

HEALTHCARE SAVINGS ASSOCIATED WITH DIETS ADEQUATE IN ESSENTIAL NUTRIENTS

DATA vs. OPINION BASED POLICY

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Estimated Healthcare Savings Associated With Adequate Dairy Food Intake

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Medical literature that has coalesced during the past two to three decades has identified adequate intake of nutrients from dairy foods as a common factor in the reduction of the disease burden of several common medical conditions. These include obesity, hypertension, type 2 diabetes, osteoporosis, kidney stones, certain outcomes of pregnancy, and some cancers. Treatment of these disorders, particularly cardiovascular, consumes a significant portion of the United States' healthcare budget. Drawing on accumulated data from prospective longitudinal studies and randomized controlled trials, this article summarizes the evidence of the net benefits of increased dairy food intake on these conditions, their outcomes, and their costs. Estimated im-

provements in outcomes were combined with available data on annual costs of the respective disorders. From the calculated annual impact, we generated first-year and fifth-year healthcare cost savings that would accrue if adult Americans simply increased their intake of dairy foods to the currently recommended 3 to 4 servings/d. Using conservative estimates of potential benefit, we project first-year savings of approximately \$26 billion and 5-year cumulative savings in excess of \$200 billion. Am J Hypertens 2004;17:88-97 © 2004 American Journal of Hypertension, Ltd.

Key Words: Healthcare costs, cost savings, economics, dairy foods, dietary calcium.

PRESENTATION OBJECTIVES

- PROVIDE EVIDENCE THAT DIET QUALITY PREDICTS HEALTH
- OUTLINE WHAT DISTINGUISHES A QUALITY DIET
- ASSESS RANDOMIZED CONTROL TRIAL EVIDENCE
- REVIEW DATA THAT DAIRY INTAKE PREDICTS DIET QUALITY
- ESTIMATE HEALTHCARE SAVINGS
- CONSIDER THE OPPORTUNITY AND THE CHALLENGE

NHANES I

Food Groups and Blood Pressure and Weight Reduction

DESCRIPTION OF THE DASH DIET

Food Group	Order of variable entry	Standardized canonical discriminant function coefficient
Dairy products	1	-0.1344
Fruit and vegetable juices	2	-0.1017
Non-sugar beverages	3	-0.0738
Fats and oils	4	-0.0644
Organ meats	5	-0.0660
Mixed protein dishes	6	-0.0564
Shellfish	7	-0.0555
Desserts	8	-0.0549

McCarron et al., *Science*, 1984

RISK REDUCTION ASSOCIATED WITH HEALTHY DIET – NHANES I

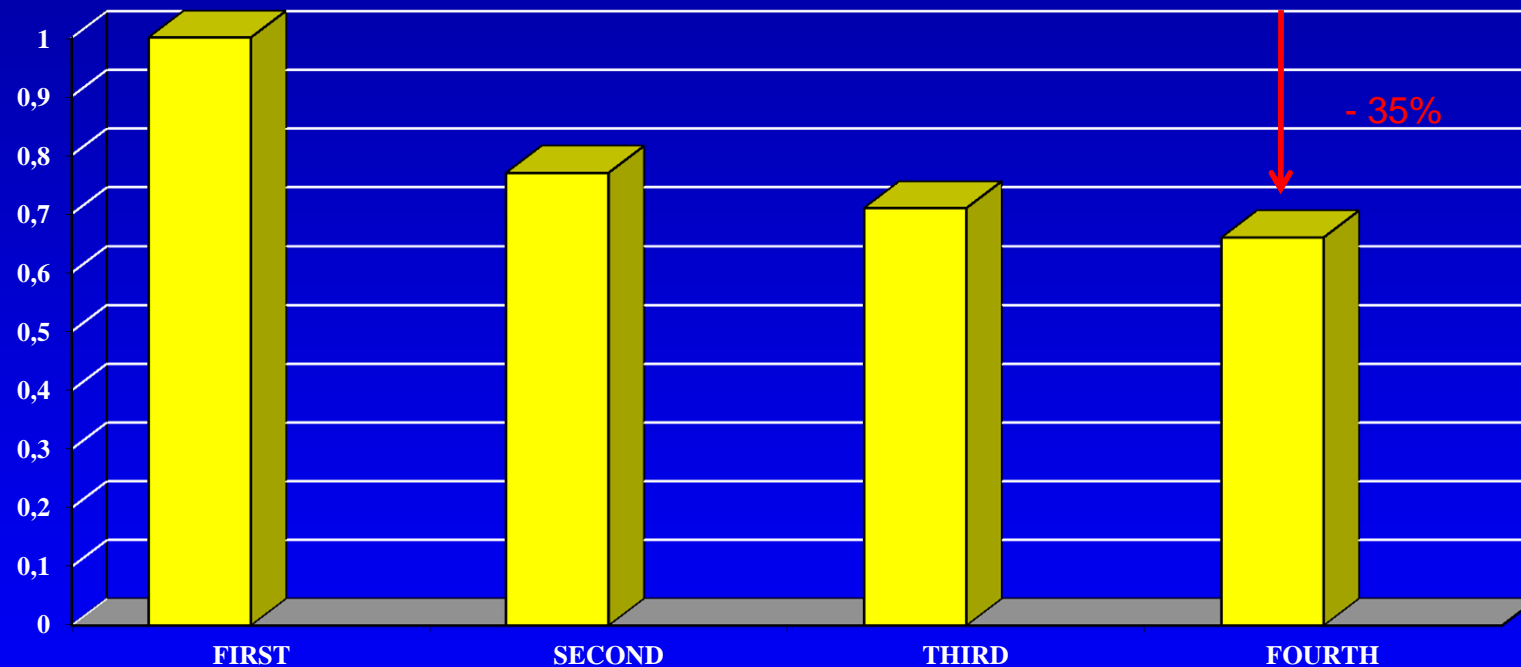
HYPERTENSION 60%
EXCESS WEIGHT 60%

Mc Carron et al, *Science*; 1984

1984 Science Paper CONCLUSION

lar disease in adult Americans. If validated, our observations do not indicate that it is routinely necessary to ingest any nutrient, including calcium or potassium, above the current recommended levels. Rather, they suggest the consumption of a diet balanced in all the essential nutrients and appropriate for the individual's level of physical activity.

DIET QUALITY and 35 % REDUCED RELATIVE RISK ALL CAUSE MORTALITY



QUARTILE OF RECOMMENDED FOOD SCORE

P<.001 for Trend

Kant, et. al., *JAMA*, 2000

DIET QUALITY AND MORTALITY

The results from this large cohort of women with prospective follow-up suggest that dietary *patterns* characterized by consumption of **fruits, vegetables, whole grains, low-fat dairy,** and **lean meats** are associated with lower risk of mortality. Given the simplicity of the diet quality score used in this study, increasing the intake of recommended **foods** – without undue emphasis on learning about hidden fat, total amount and type of fiber, or individual vitamins and minerals – **may represent a *practical recommendation*** for improving health.

Kant, et al, *JAMA*, 2000

ALL CAUSE MORTALITY REDUCED 25% WITH IMPROVED DIET QUALITY

NIH-AARP RETIRED PERSONS COHORT
N = 350,886 10.5 yrs Follow-up

TABLE 4 Age-adjusted and multivariate-adjusted risk of all-cause mortality by quintiles of DBS in men and women in the NIH-AARP Diet and Health Study cohort^{1,2}

	Men						Women					
	Q1	Q2	Q3	Q4	Q5	P-trend ³	Q1	Q2	Q3	Q4	Q5	P-trend ³
Range	0-18	18.25-22.75	23-26	26.25-29.0	29.25-36.0		0-18	18.25-22.75	23-26	26.25-29.0	29.25-36.0	
n	45,995	44,333	41,216	35,984	32,346		23,810	27,255	30,948	32,526	36,473	
Deaths, n	5884	4469	3778	2922	2382		2328	2101	2119	1924	1931	
Multivariate relative risk	1.0	0.90	0.88	0.83	0.79	<0.0001	1.0	0.90	0.87	0.80	0.75	<0.0001
95% CI		0.86-0.94	0.85-0.92	0.79-0.87	0.75-0.83			0.85-0.95	0.82-0.93	0.75-0.86	0.70-0.80	

NIH-AARP RETIRED PERSONS COHORT DEFINITION OF A HEALTHY DIET

- Fruits
- Vegetables
- Low fat dairy foods
- Whole grains
- Low fat meat and poultry

FAST FOOD CONSUMPTION PREDICTS DIET QUALITY AND DISEASE RISK - INSULIN RESISTANCE – 2 FOLD INCREASE

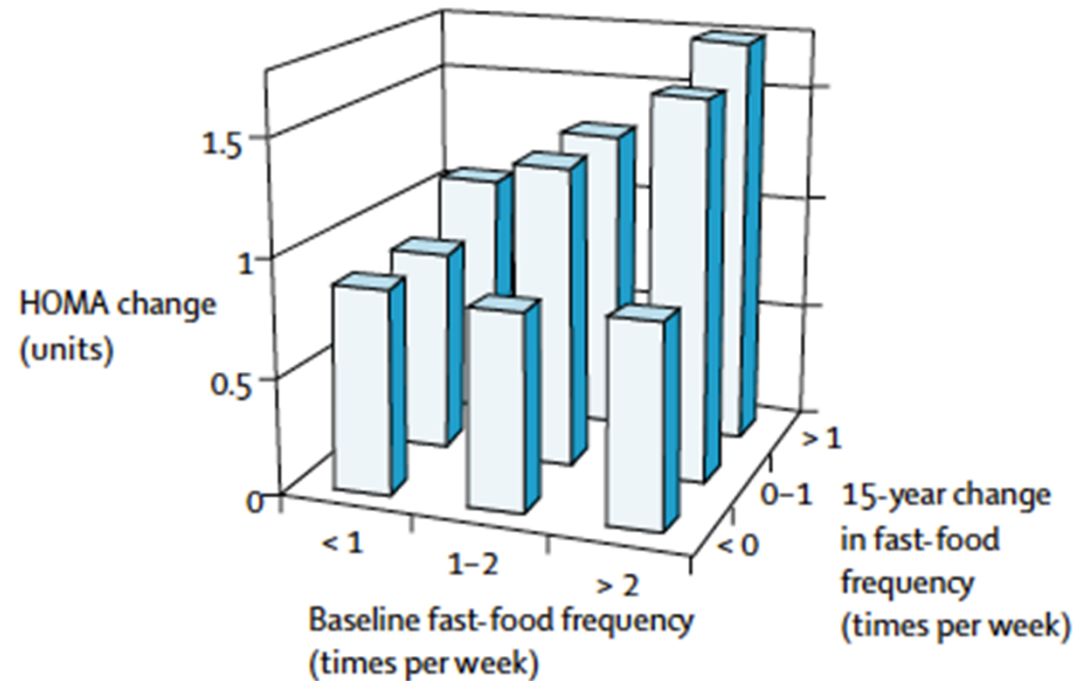


Figure 2: Joint association of year 0 fast-food frequency and 15-year changes in fast-food frequency with 15-year changes in HOMA insulin resistance
The model is adjusted for the same covariates as in model 2 of table 4, with ethnic origin as an additional covariate. Cell-specific sample sizes range from 79 (>2 times per week at baseline and >1 times per week change) to 672 (>2 times per week at baseline and <0 times per week change).

FAST FOOD CONSUMPTION PREDICTS DIET QUALITY AND DISEASE RISK - INCREASED WEIGHT (4.5 kg)

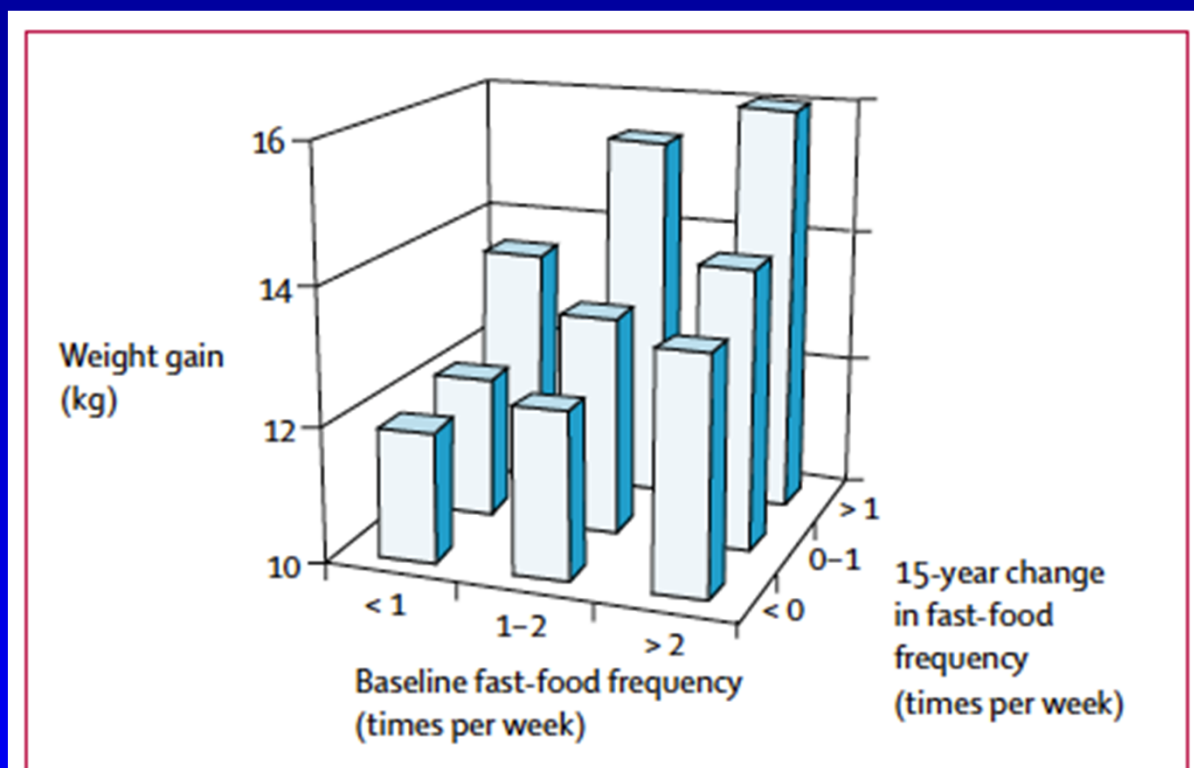


Figure 1: Joint association of year 0 fast-food frequency and 15-year changes in fast-food frequency with 15-year changes in bodyweight

The model is adjusted for the same covariates as in model 2 of table 3, with ethnic origin as an additional covariate. Cell-specific sample sizes range from 87 (>2 times per week at baseline and >1 times per week change) to 730 (>2 times per week at baseline and <0 times per week change).

FAST FOODS AND CHANGES IN DIET QUALITY

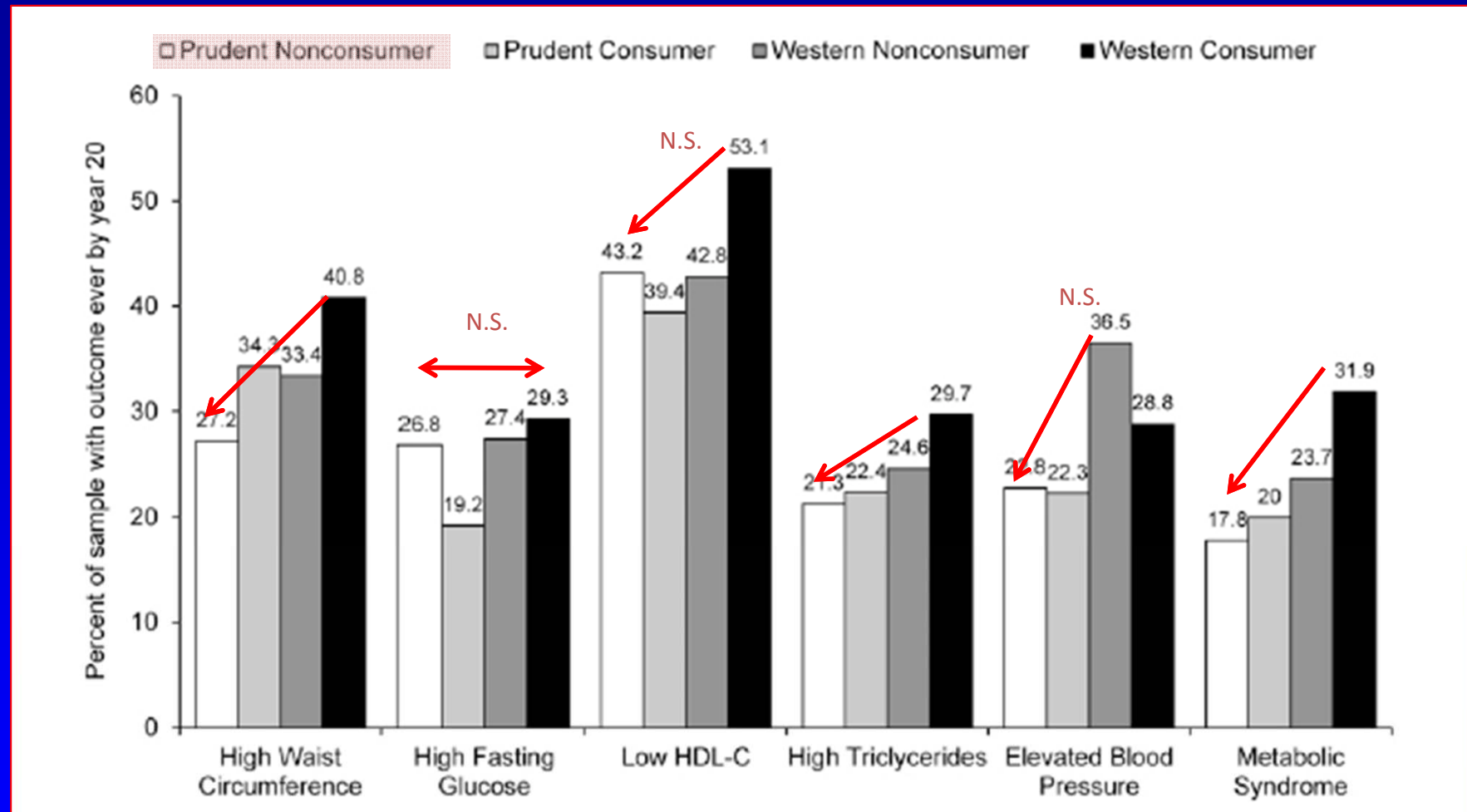
DECREASES

- Fruits and vegetables
- Whole grains
- Fiber
- Low fat dairy

INCREASES

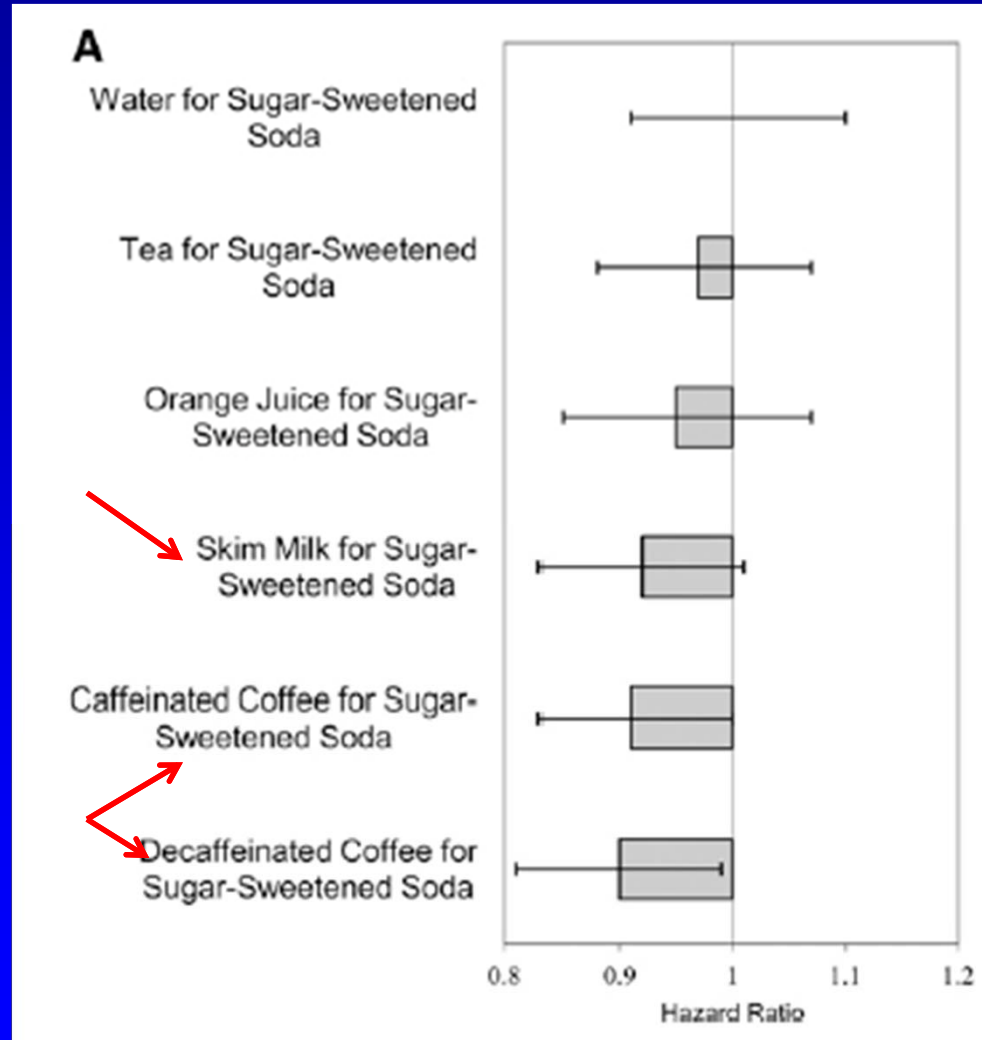
- Soda
- Alcohol
- Total fat
- Refined grain

DIETARY PATTERNS, DIET BEVERAGES METABOLIC RISKS

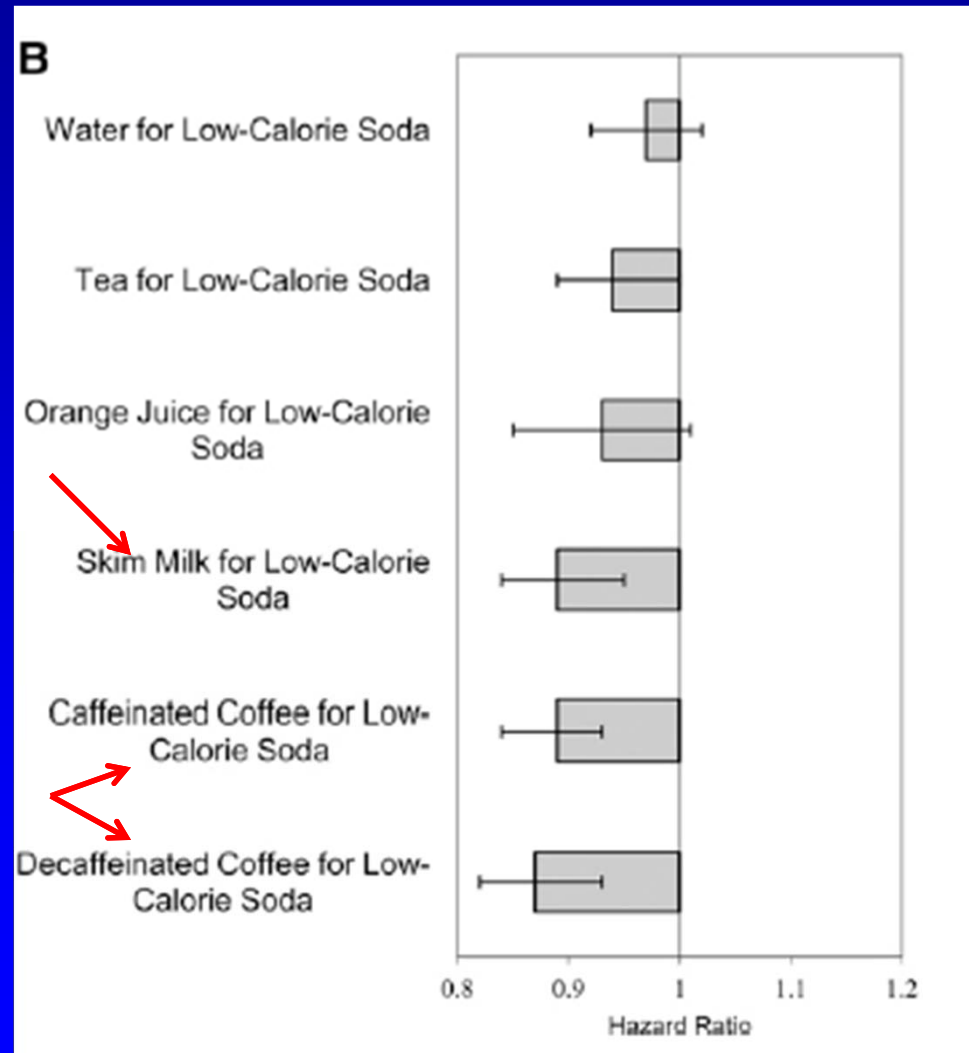


Consumption of a prudent diet and NO diet beverages
associated with 20-35% risk reduction

SUBSTITUTION OF 1 SERVING OF SUGAR-BASED SODA IMPACT ON STROKE RISK



SUBSTITUTION OF 1 SERVING OF LOW-CALORIE SODA IMPACT ON STROKE RISK



THE IQ INTERVENTION TRIALS

RANDOMIZED TRIAL EVIDENCE THAT DIET QUALITY MATTERS

- 3 RCT'S in 1200+ subjects with one or more metabolic disorders:
 - BP, lipid and diabetic disorders
 - 2 RCT's of 10 wk intervention
 - 1 RCT of 48 weeks
- Intervention was fortified frozen entrees enriched to meet:
 - Complete nutritional profile reflected in DG, AHA, Cholesterol Education Program, etc
 - Provided 100-125% of all macro and micronutrients in 3 meal occasions each day
- Control with was demographically identical cohort randomized to:
 - Routine nutrition counseling with supportive educational materials
 - Maintenance of extensive food records of purchases and preparations
- Ten peer-reviewed publications, 30 scientific presentations
- Compared to control, intervention significantly reduced risk:
 - BP, Lipids, HbA1c, Weight, Diet quality, Quality of life, **Medication use**

IMPACT OF IMPROVED DIET QUALITY SYSTOLIC BLOOD PRESSURE

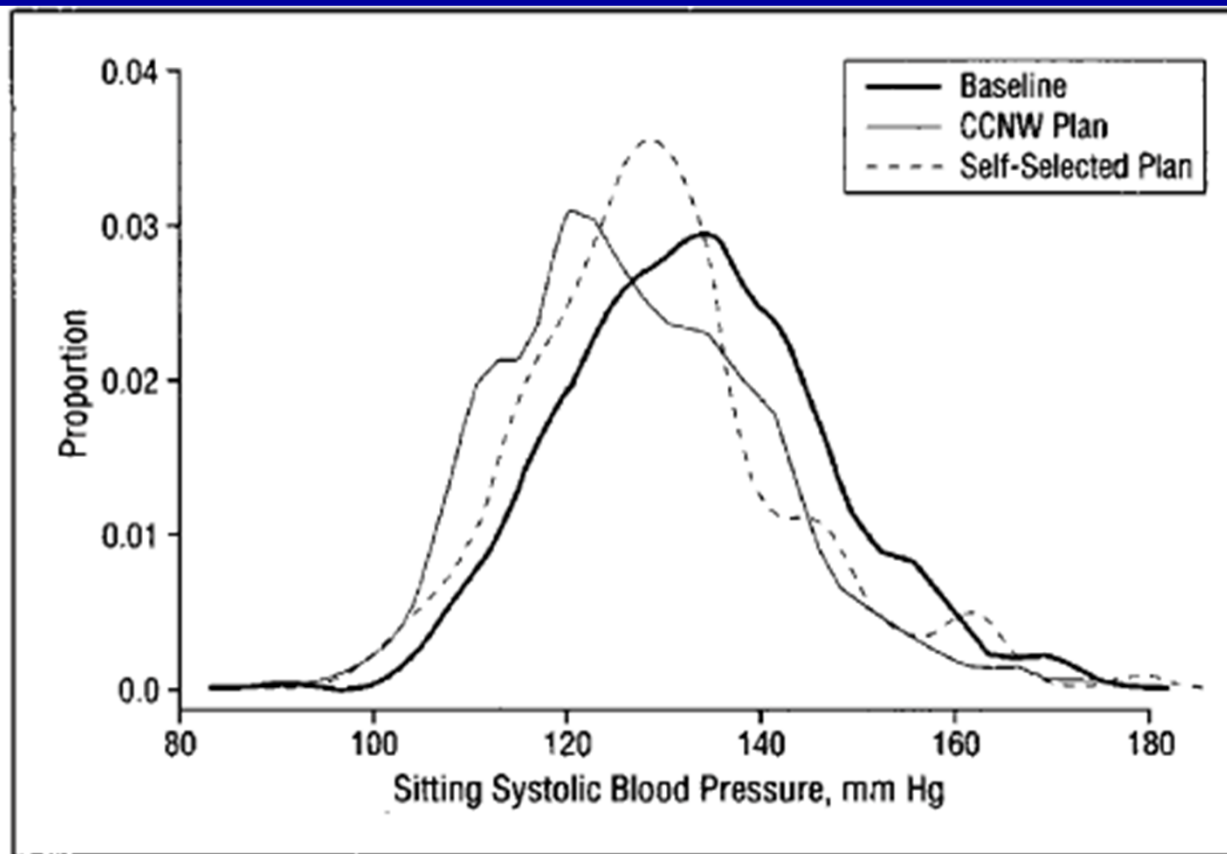


Figure 1. Distribution of blood pressure at baseline and with the Campbell's Center for Nutrition and Wellness (CCNW) and self-selected meal plans for all subjects. Proportion signifies the fraction of the cohort.

IMPACT OF IMPROVED DIET QUALITY

Hemoglobin A1c

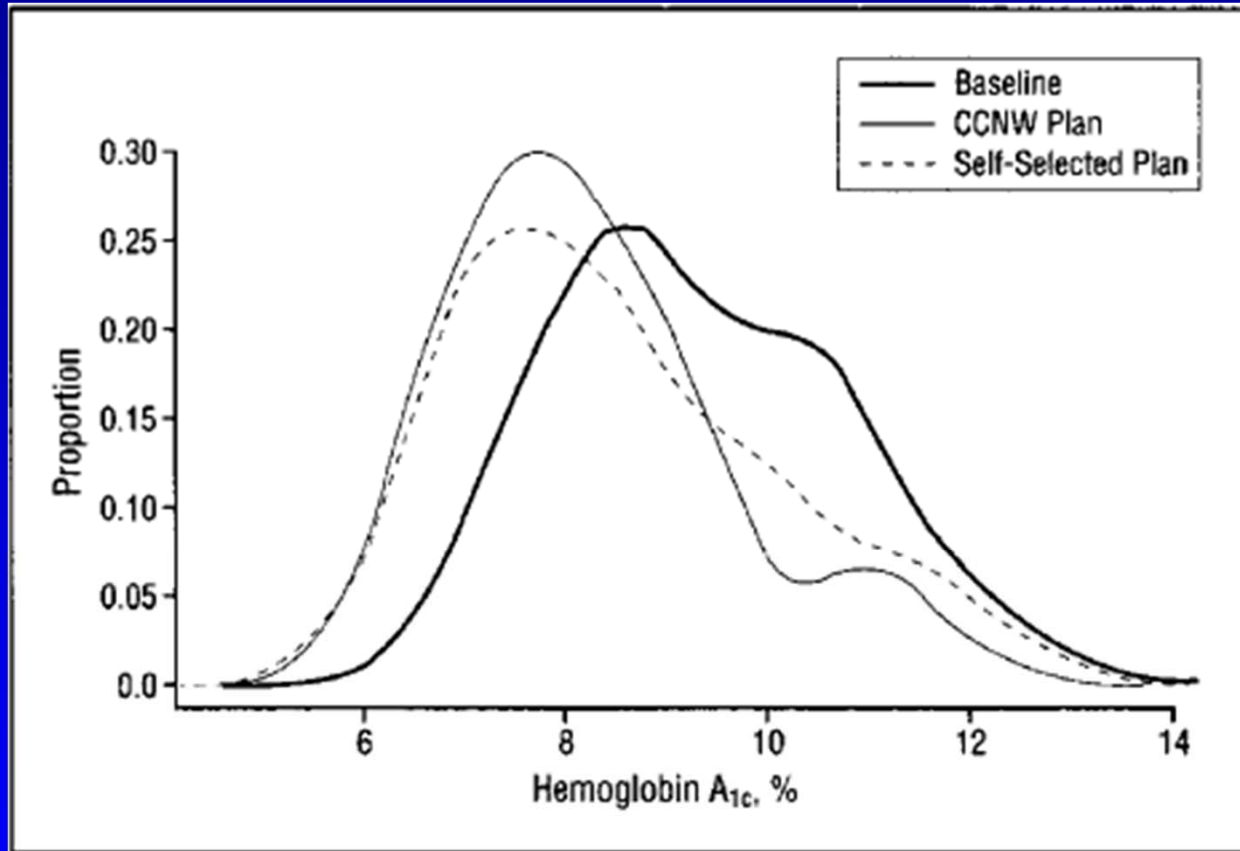


Figure 3. Distribution of hemoglobin A_{1c} in only the diabetic group at baseline and with the Campbell's Center for Nutrition and Wellness (CCNW) and self-selected meal plans. Proportion signifies the fraction of the cohort.

HEALTH CONDITIONS IMPACTED BY DIET QUALITY

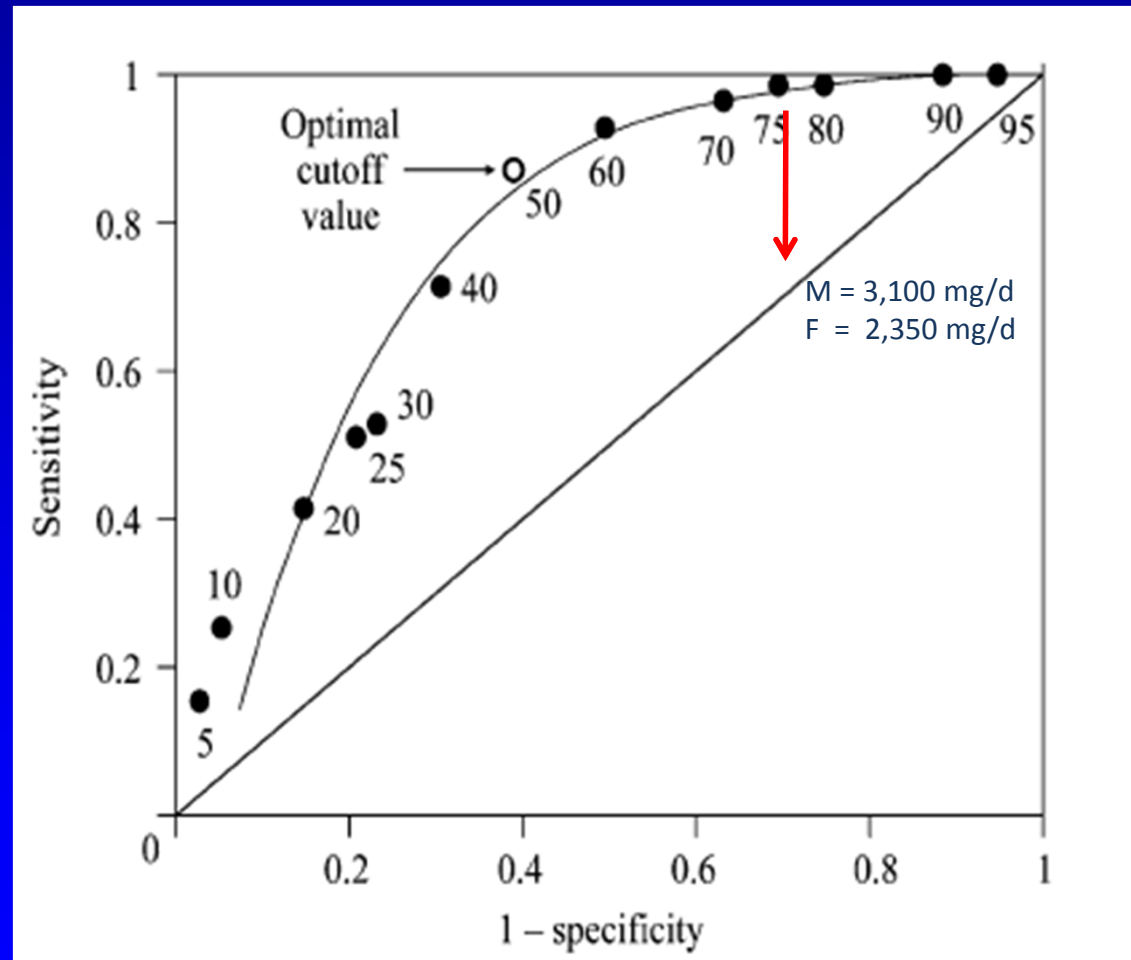
- **CARDIOVASCULAR DISEASES**
- **OBESITY**
- **DIABETES**
- **CANCER**
- **OSTEOPOROSIS**
- **RENAL FAILURE**
- **KIDNEY STONES**
- **MATERNAL AND INFANT HEALTH**

DAIRY FOODS AS SURROGATE FOR DIET QUALITY and HEALTH OUTCOMES

- Data identifies dairy with wide range of reduction of disease risk
- Significant impact on major contributors of disease burden
- Dense critical nutrient content - exceeds all other food groups
- Readily tracked marker of consumption – urinary K+

URINARY K⁺ AS MARKER OF DIET QUALITY

“ROC” CURVE



Mente et al. *J. Nutr.* 2009

ASSOCIATED ANNUAL U.S. HEALTHCARE COSTS IN \$ BILLIONS - 2010

- **CARDIOVASCULAR DISEASES**
 - HIGH BLOOD PRESSURE**\$ 55**
 - ISCHEMIC HEART DISEASE - INFARCTS – FAILURE **96**
 - STROKE..... **48**
- **OBESITY.....165**
- **DIABETES.....122**
- **COMPLICATIONS OF PREGNANCY**
 - LOW BIRTH WEIGHT – PREMATUREITY.....**24**
 - PRE-ECLAMPSIA.....**5**
 - POST-PARTUM DEPRESSION.....**35**
 - MATERNAL AND INFANT DEATH.....**??**

ASSOCIATED ANNUAL U.S. HEALTHCARE COSTS IN \$ BILLIONS

- **CANCER**
 - ALL CANCERS.....**\$ 124**
 - COLON.....**14**
- **OSTEOPOROSIS.....24**
- **RENAL INSUFFICIENCY / FAILURE.....54**
- **KIDNEY STONES.....4**

TOTAL COSTS...\$ 775**

***** 2010 TOTAL U.S HEALTHCARE COSTS.. \$ 2.5 TRILLION***

ESTIMATED BENEFIT OF DAIRY FOODS

% IMPROVEMENT IN CONDITION

- **CARDIOVASCULAR DISEASES**
 - HIGH BLOOD PRESSURE**70%**
 - ISCHEMIC HEART DISEASE - INFARCTS – FAILURE**20%**
 - STROKE.....**50%**
- **OBESITY.....30%**
- **DIABETES.....30%**
- **COMPLICATIONS OF PREGNANCY**
 - LOW BIRTH WEIGHT – PREMATUREITY.....**50%**
 - PRE-ECLAMPSIA.....**50%**
 - POST-PARTUM DEPRESSION.....**50%**
 - MATERNAL AND INFANT DEATH.....**20%**

ESTIMATED BENEFIT OF DAIRY FOODS

% IMPROVEMENT IN CONDITION

- **CANCER**
 - ALL CANCERS.....**10%**
 - COLON.....**45%**
- **OSTEOPOROSIS.....50%**
- **RENAL INSUFFICIENCY / FAILURE.....20%**
- **KIDNEY STONES.....20%**

ESTIMATED U.S. HEALTHCARE SAVINGS (\$B) WITH ADEQUATE DAIRY FOOD INTAKE

- **CARDIOVASCULAR DISEASES**
 - HIGH BLOOD PRESSURE **\$ 22.0**
 - ISCHEMIC HEART DISEASE - INFARCTS – FAILURE**19.0**
 - STROKE..... **24.0**
- **OBESITY.....49.5**
- **DIABETES.....36.6**
- **COMPLICATIONS OF PREGNANCY**
 - LOW BIRTH WEIGHT – PREMATUREITY.....**12.0**
 - PRE-ECLAMPSIA.....**2.5**
 - POST-PARTUM DEPRESSION.....**17.5**
 - MATERNAL AND INFANT DEATH.....Priceless

ESTIMATED U.S. HEALTHCARE SAVINGS (\$B) WITH ADEQUATE DAIRY FOOD INTAKE

- **CANCER**
 - ALL CANCERS.....**\$ 12.4**
 - COLON.....**6.3**
- **OSTEOPOROSIS.....12.0**
- **RENAL INSUFFICIENCY / FAILURE.....10.8**
- **KIDNEY STONES.....2.0**

TOTAL SAVINGS... \$ 226.6 B

+ 700 MOTHERS AND 890 INFANTS / YEAR

EXPANDED INTERNATIONAL HEALTHCARE SAVINGS WITH ADEQUATE DAIRY INTAKE

- BASED ON N./S.AMERICA, EUROPE AND ASIA / PACIFIC
 - 4 X'S THE NUMBER OF SUBJECTS IN THESE REGIONS
- NON-U.S. COUNTRIES' SAVINGS DISCOUNTED 30%
 - ASSUMED LOWER ABSOLUTE HEALTHCARE COSTS
- EXCLUSION OF OTHER REGIONS BASED ON LIMITED:
 - HEALTHCARE COST DATA
 - HEALTH CONDITION PREVALENCE DATA

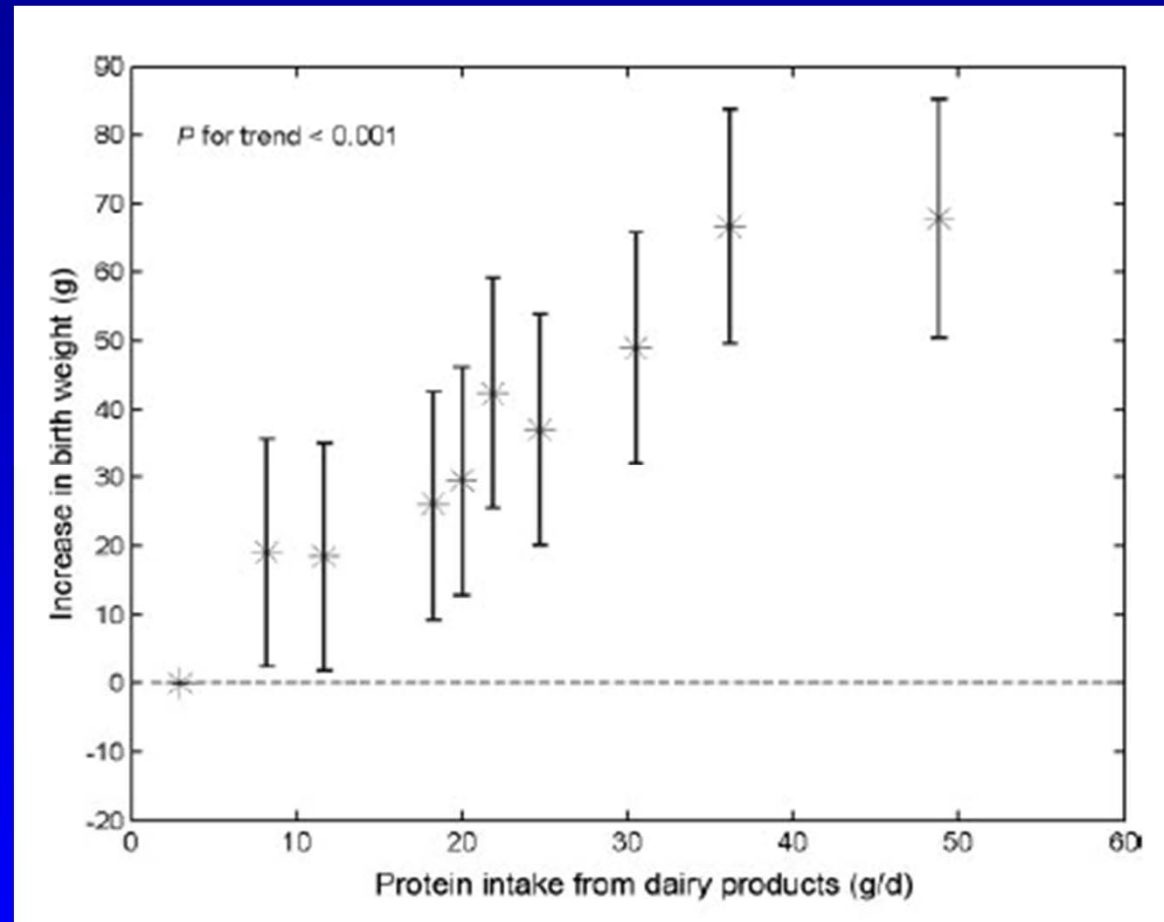
TOTAL SAVINGS \$ 861.1 BILLION

**PROJECTED "5 YEAR" HEALTHCARE SAVINGS
U.S./EXPANDED INTERNATIONAL WITH
ADEQUATE DAIRY INTAKE**

- **UNITED STATES.....\$ 1.5 TRILLION**
- **EXPANDED INTERNATIONAL...\$ 4.5-5 TRILLION****

**** MAJOR REGIONS EXCLUDED – TRUE WORLDWIDE
HEALTHCARE SAVINGS MUCH GREATER, BUT UNKNOWN!**

INCREASE IN BIRTH WEIGHT BASED ON DAIRY PROTEIN



HIGHER BIRTH WEIGHT ASSOCIATED WITH;

- INCREASED LIFE EXPECTANCY
- REDUCED HEART DISEASE AND CANCER RISK
- ENHANCED INTELLECTUAL ATTAINMENT

DECLINING DIET QUALITY – DASH 1988-94 vs 1999-2004

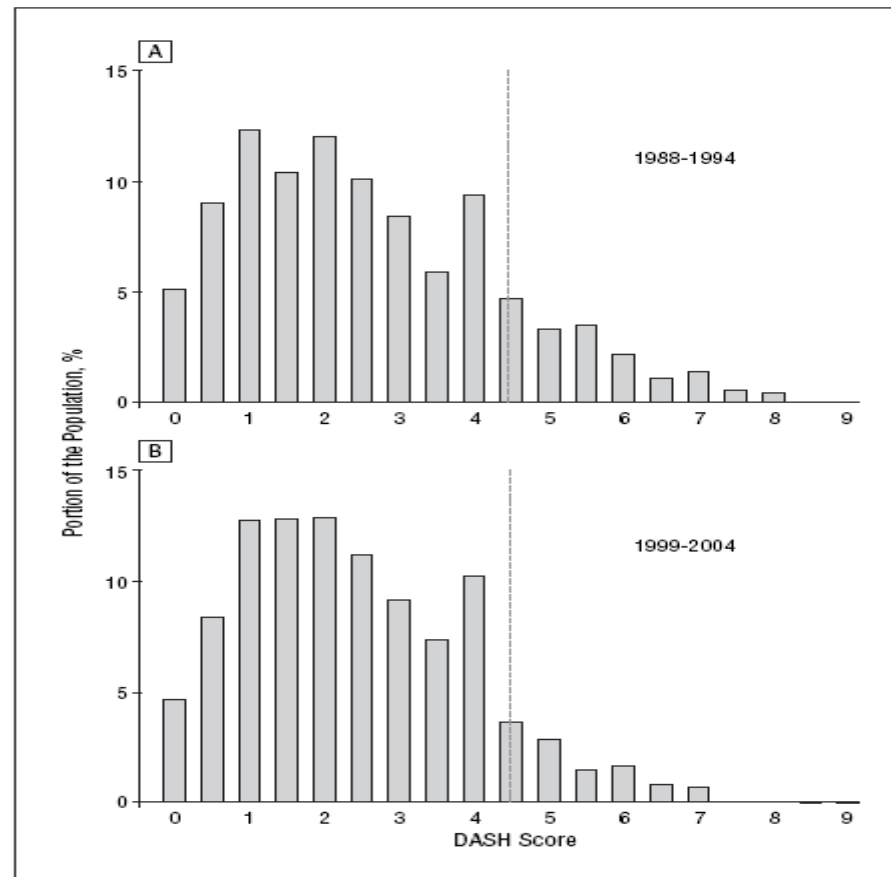


Figure 2. Distribution of DASH scores among adults with known hypertension from 2 distinct periods of the National Health and Nutrition Examination Survey,¹⁵ 1988-1994 (A) and 1999-2004 (B). DASH indicates the Dietary Approaches to Stop Hypertension trial.⁷

LIMITATIONS OF THE ANALYSIS

- IMPRECISION OF DISEASE RELATED HEALTHCARE COSTS
- ACCURACY OF THE PUBLISHED INTERVENTION EFFECT
- TIMELINE FOR EFFECT TO EMERGE VARIES
- DEFINITION OF ADEQUATE DAIRY INTAKE
 - 3-4 vs 4-5 SERVINGS/day
 - MAXIMUM BENEFITS OCCUR AT APPROXIMATELY 1500 mg/d

LIMITATIONS OF THE ANALYSIS

- **DOES NOT INCLUDE “REAL” VALUE OF :**
 - LIVES SAVED
 - IMPROVED QUALITY OF LIFE
 - GREATER PRODUCTIVITY
- **OVERLAP OF RESPONSE IN DISEASE CONDITIONS**
 - EXAMPLE: IMPROVEMENT IN WEIGHT, IMPROVES DIABETES
- **VARIATIONS IN EACH COUNTRIES’**
 - CURRENT PER CAPITA DAIRY INTAKE
 - PREVALENCE OF THE DEFINED CONDITIONS
 - ACTUAL HEALTHCARE COSTS FOR EACH CONDITION

THE CHALLENGE

- POPULAR NUTRITION ***MYTHS***:
 - DAIRY EQUALS FAT
 - LACTOSE INTOLERANCE PREVALENCE
 - FOOD ALLERGIES HYPE
 - SUPPLEMENTS SAME AS FOOD
 - ANTIBIOTICS AND HORMONES
- CONSUMER SKEPTICISM WITH NUTRITION CLAIMS
- FEDERAL MESSAGING ON: FAT, SUGAR, SALT, etc
 - HARDLINE POSITION OF ADVOCACY ORGANIZATIONS
- COMPETITION:
 - GLOBAL PHARMACEUTICALS
 - OTHER SECTORS OF FOOD AND BEVERAGE INDUSTRY

THE OPPORTUNITY

- RESPONSIBLE MARKET EXPANSION – EVERYONE ***WINS***
 - INDIVIDUAL – SOCIETY – BUSINESS
- STRONG, DEFENSIBLE MARKETING STATEMENTS
- CREDIBLE PARTNERS
 - HEALTH PROFESSIONALS AND ORGANIZATIONS
 - MAJOR CORPORATIONS – EMPLOYEE WELLNESS
 - FEDERAL AND INTERNATIONAL AGENCIES – WE CAN HOPE!
- VIRTUALLY ***NO RISK!***

THE BOTTOM LINE!

- REMARKABLE BUSINESS OPPORTUNITY
- THE PATENT ***NEVER*** EXPIRES
- IF ESTIMATES OF HEALTHCARE SAVINGS ARE OVERSTATED
 - EVEN A 50% ERROR, STILL MAKES THE BENEFIT MASSIVE
- NOT INCLUDED ARE THE UNKNOWN, BUT REAL VALUE OF:
 - LIVES SAVED, IMPROVED QUALITY OF LIFE AND PRODUCTIVITY
- ECONOMIC IMPACT FAR EXCEEDS HEALTHCARE SAVINGS

Ettie Mae Greene

Seamstress, 114

LINDSIDE, W. Va., Feb. 28 (AP) — Ettie Mae Greene, a retired seamstress and farmer, died on Wednesday at the Springfield Comprehensive Care Center here. She was 114 years old.

Her granddaughter, Rita Dillon Barker, said Mrs. Greene died after catching a cold on Monday.

Mrs. Greene was born in Wayside, W. Va., on Sept. 8, 1877. In an interview last year, she attributed her longevity to "good, clean living" and a daily milkshake.

A widow for 72 years, she outlived five of her nine children. She is survived by 4 children, 21 grandchildren, 47 great-grandchildren and 37 great-great-grandchildren.

Gertrude Baines, 115, Oldest in World

LOS ANGELES (AP) — Gertrude Baines, who lived to be the world's oldest known living person on a steady diet of crispy bacon, fried chicken and ice cream, died here Friday. She was 115.

She died in her sleep, said Emma Camanag, the administrator at Western Convalescent Hospital. Ms. Baines's longtime physician, Dr. Charles Witt, said she had probably suffered a heart attack. An autopsy is scheduled.

Born in 1894 in Shellman, Ga., Ms. Baines took over the title of the world's oldest living person when a 115-year-old woman, Maria de Jesus, died in Portugal in January.

Ms. Baines, after casting her vote for Barack Obama in the presidential election in November, said: "I'm glad I'm here. I

don't care if I live a hundred more. I enjoy nothing but eating and sleeping."

She celebrated her birthday at the nursing home April 6 with music, two cakes and a letter from President Obama.

"She told me that she owes her longevity to the Lord, that she never did drink, she never did smoke and she never did fool around," Dr. Witt said at the party.

The oldest person in the world is now Kama Chinen, 114, who lives in Japan, said Dr. L. Stephen Coles of the Gerontology Research Group, which tracks claims of extreme old age.

Ms. Baines outlived her entire family, including her only daughter, who died of typhoid. She worked as a maid in Ohio State



DAMIAN DOVARGANES/ASSOCIATED PRESS

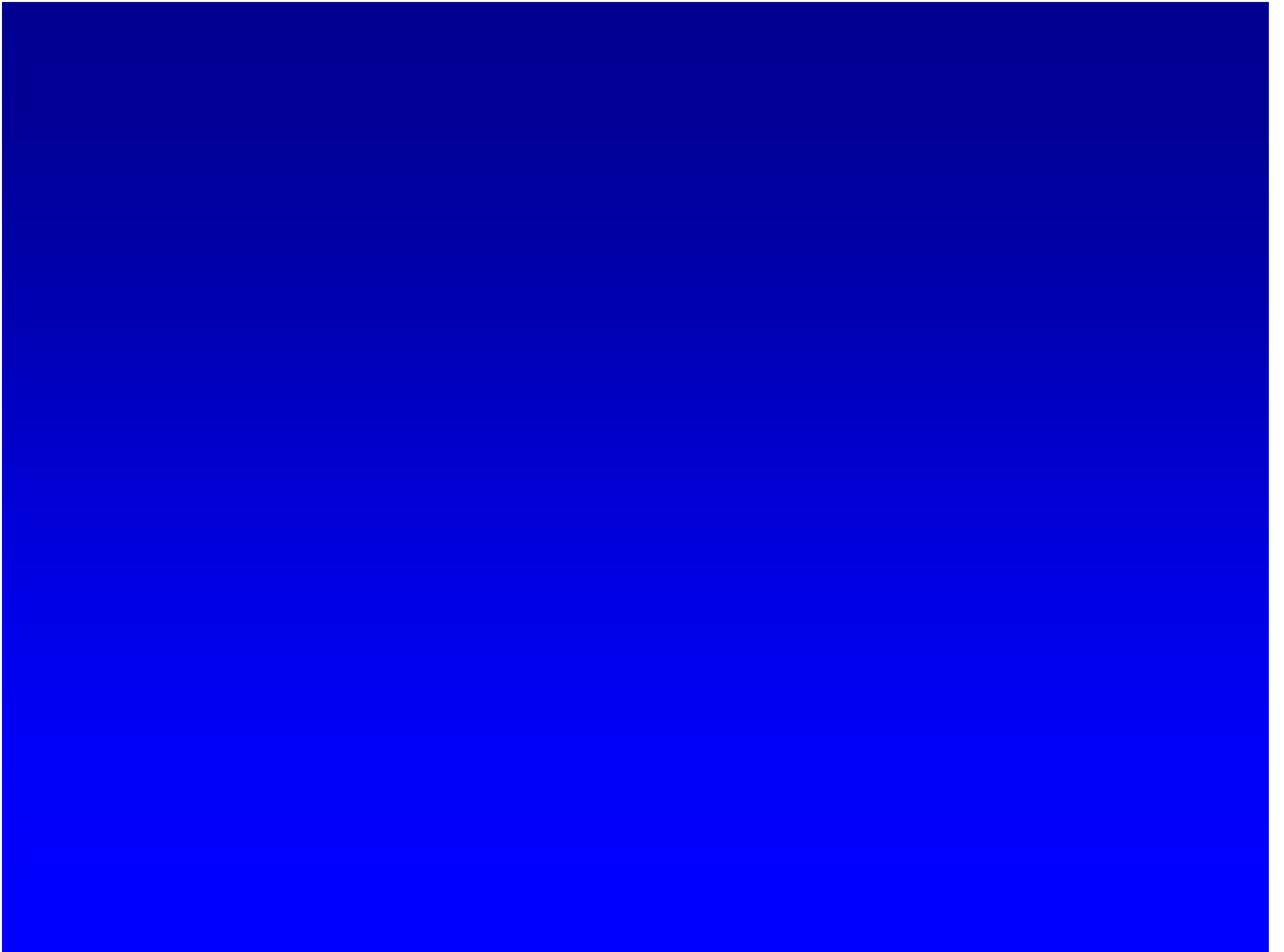
Gertrude Baines on April 6.

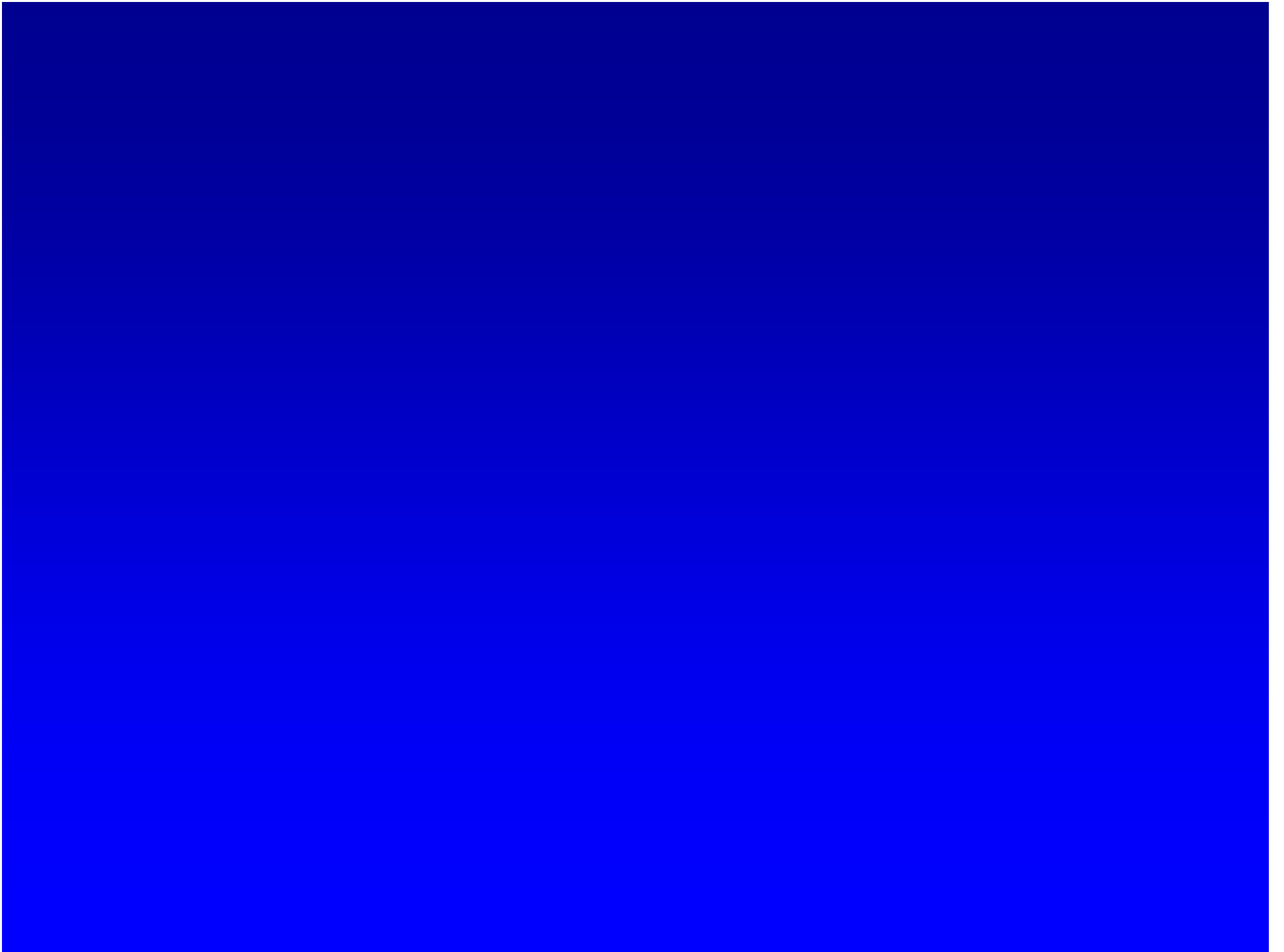
University dormitories until her retirement, and lived at the Western Convalescent Hospital after breaking a hip at 107.

I Can't Tell From the Label If the FDA Reduced the Salt Enough ????



Photo courtesy of Rahee Nerurkar of The Catlin Gabel School; Nepal 2010

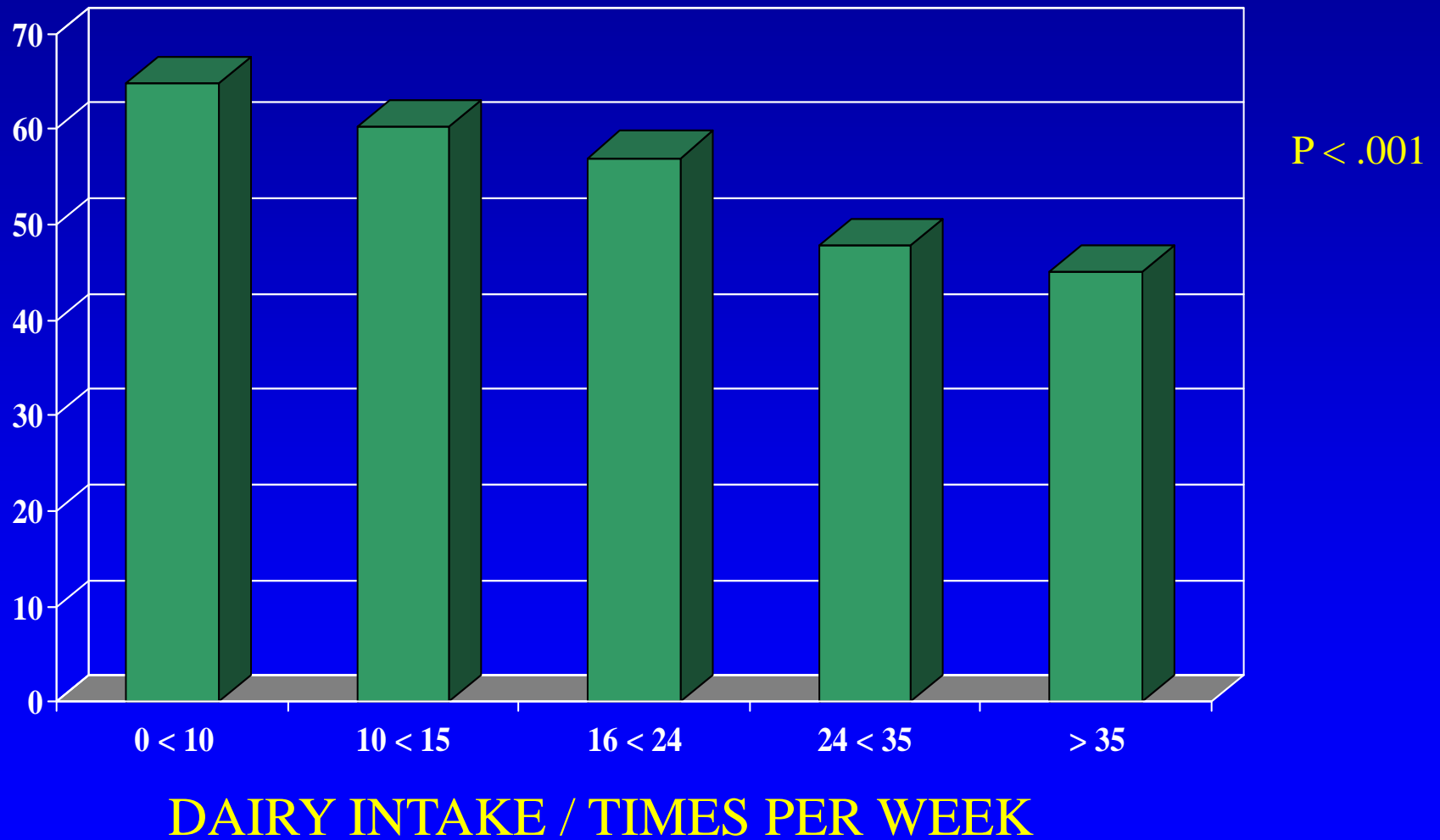




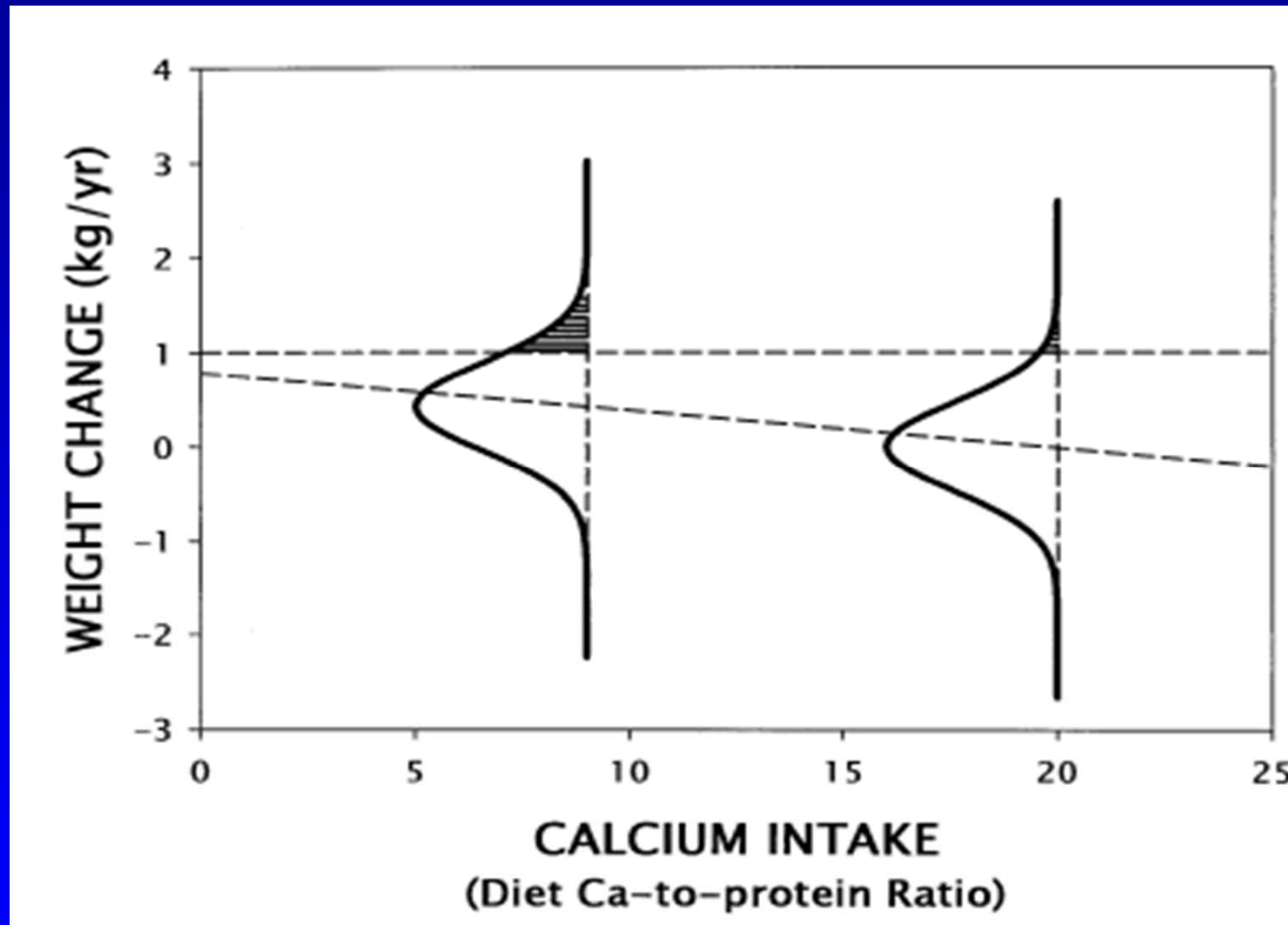




10 YEAR CUMULATIVE INCIDENCE OF OBESITY BASED ON DAIRY INTAKE IN OVERWEIGHT ADULTS

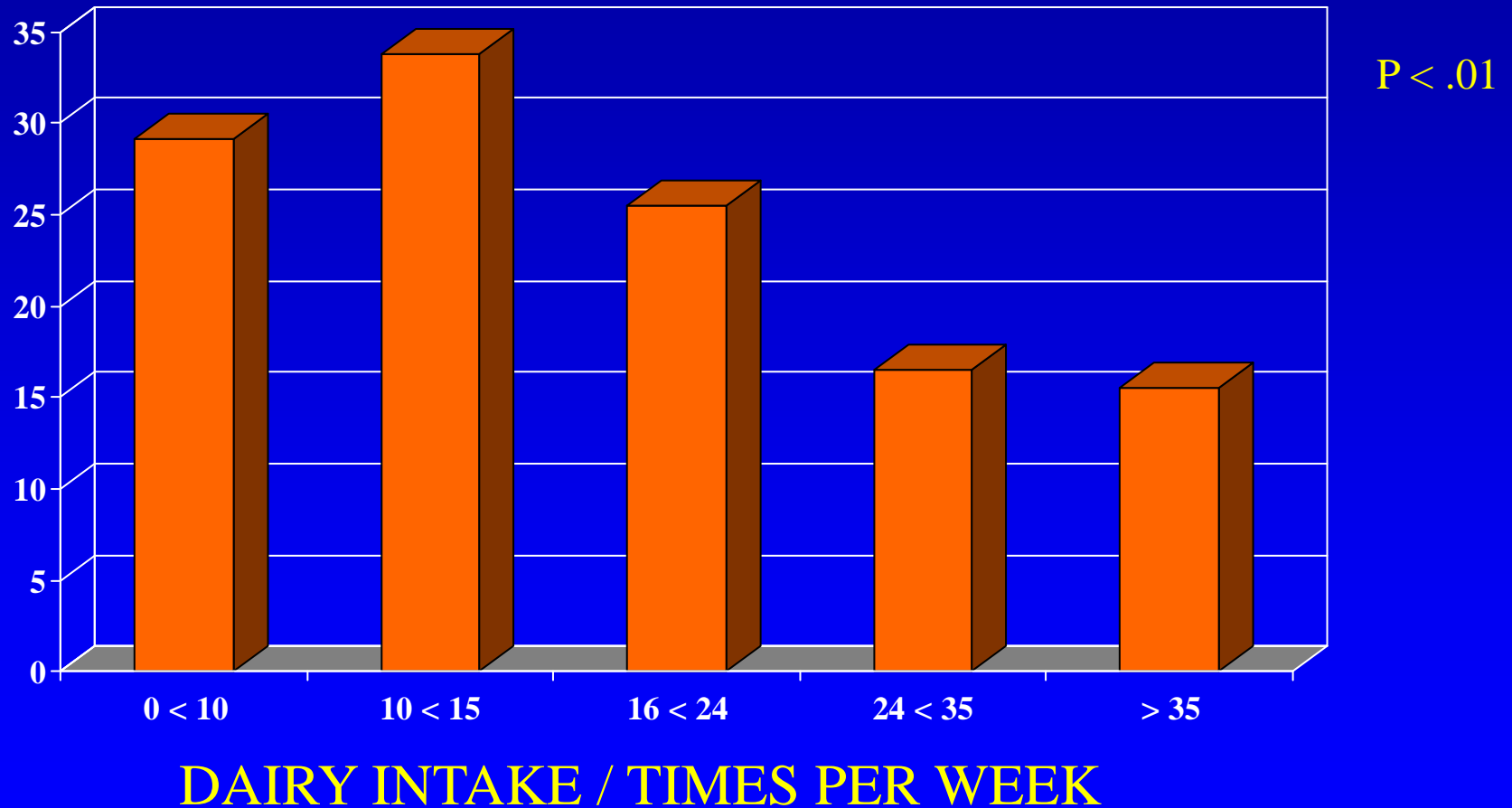


REDUCED MID-LIFE WEIGHT GAIN WITH INCREASING Ca-to-Protein Ratio



Excessive mid-life female weight gain reduced by >70%

10 YEAR CUMULATIVE INCIDENCE OF *ABNORMAL GLUCOSE TOLERANCE* BASED ON DAIRY INTAKE IN OVERWEIGHT ADULTS



RISK OF HYPERTENSION AND DIABETES PERCIEVED LACTOSE INTOLERANCE

TABLE 6

Summary of logistic regression analyses predicting diabetes and hypertension diagnoses ($n = 3436$)[†]

Variable ²	Diabetes				Hypertension			
	B	SE	Wald statistic	Odds ratio	B	SE	Wald statistic	Odds ratio
Daily calcium intake from dairy foods	-0.36	0.17	-2.06*	0.70	-0.51	0.12	-4.20**	0.60
Daily calcium intake from nondairy foods	-0.11	0.13	-0.89	0.89	-0.14	0.09	-1.50	0.87
Sex	-0.09	0.12	-0.76	0.92	-0.01	0.08	-0.10	0.99
Non-Hispanic blacks	0.79	0.12	6.45**	2.21	0.58	0.09	6.60**	1.79
Hispanics	0.32	0.14	2.32*	1.14	-0.35	0.10	-3.54**	0.70

Calcium from dairy foods decreased risk of:

- Hypertension.....40%
- Diabetes..... 30%

RISK REDUCTION IN STROKES INCREASING DAIRY FROM DASH DIET

	Tertiles of intake			<i>P</i> -trend ³
	1	2	3	
DASH				
Score (range)	8–21	22–26	27–40	
Cases/person-years	50/107,681	30/116,455	20/96,345	
HR ¹	1	0.56 (0.35–0.89)	0.47 (0.27–0.81)	0.003
HR ²	1	0.60 (0.38–0.95)	0.53 (0.30–0.91)	0.012

RISK OF ISCHEMIC STROKE REDUCED 50%

10% REDUCTION IN ALL CANCERS BASED UPON CALCIUM INTAKE

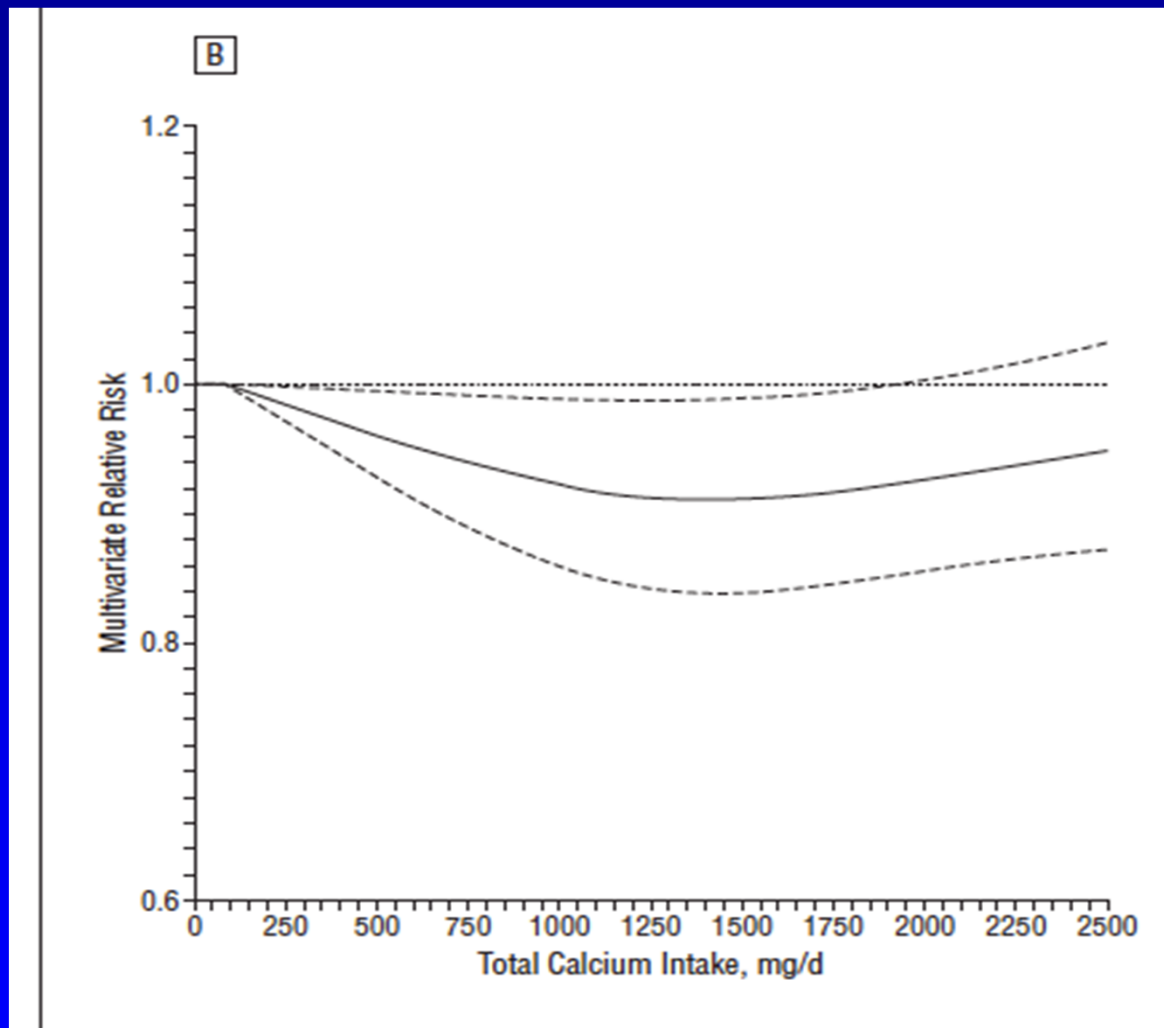


Figure 1. Nonparametric regression curve for the association between total calcium intake and risk of all cancers for men (A) and women (B). Both

10% REDUCTION IN ALL CANCERS BASED UPON CALCIUM INTAKE

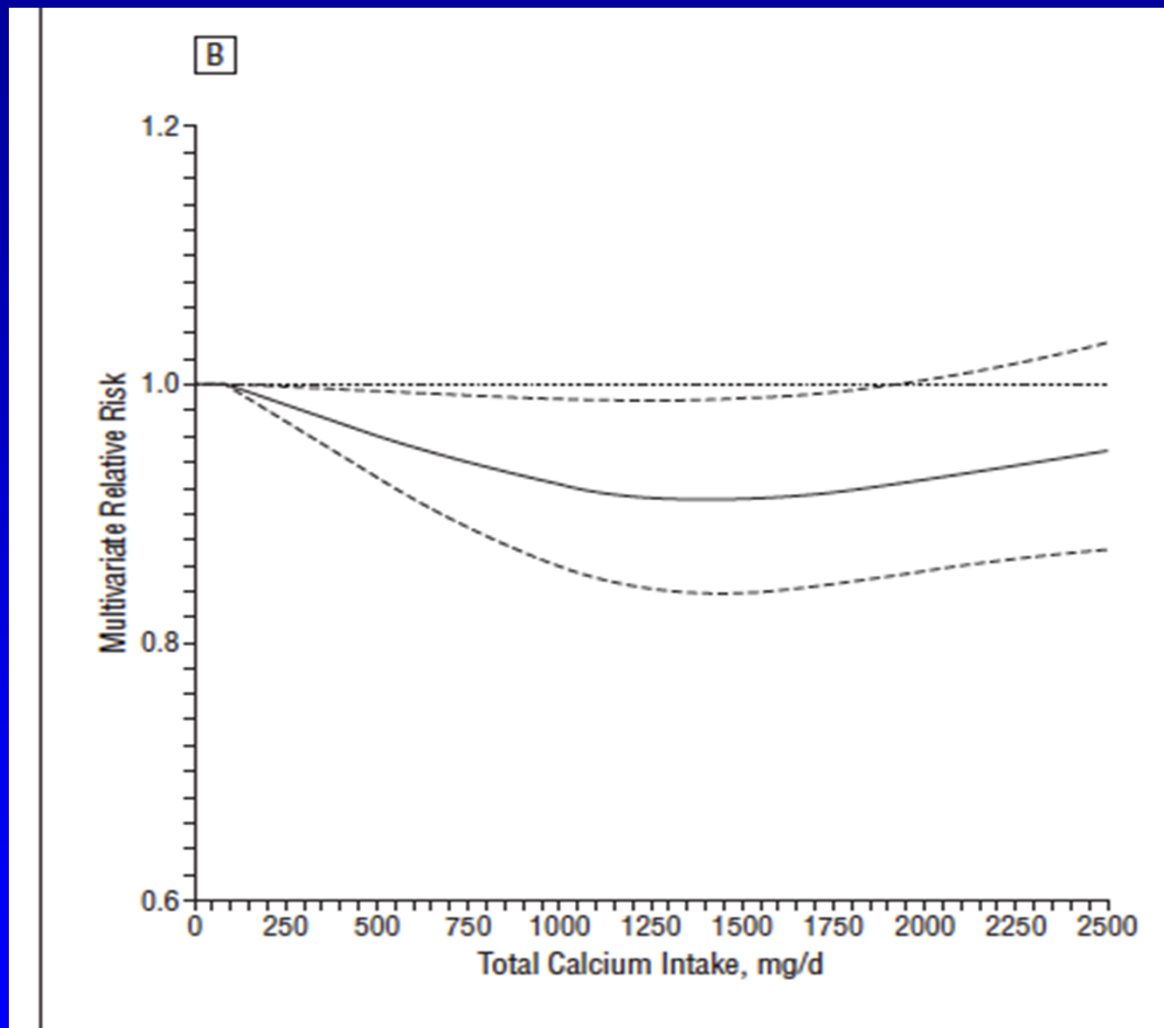
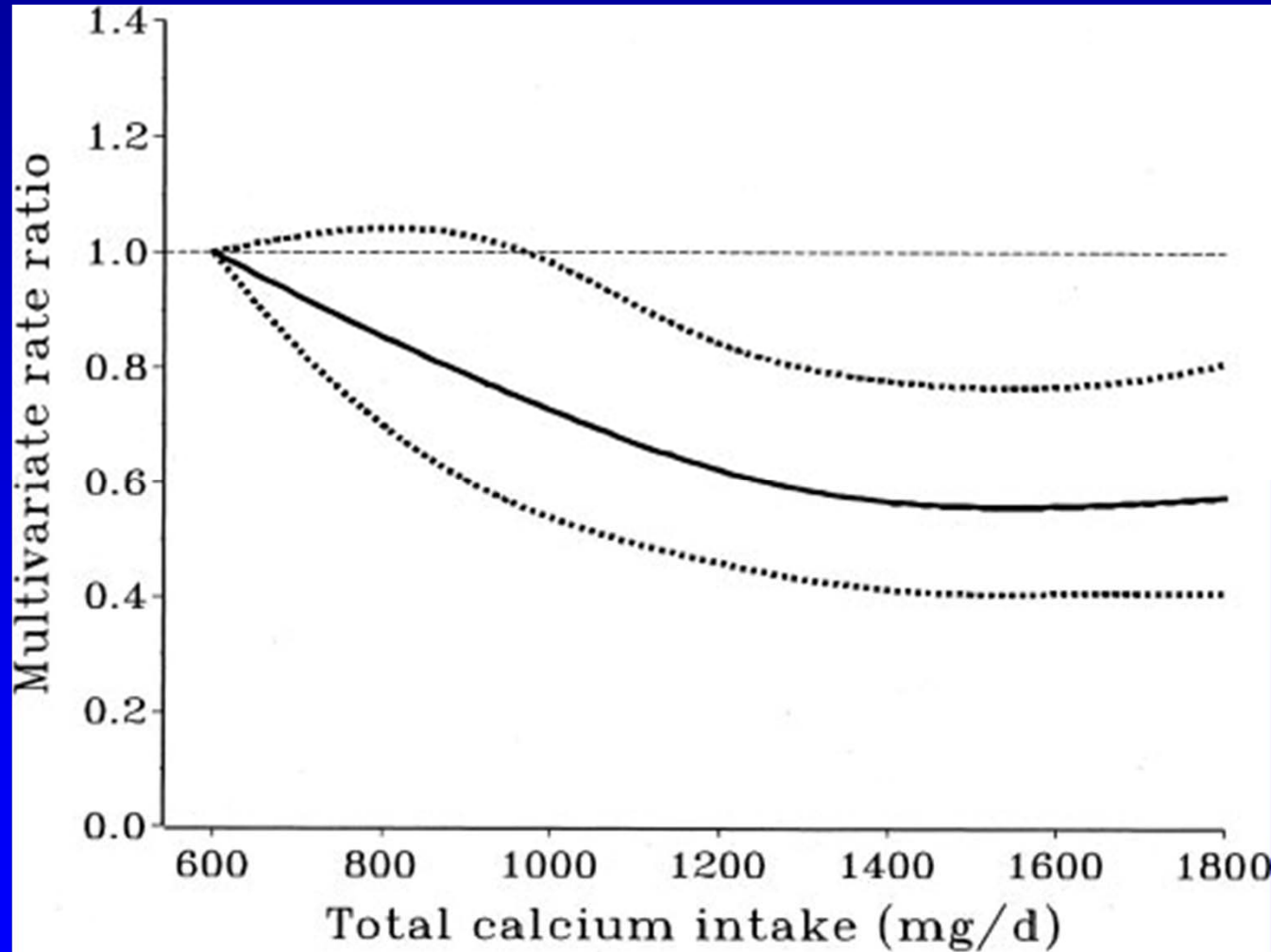


Figure 1. Nonparametric regression curve for the association between total calcium intake and risk of all cancers for men (A) and women (B). Both

42% REDUCTION IN COLON CANCER WITH DAIRY CALCIUM



Maximum benefit at 1500 mg/d – 4 servings

BIOLOGICAL BASIS OF DAIRY'S BROAD HEALTH IMPACT

- **FUNDAMENTAL ROLE OF CALCIUM IN CELL FUNCTION**
- **OVERLAP OF DISEASE STATES**
 - **OBESITY...DIABETES**
 - **HYPERTENSION...ISCHEMIC HEART DISEASE**
- **IMPACT ON CIRCULATING MEDIATORS:**
 - **ANTI-INFLAMATION**
 - **ANTI-ATHROGENESIS**
 - **ANTI-HYPERTENSIVE**

BIOLOGICAL BASIS OF DAIRY'S BROAD HEALTH IMPACT

- DIVERSE COMPOSITION OF CRITICAL NUTRIENTS
 - PROTEIN – WHEY
 - MINERALS – Ca, K, Mg, Phos, etc
 - ESSENTIAL FATS
 - VITAMINS
- MULTIPLE FORMS OF THE DAIRY FOODS
- EASE OF INCORPORATION INTO DAILY FOOD HABITS

