generally considered healthy.

Technical Notes:

76 year old Male for cardiovascular risk stratification.

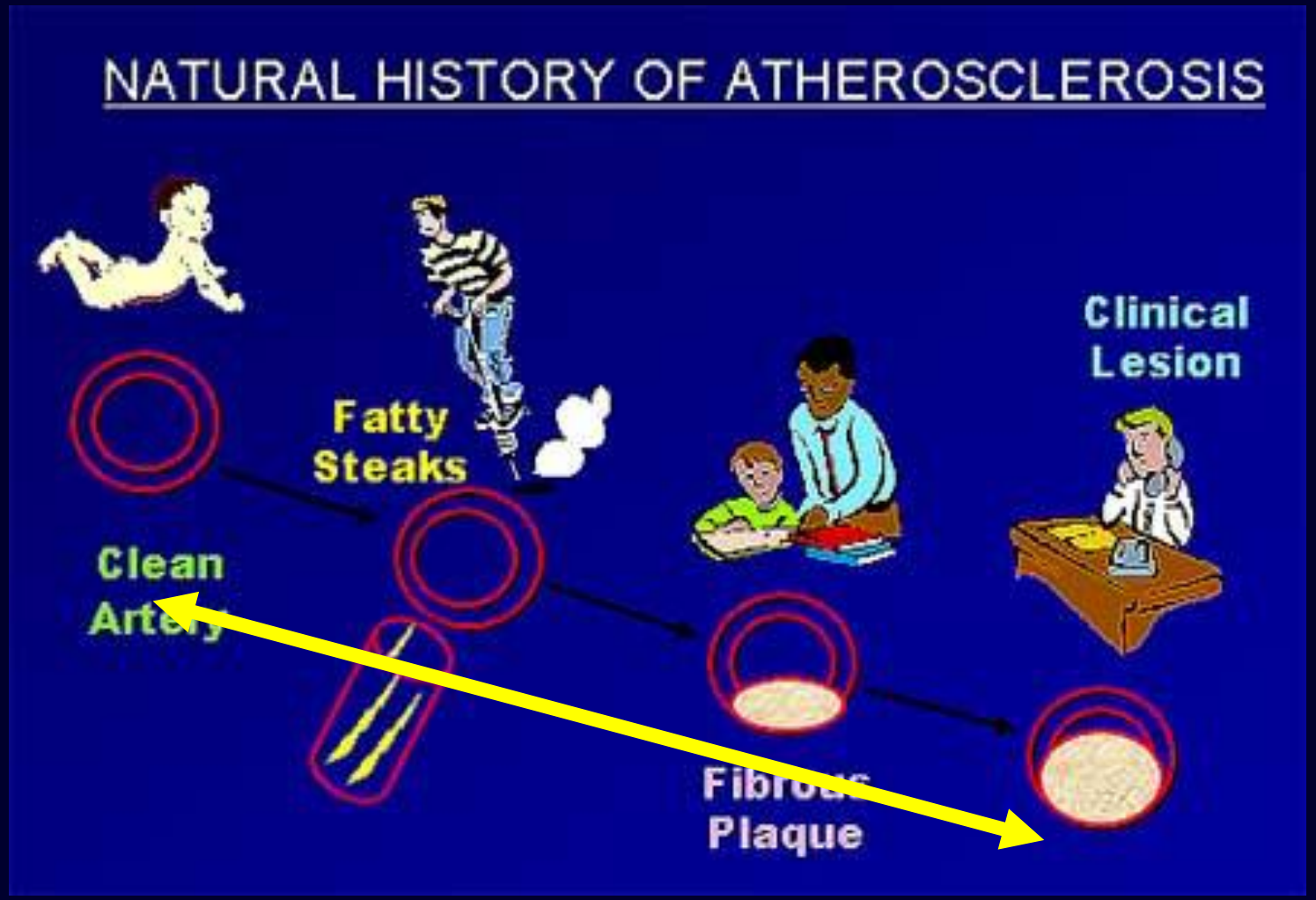
Physicians Notes:

Current and Previous CIMT Measurements

Date	Age	CIMT	Percentile
Aug 2017	76	0.946	57th
Mar 2017	75	1.013	72nd
Nov 2016	75	1.049	76th
May 2016	74	1.115	82nd
Dec 2015	74	1.048	77th

Mean Distal 1 cm CCA IMT of General Population with No Coronary Heart History

1.15

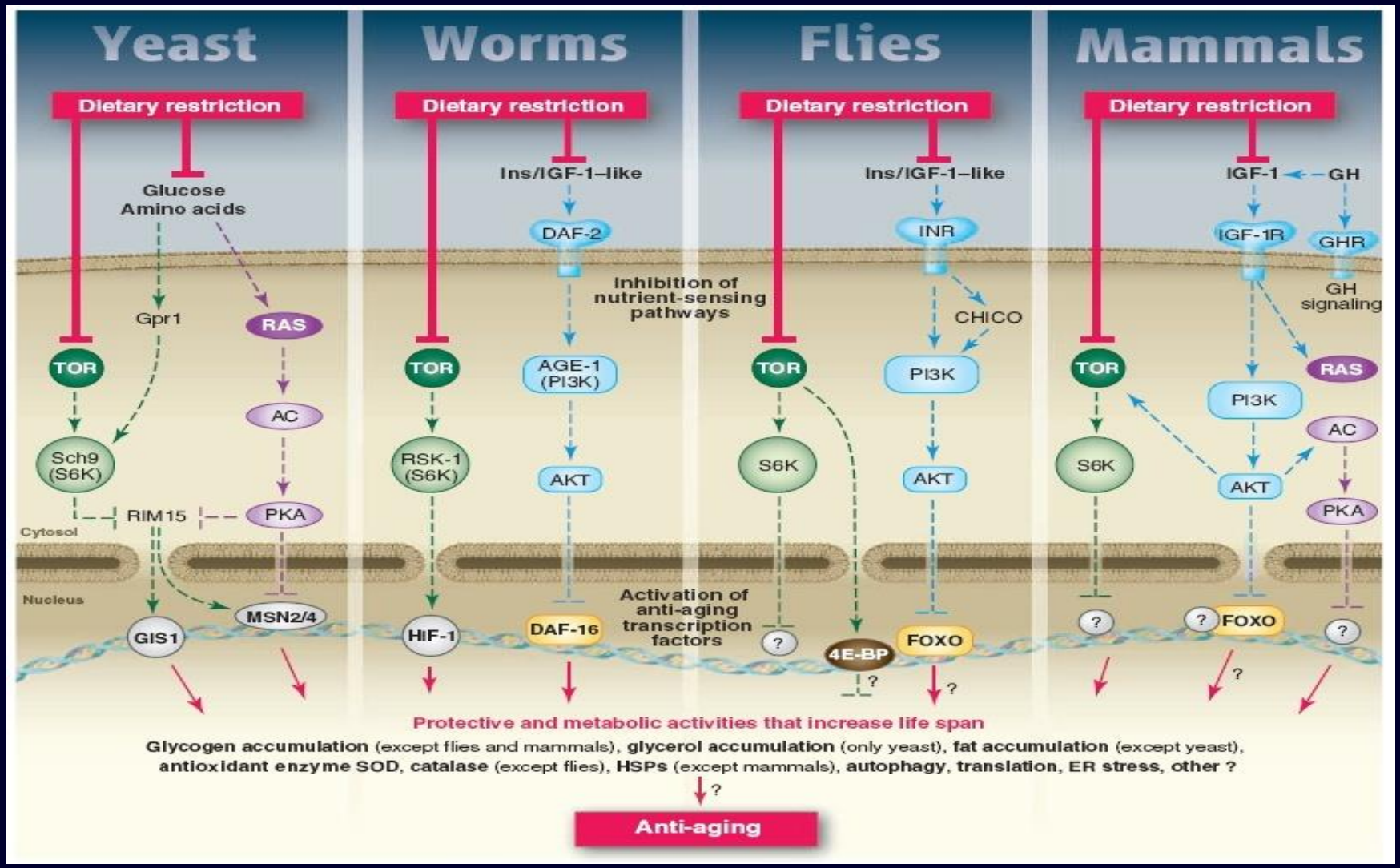

NATURAL HISTORY OF ATHEROSCLEROSIS
Fatty Steaks
Clinical Lesion
Clean Artery
Fibrous Plaque


Aging & Biology

Nutrient sensing pathways

- Valter Longom, Ph.D., USC – pioneer of nutrient sensing pathways
- Showed that the IGF-1, TOR and PKA pathways are critical for promoting aging
- Activation of nutrient-sensing pathways accelerates aging processes and their inhibition slows is
- Low levels of IGF-1 are found in centenarians

Conserved Cellular Pathways



Wei et al., 2008; Cheng et al., 2014)

FMD in humans

"The stomach receives food, while the metabolism fasts"

- Consists of soups, bars, teas, drinks, and snacks
- Five consectuvie days/month, up to 12 times/year
- Demonstrated to rejuvenate the body, induce fast fat loss without decreasing muscle or bone mass, and prevent (and potentially reverse) age-related metabolic changes

SCIENCE TRANSLATIONAL MEDICINE | RESEARCH ARTICLE

METABOLIC DISEASE

Fasting-mimicking diet and markers/risk factors for aging, diabetes, cancer, and cardiovascular disease

Min Wei,[1]* Sebastian Brandhorst,[1]* Mahshid Shelehchi,[1] Hamed Mirzaei,[1] Chia Wei Cheng,[1] Julia Budniak,[1] Susan Groshen,[2] Wendy J. Mack,[2] Esra Guen,[1] Stefano Di Biase,[1] Pinchas Cohen,[1] Todd E. Morgan,[1] Tanya Dorff,[3] Kurt Hong,[4] Andreas Michalsen,[5] Alessandro Laviano,[6] Valter D. Longo[1,7†]

Calorie restriction or changes in dietary composition can enhance healthy aging, but the inability of most subjects to adhere to chronic and extreme diets, as well as potentially adverse effects, limits their application. We randomized 100 generally healthy participants from the United States into two study arms and tested the effects of a fasting-mimicking diet (FMD)—low in calories, sugars, and protein but high in unsaturated fats—on markers/risk factors associated with aging and age-related diseases. We compared subjects who followed 3 months of an unrestricted diet to subjects who consumed the FMD for 5 consecutive days per month for 3 months. Three FMD cycles reduced body weight, trunk, and total body fat; lowered blood pressure; and decreased insulin-like growth factor 1 (IGF-1). No serious adverse effects were reported. After 3 months, control diet subjects were crossed over to the FMD program, resulting in a total of 71 subjects completing three FMD cycles. A post hoc analysis of subjects from both FMD arms showed that body mass index, blood pressure, fasting glucose, IGF-1, triglycerides, total and low-density lipoprotein cholesterol, and C-reactive protein were more beneficially affected in participants at risk for disease than in subjects who were not at risk. Thus, cycles of a 5-day FMD are safe, feasible, and effective in reducing markers/risk factors for aging and age-related diseases. Larger studies in patients with diagnosed diseases or selected on the basis of risk factors are warranted to confirm the effect of the FMD on disease prevention and treatment.

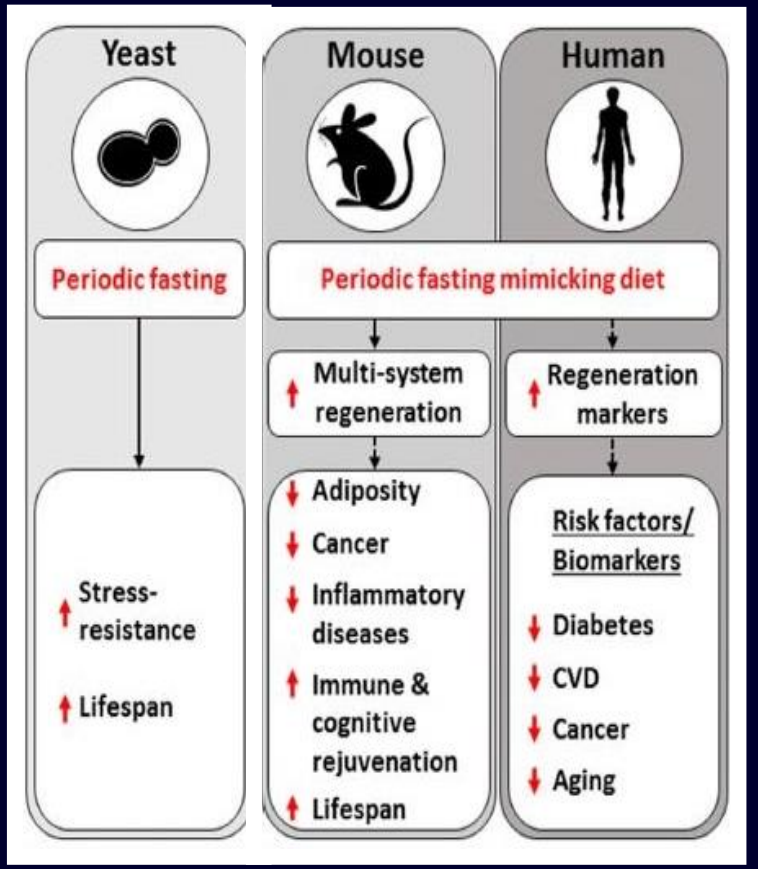
INTRODUCTION

Metabolic syndrome is defined by co-occurrence of three of five of the following conditions: abdominal obesity, elevated fasting glucose, elevated blood pressure, high serum triglycerides, and low levels of high-density lipoprotein (HDL) cholesterol (*1*). Affecting 47 million Americans (*2*), it is associated with a major increase in the risk of cardiovascular disease (CVD) and all-cause mortality (*3*). Although prolonged fasting or very low calorie fasting-mimicking diets (FMDs) can ameliorate the incidence of diseases such as cancer and multiple sclerosis in mice (*4*–*6*), randomized trials to assess fasting's ability to reduce markers/risk factors for aging and major age-related diseases have not been carried out (*7*–*9*). Prolonged fasting, in which only water is consumed for 2 or more days, reduces pro-growth signaling and activates cellular protection mechanisms in organisms ranging from single-cell yeast to mammals (*10*). In mammals, this is achieved in part by temporarily reducing glucose and circulating insulin-like growth factor 1 (IGF-1), a hormone well studied for its role in metabolism, growth, and development, as well as for its association with aging and cancer (*11*–*16*). Severe growth hormone receptor and IGF-1 deficiencies are associated with a reduced risk of cancer, diabetes, and overall mortality in humans (*17*, *18*).

Mice fed periodically with the FMD show extended healthspan and multisystem regeneration, reduced inflammation and cancer incidence, and enhanced cognitive performance (*5*). Despite its potential for disease prevention and treatment, prolonged fasting is difficult to implement in human subjects and may exacerbate preexisting nutritional deficiencies, making it not feasible and/or safe for children, the elderly, frail individuals, and even most of the healthy adults. We have investigated whether a dietary intervention more practical and safer than fasting could affect markers or risk factors for aging and diseases. To this end, we developed an FMD based on a diet previously tested in animals and designed to achieve effects similar to those caused by fasting on IGF-1, insulin-like growth factor–binding protein 1 (IGFBP-1), glucose, and ketone bodies (*17*). To prevent nutrient deficiency, this FMD provided between 3000 and 4600 kJ per day, as well as high micronutrient nourishment, to each human subject (*5*). We also previously showed the safety and feasibility of this intervention in 19 study participants who consumed three monthly cycles of this FMD lasting 5 days each (*5*).

We now report the results of a randomized controlled trial of 100 subjects, 71 of whom completed three cycles of the FMD either in a randomized phase ($n = 39$) or after being crossed over from a control diet group to the FMD group ($n = 32$). We evaluated the effects of the FMD on risk factors and markers for aging, cancer, metabolic syndrome, and CVDs in generally healthy participants ranging from 20 to 70 years of age.

[1]Longevity Institute, School of Gerontology, and Department of Biological Sciences,



Wei M, Brandhorst S, Shelehchi M, et al. Fasting-mimicking diet and markers/risk factors for aging, diabetes, cancer, and cardiovascular disease. Sci Transl Med. 2017;9(377)

Effect of FMD on biomarkers

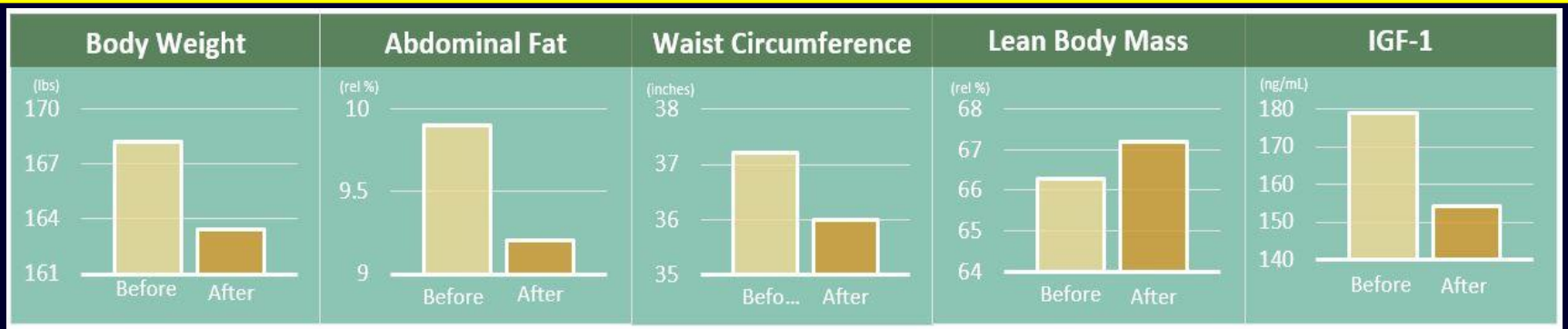


Figure 1 **Figure 2** **Figure 3** **Figure 4** **Figure 5**

Participants lost an average of 5 lbs (Fig. 1) coming mostly from abdominal fat shown as reduction in abdominal fat mass (Fig. 2) and >1-inch loss in waist circumference (Fig. 3) while preserving lean body mass (Fig. 4). IGF-1, a marker associated with increased mortality and DNA damage in human cells, was reduced by 14% (Fig. 5).

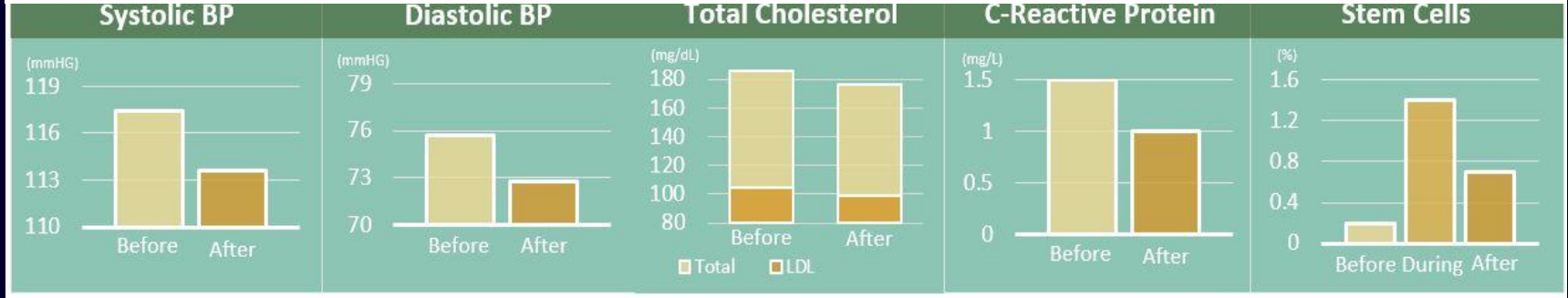
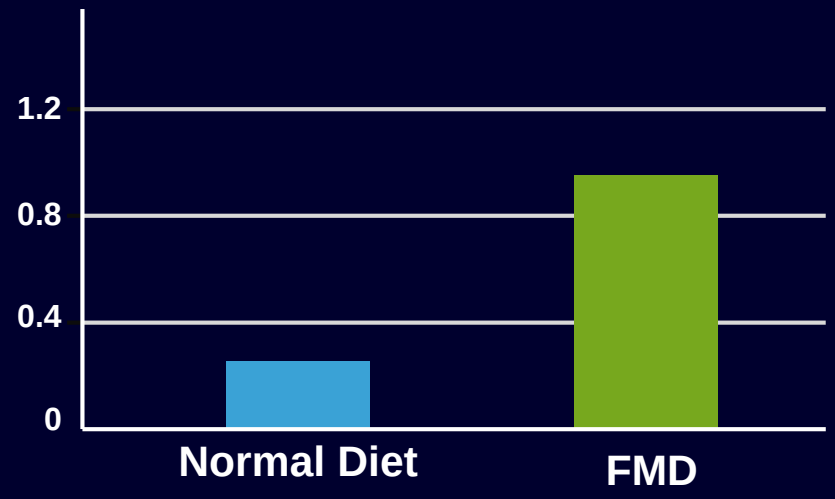


Figure 6 **Figure 7** **Figure 8** **Figure 9** **Figure 10**

Blood pressure (BP) was significantly reduced from 117.4 to 113.6 mm Hg (systolic) and 75.7 to 72.8 mm Hg (diastolic) (Fig. 6 & 7). Total cholesterol was reduced nearly 10 mg/dL with significant reductions of LDL from 104.9 to 99.2 mg/dL (Fig. 8). C-reactive protein (CRP) levels decreased from 1.5 mg/L to 1.0 mg/L after participants had resumed their normal diet for 5 – 8 days after cycle 3 (Fig. 9). A transient, major and significant elevation of stem cell/regenerative markers was also observed (Fig. 10).

Wei M, Brandhorst S, Shelehchi M, et al. Fasting-mimicking diet and markers/risk factors for aging, diabetes, cancer, and cardiovascular disease. Sci Transl Med. 2017;9(377)

Circulating stem cells in humans undergoing FMD



Adapted from Brandhorst S, Choi IY, Wei M, et al. A Periodic Diet that Mimics Fasting Promotes Multi-System Regeneration, Enhanced Cognitive Performance, and Healthspan. Cell Metab. 2015;22(1):86-99.


The best kept secret in medicine is that under the right conditions, the body can heal itself...
-Dr. Michael Greger