An historical overview of the role of solar UVB and vitamin D in reducing the risk of dental caries and periodontal disease

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- The Vitamin D Council (California)
- The Vitamin D Society (Canada)

Outline

- Vitamin D physiology
- History of dental caries, solar ultraviolet-B
- Vitamin D and calcium supplement studies
- Correlations between dental caries and periodontal disease and other diseases
- Health benefits of solar UVB and vitamin D
- Sources of vitamin D
- Vitamin D recommendations

Vitamin D

- Vitamin D_3 (cholecalciferol) is made by the action of ultraviolet-B (UVB) on 7-dehydrocholesterol in the skin, followed by a thermal process.
- Solar UVB extends from 290-315 nm
  UVA extends from 315-400 nm
- Vitamin D_3 is converted in the liver to 25-hydroxyvitamin D_3 [25(OH)D], the circulating form.
- 25(OH)D is converted in the kidneys and other organs to 1,25-dihydroxyvitamin D3 [$1,25(OH)_2D3$], the active form of vitamin D.

Vitamin D, continued

- Vitamin D receptors (VDRs) are activated by $1,25(OH)_2D$ and affect gene expression.
- VDRs come in different alleles, with different effects.
- The half life of vitamin D3 is about 4-6 weeks.
- Vitamin D is stored in adipose tissue; 25(OH)D is stored in muscles, and along with $1,25(OH)_2D$, circulates in the blood.
- Vitamin D2 (ergocalciferol) is made from yeast, and is less effective as vitamin D3; however, MDs can prescribe it but not vitamin D3.

Vitamin D Antimicrobial Actions

- The hormonal metabolite of vitamin D, 1,25-dihydroxyvitamin D [1,25$(OH)_2$D] induces production of cathelicidin and defensins, which have both antimicrobial and antiendotoxin properties.
- These polypeptides have been found effective in fighting tuberculosis, pneumonia, septicemia, and oral bacteria, as well as Epstein Barr virus, influenza, and rhinovirus.

Vitamin D Effects on Inflammation

- Vitamin D affects immune cells as follows:
  - Decreases proliferation of dendridic cells
  - In macrophages, decreases IL-6, IL-23, TNF-alpha, increases cathelicidin
  - In T cells, stimulates Th2 response, increases IL-10, decreases Th-1 response, IL-2, IL-17
  - In B cells, decreased proliferation, immunoglobin production

  - Guillot et al., Joint Bone Spine, 2010

Work by May Mellanby, Sheffield

- Edward Mellanby conducted research that established the role of vitamin D deficiency in rickets.
- His wife, May Mellanby, studied the role of vitamin D in reducing risk of dental caries in the 1920s.
- In a study reported in 1924, a diet rich in eggs, milk, and cod liver oil and low in cereals resulted in fewer caries than diets with less calcium and fat soluble vitamins and more cereals

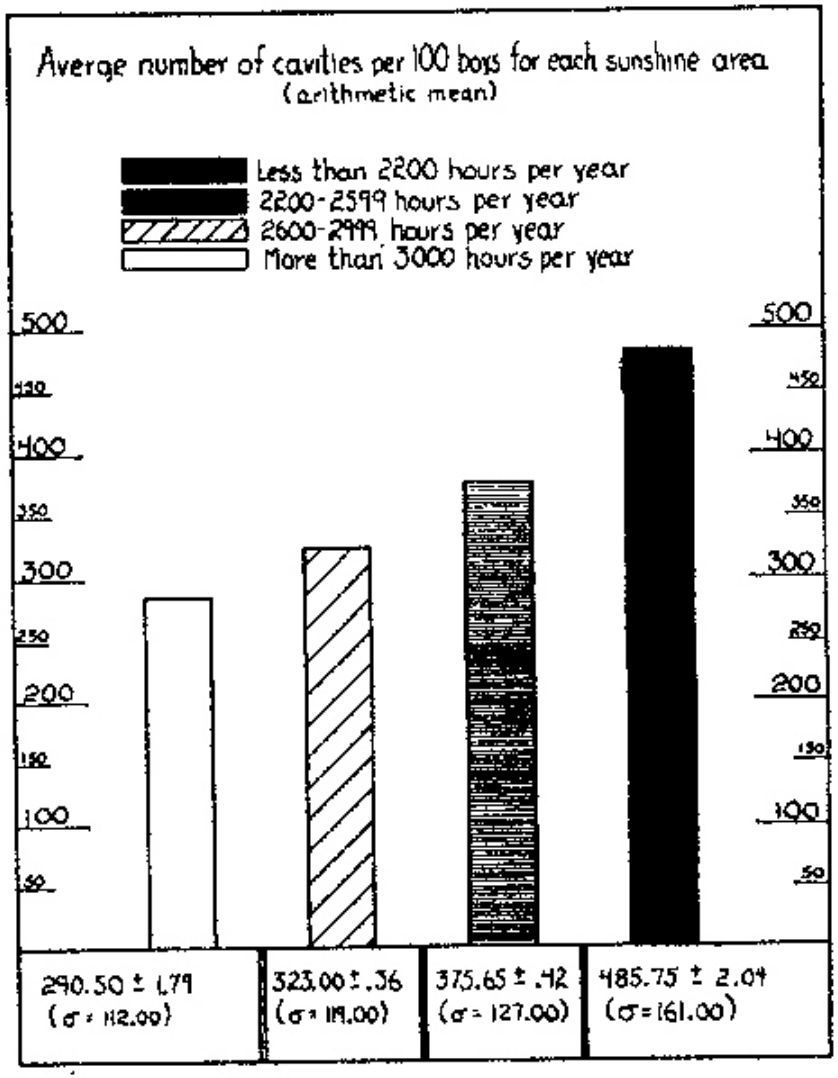
Mellanby, continued

- In 1928, she and C. Lee Pattison reported results of another study in which children were given vitamin D2 (ergocalciferol).
- Those children taking vitamin D2 had fewer caries and a higher degree of hardening of the enamel.
- The mechanism thought to explain the reduced development of caries was increased calcium absorption and better calcium metabolism.

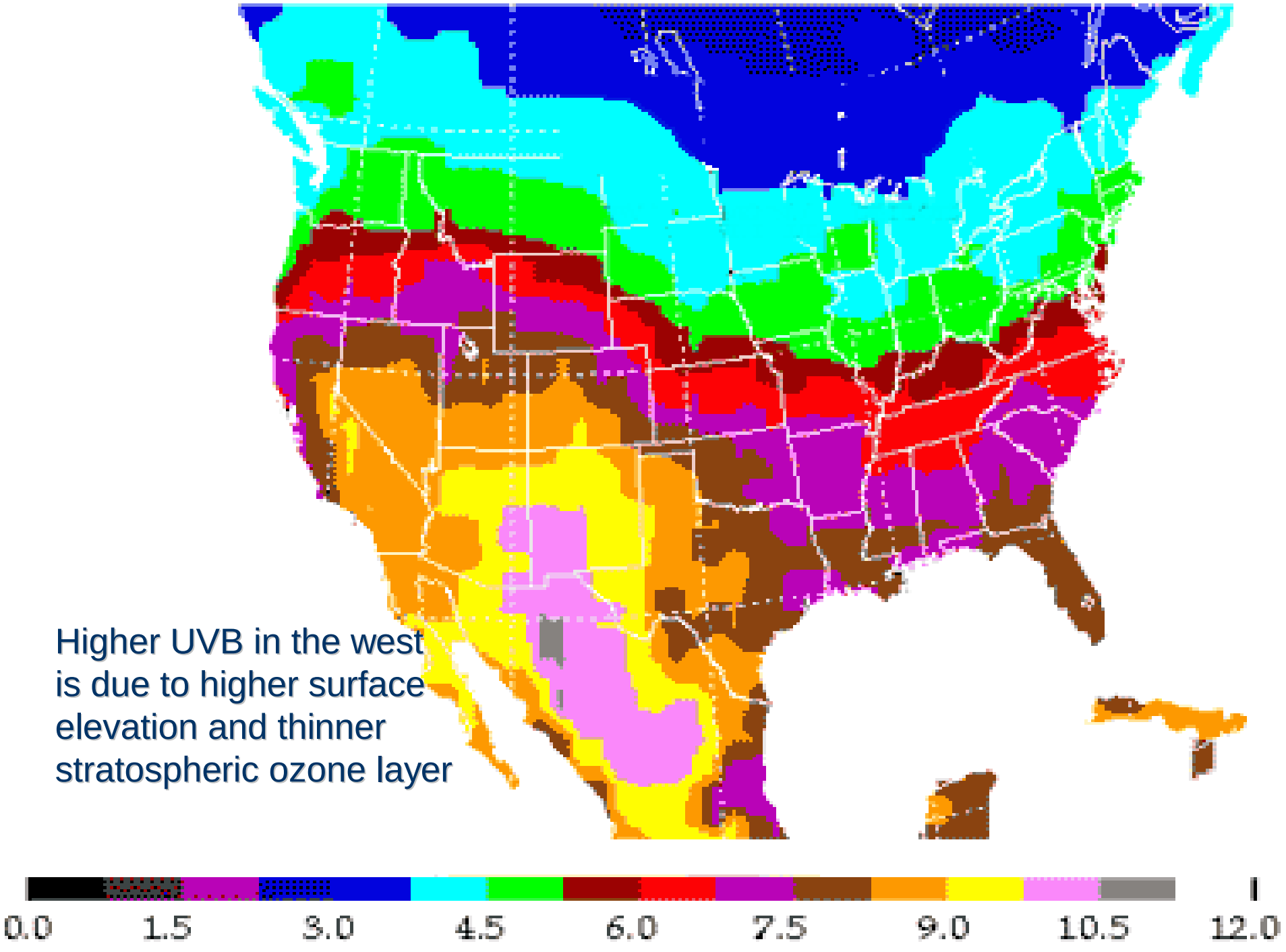
Mellanby, continued

- However, she noted:
- "… the dentinal tubule may contain microorganisms. These, however, are apparently inactive."
- Of course the anti-microbial properties of vitamin D were unknown at that time.
- Reviewed in Grant WB. A review of the role of solar ultraviolet-B irradiance and vitamin D in reducing risk of dental caries. Dermatoendocrinol. 2011;3(3):193-198.

Dental Caries, 12-14 Year Old Males, vs. Hours of Sunlight per Year, in Four US Regions, early 1930s



DNA SPECTRAL EXPOSURE (kJ/m²) FOR JULY 1992



Higher UVB in the west is due to higher surface elevation and thinner stratospheric ozone layer

Dental Health First Half 20th Century

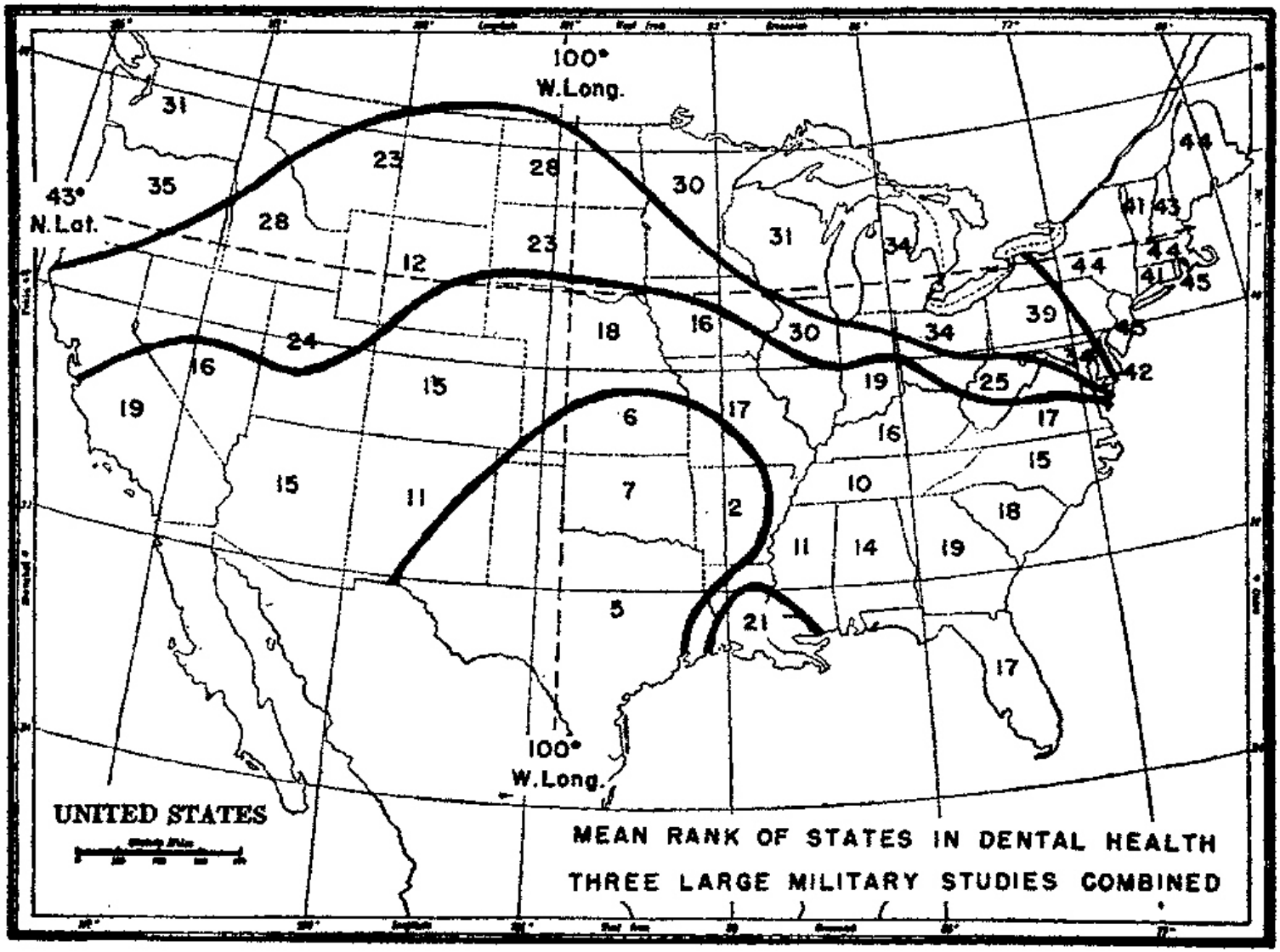
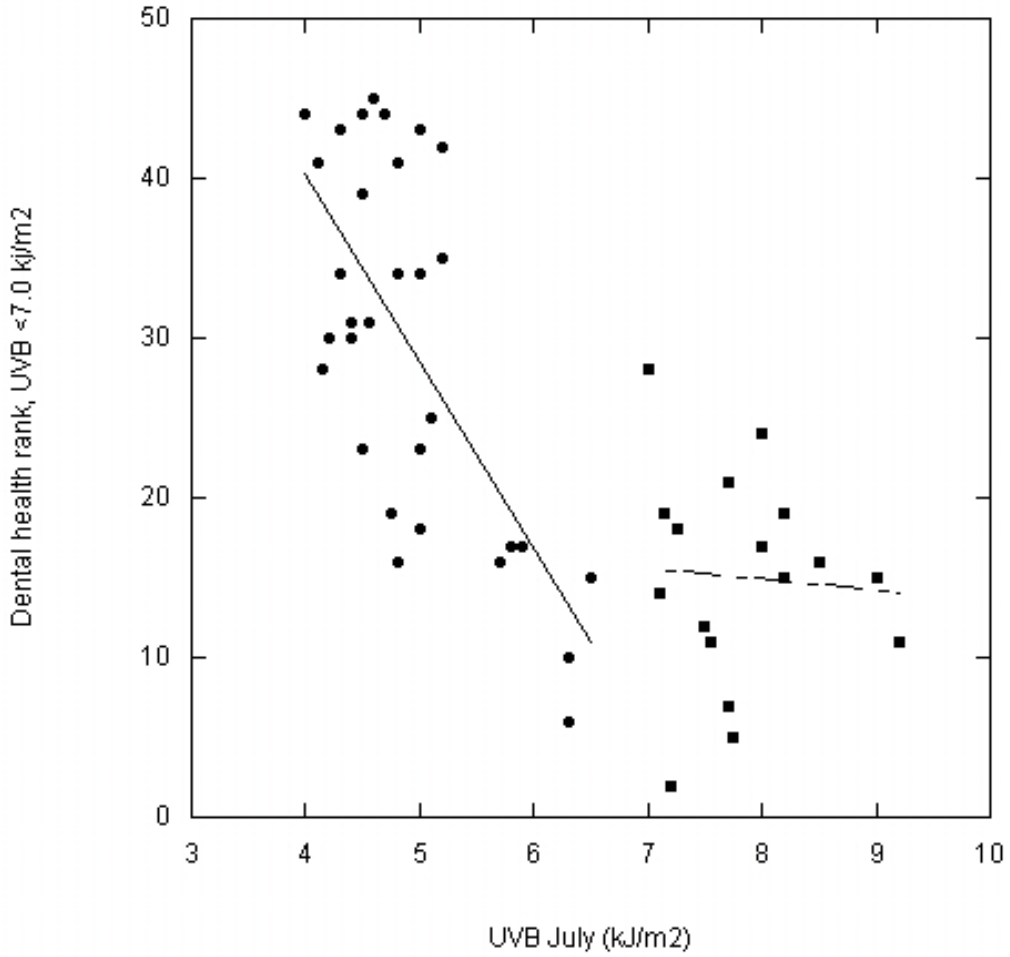
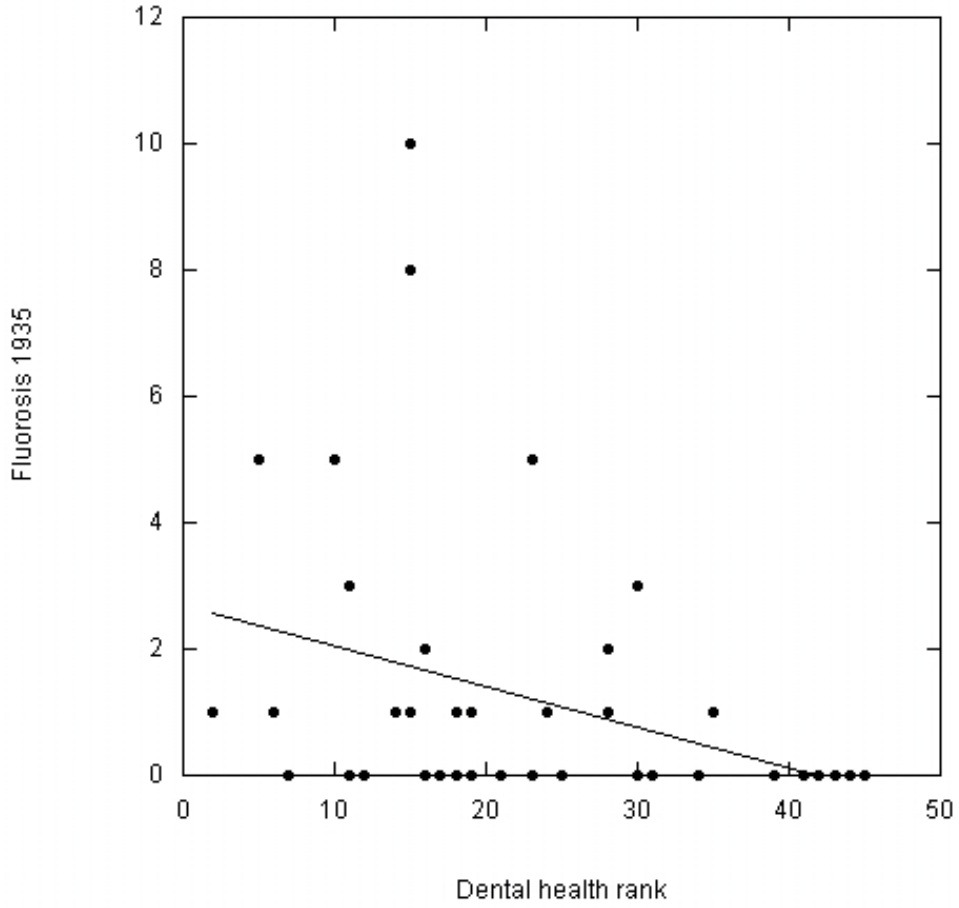


Fig. 1.

Dental Rank, Draftees 1918, 1934, 1943 from Dunning, 1953



Fluorosis 1935 vs. Dental Rank



Periodontal Disease

- An emerging hypothesis is that vitamin D may be beneficial for oral health, not only for its direct effect on bone metabolism but also due to its ability to function as an anti-inflammatory agent and stimulate the production of anti-microbial peptides.

- Stein SH, Tipton DA. Vitamin D and its impact on oral health--an update. J Tenn Dent Assoc. 2011 Spring;91(2):30-3; quiz 34-5.

Mechanisms of Vitamin D in Reducing Risk of PD

- There appear to be several mechanisms whereby vitamin D could reduce the risk of periodontal disease:
  - Increased absorption of calcium and regulation of calcium metabolism
  - Antimicrobial properties
  - Reduced concentration of matrix metalloproteinases (MMPs)
- Grant WB, Boucher BJ. Are Hill's criteria for causality satisfied for vitamin D and periodontal disease? Dermatoendocrinol. 2010 Jan/Feb/Mar;2(1):30-36.

Matrix metalloproteinases (MMPs)

- MMPs are enzymes that assist in modulation of interstitial tissue by digestion of its supportive matrix, especially collagen, and MMP-9, in particular, is known to be present in large amounts in active PD.
- Higher plasma MMP-3, MMP-8, and MMP-9 concentrations have been found in PD patients compared with healthy controls (all $P<0.05$).
- Activated vitamin D has also been shown to suppress the increases in MMP9 formation induced in white cells by tubercle bacilli (60) as well as of MMP-3

Vitamin D and Calcium Supplementation Study

- Total daily calcium and vitamin D intakes were 1,769 mg (95% confidence interval, 1,606 to 1,933) and 1,049 IU (781 to 1,317) in the taker group, and 642 mg (505 to 779) and 156 IU (117 to 195) in the non-taker group, respectively (P <0.001 for both). Clinical parameters of periodontal health improved with time in both groups (P <0.001). When clinical measures were considered collectively, after adjusting for covariates, the P values for the effect of supplementation were as follows: baseline (P = 0.028); 6 months (P = 0.034); and 12 months (P = 0.058).
- Thus, modest beneficial effects.
- J Periodontol. 2011 Jan;82(1):25-32.

The impact of vitamin D status on periodontal surgery outcomes - 1

- Vitamin D regulates calcium and immune function. This longitudinal clinical trial assessed outcomes of periodontal surgery and teriparatide administration in vitamin-D-sufficient and -insufficient individuals. Forty individuals with severe chronic periodontitis received periodontal surgery, daily calcium and vitamin D supplements, and self-administered teriparatide or placebo for 6 wks to correspond with osseous healing time. Serum 25(OH)D was evaluated at baseline, 6 wks, and 6 mos post-surgery. Clinical and radiographic outcomes were evaluated over 1 yr.

The impact of vitamin D status on periodontal surgery outcomes - 2

- Placebo patients with baseline vitamin D deficiency [serum 25(OH)D, 16-19 ng/mL] had significantly less clinical attachment loss (CAL) gain (-0.43 mm *vs*. 0.92 mm, $p < 0.01$) and probing depth (PPD) reduction (0.43 mm *vs*. 1.83 mm, $p < 0.01$) than vitamin-D-sufficient individuals.
- Vitamin D levels had no significant impact on CAL and PPD improvements in teriparatide patients at 1 yr, but infrabony defect resolution was greater in teriparatide-treated vitamin-D-sufficient *vs*. -deficient individuals (2.05 mm *vs*. 0.87 mm, $p = 0.03$).
- Vitamin D deficiency at the time of periodontal surgery negatively affects treatment outcomes for up to 1 yr. Analysis of these data suggests that vitamin D status may be critical for post-surgical healing.
- J Dent Res. 2011 Aug;90(8):1007-12.

Correlation with Other Diseases

- PD has itself been linked to many vitamin D-sensitive diseases (Seymour, 2007; Kuo, 2008; Williams, 2008), including many types of cancer (Michaud, 2008; Fitzpatrick and Katz, 2010), cardiovascular disease (Blaizot, 2009), diabetes mellitus (Dunning, 2009), and pneumonia (Awano, 2008).
- In many association studies, commonly accepted risk factors for PD such as smoking, were included in the analysis but did not explain the association.

Does Cleaning the Oral Cavity of Plaque Reduce the Risk of Disease?

- This study evaluated the role of periodontal pathogens in 50 hospitalized patients with hospital acquired pneumonia compared with 30 healthy controls. Specimens of oropharyngeal aspirate, dental plaque bronchoalveolar lavage and blood cultured 1 or more pathogens in around 80% of patients, predominatel Staphylococcus aureus, followed by coagulase-negative staphylococci, Streptococcus pneumoniae and Klebsiell pneumoniae.
- C-reactive protein (CRP) levels were significantly higher in patients than ii controls and there was a significant correlation between serum and salivary CR1' levels. Dental plaque biofllln may promote oral and oronpharyngeal colonization of respiratory pathogens in hospitalized subiects.
- East Mediterr Health J. 2010 May;16(5):563-9.

[The association of oral microbiota and general health].

- “Oral microbial diseases usually arise from growth of opportunistic pathogens. Predisposing factors for oral infections are contact with pathogen carriers, impaired immune system, poor oral hygiene, and smoking. In chronic periodontitis tooth attachment is lost as a result of inflammation, and pockets formed between the tooth and gingiva.
- Chronic periodontitis is associated with an increased risk for cardiovascular diseases, pulmonary infections, and poor glycemic control of diabetes. This may be due to constant release of pathogenic bacteria and proinflammatory cytokines into the bloodstream.”
- Uitto VJ, Nylund K, Pussinen P. Duodecim. 2012;128(12):1232-7.

[Cardiovascular diseases and periodontal diseases] - 1

- “Accumulated evidence has strongly suggested that the long-term effects of periodontal diseases can be linked to more serious systemic conditions such as cardiovascular diseases, diabetes, and complications of pregnancy. Especially, a prevalence of coronary heart disease was found to be significantly increased in patients with periodontitis after adjusting for risk factors such as smoking, diabetes, alcohol intake, obesity, and blood pressure.“

[Cardiovascular diseases and periodontal diseases] - 2

- “Furthermore, various studies have shown that Porphyromonas gingivalis, a major periodontal pathogen, is able to exacerbate atherosclerosis following oral-hematogenous spread due to the bacteremia. By P. gingivalis, endothelial cells activate and upregulate various adhesion molecules, thus increasing the likelihood of macrophage diapedesis and subsequent conversion to foam cells thus furthering athroma progression. These findings likely indicate the tight relationship between periodontitis/ periodontal pathogens and cardiovascular diseases.”
- Amano A, Inaba H. Clin Calcium. 2012 Jan;22(1):43-8.

Periodontal bacteria and hypertension - 1

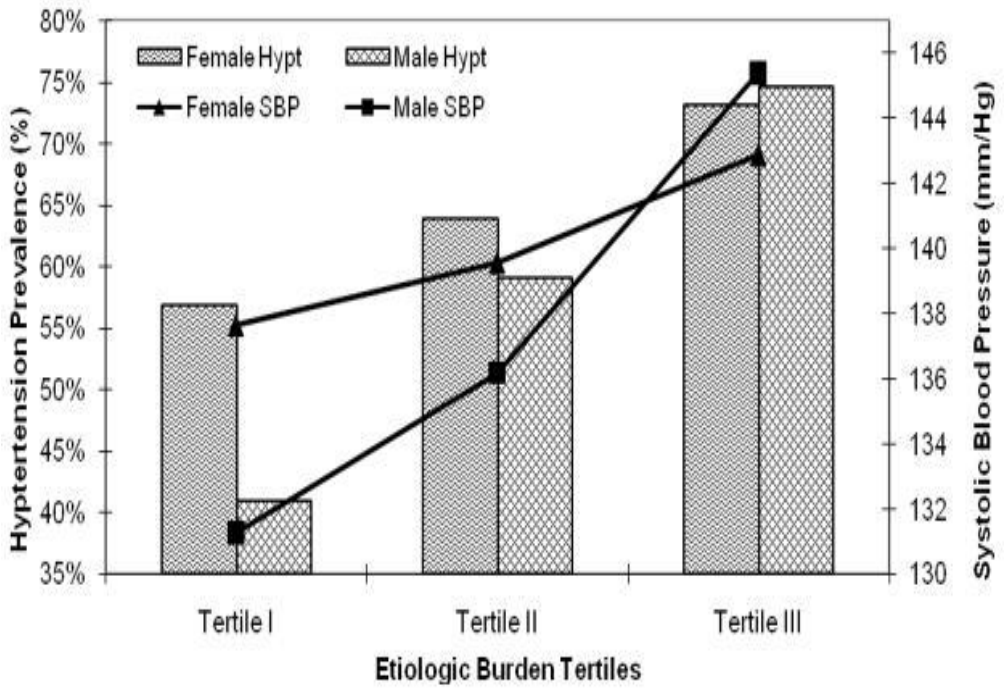
- Six hundred and fifty-three dentate men and women with no history of stroke or myocardial infarction were enrolled in INVEST. We collected 4533 subgingival plaque samples (average of seven samples per participant). These were quantitatively assessed for 11 periodontal bacteria using DNA-DNA checkerboard hybridization. Cardiovascular risk factor measurements were obtained. Blood pressure and hypertension (SBP > or =140 mmHg, DBP > or =90 mmHg or taking antihypertensive medication, or self-reported history) were each regressed on the level of bacteria: considered causative of periodontal disease (etiologic bacterial burden); associated with periodontal disease (putative bacterial burden); and associated with periodontal health (health-associated bacterial burden).

Periodontal bacteria and hypertension: - 2

- All analyses were adjusted for age, race/ethnicity, sex, education, BMI, smoking, diabetes, low-density lipoprotein and high-density lipoprotein cholesterol. Etiologic bacterial burden was positively associated with both blood pressure and prevalent hypertension. Comparing the highest and lowest tertiles of etiologic bacterial burden, SBP was 9 mmHg higher, DBP was 5 mmHg higher (P for linear trend was less than 0.001 in each case), and the odds ratio for prevalent hypertension was 3.05 (95% confidence interval 1.60-5.82) after multivariable adjustment.

- Desvarieux M, et al. J Hypertens. 2010 Jul;28(7):1413-21.

Blood Pressure vs. Etiologic Bacterial Burden



Sex Specific Systolic Blood Pressure and Hypertension Prevalence across Tertiles of Etiologic Bacterial Burden: Adjusted for health associated and protective bacterial burdens, age, body-mass index, race/ethnicity, smoking, education, diabetes, HDL-C and LDL-C;

J Hypertens. 2010 Jul;28(7):1413-21..

Tooth loss and cardiovascular disease mortality risk - 1

- “We used a prospective cohort design and data from the Scottish Health Survey. We combined data from surveys in 1995, 1998, 2003 and linked this to mortality records. Dental status was classified through self-reports as natural teeth only, natural teeth and dentures, and no natural teeth (edentate). Cox proportional hazards models were used to estimate risk of CVD mortality by dental status adjusting for potential confounders. The sample consisted of 12871 participants. They were followed for 8.0 (SD: 3.3) years.”

Tooth loss and cardiovascular disease mortality risk - 2

- During 103173 person-years, there were 1480 cases of all-cause mortality, 498 of CVD, and 515 of cancer. After adjusting for demographic, socio-economic, behavioural and health status, edentate subjects had significantly higher risk of all-cause (HR, 1.30; 95% CI, 1.12,1.50) and CVD mortality (HR, 1.49; 95% CI, 1.16,1.92) compared to subjects with natural teeth only. Dental status was not significantly associated with cancer mortality in fully adjusted analysis. Further analysis for CVD mortality showed that in the fully adjusted model, edentate subjects had 2.97 (95% CI, 1.46, 6.05) times higher risk for stroke-related mortality.
- PLoS One. 2012;7(2):e30797.

Periodontal Disease and Pancreatic Cancer

- Antibodies to periodontal disease bacteria are associated with pancreatic cancer in a European study.
- Antibodies to beneficial oral bacteria are inversely correlated with pancreatic cancer.
- Does serum 25(OH)D concentration explain the link?
- Michaud et al. Plasma antibodies to oral bacteria and risk of pancreatic cancer in a large European prospective cohort study. Gut doi:10.1136/gutjnl-2012-303006.

Periodontal Disease and Adverse Pregnancy Outcomes

- Periodontal disease during pregnancy is associated with low birth weight, premature delivery, gestational diabetes, hypertention, pre-eclampsia, miscarriage, primary Cesarean section delivery, etc.
- Thus, diagnosis of periodontal disease during pregnancy is a warning flag, very likely of vitamin D deficiency.

Pregnancy and Vitamin D

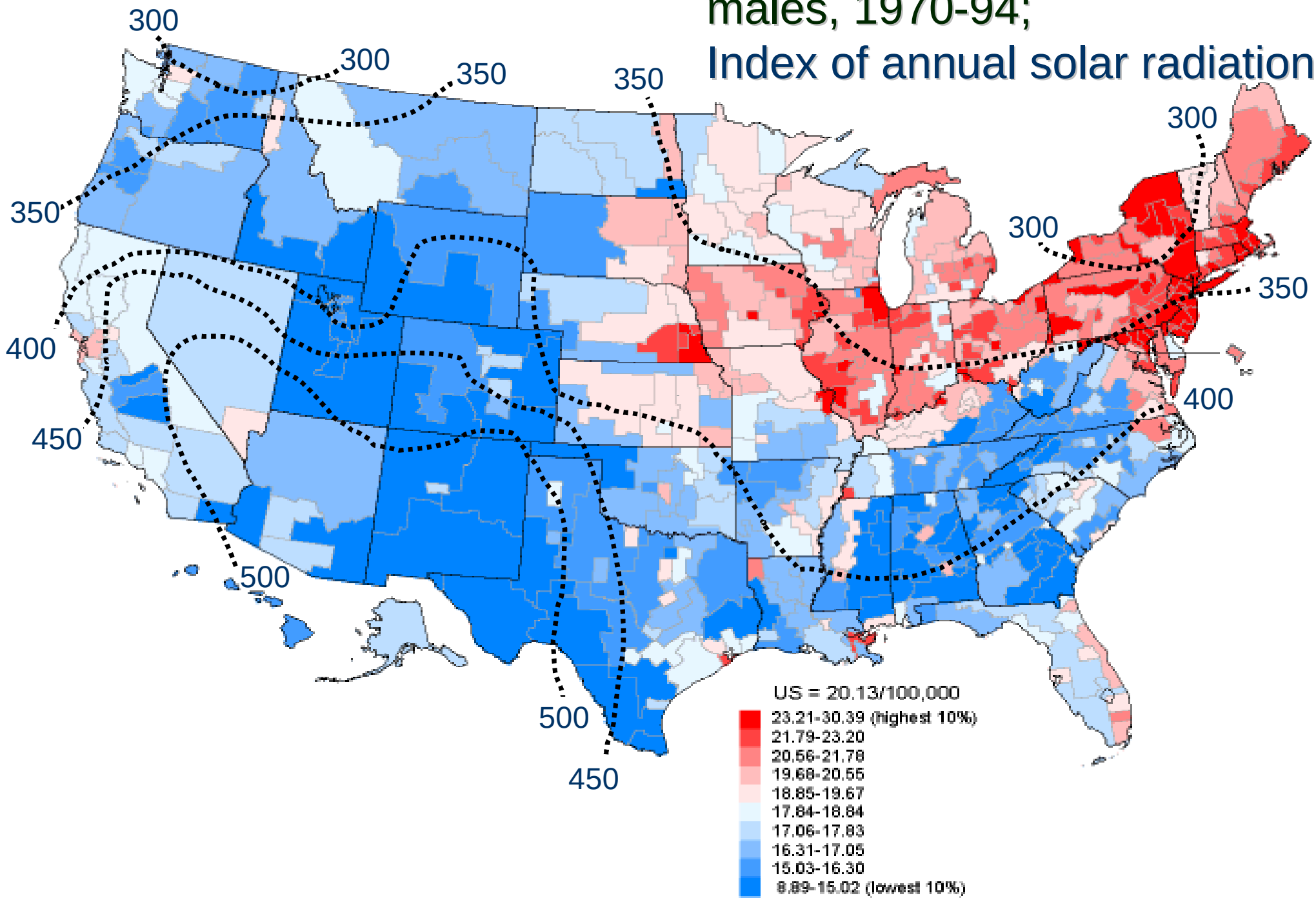
- Pregnant women with PD should be advised to take 4000 IU/d vitamin D3 and achieve a serum 25(OH)D concentration of 40 ng/ml.
- A randomized controlled trial found that these values were required in order to get 1,25-dihydroxyvitamin D concentrations to optimal values.
- There were no adverse effects.

- Hollis BW, et al. Vitamin D supplementation during pregnancy: double-blind, randomized clinical trial of safety and effectiveness. J Bone Miner Res. 2011 Oct;26(10):2341-57.

Evidence that Vitamin D Reduces the Risk of Many Types of Disease

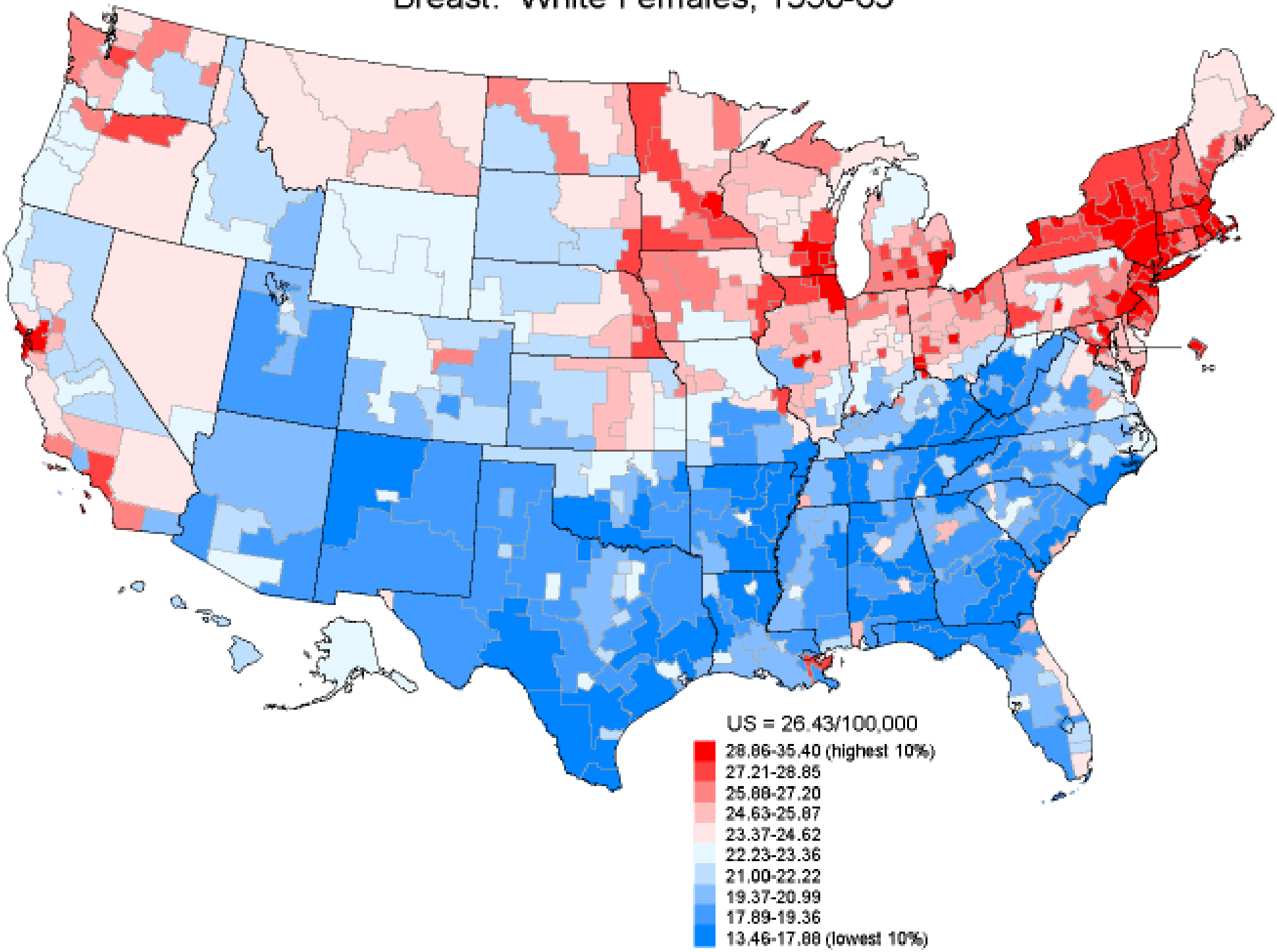
- The major diseases with strong evidence that vitamin D reduces risk include:
  - Cancer – at least 18 types
  - Cardiovascular disease (coronary heart disease, stroke, peripheral arterial disease, and congestive heart failure)
  - Diabetes mellitus, types 1 and 2
  - Respiratory infections
  - Autoimmune diseases (multiple sclerosis)
  - Falls and Fractures

Colon cancer mortality rates, males, 1970-94; Index of annual solar radiation



Cancer Mortality Rates by State Economic Area (Age-adjusted 1970 US Population)

Breast: White Females, 1950-69



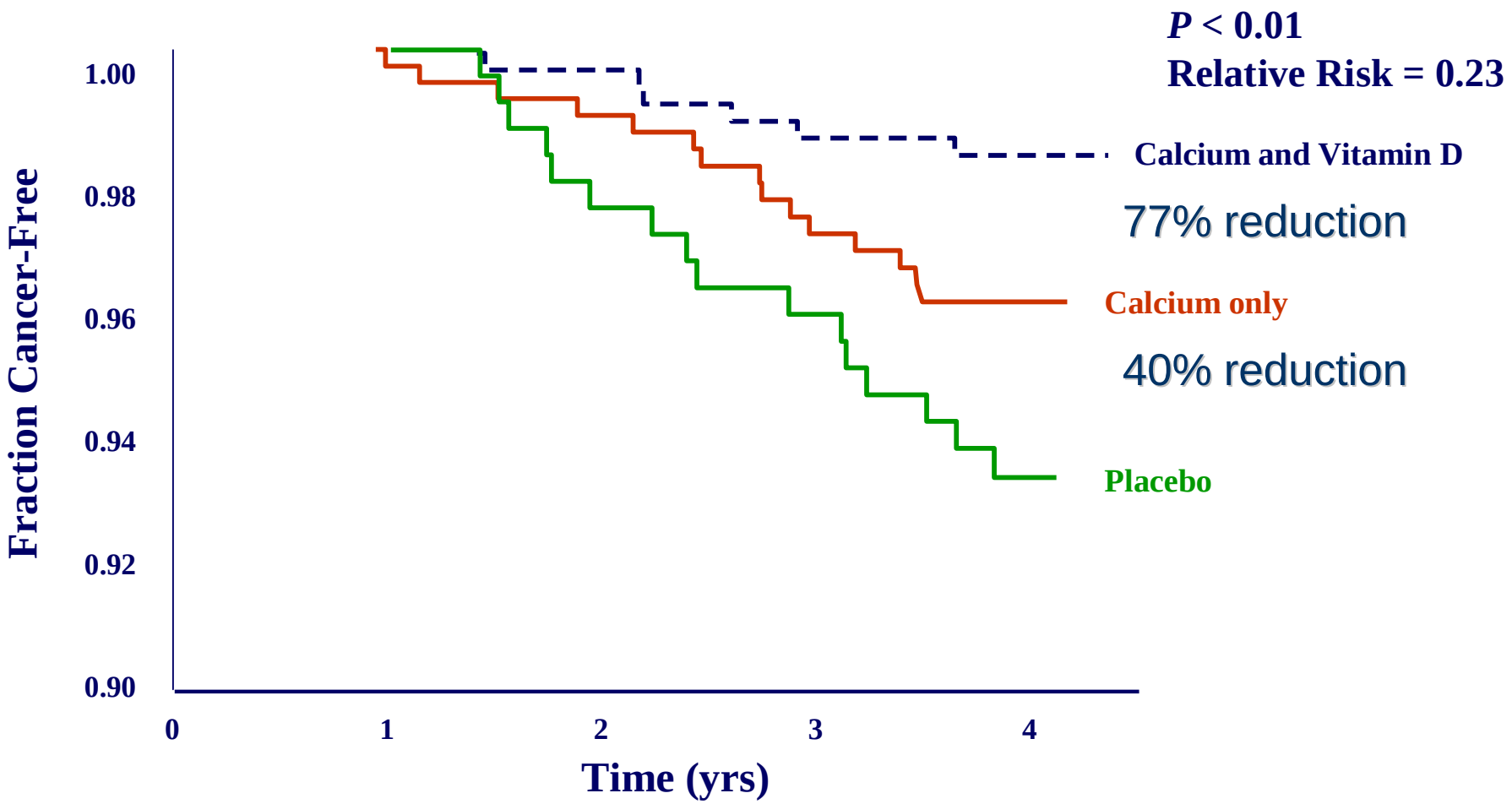
RCT and All-Cancer Incidence

Recent prospective study of vitamin D_3 and calcium and cancer risk in post-menopausal women in Nebraska[1]

- 1100 IU of vitamin D_3 and/or 1400 mg of calcium per day, or a placebo.
- Serum calcidiol levels rose from 71.8 nmol/L (28.7 ng/mL) to 96.0 nmol/L (38.4 ng/mL)
- The all-cancer incidence for women over the age of 55 years at time of enrollment was reduced by 77% between the ends of the first and fourth years of the study.

1. Lappe JM, Travers-Gustafson D, Davies KM, Recker RR, Heaney RP. Vitamin D and calcium supplementation reduces cancer risk: results of a randomized trial. Am J Clin Nutr 2007 Jun; 85(6): 1586-91.

All Except First Year Cases



Source: Lappe JM, Travers-Gustafson D, Davies KM, Recker RR, Heaney RP. Vitamin D and calcium supplementation reduces cancer risk: results of a randomized trial. Am J Clin Nutr. 2007;85:1586-91.

18 Vitamin D-Sensitive Cancers

- Vitamin D-sensitive cancers with strong support after accounting for other factors:
  - Gastrointestinal: colon, esophageal, gallbladder, gastric, pancreatic, rectal
  - Urinary: bladder, kidney
  - Other: lung, melanoma
  - Male: prostate
  - Female: breast, cervical, endometrial, ovarian, vulvar
  - Blood: Hodgkin's and non-Hodgkin's lymphoma

Hill's Criteria for Causality in a Biological System

- A. Bradford Hill [1965] laid down criteria for causality in a biological system . The main criteria are:
  - Strength of association
  - Consistency (repeated in different populations)
  - Biological gradient
  - Plausibility (mechanisms)
  - Experiment (e.g., randomized controlled trial)
  - Analogy
  - (Account for confounding factors)

Hill's Criteria Applied to Cancer

- Strength of association – yes
- Consistency – yes – ecological studies in Australia, China, France, Japan, Spain, United States; case-control studies for breast cancer in four countries
- Biological gradient – yes, both UVB and 25(OH)D
- Plausibility (mechanisms) - yes
- Experiment – yes (two randomized controlled trials)
- Analogy – yes, similar geographical findings for dental caries (shown earlier)
- (Account for confounding factors) - yes

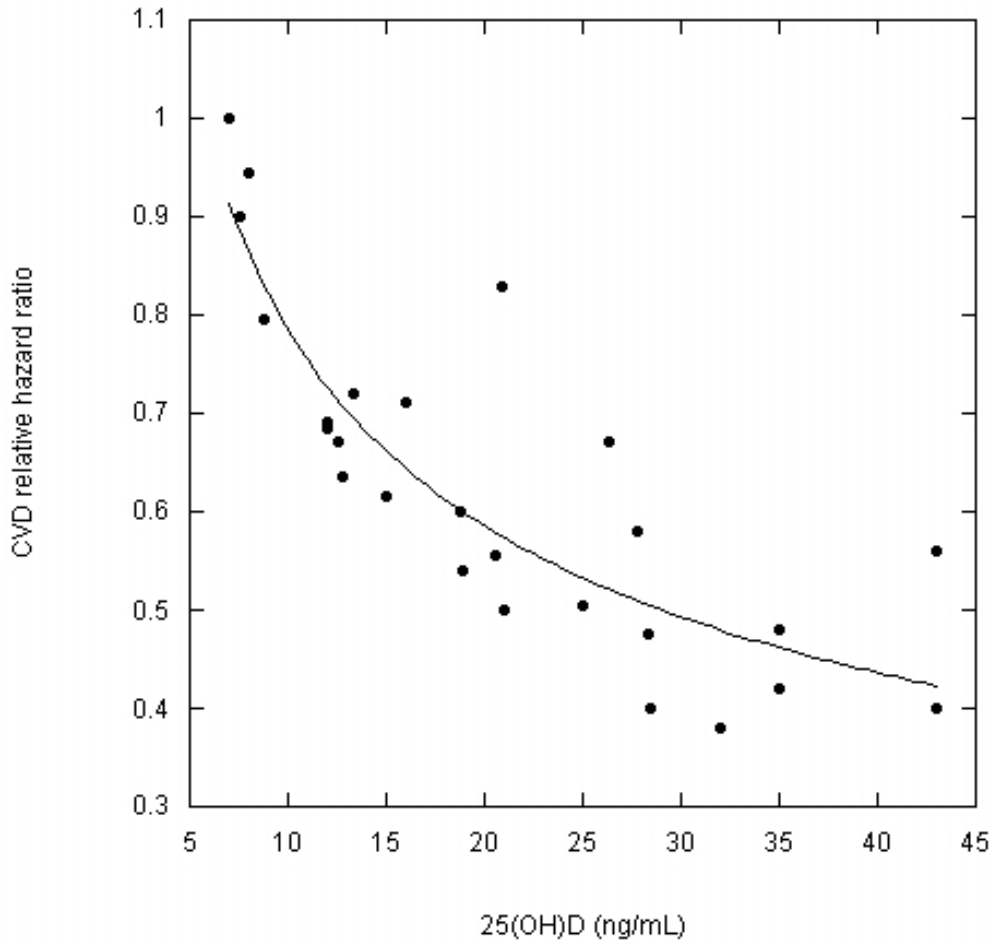
Vitamin D and Cardiovascular Disease

- Several recent observational studies found that those with lower serum 25(OH)D had higher risk of cardiovascular disease (coronary heart disease and/or stroke) incidence or mortality rate.
- The hazard or odds ratios were as high as a factor of two or more for <25 nmol/L vs. >75 nmol/L.
- Dobnig et al., 2008; Giovannucci et al., 2008; Ginde et al., 2009; Kilkkinen et al., 2009.

Pooled Analysis – Cardiovascular Disease Incidence and Mortality Rate vs. 25(OH)D Concentration

Data from
Dobnig, 2008;
Giovannucci, 2008;
Ginde, 2009;
Kilkkinen, 2009

Similar results were reported in Anderson et al., Am J Cardiol. 2010



Caveats Regarding Cardiovascular Disease (CVD) and Vitamin D

- There are no studies showing that geographical variations in solar UVB doses are correlated with CVD risk.
- However, CVD risk is about 20% higher in winter than in summer, even in sunny and warm countries.
- There are no randomized controlled trials showing that vitamin D reduces the risk of CVD.
- The mechanisms are not well understood, but may involve reduction in inflammation and arterial calcification.

Type 2 Diabetes Mellitus

- Vitamin D and calcium have been found inversely correlated with incidence and prevalence of type 2 diabetes mellitus.

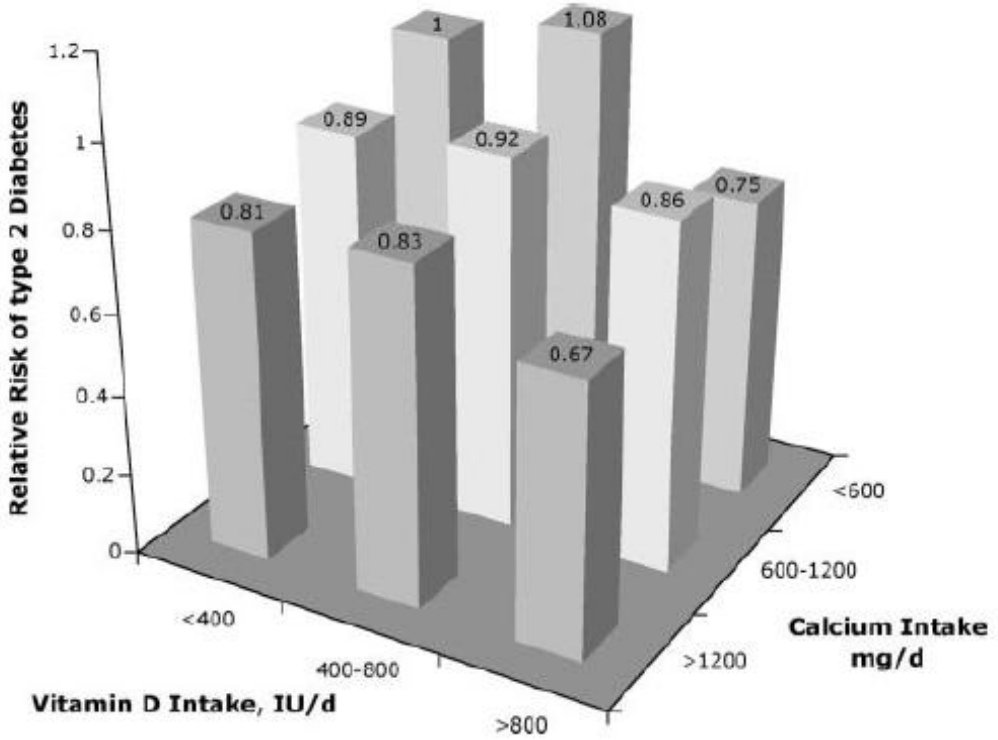
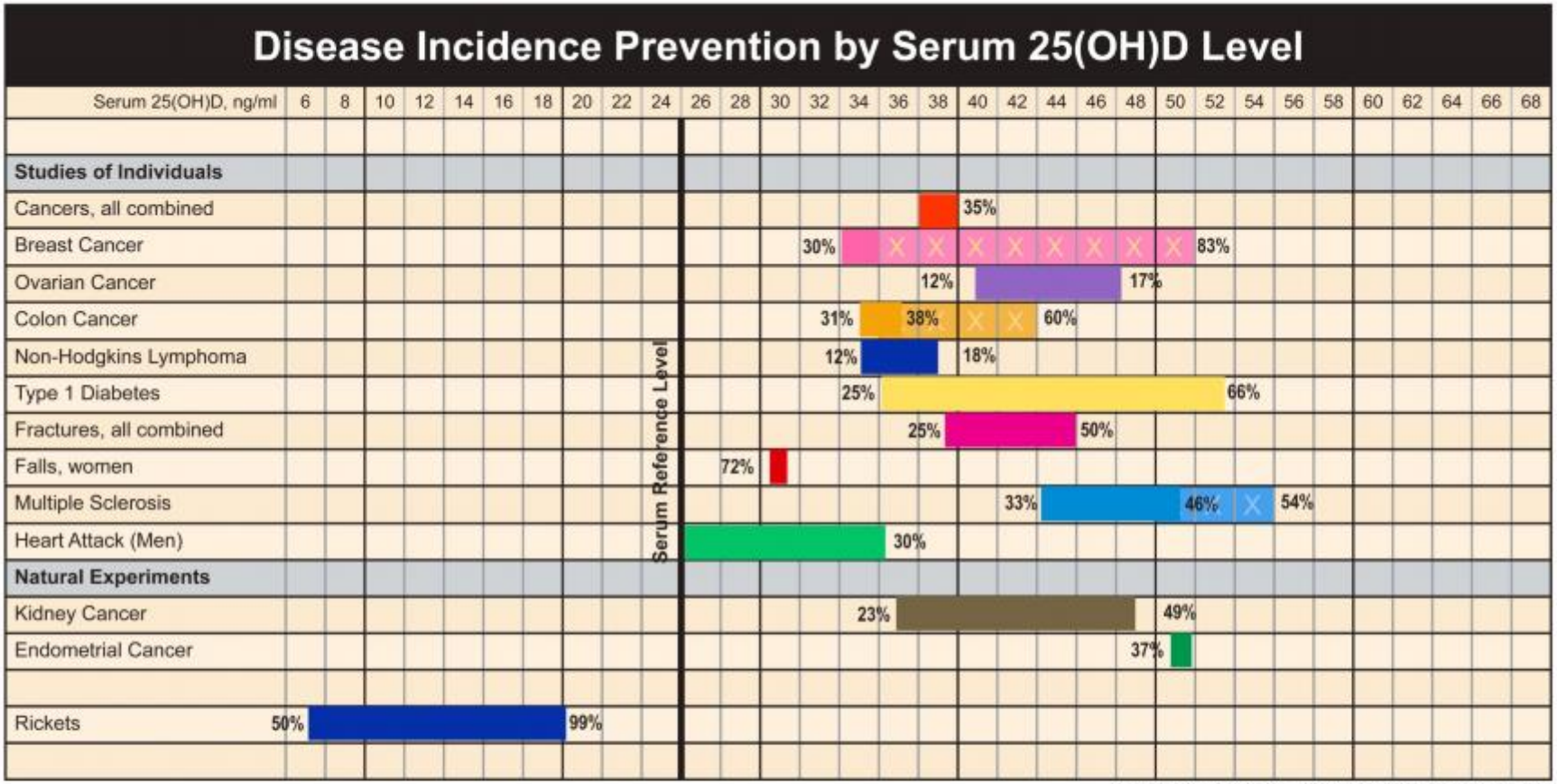


FIG. 1. Adjusted relative risk of incident type 2 DM in the Nurses Health Study by calcium and vitamin D intake (52).

Pittas, Diabetes Care. 2006 Mar;29(3):650-6.

Autoimmune Diseases

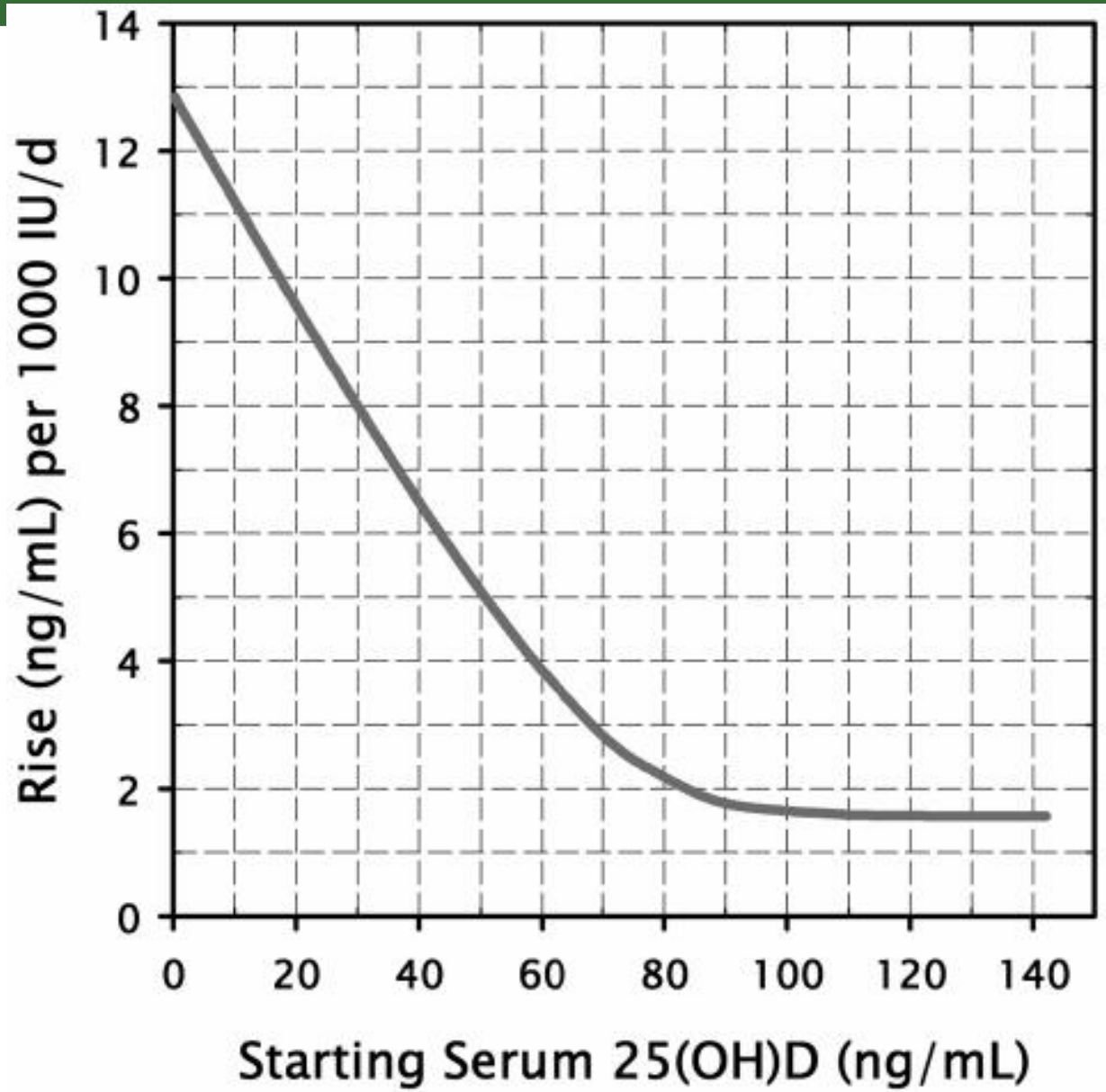
- Several types of autoimmune diseases appear to be the result of viral infections, especially early in life:
  - Asthma
  - Diabetes mellitus, type 1
  - Multiple sclerosis (Epstein-Barr virus as risk factor)
- The primary beneficial role of vitamin D in reducing risk of autoimmune diseases is reduced risk of viral infections.
- An additional mechanism is regulation of cytokine production by $1,25(OH)_2D$, shifting from production of Th1 cells and inflammatory cytokines (IL-2, IL-5, IFN-gamma, and TNF-alpha) to Th2 cells and other cytokines (IL-4, IL-10).



**All percentages reference a common baseline of 25 ng/ml as shown on the chart.

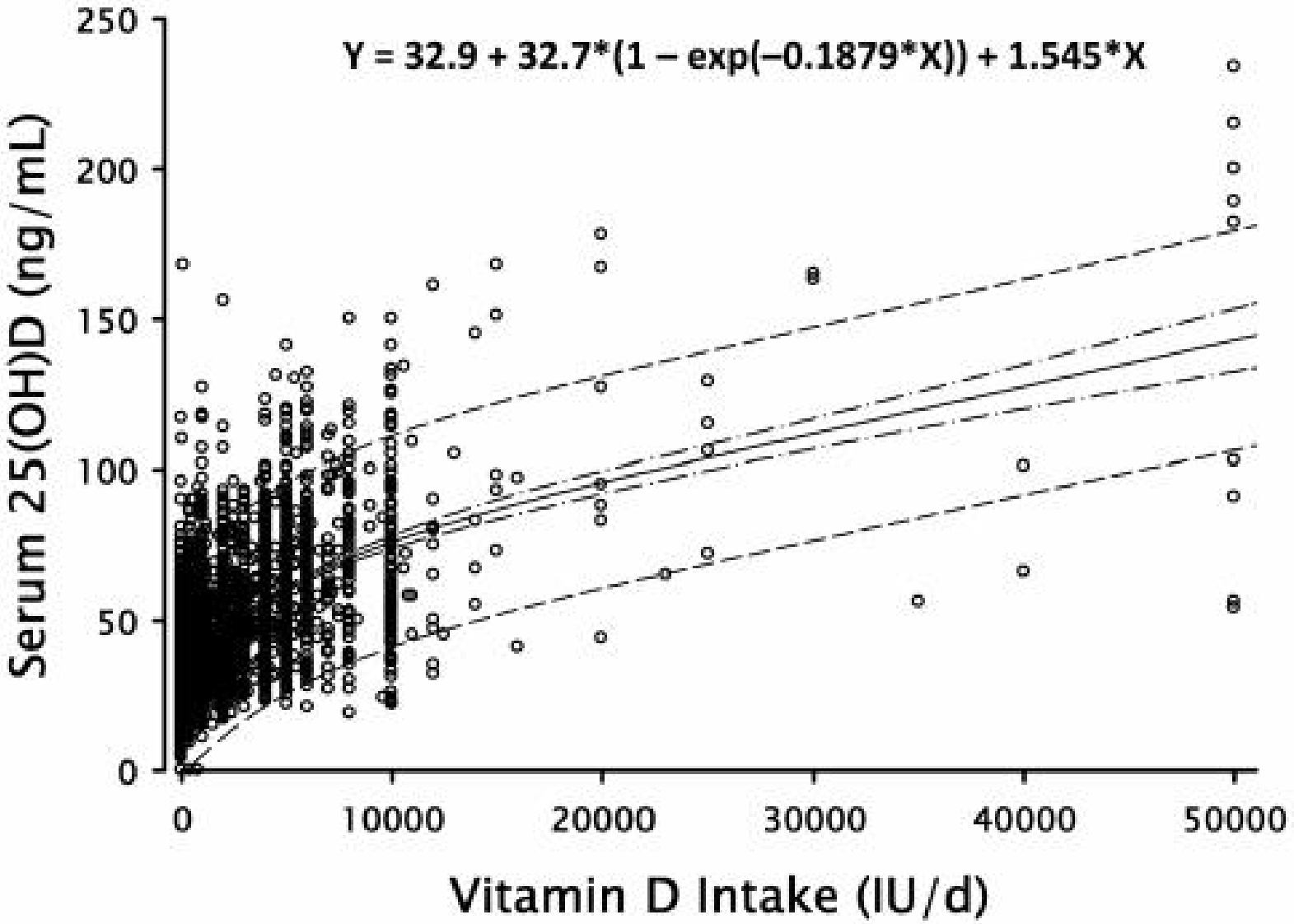
References:
All Cancers: Lappe JM, et al. Am J Clin Nutr. 2007;85:1586-91. Breast: Garland CF, Gorham ED, Mohr SB, Grant WB, Garland FC. Breast cancer risk according to serum 25-Hydroxyvitamin D: Meta-analysis of Dose-Response (abstract).American Association for Cancer Research Annual Meeting, 2008. Reference serum 25(OH) D was 5 ng/ml. Garland, CF, et al. Amer Assoc Cancer Research Annual Mtg, April 2008,. Colon: Gorham ED, et al. Am J Prev Med. 2007;32:210-6. Diabetes: Hyppönen E, et al. Lancet 2001;358:1500-3. Endometrium: Mohr SB, et al. Prev Med. 2007;45:323-4. Falls: Broe KE, et al. J Am Geriatr Soc. 2007;55:234-9. Fractures: Bischoff-Ferrari HA, et al. JAMA. 2005;293:2257-64. Heart Attack: Giovannucci et al. Arch Intern Med/Vol 168 (No 11) June 9, 2008. Multiple Sclerosis: Munger KL, et al. JAMA. 2006;296:2832-8. Non-Hodgkin's Lymphoma: Purdue MP, et al. Cancer Causes Control. 2007;18:989-99. Ovary: Tworoger SS, et al. Cancer Epidemiol Biomarkers Prev. 2007;16:783-8. Renal: Mohr SB, et al. Int J Cancer. 2006;119:2705-9. Rickets: Arnaud SB, et al. Pediatrics. 1976 Feb;57(2):221-5.

Increase in Serum 25(OH)D from Vitamin D Supplementation



Garland et al., Anticancer Research, 2011

Testing Serum 25(OH)D is Suggested

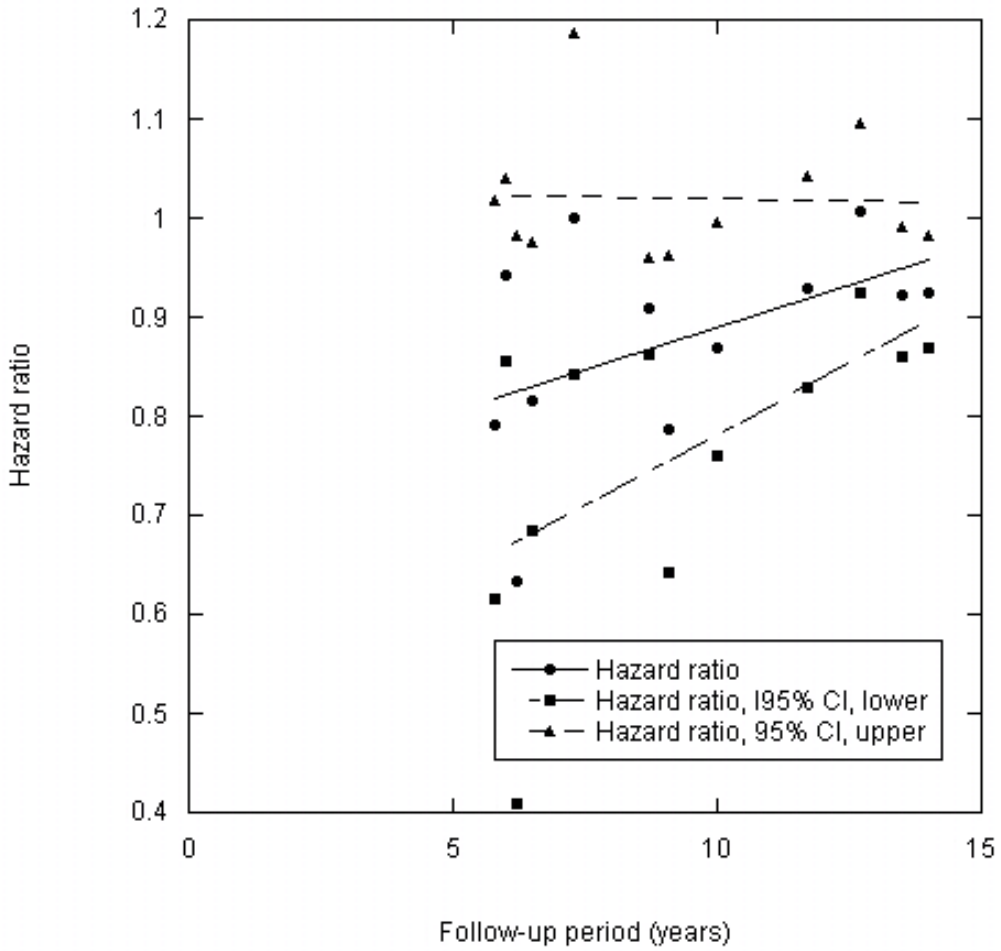


Garland et al., Anticancer Research, 2011

Reduction in Deaths with More Vitamin D: Estimate for U.S. for 2002 for a Mean Serum 25(OH)D Level of 42 ng/mL

Disease	Deaths (x1000)	Vitamin D Reduction %	Deaths Reduction
CVD	923	25	231
Cancer	559	25	139
Diabetes, T2	77	10	8
Lower respir.	60	25	15
Septicemia	31	30	9
Hip fractures	14	30	4
TB	1	30	0.3
Total, vit. D	1665	24	406
Total, all	2401	17 (9-24)	406

All-cause Mortality Rate vs. Follow-up Period



Mortality rate reduction for the mean follow-up period of 9.6 years is 8%; the extrapolation to zero years follow up is 28% reduction.

Grant, Dermato-Endocrinology 2012

Serum 25(OH)D levels

The consensus of scientific understanding appears to be:

- Vitamin D deficiency in serum calcidiol levels
  - <20 ng/mL (50 nmol/L)
- Insufficiency in the range: 20-32 ng/mL
- Gray area – almost sufficient 32-40 ng/mL
- Optimal in the range: 40-80 ng/mL
- Normal in sunny countries: 54-90 ng/mL
- Vitamin D excess: >100 ng/mL

Risks of High Vitamin D Intake

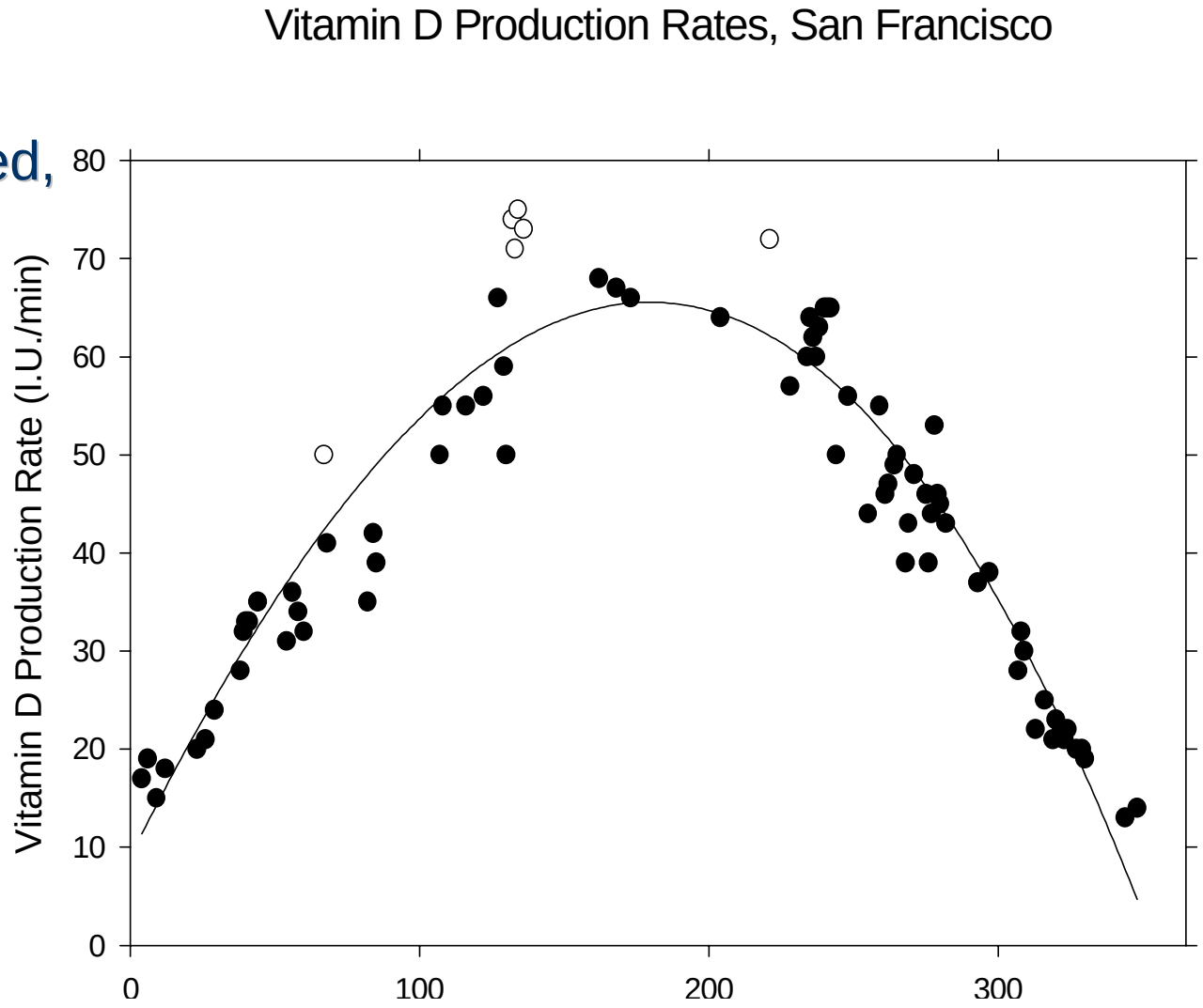
- There are very few adverse effects of higher vitamin D intake:
  - For most people hypercalcemia will not occur for <20,000 IU/day
  - For those with active TB, sarcoidosis or granulomatous diseases and some with lymphoma, adverse effects from hypercalcemia may occur at lower intakes due to increased serum $1,25(OH)_2D$ levels due to the innate immune system using vitamin D to fight the disease.
  - The current upper limit according to the Institute of Medicine is 4000 IU/d, but no adverse effects have been noted for less than 10,000 IU/d.

Sources of Vitamin D

- Solar UVB, especially near solar noon, with as much skin exposed as possible, not so long as to turn pink or red. Gradual increase in UV in spring/summer leads to tanning and development of a SPF value of 2-4.
- Supplements, 1000-4000 IU/day (each 1000 IU/day increases serum 25(OH)D by about 10 ng/mL)
- Diet, provides 250-300 IU/day in the U.S.
- Artificial UVB sources such as in indoor tanning facilities with 3-5% UVB of total UV
  - One can produce 10,000-15,000 IU in a few minutes in a sunbed.

Vitamin D Production Rate, Season

Young person,
pale skin,
10% of body exposed,
near solar noon,
IU/minute



Vitamin D Recommendations by the IOM

- The Institute of Medicine recommended 600 IU/d vitamin D and 20 ng/ml for those up to age 70 years, 800 IU/d for those above 70 years.
- The basis for their recommendations was randomized controlled trials by 2010.
- All they found strong evidence for was bones.

- Ross AC, Manson JE, Abrams SA, Aloia JF, Brannon PM, Clinton SK, Durazo-Arvizu RA, Gallagher JC, Gallo RL, Jones G, Kovacs CS, Mayne ST, Rosen CJ, Shapses SA. The 2011 report on dietary reference intakes for calcium and vitamin D from the Institute of Medicine: what clinicians need to know. J Clin Endocrinol Metab. 2011 Jan;96(1):53-8.

Vitamin D Recommendations The Endocrine Society

- The Endocrine Society recommended up to 1500-2000 IU/d vitamin D and serum 25(OH)D concentrations above 30 ng/ml.
- Treatment with either vitamin D(2) or vitamin D(3) was recommended for deficient patients. At the present time, there is not sufficient evidence to recommend screening individuals who are not at risk for deficiency or to prescribe vitamin D to attain the noncalcemic benefit for cardiovascular protection.
- Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, Murad MH, Weaver CM. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab, 2011 Jul;96(7):1911-30.

Vitamin D Scientists' Call to Action

- Organized by www.grassrootshealth.net
- 16 leading vitamin D researchers calling for a standard vitamin D intake of 2000 IU/day and the achievement of a serum level of 40-60 ng/ml.
- Signed by JJ Cannell, CF Garland, FC Garland, E. Giovannucci, ED Gorham, WB Grant, J Hathcock, RP Heaney, MF Holick, BW Hollis, C Johnson, JM Lappe, AW Norman, DL Trump, R Vieth, and WC Willett.

Conclusion

- There is reasonable evidence that low serum 25(OH)D level is a risk factor for PD.
- There is reasonable evidence that low serum 25(OH)D levels explain some of the link between PD and systemic and infectious diseases.
- Dentists and allies could perform an important service to their patients if when they discover PD, they inform the patient that low serum 25(OH) level could be an important risk factor.

Additional Resources

- http://www.grassrootshealth.net/
- http://www.healthresearchforum.org.uk/
- http://www.pubmed.gov
- http://www.sunarc.org/
- http://www.vitamindcouncil.org/
- http://vitamindwiki.com/

- To contact the speaker:
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