The Use of Vitamin D in Clinical Practice

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The Use of Vitamin D in Clinical Practice

- Disclosures
  - I am paid a salary as the Executive Director of the Vitamin D Council, a 501(c)(3) non-profit.
  - I receive royalties from Purity Products for a vitamin D formula with my name and likeness on it, but I don't have any of it with me).
  - I have a book out on athletic performance and vitamin D, entitled *Athletes Edge, Faster, Quicker, Stronger with vitamin D,* but I don't have any copies with me.

The Use of Vitamin D in Clinical Practice

- Phase III large randomized controlled trials have not been done for vitamin D supplementation.
- However, doctors have always been ethically and legally obligated to act on what is currently known.

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- What do we know about vitamin D?
  - We live in a sun-deprived developed world
    - Common sense says vitamin D-deprived world, too
  - Hunter-gatherers have 25(OH)D levels of around 45 ng/ml.
    - For now, fair to presume that these are the levels humans should have
    - CDC reported average American has a level of 22 ng/ml
  - Serum levels up to 100 ng/ml are safe. This means doses of up to 10,000 IU/day are safe (probably much higher).

Luxwolda M et al. Vitamin D status indicators in indigenous populations in East Africa. Eur J Nutr, 2012.

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- What kind of studies have been done for vitamin D?
  - Lots of cross-sectional and case-control studies
  - Some prospective cohort studies
  - Phase IIb randomized controlled trials are just now pouring out
    - These trials are demonstrating that vitamin D can be used to treat or aid traditional therapies for a wide array of diseases.

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- “Level I evidence is evidence obtained from at least one properly designed randomized controlled trial.” (US Preventive Services Task Force or USPTF). Does not say Phase III.
- Level A recommendations: “Good scientific evidence suggests that the benefits of the clinical service substantially outweigh the potential risks. Clinicians should discuss the service with eligible patients.” (USPTF)

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- Before we look at current RCTs, keep in mind:
  - Activated vitamin D is a seco-steroid hormone.
  - It works through regulation of the steroid hormone/thyroid hormone class of super-receptors.
  - It directly or indirectly regulates anywhere from 200 (known) to 2,700 genes (VDR present) on the active human genome.
  - This means vitamin D has as many different mechanisms of action as genes it regulates.

Multiple Sclerosis

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- Randomized controlled trial for patients recently diagnosed with clinically isolated syndrome (CIS)
  - 13 patients in vitamin D group take 50,000 IU/week. 11 take placebo.
  - Over the next year, 5 of 11 CIS patients in placebo group are diagnosed with MS, experiencing a second attack.
  - 0 of the 13 patients in the vitamin D group develop MS (p=.007).

Derakhshandi H et al. Preventive effect of vitamin D3 supplementation on conversion of optic neuritis to clinically definite multiple sclerosis: a double blind, randomized, placebo-controlled pilot clinical trial. Acta Nerol Belg, 2012

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- More findings:
  - The incidence rates of positive MRI findings, including new T2 lesions were significantly lower in the vitamin D treatment group than in the placebo group. The incidence rate for black holes in the vitamin D group was 84% less than the placebo group.

Derakhshandi H et al. Preventive effect of vitamin D3 supplementation on conversion of optic neuritis to clinically definite multiple sclerosis: a double blind, randomized, placebo-controlled pilot clinical trial. Acta Nerol Belg, 2012

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- Authors conclude:
  - "Our results indicate that vitamin D3 protects optic neuritis patients developing MS… The immunomodulatory effects of vitamin D3 can delay or prevent future relapses in CIS patients, even after the first demyelinative attack, thus reducing the risk of MS development."
- Furthermore, the researchers recommend:
  - "We recommend the optimization of serum 25(OH)D status in all patients presenting with optic neuritis who have low serum levels of this vitamin. We also propose that all other CIS patients who are at risk of developing MS should be similarly treated."

Derakhshandi H et al. Preventive effect of vitamin D3 supplementation on conversion of optic neuritis to clinically definite multiple sclerosis: a double blind, randomized, placebo-controlled pilot clinical trial. Acta Nerol Belg, 2012

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- Another randomized controlled trial
  - 66 MS patients, randomized to 20,000 IU/week or placebo.
  - 25(OH)D levels only went from 22 ng/ml to 44 ng/ml in one year.
  - Fewer lesions on brain MRI ($p<.05$) and strong trends toward lower lesion burden, reduced disability scales, and improved ability to walk, compared to controls.

Soilu-Hänninen M et al. A randomised, double blind, placebo controlled trial with vitamin D3 as an add on treatment to interferon β-1b in patients with multiple sclerosis. J Neurol Neurosurg Psychiatry. 2012 83(5):565-71.

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- Recent debate in the journal, *Multiple Sclerosis*. Would you take 10,000 IU/day if you had early MS?

- Papeix C, Lubetzki C. If I had clinically isolated syndrome with MRI diagnostic of MS I would take vitamin D 10,000 IU daily; no. MSJ. 2013.
  - No, I would not and I would advise my patients not to do so.

- Correale J. If I had clinically isolated syndrome with magnetic resonance imaging diagnostic of multiple sclerosis, I would take vitamin D 10,000 IU daily; yes. MS Journal. 2013.
  - Yes, I would and I would advise my MS patients to do so.

- Hutchinson M. If I had CIS with MRI diagnostic of MS, I would take vitamin D 10,000 IU daily; commentary. MS Journal. 2013.
  - Yes, I would but I would not advise my MS patients to do so.

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- Vitamin D in MS: How does it work?
  - The active form of vitamin D has been shown to modulate nerve fiber loss.
  - Vitamin D also has a modulatory effect on inflammation that may be involved in MS.
  - Anti-inflammatory
  - Decrease autoantibodies in MS?
  - Thus, there is some thought that vitamin D can aid in treatment of early lesions in MS.

Cystic Fibrosis

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- RCT administered mega-dose vitamin D to cystic fibrosis patients admitted to hospital for pulmonary exacerbation
  - Administered 250,000 IU to 15 patients and placebo to 15 patients
  - Vitamin D levels raised from 30.6 ng/ml to 58.1 ng/ml after one week
  - After 6 months, 5 placebo patients died, 1 vitamin D patient died (P <.05).

Grossmann RE et al. Pilot study of vitamin D supplementation in adults with cystic fibrosis pulmonary exacerbation: A randomized, controlled trial. Dermato-Endocrinology, 2012

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- More findings:
  - More of the vitamin D group returned to baseline lung function (before pulmonary exacerbation).
  - Vitamin D group had more hospital-free days.
  - Vitamin D group needed less antibiotics.
  - Despite mega-dose, vitamin D group's levels dropped down to 36.7 after 6 months.

Grossmann RE et al. Pilot study of vitamin D supplementation in adults with cystic fibrosis pulmonary exacerbation: A randomized, controlled trial. Dermato-Endocrinology, 2012

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- How does it work?
  - Vitamin D is particularly important in cystic fibrosis (CF) because of the number of complications in CF, like respiratory infections, diabetes and bone disease.
  - Vitamin D reduces markers of inflammation, while simultaneously increasing production of the body's own antimicrobial peptide (AMP), LL-37 or cathelicidin, to fight infection.
  - Cathelicidin is directly upregulated by vitamin D.

Infant heart failure

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- Randomized controlled trial for 80 infants with congestive heart failure (CHF)
  - 1,000 IU of vitamin D/day or placebo to 80 infants with CHF for 12 weeks.
  - Vitamin D status increased from 13 ng/ml to 22 ng/ml in the vitamin D group.
  - Researchers observed a significant improvement of heart failure score, left-ventricular end-diastolic diameter, left-ventricular end-systolic diameter and ejection fraction (all P<.001).
  - “Vitamin D supplementation has great benefits as an anti-inflammatory agent in infants with CHF. It helps acceleration of the clinical improvement and cytokine profile balance.”

Shedeed SA. Vitamin D Supplementation in Infants With Chronic Congestive Heart Failure. Pediatr Cardiol, 2012

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- How does it work?
  - The vitamin D receptor has been identified in human cardiomyocytes where it regulates many processes, including:
    - calcium influx
    - myocyte proliferation
    - hypertrophy

Hypertension

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- Randomized controlled trial of 112 patients, administered 3,000 IU/day of vitamin D or placebo for 20 weeks during winter.
  - The vitamin D group's central systolic and diastolic blood pressure dropped by 6.8 mmHg (p = 0.007) and 1.7 mmHg (p = 0.15) respectively compared to placebo.
  - There was no significant change in 24-hour ambulatory blood pressure. However, in patients that started below 30 ng/ml and were in the vitamin D group, they saw borderline reduction in systolic (3.7 mmHg, p = 0.08) and slightly significant diastolic blood pressure improvement (2.7 mmHg, p = 0.02) after supplementing compared to placebo.

Larsen T et al. Effect of cholecalciferol supplementation during winter months in patients with hypertension: a randomized, placebo-controlled trial. Am J Hypertens, 2012.

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- How does it work?
  - Inhibits the renin-angiotensin-aldosterone (RAS) system.
  - Chronic vitamin D receptor stimulation blunts systemic RAS activity.
  - Smooth muscle cells lining the artery have a VDR and the 25-hydroxylase.

Larsen T et al. Effect of cholecalciferol supplementation during winter months in patients with hypertension: a randomized, placebo-controlled trial. Am J Hypertens, 2012.

Chronic Obstructive Pulmonary Disease

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- Randomized controlled trial of 182 patients with moderate to severe chronic obstructive pulmonary disease (COPD) with recent exacerbations who were currently undergoing treatment
  - Patients were assigned to placebo or vitamin D group (100,000 IU/month)
  - Seriously D deficient participants(<10 ng/mL), reduced their rate of flare-ups/year by 43% with D

Lehouck A et al. High Doses of Vitamin D to Reduce Exacerbations in Chronic Obstructive Pulmonary Disease (COPD): A Randomized Trial, Annals of Internal Medicine, 2012 Jan 17.

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- How does it work?
  - Vitamin D may…
    - help reduce chronic airway and systemic inflammation.
    - help microbial clearance by up-regulating cathelicidin.
    - have a direct effect on bronchial mucosa.

General Pain and Well-Being

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- Researchers wanted to see if vitamin D could ease pain symptoms in patients with sickle cell disease
  - They administered 4,000 to 100,000 IU of vitamin D once per week or placebo for 6 months
  - Participants who received high-dose vitamin D achieved higher serum 25-hydroxyvitamin D, experienced fewer pain days per week ($P < .05$), and had higher physical activity quality-of-life scores ($p < .05$).

Osunkwo I et al. High dose vitamin D therapy for chronic pain in children and adolescents with sickle cell disease: results of a randomized double blind pilot study. Br J Haematol, 2012.

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- RCT of 87 non-western immigrants living in the Netherlands who visited their doctor for recurring or chronic musculoskeletal pain
  - They administered a onetime dose of 150,000 IU or placebo at baseline and 6 weeks.
  - Vitamin D group reported significant improvement in pain compared with the placebo group (p=0.04)

Schreuder F, Bernsen RMD, van der Wouden JC. Vitamin D supplementation for nonspecific musculoskeletal pain in non-western immigrants: A randomized controlled trial. Annals of Family Medicine. 2012.

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- How does it work?
  - Several possible mechanisms to explain why vitamin D supplementation may have a pain-relieving effect:
    - A rapid nongenomic influence of vitamin D on the metabolism of muscle cells
    - Growth of muscle fibers by a slow genomic effect on muscle cells
    - A nonspecific effect on the central or peripheral nervous system.
    - Reducing inflamation.

Traumatic Brain Injury

The Use of Vitamin D in Clinical Practice

- RCT: Patients admitted to the hospital for traumatic brain injury were injected with one mg/kg of progesterone intramuscularly every 12 hours for 5 days and also 200 IU/kg of vitamin D once-a-day for 5 days, or progesterone, or just placebo.
  - For a 150 lb person, this would be 13,600 IU of vitamin D/day for five days.
  - Ten-percent died in the progesterone + vitamin D group, compared to 20% in the progesterone group and 40% in the placebo group (p=.03).

Aminmansour B et al. Comparison of the administration of progesterone versus progesterone and vitamin D in improvement of outcomes in patients with traumatic brain injury: A randomized clinical trial with placebo group. Adv Biomed Res, 2012

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- More findings:
  - On a Glasgow Coma Scale (15 point scale), three months after intervention, patients in the progesterone + vitamin D group had the highest mean scale rating at 11.27, followed by progesterone alone at 10.25 and then placebo at 9.16 (p=.001).
  - 35% of patients in the progesterone + vitamin D group made “Good Recovery,” as assessed by the Glasgow Outcome Scale, while only 25% met this assessment in the progesterone group and only 15% in the placebo group (p=.03).

Aminmansour B et al. Comparison of the administration of progesterone versus progesterone and vitamin D in improvement of outcomes in patients with traumatic brain injury: A randomized clinical trial with placebo group. Adv Biomed Res, 2012

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- How does it work?
  - Progesterone is safe and effective, protecting the blood-brain barrier, and helping prevent cerebral edema, excessive inflammatory response, and necrosis. It also helps stimulate myelin formation, reduces free radicals, and helps prevent neuronal loss.
  - Like progesterone, activated vitamin D is a neurosteroid and has proven to be effective aiding recovery in animal models, perhaps by mechanisms similar to progesterone.

Depression

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- RCT: 42 patients with major depression, half of them receive 20 mg/day of Prozac and the other half 20 mg/day of Prozac plus 1,500 IU/day of vitamin D.
  - Prozac often takes 8 weeks to begin working, but here, after only 4 weeks, they saw that the Prozac and vitamin D group had improved more than the Prozac only group ($p<.001$).
  - This improvement continued throughout the study (6 and 8 weeks).

Khoraminya N, Tehrani-Doost M, Jazayeri S, Hosseini A, Djazayery A. Therapeutic effects of vitamin D as adjunctive therapy to fluoxetine in patients with major depressive disorder. Aust N Z J Psychiatry, 2012

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- How does it work?
  - There are vitamin D receptors in the brain.
  - Tyrosine hydroxylase (the rate-limiting step for the brain's monoamines) is directly upregulated.
  - Many anti-depressant medicines work by increasing the amount of monoamines in your brain.

Systemic lupus erythematosis

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- RCT: 267 SLE patients were randomized to receive 2,000 IU/day (n=178) vitamin D3 or a placebo (n=89) for 1 year.
  - Over the course of the year, only 10% of patients in the vitamin D group experienced a flare-up, compared to 24% experiencing flare-ups in the placebo group over the course of the year ($p<0.05$).
  - The authors noticed a significant reduction in SLE-related antibodies (indicate inflammation) in the vitamin D group compared with the placebo group ($p=0.05$).

Abou-Raya A, Abou-Raya S, Helmii M. The effect of vitamin D supplementation on inflammatory and hemostatic markers and disease activity in patients with systemic lupus erythematosis: A randomized placebo-controlled trail. The Journal of Rheumatology, 2012.

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- How does it work?
  - Reduces inflammation
  - Appears to reduce autoantibodies.
  - Various cells of the immune system express the vitamin D receptor.
  - Beneficial effects on…
    - T cells
    - T helper lymphocytes
    - B cells

Respiratory Tract Infections

The Use of Vitamin D in Clinical Practice

- RCT: 4,000 IU/day of vitamin D3 or placebo for one year in 140 patients with immune deficiency (60%) or a history of frequent infections (40%).
  - Vitamin D group had a reduced total infectious score, about a 25% reduction in self reported infections.
  - Antibiotic use was reduced by 64% in the treatment group.

Bergman P et al. Vitamin D3 supplementation in patients with frequent respiratory tract infections: a randomised and double-blind intervention study. BMJ Open, 2012.

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- More findings
  - Only normal flora existed in the nasal cultures of the vitamin D group, while the usual mix of normal and pathological flora existed in the placebo group.
  - There was a trend toward fewer non-respiratory infections in the treatment group.
  - Infection with Candida was significantly less in the treatment group.

Bergman P et al. Vitamin D3 supplementation in patients with frequent respiratory tract infections: a randomised and double-blind intervention study. BMJ Open, 2012.

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- How does it work?
  - Both epithelial cells and macrophages increase expression of the antimicrobial cathelicidin upon exposure to microbes, an expression that is dependent upon the presence of vitamin D.
  - Pathogenic microbes, much like the commensals that inhabit the upper airway, stimulate the production of a hydroxylase that converts 25(OH)D to 1,25(OH)2D, a seco-steroid hormone. This, in turn, activates a suite of genes involved in defense.

Tuberculosis

The Use of Vitamin D in Clinical Practice

- RCT: 800 IU/day or placebo for 120 Mongolian schoolchildren for 6 months
  - The vitamin D children had a trend toward fewer TB test conversions (P=.06) compared to placebo.
  - Only one newly positive TB test occurred in those children who achieved a 25(OH)D of >20 ng/ml.
  - In a surprise finding, the treated children grew faster than the placebo children did (P=.0025). As the authors point out, this may explain the fact that children grow faster in the spring and summer.

Ganmaa D et al. Vitamin D, tuberculin skin test conversion, and latent tuberculosis in Mongolian school-age children: a randomized, double-blind, placebo-controlled feasibility trial. Am J Clin Nutr, 2012.

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- How does it work?
  - Activated vitamin D is a modulator of macrophage function that helps suppress the intracellular growth of *M. tubrculosis*
  - May inhibit growth during the initial bacterial invasion
  - Cathelicidin.

Venous Leg Ulcers

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- RCT: 22 venous leg ulcer patients received 50,000 IU of vitamin D/week or placebo for two months
  - Vitamin D *decreased* the size of ulcers in the vitamin D group by a median .75cm^2.
  - The placebo group experienced a median *increase* of 4cm^2.
  - These finding weren't quite statistically significant (p=.06), but trending.
  - The investigators concluded:

    "Presently, venous ulcers have no effective therapeutic options and have a high treatment cost due to very slow healing…The study of vitamin D as a potential treatment can be a worthwhile innovation."

Burkiewicz CJ et al. Vitamin D and skin repair: a prospective, double-blind and placebo controlled study in the healing of leg ulcers. Revista do Colégio Brasileiro de Cirurgiões, 2012.

The Use of Vitamin D in Clinical Practice

- How does it work?
  - Vitamin D could play a role because of its regulatory effect on keratinocytes, which can affect wound healing.
  - Cathelicidin

Atopic Dermatitis

The Use of Vitamin D in Clinical Practice

- RCT: 60 adult AD patients randomized to take either 1,600 IU of vitamin D/day or placebo for 60 days.
  - The severity of AD was evaluated based on SCORAD (Scoring Atopic Dermatitis) and TIS (Three Item Severity score) value by the same physician before and after the trial.
  - According to SCORAD and TIS value index in the vitamin D group showed significant improvement in patients with mild, moderate and severe AD ($P<0.05$) but not in placebo.

Amestejani M et al. Vitamin D supplementation in the treatment of atopic dermatitis: a clinical trial study. J Drugs Dermatol. 2012 Mar;11(3):327-30.

The Use of Vitamin D in Clinical Practice

- How does it work?
  - Atopic dermatitis involves both epidermal barrier failure and immunologic dysfunction.
  - Vitamin D suppresses inflammatory responses, enhances antimicrobial peptide activity, and promotes the integrity of the permeability barrier.
  - It has intimate involvement with the various barrier functions (lung, upper airway, intestine, skin).

Type II Diabetes

The Use of Vitamin D in Clinical Practice

- RCT: 81 T2D patients randomized to either take 4,000 IU/day or placebo
  - Improvements were seen in insulin sensitivity and insulin resistance (p=0.003 and 0.02, respectively).
  - Fasting insulin decreased in vitamin D group (p=0.02).
  - Insulin resistance improved best when vitamin D levels were over 80 nmol/l (32 ng/ml).

von Hurst PR, Stonehouse W, Coad J. Vitamin D supplementation reduces insulin resistance in South Asian women living in New Zealand who are insulin resistant and vitamin D deficient - a randomised, placebo-controlled trial. Br J Nutr. 2010 Feb;103(4):549-552012.

The Use of Vitamin D in Clinical Practice

- RCT: 21 children take 4,000 IU/day of vitamin D and 23 placebo for six months. The average BMI was very high at 39
  - Fasting plasma glucose fell from 89.7 to 84.1 in the treatment group but were essentially unchanged in the placebo group, just missing significance (p=.08).
  - Fasting plasma insulin fell in the treatment group but went up in the placebo group (p= .026).
  - Calculated insulin resistance, as measured by two different markers, fell in the treatment group but increased in the placebo group (p= 0.033) and (p= 0.016)
  - Leptin (a hormone that regulates appetite and hunger and that is elevated in obesity) fell from 43.5 to 36.7 while it increased in the placebo group (p= 0.028).
  - Adiponectin (a hormone that is decreased in the obese) was not different between groups.
  - However, the leptin/adiponectim ratio was significantly better in the 21 children in the treatment group (p= 0.045).

Belenchia AM, Tosh AK, Hillman LS, Peterson CA. Correcting vitamin D insufficiency improves insulin sensitivity in obese adolescents: a randomized controlled trial. Am J Clin Nutr. 2013 Feb 13.

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- How does it work?
  - Experimental evidence suggests that the mechanism by which vitamin D may preserve glucose tolerance acts through effects on insulin secretion and sensitivity.
  - It decreases (not increases) intracellular calcium.
  - The regulation of insulin receptor expression.
  - Increased resilience of beta-cells to the systemic inflammation seen in type 2 diabetes.

Breast Cancer

Side effects of aromatase inhibiters

The Use of Vitamin D in Clinical Practice

- RCT: 60 women with breast cancer randomized to either 50,000 IU/week of D2 or placebo.
  - The question was did vitamin D improve aromatase inhibitor-induced musculoskeletal symptoms (AIMSS)?
  - AIMSS was assessed by the Brief Pain Inventory (BPI), the Fibromyalgia Impact Questionnaire (FIQ), and the Health Assessment Questionnaire-Disability Index (HAQ-DI) at baseline, 2, 4, and 6 months.
  - At 2 months, FIQ pain (P = 0.0045), BPI worst-pain (P = 0.04), BPI average-pain (P = 0.0067), BPI pain-severity (P = 0.04), and BPI interference (P = 0.034) scores were better in the vitamin D group than the placebo group. HAQ-DI not significantly changed.

Rastelli AL et al. Vitamin D and aromatase inhibitor-induced musculoskeletal symptoms (AIMSS): a phase II, double-blind, placebo-controlled, randomized trial. Breast Cancer Res Treat. 2011 Aug;129(1):107-16.

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- How it works?
  - –Vitamin D may…
    - suppress COX-2 expression
    - reduce levels of inflammatory prostaglandins
    - decrease the expression of aromatase via promoter II
    - have anti-inflammatory actions

ICU Mortality

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- No RCTS exist. A multicenter prospective observational study from Harvard showed:
  - 2,399 ICU patients followed for 30 days.
  - In those with severe vitamin D deficiency (<15 ng/ml) the odds ratio for mortality was 1.69 ($p < .0001$).
  - The odds ratio blood culture positivity 1.64 ($p = .03$).

Braun A al. Association of low serum 25-hydroxyvitamin D levels and mortality in the critically ill. Crit Care Med. 2011 Apr;39(4):671-7.

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- Consider giving 50,000 IU/day of D3 for 5 days to ICU patients.
- 50,000 IU capsules of D3 (not D2 or Drisdol) are now available to your pharmacy through McKesson.
- Put it in the NG tube.
- No IM or IV preparation available in the USA.

In Summary…

The Use of Vitamin D in Clinical Practice

- Vitamin D may be useful in the prevention and treatment of many diseases and may be useful in a wide range of disciplines:

  - Allergy/Immunology
  - Cardiology
  - Dermatology
  - Emergency Medicine
  - Endocrinology
  - Geriatrics
  - Gastroenterology
  - Internal Medicine
  - Nephrology
  - Neurology
  - Orthopedics
  - Pediatrics
  - Psychiatry
  - Pulmonology
  - Rheumatology
  - Urology

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- Vitamin D receptors exist in the following tissues:
  - Esophagus
  - Stomach
  - Small intestine
  - Large intestine
  - Colon
  - Kidney
  - Cardiac muscle
  - Parathyroid gland
  - Sebaceous gland
  - Testis
  - Ovary
  - Placenta
  - Uterus
  - Endometrium
  - Yolk sac
  - Avian chorioallantoic membrane
  - Avian shell gland
  - Thymus
  - Bone marrow
  - B cells
  - T cells
  - Lung alveolar cells
  - Bone osteoblasts and osteocytes
  - cartilage chondrocytes
  - Skin
  - Breast
  - Hair folicules
  - Brain neurons
  - Fibroblasts
  - Stroma

Pike W et al. Vitamin D: Third Edition. Feldman, Adams and Pike. Elsevier Press, 2011

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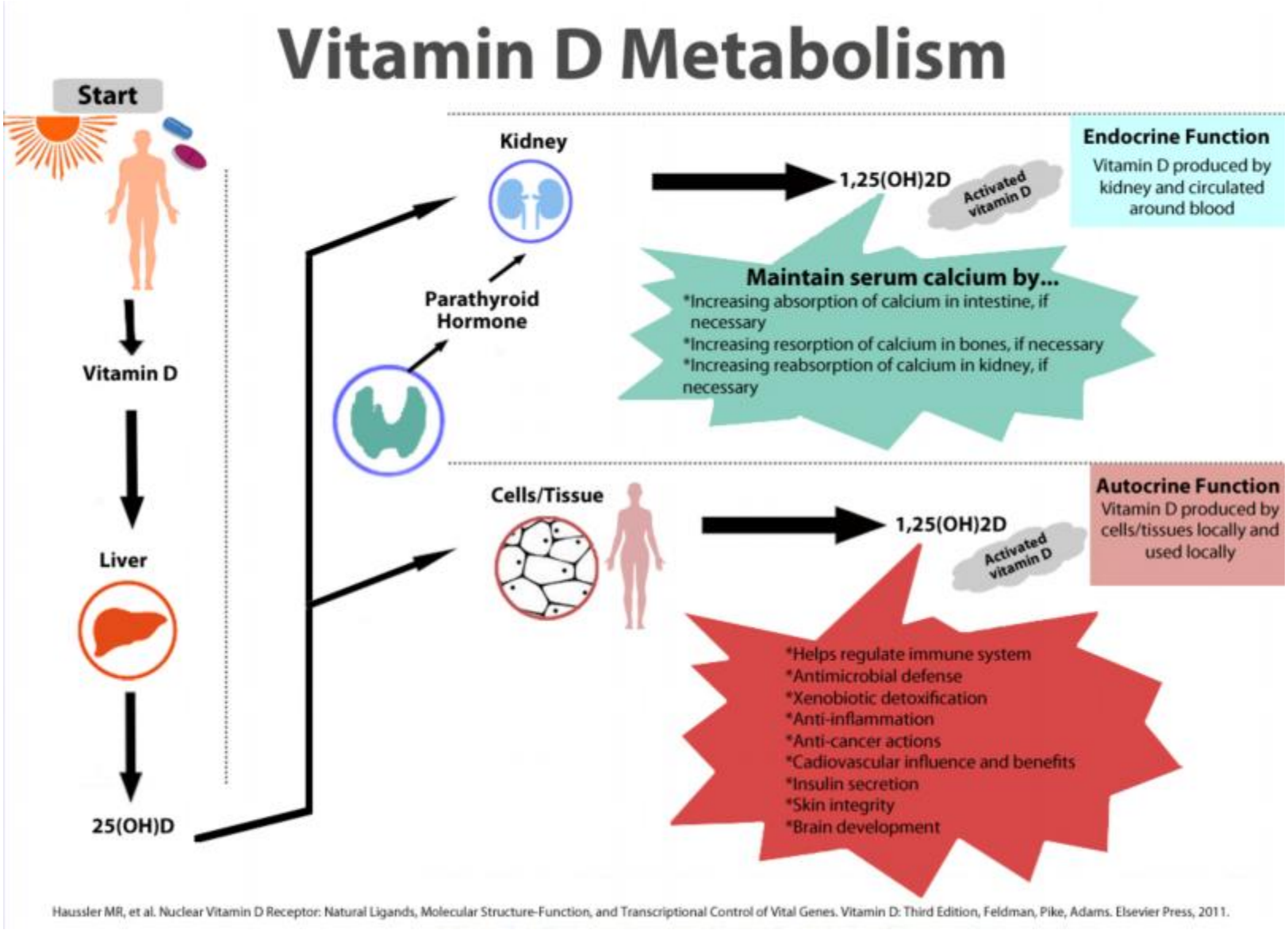

Haussler MR, et al. Nuclear Vitamin D Receptor: Natural Ligands, Molecular Structure-Function, and Transcriptional Control of Vital Genes. Vitamin D: Third Edition, Feldman, Pike, Adams. Elsevier Press, 2011.

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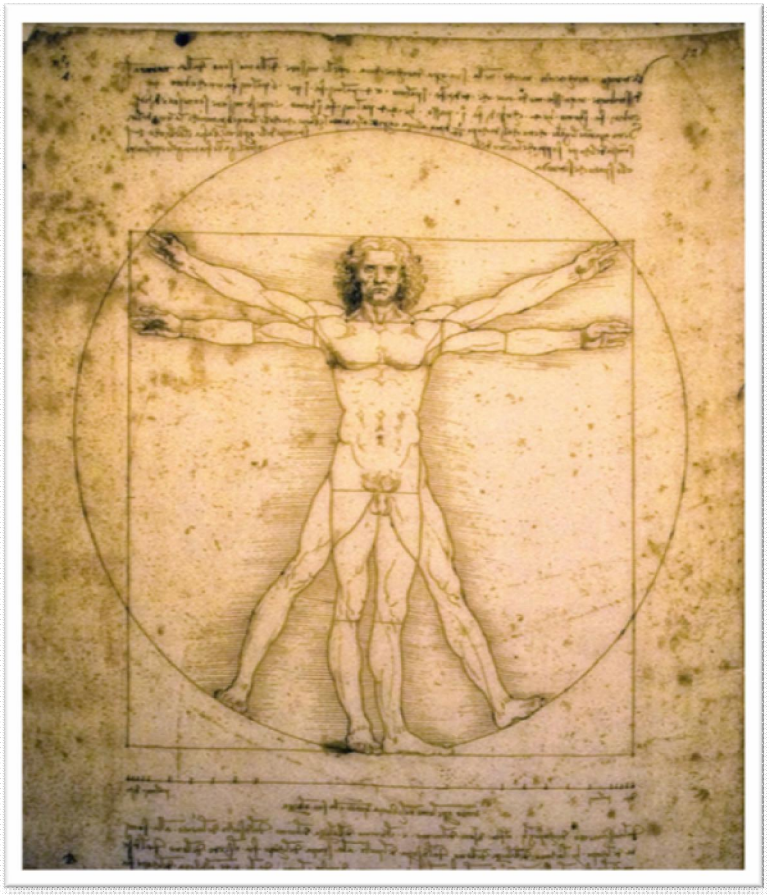
- Considering the widespread distribution of vitamin D receptor in the human body, it shouldn't be surprising that research is continually uncovering new roles and beneficial effects for vitamin D.



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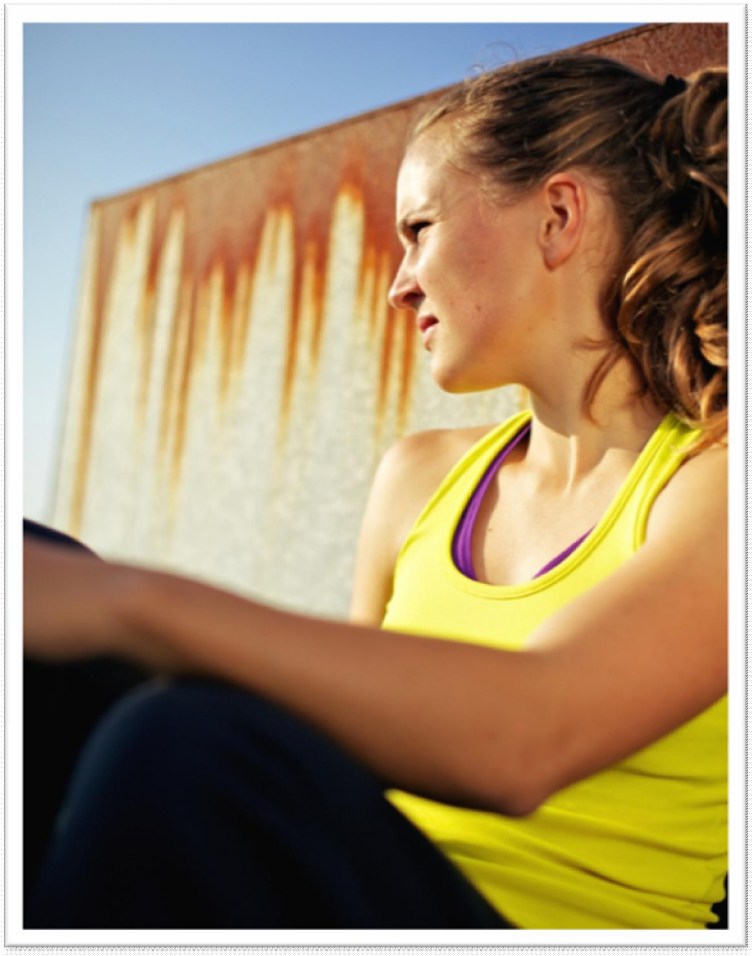

- For whatever reason, the body developed an elaborate autocrine and endocrine system that depended on the sun to adequately provide the building blocks for a seco-steroid hormone, calcitriol or activated vitamin D.

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- Given these circumstances, given what vitamin D has been shown to do, I believe vitamin D should be monitored and treated in clinical settings.

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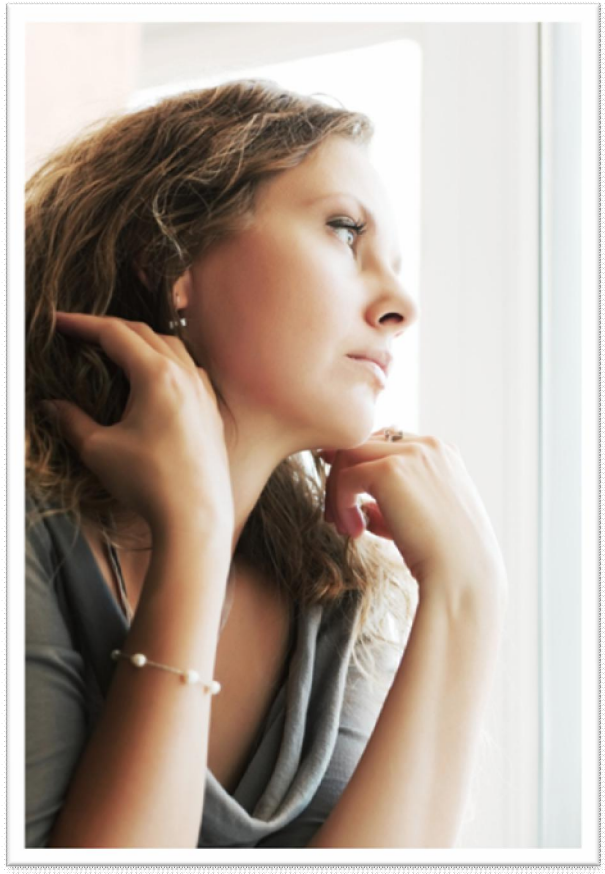

- The IOM's FNB, while setting a public recommendation of 600 IU/day, made it crystal clear that their recommendations were for people taking it on their own and did not substitute for the decision making of doctors.

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- Medical ethics have always required physicians to act based on what is known now, not on what may be learned in the future.

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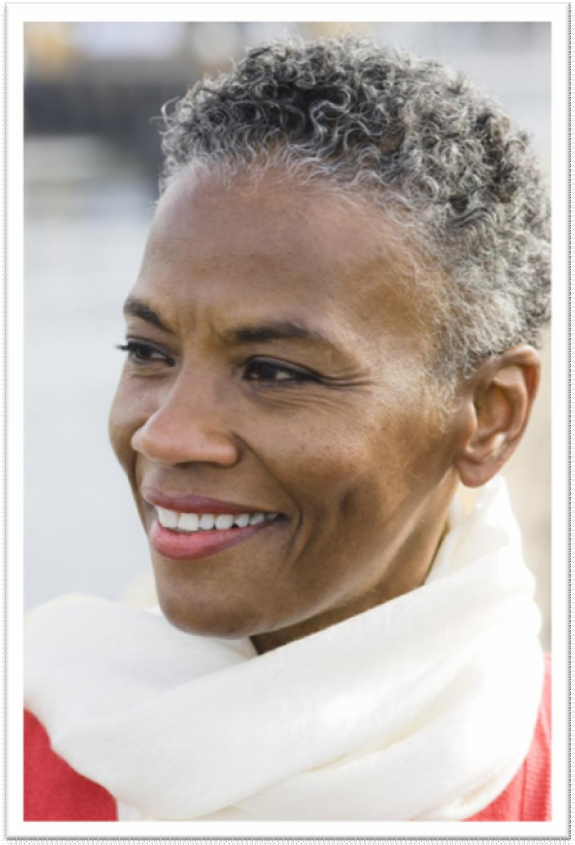
- My 25(OH)D recommendations:
  - Patients should have natural vitamin D levels:
    - Somewhere in the range between 40-80 ng/ml
    - Aim for about 50 ng/ml
    - Monitoring levels is especially important for patients with implicated diseases, like CVD, MS, lupus, CF, COPD, chronic pain, asthma and others.



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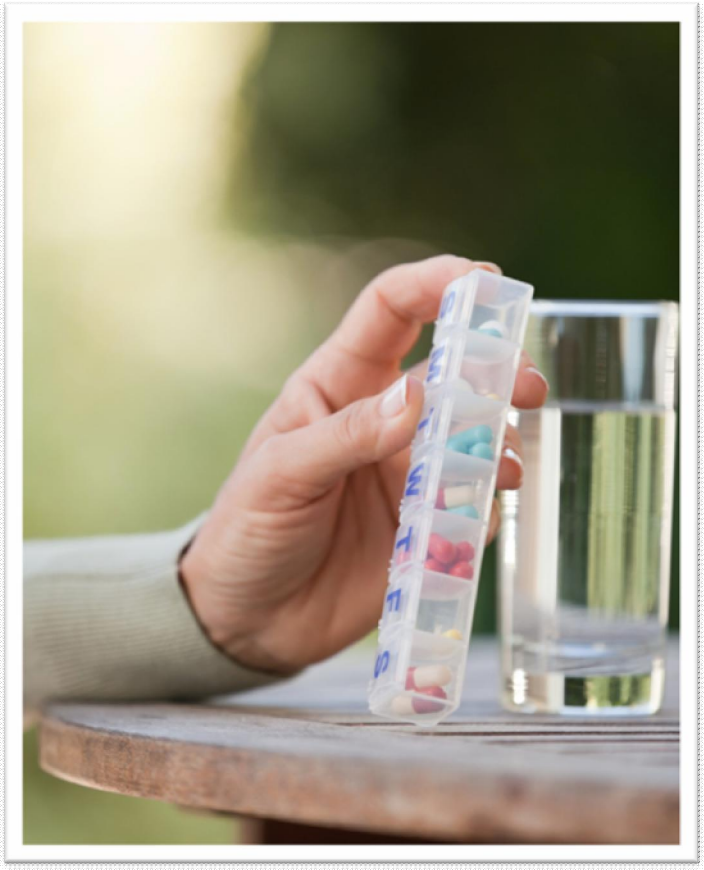

- My dosage recommendations:
  - Average adults require 5,000 IU/day to achieve a level of 40 ng/ml
  - Avoid prescription Drisdol (50,000 IU/week D2)
    - D2 is less potent and less efficacious, and is not normally present in the human body
  - 5,000 IU capsules or tablets of vitamin D3 over the counter supplements are widely available
  - Take one a day with the largest meal of the day for the rest of your life.

The Use of Vitamin D in Clinical Practice

- My sun exposure recommendations:
  - If a patient wants some sun exposure and dermatology is okay with it, then recommend brief, full body, summer, solar noon, sun exposure. The skin makes almost 1,000 IU/minute under those conditions.
    - Can only produce significant vitamin D when the sun is high in the sky and it is not in the winter here.
    - Most made when your shadow is shorter than you.
    - Is solar derived vitamin D better than oral supplements?
    - Don't need to supplement on days sunbathing.
    - Begin with 10-30-minutes, 5-15 minutes on each side.
    - Sunbathe at solar noon but don't burn.

Thank you.
Questions?

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