Food As Prevention in Cardiovascular Disease

McMaster Mini Medical School
February 26th, 2019

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St. Joseph's Healthcare Hamilton

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Subhas Ganguli – Conflict of Interest Slide

Last 2 years: None

No off-label uses of medications will be discussed.

Updated 3/27/17

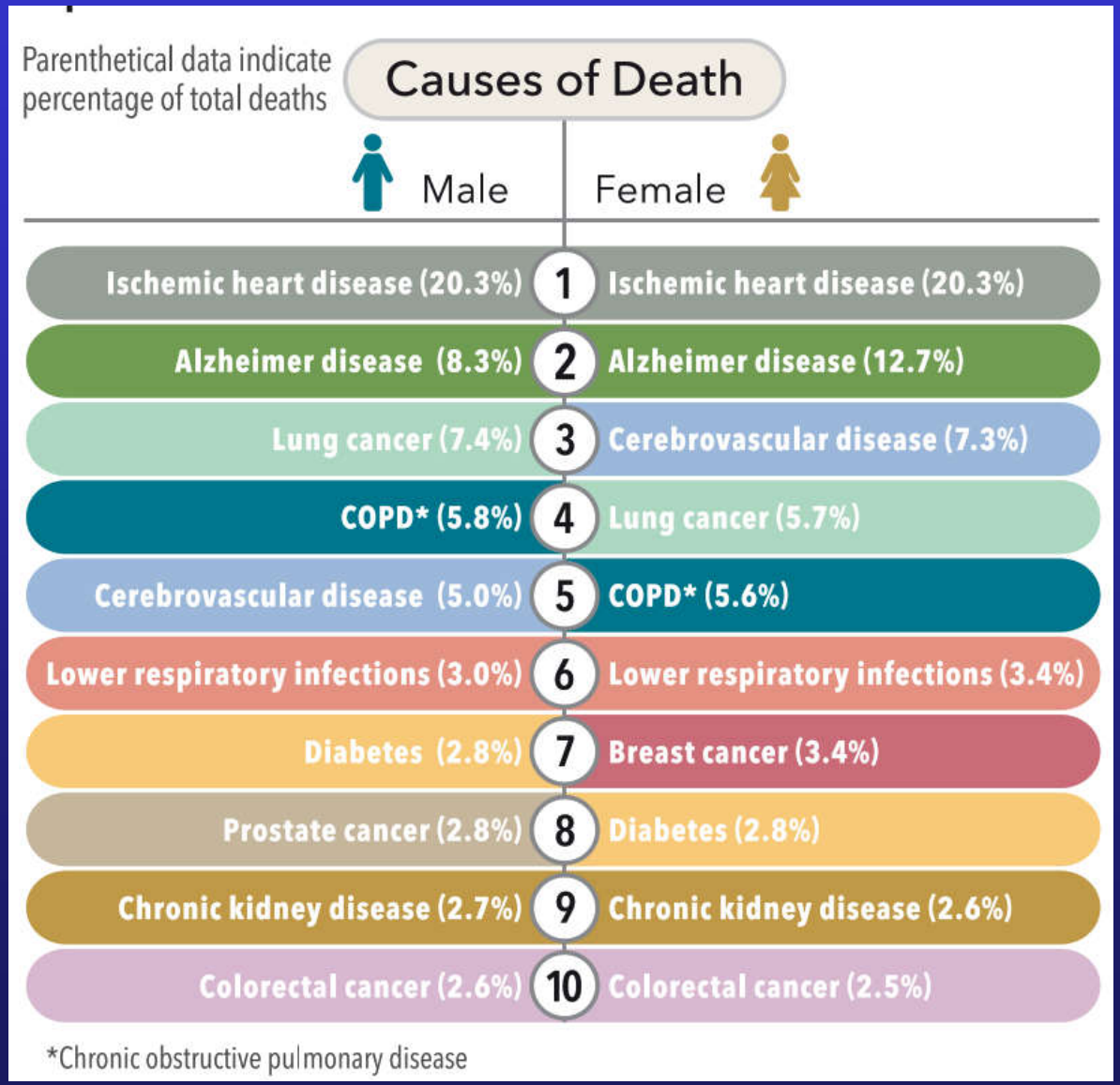
St. Joseph's Healthcare Hamilton

McMaster University

I will be addressing the following questions:

1) Is there good evidence of a 'signal' for the role of diet in the prevention and/or treatment of:
    1) Atherosclerotic heart disease
    2) Risk factors for atherosclerosis
2) If so, what is the most effective dietary intervention
3) What is necessary for this intervention to succeed.

Top 10 Causes of Death, USA, 2013



SCG 2018

L Marczak JAMA 2016:315(3):241

Risk Factors for Top 10 Causes of Death, USA, 2013

	Risk Factors	
	Male	**Female**
1	Dietary	Dietary
2	Smoking	Blood Pressure
3	Blood Pressure	Smoking
4	Body Mass Index	Body Mass Index
5	Blood Glucose	Blood Glucose
6	Total Cholesterol	Total Cholesterol
7	Physical Activity	Physical Activity
8	Kidney Function	Kidney Function
9	Air Pollution	Air Pollution
10	Occupational Risks	EtOH / Drugs

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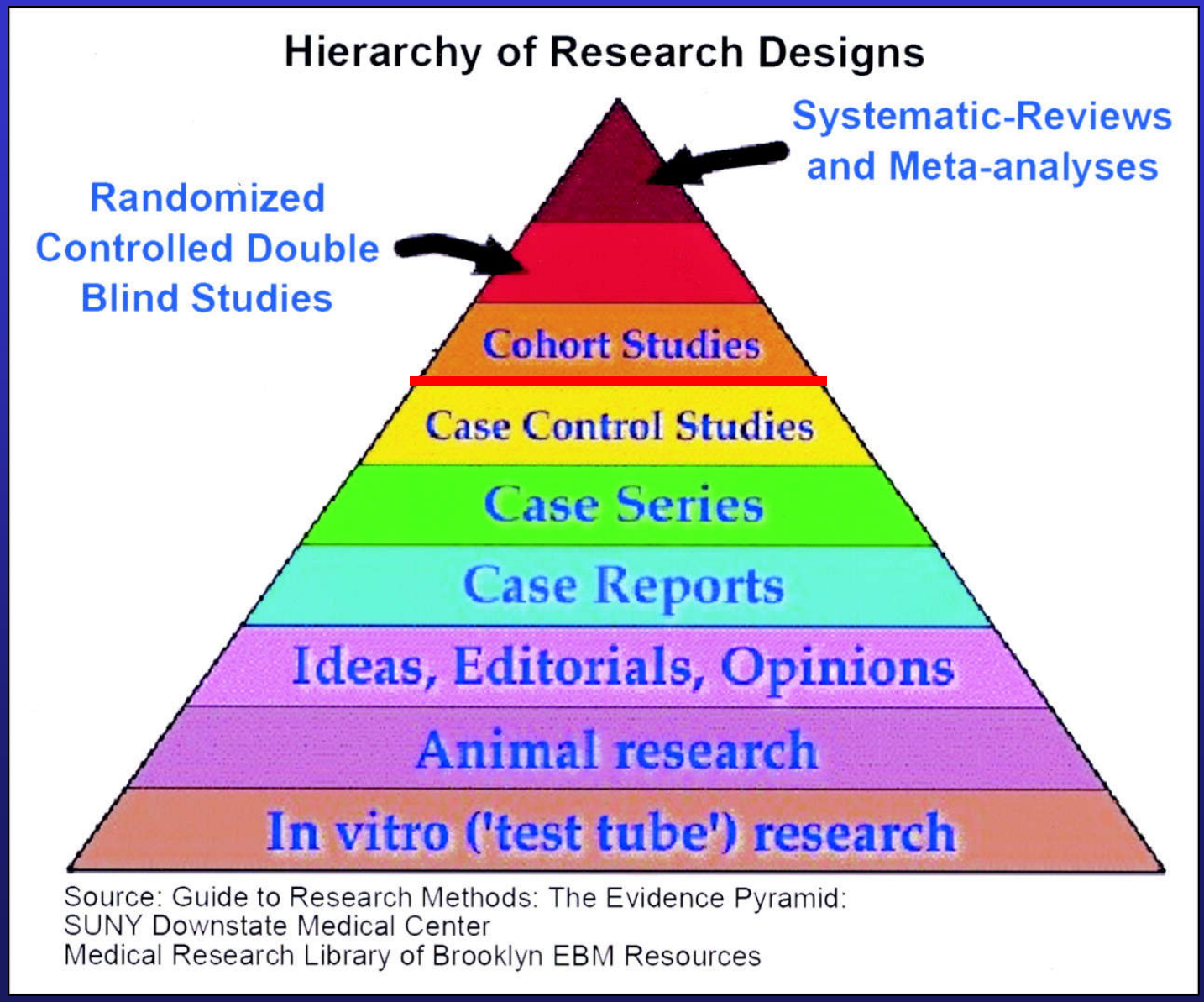
L Marczak JAMA 2016:315(3):241

Understanding Medical Evidence



Source: Guide to Research Methods: The Evidence Pyramid:
SUNY Downstate Medical Center
Medical Research Library of Brooklyn EBM Resources

Important Safety Information about Lifestyle Changes

A whole food plant-based diet can reverse conditions such as high blood pressure or diabetes. When this happens, medication doses need to be reduced or there may be complications due to low blood pressure or low blood sugar such as fainting.

Always consult your physician before making diet, or medication changes or starting an exercise program .

Subjects on a WFPB diet need to supplement with vitamin B12 which is essential for the function of nerves and should consider supplementation with vitamin D and omega 3 (DHA, EPA).

How Important is Lifestyle

29712712

Healthy Lifestyle Factors & US Life Expectancy

Aim: Assess impact of lifestyle factors on US mortality & life expectancy.

Design: prospective cohort study of:

78,865 women from NHS followed for 34 yrs (1980-2014)

44,354 men from HPFUS followed for 27 yrs (1986-2014)

Low risk lifestyle factors:

1) Never smoking
2) BMI 18.5-24.9
3) >= 30 min/d moderate/vigorous physical activity
4) Moderate alcohol intake (5-15 g women, 5-30 g men)
5) High diet quality score (upper 40%)

Total lifestyle score: 0-5 scale

Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047

Healthy Lifestyle Factors & US Life Expectancy

Alternate Healthy Eating Index Score 29712712

Assigned points (0 to10) for intake of each of 10 components:

High intake of:

1) Vegetables
2) Fruits
3) Nuts
4) Whole grains
5) Polyunsaturated fats
6) Omega 3 fatty acids

Low intake of:

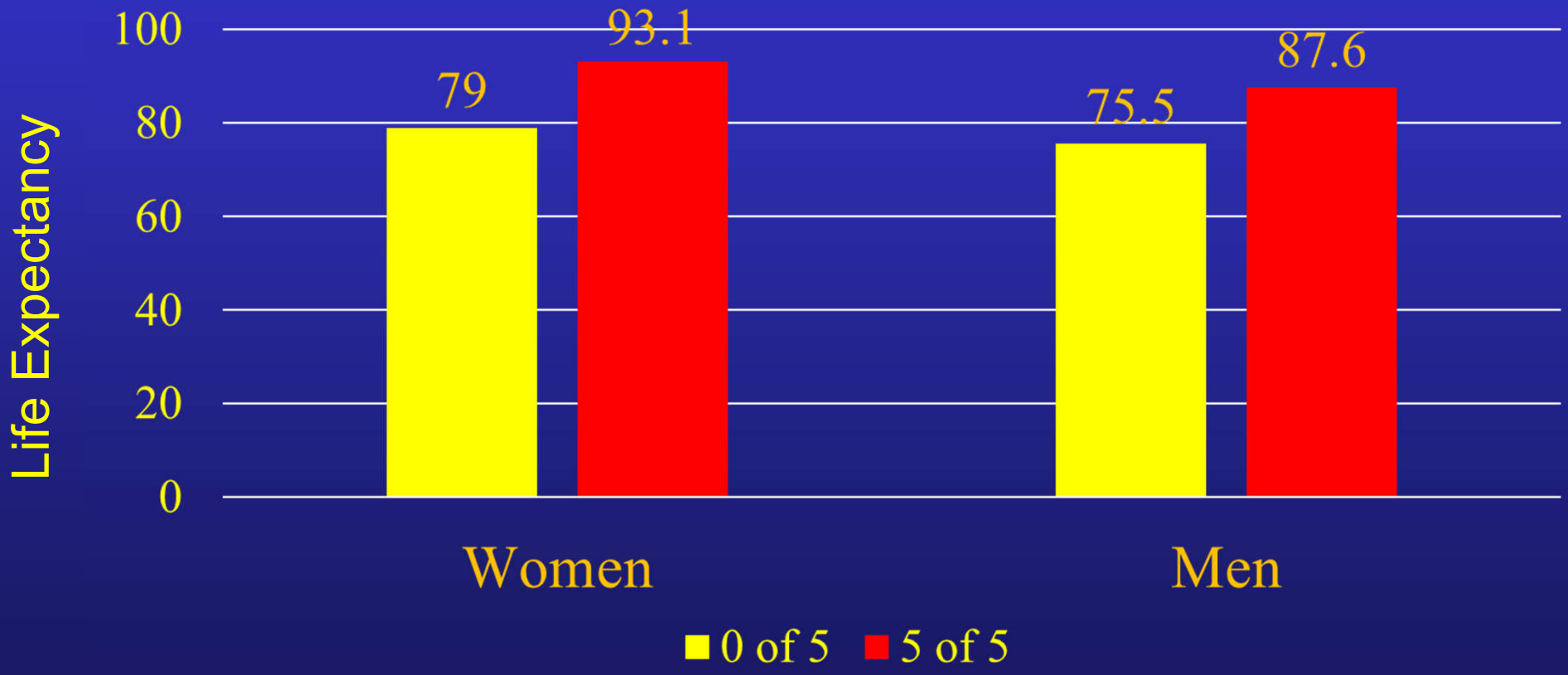
7) Red meats
8) Processed meats
9) Sugar sweetened beverages

SCG 2018

Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047

Healthy Lifestyle Factors & US Life Expectancy

Life Expectancy at 50 Yrs of Age



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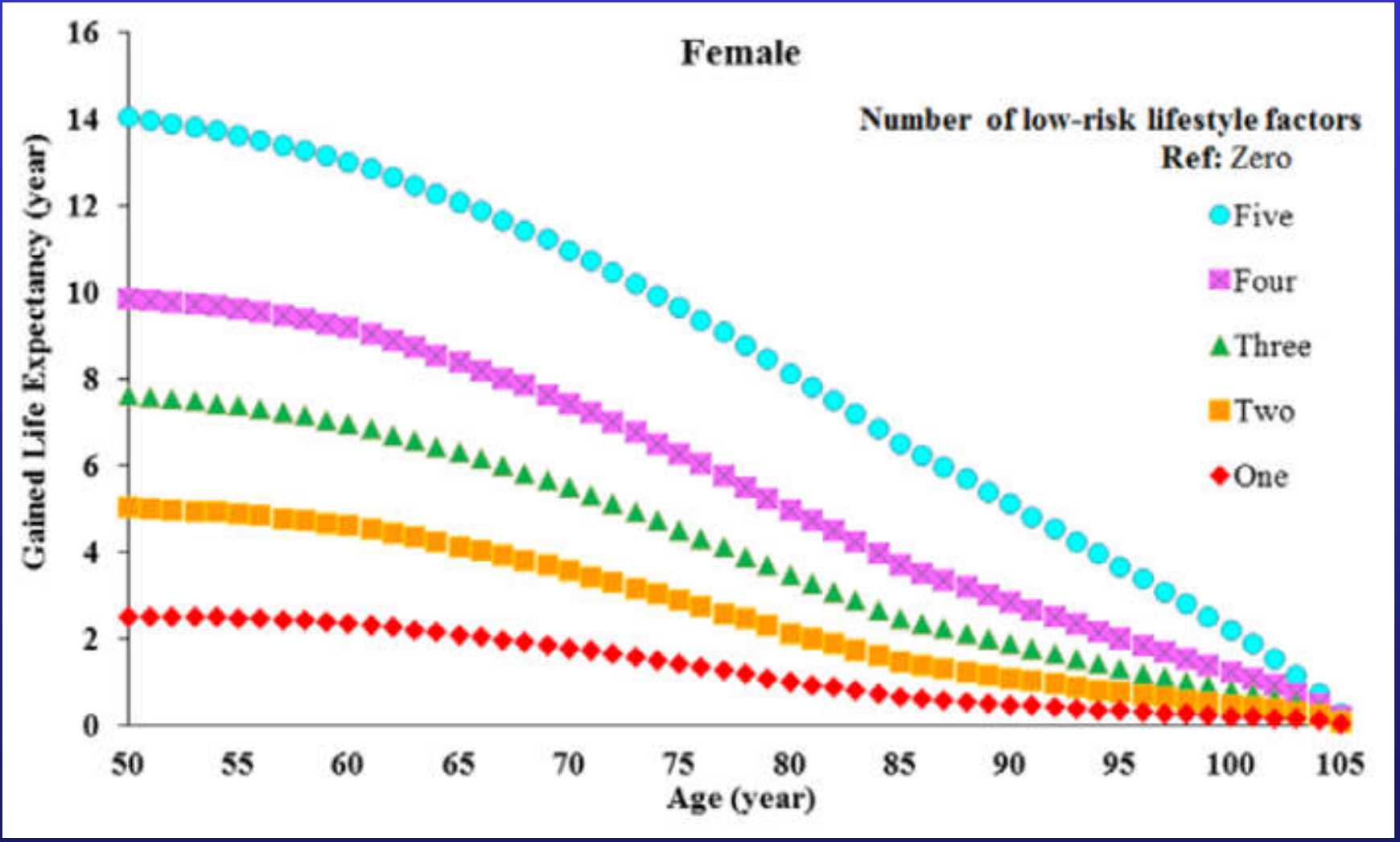
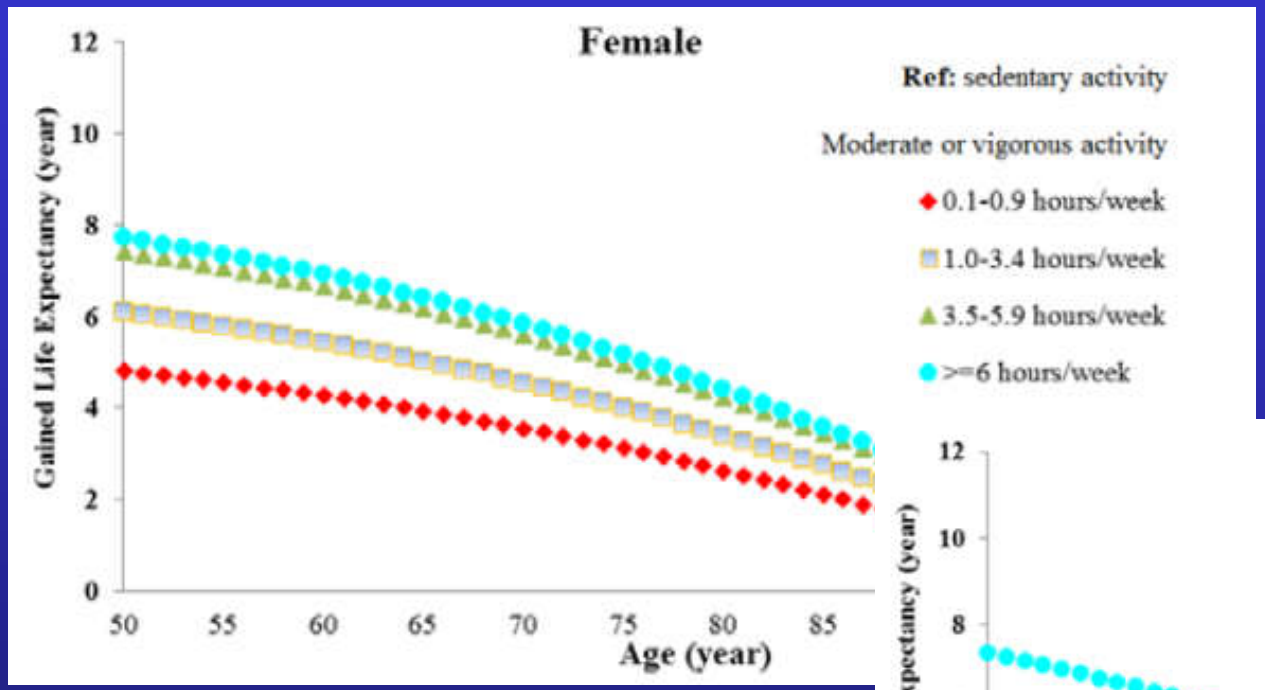
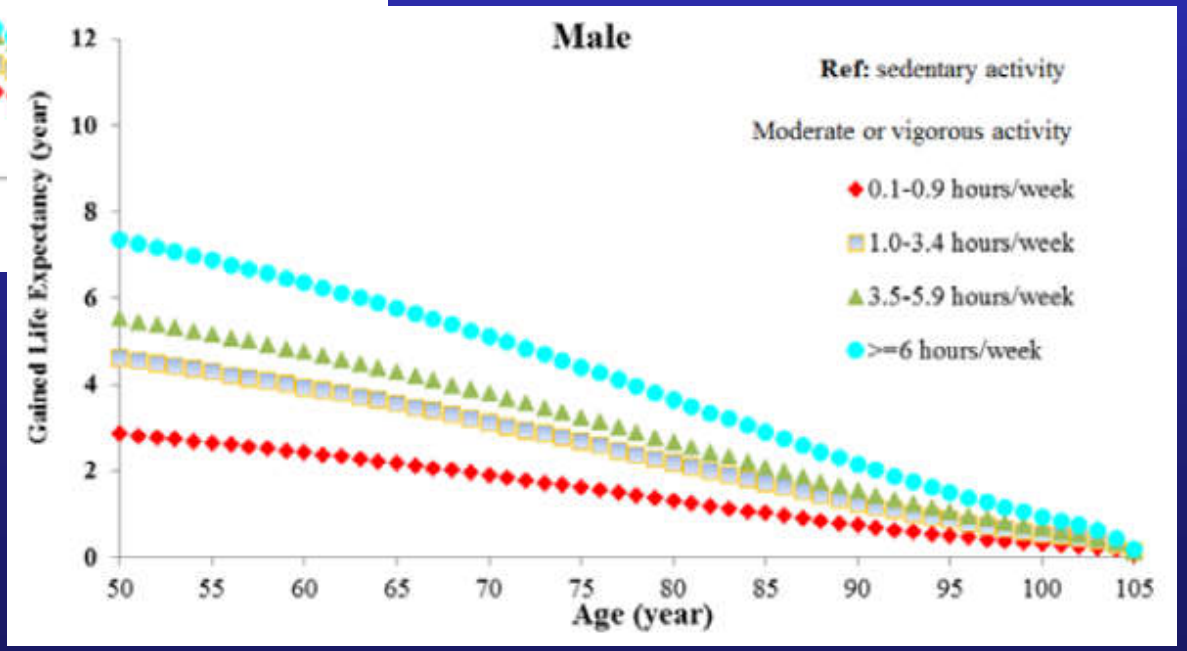
Years Gained: Healthy vs No Healthy Lifestyle



Y Li Circulation 2018 in press
DOI: 10.1161/CIRCULATIONAHA.117.032047

Years Gained: Moderate/Vigorous Activity





Y Li Circulation 2018 in press
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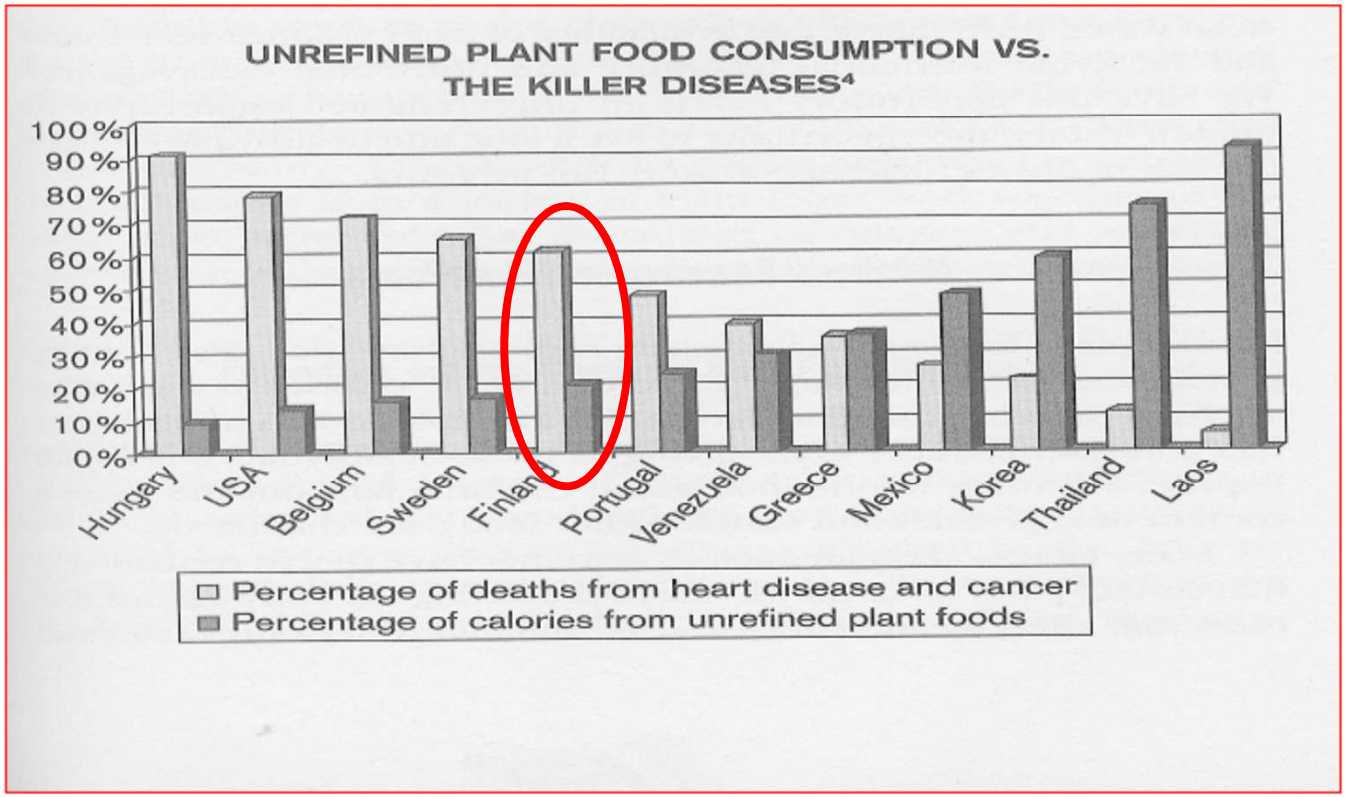
Does Lifestyle work in

Real Life ?

UNREFINED PLANT FOOD CONSUMPTION VS. KILLER DISEASES



World Health Statistics Annual 1994–1998. Online version. www.who.int/whosis; Food and Agriculture Organization of the United Nations. Statistical database food balance sheets, 1961– 1999. Available online at www.fao.org; National Institutes of Health. Global cancer rates, cancer death rates among 50 countries, 1986–1999. Available online at www.nih.gov.

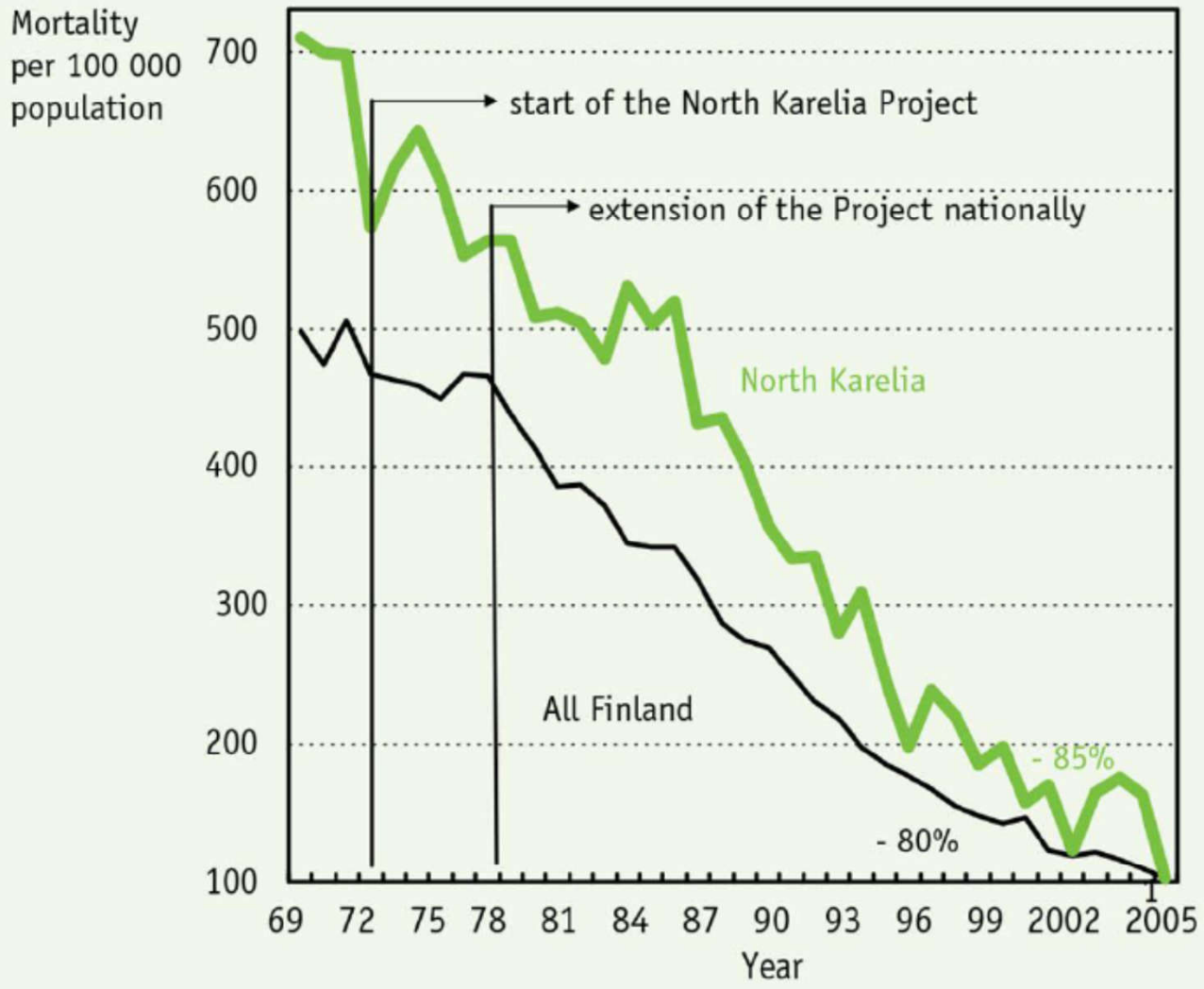
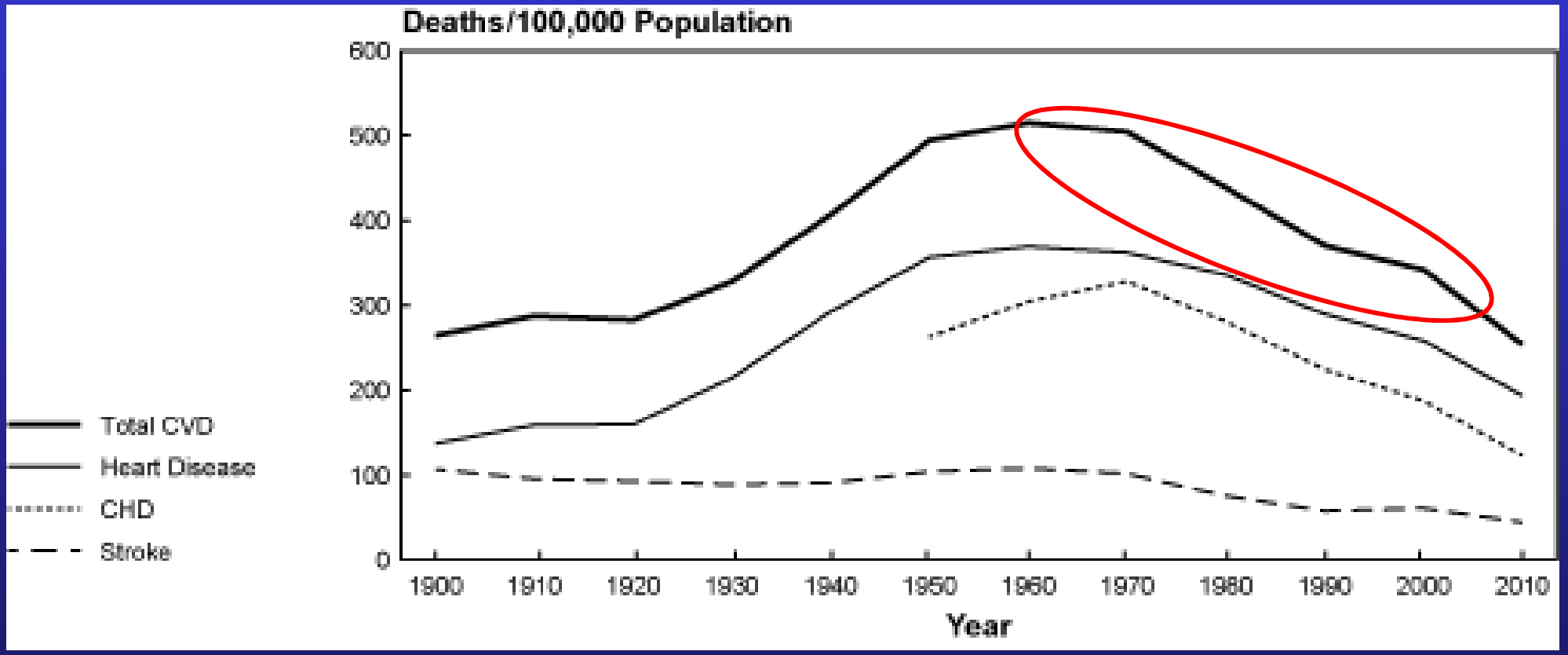


Figure 1. Age-adjusted mortality rates of coronary heart disease in North Karelia

USA Deaths from Cardiovascular Diseases

(1900-2010, Per 100,000 Population)



www.nhlbi.nih.gov/about/documents/factbook/2012/chapter4

Mortality Changes, N Karelia, 1970-2006

	1969-1971	2006	Change
All causes	1 509	572	-62%
All cardiovascular	855	182	-79%
Coronary heart disease	672	103	-85%
All cancers	271	96	-65%
Lung cancers	147	30	-80%

Diabetes Voice 2008:53:26-29

Importance of Risk Factors

In Heart Attacks

SG2

SG3

Modifiable Risk Factors & MI in 52 Countries

Risk Factor	Cases (%)	Controls (%)	OR	PAR-2
Smoking	48.1	65.2	2.0	36%
Diabetes	7.5	18.4	2.4	10%
Hypertension	21.9	39.0	1.9	18%
Obesity	33.3	46.3	1.6	20%
Psychosocial	-	-	2.7	32.5%
Vegetables/fruit	42.4	35.8	0.70	14%
Exercise	19.3	14.3	0.86	12%
EtOH intake	24.4	24.0	0.91	7%
ApoB/ApoA1	20.0	33-49	3.25	49%
All Risk Factors			129.2	90%

SCG
2017

Cases = 15, 152

Controls = 14,820

Significant (P<0.05)

S Yusuf, Lancet 2004:364:937-952

Slide 22

SG2 Consider making into a histogram
Subhas Ganguli, 2017-04-28

SG3 What data collected on diet ?
Subhas Ganguli, 2017-04-28

Relative Importance of

Stress vs Diet

Norway: Circulatory Disease Mortality

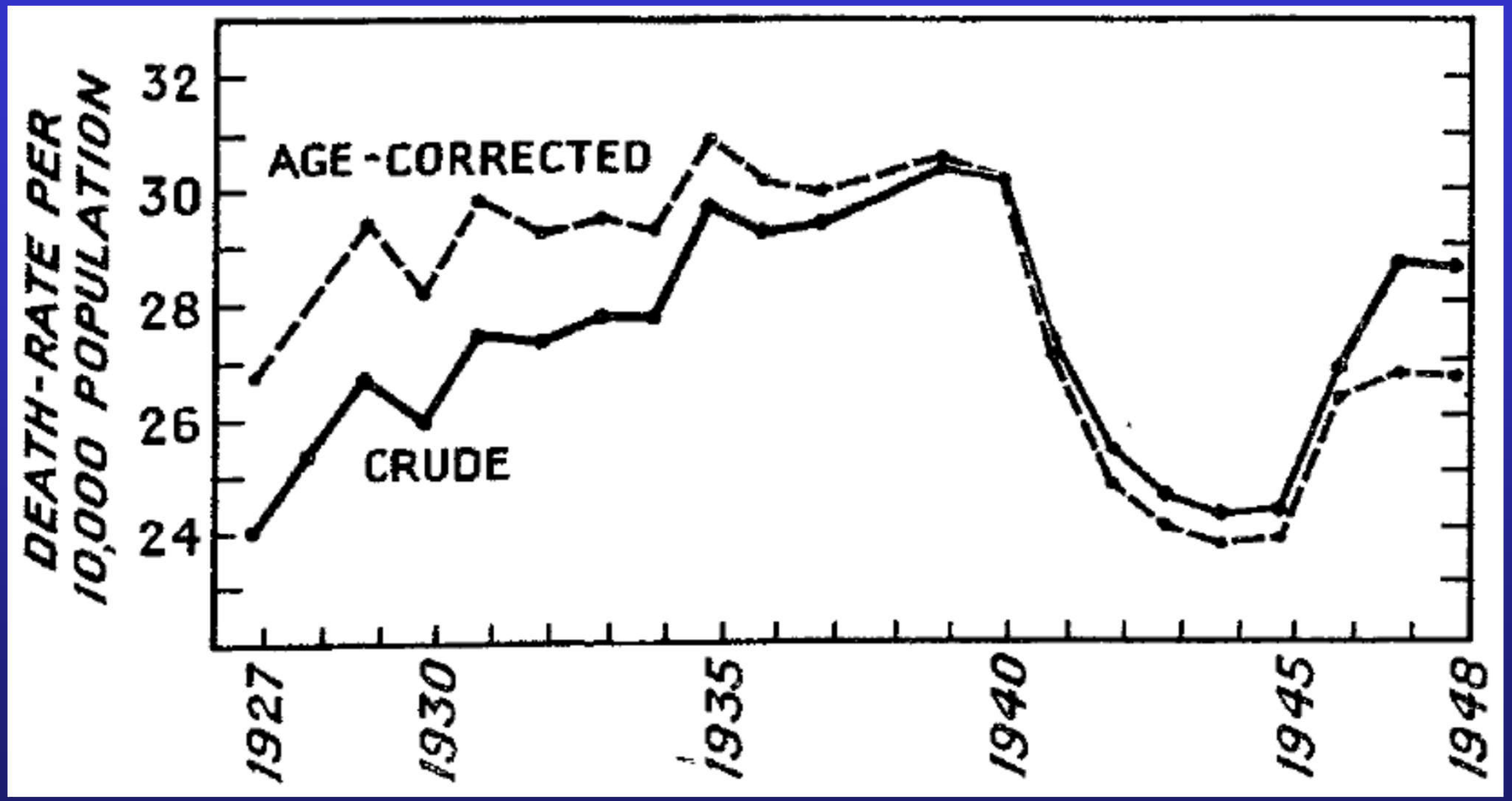
	1936-1937	1942-1945	Change (%)
Average Calories/day	3470	2850	- 18%
Fat (g/day)	159	71	- 55%
Protein (g/day)	115	93	- 19%
Carbohydrates (g/day)	395	429	+9%

Decreased: Meat, whole milk, cream, margarine, cheese, eggs, fruits, berries

Increased: Fish, skimmed milk, cereals, potatoes, vegetables

A Strom Lancet 1/20/1951:6647(257):126-129

Norway: Circulatory Disease Mortality



Decreased: Meat, milk, cream, margarine

Increased: Vegetables, fish, skimmed milk, cereals, potatoes

A Strom Lancet 1/20/1951:6647(257):126-129

The Role of Meat

Red Meat Consumption & Mortality

Prospectively followed 37,698 men (Health Professionals follow-up study, 1986-2008) & 83,644 women (Nurses Health Study 1980-2008) who were free of CV disease and cancer at baseline.

Diet assessed by validated questionnaire & updated every 4 years.

Documented 23,926 deaths (5910 CVD & 9464 cancer) during 2.96 million person-yrs of FU.

Multivariate adjustments for major lifestyle & dietary risk factors.

A Pan Archives IM 2012 172(7):555-63

Red Meat Consumption & Mortality

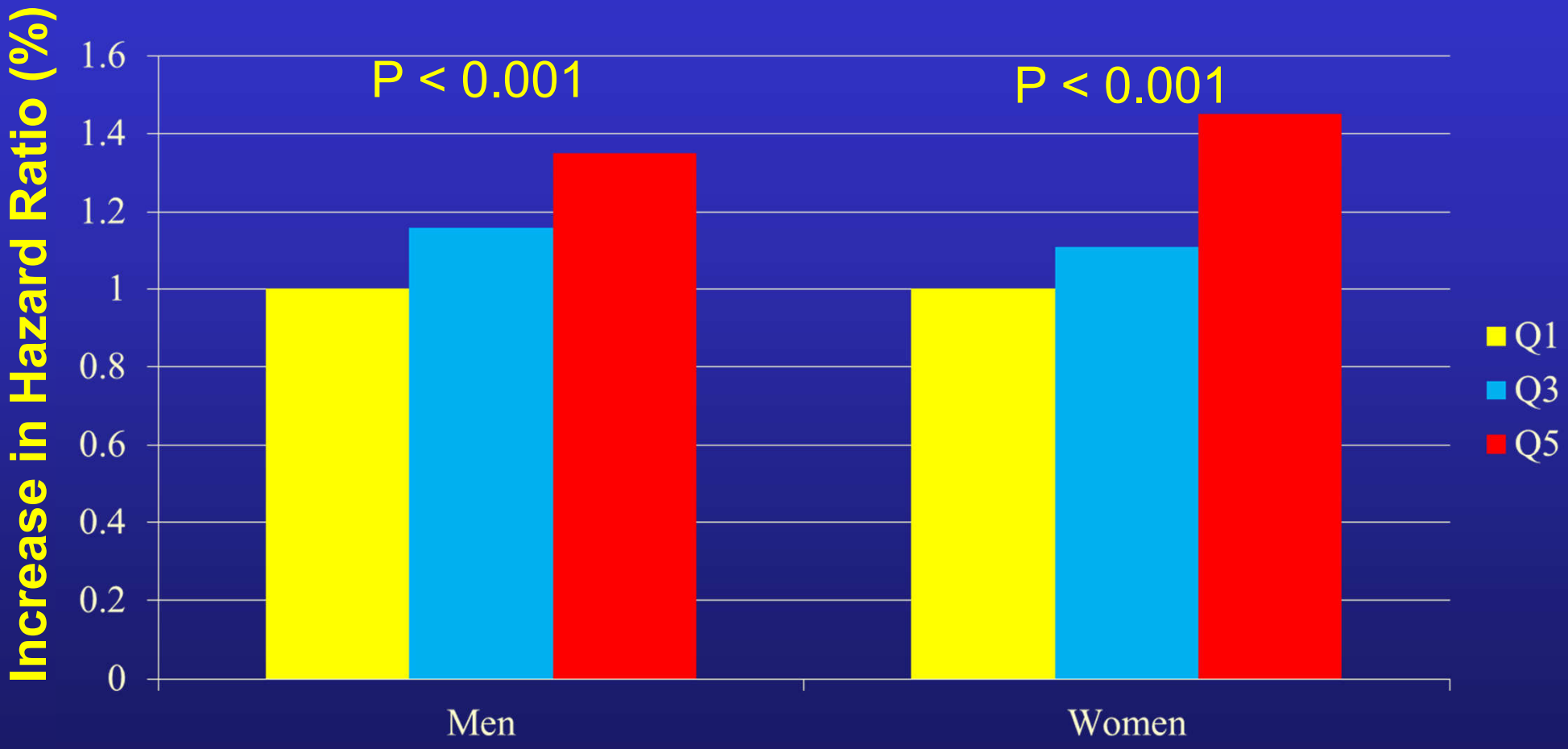
Multivariate analysis to adjust for:

1) Intakes of : total energy, whole grains, fruits, vegetables (all in quintiles)
2) Age, BMI
3) Race (white, nonwhite)
4) Smoking status (never, past, current [3 ranges])
5) EtOH intake (0 plus 3 levels)
6) Physical activity (5 levels)
7) MVI use
8) ASA use
9) Family Hx: DM, MI, cancer
10) Baseline history of DM, Htn, hypercholestrolemia
11) Women: postmenopausal status, menopausal hormone use

A Pan Archives IM 2012 172(7):555-63

Total Red Meat & Cardiovascular Mortality

Total meat intake by Quintile



	Q1	Q3	Q5
Men	0.25	0.95	2.07
Women	0.51	1.14	2.17

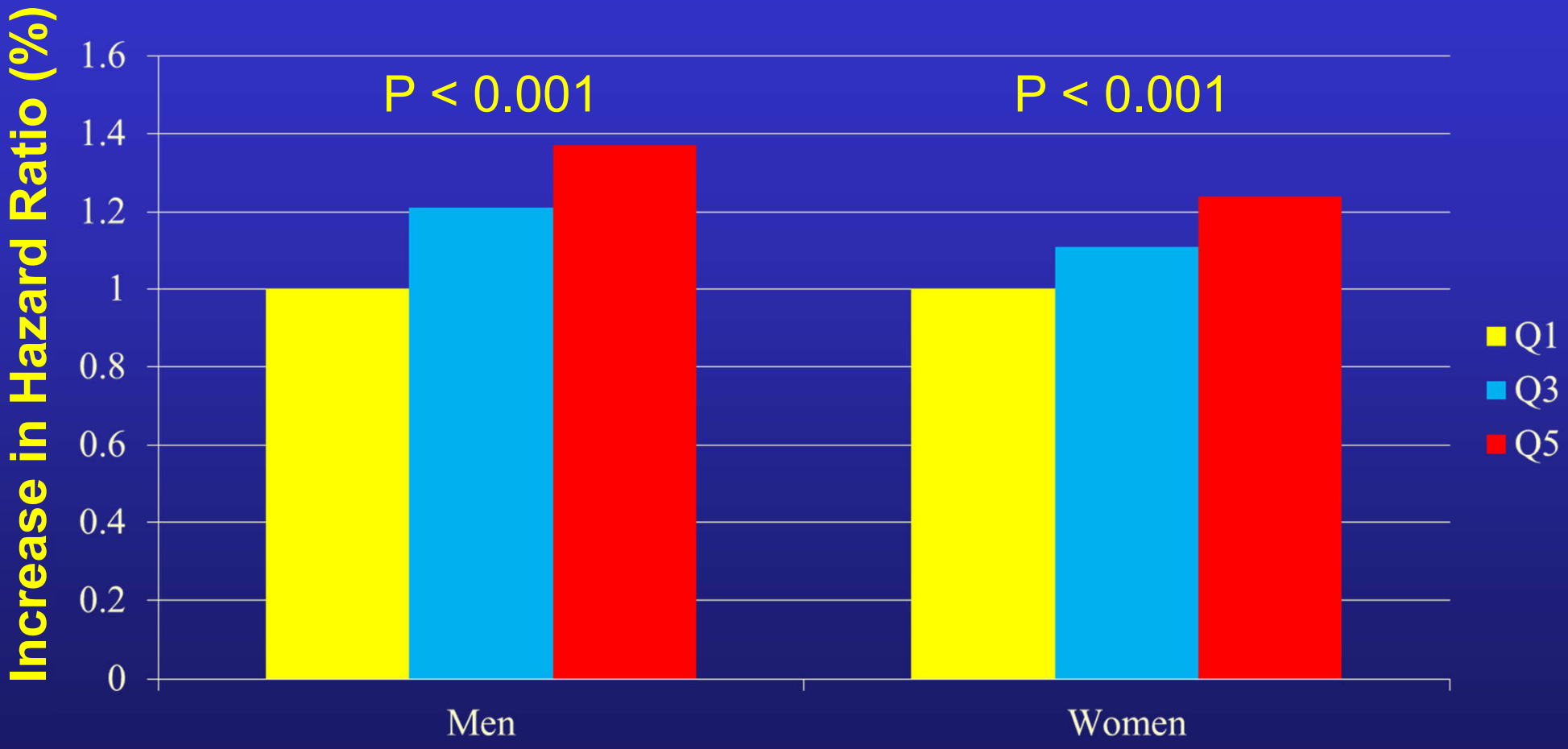
Portions per day

A Pan Archives IM 2012 172(7):555-63

SCG 2016

Total Red Meat & Total Mortality

Total meat outcome by Quintile



	Q1	Q3	Q5
Men	0.25	0.95	2.07
Women	0.51	1.14	2.17

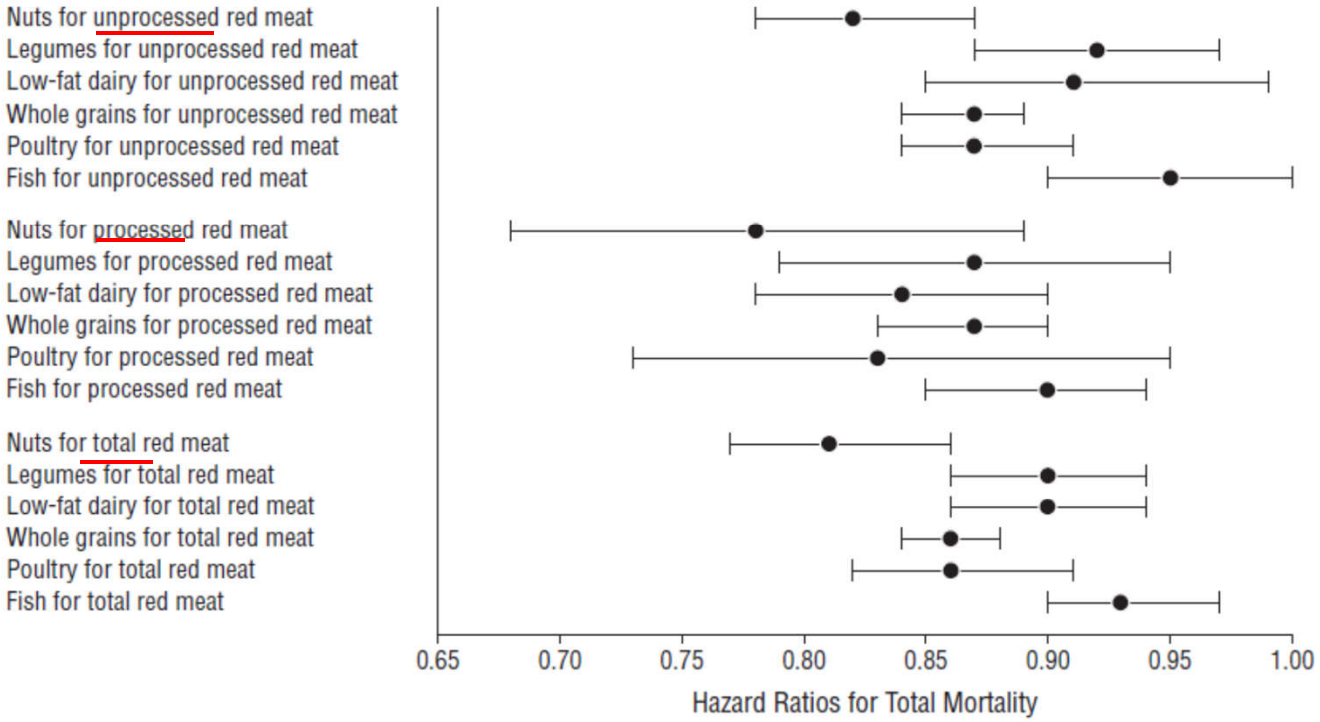
Portions per day

A Pan Archives IM 2012 172(7):555-63

SCG 2012

Meat Intake & All-Cause Mortality

Effect of replacing 1 portion red meat/day

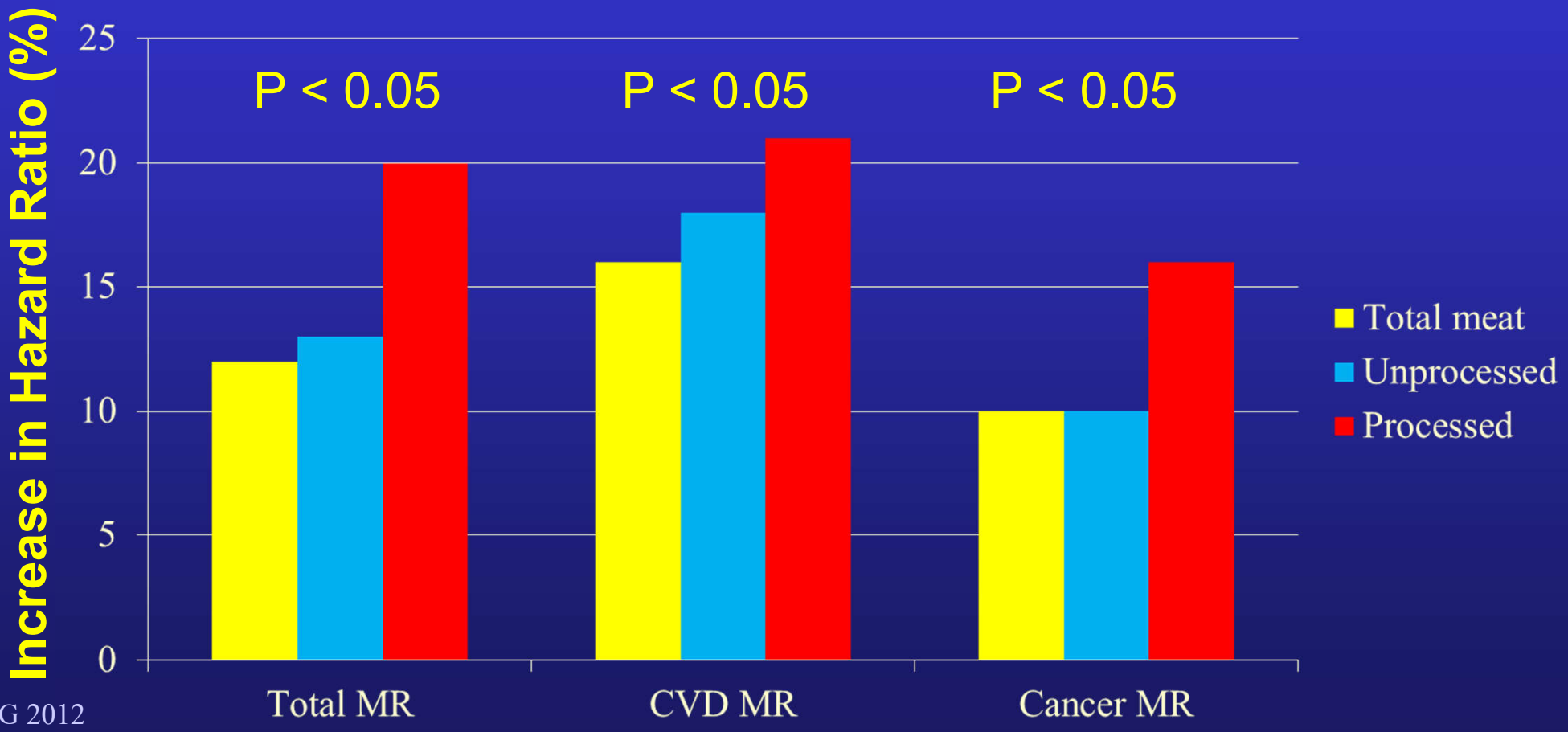


SCG 2012

A Pan Archives IM 2012 172(7):555-63

Red Meat Consumption & Outcomes

Effect of a 1 serving per day increase



SCG 2012

CVD = cardiovascular disease

A Pan Archives IM 2012 172(7):555-63

CV Mortality & Cancer in Vegetarians:
Systematic Review & Meta-analysis

Seven cohorts: UK, Germany, California, USA, Netherlands, Japan

Total subjects = 124,706

Significant reduction in:

1) Ischemic heart disease mortality (29%, $p < 0.05$)
2) Cancer incidence (18%, $p < 0.05$)

Non-significant reduction in:

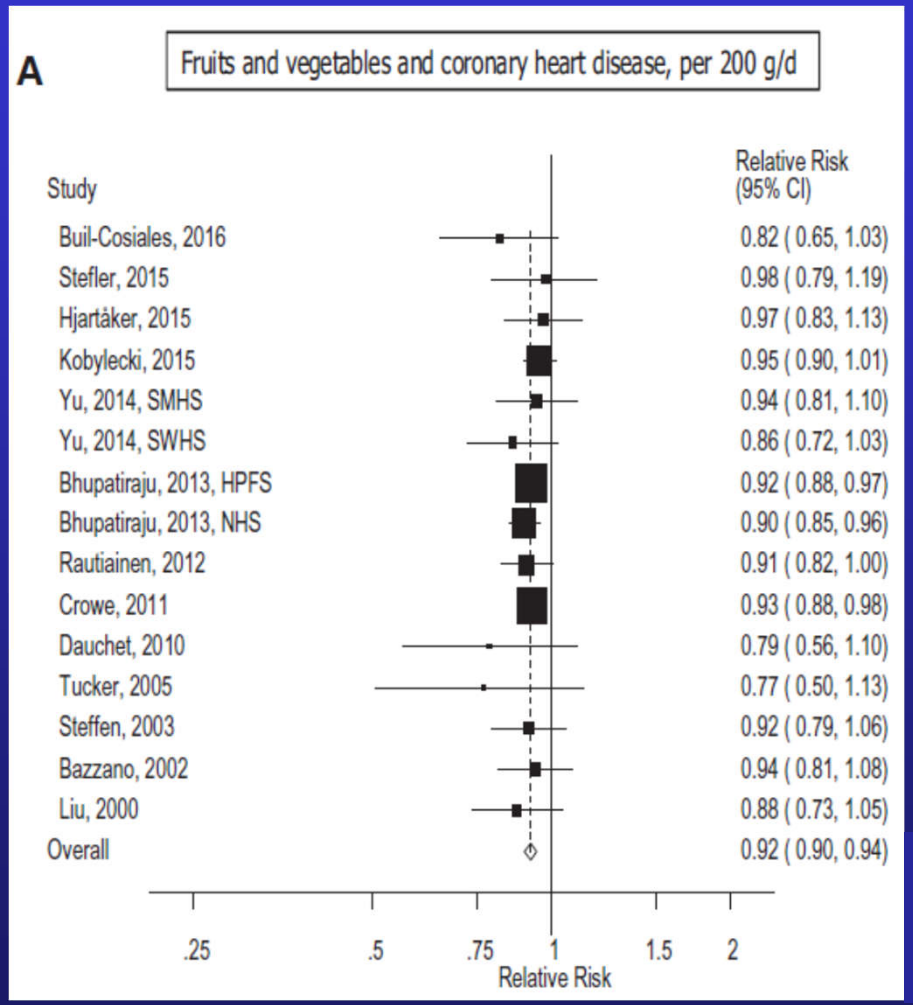
1) All cause mortality (9%, p=NS)
2) Circulatory disease mortality (16%, p=NS)
3) Cerebrovascular disease mortality (12%, p=NS)

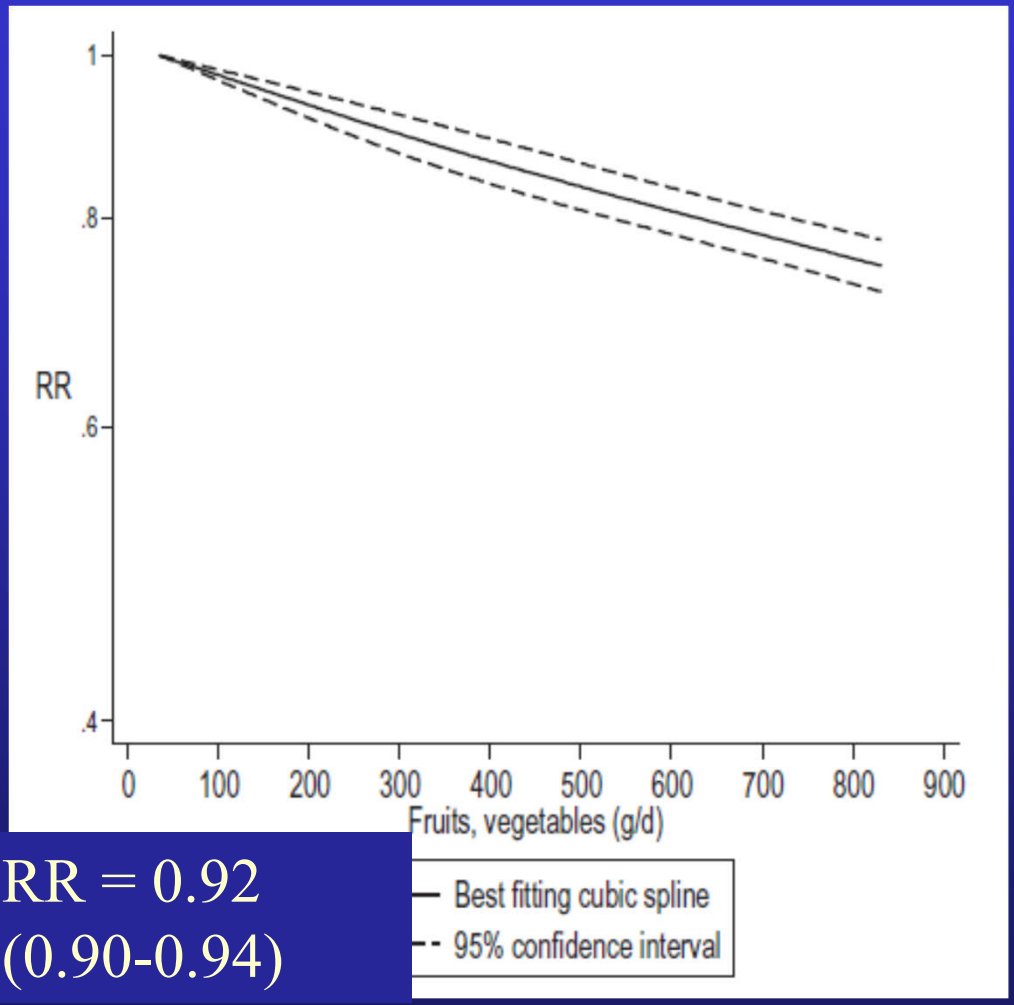
T Huang Annals Nutrition Metabolism 2012

How Much Fruit & Vegetables

Should I Eat ?

Meta Cohort Studies: Fruit & Vegetables & Mortality Coronary Heart Disease





RR = 0.92
(0.90-0.94)

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2017

N = 15 studies,
n= 17,742 cases, 775,132 participants

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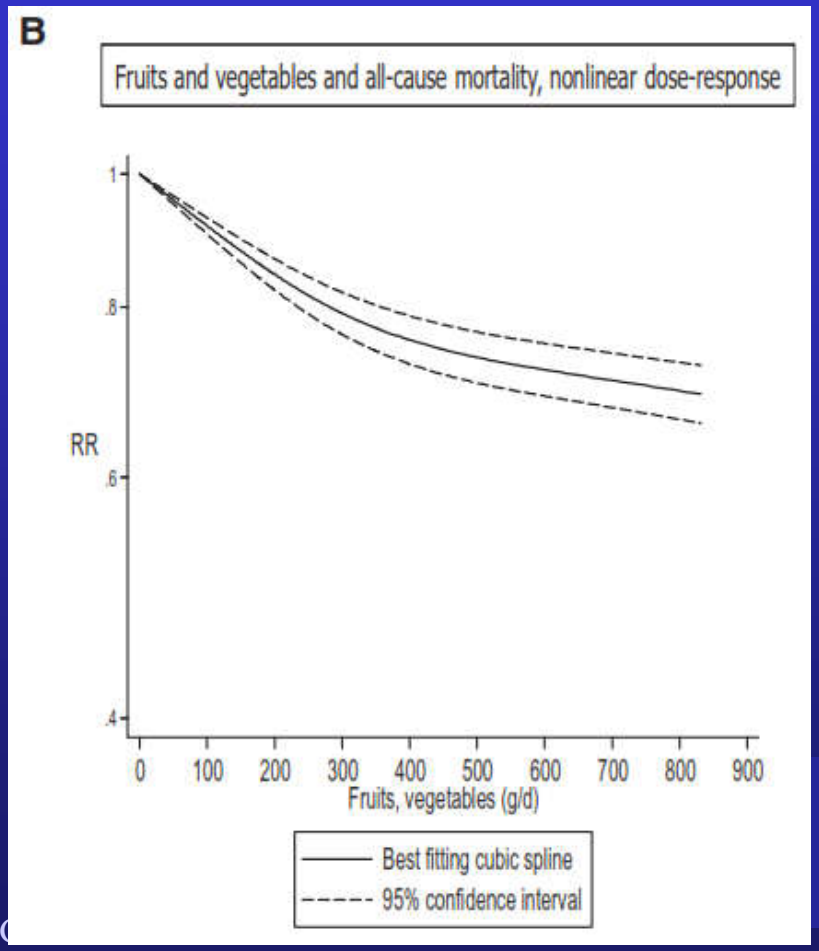
D Aune Int J Epidemiology 2017:1-28

Meta Cohort Studies: Fruit & Vegetables & Mortality
All Cause Mortality



RR = 0.90
(0.87-0.93)

Fruit and vegetables	
g/d	RR (95% CI)
0	1.00
50	0.96 (0.95-0.97)
100	0.92 (0.90-0.93)
150	0.88 (0.86-0.90)
200	0.84 (0.82-0.87)
250	0.82 (0.79-0.84)
300	0.79 (0.76-0.82)
350	0.77 (0.74-0.80)
400	0.76 (0.73-0.79)
450	0.74 (0.71-0.78)
500	0.73 (0.70-0.77)
550	0.73 (0.70-0.76)
600	0.72 (0.69-0.75)
650	0.71 (0.68-0.75)
700	0.71 (0.68-0.74)
750	0.70 (0.67-0.73)
800	0.69 (0.66-0.73)
830	0.69 (0.66-0.73)
$P_{nonlinearity}$	<0.0001

SC
2017

N = 15 studies,
n= 71,160 cases, 959,083 participants

D Aune Int J Epidemiology 2017:1-28

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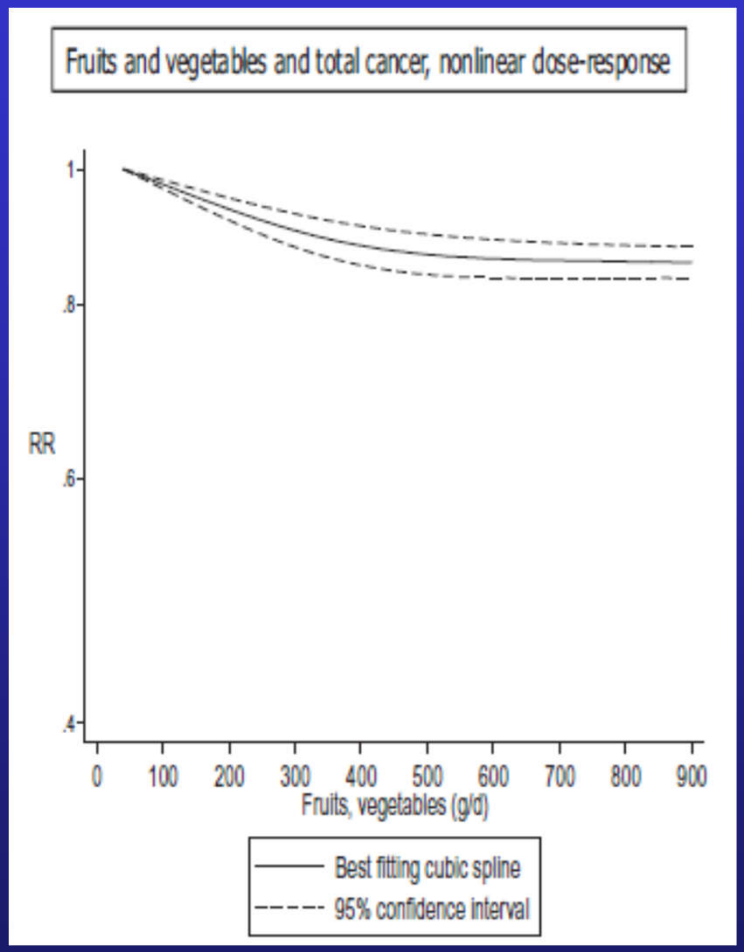
Meta Cohort Studies: Fruit & Vegetables & Total Cancer



RR = 0.97
(0.95-0.99)

I2 = 49%

Fruit and vegetables and total cancer incidence/mortality	
g/d	RR (95% CI)
40	1.00
50	1.00 (0.99-1.00)
100	0.98 (0.97-0.98)
150	0.95 (0.94-0.97)
200	0.94 (0.92-0.95)
250	0.92 (0.90-0.94)
300	0.90 (0.88-0.93)
350	0.89 (0.86-0.92)
400	0.88 (0.85-0.91)
450	0.87 (0.85-0.90)
500	0.87 (0.84-0.90)
550	0.86 (0.84-0.89)
600	0.86 (0.84-0.89)
650	0.86 (0.84-0.89)
700	0.86 (0.84-0.88)
750	0.86 (0.84-0.88)
800	0.86 (0.84-0.88)
850	0.86 (0.84-0.88)
900	0.86 (0.84-0.88)
$P_{nonlinearity}$	<0.0001

SCG
2017

N = 12 studies

28338764

D Aune Int J Epidemiology 2017:1-28

Meta: Fruit & Vegetable Intake & Mortality

Canada – Attributable Fractions/Mortality

	500 g/day	Deaths	800 g/day	Deaths
Coronary Heart Disease	9.1%	4,832	16.9%	8,790
Stroke	23.2%	4,061	41.2%	7,215
Total Cancer	7.3%	5,785	8.5%	6,716
All-cause mortality	11.9%	32,326	16.9%	45,767

D Aune Int J Epidemiology 2017:1-28
Supplementary Table 33

How Effective Are

Dietary Interventions ?

RCT Primary Prevention of Cardiovacsular Disease with a Mediterranean Diet

Population: (n=7,447) Individuals 55-80 yrs (M 55-80, F 60-80) without CV disease at baseline and either NIDDM or 3 of: (smoking, Htn, inc LDL, low HDL, overweight/obese, FH premature CAD).

Intervention (1:1:1):

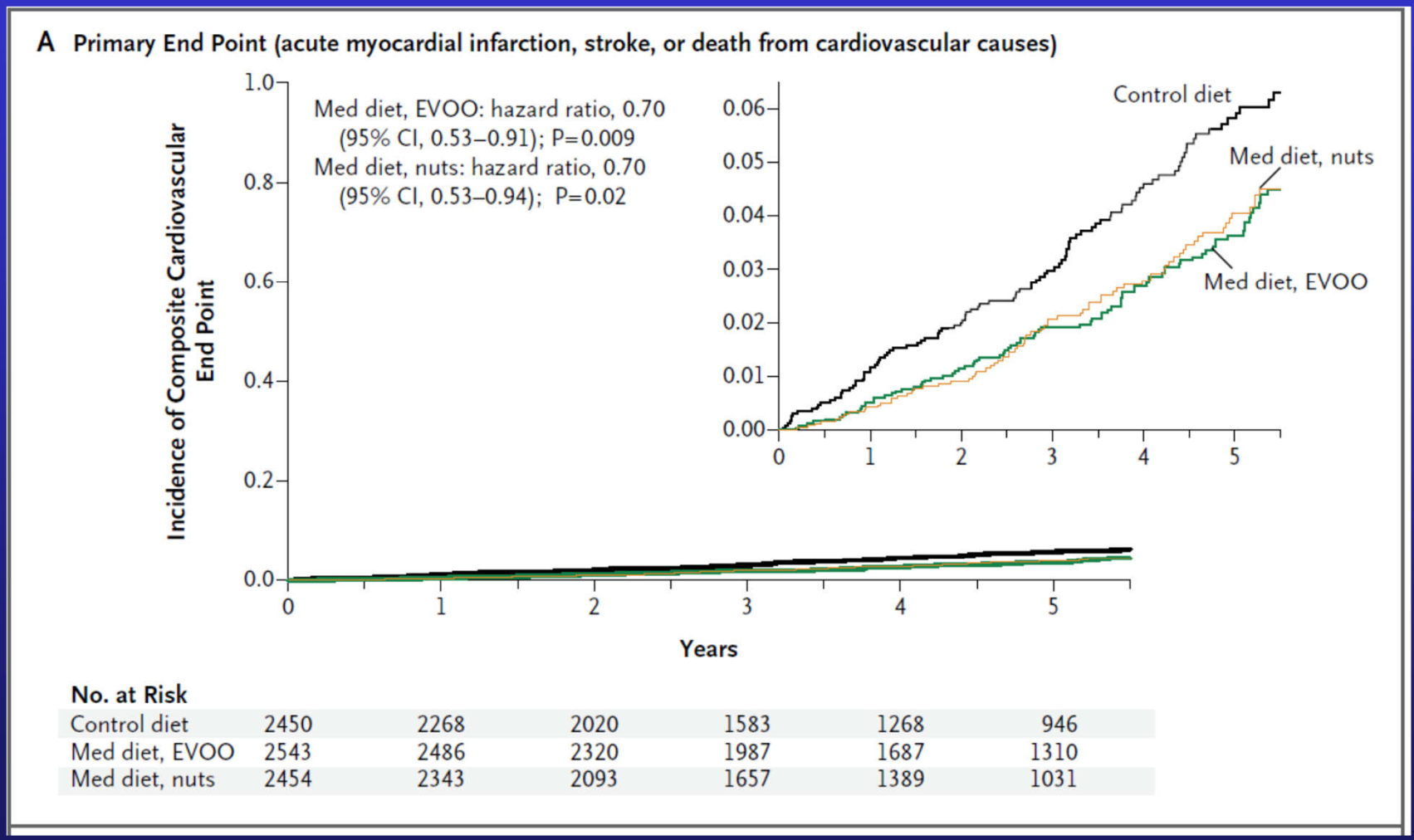
1) Advice to reduce dietary fat
2) Mediterranean diet + extra-virgin olive oil
3) Mediterranean diet + nuts (15 g walnuts, 7.5 g hazelnuts, 7.5g almonds)

Outcomes:

Primary: rate of major CV events (MI, CVA, death from CV causes). Occurred in 288 participants (3.8%) resulting in premature termination after median follow-up of 4.8 years.

Estruch R NEJM 2013:368(14):1279-90

Primary Prevention of CVD with a Mediterranean Diet: Primary End Point



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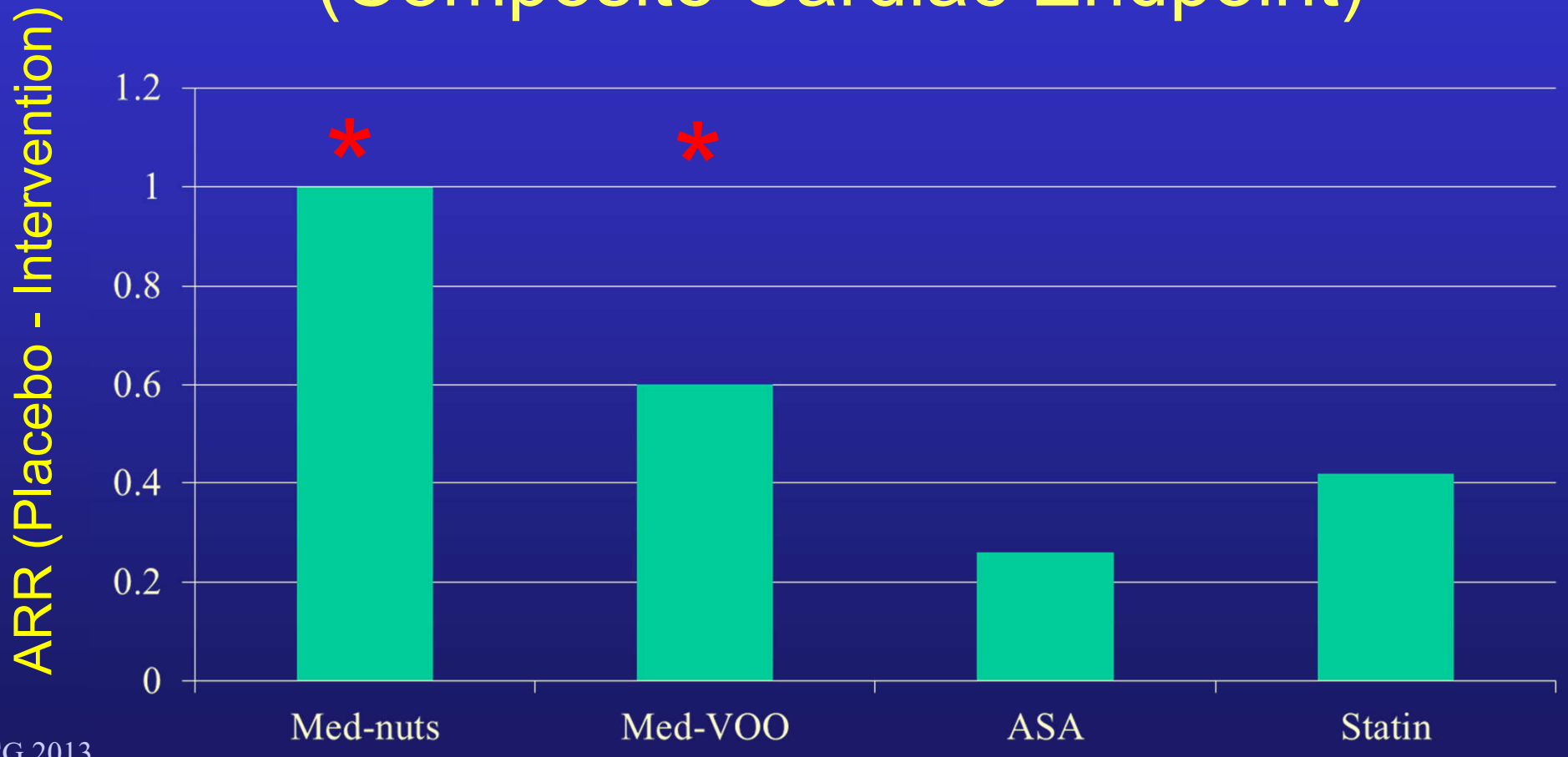
Endpoint: Acute MI, CVA, death from CV

Estruch R NEJM 2013:368(14):1279-90

Comparison: Diet vs ASA vs Statin
(Composite Cardiac Endpoint)



* P < 0.05 in original RCT

Estruch R NEJM 2013:368(14):1279-90
Arch IM 2012:172(3):209-216 (Meta)
Lancet 2012:380:581-587 (Meta)

Lyon Study: RCT Mediterranean Diet in Secondary Prevention

Population: 423 pts after first MI

Design: RCT of standard post-MI diet vs Mediterranean diet.

Followup: Mean 4 years.

ITT analysis

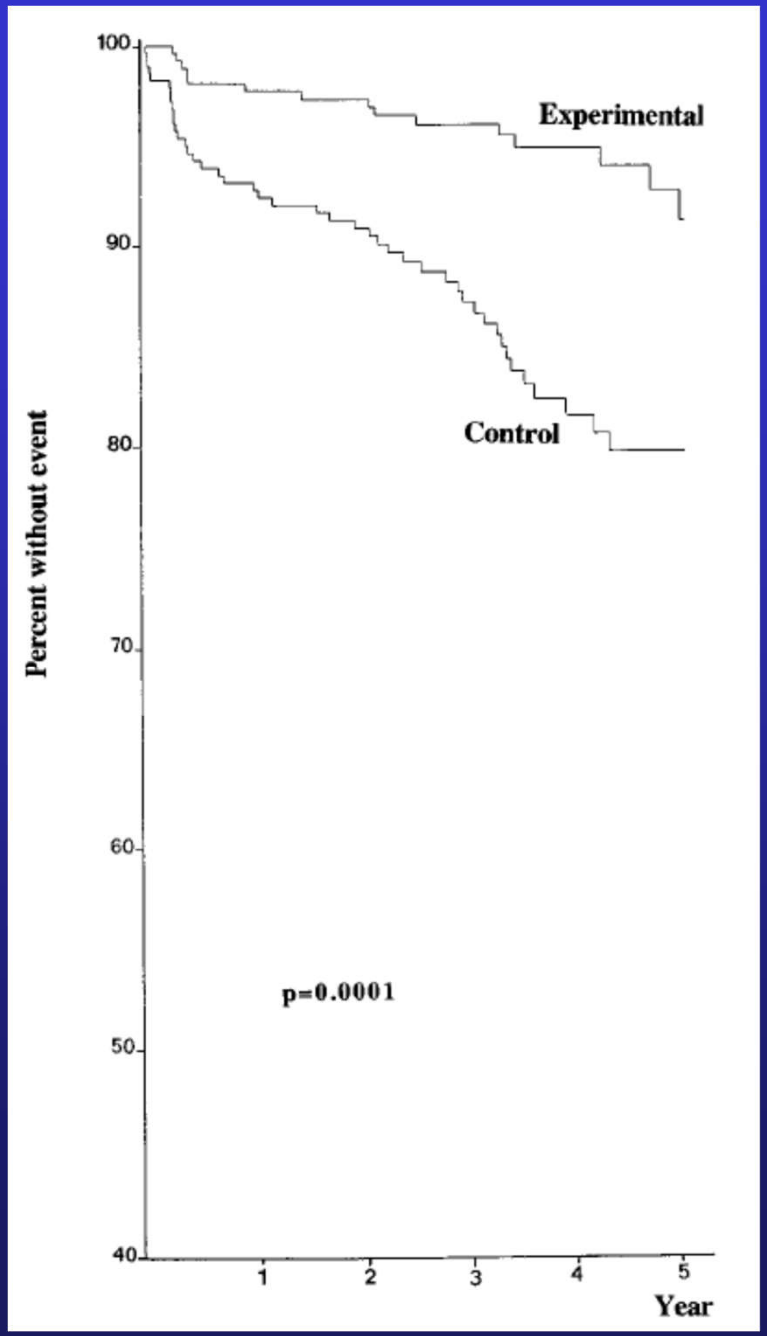
Outcomes:

CO1: MI + cardiovascular death

CO2: Same plus unstable angina, CHF, CVA, embolism (DVT, PE)

CO3: CO2 plus minor events requiring hospitalization

Circulation 1999:99:779-785
Lancet 1994:343:1454-1459



Lyon Study

Nonfatal MI + CV Death (CO1)

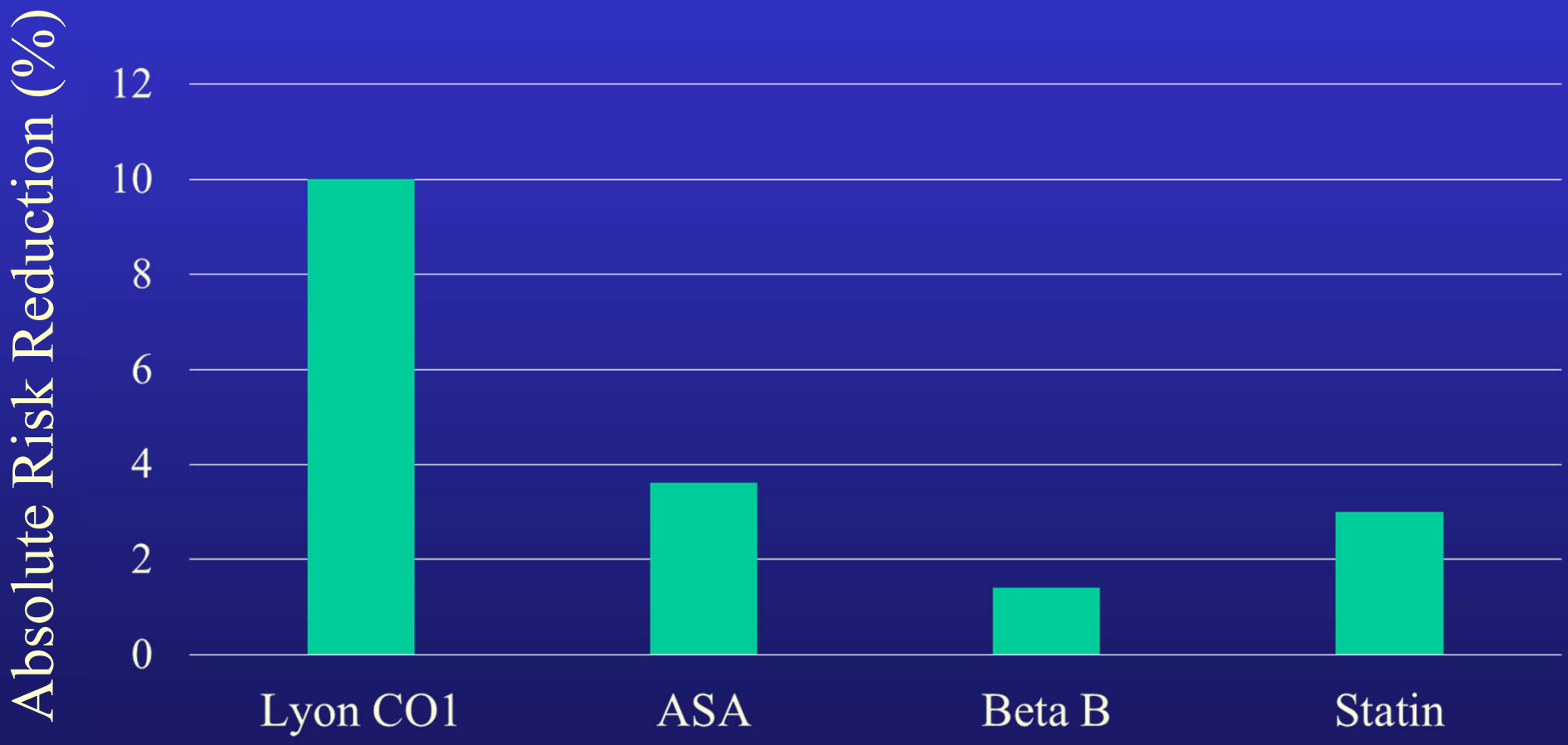
ARR = 0.10

NNT = 10.0

P < 0.0001

Circulation 1999:99:779-785
Lancet 1994:343:1454-1459

Secondary Prevention of MI



Circulation 1999:99:779-785
Lancet 1994:343:1454-1459

Circulation 2000:101:1206-18 Am J Medicine 2014:127:929-53
Arch Intern Med 2012:172(12):909-19

Role of a ‘Heart Healthy’ Diet

RCT Low Fat Diet + Risk of CVD

(Women's Health Initiative)

Question: Would a dietary intervention intended to be low in fat & high in vegetables, fruits, and grains to reduce cancer also reduce CVD risk.

Patients: 48,835 post-menopausal women, 59-79 yrs. Follow-up 8.1 yrs.

Intervention (40%): Intensive behavior modification in group and individual sessions designed to reduce total fat intake to 20% and increase intake of (vegetables + fruits) to 5 servings/day and grains to at least 6 servings/d.

- 18 group sessions in the first year and quarterly maintenance sessions thereafter.

Control: Received diet-related education materials.

Analysis: Intention to treat.

BV Howard JAMA 2006:295:655-666

RCT Low Fat Diet + Risk of CVD

Nutrient Intake at 6 yr

Food	BL	Intervention	Control	Difference	P
Energy kcal/d	1790	1432	1546	-114	< 0.01
Total fat (%)	37.8	28.8	37.0	-8.2	< 0.01
Saturated fat (%)	12.7	9.5	12.4	-2.9	< 0.01
Protein (%)	16.4	17.7	17.1	0.6	< 0.01
Carbohydrate (%)	45.6	53.9	45.9	8.1	< 0.01
Fiber g/d	15.4	16.9	14.4	2.4	< 0.01
Soluble fiber g/d	4.2	4.5	3.8	0.6	< 0.01
Folate ug/d	259	469	422	47	< 0.01
Cholesterol mg/d	260	194	244	-50	< 0.01
Veg + Fruit, servings/d	3.6	4.9	3.8	1.1	< 0.01
Grains, serv/d	4.7	4.3	3.8	0.5	< 0.01
Whole grain serv/d	1.1	1.2	1.0	0.2	< 0.01
Nuts, serv/week	1.5	**1.0**	1.8	-0.8	< 0.01

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2017

BV Howard JAMA 2006:295:655-666

RCT Low Fat Diet + Risk of CVD

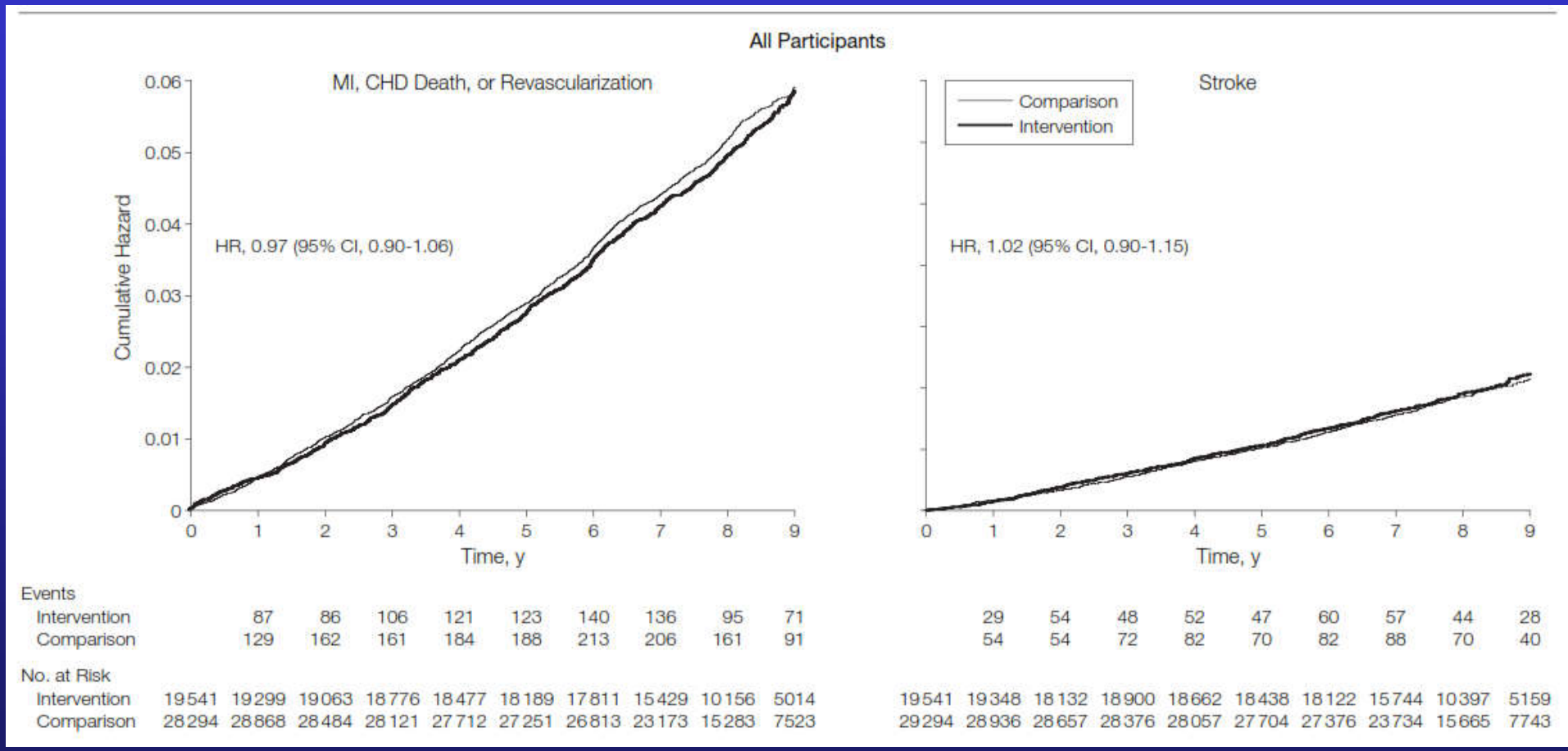
Changes in Risk Factors at 3 yrs

Food	BL	Intervention	Control	Difference	P
Weight, kg	76.8	-0.7	0.6	-1.3	< 0.01
BMI	29.1	-0.2	0.3	-0.5	< 0.01
Waist circumference, cm	89.0	-0.4	0.5	-1.0	< 0.01
Activity, METS/wk	10.0	1.4	1.0	0.4	< 0.01
SBP	127.7	-2.2	-2.1	-0.2	NS
DBP	76	-2.6	-2.3	-0.3	< 0.01
T-Cholesterol mg/dL	224.1	-10.2	-6.9	-3.3	< 0.05
LDL mg/dL	133.7	-9.7	-6.2	-3.5	< 0.05
HDL mg/dL	59.2	-0.7	-0.3	-0.4	NS
TG mg/dL	139.8	1.0	1.0	0.0	NS
Lipoprotein (a) mg/dL	15.6	0.9	0.9	0.0	NS
Glucose mg/dL	100.2	-1.7	-0.7	-1.0	NS
Total carotenoids mcg/mL	0.7	0.0	0.0	0.04	< 0.05

SCG 2017

BV Howard JAMA 2006:295:655-666

RCT Low Fat Diet + Risk of CVD Clinical Outcomes



SCG 2017

BV Howard JAMA 2006:295:655-666

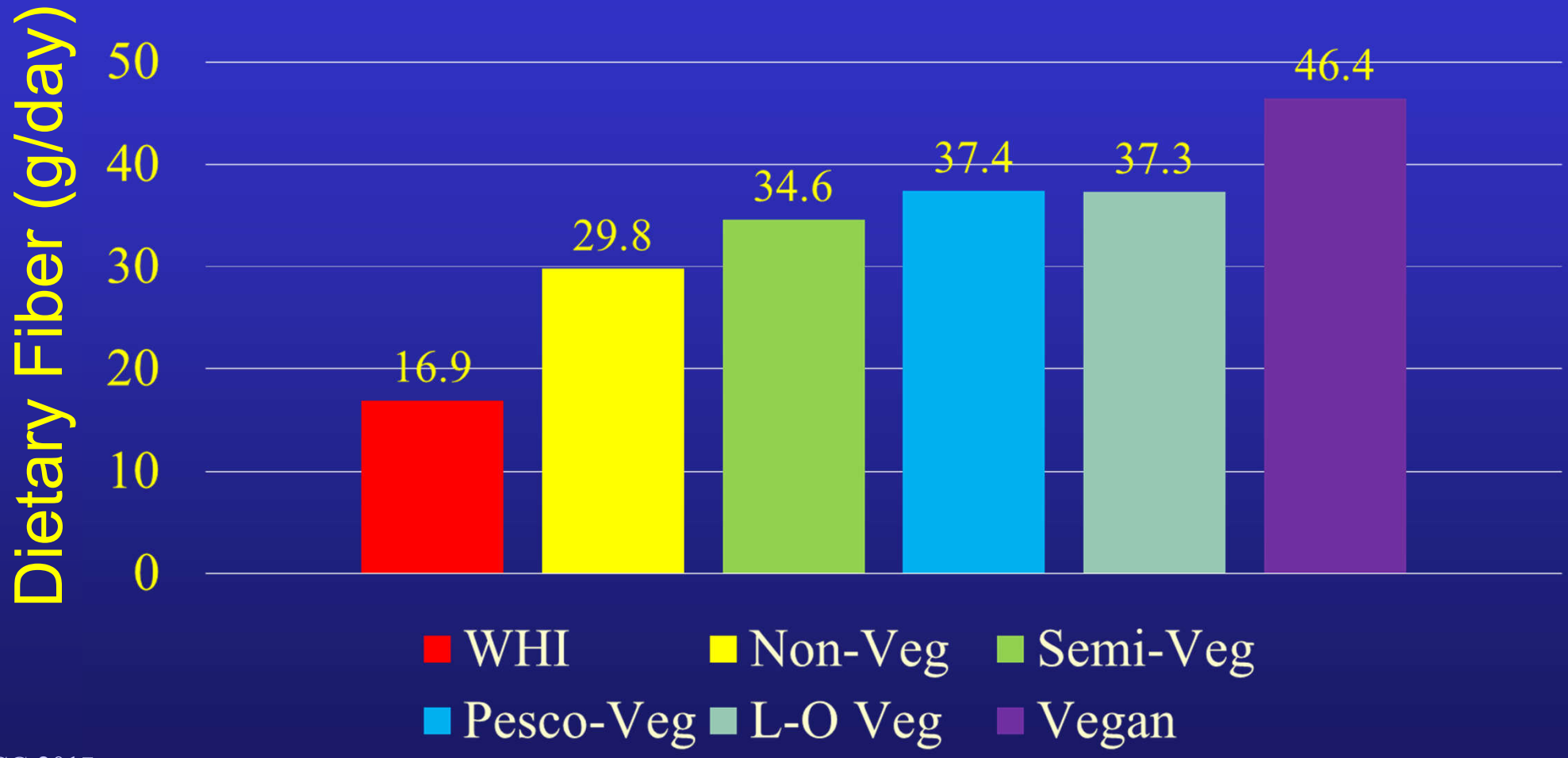
Women's Health Initiative - Conclusions

1) In this study which resulted in an 8.2% decrease in total fat intake and an increase in daily (fruit + vegetable) intake of 1.1 servings/day there was no significant reduction in Cardiovascular disease or stroke overall.
2) Significant differences in CHD risk were seen in subgroups:

a) Lowest levels of saturated fat intake (HR 0.81; P<0.05)
b) Lowest intake of trans fat (HR 0.81; P<0.05)
c) Highest intake of vegetables (HR 0.88;P<0.05)

BV Howard JAMA 2006:295:655-666

Nutrient Profiles of Different Dietary Patterns
Adventists Compared to WHI



SCG 2017

BV Howard JAMA 2006:295:655-666
J Acad Nutrition & Dietetics 2013:113:1610-1619

Role of a Low Fat Vegetarian Diet In CAD

RCT Diet + Lifestyle in CAD

Aim: Assess effect of a comprehensive lifestyle intervention for 1 year in pts with atherosclerosis.

Patients: Angiographically documented CAD (1, 2 or 3 vessels)

- EF > 25%, no MI last 6 weeks

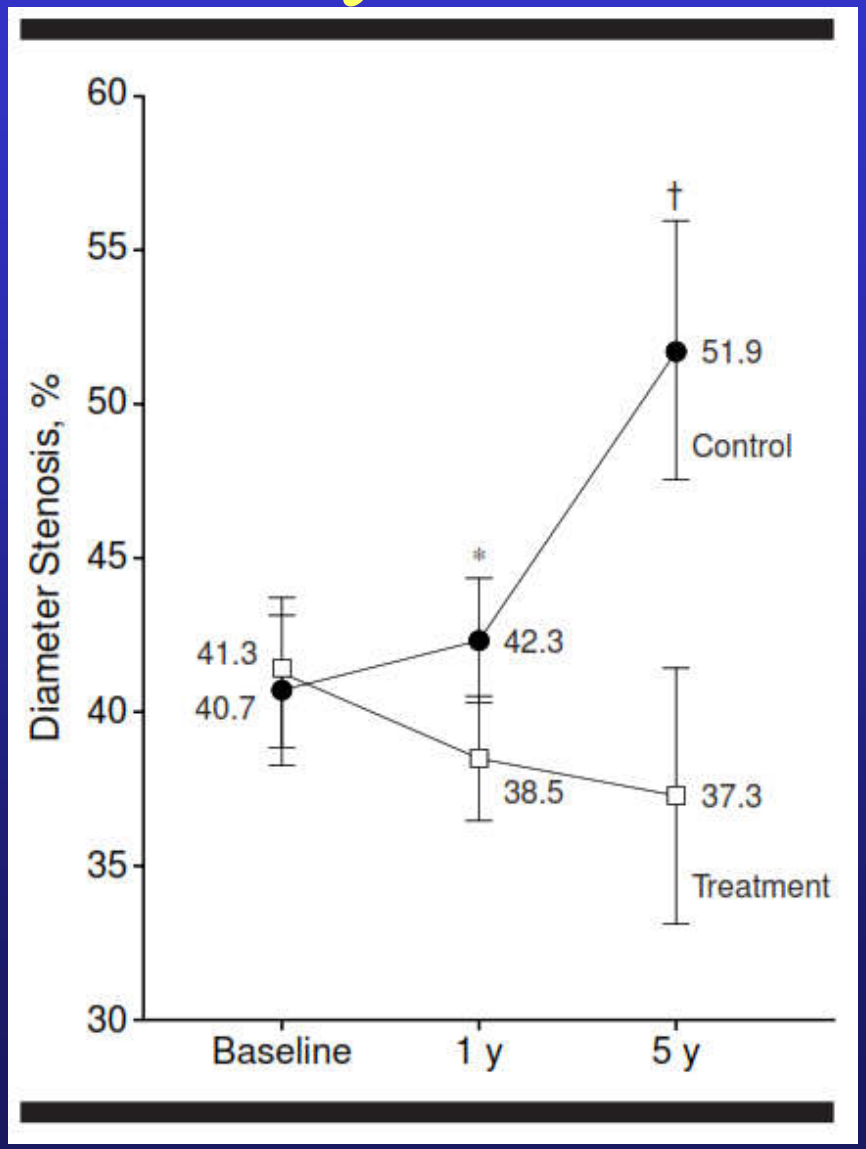
Randomised (n=28) (control = 20)

1) Low-fat vegetarian diet
2) Moderate aerobic exercise
3) Stress management training
4) Stopping smoking
5) Group support

Progression of CAD (195 lesions) assessed by blinded quantitative coronary angiography at baseline and after 1 year.

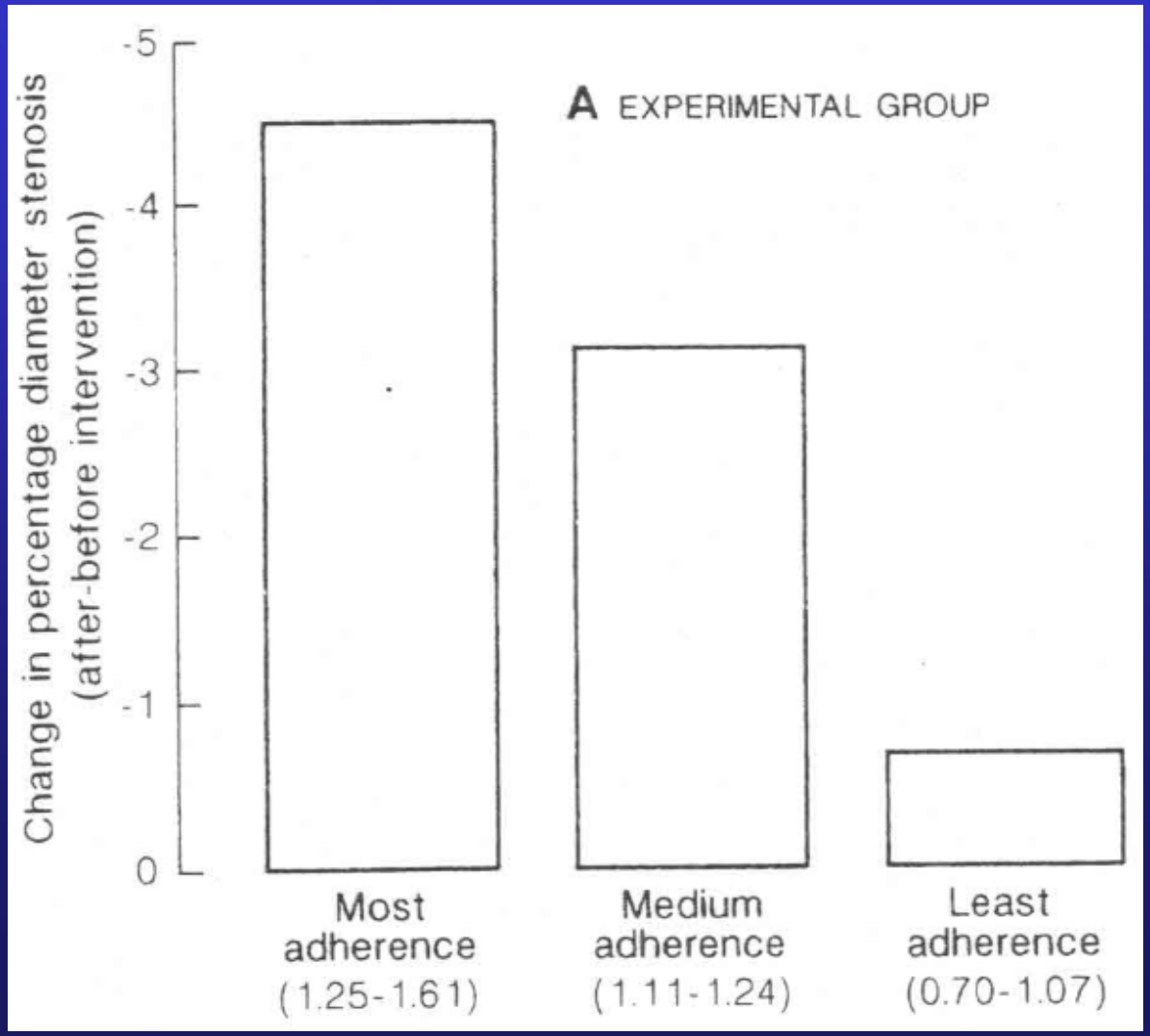
Ornish Lancet 1990:336:123-133

RCT Lifestyle in CAD: 5 Yr Results



Ornish JAMA 1998:280:2001-7

RCT Lifestyle in CAD: Role of Adherence



Ornish Lancet 1990:336:123-133

Real World Studies of Diet and Health

Intensive Cardiac Rehab Program (at baseline and 1 year)

Food	Baseline	1 Year	Change	% Change
Triglycerides mg/dL	179.1	160.3	- 18.8	-10.5
BMI	32.0	29.5	- 2.5	-7.8
LDL mg/dL	107.9	99.8	- 8.1	-7.5
HDL mg/dL	45.1	44.6	- 0.5	-1.1
Systolic BP mmHg	132.7	126.4	- 6.3	-4.7
Diastolic BP mmHg	79.0	75.2	- 3.8	-4.8
Total cholesterol mg/dL	186.8	175.3	-11	-6.2
Dietary fat g/day	27.1	11.1	-16	-59.0
HbA1c %	7.3	6.89	- 0.41	-5.6
Exercise min/wk	90.2	197.4	+107.2	228.8
Hostility (0 – 27)	7.8	6.0	-1.8	-23.1
Depression (0 – 60)	11.4	6.3	-5.1	-44.7

$P < 0.05$

Ornish Am J Health Promotion 2010:260-266

Role of a Low Fat

Vegetarian Diet

In Those At Risk

RCT plant based nutrition & body weight/CV risk (GEICO)

Aim: Assess effects of a low-fat, plant-based diet program on anthropometric & biochemical measures in a corporate setting.

Design: RCT, 10 sites, duration = 18 weeks

Population (n=291): 1) BMI > 25 +/or 2) NIDDM

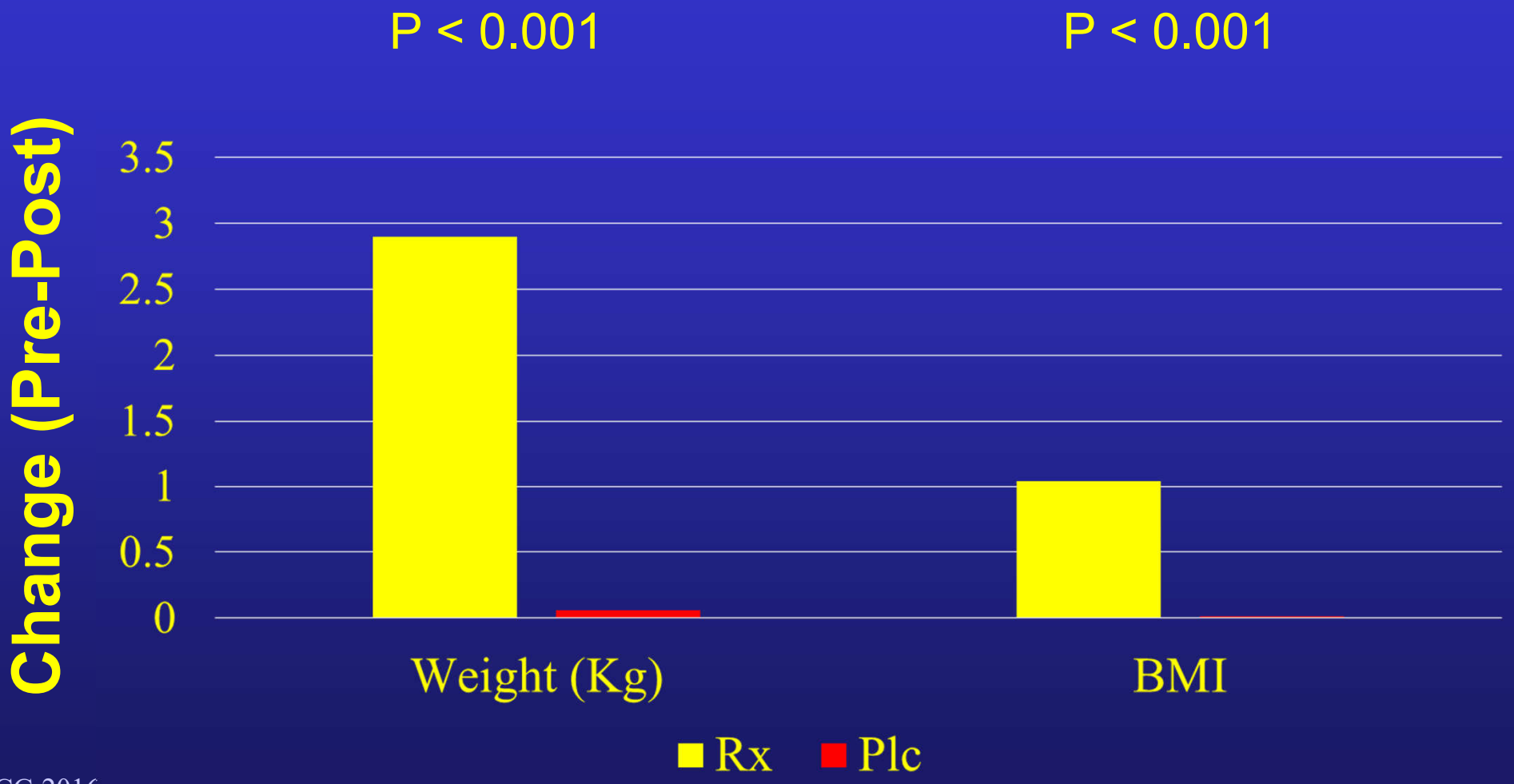
- 83% female

Intervention:

1) Low-fat vegan diet, **weekly 1hr support group**, work cafeteria options available
2) Control group: No diet changes

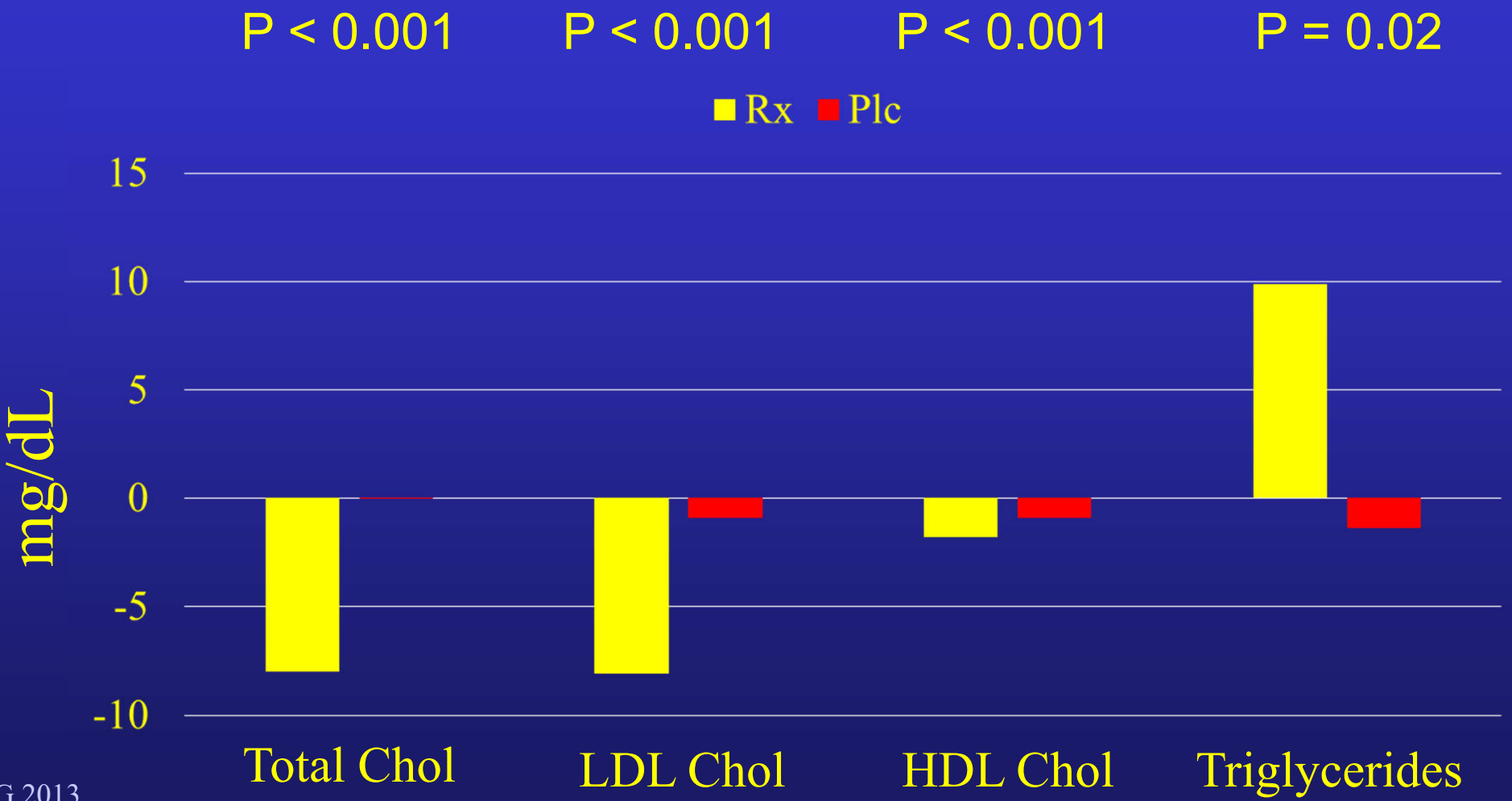
ND Barnard Eu J Clin Nutrition 2013:67:718-24

GEICO RCT: Outcomes – all participants



ND Barnard Eu J Clin Nutrition 2013:67:718-24

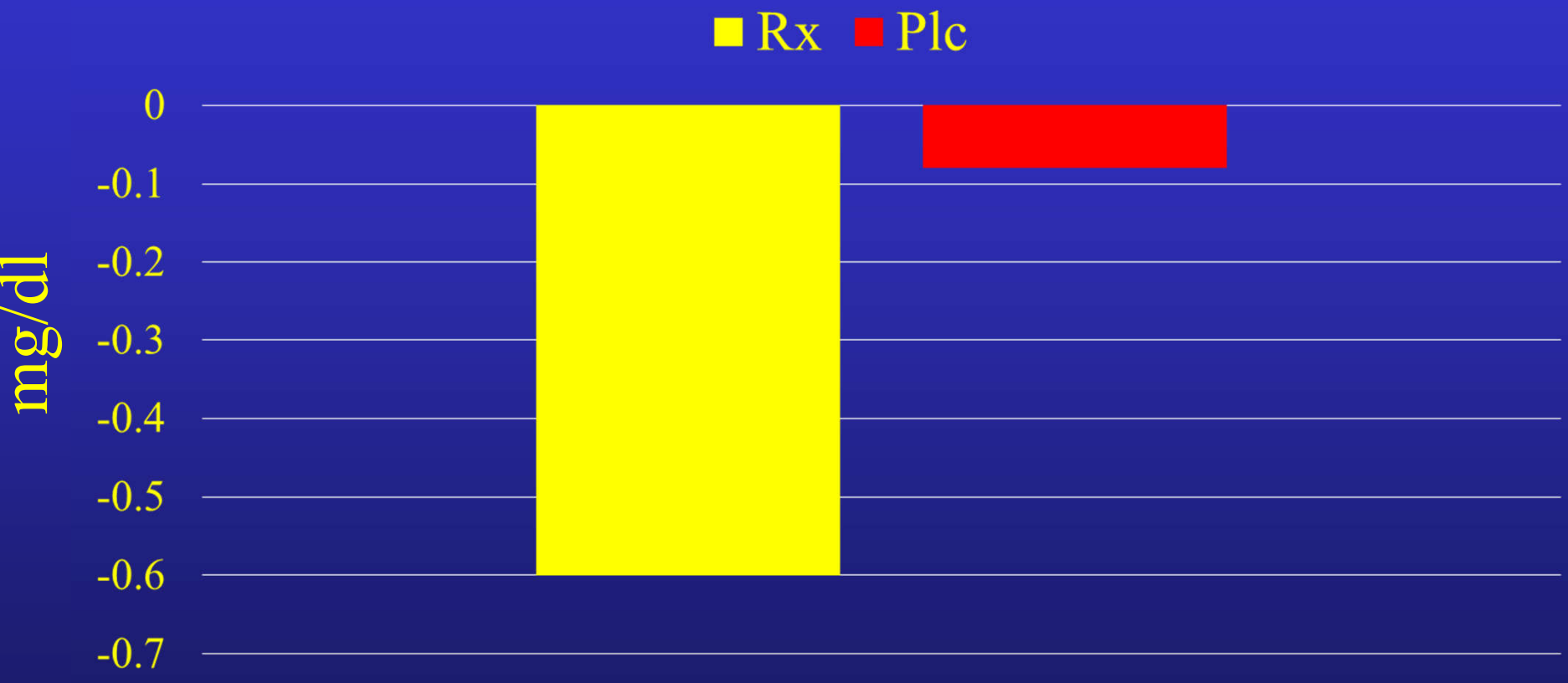
GEICO RCT: Outcomes – all participants



SCG 2013

ND Barnard Eu J Clin Nutrition 2013:67:718-24

GEICO RCT: Outcomes – all participants



P = 0.004

SCG 2016

ND Barnard Eu J Clin Nutrition 2013:67:718-24

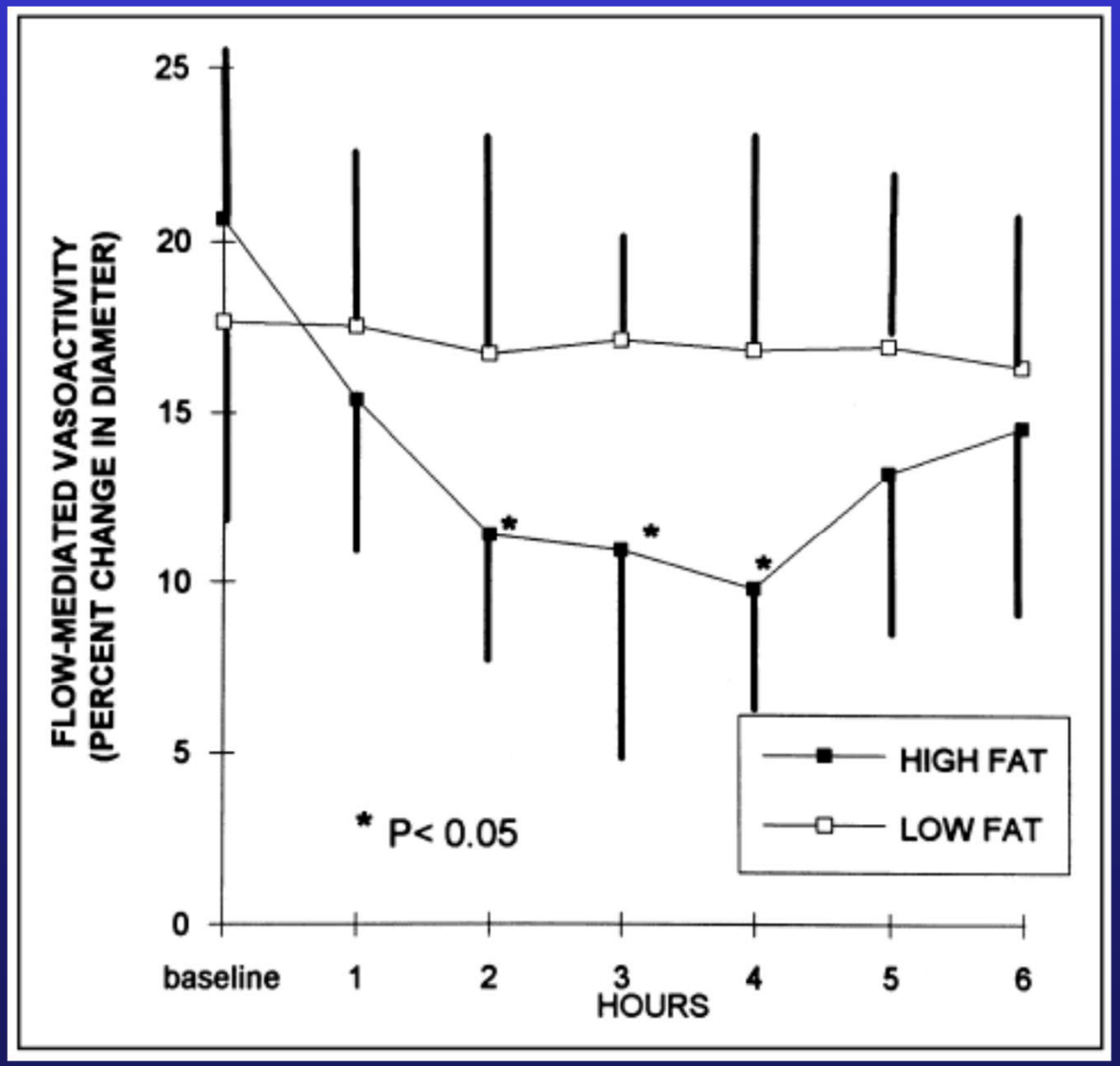
GEICO: Discussion

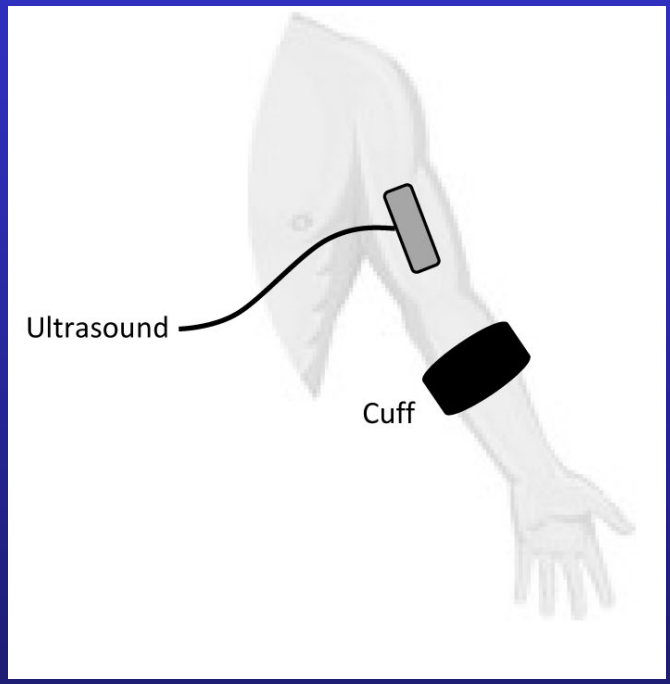
1) Saw statistically and clinically relevant changes body weight, lipids, and glycemic control among diabetics in a workplace-based nutrition program.
2) Weight changes were similar to those seen in plant-based diets in observational or research settings
3) The changes seen lipids are typically more than those seen with more moderate diets. Other studies have shown that the decreases in HDL seen are not associated with poor cardiovascular health.
4) Strengths: geographically diverse population; used a simple & reproducible intervention; sufficient statistical power to show changes
5) Weaknesses: underrepresentation of males; lack of data on physical activity

ND Barnard Eu J Clin Nutrition 2013:67:718-24

Possible Mechanism of Action

Endothelial Function after a High Fat Meal





Am J Cardiol 1997:79:350-354

My Lifestyle Then & Now

Then

Breakfast

- Bran flakes + granola + milk

Lunch

- Sandwich +/- veggies + diet coke

Suppers

- Spaghetti Bolognese +/- salad
- Chicken curry, rice, dal

Now

Breakfast

- Oats + Chia + blueberries + flax

Lunch

- Kale salad + nuts

Suppers

- Veggie stir fry (Mediterranean, Asian, Indian) w garlic/ginger
- Rice/quinoa, dal/beans

Exercise: Minimal => 2-3 hrs per week

Food As Prevention

Avoiding chronic disease through a healthy diet

HOME | START HERE | RESOURCES | VIDEOS ETC | ABOUT

Welcome to 'Food as Prevention'

Welcome to the Food as Prevention website !

This website is maintained by a Canadian physician who is a gastroenterologist (specialist in diseases of the intestines) with the aim of connecting members of the public with information on a healthier diet to lower mortality and the risk of developing diseases such as heart attacks, strokes, adult-onset (type 2) diabetes, and cancer.

I have a masters degree in health research methodology and have tried to make the information in this site as evidence-based as possible. Fortunately, the peer-reviewed medical literature has a lot of information on the role of food in preventing disease.

The site is divided into an 'evidence' section that guides you through evidence about the healthiest diet and an 'application' section to help you make changes to your diet and lifestyle.

This site is aimed at several audiences:

1. **Members of the general public** who are looking for credible information on the healthiest diet. I

MICHAEL GREGER, M.D.

DAILY DOZEN

1. BEANS 

2. BERRIES 

3. OTHER FRUITS 

4. CRUCIFEROUS VEGETABLES 

5. GREENS 

6. OTHER VEGETABLES 

7. FLAXSEEDS 

8. NUTS 

9. SPICES 

10. WHOLE GRAINS 

11. BEVERAGES 

5 SERVINGS

12. EXERCISE 

INFOGRAPHIC created by Modern Vegan Family based on healthy diet recommendations by Dr. Michael Greger's DAILY DOZEN, suggested daily servings and New York Times Bestselling Book, "How Not to Die". www.nutritionfacts.org

www.foodasprevention.com

- Newsletter

4leafsurvey.com

DVD: Forks Over Knives

Book How Not to Die - Greger

Questions