Taking Care of Your Heart:
Chemistry and Heart Disease

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Metabolism is life!

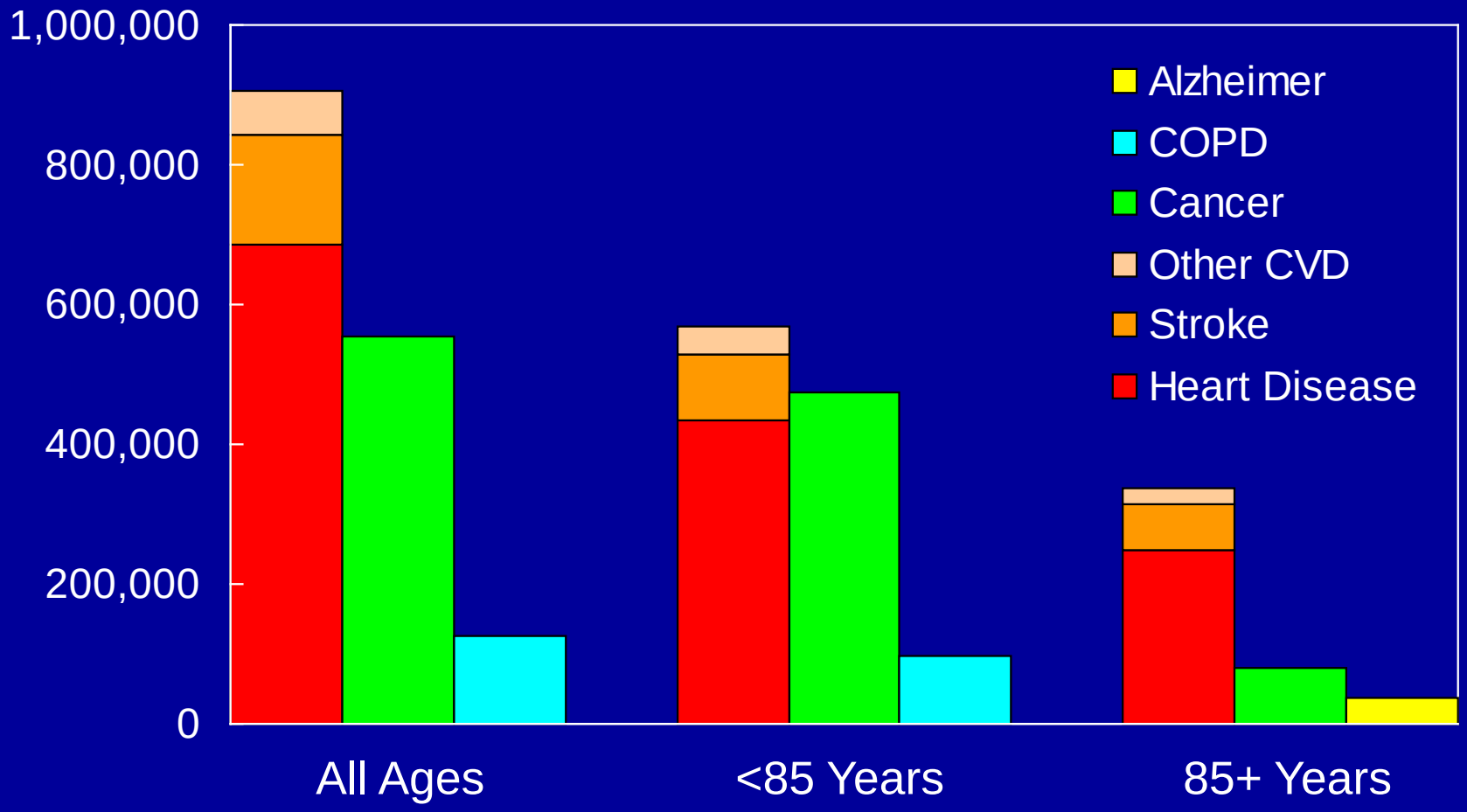
- Review the role of cholesterol and obesity in heart disease
- Discuss the role of nutrition and activity in prevention
- Discuss common clinical and public health problems with cholesterol, metabolism, and obesity

Heart Disease

- **Heart disease risk factors**
  - **Men and Women at similar risk – long term**
- **Lifestyle Change Works!**
- **Take Your Medicine…**
  - **The Internet - Friend or Foe?**

Leading Causes of Death in the United States

CDC / NCHS and NIH Statistics



American Heart Association Heart Disease and Stroke Statistics
www.americanheart.org

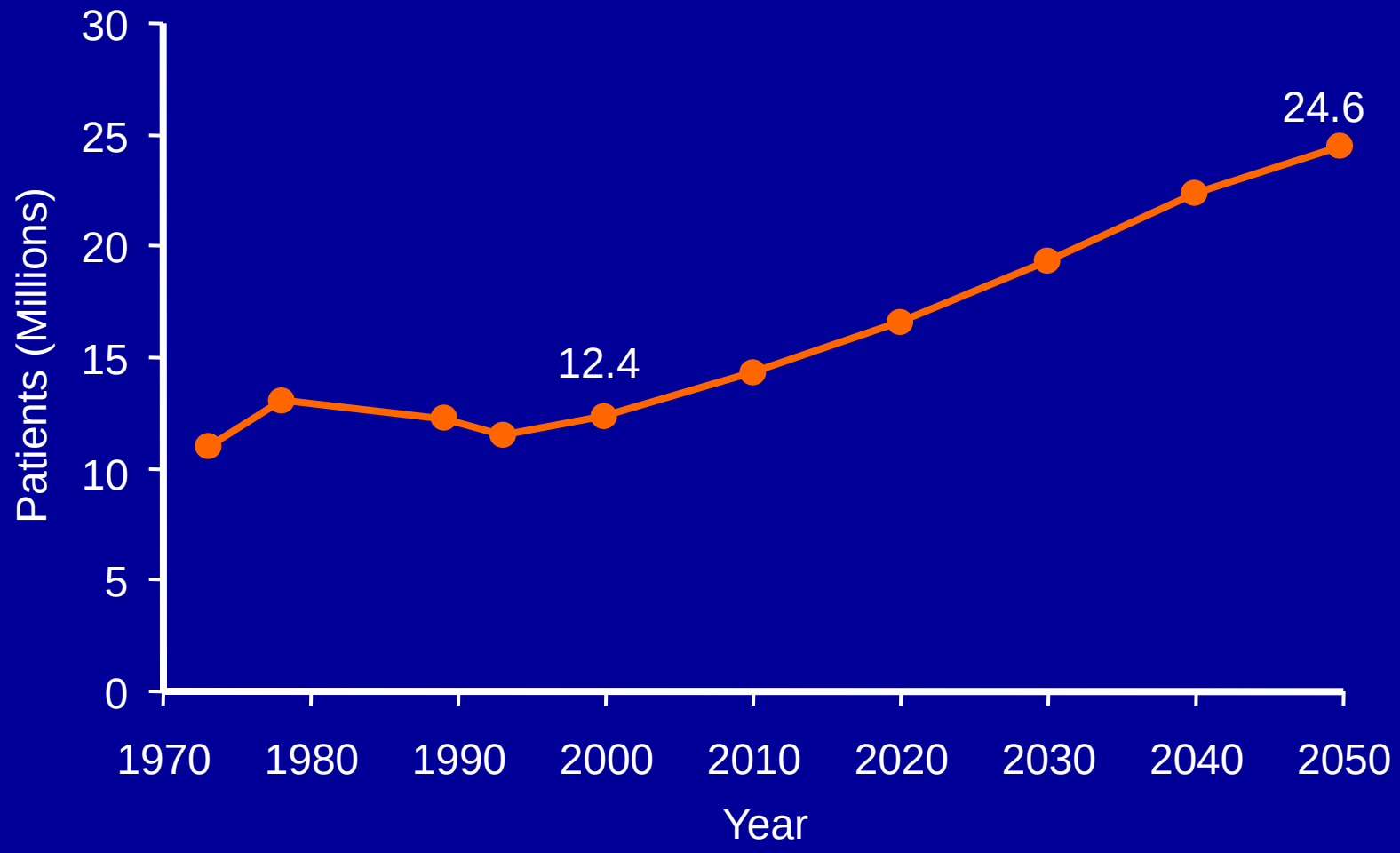
Good News!
A Significant Decrease in Heart Disease and Stroke

In the past 30 years:

- **Stroke decrease by 70%**
- **Heart attack decrease by 50%**
- **Decrease in heart disease and stroke has led to over 4 years of prolongation in life expectancy**
- **Total increase in life expectancy is 6 years**
- **Improvement = 2/3 lifestyle and 1/3 medicine**

Scope of the Problem

U.S. Heart Disease



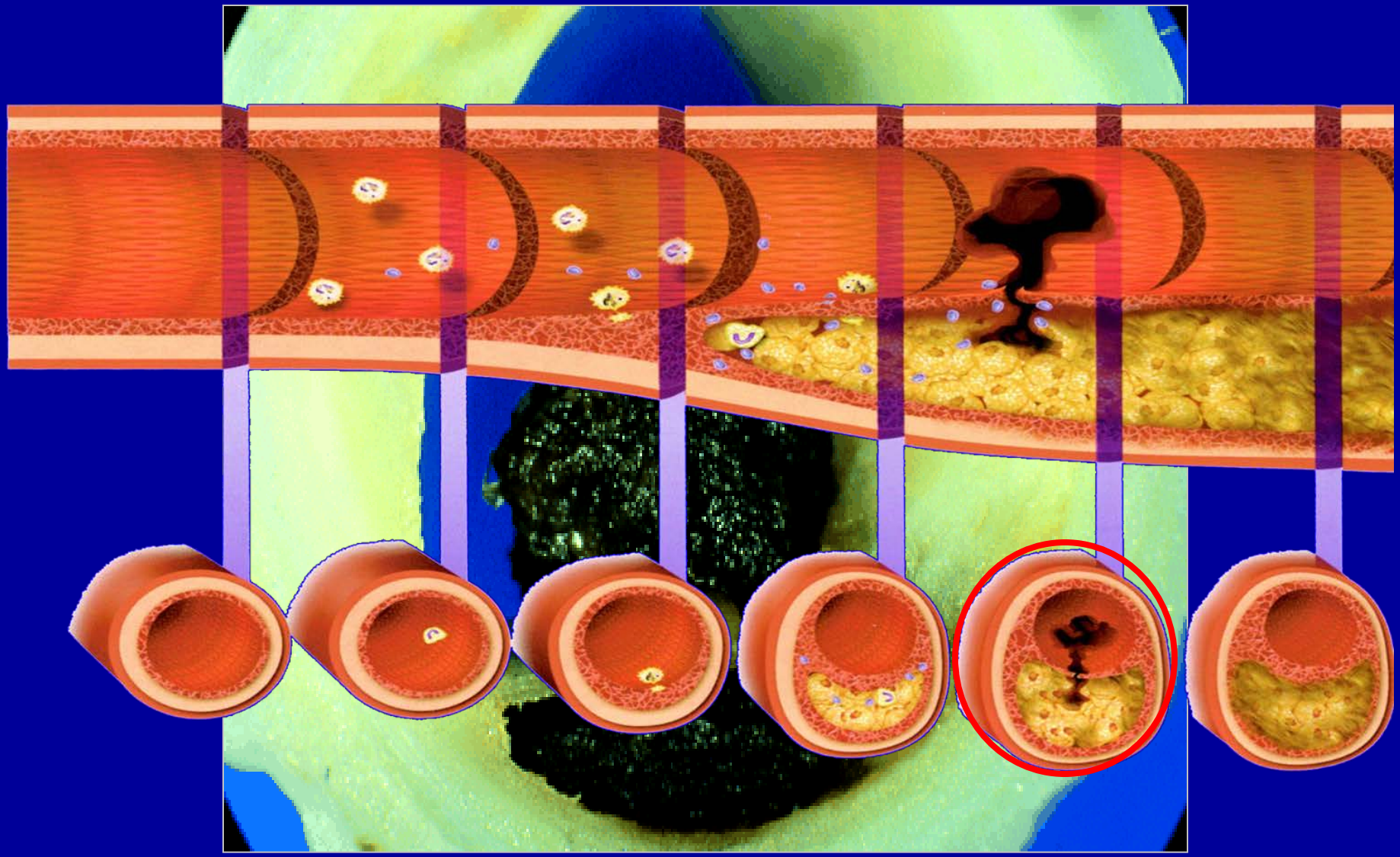
Foot DK et al. *JACC* 2000;35:1067-81

What Are We Treating?

Atherosclerosis

(“Blockages or plaques”)

Evolution of Heart / Blood Vessel Blockages



Davies MJ. *Heart* 2000;83:361-366
Libby P. *Circulation* 2001;104:365-72

Is This Reversible?

Heart and Stroke Risk Factors

- Age
- High cholesterol
- Low HDL cholesterol
- High blood pressure
- Lack of physical activity
- Tobacco
- Diabetes
- Obesity (especially central)
- Stress (including loss)
- Family History of heart disease or stroke
- Genetics…other?

How Do I Know My Risk?

- **Risk assessment tool:**

www.healthdecision.org

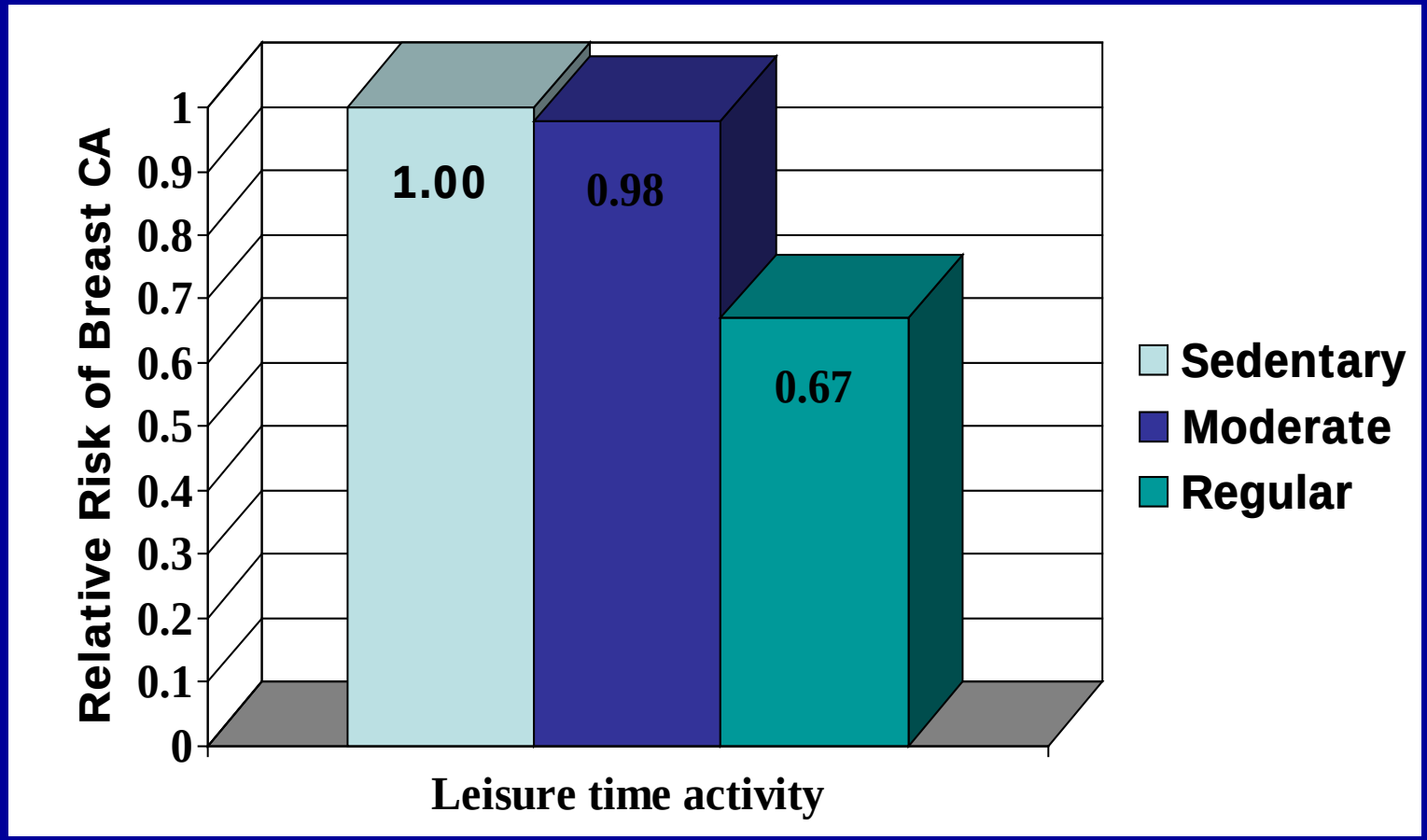
Gives 10 year and longer heart risk –
And handouts to reduce risk

www.heart.org

Cancer risk factors

- Tobacco use / smoking
- High fat intake
- Low intake of vegetables and fruits
- Physical inactivity
- Lack of appropriate screening

Physical Activity and Breast Cancer



Thune et al. NEJM 1997; 336:1269-75.

Reducing Risk of heart disease and stroke

- Activity daily
- Healthy eating
- Avoiding tobacco
- Maintain optimal weight
- Aspirin if your clinician recommends
- Control blood pressure and cholesterol
- Take your medicine!

Cholesterol

"Bad" (only if high in our blood)

- **LDL – cholesterol**
- **Triglycerides**

"Good cholesterol"

- **HDL - cholesterol**

Cholesterol Management – Normal Levels

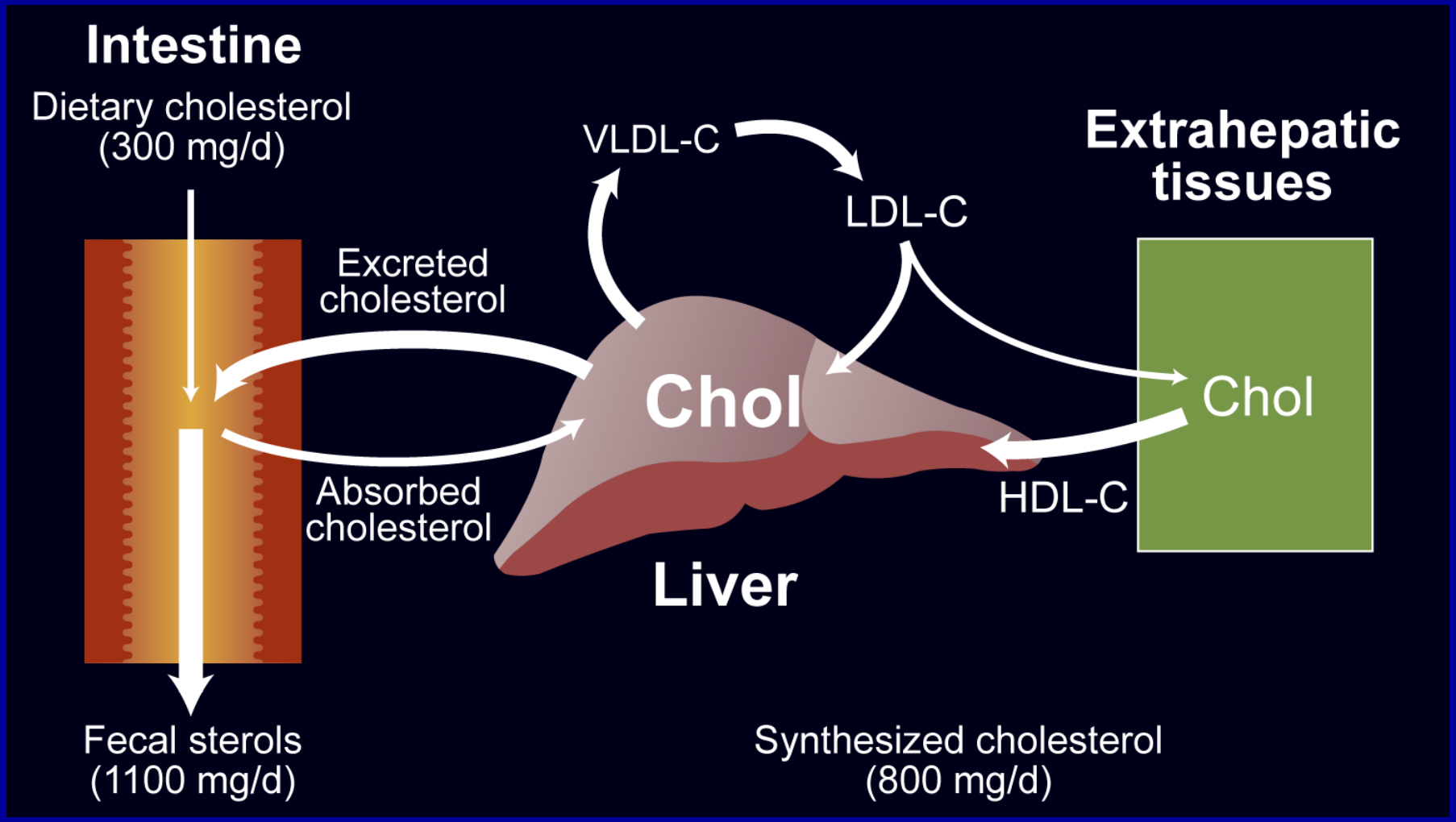
- LDL-C < 130 mg/dL (lower if we have heart disease or stroke)
- Triglycerides < 150 mg/dL
- HDL-C > 40 mg/dL
  (> 50 mg/dL for females)

Cholesterol Guidelines

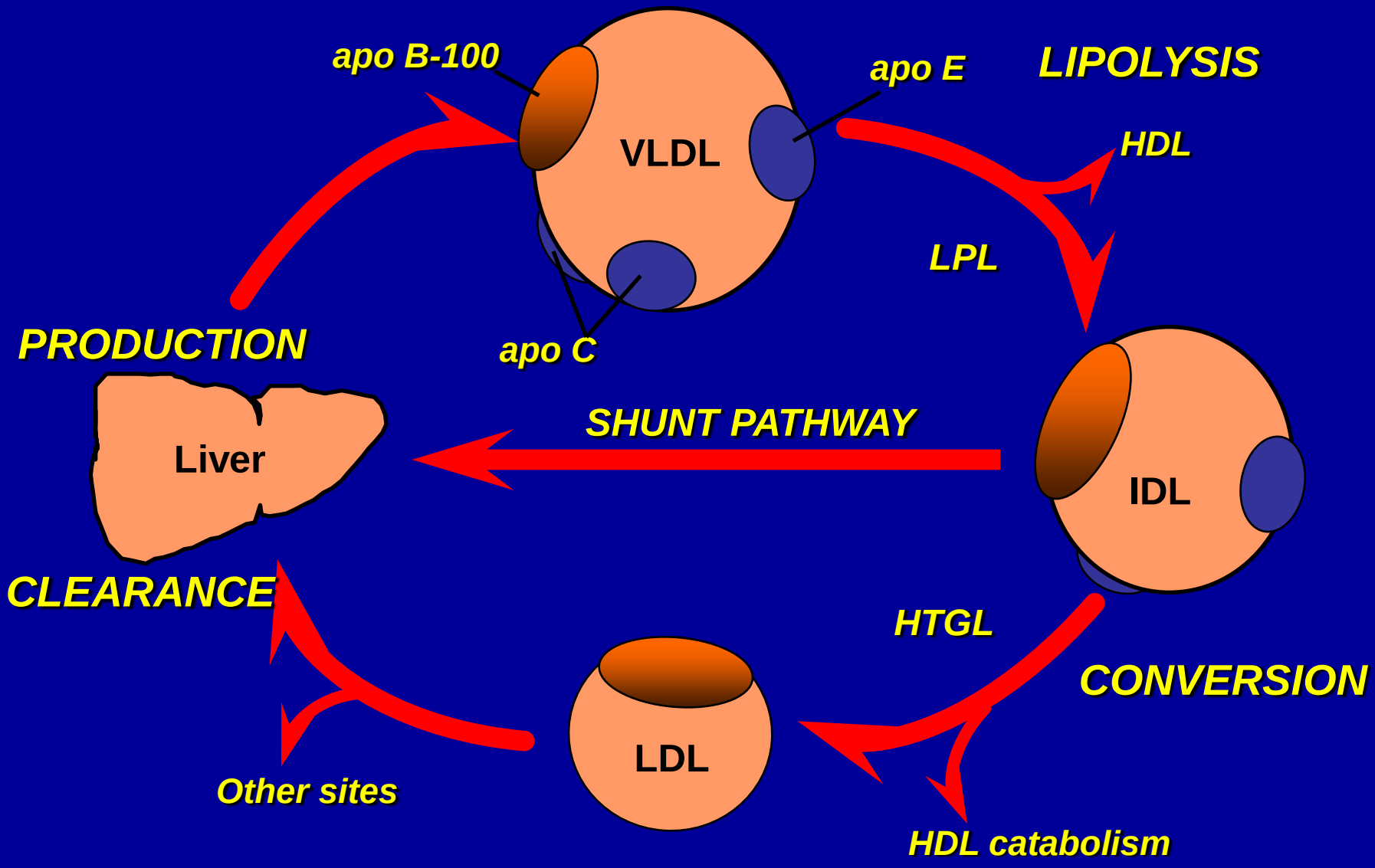
- HDL > 40 (women > 50)
- Triglycerides < 150
- LDL cholesterol depends on condition:
  - LDL 30 - 40% reduction if no heart disease
  - LDL 50% or more reduction if heart disease / stroke / diabetes
  - Lifestyle is the cornerstone of therapy…

Cholesterol guidelines www.heart.org

Net Cholesterol Balance in Humans



Lipid Metabolism - Metabolic Pathway



Key Facts - Cholesterol

Genetics and lifestyle play a significant role in our cholesterol pattern

Major influences for LDL-C are:

- Dietary saturated fat, trans-fats and genetics

Major influences for VLDL (triglycerides) are:

- Dietary carbohydrates and fats (excess converted to triglycerides / VLDL and stored in adipose)
- Alcohol intake
- Body weight / fat distribution
- Physical activity

HDL cholesterol – reduces risk / removes cholesterol from blood vessel / affected by genetics / exercise, weight, weight distribution, alcohol

Types of Dietary Fat

Saturated

Trans – fats

Monounsaturated

Polyunsaturated

Clinical Effects of dietary fats on serum lipids

- **Saturated and trans - fats:** Increase LDL – C
- **Polyunsaturated fats:** Decrease LDL – C
- **Monounsaturated fats: (e.g. olive oil)**
  - Decrease LDL – C
  - Increase HDL – C

- **Note: all may increase TGs if patient is susceptible, and all are caloric dense**

Trans Fatty Acids

- Created when liquid oils are hydrogenated.
- Very stable at room temperature.
- Are monounsaturated fats, but act like saturated.
- May decrease HDL.
- Average US intake is about 3% of total calories.
- Major sources – cookies, crackers, microwave popcorn, donuts, margarine, pie crust, fried foods **BANNED COMPLETELY IN 2018**

Natural Ways to Lower Cholesterol

- Low-saturated fat
- High soluble fiber (oats, psyllium)
- Fish oils and flax
- Nuts
- Olive oil or canola oil (in place of saturated)
- Sterols
- Soy
- Exercise and weight loss

Lifestyle Guidelines: www.heart.org

Dietary Adjuncts: Efficacy at Reducing LDL-C

Therapy	Dose (g/day)	Effect
Dietary soluble fiber	2-8	↓ LDL-C 5-10%
Soy protein	20-30	↓ LDL-C 5-7%
Sterols	1.5-4	↓ LDL-C 10-15%

Jones PJ. *Curr Atheroscler Rep* 1999;1:230-235
Lichtenstein AH. *Curr Atheroscler Rep* 1999;1:210-214
Rambjor GS et al. *Lipids* 1996;31:S45-S49
Ripsin CM et al. *JAMA* 1992;267:3317-3325

Carbohydrates and Cholesterol

Simple Sugar in Foods

US Dietary Guidelines recommend no more than 10 teaspoons per day.

Cola, 12 oz	**10 teaspoons**
Pancake syrup, 1/4 cup	**10**
Hostess Lemon Fruit Pie	**11**
McDonald's Vanilla Shake	**12**
Fruitopia, 20 oz	**18**
Dairy Queen Mr. Misty, 32 oz	**28**
Mountain Dew, 44 oz	**37**

American Diabetes Association: Carbohydrate and Glycemic Effects of Foods

- Foods containing carbohydrates from whole grains, fruits, vegetables, and low-fat milk should be included.
- Total amount of carbohydrate is more important to the total glycemic effect than type of carbohydrate.
- The use of restrictive diets should not be a primary strategy in food/meal planning, but an overall strategy is needed to reduce diabetes complications.

Diabetes Care, January 2002, 25:202-212

Triglyceride Disorders

- **Highly diet responsive: fat, alcohol, simple carbohydrates, total cals.**
- **Very low-fat and low carbohydrates**
- **Physical Activity and Weight Loss**
- **Medications:**
  - **Fibrates - Niacin - Fish oils**

American Heart Association Dietary Guidelines

Include foods from each of the major food groups:

- **5 or more fruits and vegetables per day**
- **6 or more grains per day, including whole grains**

Achieve and maintain a healthy body weight:

- **Match energy intake to energy needs**
- **Participate in physical activity that achieves fitness and matches or exceeds energy intake**

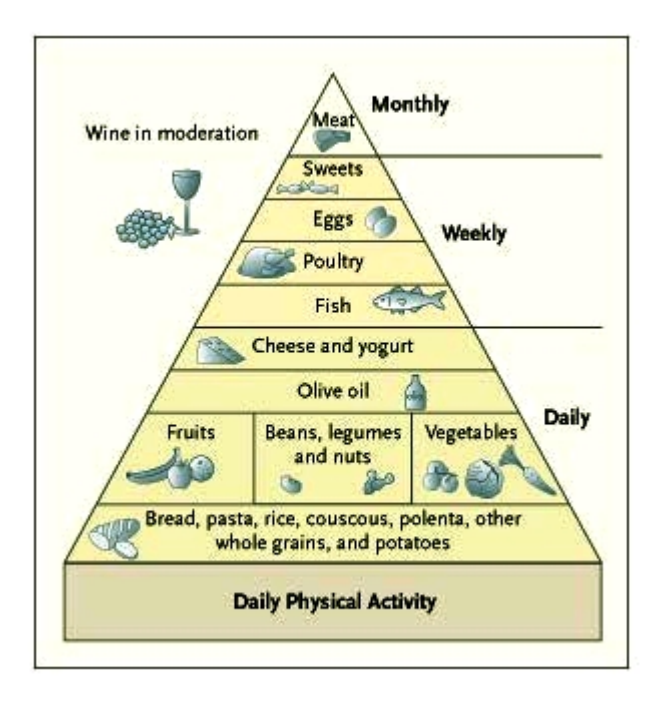
www.heart.org

Healthy Lifestyle

Multiple Lifestyle Trials Show Heart Disease is Reversible

- Lifestyle Heart Study (Ornish) – 60% reduction in progression of heart disease and twofold increase in regression
- STARS trial – health lifestyle reduced atherosclerosis progression by 85%
- CLAS trial – atherosclerosis progression was related to higher consumption of total and saturated fat; increasing protein and lower saturated fat had lowest progression

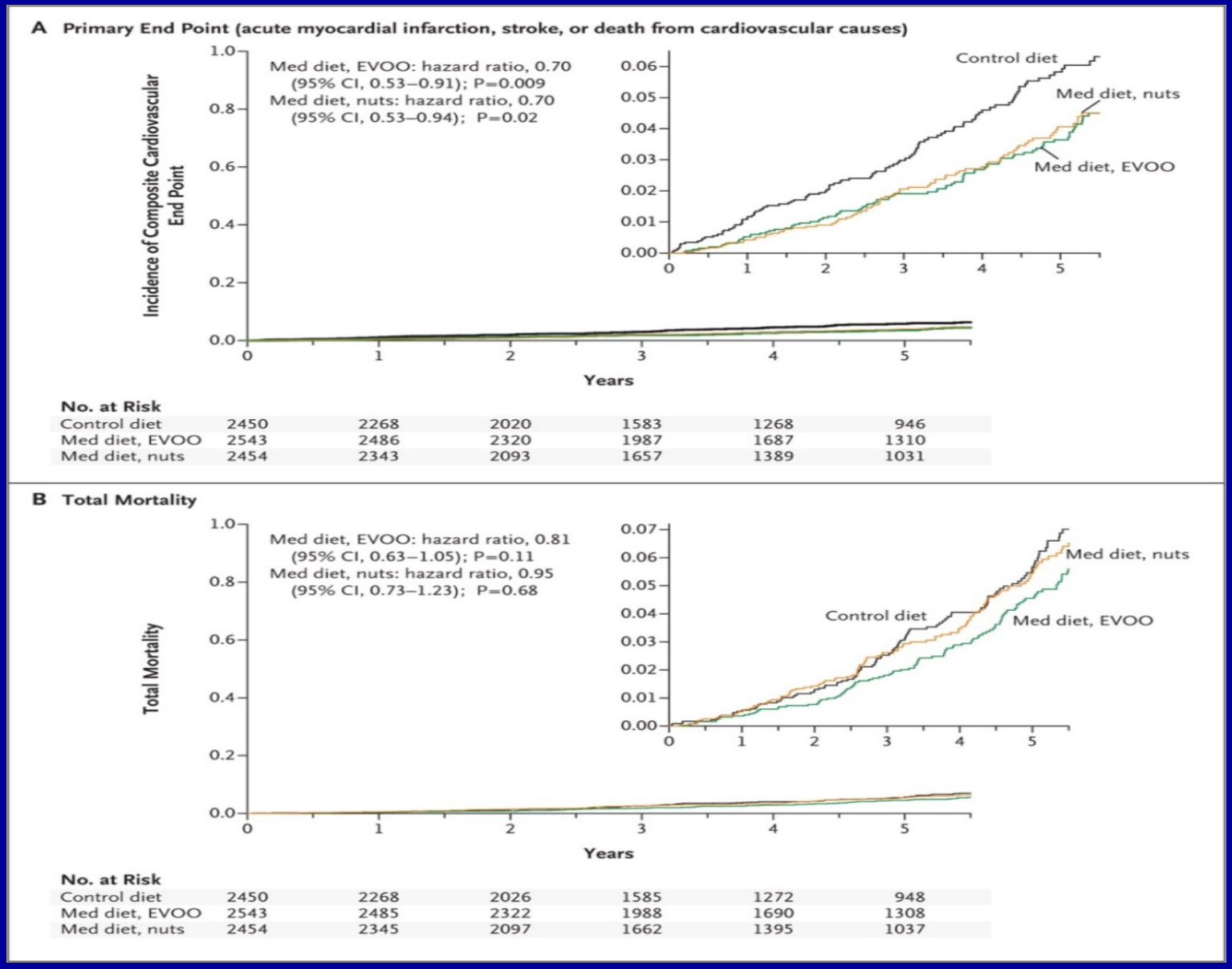
Mediterranean Diet



- Complex carbohydrates
- Nuts and legumes
- Daily fruit and vegetables
- Fish
- Less red meat (use poultry)
- Olive oil
- 2 studies show decrease in heart disease by 50%

Estruch R et al. N Engl J Med 2013;368:1279-1290
Hu, FB. N Engl J Med 2003;348:2595
Kris-Etherton P, et al. Circulation 2001;103:1823

The Use of Mediterranean Diet & Olive Oil



Estruch R et al. N Engl J Med 2013;368:1279-1290.

The NEW ENGLAND JOURNAL of MEDICINE

DASH Diet:
Dietary Approach to Stop Hypertension

- High intake of vegetables and fruits
- Low salt (sodium)
- Modest alcohol intake
- High intake of low-fat dairy products (calcium and vitamin D)
- Appropriate calorie intake to improve body weight
- Can drop BP by 12 / 8

Practical Approach

- There are no good or bad foods, just good or bad meal plans
- Use the 3 X 3 approach - at least three meals per day and at least three food groups at each meal
- Liquid calories can be trouble
- Vegetables every day - the more the better
- Live life in balance

Statins and other cholesterol Medicines

- Safe!
- Effective!
- Low side effects
- Reductions in heart disease and stroke of 30 – 45%
- Highest effect in highest risk

www.heart.org http://circ.ahajournals.org/content/129/25_suppl_2/S1

JACC Journals

Can Artery Blockages Reverse? The Effects of Cholesterol Treatment

From: Impact of Statins on Serial Coronary Calcification During Atheroma Progression and Regression *J Am Coll Cardiol*. 2007;49(2):271-273

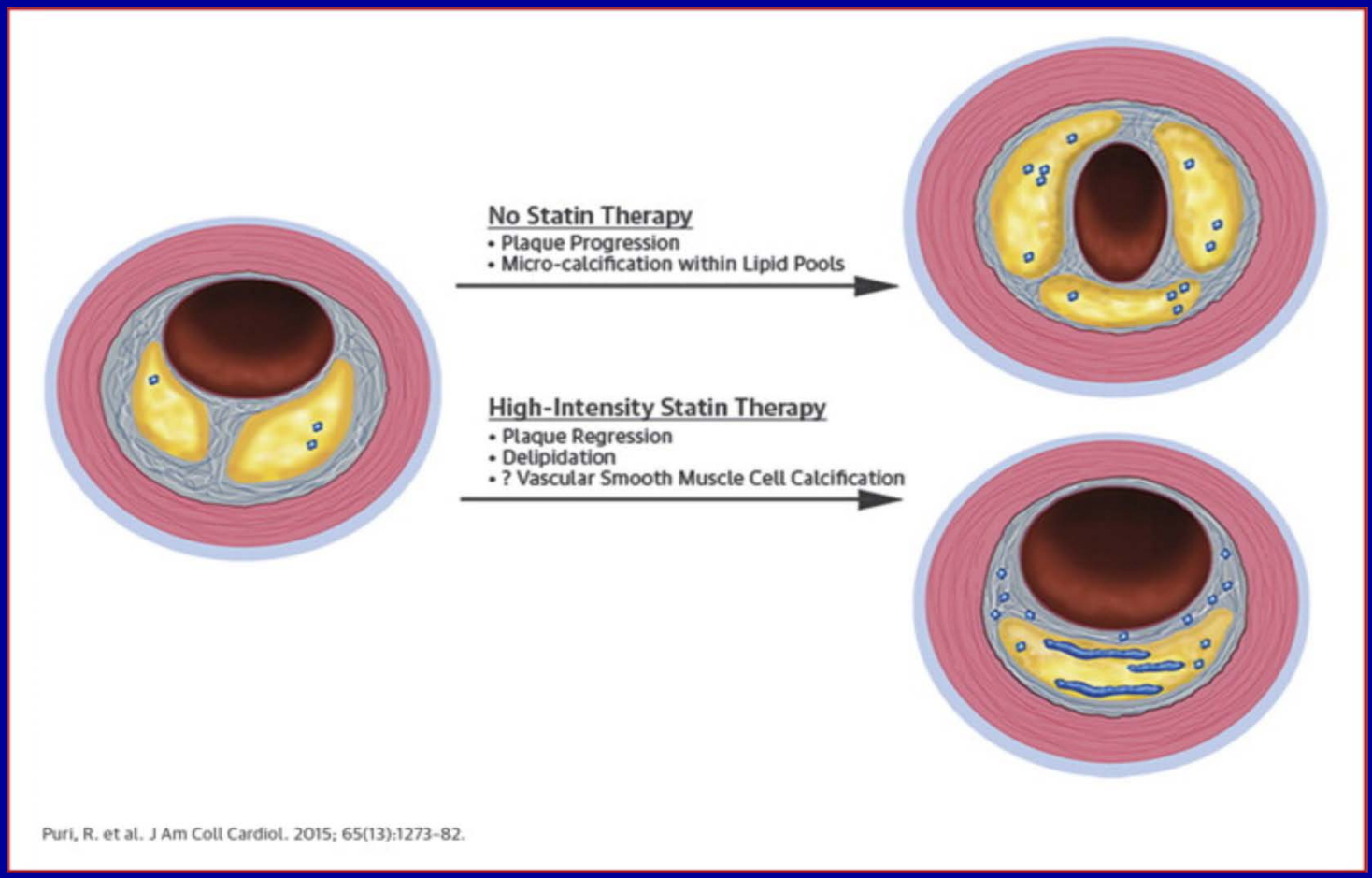


Figure Legend:

Plaque Calcification in the Setting of No-Statin Therapy or High-Intensity Statin Therapy

Natural plaque progression likely involves lipid-pool expansion coupled with microcalcifications within lipid pools. Following long-term high-intensity statin therapy, plaque regression manifests as delipidation and probable vascular smooth muscle cell calcification, promoting plaque stability.

From: Efficacy and Safety of Statin Therapy in Children With Familial Hypercholesterolemia: A Randomized Controlled Trial

JAMA. 2004;292(3):331-337.

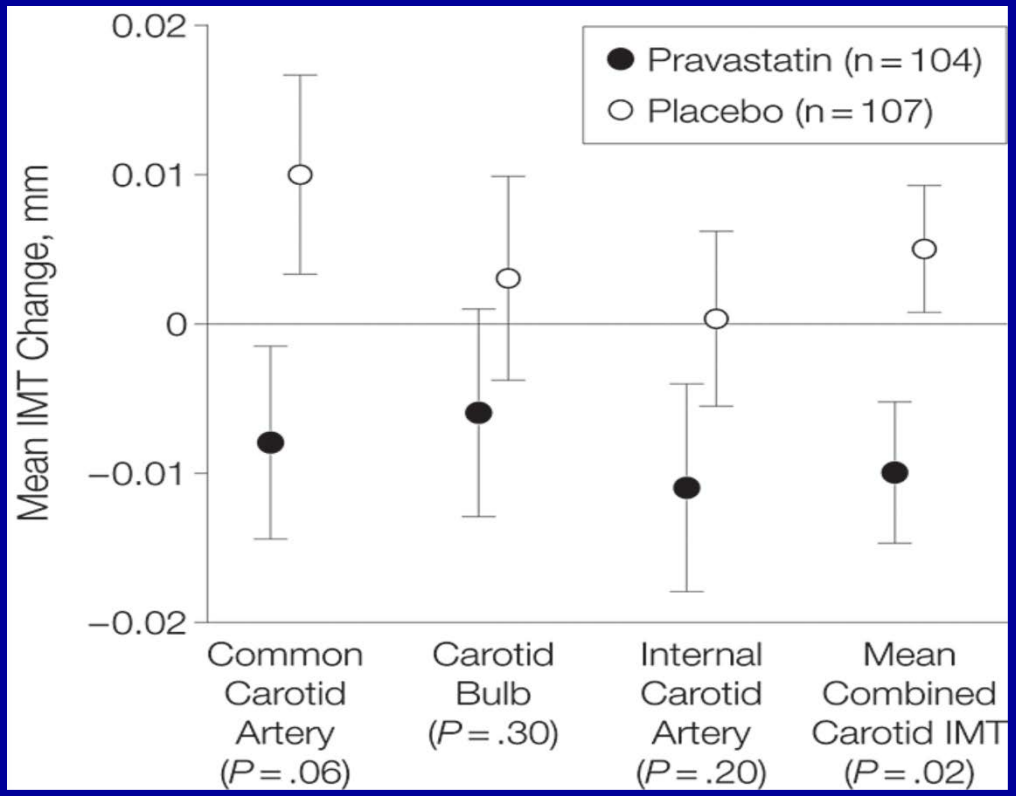


Figure Legend:

IMT indicates intima-media thickness. Error bars indicates SE. P values for the difference between the 2 groups in changefrom baseline were calculated using analysis of covariance adjusted for baseline values.

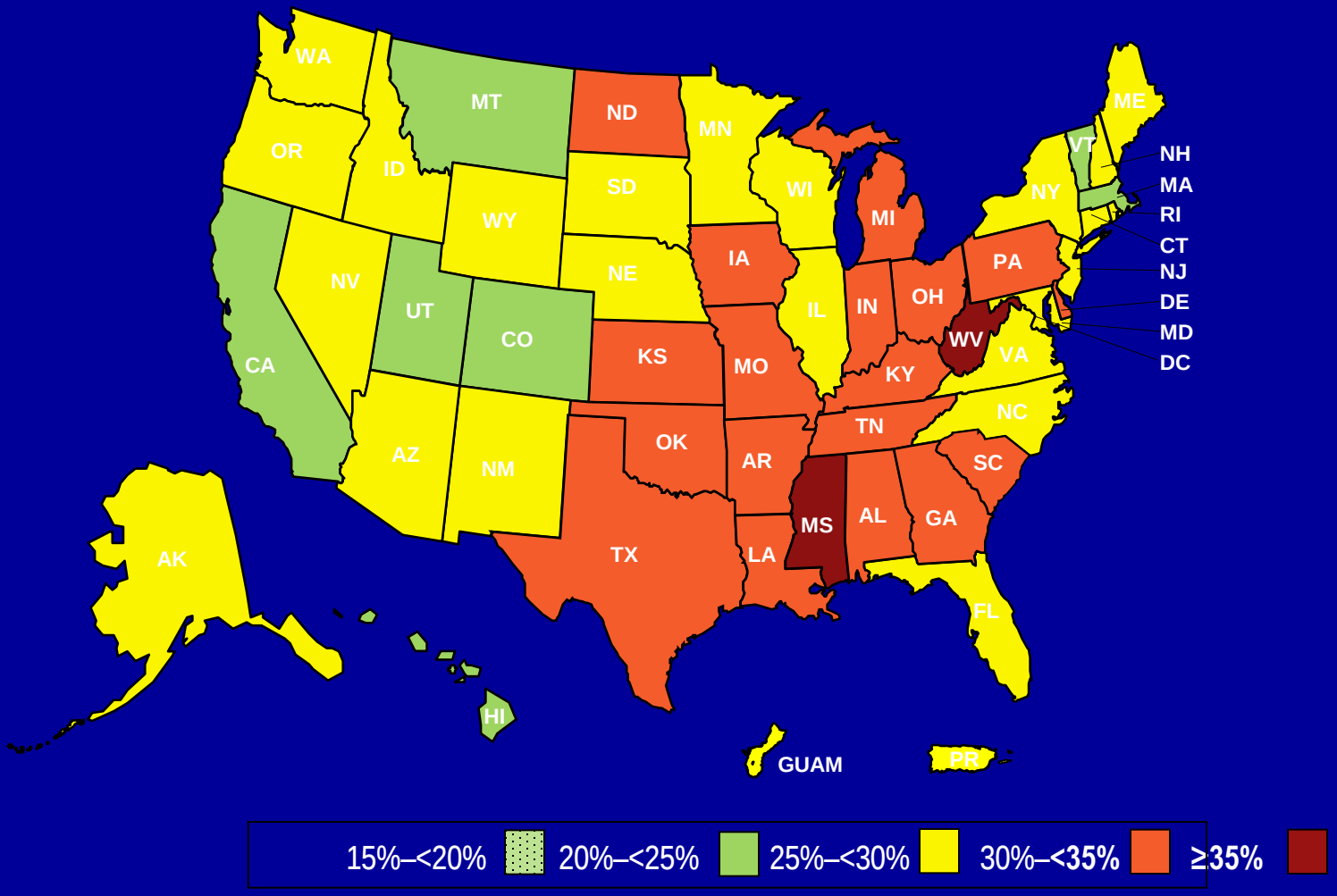
Can Blockages (Plaque) in Arteries Reverse? Atherosclerosis Regression, Vascular Remodeling, and Plaque Stabilization

- **Significant change in plaques are noted by 2 years with statin treatment – also with aggressive lifestyle change and treatment of blood pressure with ACE / Calcium Blockers**
- **Placebo groups in statin trials show plaque progression**
- **Statins diminish the lipid pool in plaques; the fibrous portion of plaques remains**
- **Plaques become far more stable and less likely to rupture = less heart attacks and strokes**
- **Plaques most likely to rupture – those with the most fat and most inflammatory cells – are most positively affected by lifestyle and statins**

J Am Coll Cardiol. 2007;49(2):271-273

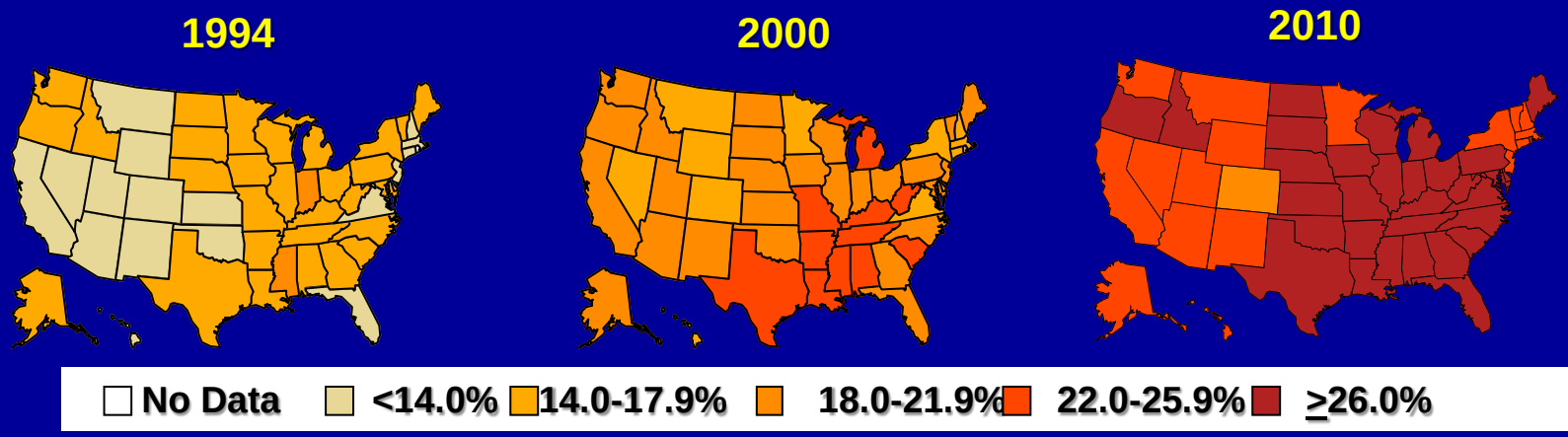
Obesity Among U.S. Adults
2013

*Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.

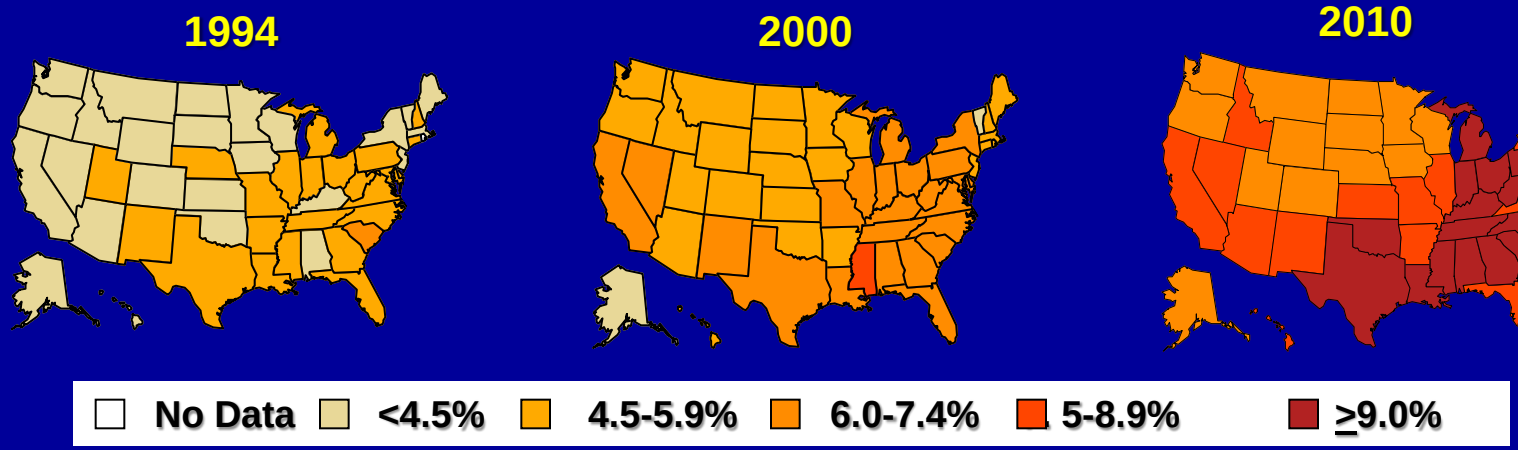


Age-Adjusted Prevalence of Obesity and Diagnosed Diabetes Among U.S. Adults Aged 18 Years or older

Obesity (BMI ≥30 kg/m^2)



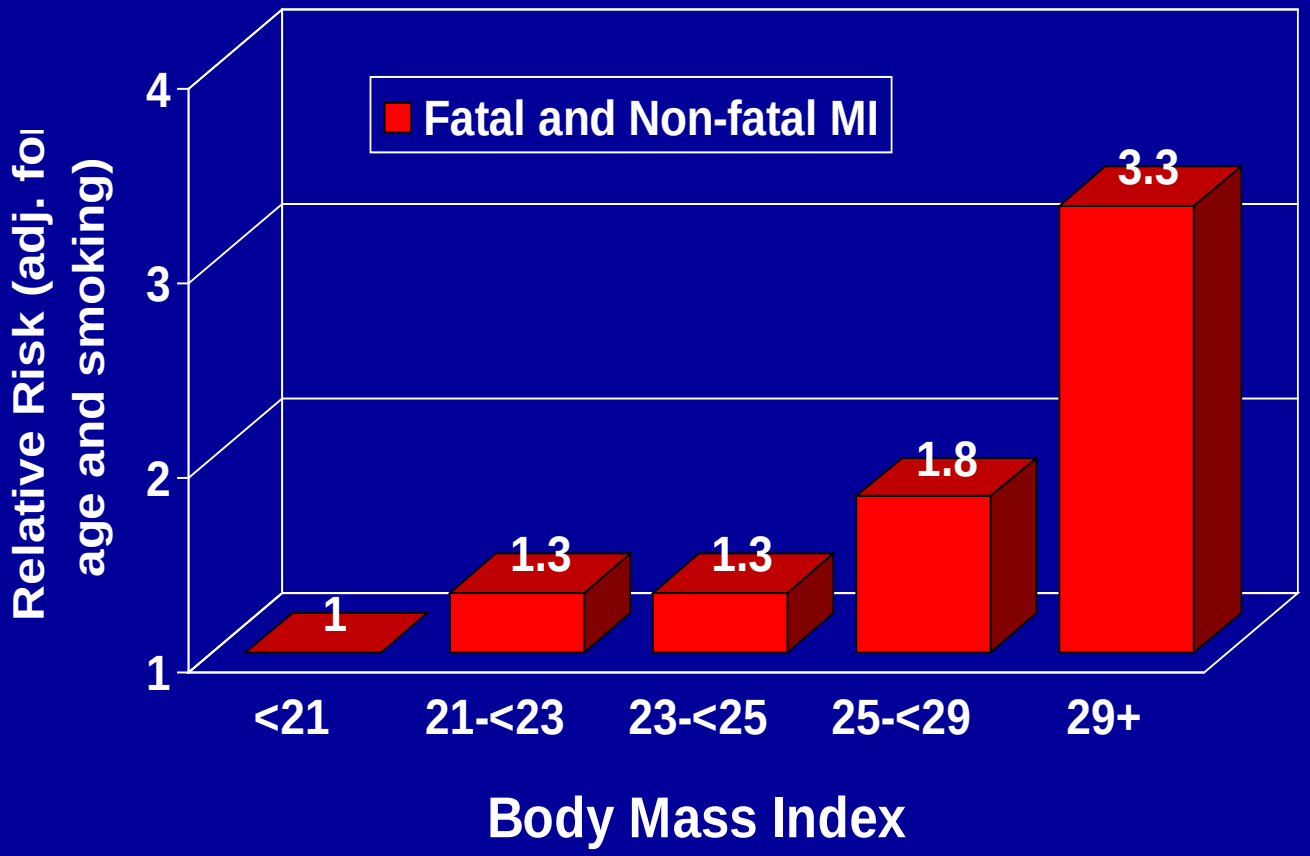
Diabetes



CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

Obesity and CHD Risk in Women

Nurses' Health Study - 8-year Follow-up



Manson et al. NEJM 1990;322:882-889

The Increase In Diabetes Is Epidemic

- 33% from 1990-1998
- 76% in patients 30-39 y.o.

…With More to Come

- Obesity / weight gain are major risk factors
- 2 pounds of weight gain translated to a 9% increase in risk of developing diabetes*
- Higher rates of obesity will lead to more diabetes

*Mokdad AH, et al. *Diabetes Care*. 2000;23:1278-1283.

Diabetes & Vascular Disease

Blockages in legs

- 2 - 4 times higher with Diabetes
- Leg pain 4 - 8 times higher w/ Diabetes
- Leading cause of leg amputation

Stroke

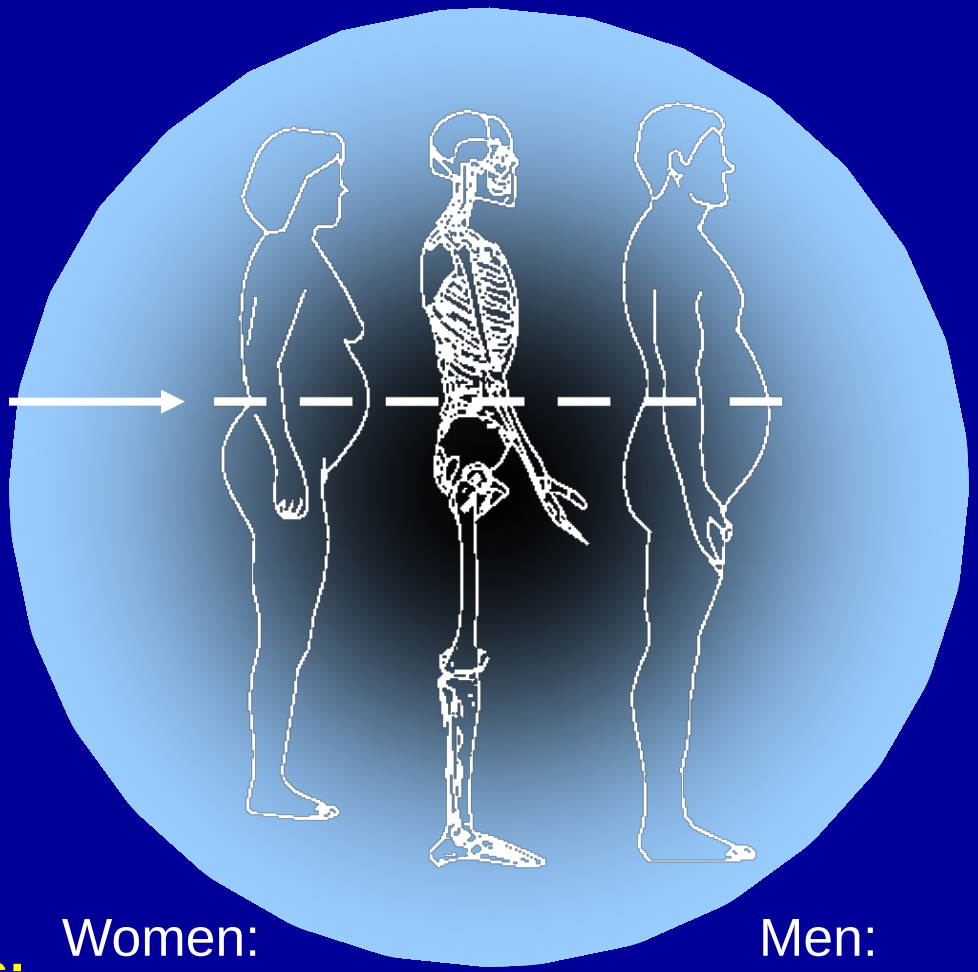
- Stroke risk 1.5 - 4 times more with Diabetes
- Stroke outcomes worse
- Even elevated blood sugar a risk!

“Metabolic Syndrome”

- Weight gain in middle
- Causes:
  - Increased blood sugar and diabetes risk
  - High blood pressure
  - Abnormal cholesterol levels (low HDL, high triglycerides, small LDL)
  - Inflammation in arteries
  - Increased risk of heart disease & stroke

Measuring waist circumference

Iliac crest



- Locate upper hip bone and top of right iliac crest
- Place measuring tape horizontally around abdomen at level of iliac crest
- Tape should be snug without causing compression

Normal values:

Women:
≤ 35 inches

Men:
≤ 40 inches

NHLBI.
www.nhlbi.nih.gov

How Common is the Metabolic Syndrome?

- Adults > 20 years of age
- 24% all adults, 42% over age 60 yrs
- Similar for men and women!
- Mexican Americans 32%
- African American women >> men
- 47 million adults in the U.S.

Adipose Tissue - Adverse Endocrine Effects

↑ "Resistin"

Insulin Resistance

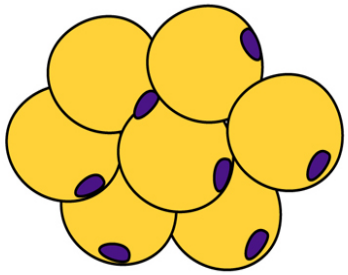
(↑ glucose)

↑ Sympathetic Nervous System

(? hypertension)

↑ Leptin

(↑ appetite)



Enlarged Adipose Cells

↑ Angiotensin

(? hypertension)

↑ Fatty Acids

(↑ atherosclerosis)

↑ Inflammatory Mediators

(TNFα, IL-6, CRP)

Does Weight Loss Work?

- 200 pounds X 5% = 10 pounds
- Total cholesterol down 15%
- Triglycerides down 20%
- HDL up 15%
- Systolic BP / Diastolic BP down 12/9 mmHg
- Improved blood glucose – Diabetes down 60 - 70% with weight loss of 5%
- Improved life expectancy

1 Pound Equals =

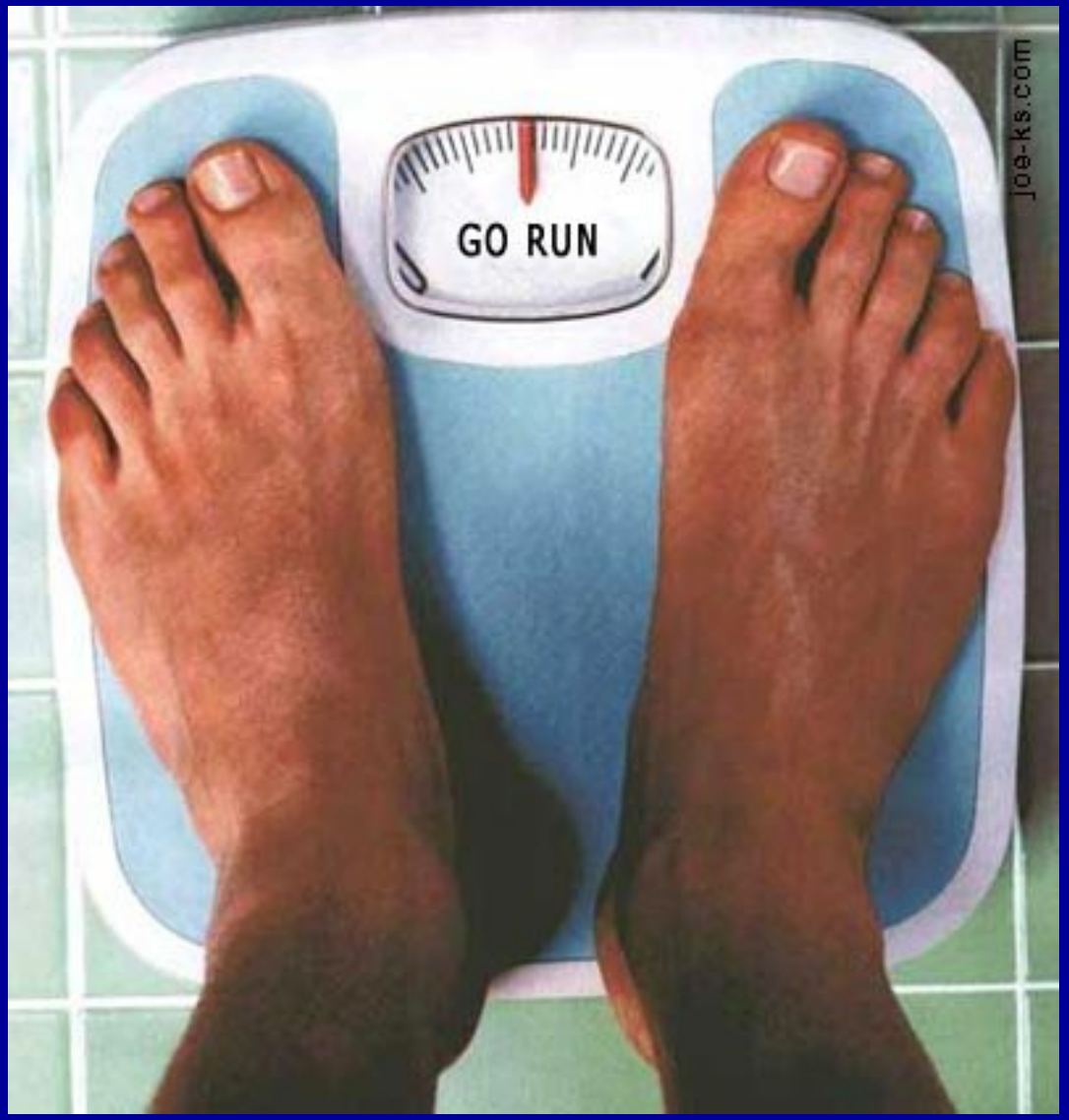
- 3500 calories per day for one week
- 100 calories per day for one month

- Foods = 100 calories
  - 10 potato chips
  - 20 corn chips
  - ¼ cup ice cream
  - ¼ cup pudding
  - ½ cup frozen yogurt

- 1 gum drop per day for one year = 1 pound

UW Active Living and Learning Program

- **Goal: 7% weight loss through lifestyle change**
- **Group program, multidisciplinary professionals**
- **Data show 5 - 7% weight loss at 3 months!**
- **Waist circumference decreased 3 inches**
- **Fasting glucose decreased from 131 to 119**
- **Average exercise time increased from less than 40 minutes per week to over 120 minutes per week**
- **Over 90% adherence to program at 11 months**
- **Covered by insurers, behaviorally based**


GO RUN
joe-ks.com

Health Benefits of Exercise

- Reduce Cardiovascular Disease
- Reduce Cancer (breast, colon, bladder)
- Reduce diabetes mellitus
- Improve / prevent osteoporosis
- Reduce weight
- Improve blood lipoproteins
- Reduce systolic / diastolic BP
- Psychological well being
- Reduce total and cardiac mortality

Obesity Guideline:
http://circ.ahajournals.org/content/129/25_suppl_2/S102

Guidelines for Exercise Prescription

- **F**requency — Most days (3-6 days/wk)
- **I**ntensity — Just do it
- **T**ime — 30-60 min **total**
- **T**ype — Aerobic/Resistance

Summary

- Regular physical activity
- Healthy eating
- Weight reduction as appropriate
- Take your medicines as recommended by a doctor you trust
- Metabolism is life!

Thank You!

Questions?

Best Resources for Heart Disease and Prevention Information

- American Heart Association: www.heart.org
- UW Health – Health Facts: www.uwhealth.org
- Heart Decision: www.heartdecision.org
- Harvard Health Letter: www.health.harvard.edu
- Mayo Clinic Newsletter
- Up To Date: www.uptodate.com
- SHAPE Society: www.shapesociety.org

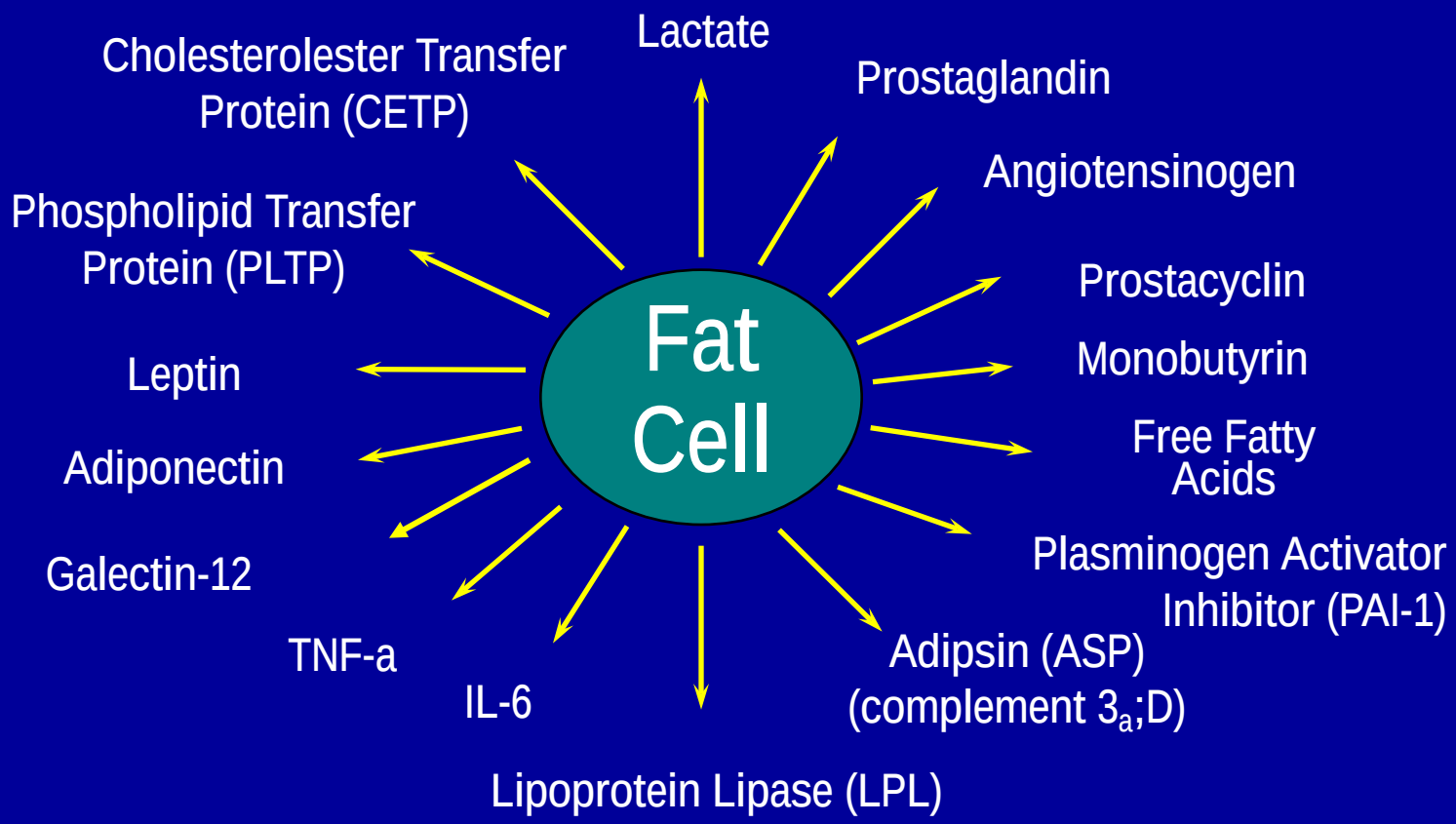
AHA Nutrition Committee Dietary Recommendations

Recommendations for Cardiovascular Disease Risk Reduction

- Balance calorie intake and physical activity to achieve or maintain a healthy body weight
- Consume a diet rich in fruits and vegetables
- Consume whole-grain, high-fiber foods
- Consume fish, especially oily fish, at least twice a week
- Limit intake of saturated fat to <7%, trans fat to <1% of energy and cholesterol <300 mg/day by
  - Choosing lean meat and vegetable alternatives
  - Choosing fat free (skim), 1% fat and low-fat dairy products
  - Minimizing intake of partially hydrogenated fats
- Minimize intake of beverages and foods with added sugar
- Choose and prepare foods with little or no salt
- If alcohol is consumed, do so in moderation

AHA = American Heart Association; AHA Nutrition Committee. *Circulation* 2006;114:82-96

The Fat Cell (adipocyte) Is An Endocrine Gland



Adapted from: Bray GA. *Contemp Diagn Obes.* 1998.