Nutrition and Oral Health in Aging

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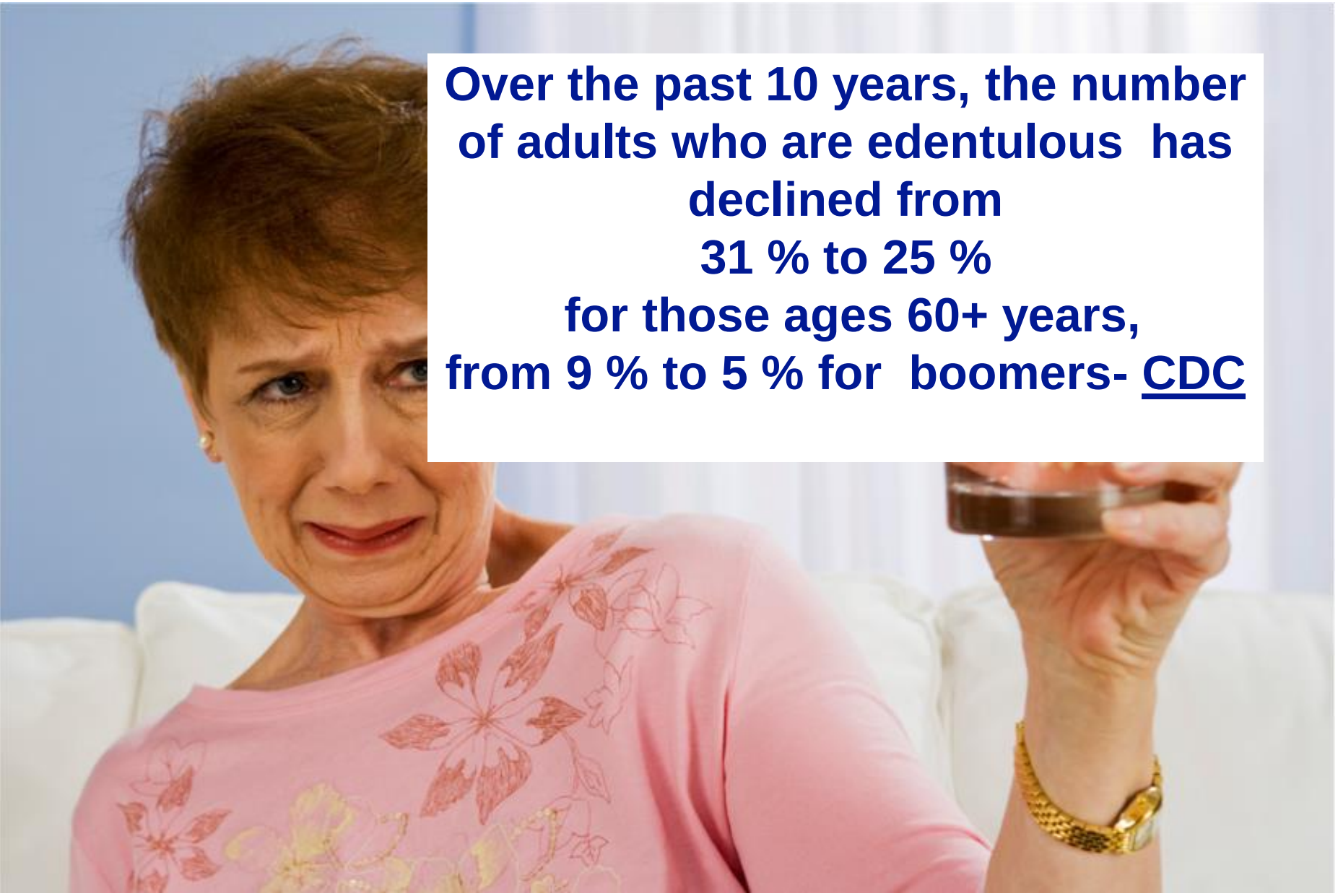
Baby Boomers

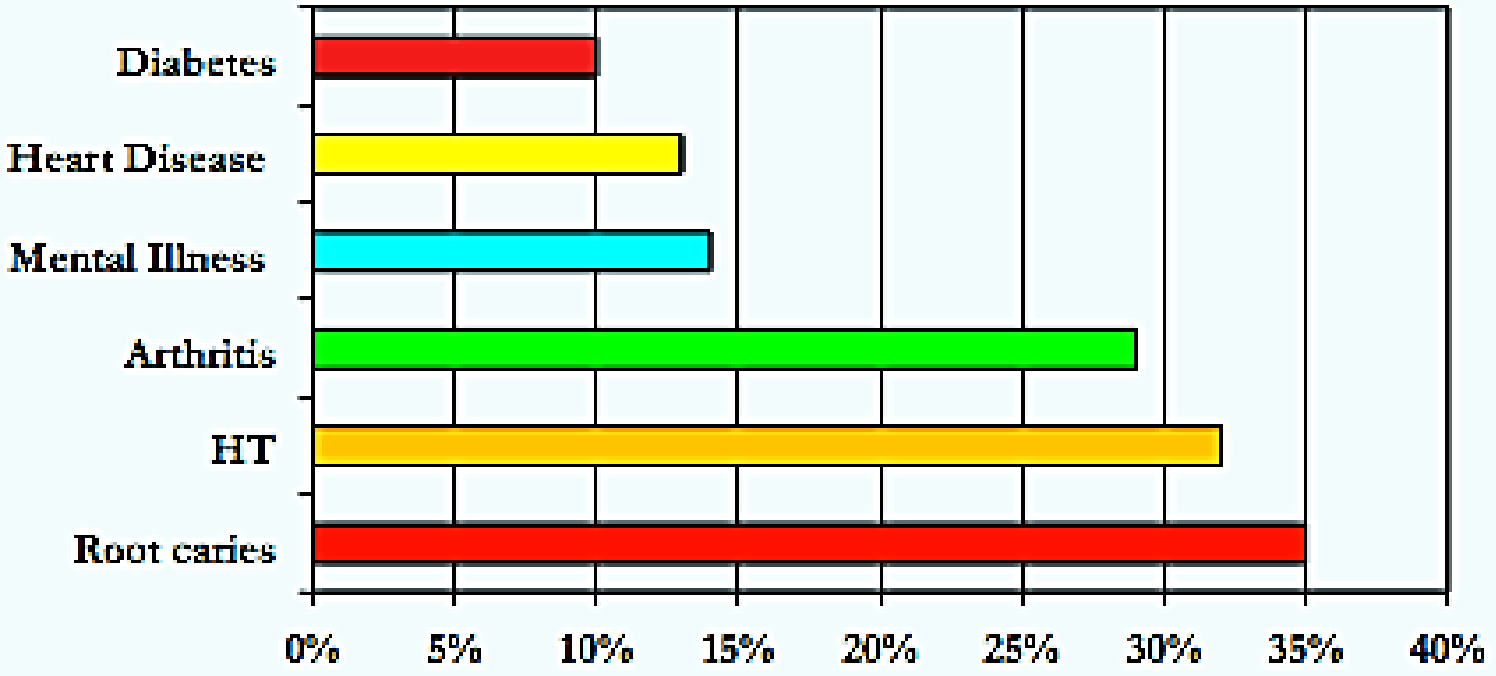
- don't like hearing gingivitis and periodontitis applied to themselves
- Previous generations accepted tooth loss as a natural part of aging
- Boomers want to know what they can do to keep or restore their oral health,"

Kelly Kaplan, - Dental Concepts.



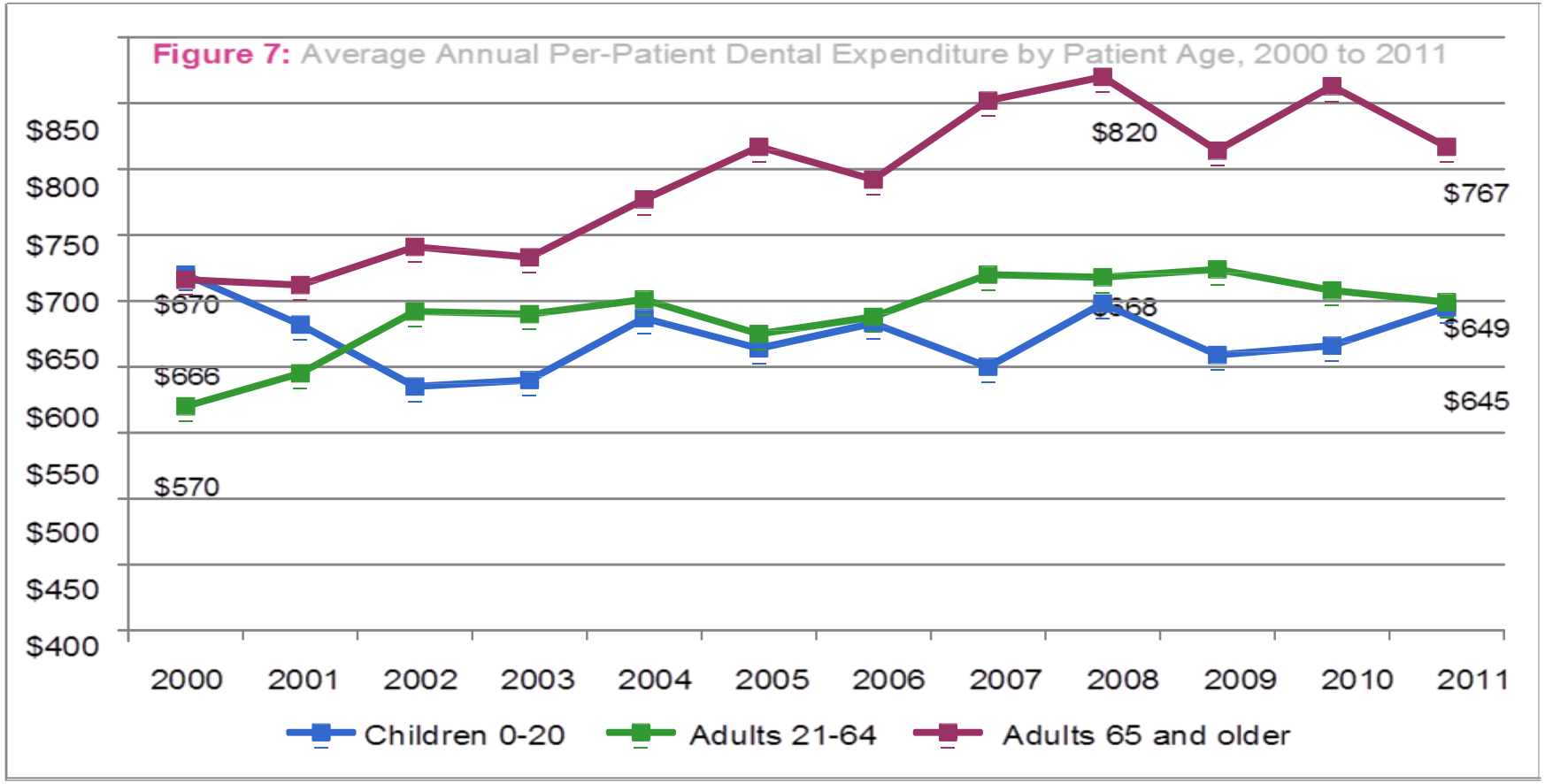
Over the past 10 years, the number of adults who are edentulous has declined from
31 % to 25 %
for those ages 60+ years,
from 9 % to 5 % for boomers- CDC

Prevalence of Common Diseases in 45-64 year olds



(Winn et al, 1996)

Average Annual/Patient Dental Spending by Age (ADA)



U.S. Dental Spending Remains Flat Through 2012

Authors: Thomas Wall, M.B.A.; Kamyar Nasseh, Ph.D.; Marko Vujicic,Ph.D

Nutritional Status Survey

- N= 1016
- Mean Age 75 (60-101)
- 64% Female

- Race
  - 94% Caucasian
  - 5% African American
  - 1% Other

Education

65% High School or less
25% College
10% Graduate Education

62% Nonsmokers

Nutrition and Oral Health

- N=392
- Mean Age = 66 (30-91)
- 57% Female

- Race

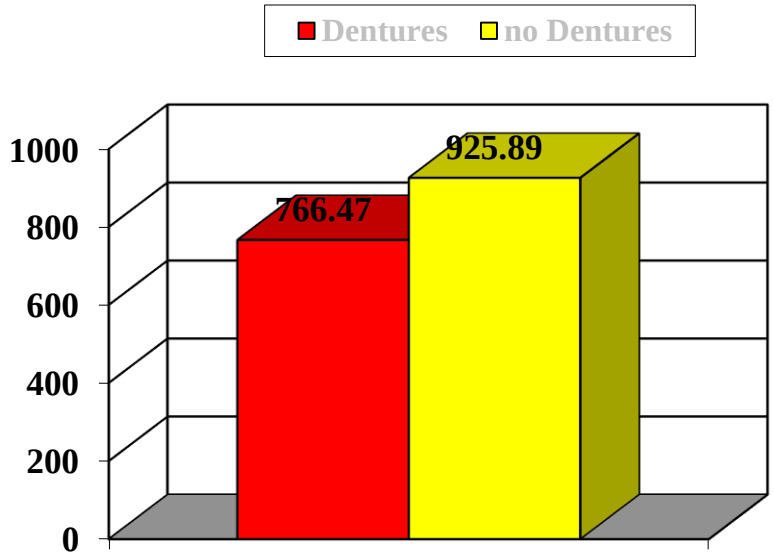
Caucasian	89.7%
African American	8.4%
Other	1.9%

Education 13.4 +/- 2.5

93 % Nonsmokers

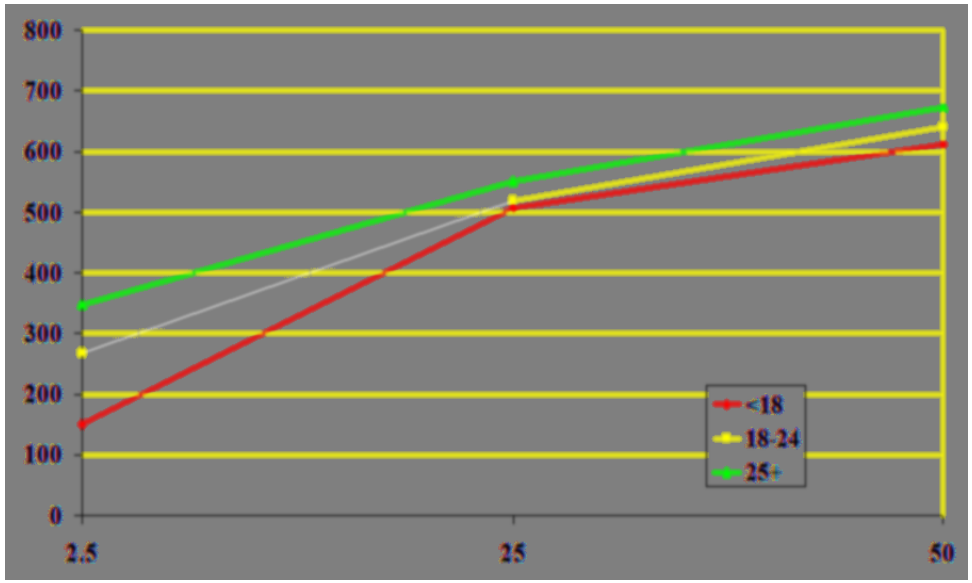
The NOHS recruited from the inner city to increase minority representation and included Oral Exams and Nutritional Studies

Calcium in 2 studies



p<.0001MW

Total Calcium Intake in NSS



Calcium Females in NOHS

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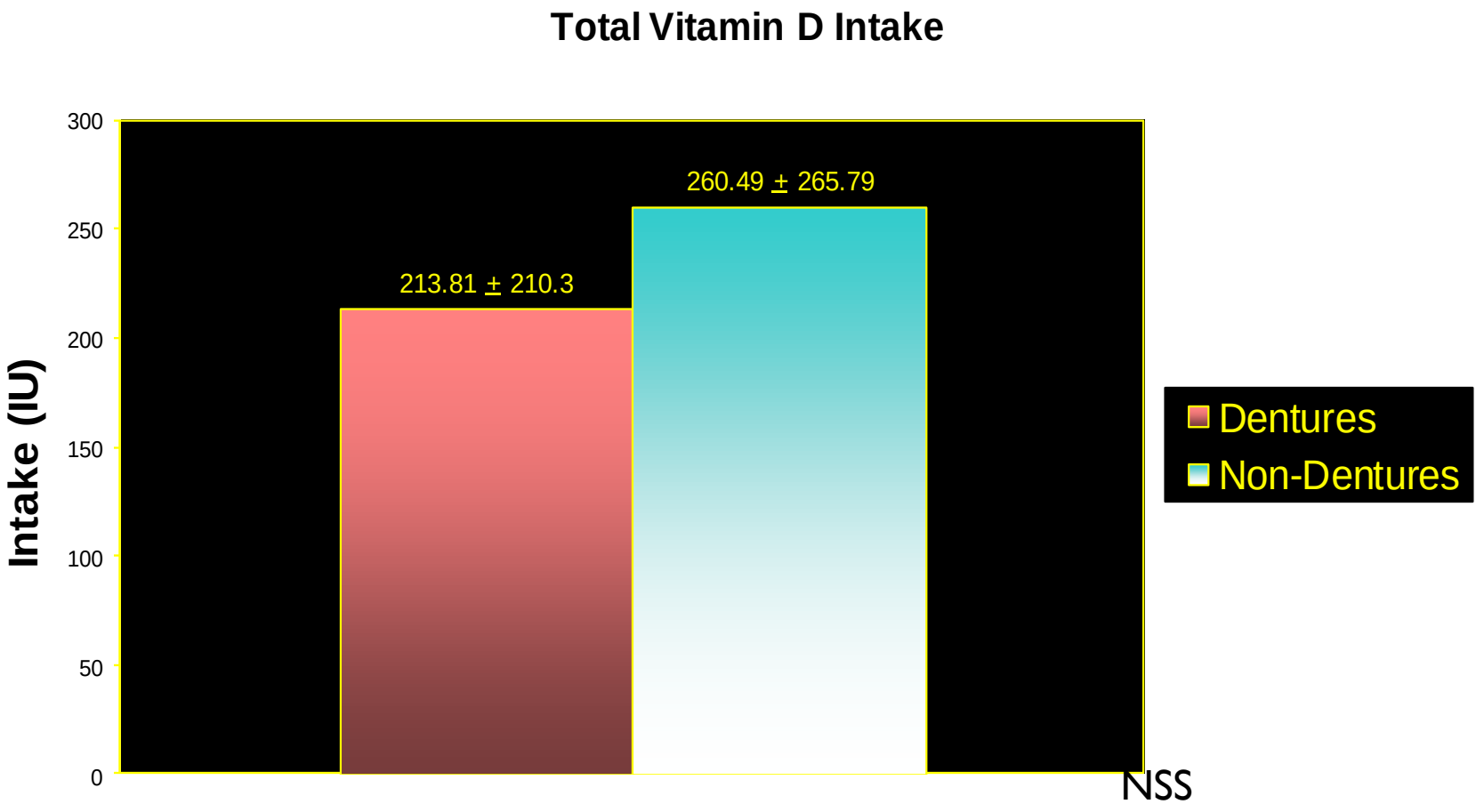
Individuals (especially the elderly) who lack sufficient levels of Vitamin D (Food + supplements) are at a greater risk for developing osteoporosis.



p<0.0001 MW

Calcium and Vitamin D – Other studies

- Krall *et al*, Dietrich *et al* have published several papers showing a relationship between Vitamin D, Calcium and Tooth Loss.

- Conversely-Higher Calcium intake was associated with lower alveolar bone loss.

Bone Density Study-

As bone is lost at the Spine, Femoral neck and Radius, the Number of Teeth goes Down

BESS DAWSON HUGHES, RAUL GARCIA AND LIZ KRALL-COLABORATORS

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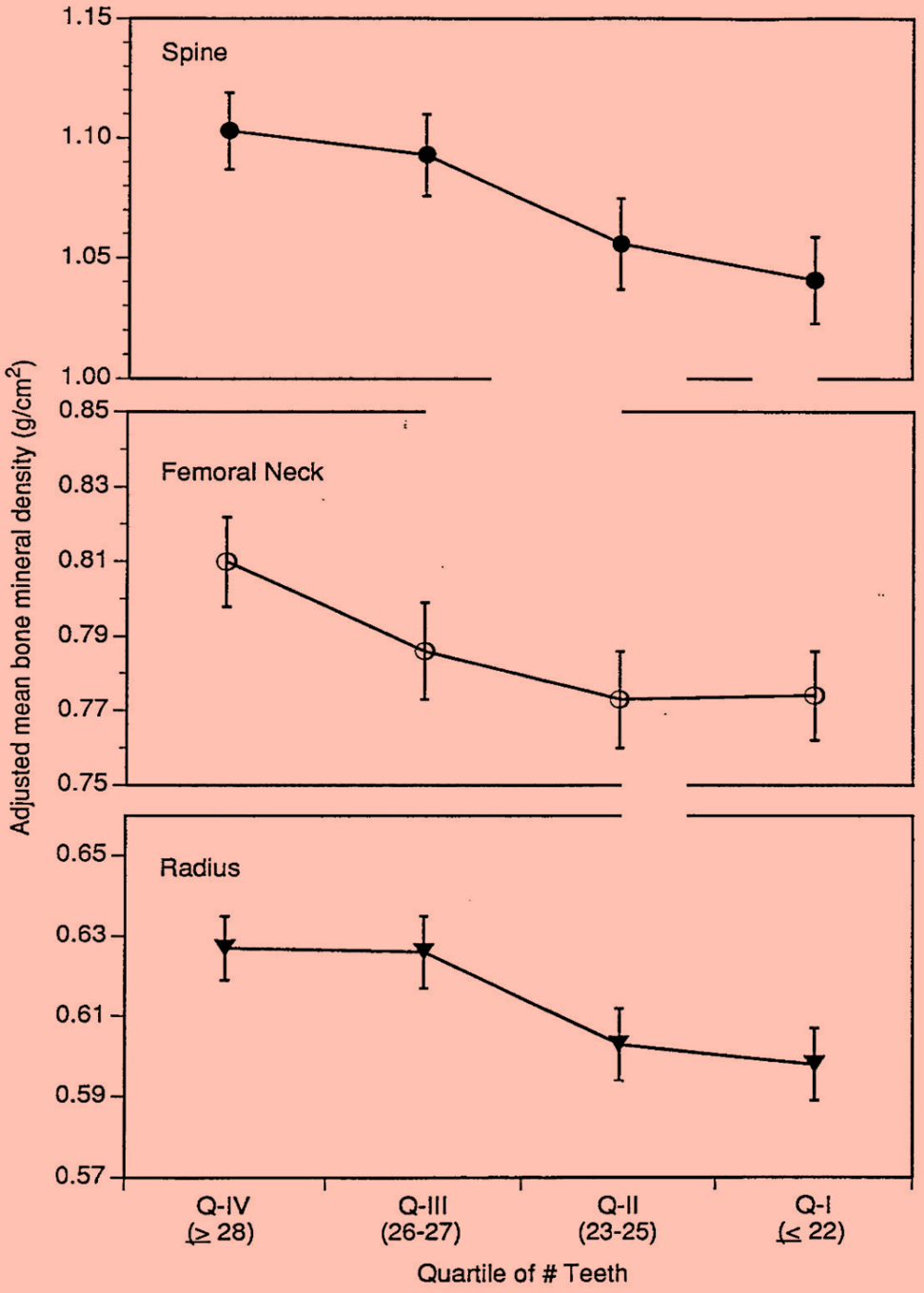
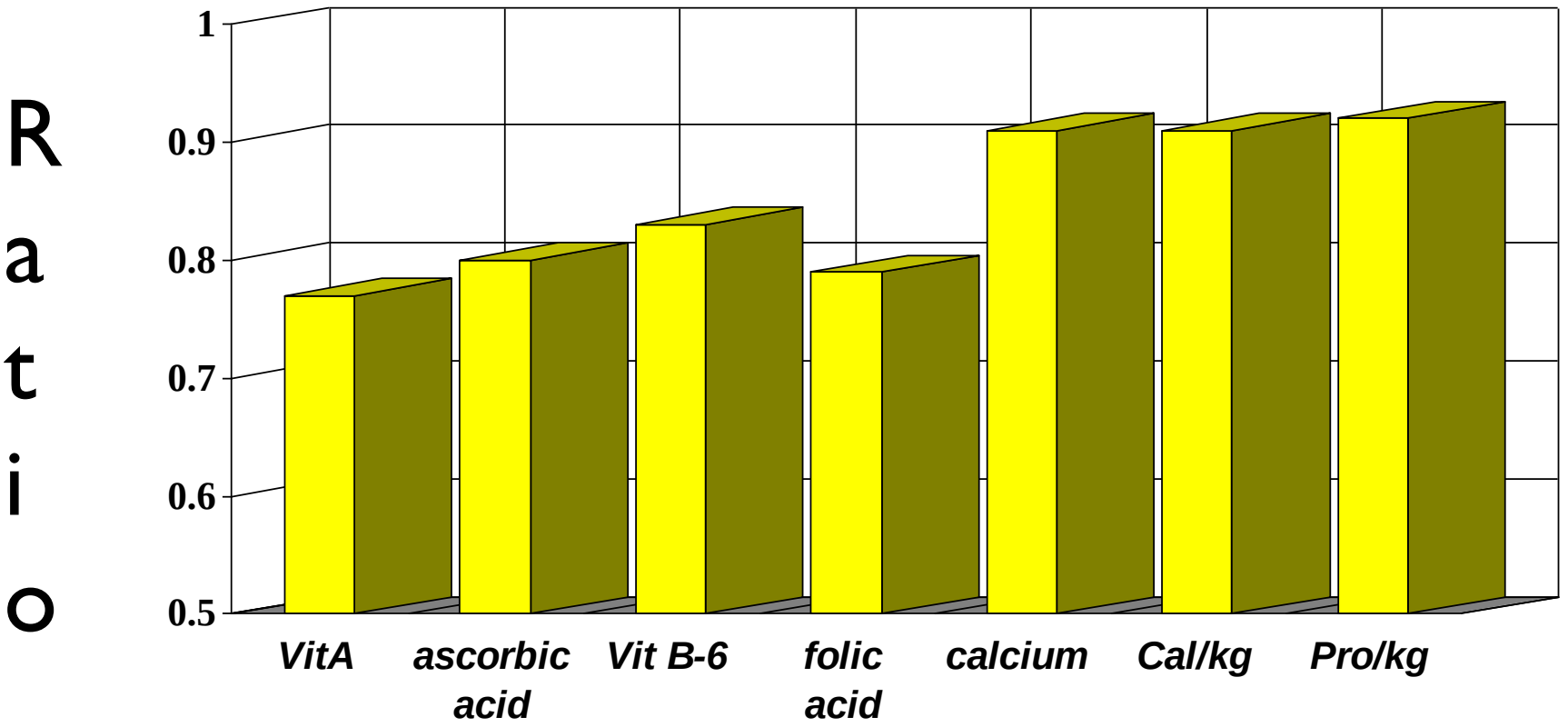


Effects of Dentures (partial or full) on Mean Intakes

Ratio of the $\frac{\text{MEAN INTAKE OF DENTURE WEARERS}}{\text{MEAN INTAKE OF NONWEARERS}}$

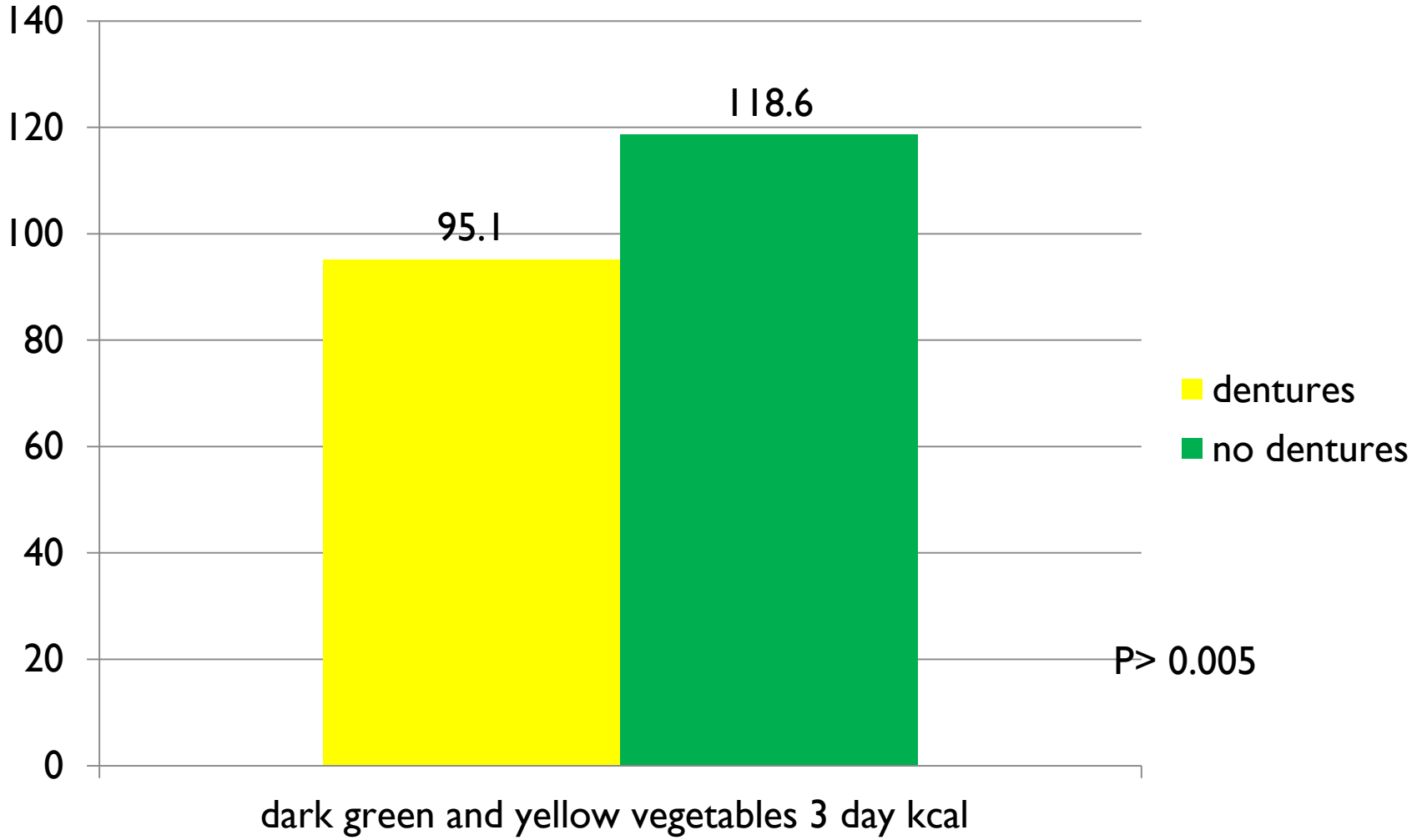


all significant at 0.05 level

The diet of full or partial denture-wearers was lower in dairy, dark green and yellow vegetables, fiber, meat consumed than non-wearers resulting in significantly lower:

- **Cal, Pro, Fat intake 3 day diary** $p<0.0001$
- **CHO** $p<0.0005$
- **Total Intake diet + supplements**
- Vit A $p<0.0001$
- Vit C and Folate $p<0.017$
- Vit B1 $p<.005$, Vit B2 $p<0.002$,
- Vit B6 $p<0.0001$, Niacin $p<0.035$
- Calcium $p<.0001$
- Vitamin D $p<.0001$
- Fe $p<.0001$

Dentate *vs.* Partial or Full Dentures



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Results of Intervention Studies

Systematic reviews and meta-analyses of cohort studies indicate that small differences in Fruits and Vegetables intake are associated with reductions in the risk for cardiovascular events .

Increasing F and V consumption by around 100 to 150 g/day decreases:

stroke by 11%,
coronary heart disease by 4% to 7%
diabetes by 10% to 14%

Lara J et al BMC Medicine. 12:177, 2014.

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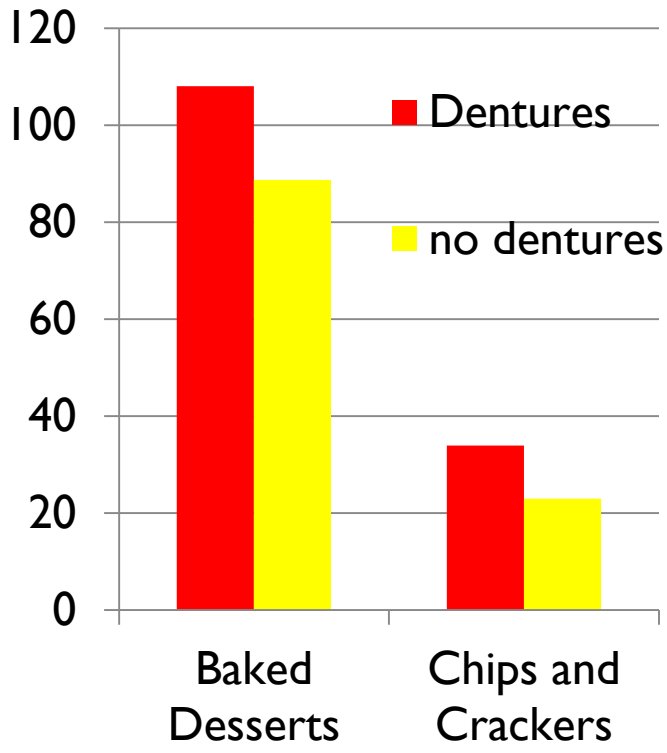
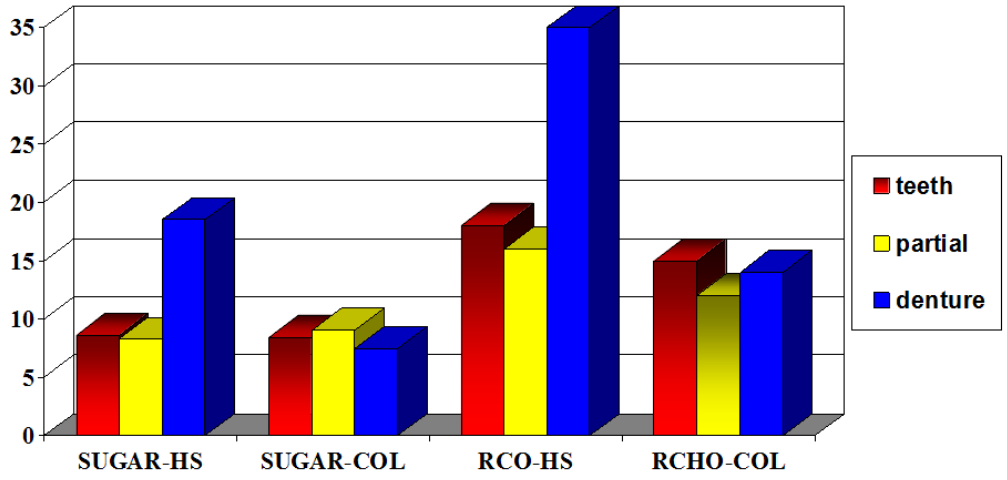
Refined CHO in NSS and NOHS



NSS



NOHS

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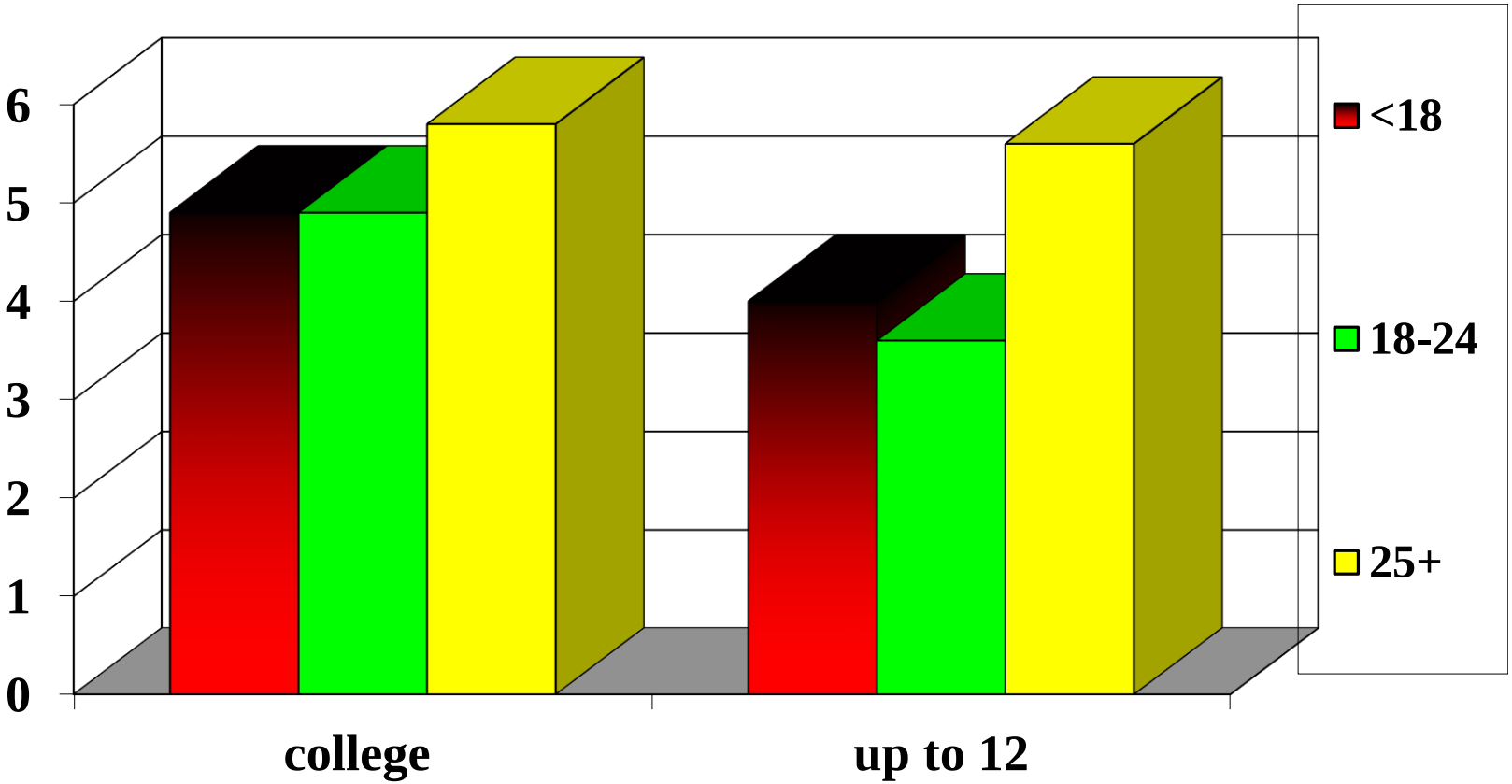
Crude Fiber, Number of Teeth and Education



NOHS

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Weight and Blood values

	Significance
The weight of the denture wearer was lower	p> .002
The skinfold test of the denture wearer was lower	p> .0001

Dentures Wearers have lower levels of:

Plasma Albumin (G/DL)	p> .001
Plasma Carotenoids (UG/DL)	p> .0001
Plasma Vitamin B12 (PG/ML)	p> .0001

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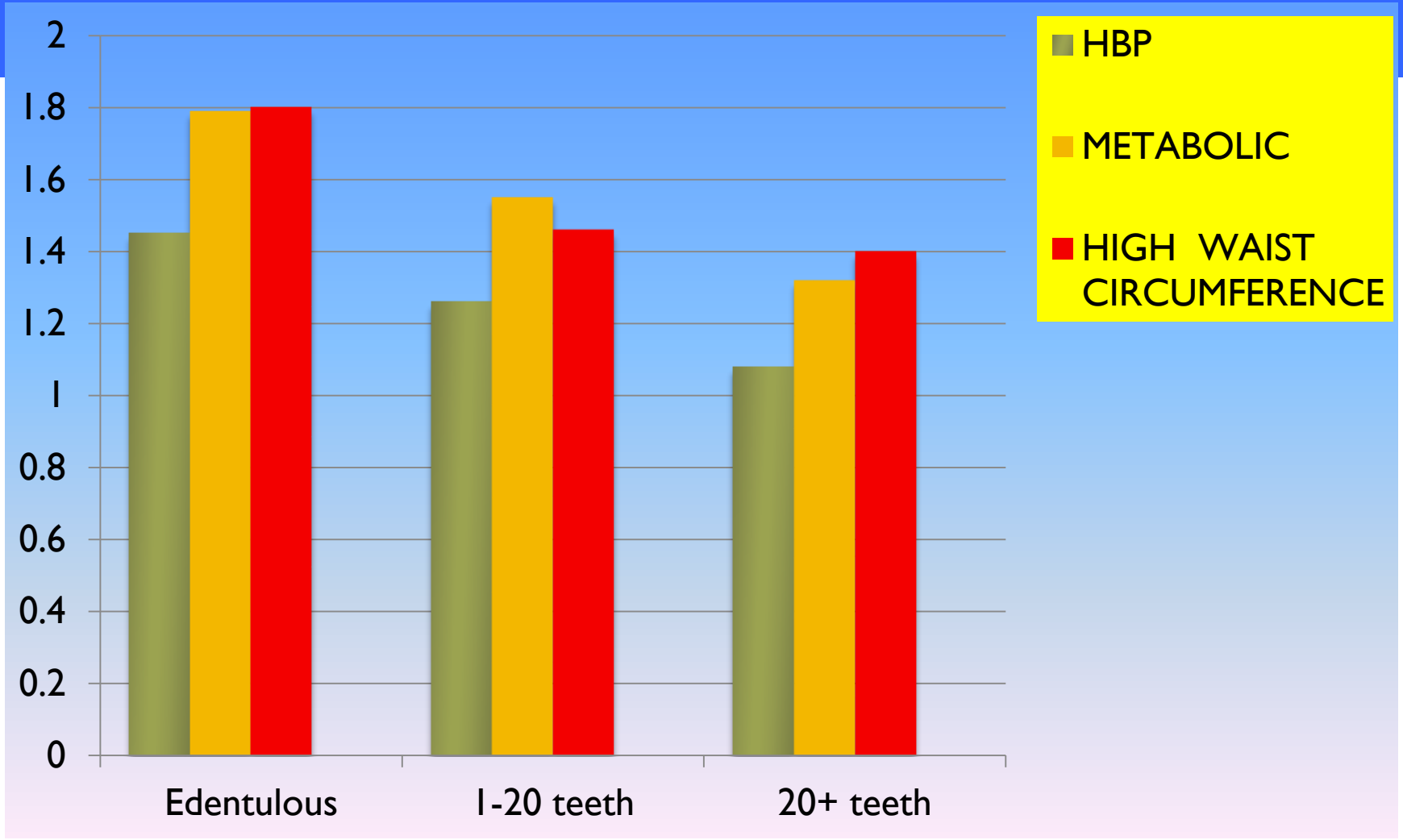
Associations between the # Teeth and Metabolic Syndrome - NHANES n = 5511



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Zhu and Hollis J Clin. Perio. 2015

Finding in NHANES Study

- Tooth loss was significantly associated with metabolic syndrome ($p = 0.002$) adjusting for age, gender, race/ethnicity, ratio of family income to poverty, physical activity, smoking, and energy intake.

- Compared to participants with full dentition, the odds were
  - **32% higher in those with 21–27 teeth,**
  - **55% higher in those with 1–20 teeth**
  - **79% higher in edentulous participants.**
- The number of natural teeth was **inversely associated** with BMI, waist circumference, blood pressure, fasting plasma glucose and insulin concentrations ($p < 0.01$ for all);
- it was **positively associated** with serum HDL cholesterol concentration ($p = 0.003$).

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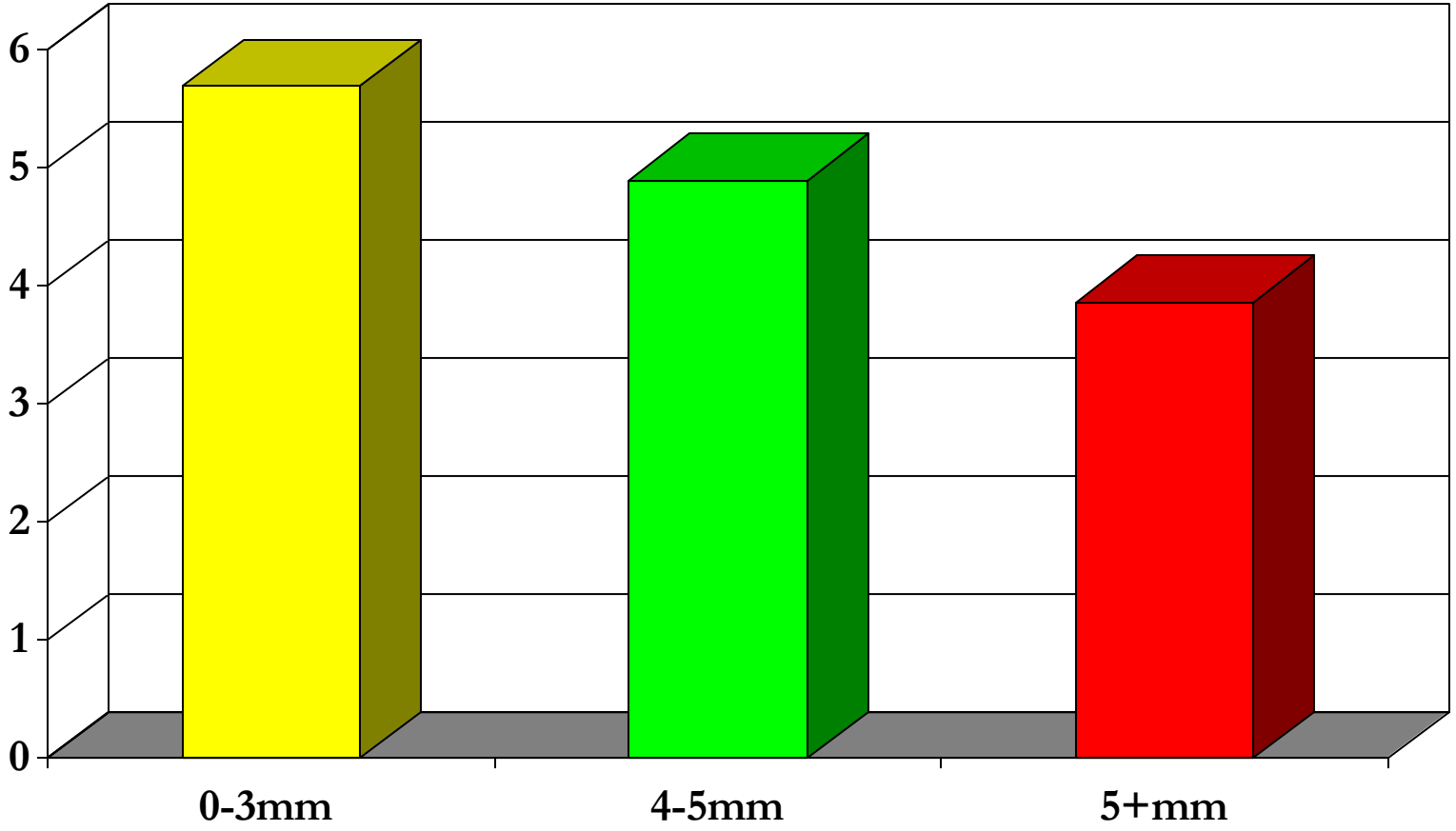
Zhu and Hollis J Clin. Perio. 2015

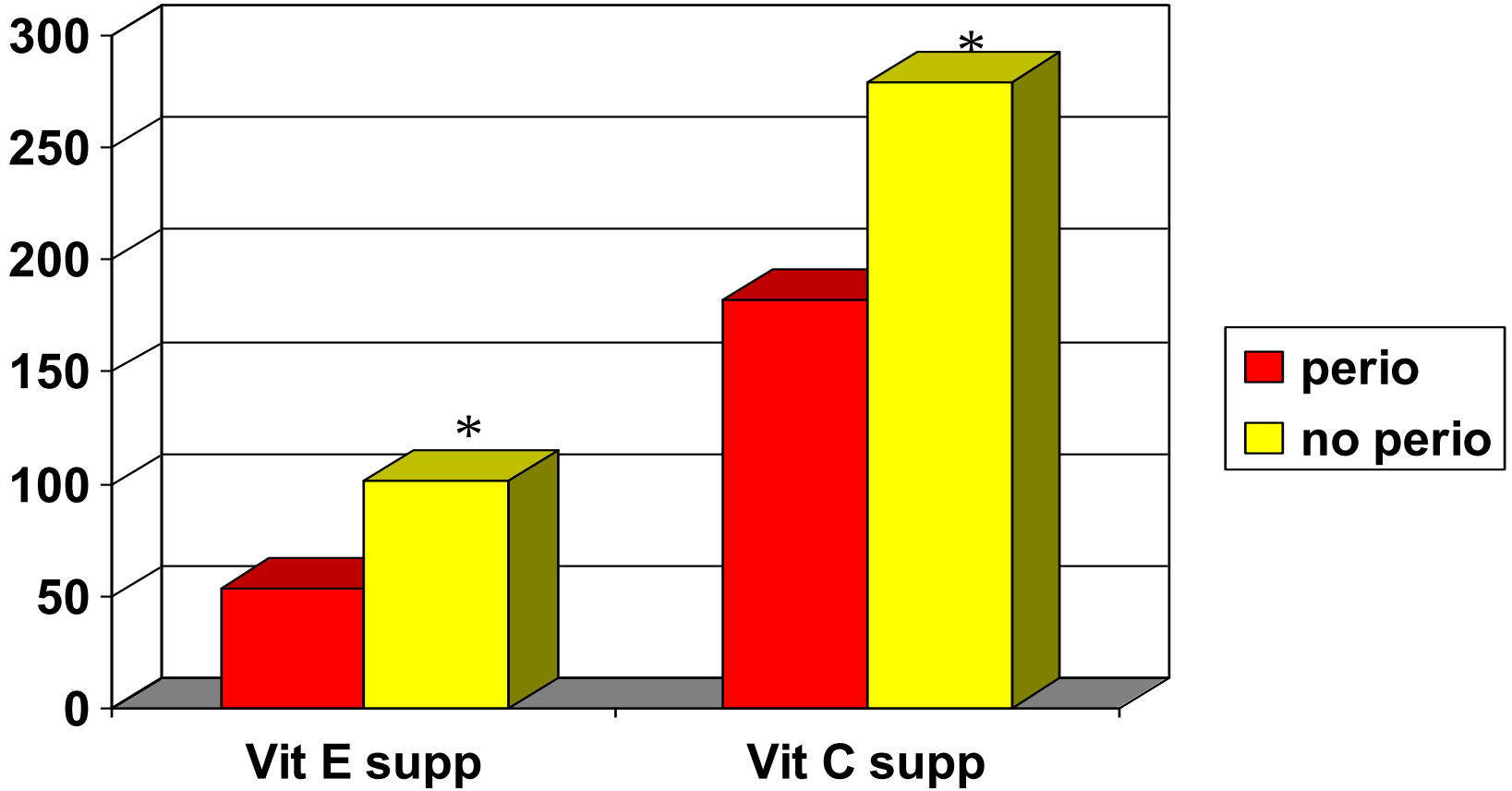
Fiber Consumption from 3 Day Food Diaries



ANOVA $p > 0.05$

Periodontal Pocket Depth

Supplementation with Antioxidants Dental NSS and Periodontal Disease n=133



* Signifcant p≤0.05

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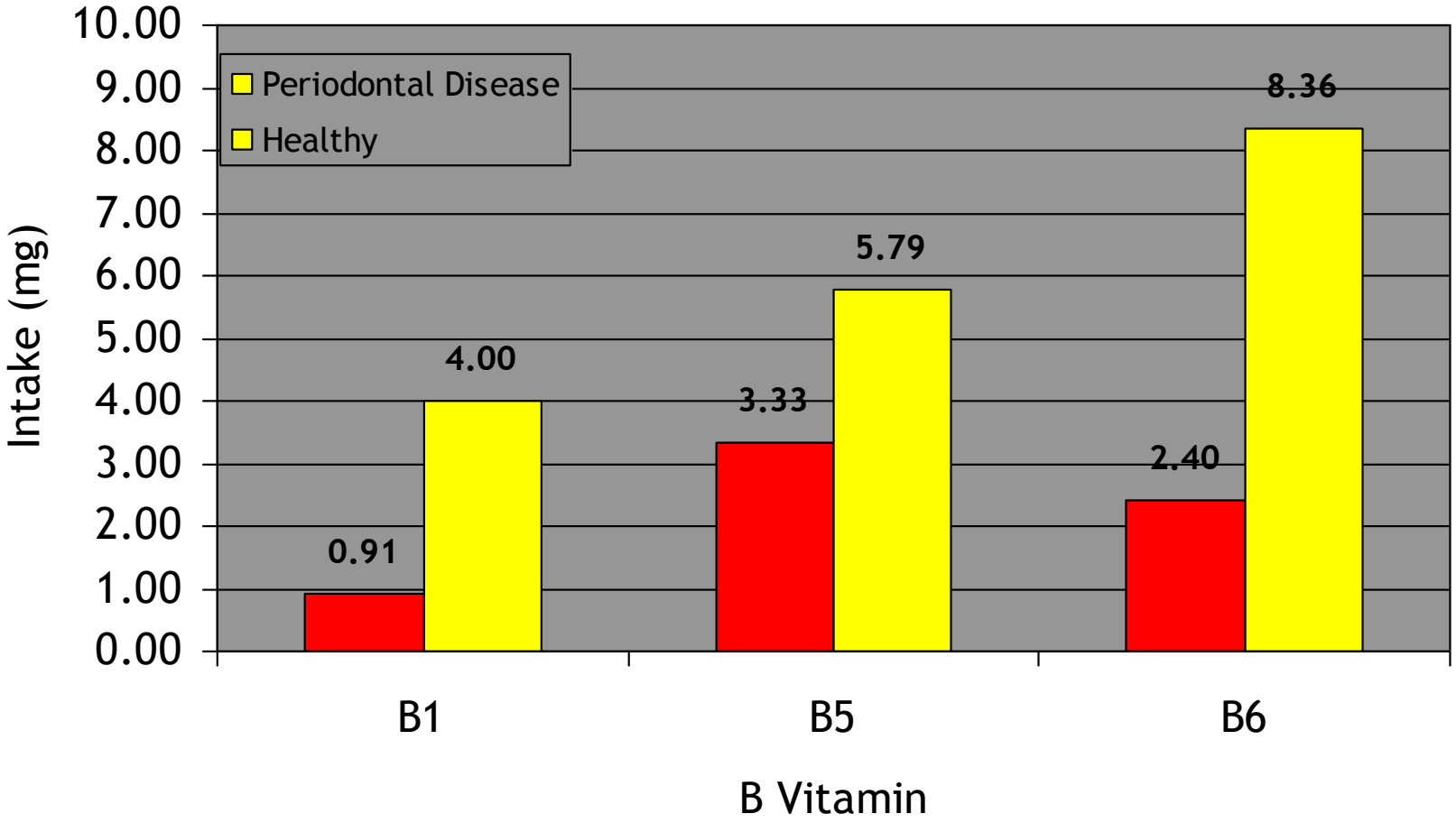
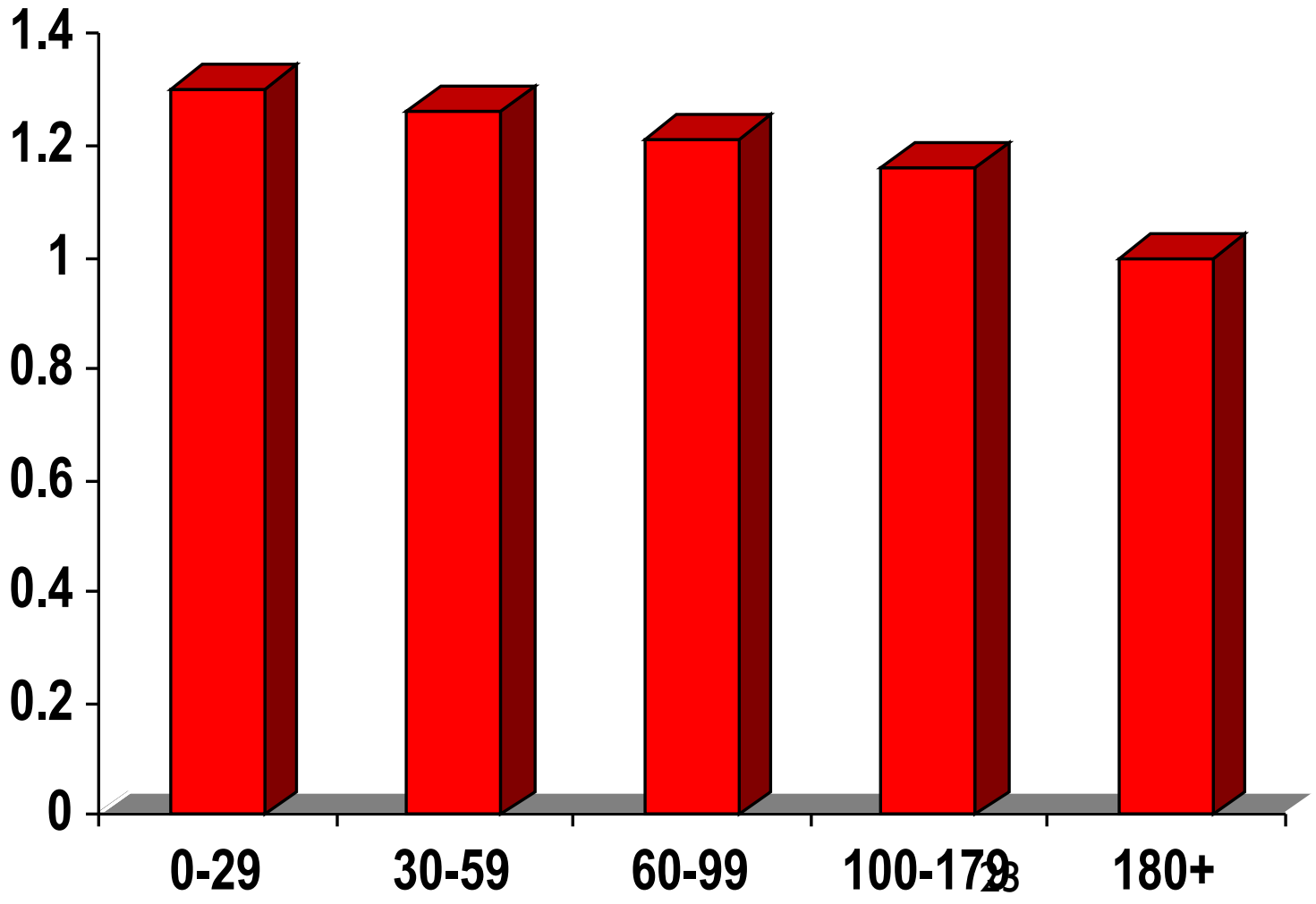
B Vitamin intake and Periodontal Status at Baseline



Odds Ratio for Periodontal Disease by Level of Vitamin C Intake



Association of Periodontal (mean AL≥1.5)with Vitamin C Intake, n= 12,419) NHANES III

Variable	Odds Ratio	95% CI	P value
Age	2.25	2.17-2.33	<0.0001
Male sex	1.57	1.40-1.76	<0.0001
Current Tobacco User*	4.48	3.81-5.27	<0.0001
Gingival Bleeding	11.59	7.72-17.39	<0.0001
Vitamin C	1.19	1.05-1.33	<0.0001

* Tobacco user had a significantly lower Vit C consumption

Conclusions of NOHS

- Those people who had one denture had a significantly lower consumption of 20 key nutrients than people with teeth.

- This represented a 20% decrease

CONCLUSION OF NSS

- The diet of full or partial denture-wearers was lower in dairy and vegetable consumption than that of individuals with their own teeth.

- Denture-wearers had a lower intake of key nutrients that are important to both oral and general health.

- With their insufficient nutrient consumption, denture-wearers may be at an increased risk for cancer, osteoporosis, and other diseases that are already common for elderly populations.

The Link between Oral Disease and Nutrition goes both ways

88%- 60+ take medications and the number will grow and so will side effects.

- 76% used two or more prescriptions,
- 36.7 % took five or more prescription

Center for Disease Control and Prevention. Prescription Drug Use Continues to Increase: U.S. Prescription Drug Data for 2007-2008. http://www.cdc.gov/nchs/data/databriefs/db42.htm

Demographics of Study Population
Inner City Boston n=1058

Number

- Meds 912
- No Meds 146

Mean Age 40-80

- Med 64
- No-med 62

Sex

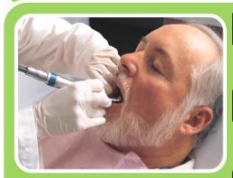
- Med- 57% female
- No med 52% male

Meds

- Med 3.5
- No Med-0

Number of Teeth

- **Med 23.1**
- **No-med 24.9**



Fred Joyal

Freq of Dental Visits

Med 1.9

No-med 1.2

Kyle Rodriguez

Smoking

- **Med 8.4% current 33.4% past**
- **No- med 16.2% past 16.2%**

Oral B

Floss

Med 2

No- med 1

Single Calibrated Caries Examiner and Periodontal Examiner

- Training and Calibration were performed annually
- Repeatability was performed on 5% of the subjects with a 0.9 repeatability for the Examiner

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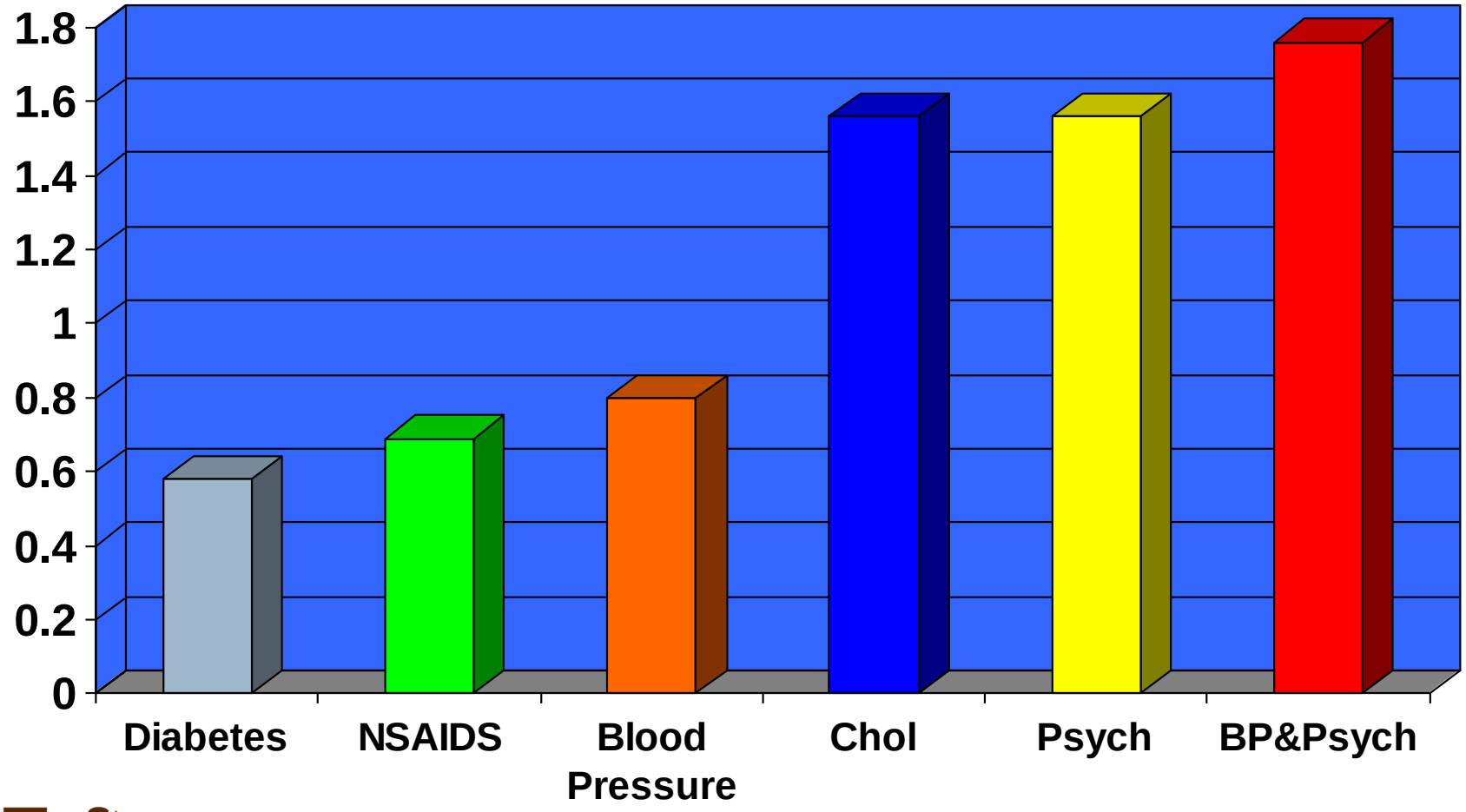
Coronal Increment by Medication Class



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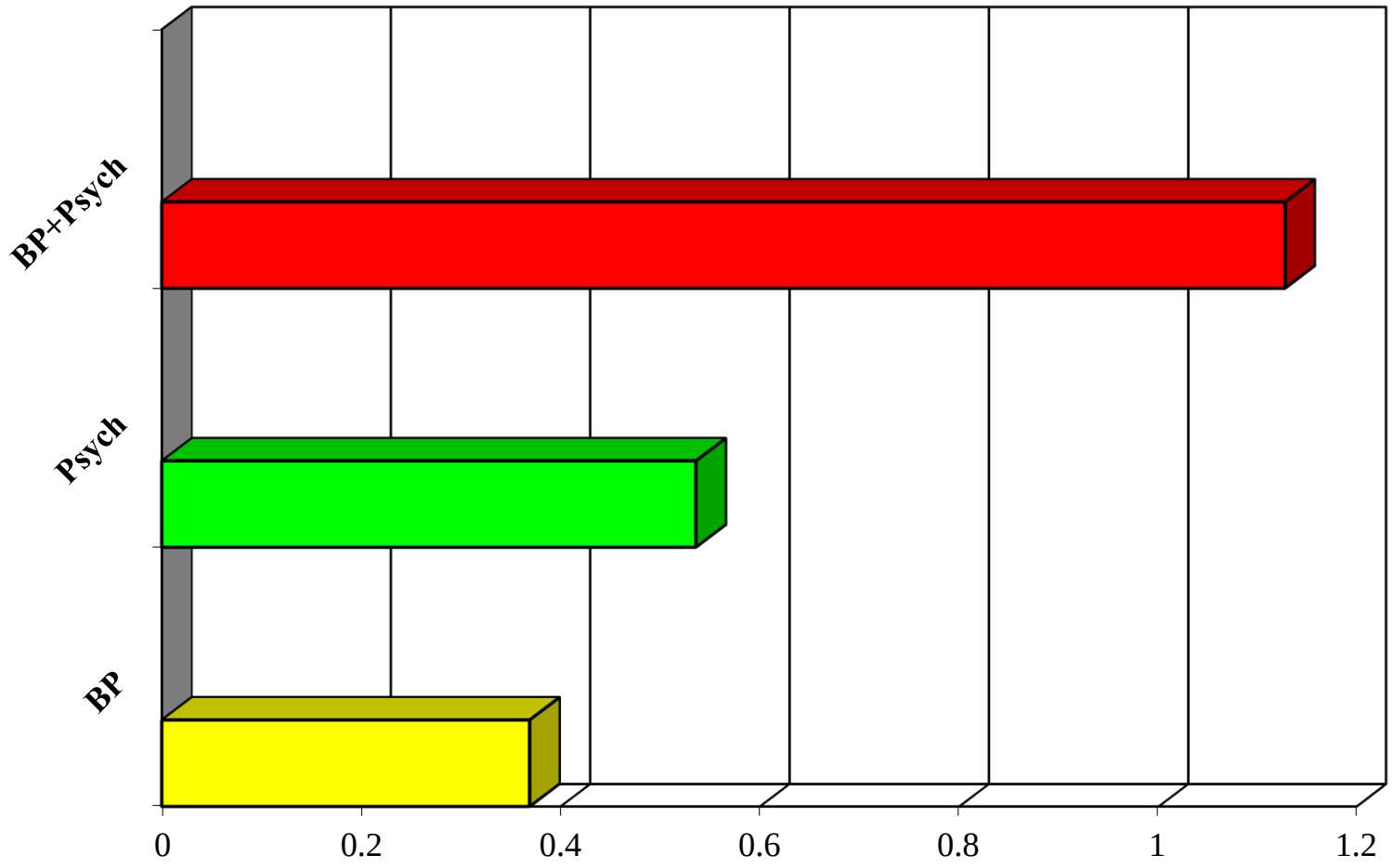
Multiple Medications Affect on Root Increments as Well



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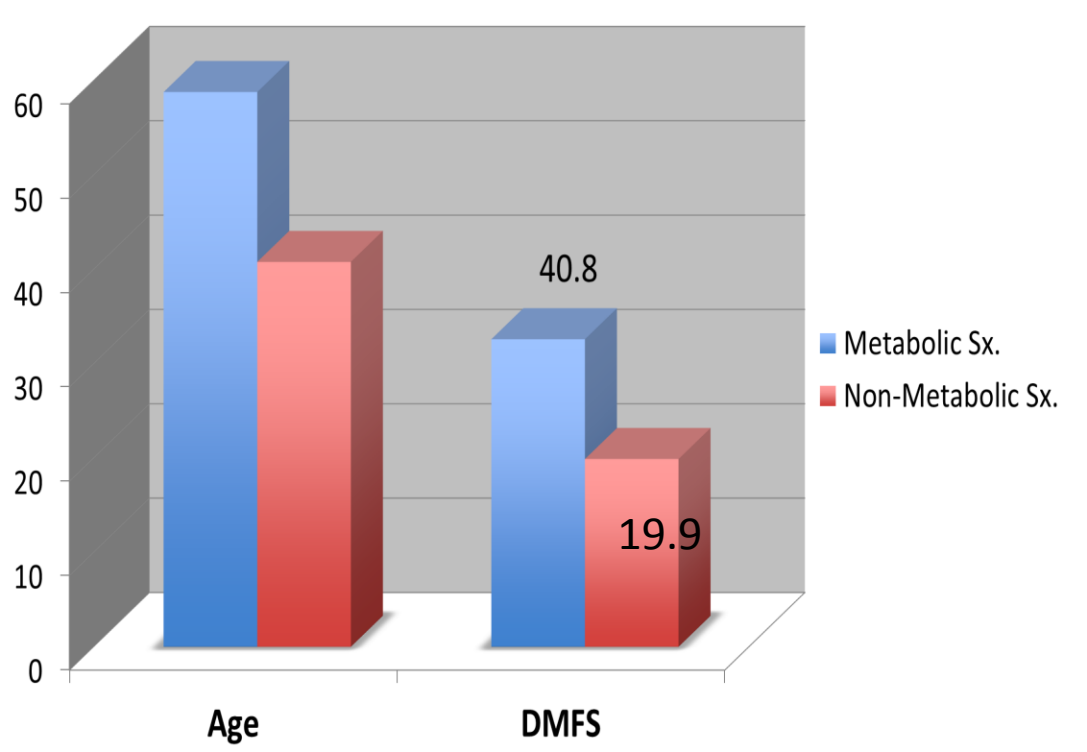
Metabolic Syndrome



Mean Age & DMFS in Metabolic Sx vs. Non-Metabolic Sx

Caries multiple linear regression model:

BMI (p=0.005)

African American (p=0.003)

Age (p=0.006)

Dietary Methods

- Patients completed modified Block food frequency questionnaire.
- Patients provided all dietary supplements taken.
- Analysis of data provided daily intake levels of patient's vitamin A and beta-carotene quantified in activity retinol equivalents.

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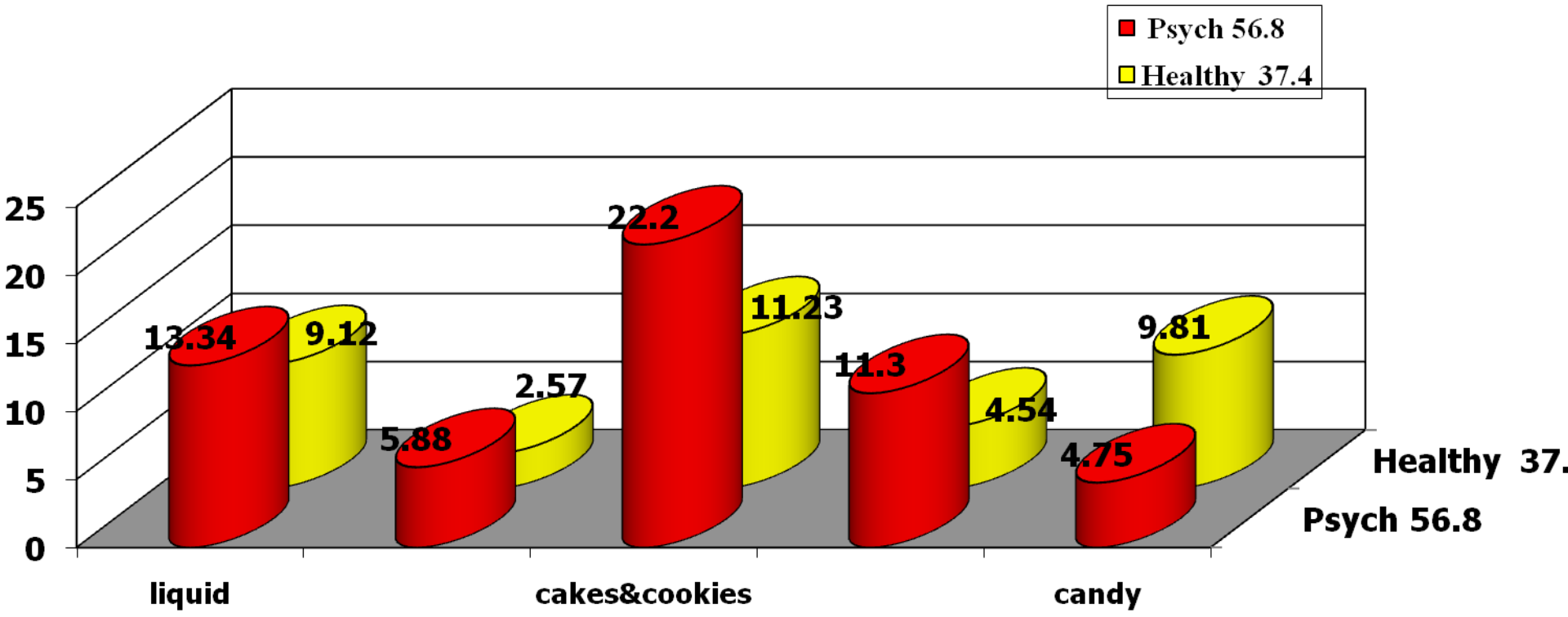
		Your Serving Size			How Often?					When?		
	Medium Serving	S	M	L	Day	Week	Month	Year	Rarely/Never	At Meals	Between Meals	Both
Cantaloupe (in season)	1/2 medium											
Doughnuts, Cookies, Cake, Pastry	1/2 medium											
Grapefruit, grapefruit juice	6 oz.											
Sweet potatoes, yams	1/2 cup											
Hamburger, cheeseburger, meetloaf	1 medium											

Consumption of Sugars in Psychiatric *vs.* Healthy



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Predictors of Caries Incidence

Variable	*t*	*Significance*
Psychiatric Medications	**3.157**	**0.002**
Previous caries	**4.952**	**0.0001**
Sugar	**3.124**	**0.002**

age, sex flossing, frequency of visits, unstimulated salivary flow, smoking and HBP not significant in the model

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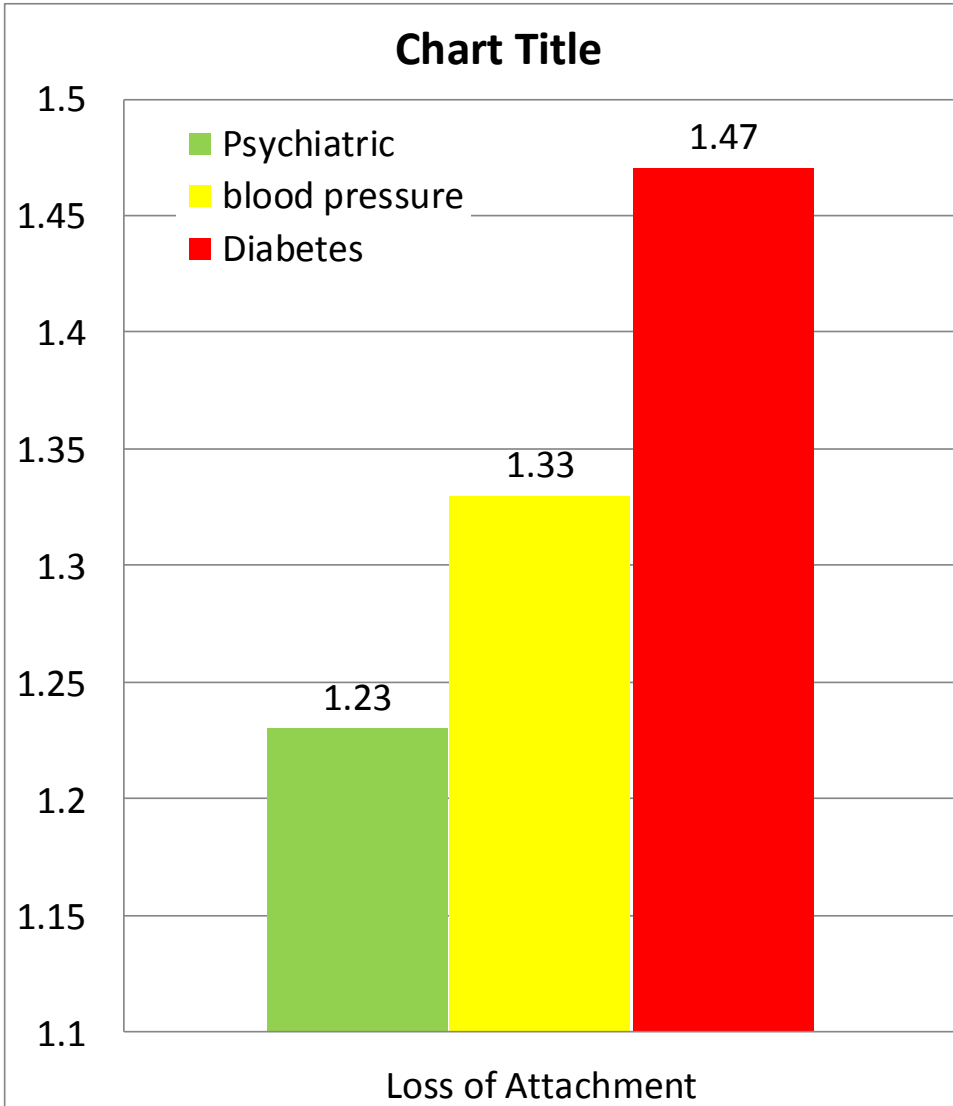
1 year increments in Attachment Loss



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Intervention Studies have shown

TX-debridement, antimicrobial solution, doxycycline -- chosen for its anticollagenase activity -- resulted in significant short-term improvement in glucose.

A control group receiving only debridement did not share the gains in periodontal health, or reduced hyperglycemia that the treatment group experienced.

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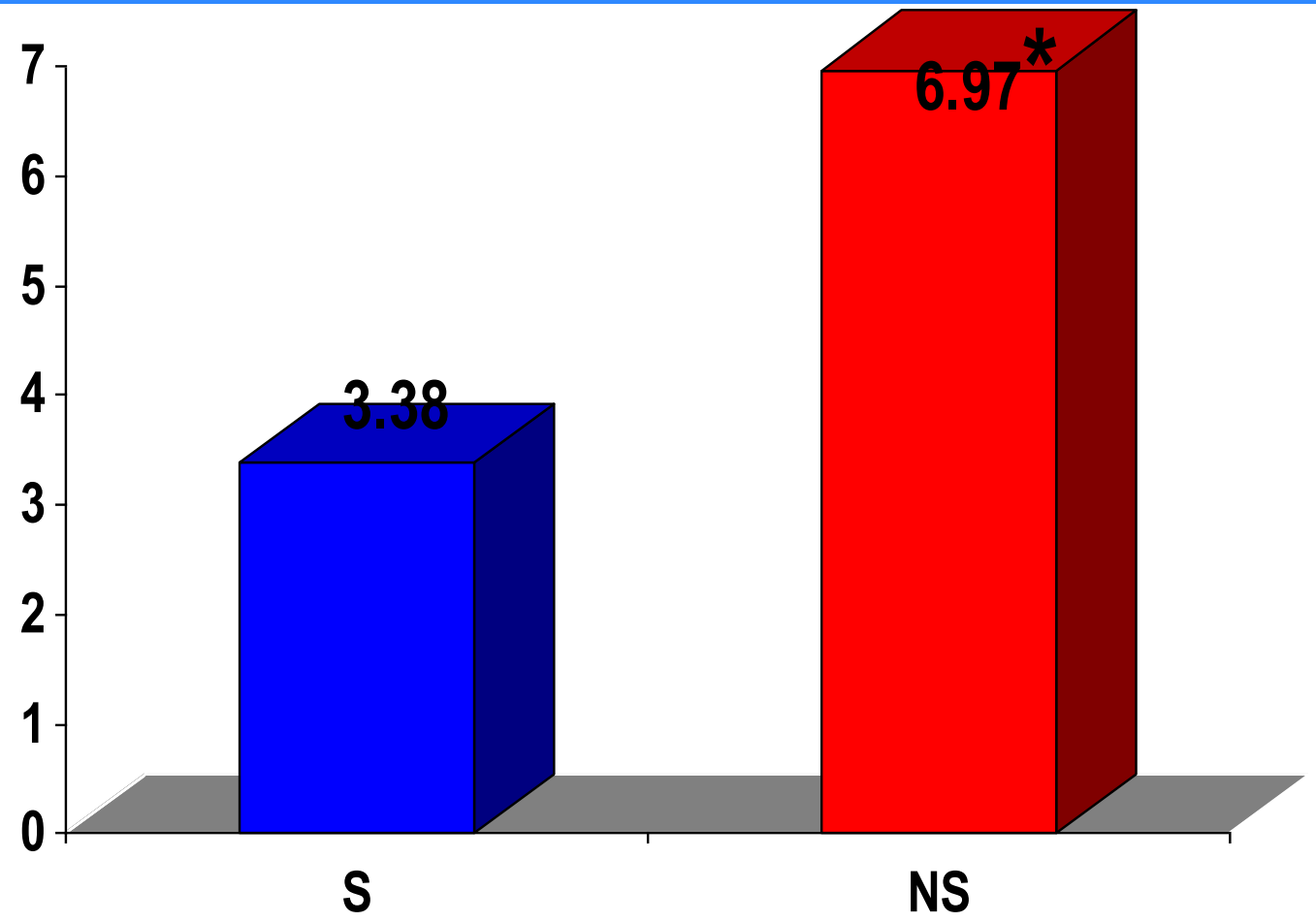
Medication Induced Xerostomia Study (n=980) Two Sub- groups Were Identified

- Group NS -was not taking any supplementation n= 195
  - Mean age 65
  - 64% female, 46% male
- Group S – was taking 1 multivitamin a day n=372
  - Mean age 65
  - 61% female, 39% male

Percent of Sites with Severe Periodontal Disease at 1 year



MW p≤0.021

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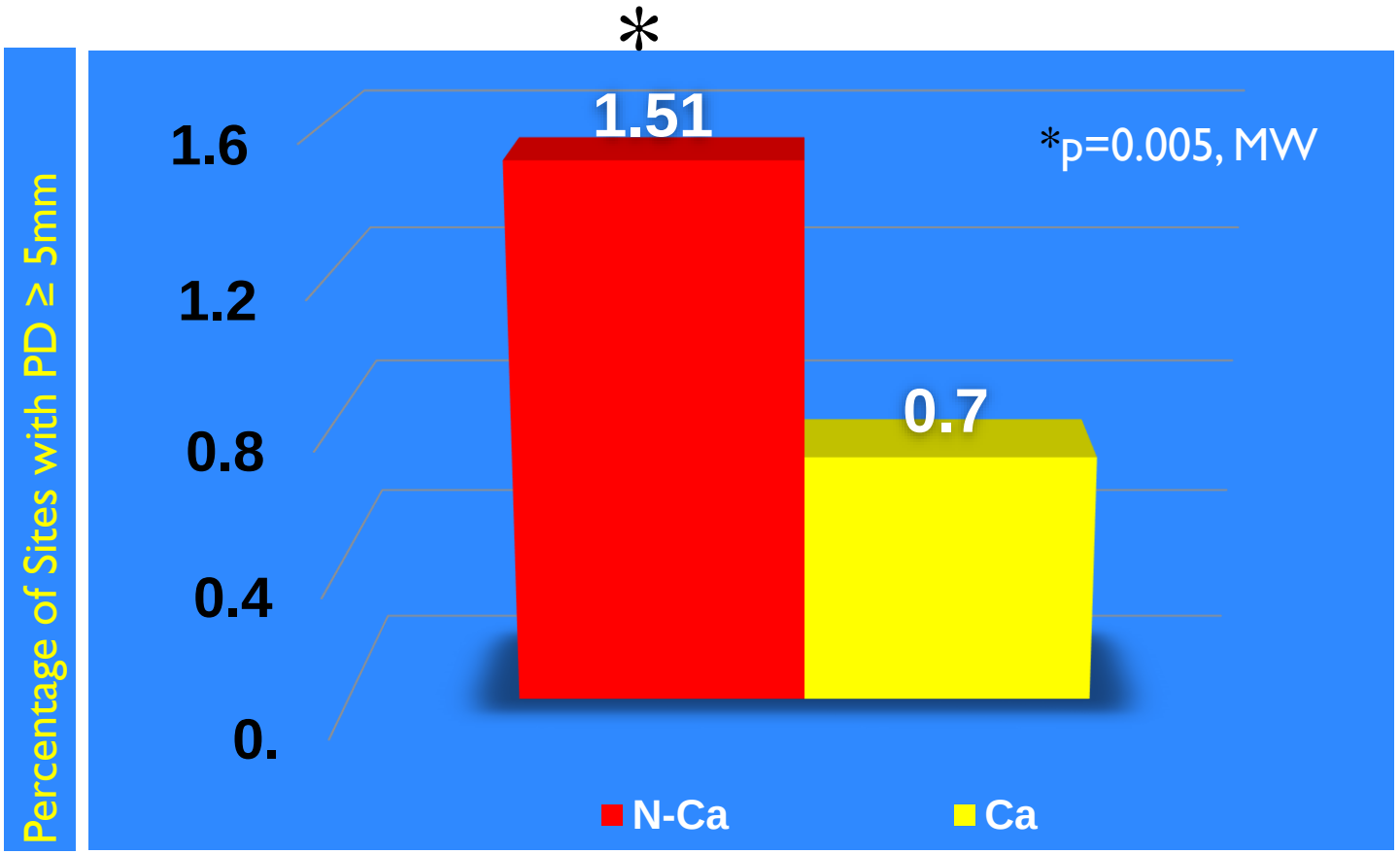
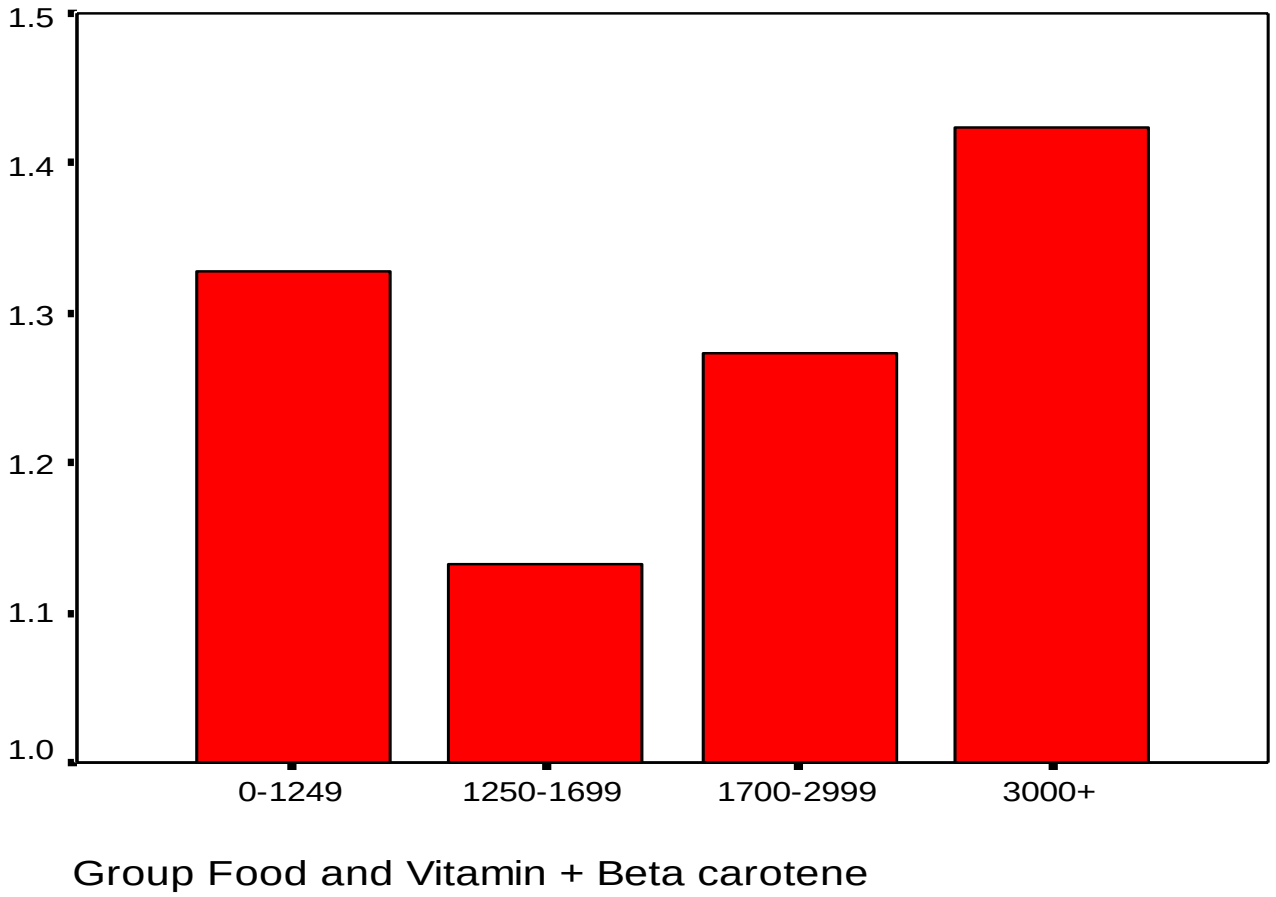
Calcium Supplementation



On comparing, the group not supplementing with calcium showed a statistically significant increase in the percentage of sites with PD ≥ 5 mm (p=0.005, MW)

The mean (SE) increase for the group not supplementing with calcium was 1.51 (0.29) % and for calcium supplementing group was 0.70 (0.31) %

Vitamin A & β-carotene in Food + Supplements affect on Periodontal Disease Increments



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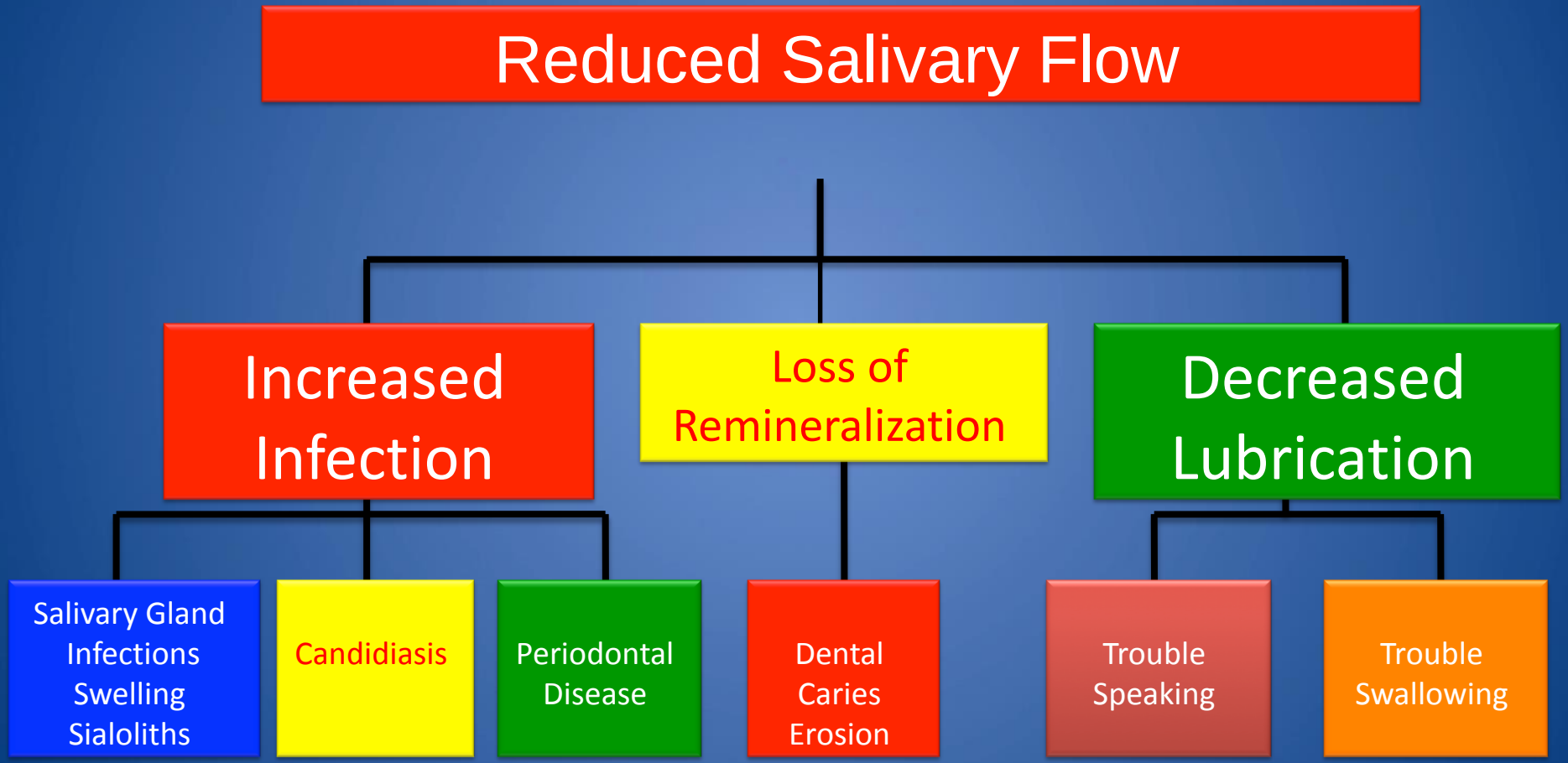
Consequences of Salivary Hypofunction



Sjögren's Syndrome

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Sjögren's Syndrome

One of the most common autoimmune rheumatic diseases

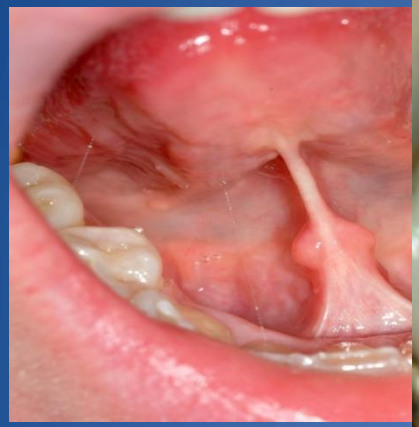
9:1 ratio of women : men

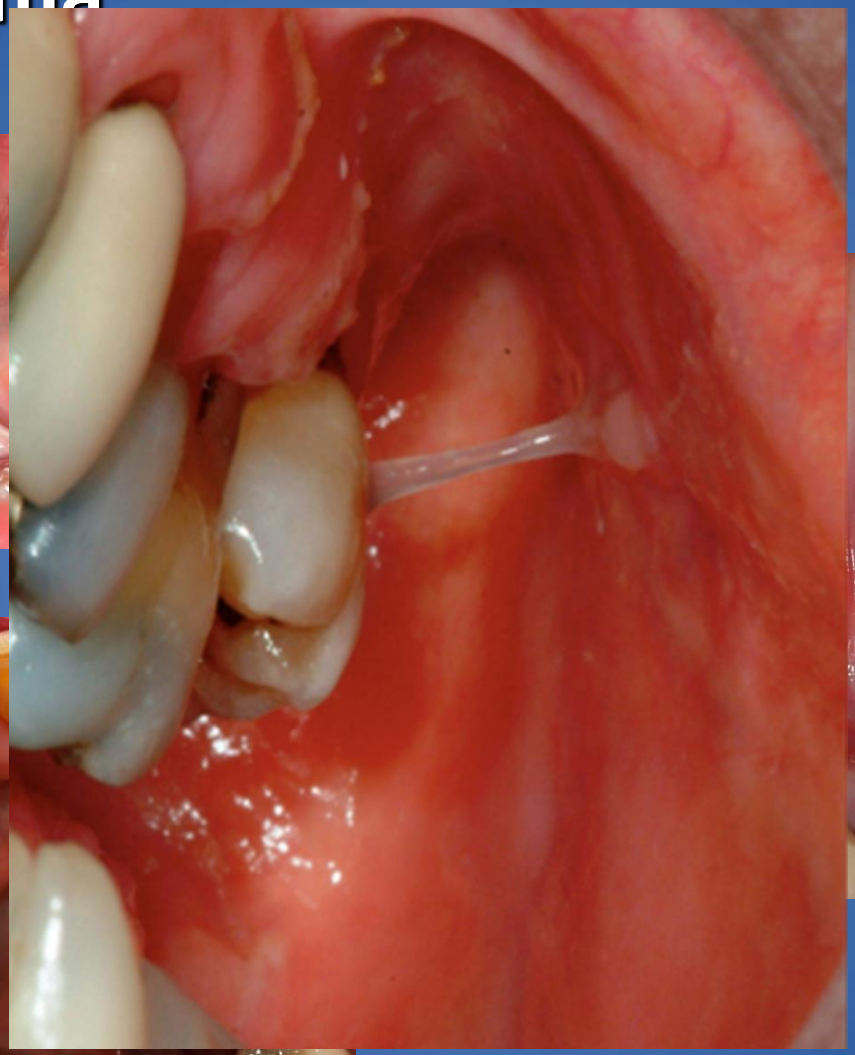
1-4 million individuals affected in USA

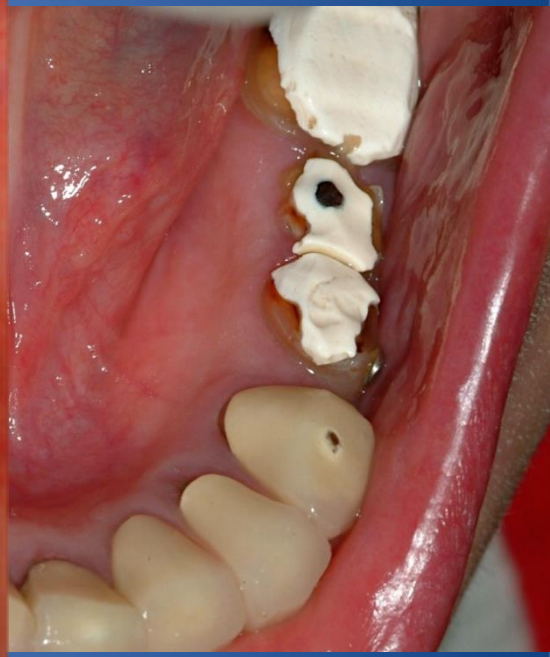
Typical diagnosed patient is perimenopausal or postmenopausal female

Documented pediatric cases exist

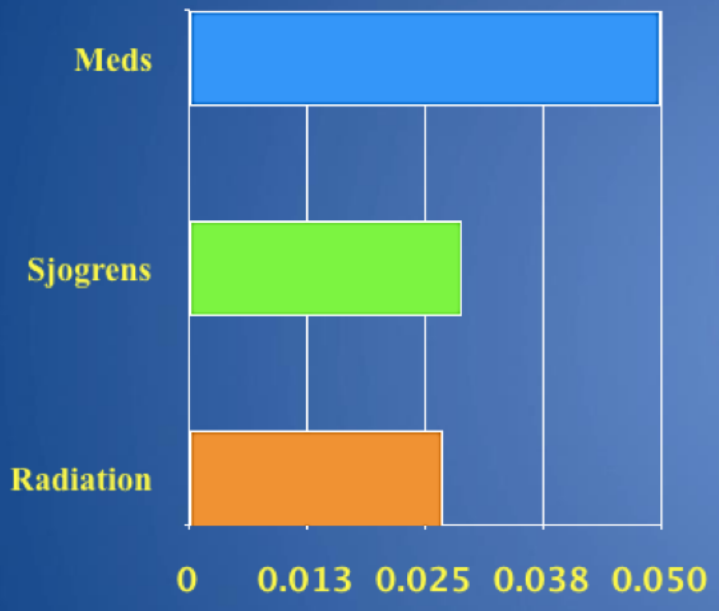
Increased Dryness & Erythema



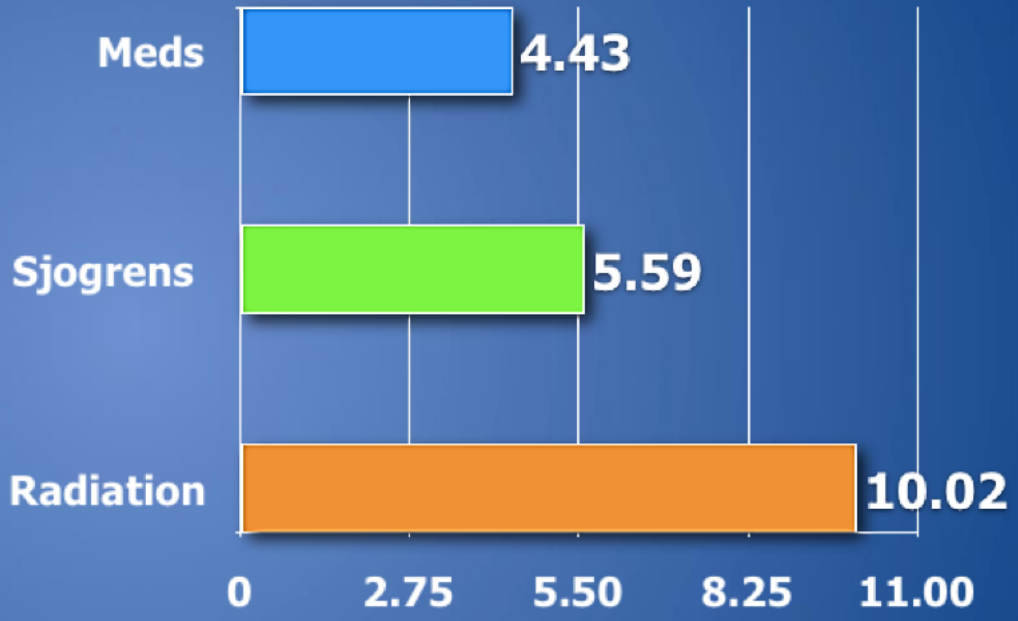




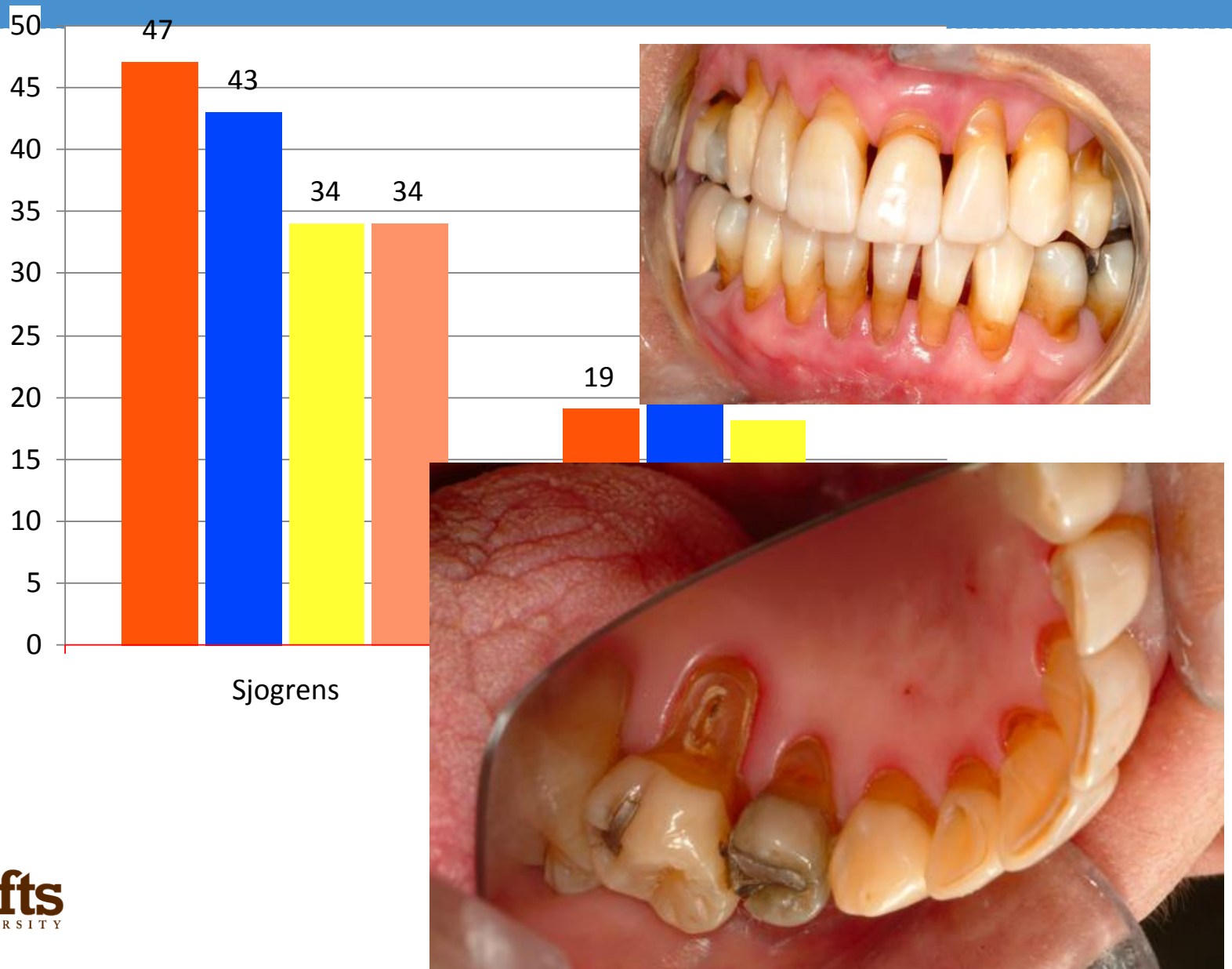
Salivary Flow



Decayed Surfaces



GERD



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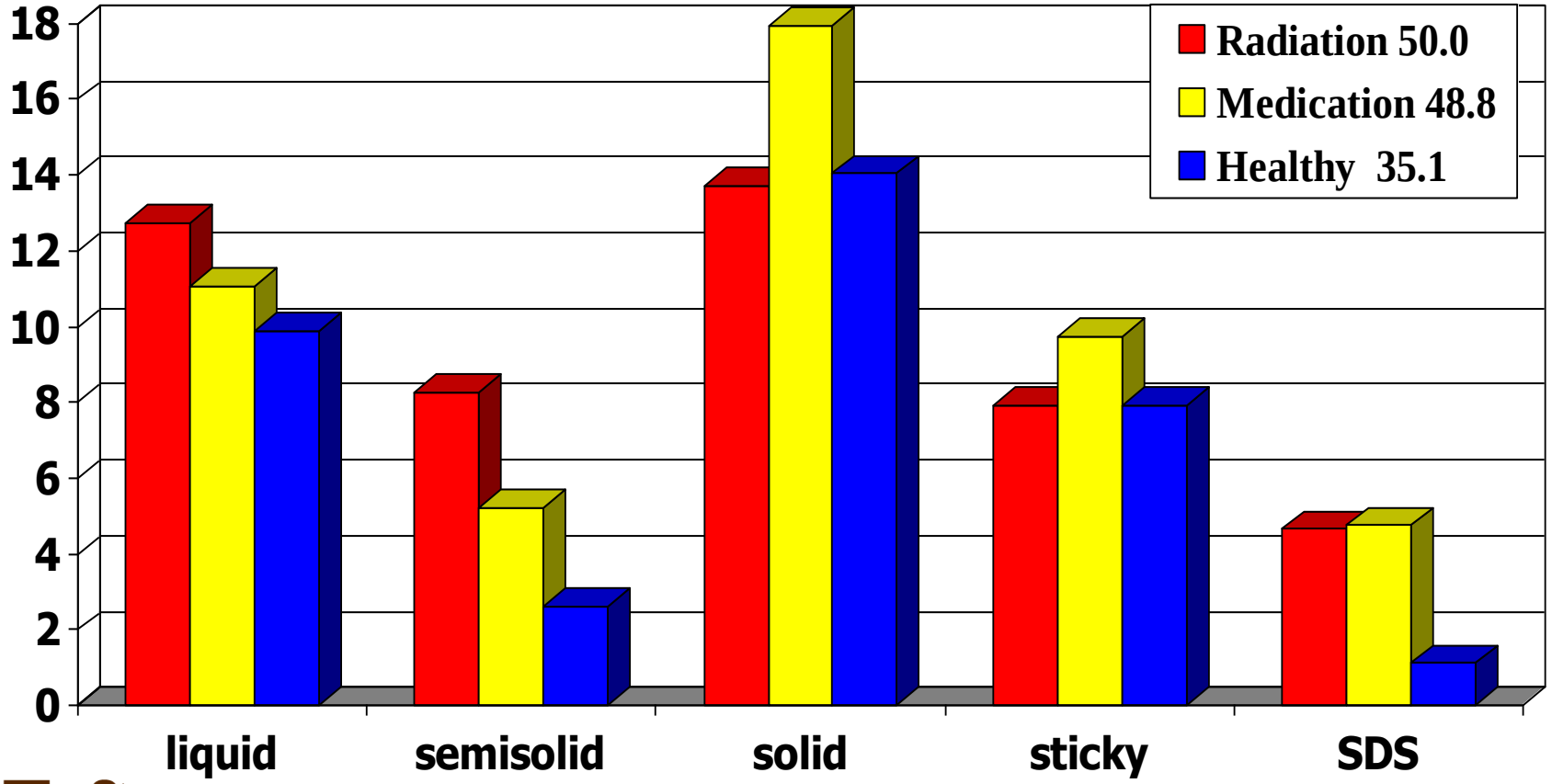
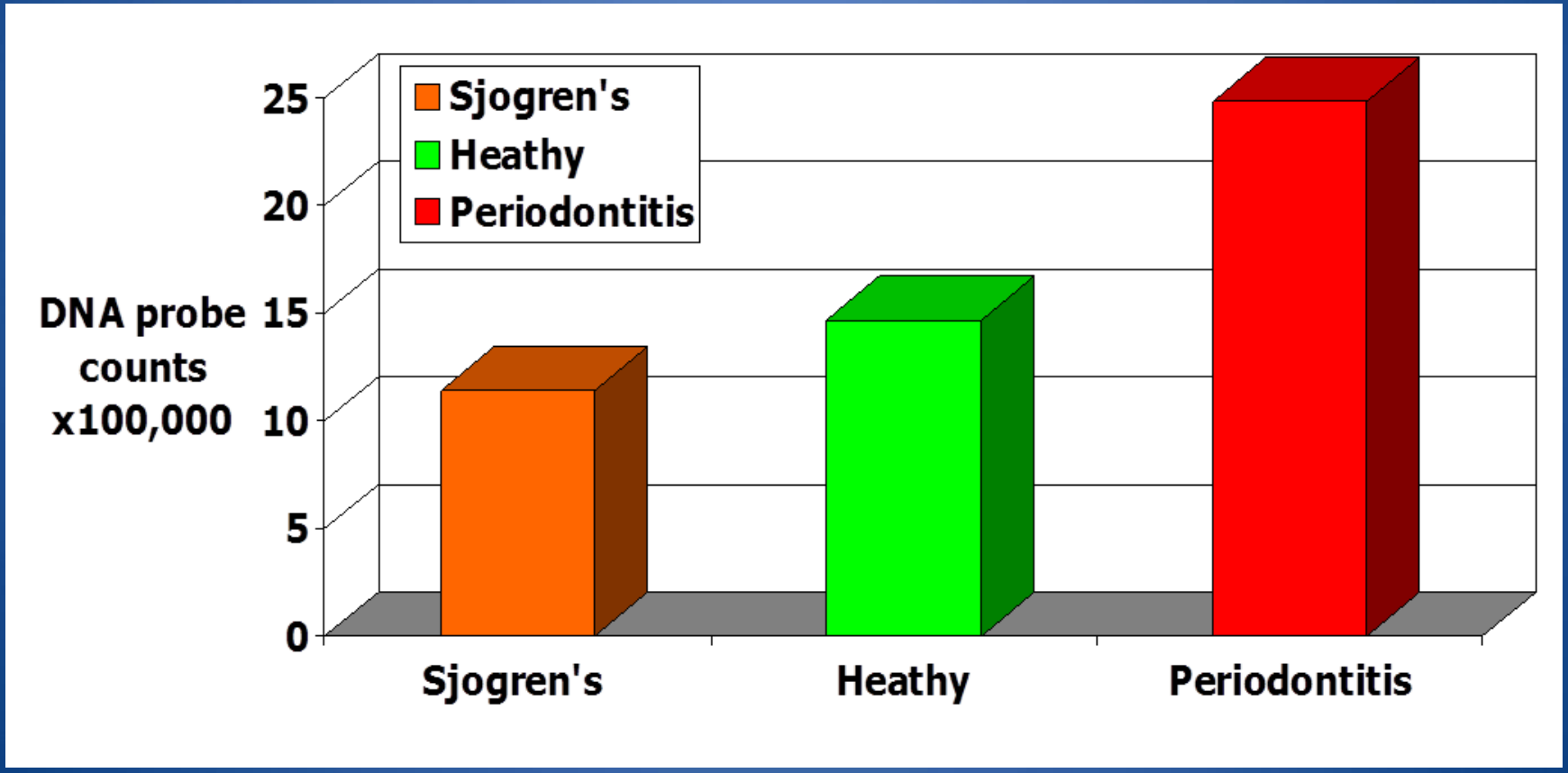
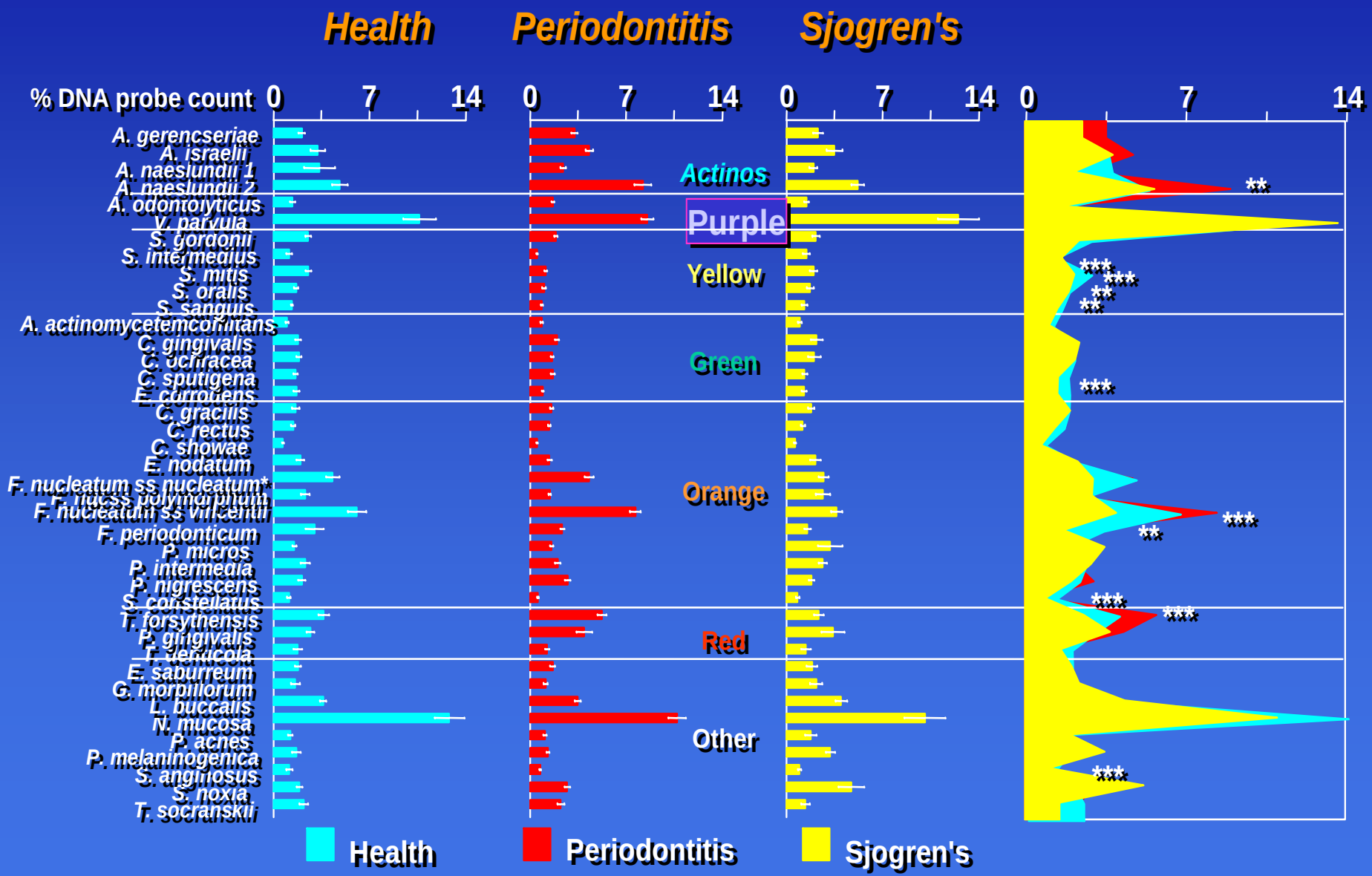
Consumption of Sugars in Radiation, Medication and Healthy Control

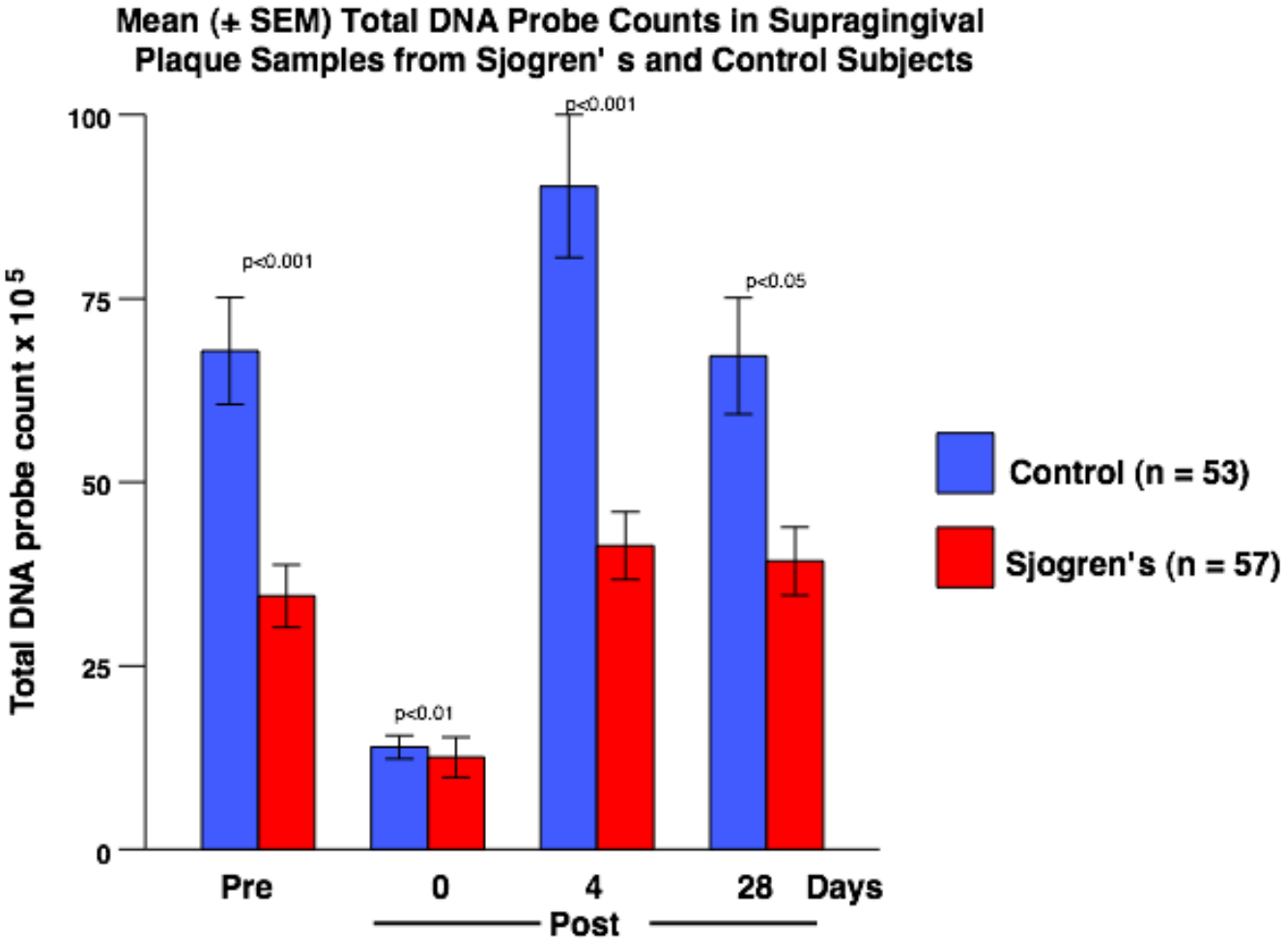


DNA Count of Oral Microbiome



MEAN % (± SEM) OF 40 BACTERIAL SPECIES IN *SUBGINGIVAL* PLAQUE SAMPLES





Funded by NIDCR DE14368

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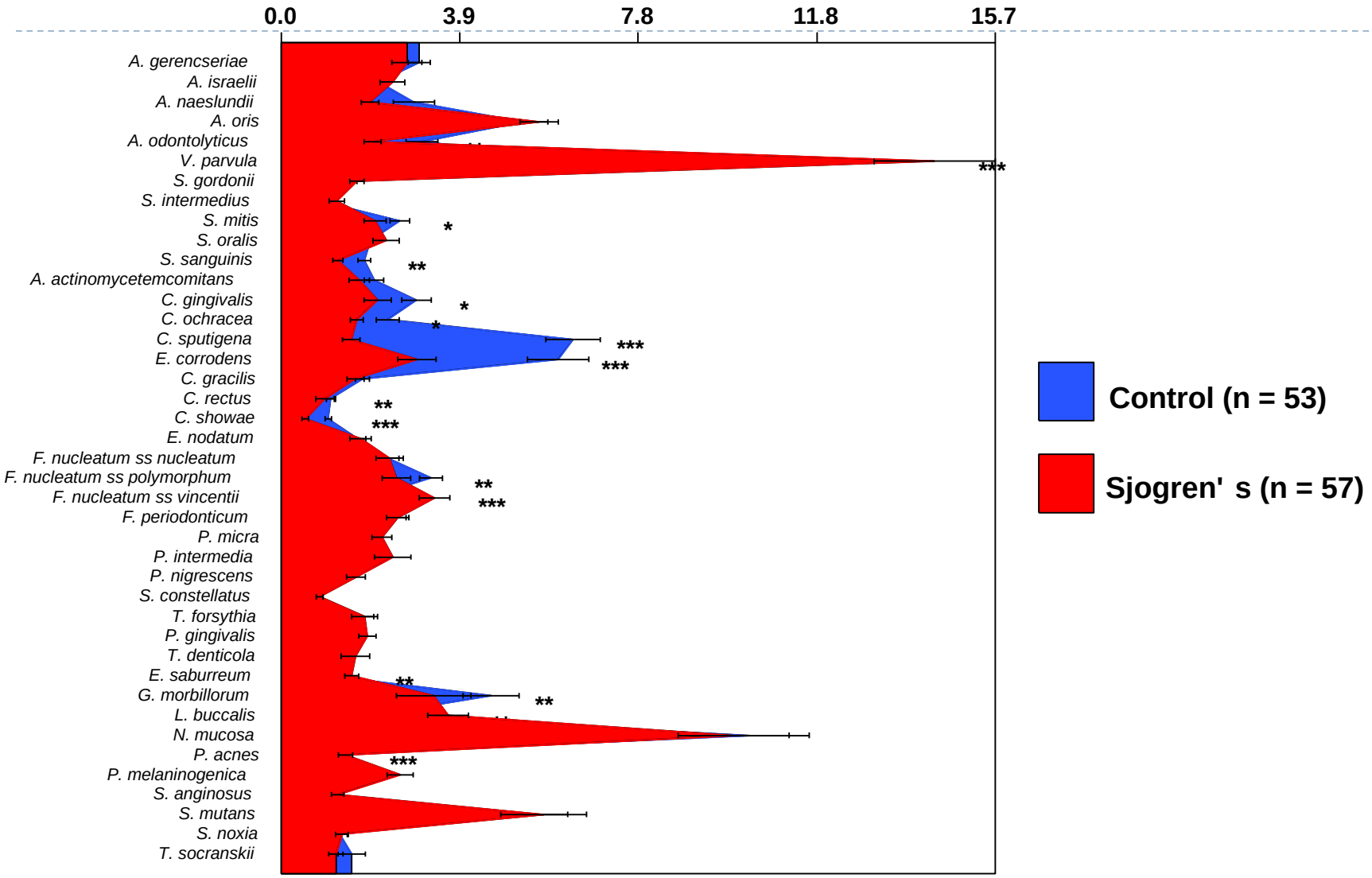
Mean (+_SEM) % DNA probe count in Supragingival Sjögren's and Control Plaque Samples -



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Dietary Findings for Sjögren's Patients

- Consumed less Omega 3 fatty acids
- consumed more carbohydrates
- consumed more sodium
- consumed more tryptophan
- consumed more caffeine (**204mg/ 116mg)**

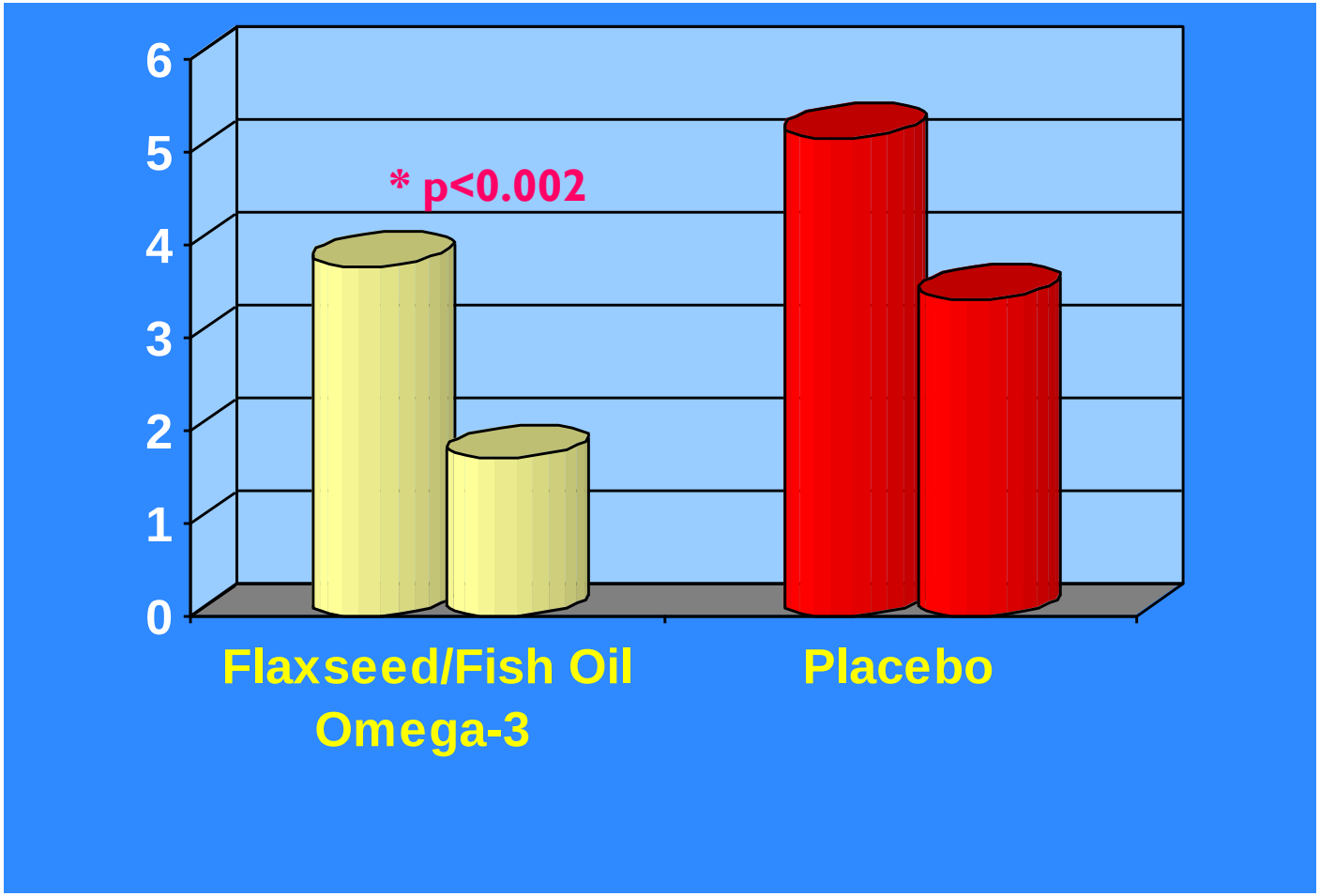
Caffeine has an antinociceptive ,stimulatory effect on secretion(amplifies cholinergic transmission)

With David Sullivan

Intervention with Omega 3 supplements

- Omega 3 fatty acids
- Block the gene expression of the pro-inflammatory cytokines tumor necrosis factor alpha (TNF-a), interleukin-1 a (IL-1a), interleukin-1b (IL-1b), and cyclooxygenase (COX-2).
- It is proposed that the consumption of omega-3s reduce inflammation and block cytokine production which interferes with lacrimal and salivary gland secretion

Periodontal Pockets improved



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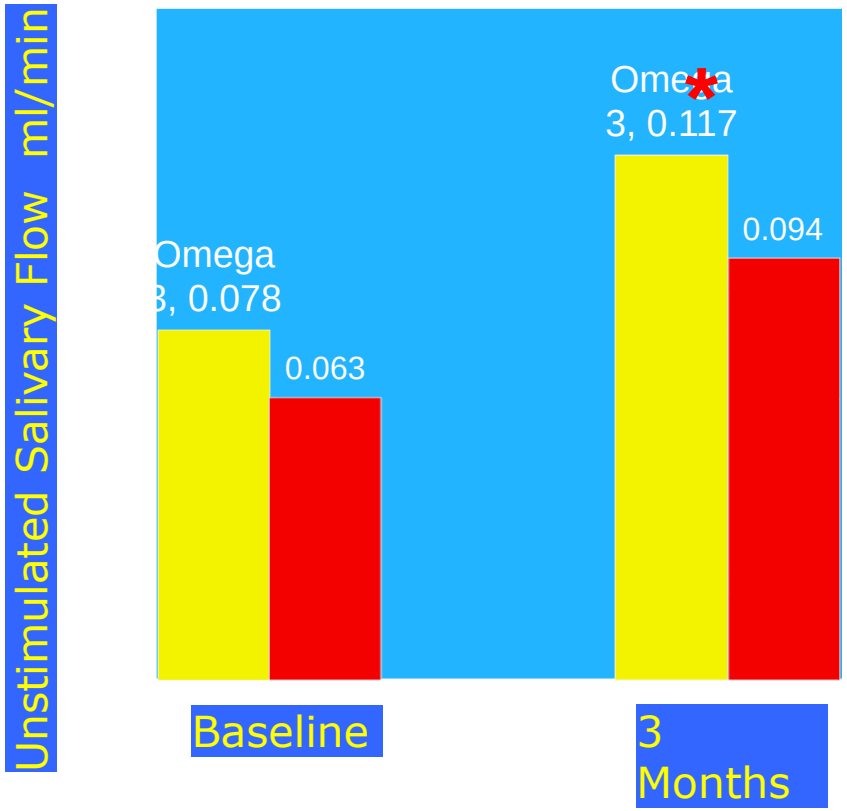
Effect of Omega 3 on Unstimulated Salivary Flow



*p<0.01

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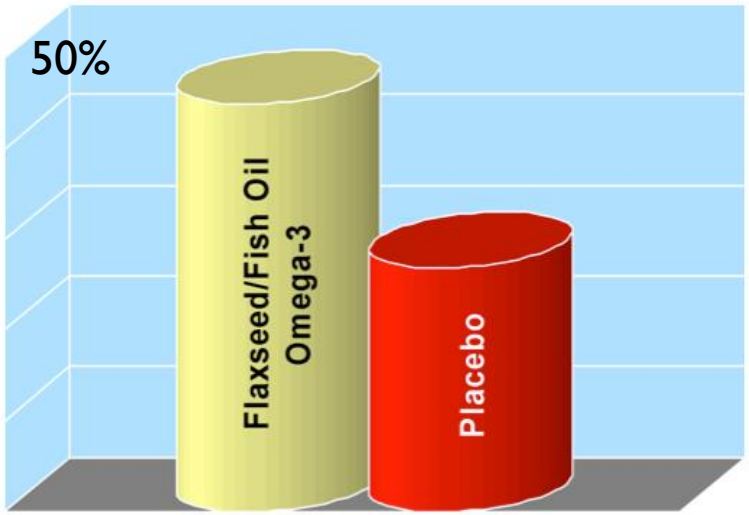
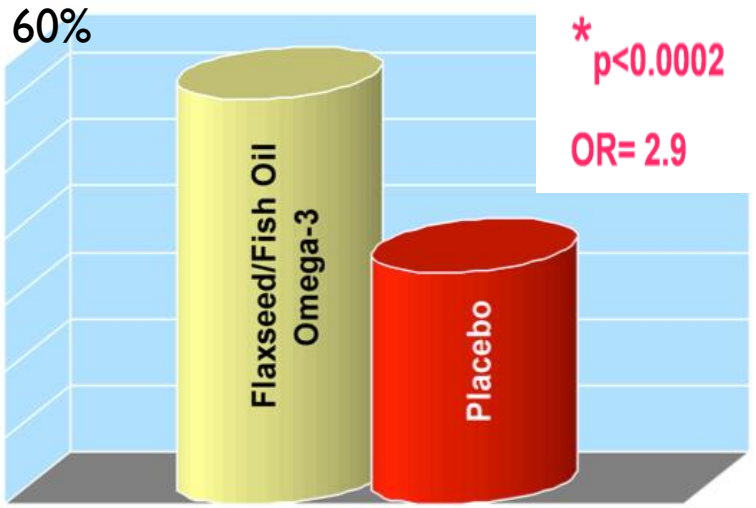
Dry-Eye Symptoms



Dry Mouth Symptoms



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Vitamins A and E may influence the autoimmune processes

- Fat-soluble vitamins possess immunoregulatory
- properties and have been implicated in the development of autoimmune diseases
- .The levels of vitamins A and E are different in
- patients with SS.
- There is a positive correlation between NK, Th1 cells and the plasma levels of vitamin E,
- Th1/Th2 ratio showed a positive correlation with
- The levels of vitamins A and E

Follow-up Mortality Studies were conducted at the Tufts – NSS and NOHS

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NSS Methods for Survival Analysis

- Death Records were obtained using the National Death Index and Obtaining copies of death Certificates, with IRB approval,
  - to determine cause of death of the volunteers
  - To determine factors affecting Survival

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NSS Survival using Proportional Hazzard Regression N=602

Parameter	Estimate	Error	Chi-Square		Hazard Ratio
Age	-0.19638	0.01786	120.8353	<0.0001	0.822
Sex	0.23527	0.13555	3.0126	0.0826	1.265
Dentures	0.33423	0.15808	4.4703	0.0345	1.397
Wine years	-0.00958	0.00401	5.720	0.0168	0.990
Income*	0.0000221	$9.45913E^{-6}$	5.4568	0.0195	1.000
Smoking years	0.00697	0.00335	4.3220	0.0376	1.007

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NOHS Methods

- Death Records were searched, with IRB approval,
  - to determine cause of death of the volunteers.

- This data was compared for baseline data on:
  - Number of teeth present,
  - Number of root tips present,
  - Number of surfaces with pocket depth ≥4 mm.

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Data was obtained after 30 years from National Death Index & Massachusetts Death Registry

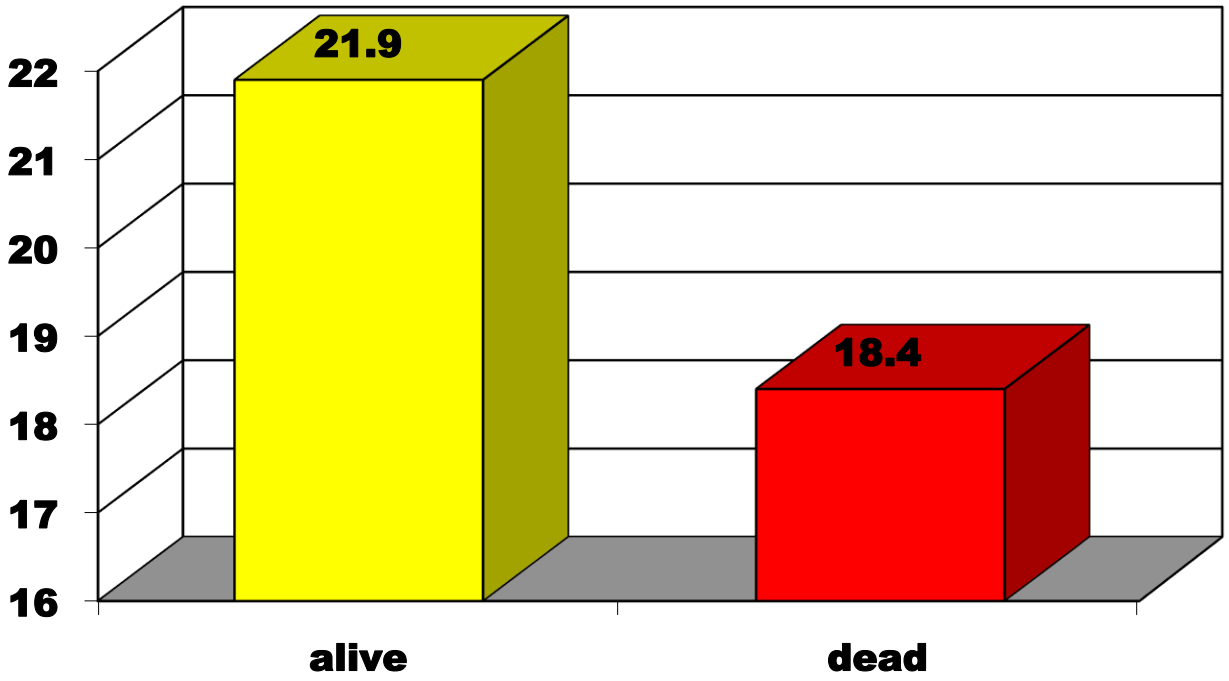
Deceased 82.76

- Race -
  - 90.9% Caucasian
  - 8.5% African Americans
  - .6% Asians
- 51.2% were females
- Had an average of 12.9 years of educations

Survivors 84.01

- Race
  - 88% - Caucasian,
  - 9%-African Americans
  - 3% Asian
- 61.1% were females
- Had an average of 13.8 years of education

The People that Survived Had More Teeth- Dental NOHS Study



$p \leq 0.0001$

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Having more that 23 teeth affected Survival

23+	mean# teeth 25.71	>23	Mean # teeth 15.12 p>.0001
	Education 13.68 year		Education 12.65 years p>.0001
	46% dead		54% dead p>.002

African American had fewer teeth and were less well educated p> .040

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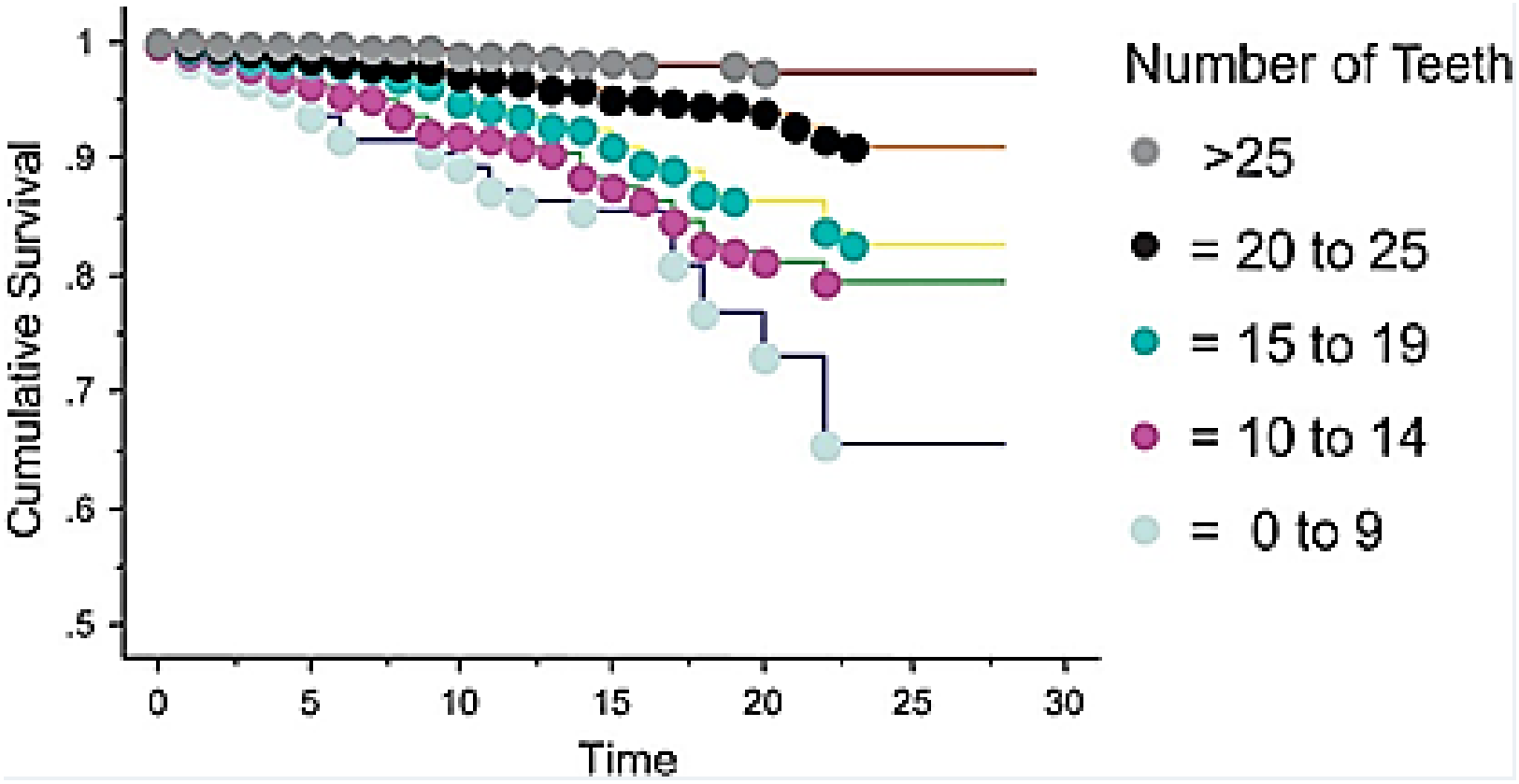
Survival and Number of Teeth N 7684 (20 -89- 12 year survival- Sweden)



Holmlund et al J Perio 2010 81:870-876

Conclusions

- Loss of Dentition may lead to poorer nutritional quality of the diet and can ultimately affect survival
- This was found to be true based on mortality data from 2 Nutritional Studies

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