DEBATE:

Weight as a Measure of Health

vs.

Health at Every Size Concepts

Christopher Gardner, PhD
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Nutrition Scientist

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STANFORD PREVENTION RESEARCH CENTER
the science of healthy living

No Conflicts of Interest to Disclose

Stanford | MEDICINE

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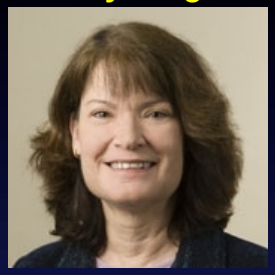
the science of healthy living

Abby King



John Ioannidis

Tom Robinson

Jennifer Robinson

Antonella Dewell

Josephine Hau

Alana Koehler

Manisha Desai

Julie Parsonnet

Robert Haile

Mandy Murphy

Rise Cherin

Susan Kirkpatrick

Dalia Perlman

Jae Berman

Sarah Farzinkhou

Valerie Alaimo

Mollie Shimer

Diane Demis

Tracey McLaughlin

Kari Nadeau

Justin Sonnenberg

Kenji Nagao, PhD
Ben Chrisinger, PhD
Katarina Balter, PhD

Erin Avery

Katherine Dotter

Michelle Hauser MD

Lucia Aronica PhD

John Trepanowski PhD

Liana Del Gobbo PhD

Lisa Offringa PhD

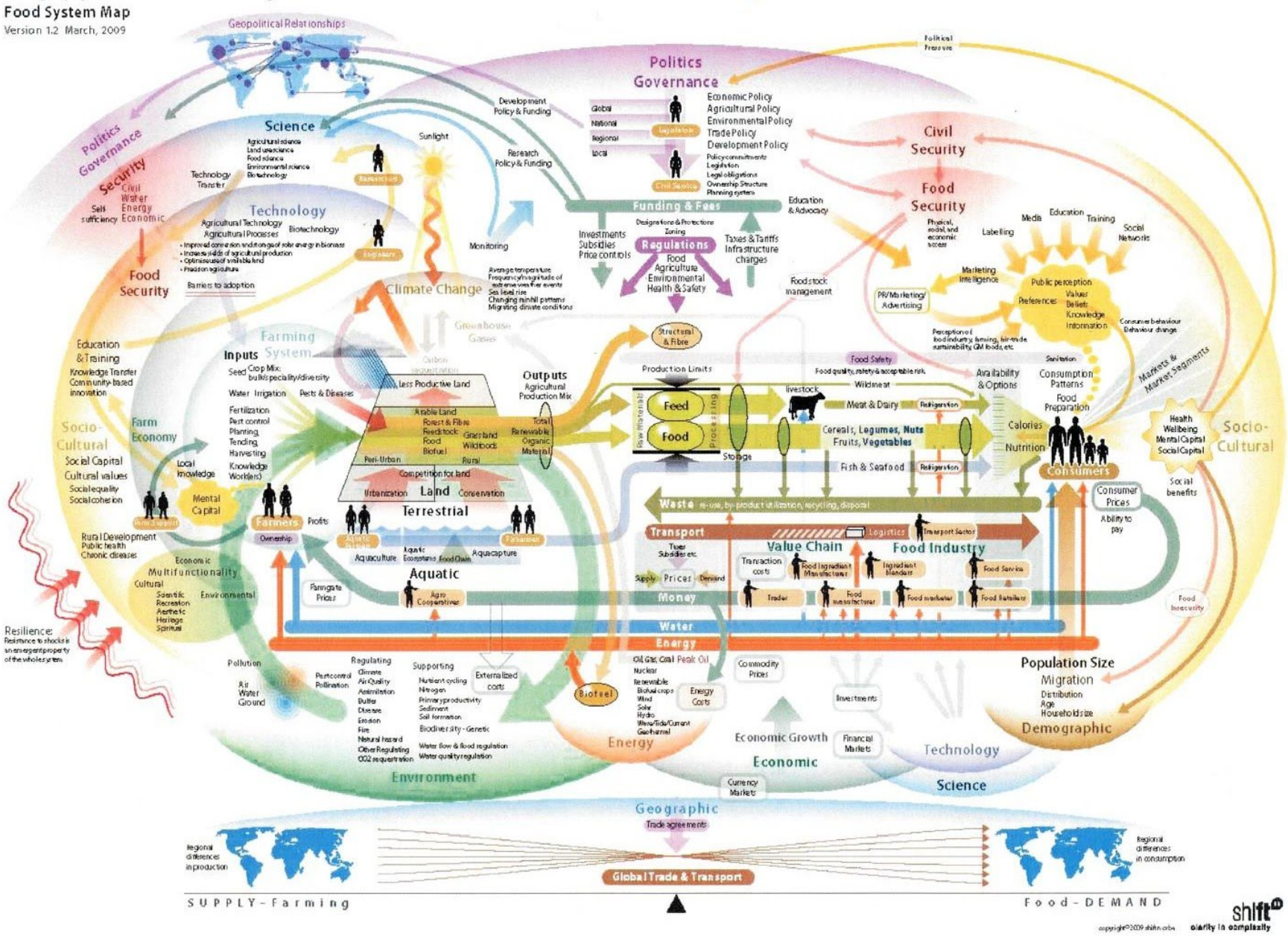
Jennifer Hartle PhD

Cindy Shih, MS


qualifying
statement


KRAFT
Coca-Cola
PEPSICO
Kellogg's
MARS
Nestlé
P&G
Johnson & Johnson
Unilever
Spin-off
$$$
(30%)
(Parfums)

The Global Food System



Summer Camp for Underserved Kids
Full Circle Farm
at Peterson Middle School

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Stanford University Medical Center

ACTION
APATHY
Haas Center
for Public Service
http://haas.stanford.edu
Choosing action over apathy since 1985.
25 years!

Hum Bio

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HUMANITIES AND SCIENCES

FULL CIRCLE FARM

Outline

- **My research & lessons learned**
- *Evidence for Obesity links to Morbidity/Mortality*
- *Health at Every Weight*
- *Take Home / Actionable Conclusions*

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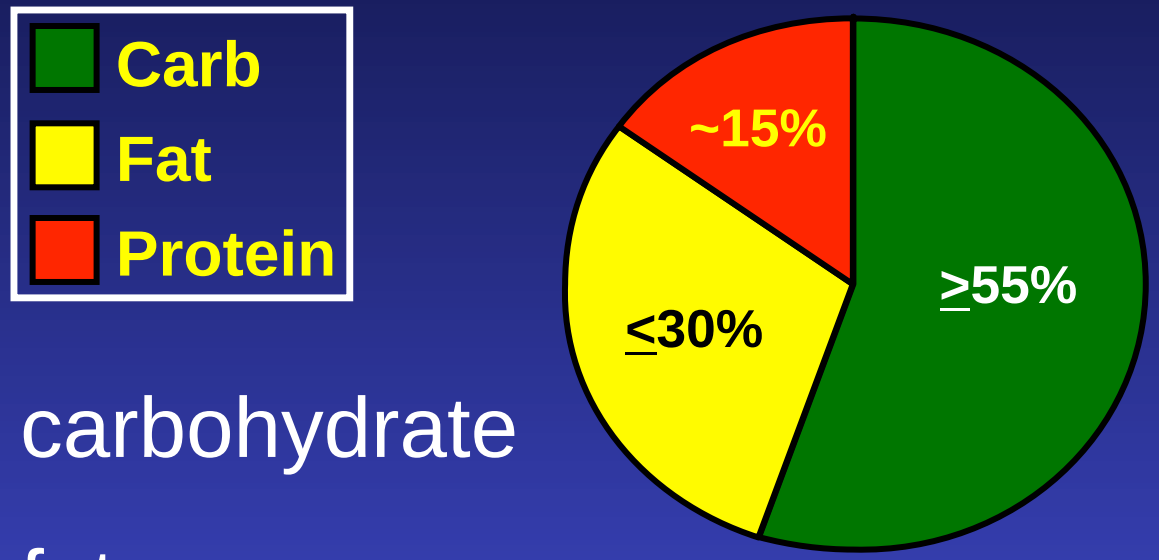
Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults

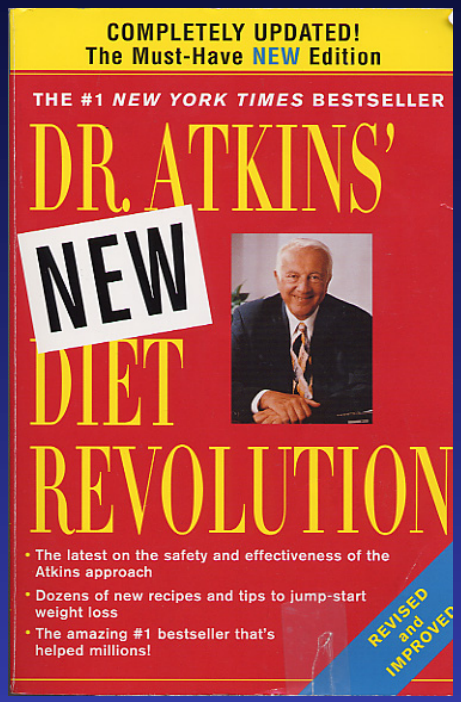
The Evidence Report. National Institutes of Health.
Obes Res 1998;6(Suppl)2:51S-209S.

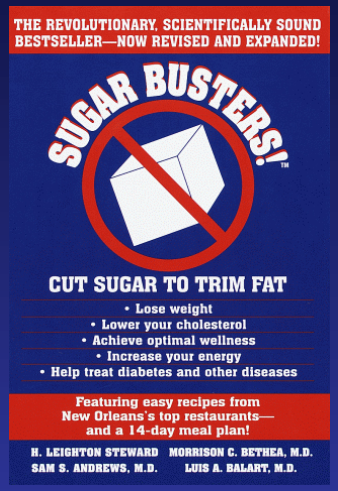


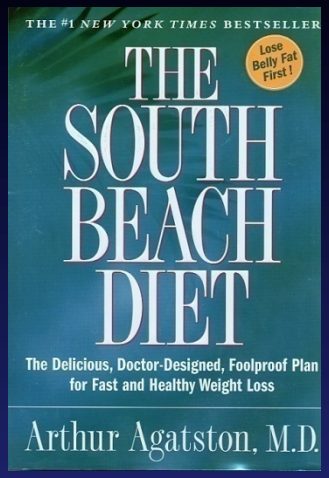
≥55% energy from carbohydrate

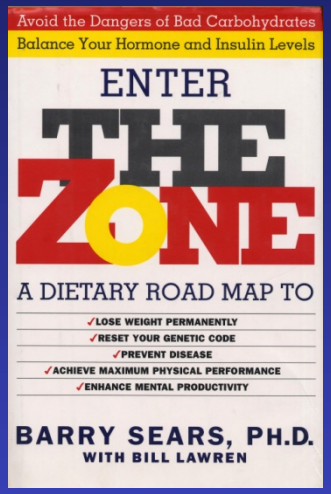
≤30% energy from fat

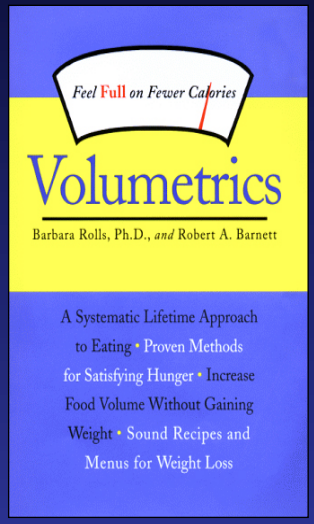
and approximately 15% energy from protein

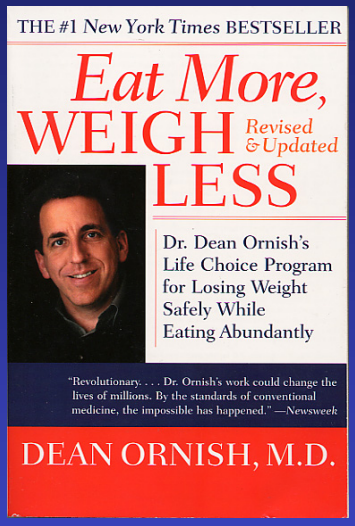












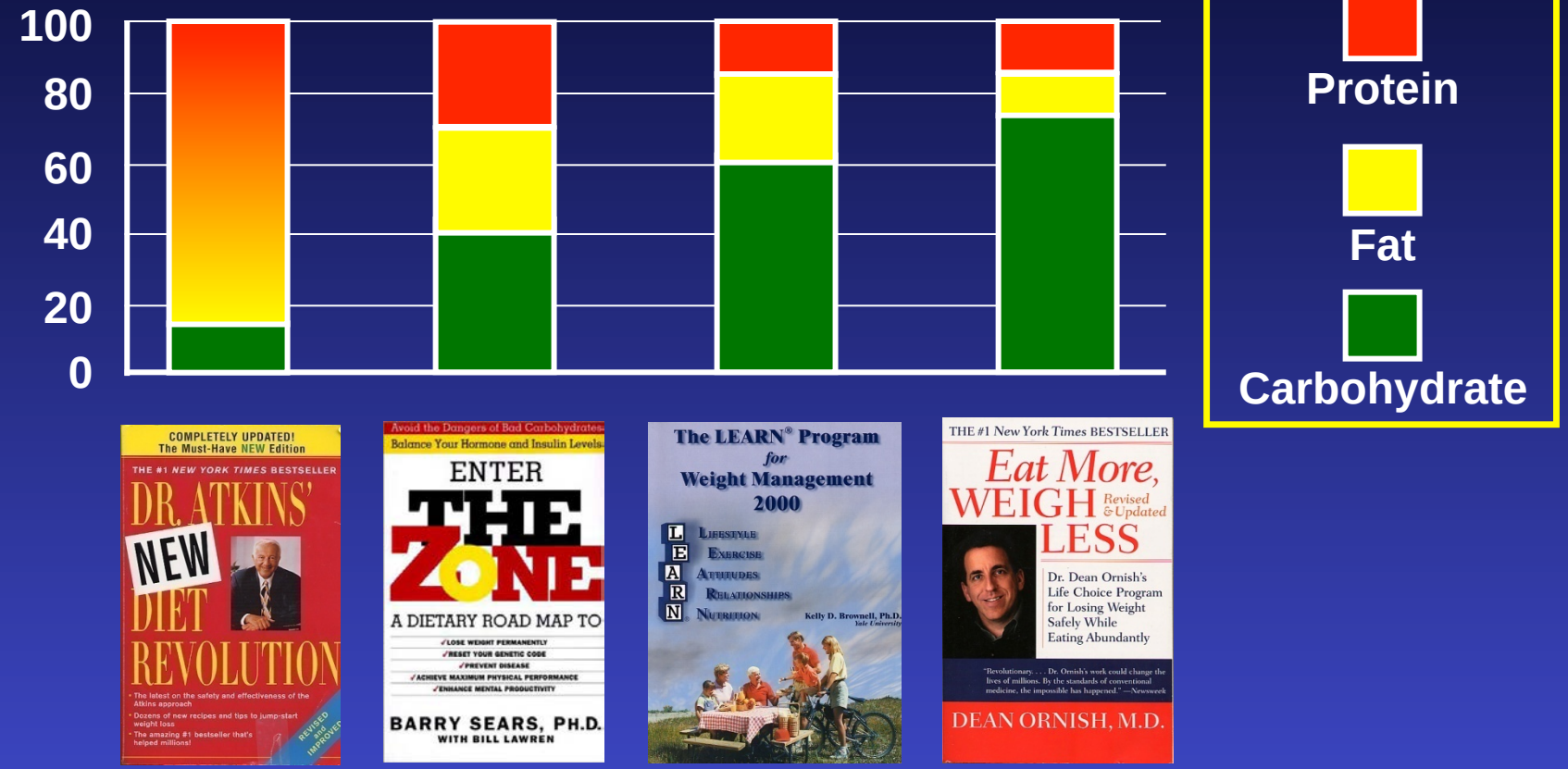
Low carb ◀——▶ **High carb**

A TO Z

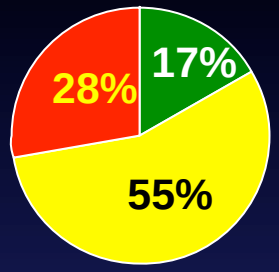
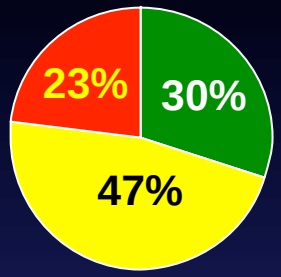
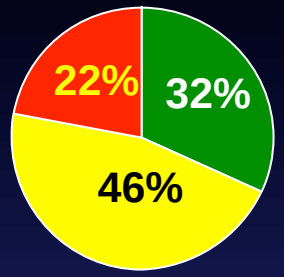
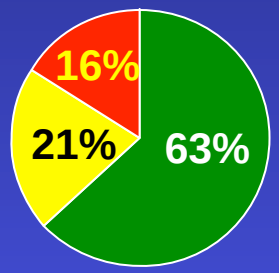
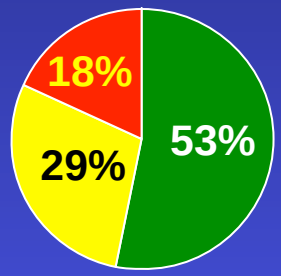
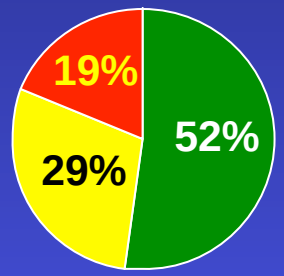
Gardner, JAMA
2007;297:969-77

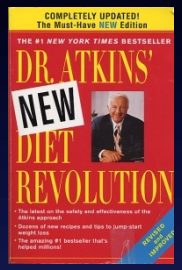
A Weight Loss Diet Study

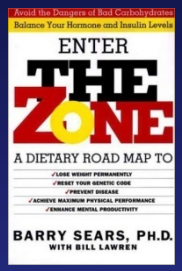
From Low-Carb to Low-Fat

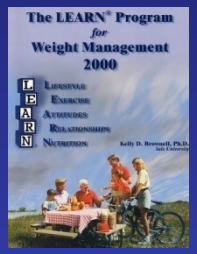


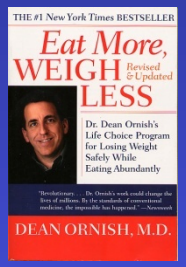
Gardner, JAMA 2007;297:969-77

	8 weeks	6 months	1 year
Atkins			
Zone	*Data not presented*		
LEARN	*Data not presented*		
Ornish			









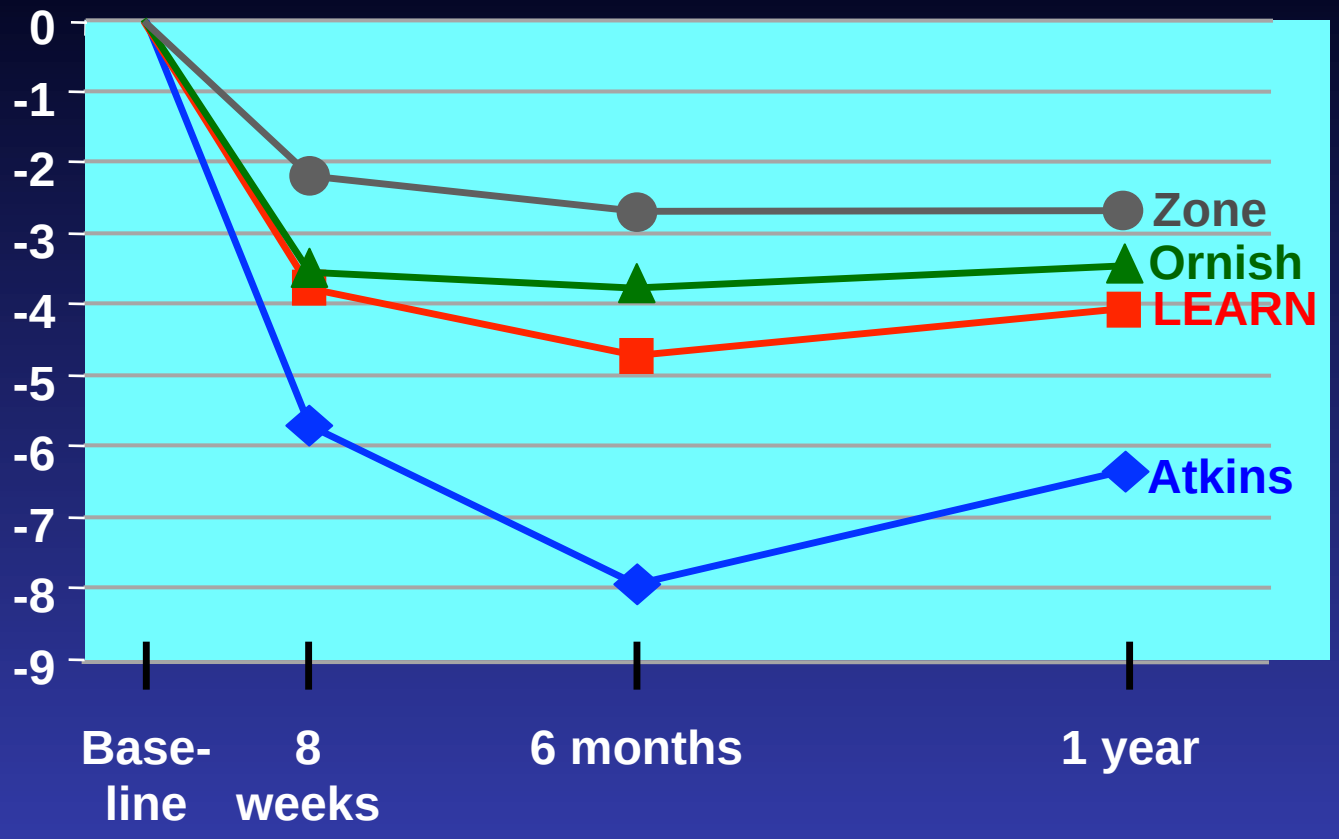
A TO Z Study
Diet Data
NDS
3-day
unannounced
24-hr recalls
(3,137 recalls)

Carb
Fat
Protein

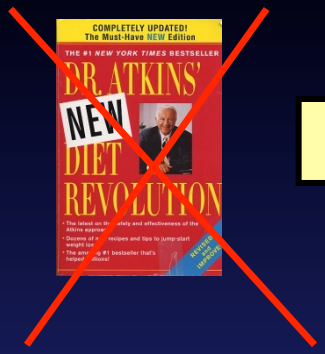
Gardner, JAMA
2007;297:969-77

Percent weight change across time, by group

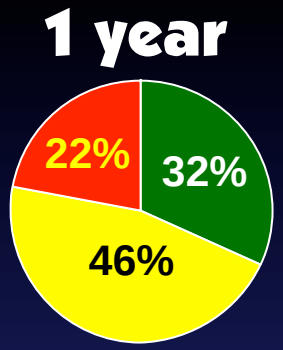
Gardner, JAMA 2007;297:969-77



	Participants with available data				% Retention 1-year
Atkins	77	72	71	68	88%
Zone	79	72	66	61	77%
LEARN	79	72	64	60	76%
Ornish	76	71	65	58	78%



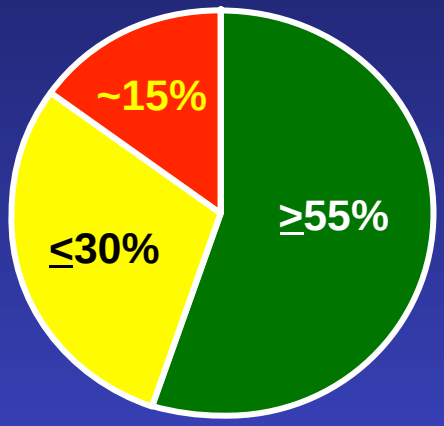
Low-Carbohydrate

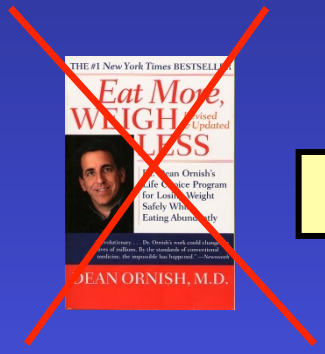


Favored Group assigned to Atkins

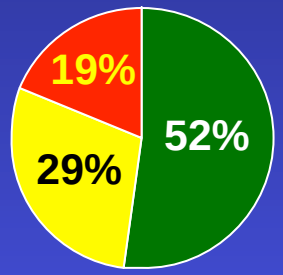
WEIGHT p=0.03
HDL-C p=0.0004
SBP p=0.001
DBP p=0.004
(not adjusted for multiple testing)

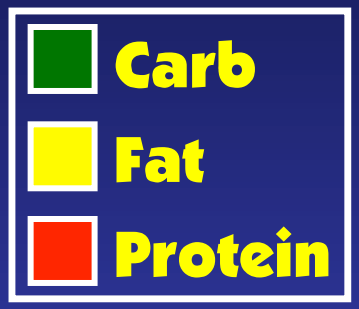
Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults
The Evidence Report. National Institutes of Health.
Obes Res 1998;6(Suppl)2:51S-209S.





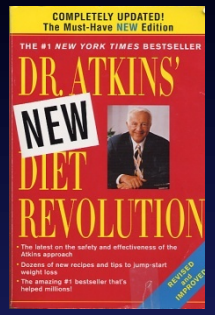
National Guidelines

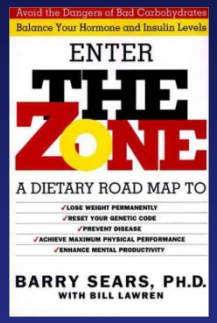


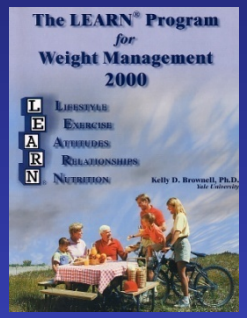


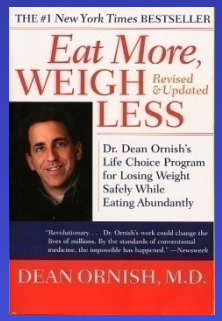
Gardner, JAMA
2007;297:969-77

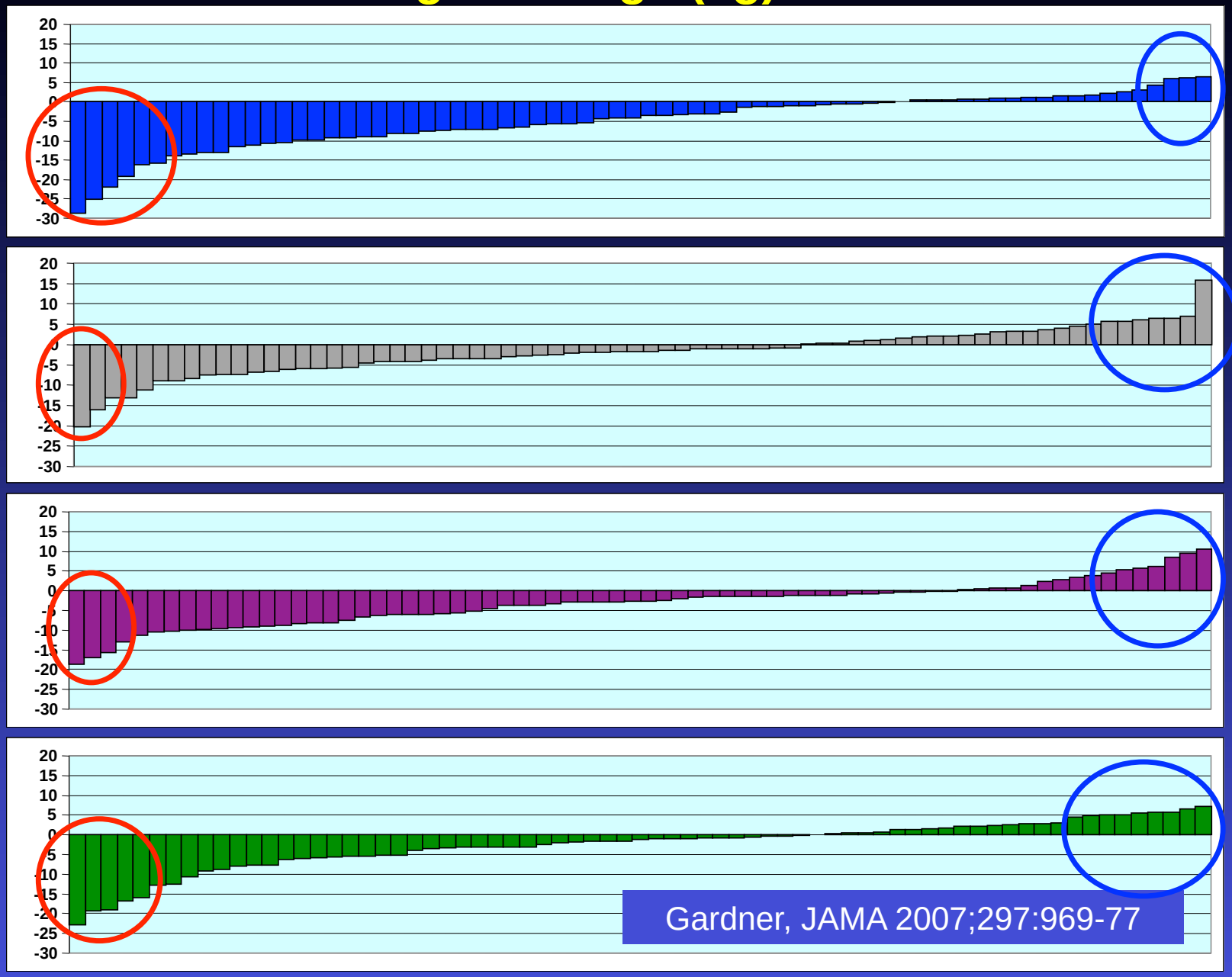
12-month net weight change (kg): Individual results



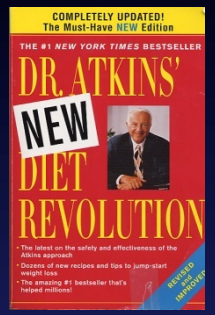


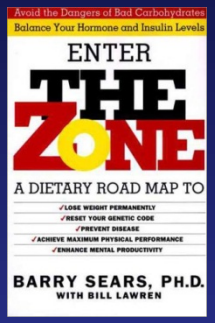


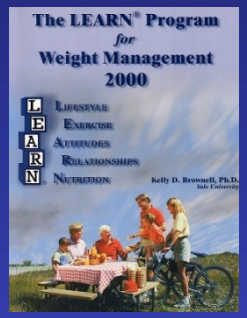


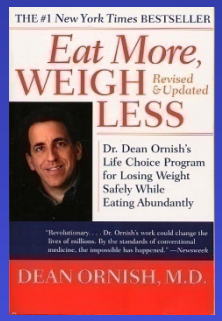


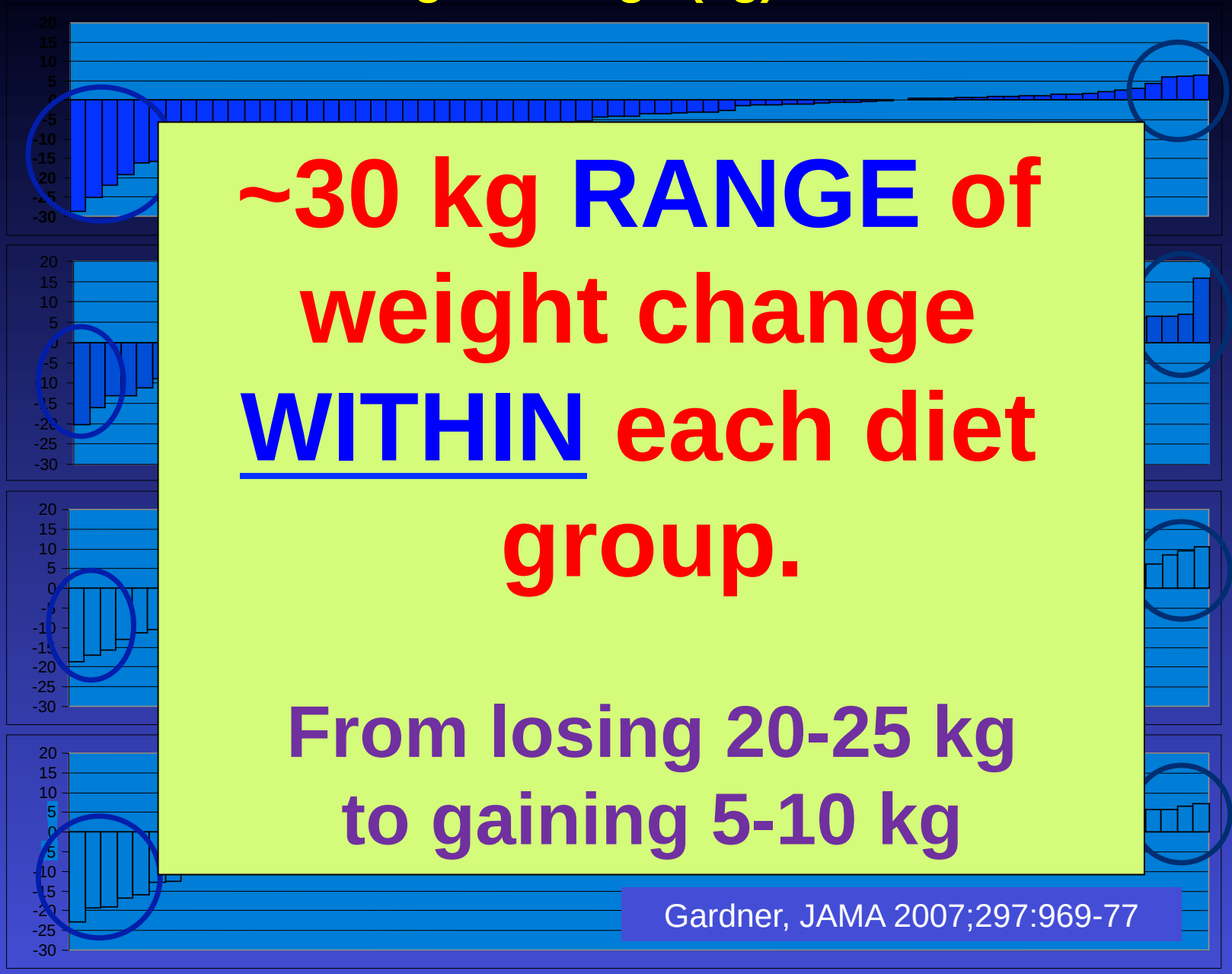
12-month net weight change (kg): Individual results











~30 kg RANGE of weight change WITHIN each diet group.

From losing 20-25 kg to gaining 5-10 kg

Gardner, JAMA 2007;297:969-77

ORIGINAL INVESTIGATION

A Randomized Trial of a Low-Carbohydrate Diet vs Orlistat Plus a Low-Fat Diet for Weight Loss

William S. Yancy Jr, MD, MHS; Eric C. Westman, MD, MHS; Jennifer R. McDuffie, PhD, RD, MPH; Steven C. Grambow, PhD; Amy S. Jeffreys, MStat; Jamiyla Bolton, MS; Allison Chalecki, RD; Eugene Z. Oddone, MD, MHS

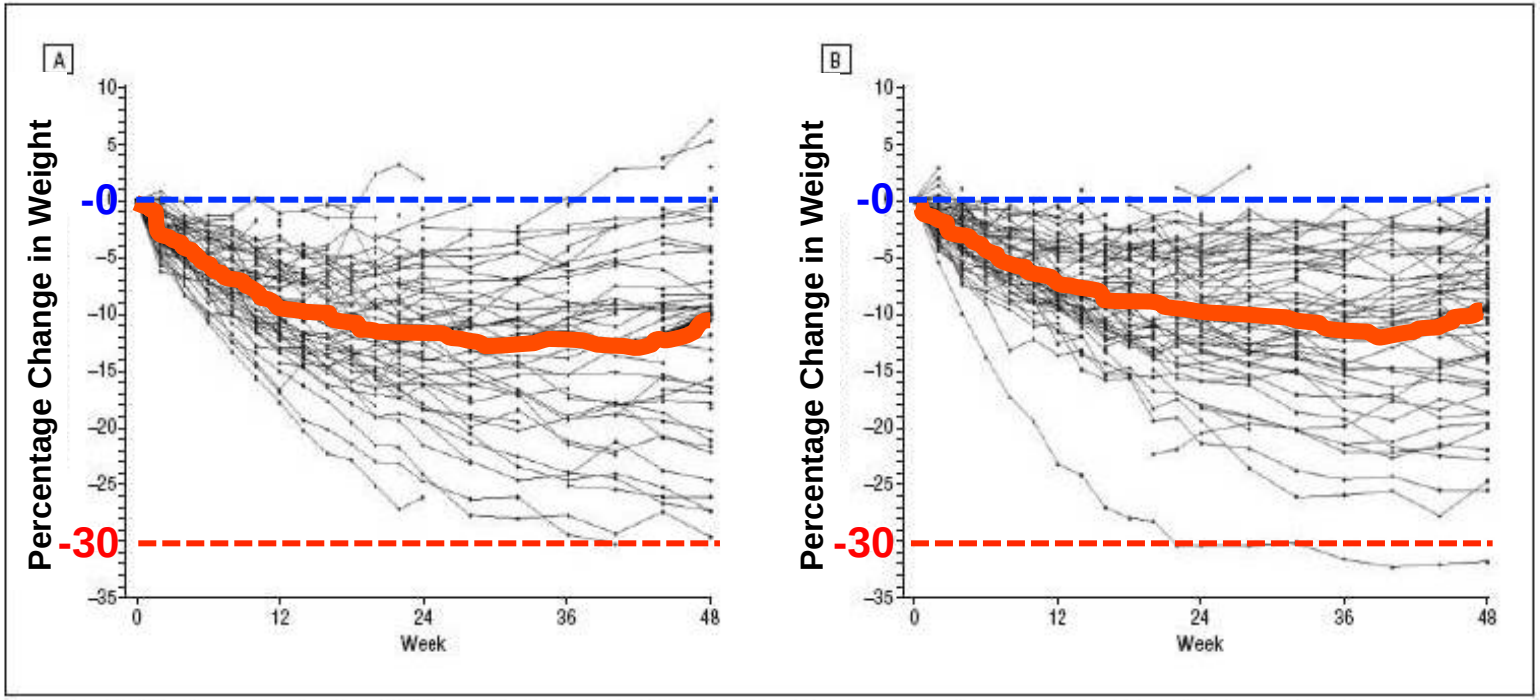
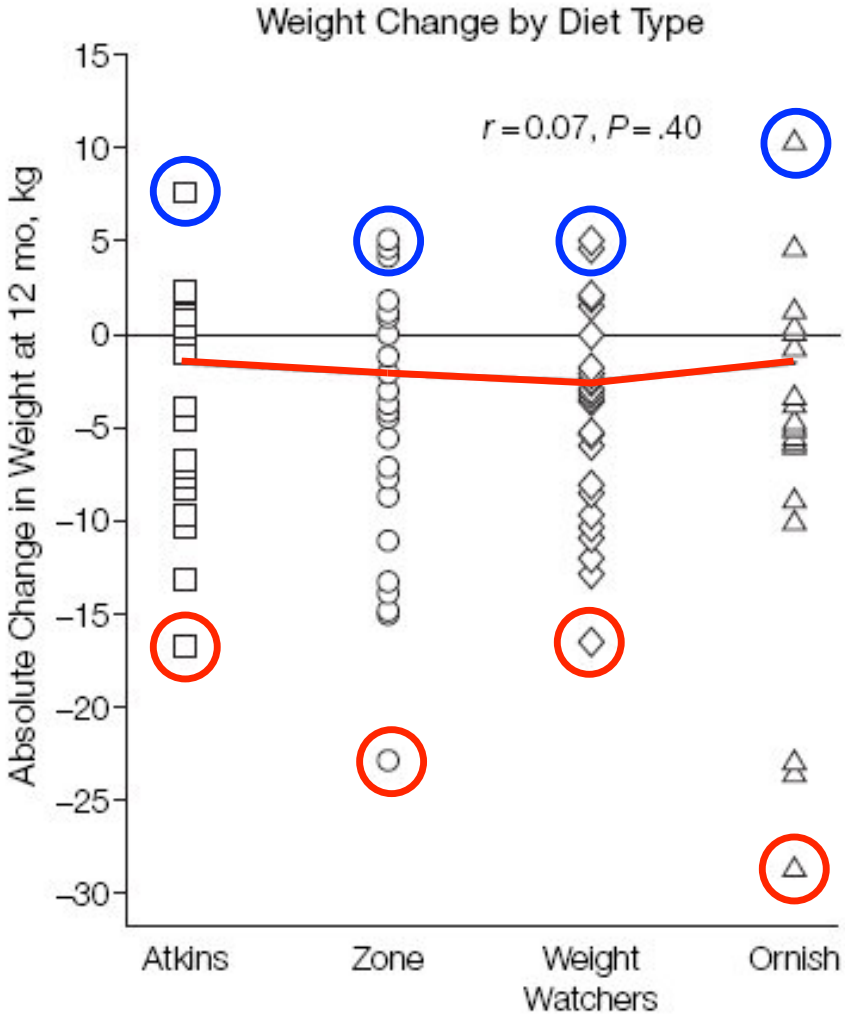


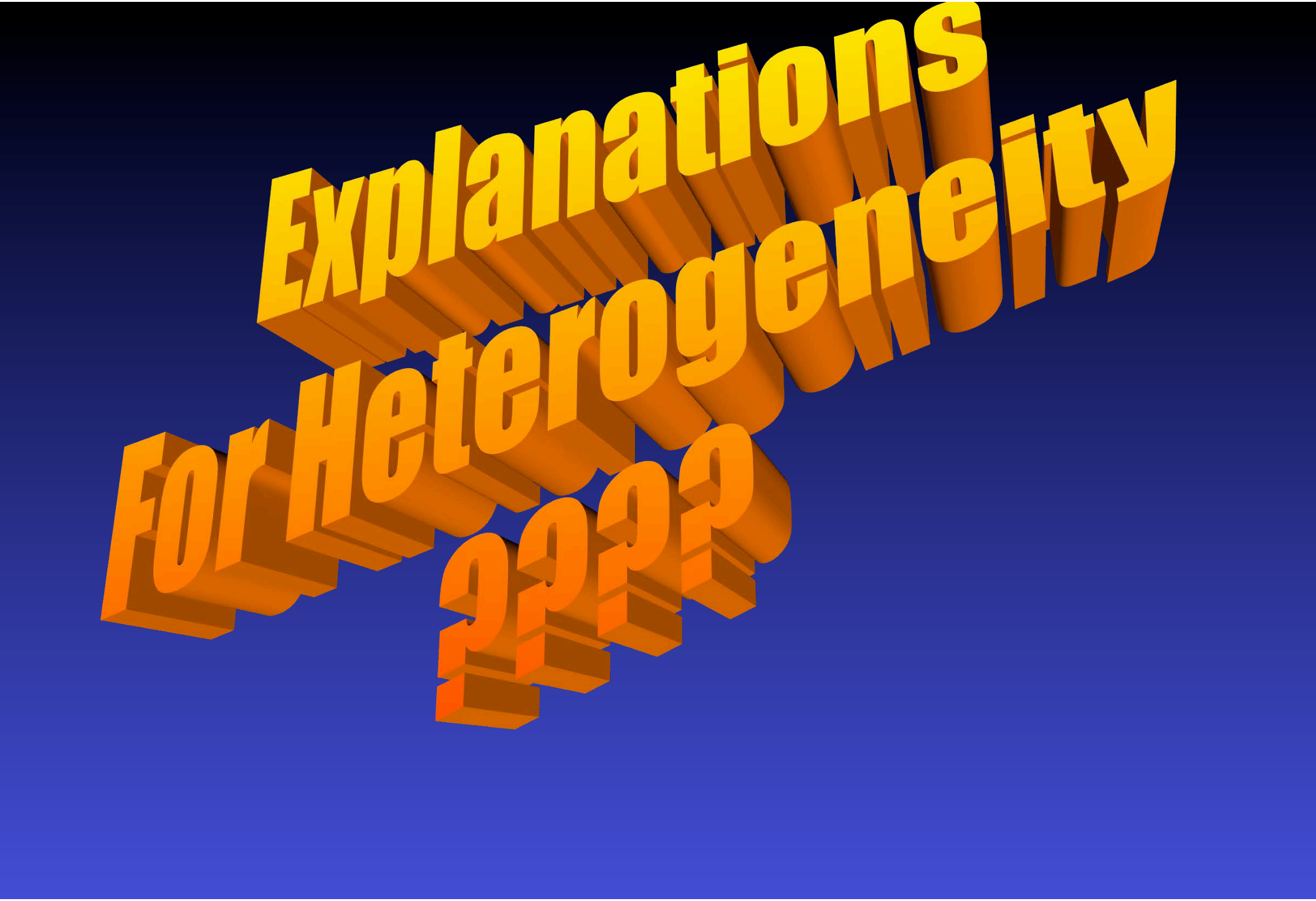
Figure 3. Individual percentage body weight change trajectories by diet group. The bold line represents a smoothed spline of the observed trajectory for the mean percentage body weight change in the low-carbohydrate, ketogenic diet group (A) or the orlistat plus low-fat, reduced-calorie diet group (B).

Yancy et al., Arch Int Med, 2010;170:143

Figure 3. One-Year Changes in Body Weight as a Function of Diet Group and Dietary Adherence Level for All Study Participants

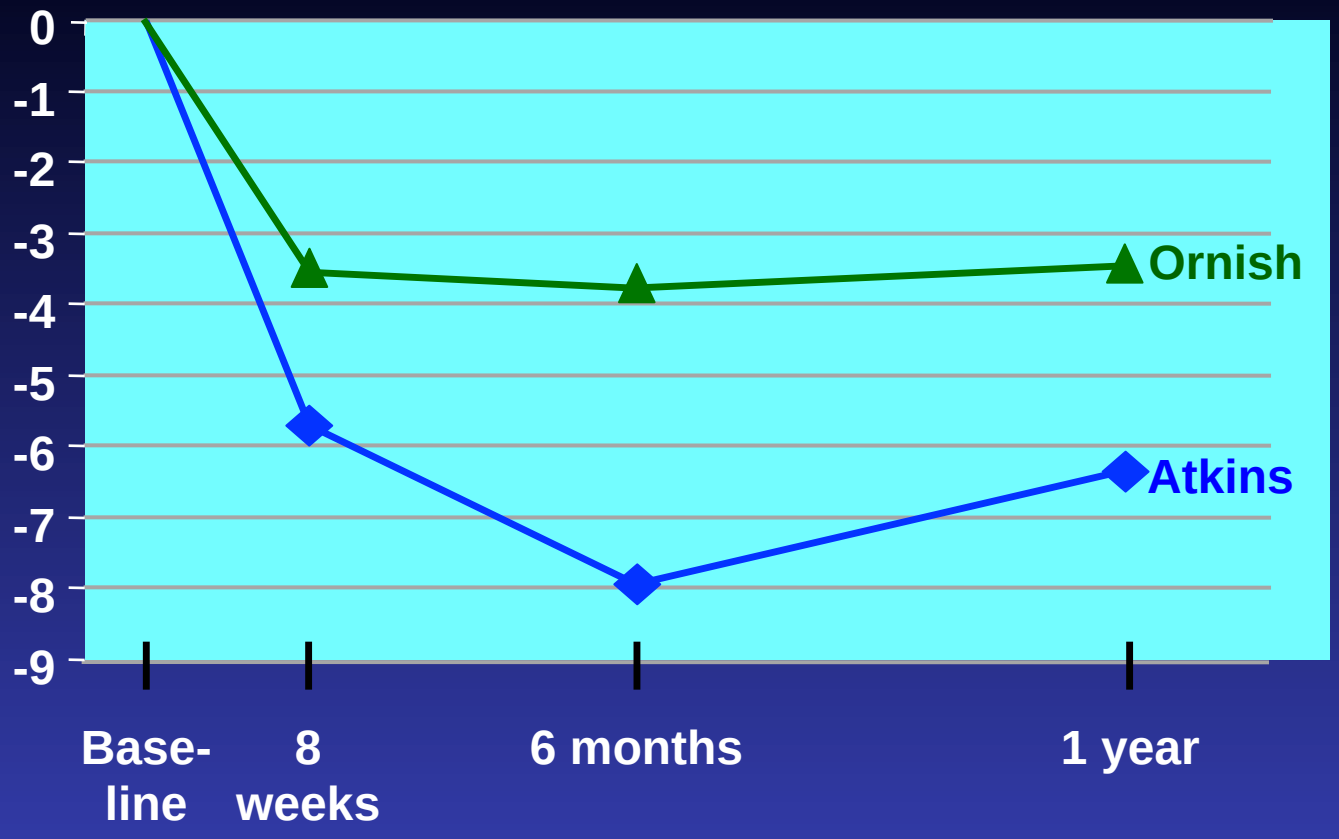


Dansinger et al.,
Comparison of the Atkins, Ornish, Weight Watchers, and Zone Diets for Weight Loss and Heart Disease Risk Reduction: A Randomized Trial.
JAMA, 2005; *293:43-53*


Explanations
For Heterogeneity
???


insulin
resistance
???

Percent weight change across time, by group



	Participants with available data				% Retention 1-year
Atkins	77	72	71	68	88%
Ornish	76	71	65	58	78%

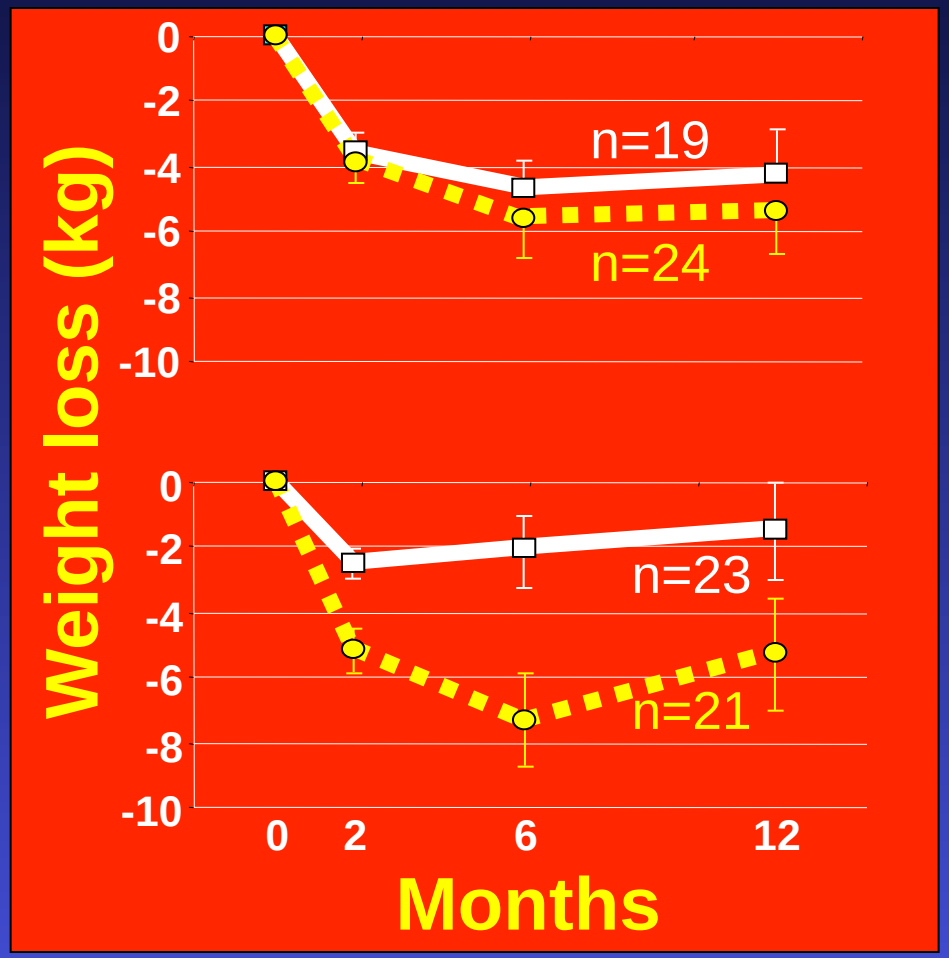
A TO Z Study: Exploratory analyses

Fasting Insulin Tertiles

Most Insulin Sensitive (<7 µIU/mL)

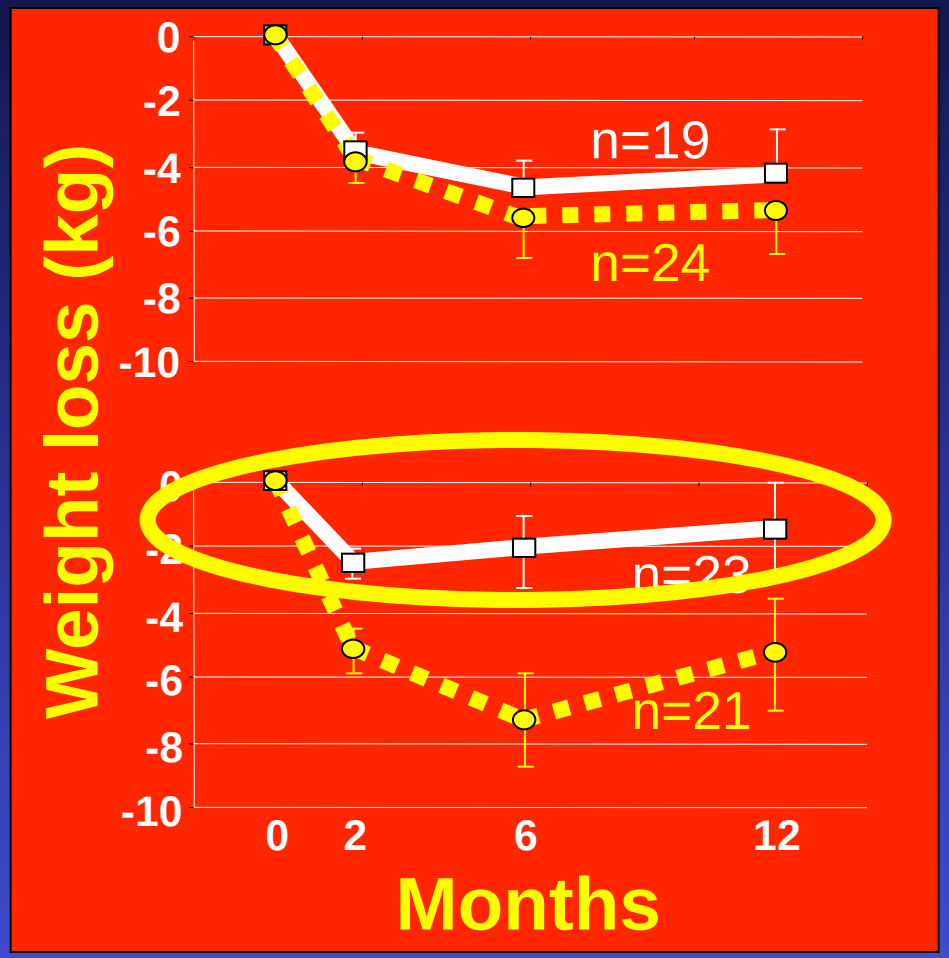
Most Insulin Resistant (>10 µIU/mL)

Mean, SEM



A TO Z Study: Exploratory analyses

Fasting Insulin Tertiles



Most Insulin Sensitive (<7 µIU/mL)

Most Insulin Resistant (>10 µIU/mL)

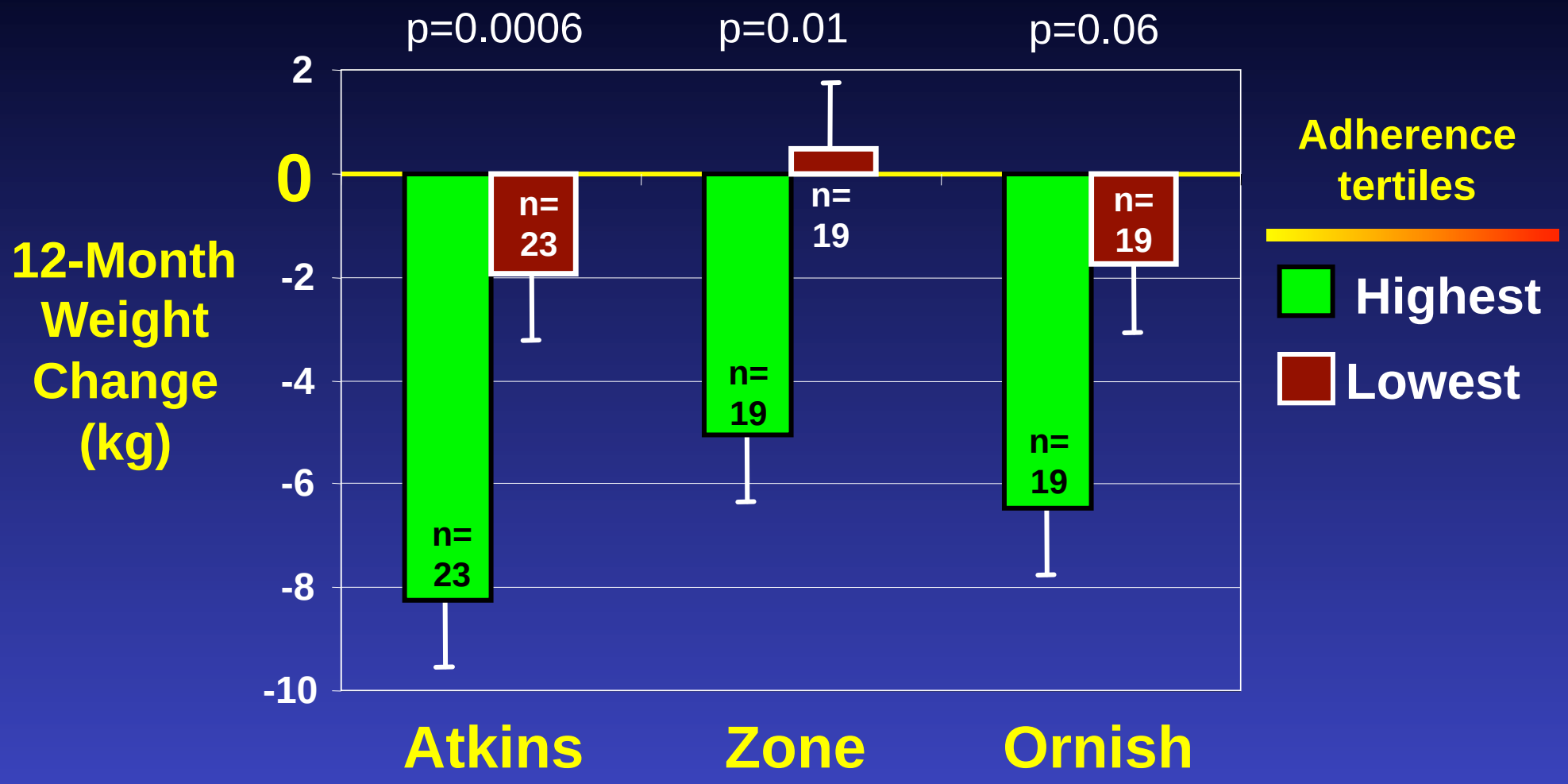
Mean, SEM

Success with either diet for those who are relatively insulin sensitive

For those who are insulin resistant, low-fat diet ineffective compared to low-carb diet


Adherence

Weight Loss by Adherence Tertile (A TO Z Study)

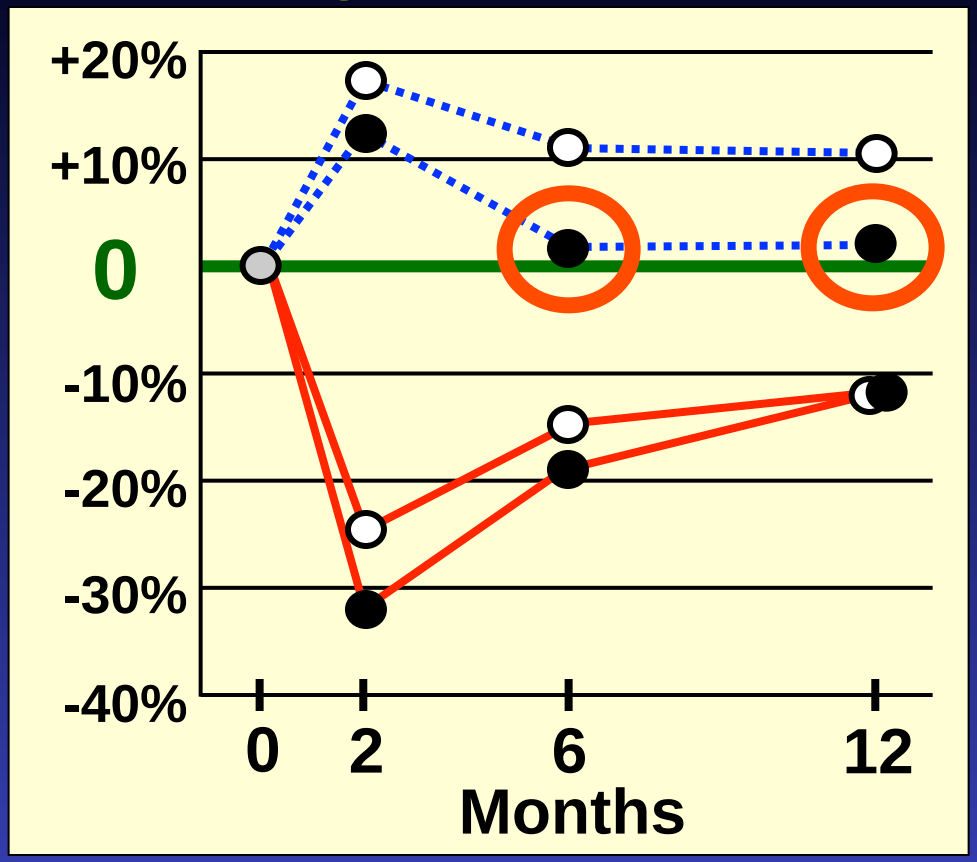


Alhassan, *Intl J Obesity*, 2008; 57:49-56

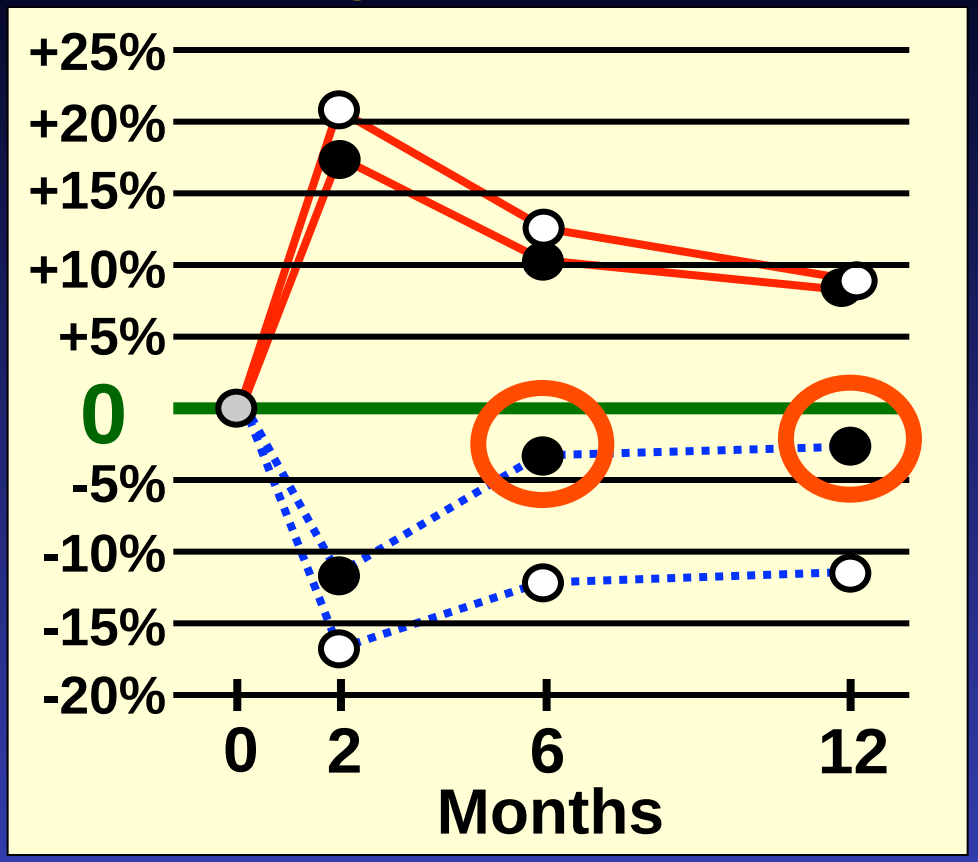
Insulin resistance, Low carb vs. Low Fat, & Adherence

McClain et al., *Diabetes Obes Metab* 2013;15:87-90

Change in % Carbs



Change in % Fats



Fasting Insulin Tertiles	Assigned to Atkins (Lowest Carb)	Assigned to Ornish (Lowest Fat)
Lowest (most Ins Sens)	○	○
Highest (most Ins Res)	●	●

Differential Adherence by Insulin Resistance Status

Insulin resistant individuals may find it inherently more difficult to adhere to a lower-fat/higher-carb diet

Ongoing Study: NIH R01 DK091831 + NuSI

- **Study Population:** Women & men, BMI 28-40, age 18-50, non-diabetic, general good health
- **Sample size:** n=609 (enrollment complete)
- **Intervention:** Healthy Low-Fat vs. Healthy Low-Carb Weight loss diets
  Delivered in 22 instructional sessions (~17/class)
- **Primary outcome**: 12-month weight loss
- **Possible mediators/moderators:**
  Genome, metabolome, microbiome
  Insomnia, food addiction, psychosocial, many others

HOW LOW?

STANFORD PREVENTION
RESEARCH CENTER
the science of healthy living

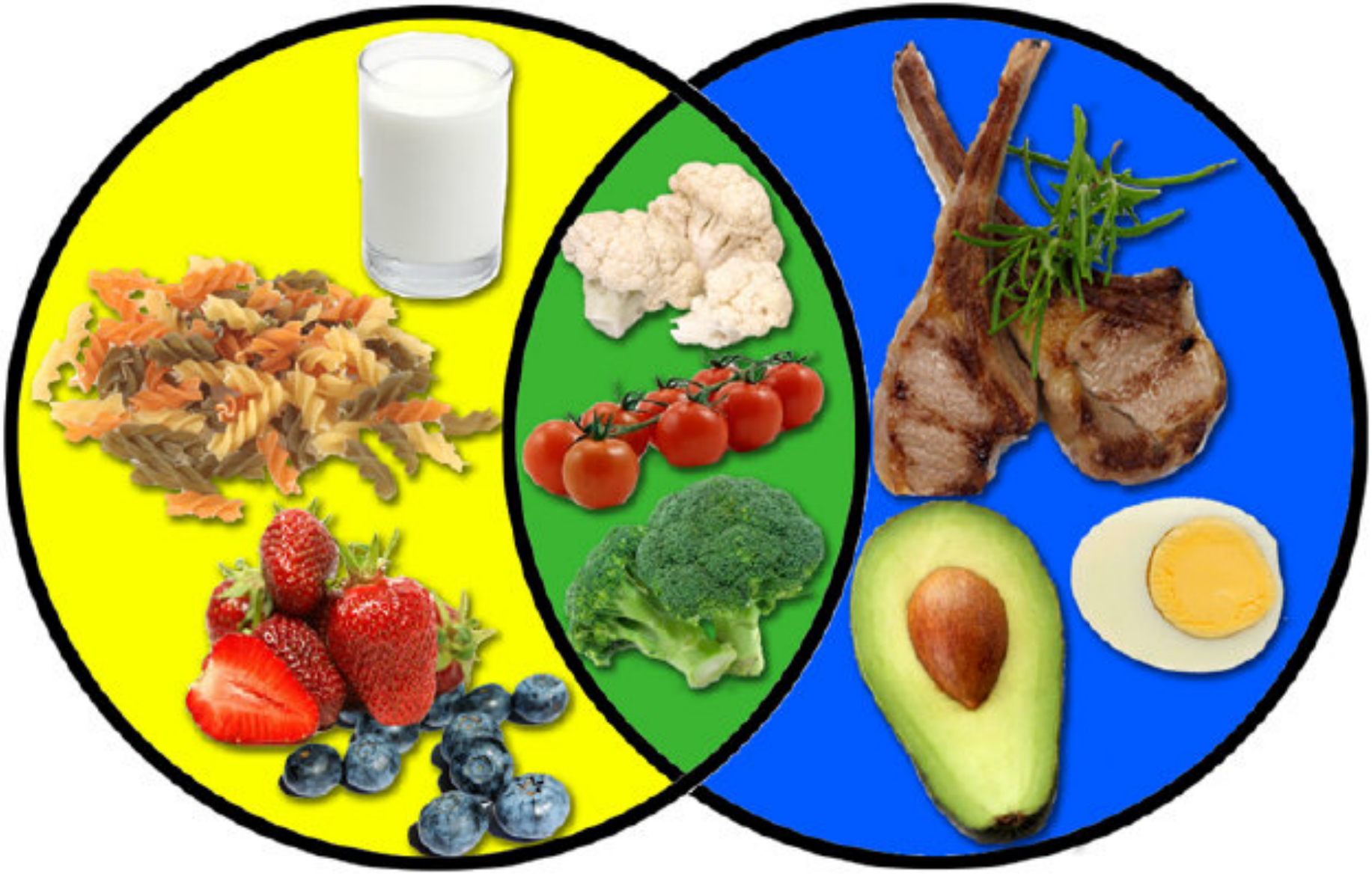
How Low can you go?

~20 grams/day (carbs or fat)?

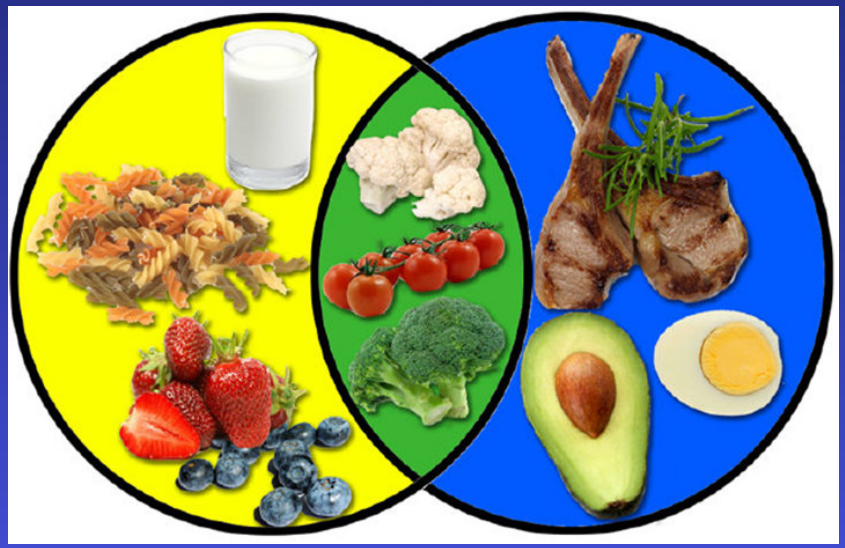
Titrate up to a level you can maintain.....

FOREVER

Healthy Low-Fat vs. Healthy Low-Carb

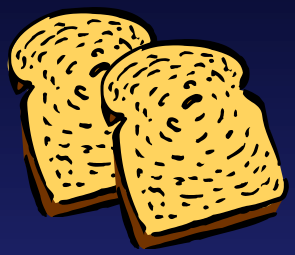


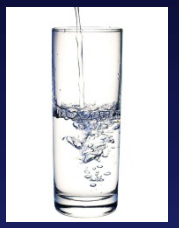
Variability



ID 14: Low Fat

BREAKFAST





2 slices whole wheat bread w/mustard
Multigrain cereal w/skim milk
Water

LUNCH


4 c salad mix w/ fat-free dressing
Spinach spaghetti w/ marinara sauce

Mid-afternoon snack

Coffee

DINNER


Stir fried veggies w/ kung pao sauce, soy sauce and garlic on brown rice
Water

Evening Snack

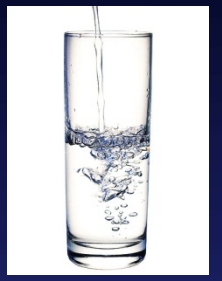
Pita bread w/ low-fat red pepper hummus

ID 36: Low Fat

BREAKFAST

Low Fat Latte

Scone



LUNCH

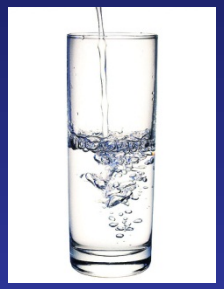
Vegetable lasagna

Soda

Mid-afternoon snack

Water

Martini w/ olives



DINNER

Minestrone soup

Linguini w/ shrimp, alfredo & marinara sauce

Caesar Salad

Evening Snack

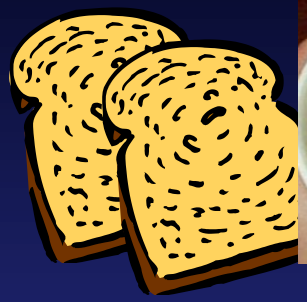
Red wine

Chocolate cake

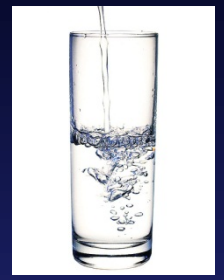
ID 14

ID 36

Low Fat


















Low Fat

	ID 14	ID 36
Kcal	1,700	1,950
Fat	13%	36%
Carbohydrate	73%	37%
Protein	14%	17%
Alcohol	0%	10%
Fiber	45 g	15 g
Omega-3	1 g	1 g
Saturated fat	4 g	36 g
Added Sugars	20 g	39 g

ID 10: Low Carb

BREAKFAST

Tuna salad w/ tomatoes, olives & lettuce
Fat free dressing
Water


LUNCH

Deli ham
Laughing cow cheese


Afternoon Snack

Coffee w/ half and half

DINNER

Chicken w/o skin
Zucchini & Broccoli sauteéd in butter

Evening Snack

Strawberries & sparkling water


ID 51: Low Carb

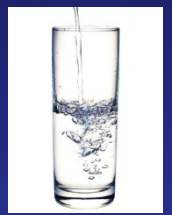
BREAKFAST

Omelette w/ cheese, ham, spinach
Coffee with half & half
Water



LUNCH

Steak w/ cheese
Pork ribs
Bratwurst
Broccoli salad
Water






DINNER

Cheeseburger
Sausage
Avocado, tomato, spinach
Red wine




Low Carb

ID 10







ID 51

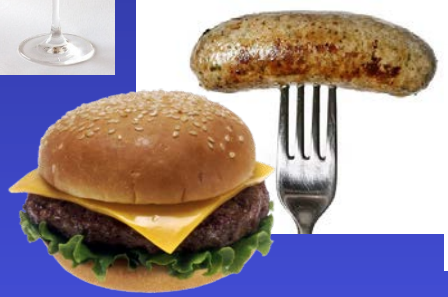
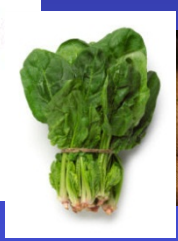










Low Carb ID 10 ID 51

Kcal	1,200	2,150
Fat	48%	66%
Carbohydrate	13%	5%
Protein	39%	23%
Alcohol	0%	6%
Fiber	13 g	8 g
Omega-3	2 g	2 g
Saturated fat	21 g	61 g
Added Sugars	5 g	4 g

Do Genotype Patterns Predict Weight Loss Success for Low Carb vs. Low Fat Diets? R01 DK091831 (2013-17) + NuSI

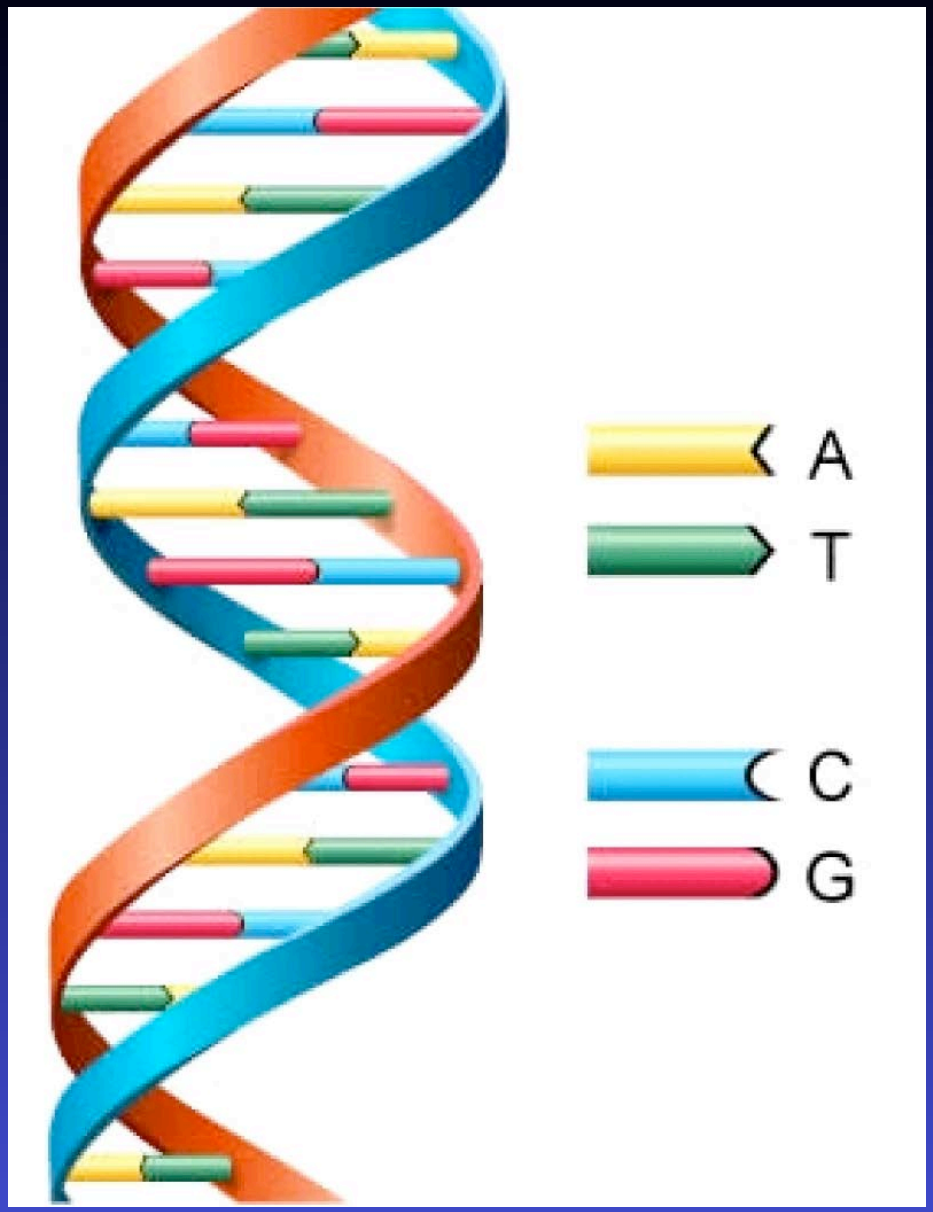
n=609
BMI 28-40 kg/m^2
non-diabetic
generally healthy
adults 18-50 yrs
~55% women

Low Carbohydrate (n=305)

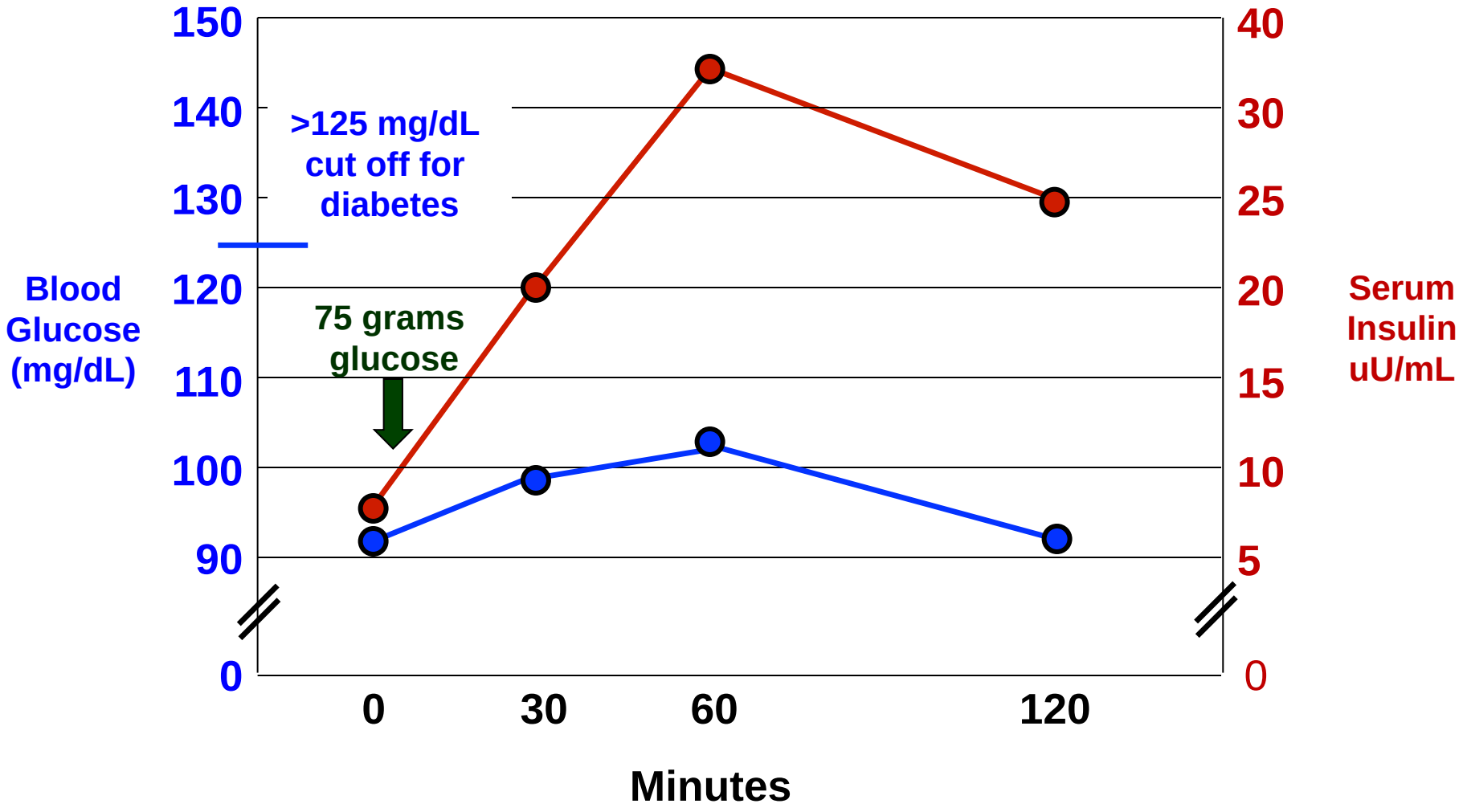
Low Fat (n=304)

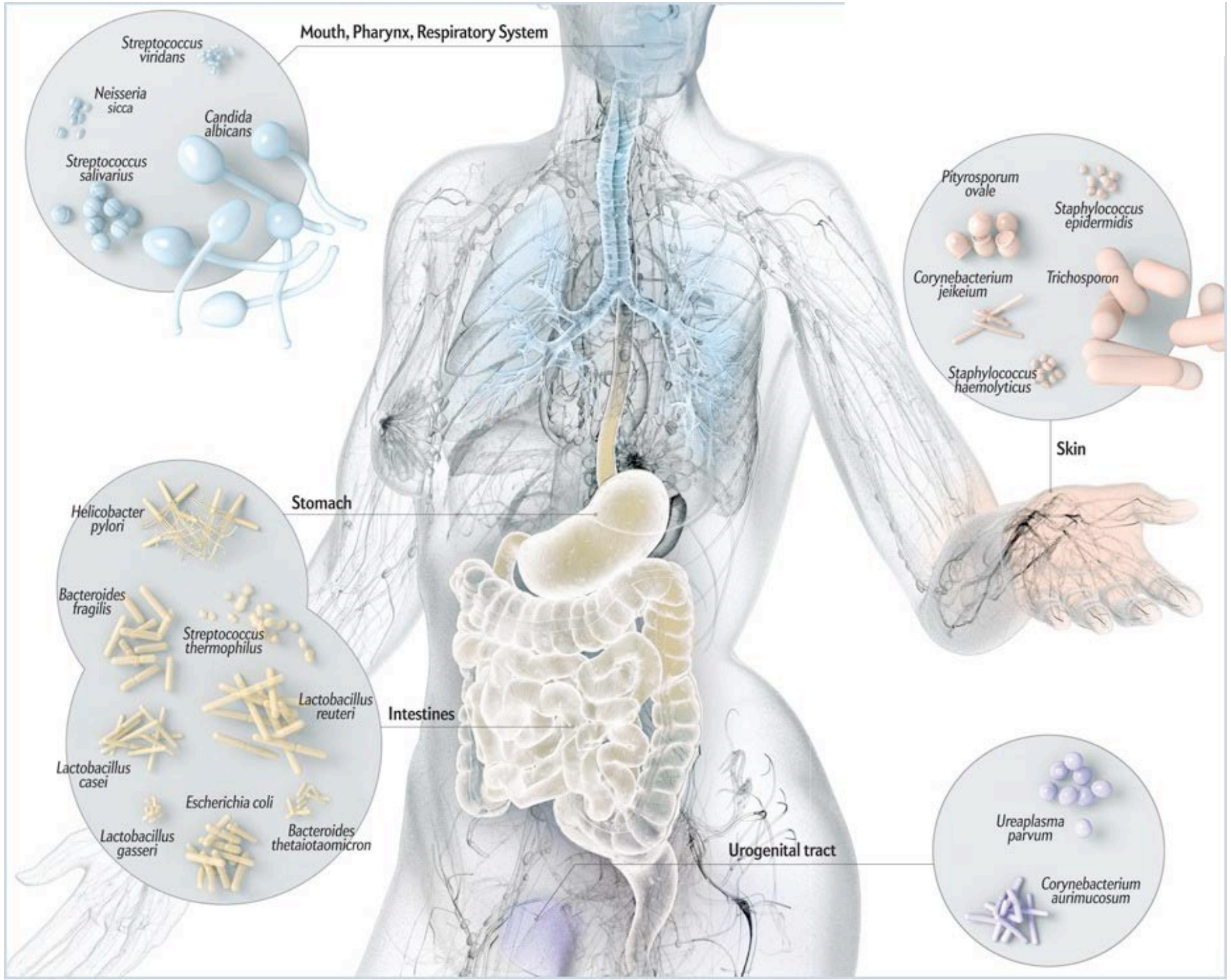
Months	0	3	6	12
INTERVENTION: 22 group classes, 15-22 participants/group	XXXXXXXX X X X X X X X X X X X X X X			
WEIGHT (1° outcome)	X	X	X	X
Blood (DNA, lipids, glucose, insulin, OGTT, cytokines)	X	X (no OGTT)	X	X
Diet Assessment (NDS-R)	X	X	X	X
Psychosocial (Questionnaires)	X	X	X	X
DEXA, REE (Metabolic cart)	X		X	X

Other: Microbiome (fecal samples) Adipocytes (fat biopsies), Other – Various times points, specific cohorts


A
T
C
G

Non-Diabetic, Insulin Resistant




Mouth, Pharynx, Respiratory System
Streptococcus viridans
Neisseria sicca
Candida albicans
Streptococcus salivarius
Pityrosporum ovale
Staphylococcus epidermidis
Corynebacterium jeikeium
Trichosporon
Staphylococcus haemolyticus
Skin
Stomach
Helicobacter pylori
Bacteroides fragilis
Streptococcus thermophilus
Lactobacillus reuteri
Intestines
Lactobacillus casei
Escherichia coli
Lactobacillus gasseri
Bacteroides thetaiotaomicron
Urogenital tract
Ureaplasma parvum
Corynebacterium aurimucosum

VIEWPOINT

The Merits of Subtyping Obesity
One Size Does Not Fit All

Alison E. Field, ScD, Carlos A. Camargo Jr, MD, DrPH, Shuji Ogino, MD, PhD

Obesity is a heterogeneous and complex disease influenced by exogenous and endogenous exposures.

Stratifying obesity into meaningful subtypes could provide a better understanding of its causes and enable the design and delivery of more effective prevention and treatment interventions.

JAMA November 27, 2013 Volume 310, Number 20

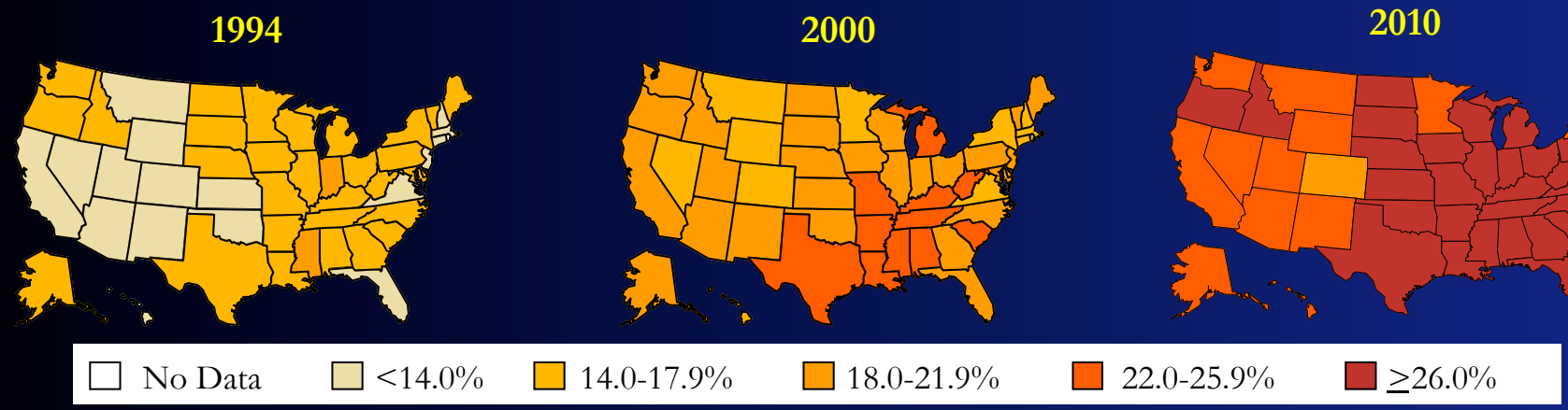
Outline

- *My research & lessons learned*
- **Evidence for Obesity links to Morbidity/Mortality**
- *Health at Every Weight*
- *Take Home / Actionable Conclusions*

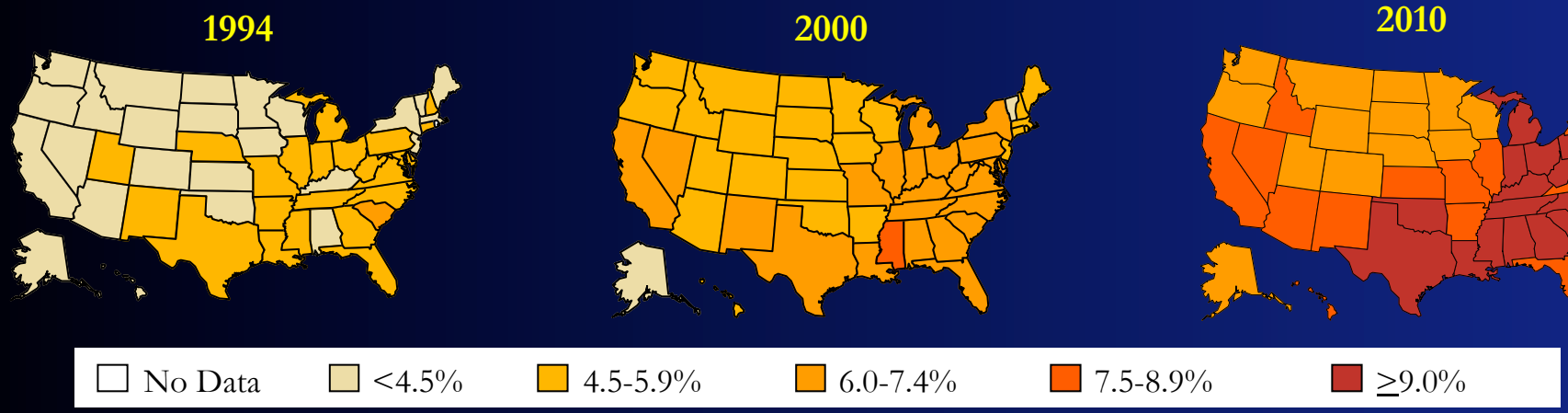
STANFORD PREVENTION RESEARCH CENTER
the science of healthy living

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

Journal of the American College of Cardiology

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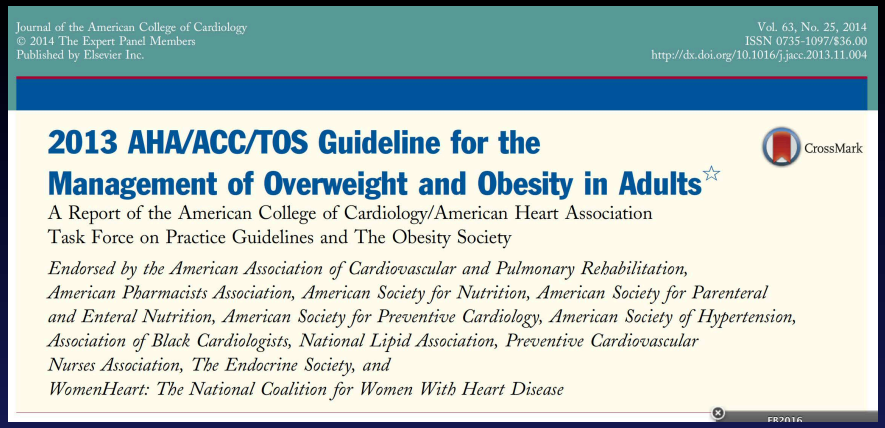
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2013.11.004

2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults☆

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society

Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, American Pharmacists Association, American Society for Nutrition, American Society for Parenteral and Enteral Nutrition, American Society for Preventive Cardiology, American Society of Hypertension, Association of Black Cardiologists, National Lipid Association, Preventive Cardiovascular Nurses Association, The Endocrine Society, and WomenHeart: The National Coalition for Women With Heart Disease

More than 78 million adults in the US were obese in 2009 & 2010.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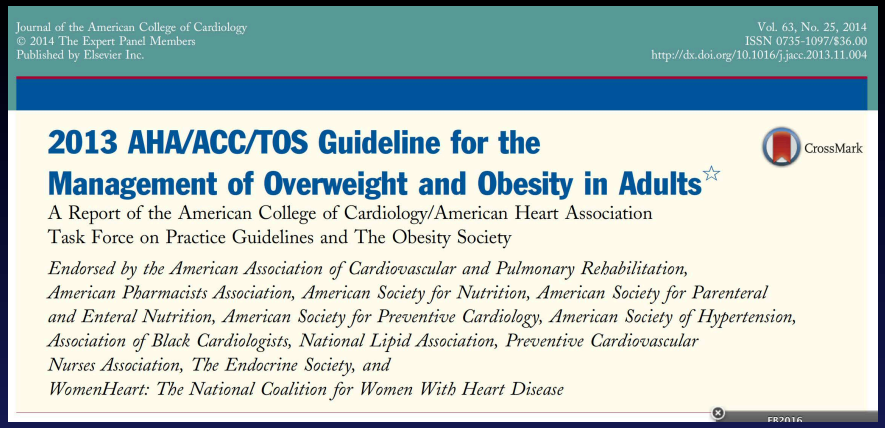
Obesity raises the risk of MORBIDITY from hypertension, dyslipidemia, type 2 diabetes, heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, and some cancers.

Obesity is also associated with increased risk of all-cause and CVD MORTALITY.

…biomedical, psychosocial, and economic consequences…

All of the following are associated with weight loss

AHA-style Step 1
Higher protein
Higher protein Zone-type
Lacto–ovo–vegetarian–style
Low calorie
Low carbohydrate
Low fat
Low fat vegan-style
Lower fat, high-dairy
Low–glycemic–load
Macronutrient targeted diets
Mediterranean style
Moderate protein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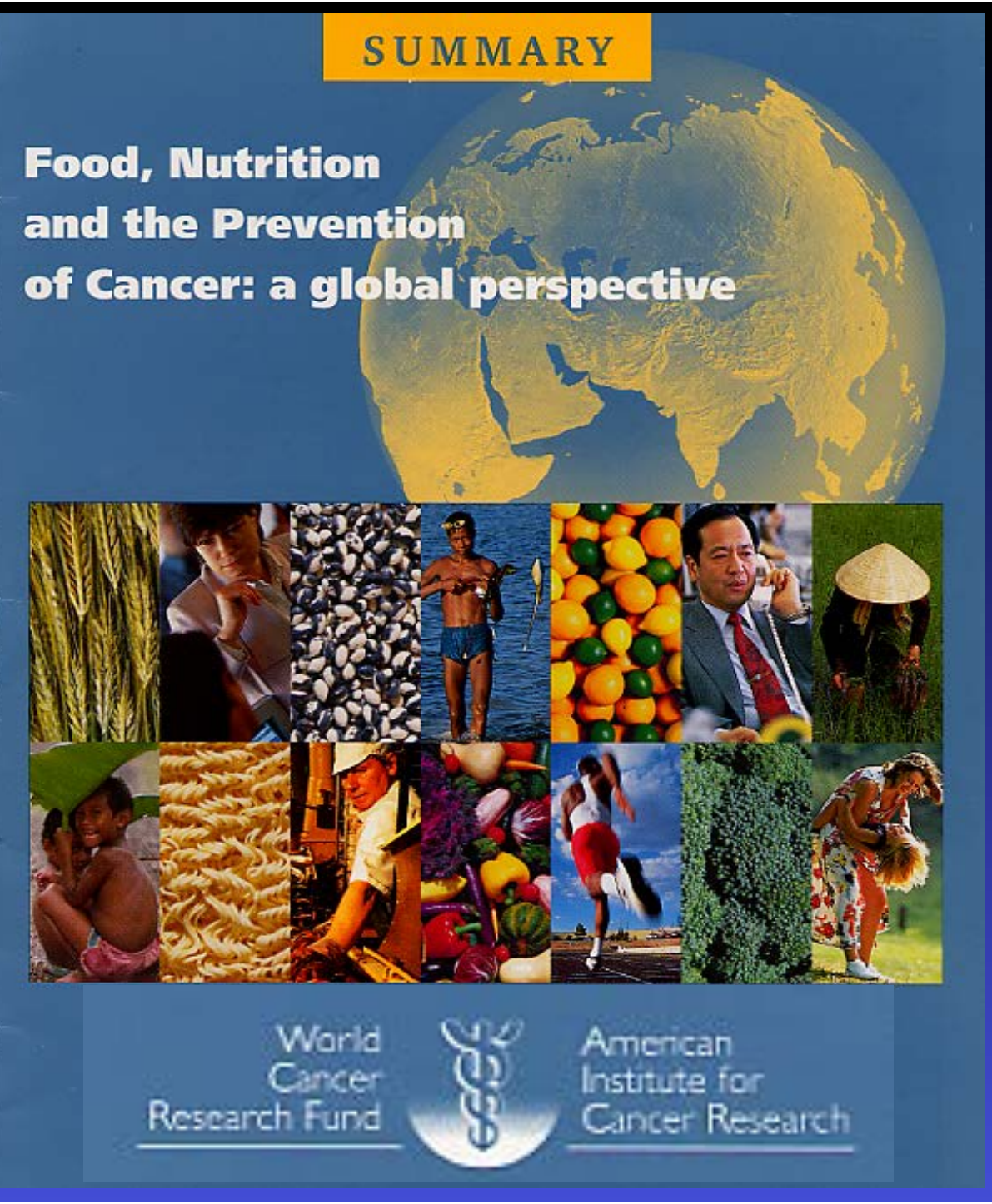
With prescribed energy restriction, or

Without formal prescribed energy restriction, but with a realized energy deficit.

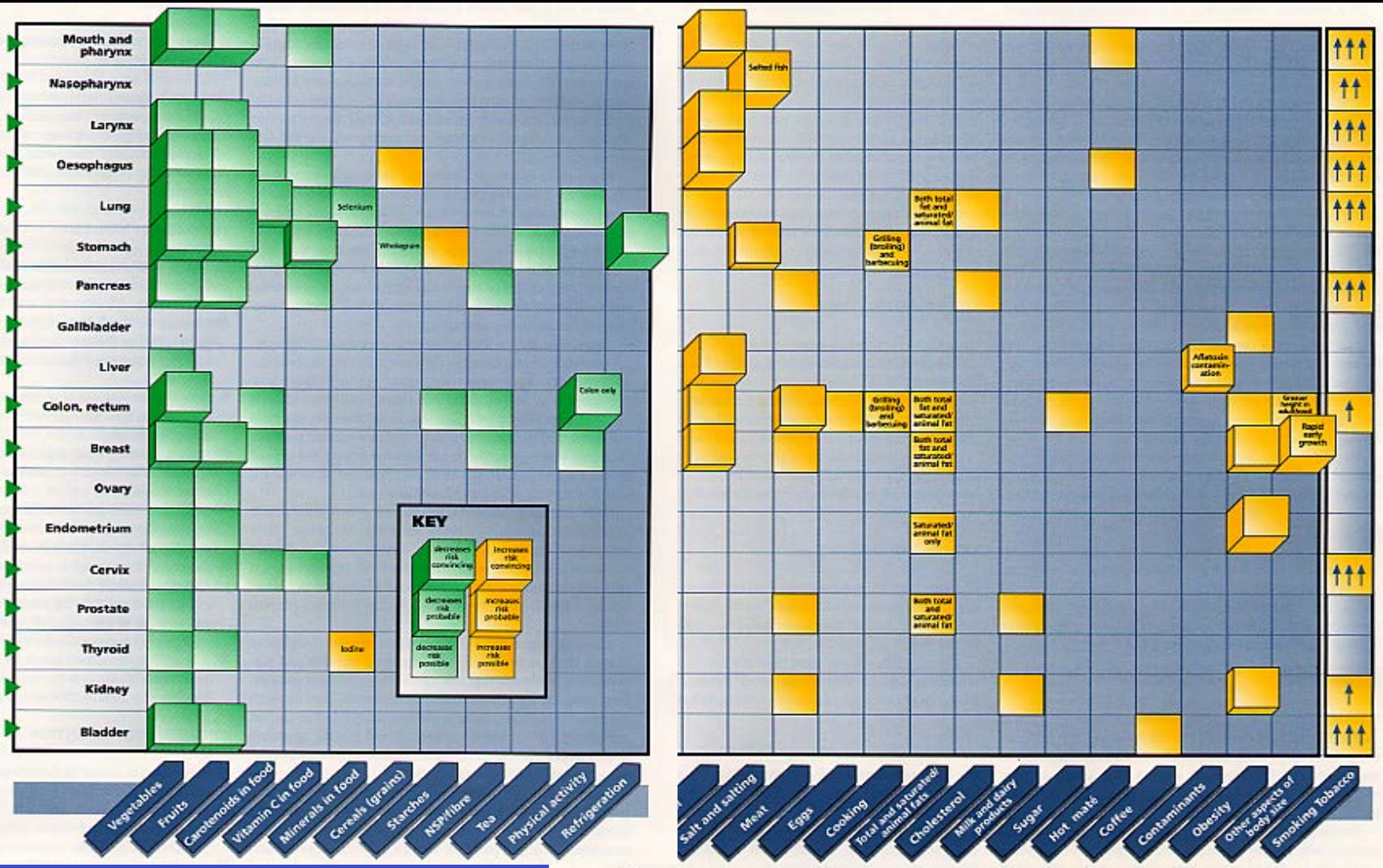
…if reduction in dietary energy intake is achieved:

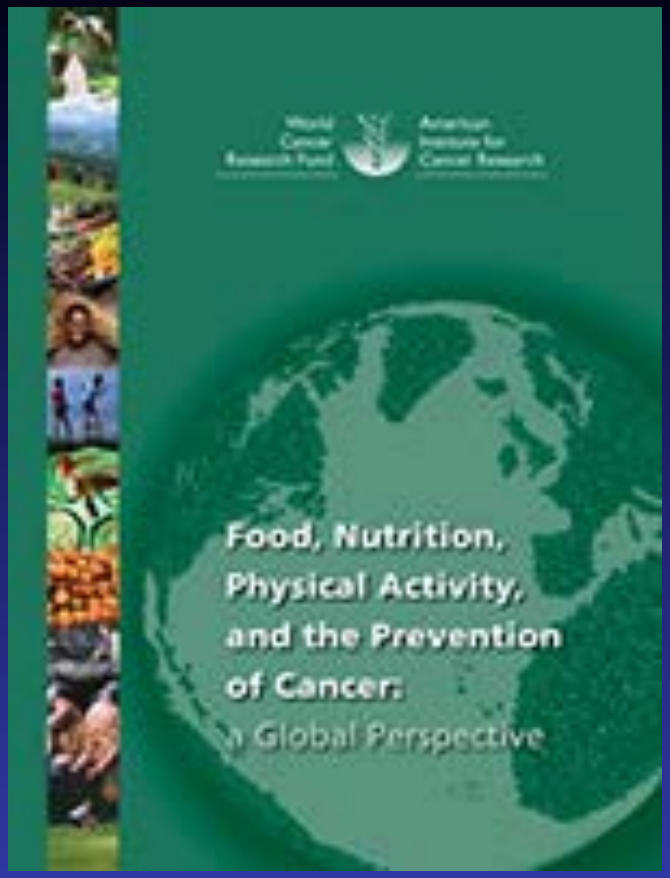


Food, Nutrition and the Prevention of Cancer: a global perspective

World Cancer Research Fund American Institute for Cancer Research

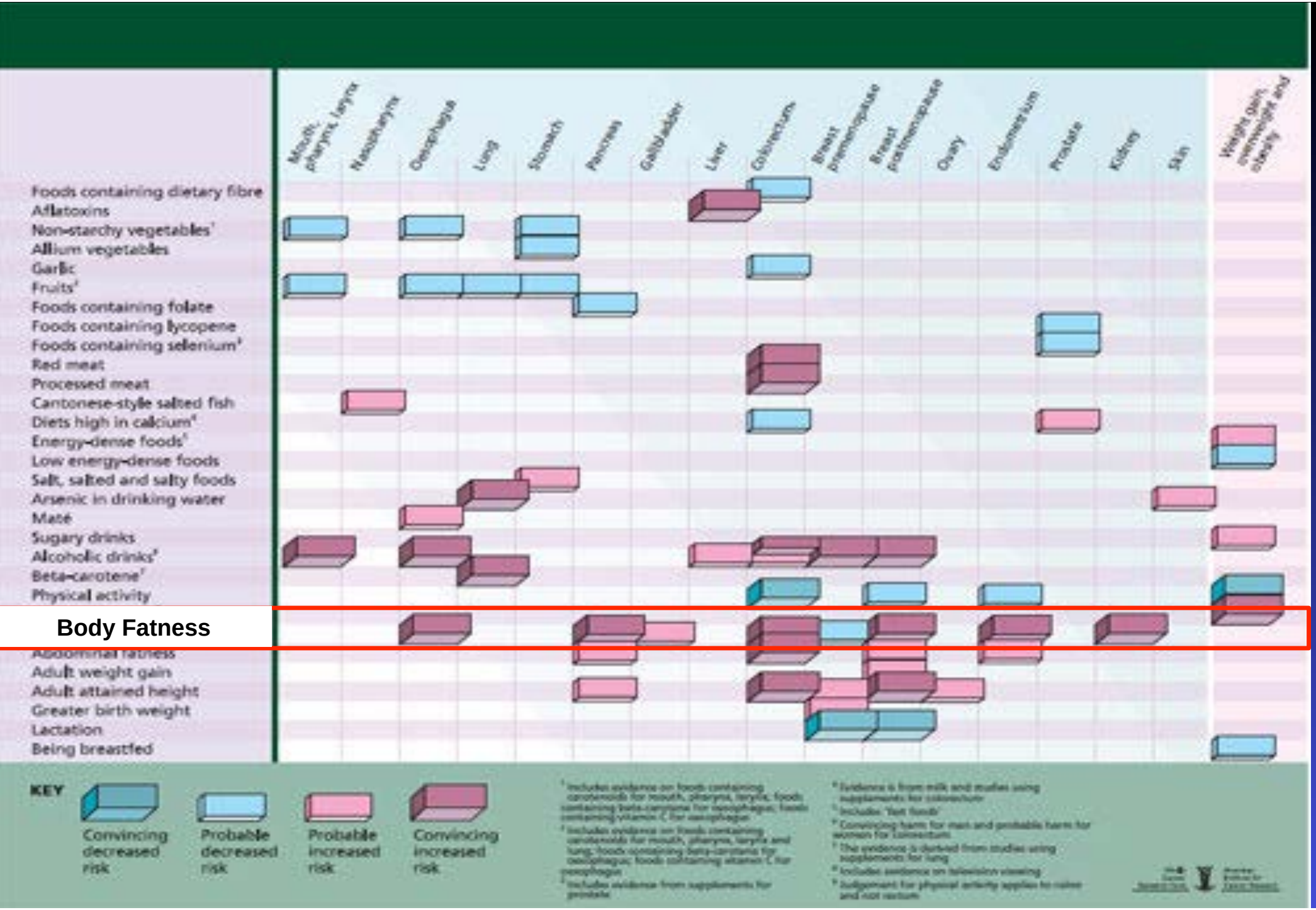
1997


Mouth and pharynx
Nasopharynx
Larynx
Oesophagus
Lung
Stomach
Pancreas
Gallbladder
Liver
Colon, rectum
Breast
Ovary
Endometrium
Cervix
Prostate
Thyroid
Kidney
Bladder
Selenium
Wholegrain
Colon only
Iodine
KEY
decreases risk convincing
increases risk convincing
decreases risk probable
increases risk probable
decreases risk possible
increases risk possible
Vegetables
Fruits
Carotenoids in food
Vitamin C in food
Minerals in food
Cereals (grains)
Starches
NSP/fibre
Tea
Physical activity
Refrigeration
Salted fish
Both total fat and saturated/ animal fat
Grilling (broiling) and barbecuing
Both total fat and saturated/ animal fat
Both total fat and saturated/ animal fat
Saturated/ animal fat only
Both total and saturated/ animal fat
Aflatoxin contamination
Rapid early growth
Salt and salting
Meat
Eggs
Cooking
Total and saturated animal fats
Cholesterol
Milk and dairy products
Sugar
Hot maté
Coffee
Contaminants
Obesity
Other aspects of body size
Smoking Tobacco



Second Expert Report
Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective
2007

American Institute for Cancer Research
World Cancer Research Fund


Mouth, pharynx, larynx
Nasopharynx
Oesophagus
Lung
Stomach
Pancreas
Gallbladder
Liver
Colorectum
Breast premenopausal
Breast postmenopausal
Ovary
Endometrium
Prostate
Kidney
Skin
Weight gain, overweight and obesity
Foods containing dietary fibre
Aflatoxins
Non-starchy vegetables[1]
Allium vegetables
Garlic
Fruits[2]
Foods containing folate
Foods containing lycopene
Foods containing selenium[3]
Red meat
Processed meat
Cantonese-style salted fish
Diets high in calcium[4]
Energy-dense foods[5]
Low energy-dense foods
Salt, salted and salty foods
Arsenic in drinking water
Maté
Sugary drinks
Alcoholic drinks[6]
Beta-carotene[7]
Physical activity
Body Fatness
Abdominal fatness
Adult weight gain
Adult attained height
Greater birth weight
Lactation
Being breastfed
KEY
Convincing decreased risk
Probable decreased risk
Probable increased risk
Convincing increased risk

Association of All-Cause Mortality With Overweight and Obesity Using Standard Body Mass Index Categories

A Systematic Review and Meta-analysis

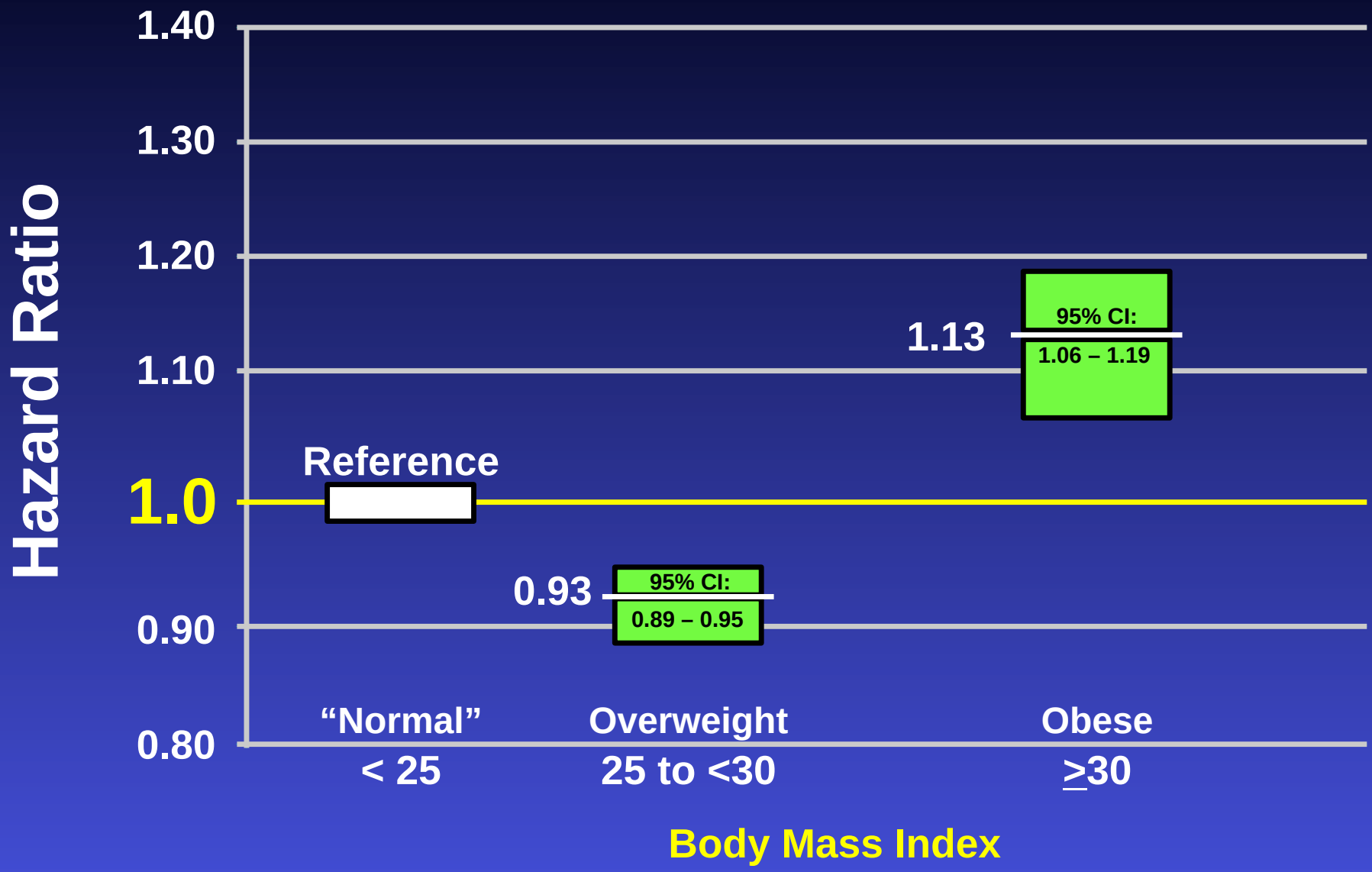
Katherine M. Flegal, PhD
Brian K. Kit, MD
Heather Orpana, PhD
Barry I. Graubard, PhD

Importance Estimates of the relative mortality risks associated with normal weight, overweight, and obesity may help to inform decision making in the clinical setting.

Objective To perform a systematic review of reported hazard ratios (HRs) of all-cause mortality for overweight and obesity relative to normal weight in the general population.

Random-Effects Hazard Ratios of All-Cause Mortality for Overweight and Obesity Relative to Normal Weight

Flegal K, et al.
JAMA. 2013;309:71-82
97 Prospective Studies



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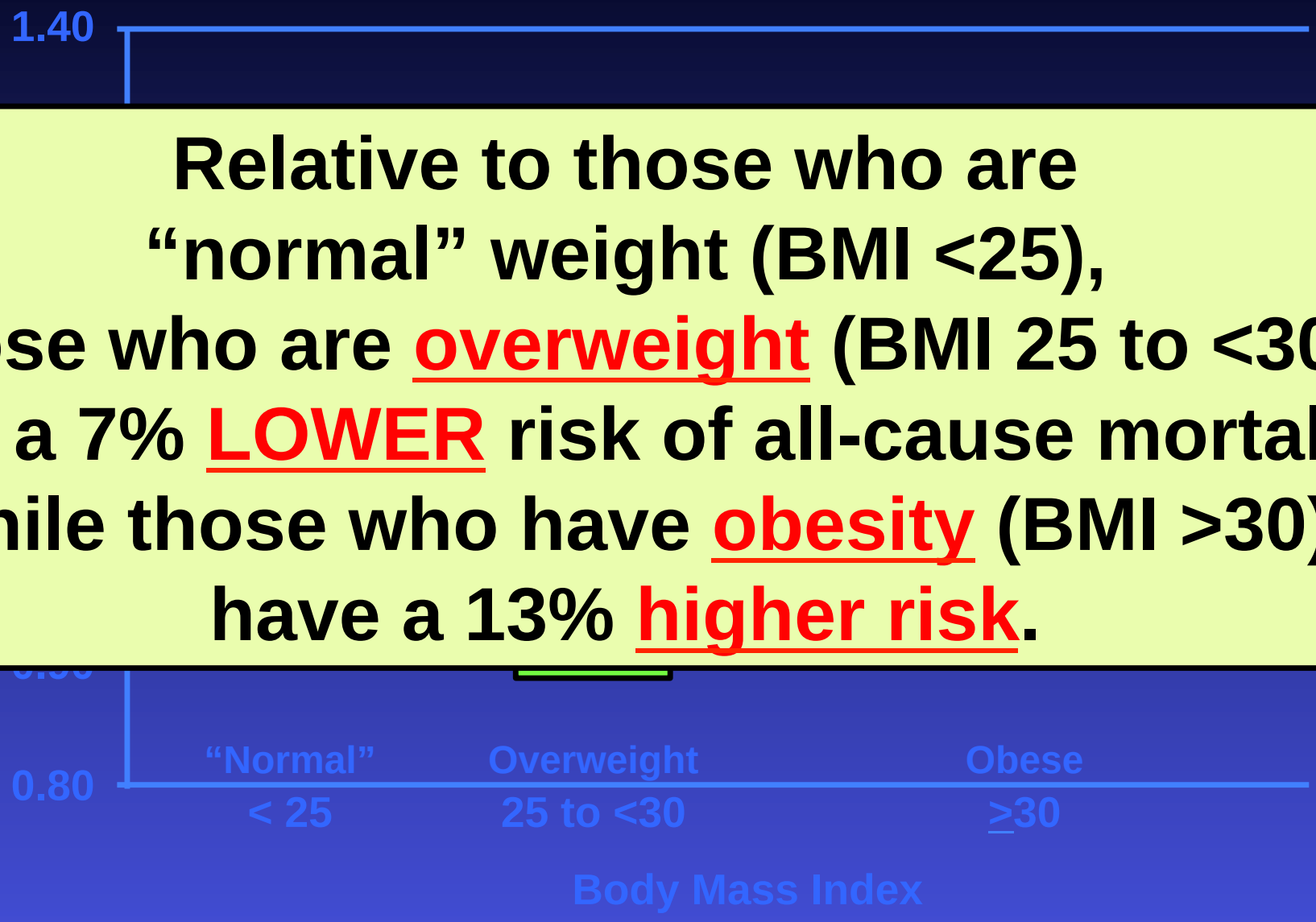

Relative to those who are "normal" weight (BMI <25), those who are overweight (BMI 25 to <30) have a 7% LOWER risk of all-cause mortality, while those who have obesity (BMI >30) have a 13% higher risk.

Random-Effects Hazard Ratios of All-Cause Mortality for Overweight and Obesity Relative to Normal Weight

Flegal K, et al.
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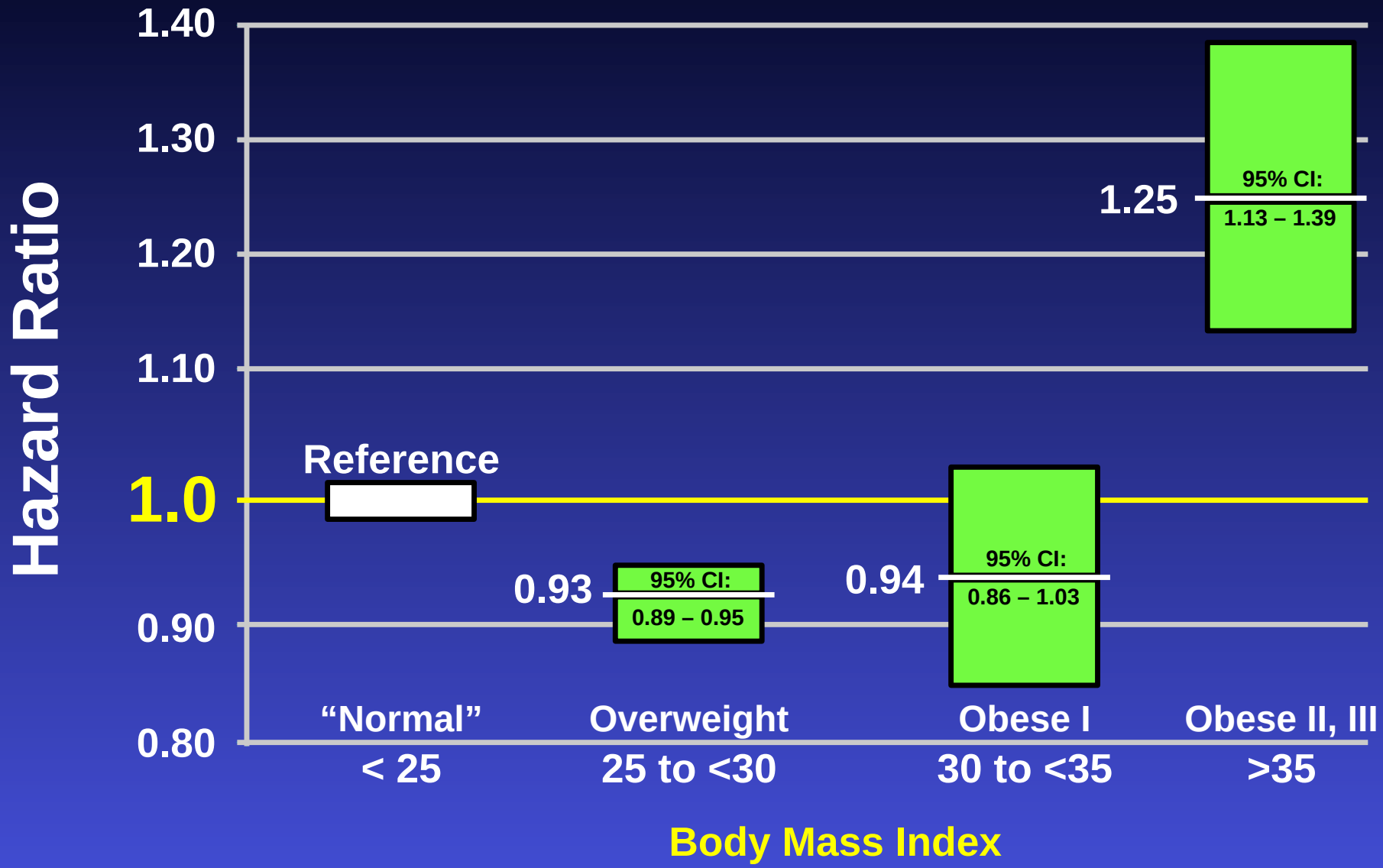

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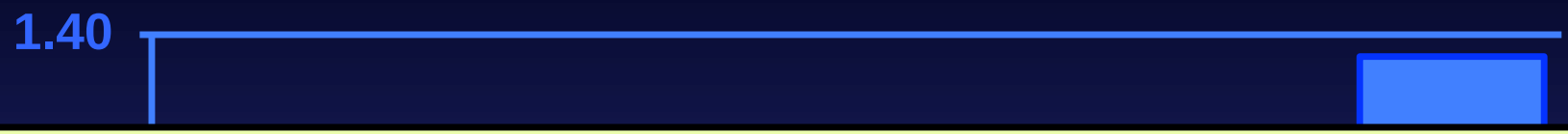


The HIGHER risk of all-cause mortality, is observed in those who have obesity at the higher levels of stage 2 and 3 and morbid obesity (BMI ≥35).

Even those with stage 1 obesity (BMI 30 to <35) have a LOWER risk of mortality (not significant) than those with BMI <25

Body Mass Index

The NEW ENGLAND JOURNAL of MEDICINE

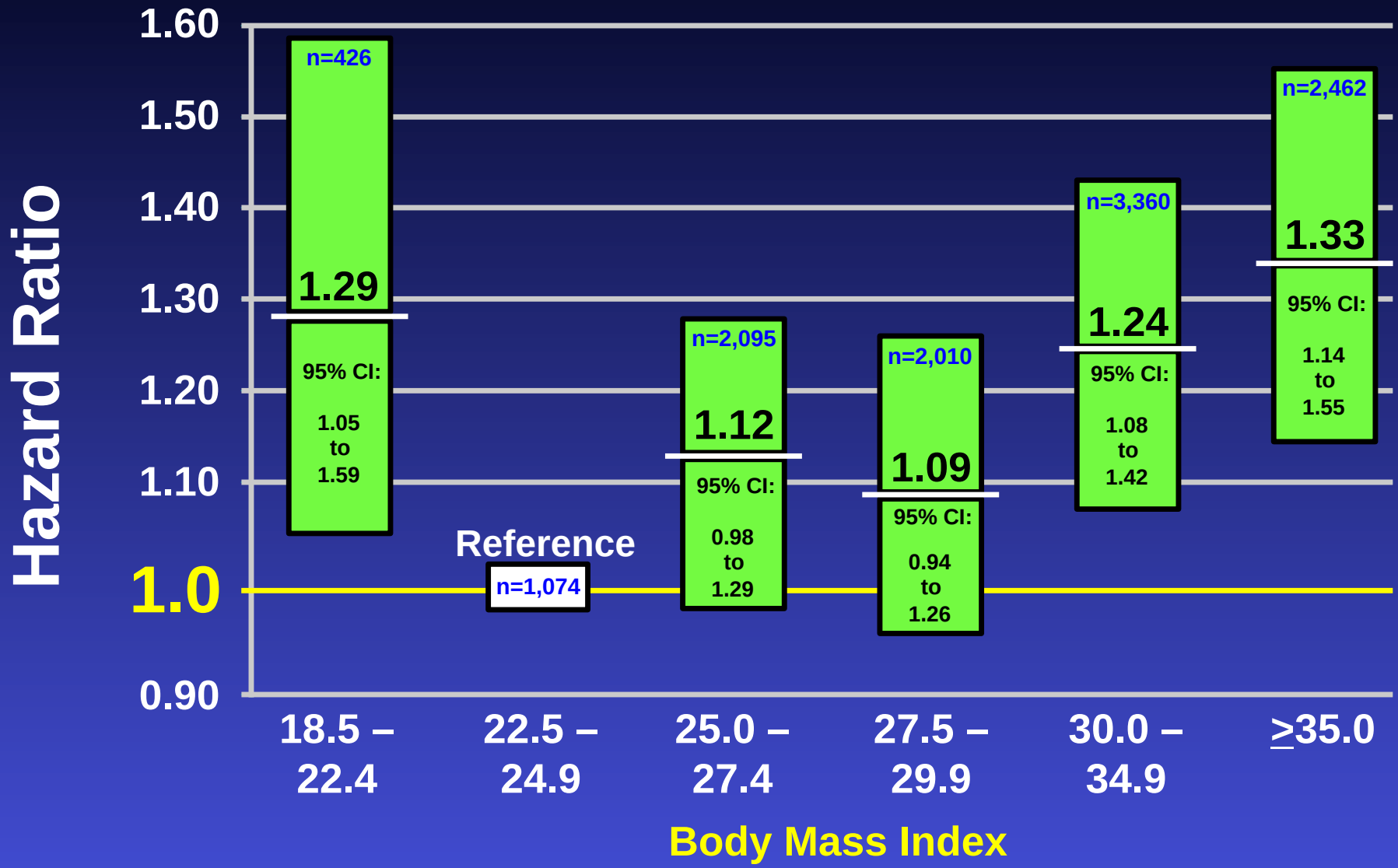
ORIGINAL ARTICLE

Body-Mass Index and Mortality among Adults with Incident Type 2 Diabetes

Deirdre K. Tobias, Sc.D., An Pan, Ph.D., Chandra L. Jackson, Ph.D., Eilis J. O'Reilly, Sc.D., Eric L. Ding, Sc.D., Walter C. Willett, M.D., Dr.P.H., JoAnn E. Manson, M.D., Dr.P.H., and Frank B. Hu, M.D., Ph.D.

Body-Mass Index and Mortality among Adults with Incident Type 2 Diabetes

Tobias & Hu, et al.
NEJM. 2014;370:233-44
NHS & HPFS, >12,000,
~16 years, >3,000 deaths



Body-Mass Index and Mortality among Adults with Incident Type 2 Diabetes

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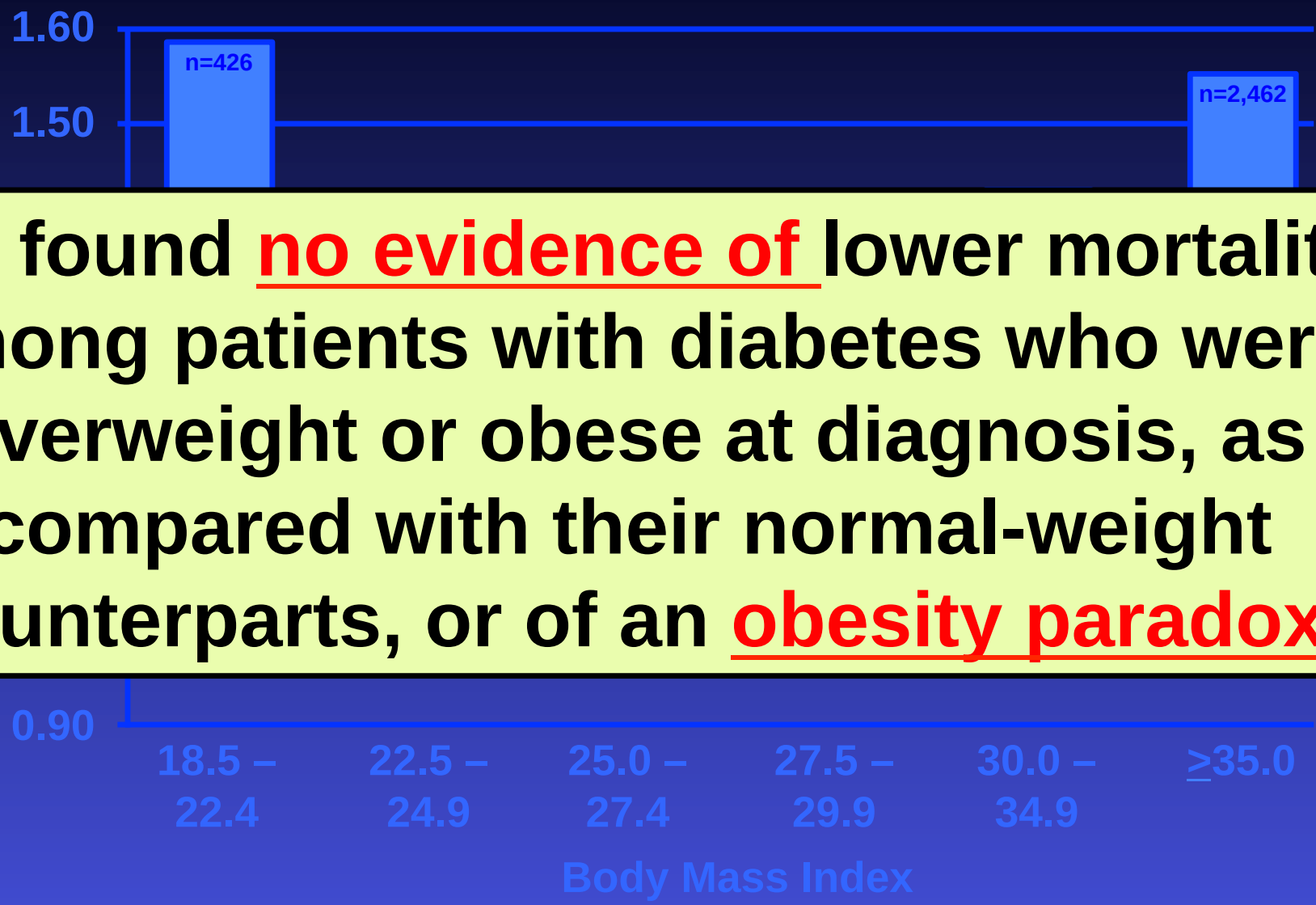


We found no evidence of lower mortality among patients with diabetes who were overweight or obese at diagnosis, as compared with their normal-weight counterparts, or of an obesity paradox.

Online First >

Original Investigation | August 01, 2016

Risks of Myocardial Infarction, Death, and Diabetes in Identical Twin Pairs With Different Body Mass Indexes ONLINE FIRST

Peter Nordström, PhD[1]; Nancy L. Pedersen, PhD[2]; Yngve Gustafson, PhD[1]; Karl Michaëlsson, PhD[3]; Anna Nordström, PhD[4]

Conclusions and Relevance In MZ twin pairs, higher BMI was not associated with an increased risk of MI or death but was associated with the onset of diabetes. These results may suggest that lifestyle interventions to reduce obesity are more effective in decreasing the risk of diabetes than the risk of cardiovascular disease or death.

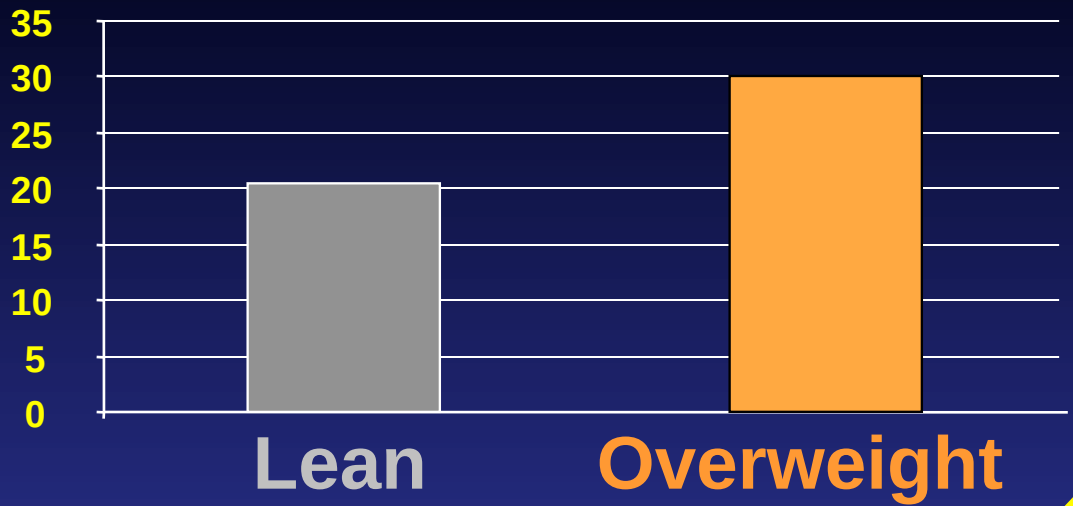
Outline

- *My research & lessons learned*
- *Evidence for Obesity links to Morbidity/Mortality*
- **Health at Every Weight**
- *Take Home / Actionable Conclusions*

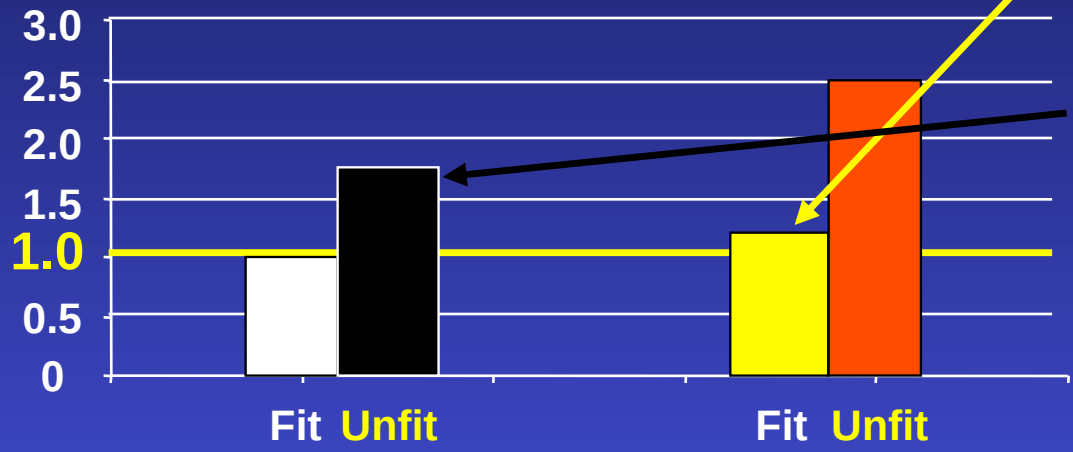
STANFORD PREVENTION RESEARCH CENTER
the science of healthy living

Fit and Fat?

All-cause deaths per 10,000 men per year



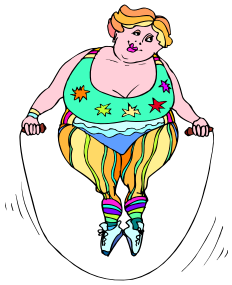
Relative Risk all-cause mortality



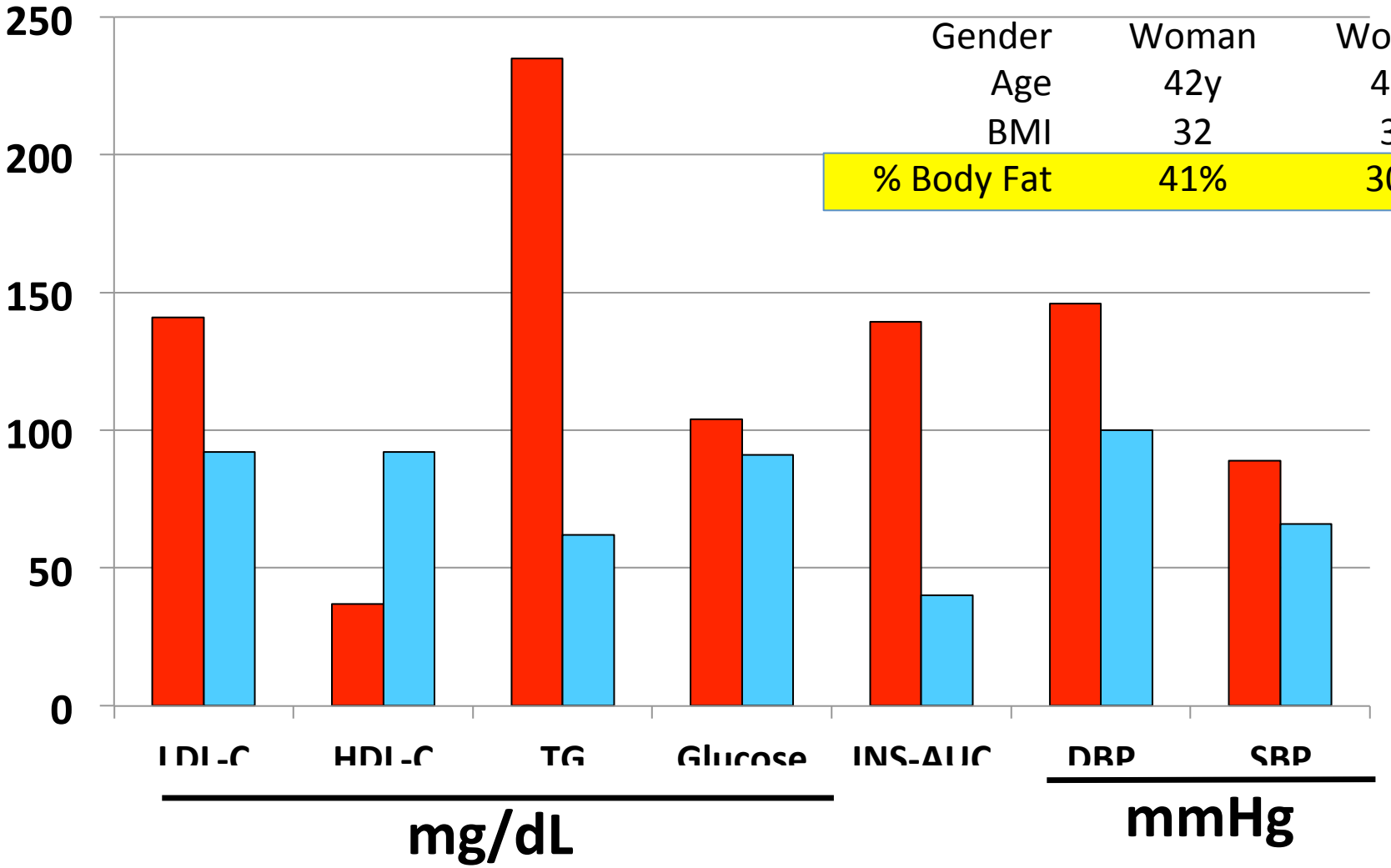
Conclusion:
Fit and obese healthier than lean and unfit

Lee, Blair, Jackson,
Am J Clin Nutr.
1999;69:373-80

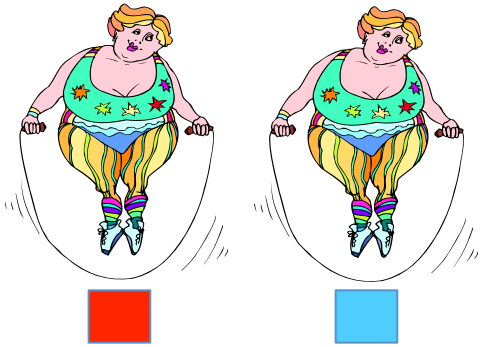
Same Gender, Age, BMI
Different % Body Fat



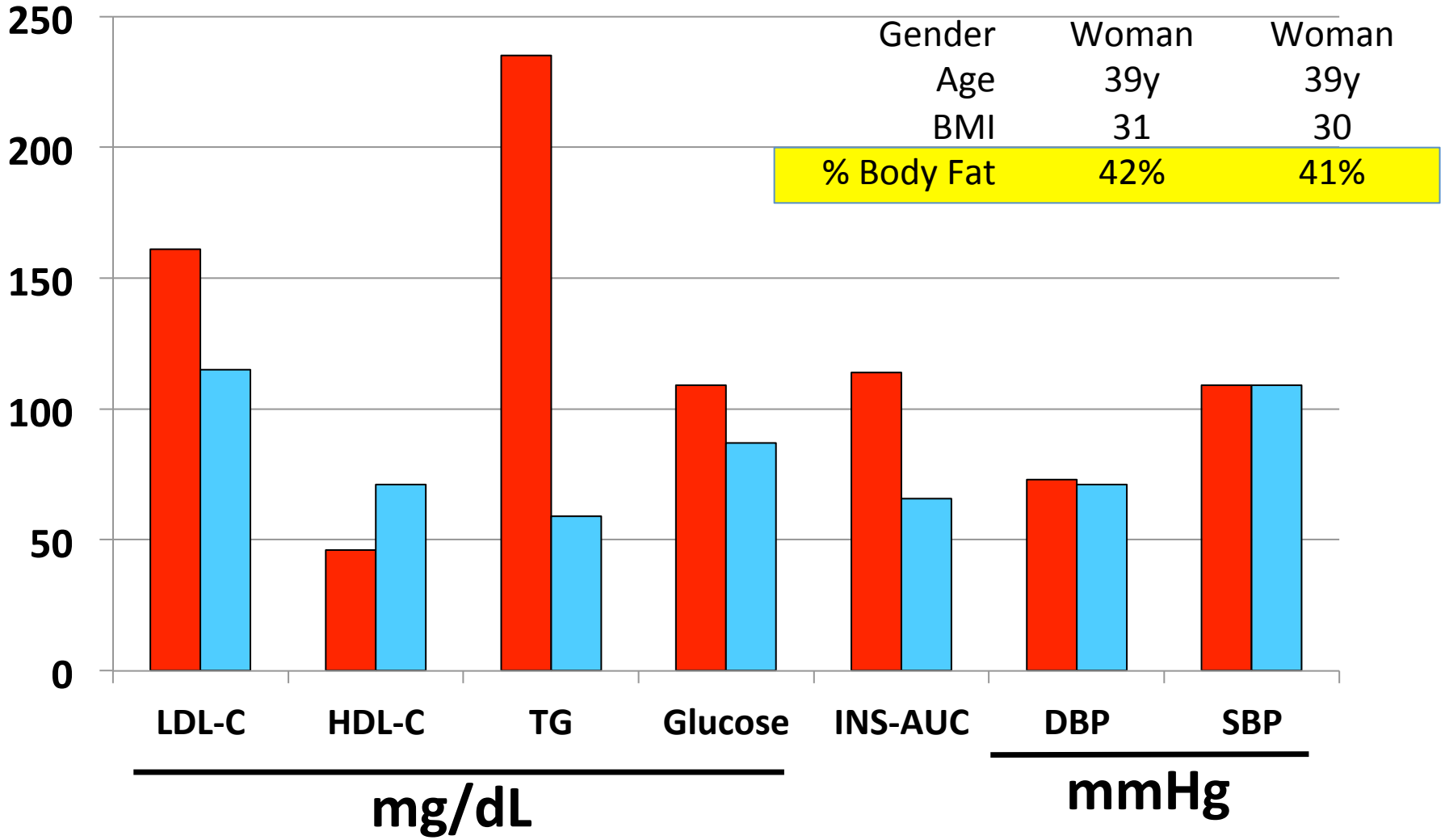
Gender	Woman	Woman
Age	42y	42y
BMI	32	32
% Body Fat	41%	30%



Same Gender, Age, BMI, and % Body Fat



Gender	Woman	Woman
Age	39y	39y
BMI	31	30
% Body Fat	42%	41%



Healthier at a Higher % Body Fat

Gender	Man	Man
Age	48y	25y
BMI	30	34
% Body Fat	25%	34%
LDL-C	88	114
HDL-C	27	44
Triglycerides	429	101
Glucose	103	103
INS-AUC	224	119
SBP	125	118
DBP	82	78

Outline

- *My research & lessons learned*
- *Evidence for Obesity links to Morbidity/Mortality*
- *Health at Every Weight*
- **Take Home / Actionable Conclusions**

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Take Home Point: #1

Reframe the Question

What is the "best diet"?

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Take Home Point: #1

Reframe the Question

~~What is the "best diet"?~~

Which diet is best for whom?

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Take Home Point: #2

Stop using the term "diet"

For many people a "diet" is something you go on and off.

Which meal plan(?)

is best

for whom?

Take Home Point: #3

Evidence for long-term weight loss maintenance?

INADEQUATE / LACKING

Take Home Point: #4

Individually

Embrace the Variabiilty

Societally

Food System

Food Environment

Social Justice


thank
you