Welcome to the 28th Annual Alaska Breastfeeding Coalition Conference ~ Shakin' it up in Alaska!

Approved Provider Statements:

This activity has been planned and implemented in accordance with the accreditation requirements of the Washington State Medical Association (WSMA) through the joint Providership of the Alaska Native Tribal Health Consortium (ANTHC) and the Alaska Breastfeeding Coalition (ABC).

ANTHC is approved as a provider of nursing continuing professional development by the Montana Nurses Association, an accredited approver with distinction by the American Nurses Credentialing Center's Commission on Accreditation.

Contact Hours:

ANTHC designates this live or enduring activity for a maximum of 13.50 *AMA PRA Category 1 Credit(s)* ™. Physicians should claim only the credit commensurate with the extent of their participation in the activity. **Enduring access for credit expires December 31, 2020.**

ANTHC in joint providership with ABC, designates this activity as meeting the criteria for one nursing contact hour credit for each hour of participation up to a maximum of 13.50 hour(s). **Enduring access for credit expires December 31, 2020.**

Conflict of Interest Disclosures:

All Presenters and Conference Planners for this activity do not have any relevant relationships or conflict of interests to disclose.

Requirements for Successful Completion:

To receive CE credit please make sure you have completed the evaluation tool provided for each session of participation: Participants will be provided an electronic evaluation form to complete for participation tracking, this form provides electronic merge capability, providing the participant a certificate of credit upon completion/submission.

For more information contact jlfielder@anthc.org
or (907) 729-1387

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

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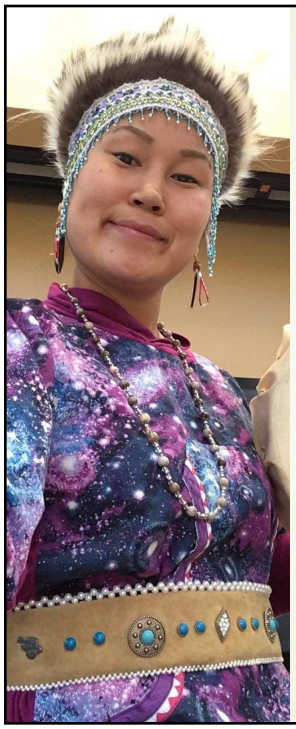

Welcome to the Native Land – Dena'ina

The Alaska Breastfeeding Coalition wishes to …

- Offer recognition and respect.
- Create a broader public awareness of the history that has led to this moment.
- Begin to repair relationships with Native communities and with the land.
- Support larger truth-telling and reconciliation efforts.
- Take a cue from Indigenous protocol, opening up space with reverence and respect.
- Inspire ongoing action and relationship.

Thank You Tia Hale for yesterday's Welcome Ceremony!

"Aaqarlria" Jackie Alstrom – Yupik Eskimo – Native Village of Alakanuk

2

Slipping Vitamin D: Supplementation in Alaska

Heidi A. Koslo
DNP, APRN, FNP-BC, IBCLC

September 22, 2020

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I am …

- A retired La Leche League Leader and current IBCLC. RN with LDRP, mother/baby and high-risk perinatal experience. APRN with a family practice specialty focus. A DNP (Doctor of Nursing Practice) with a passion for maternal-child health issues, especially lactation.
- Current President of the Alaska Breastfeeding Coalition & Chapter Breastfeeding Coordinator for the Alaska Chapter of the American Academy of Pediatrics, Section on Breastfeeding.
- Experience includes several years in both Indian Health Services and a Federally Qualified Health Center that achieved Patient-Centered Medical Home status.
- Wife of a former Marine and the PROUD mother of an active-duty servicewoman in the USAF.

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Disclosures

- I have no actual or potential financial or other conflict of interest in relation to this presentation.
- I have a personal conviction that human milk and breast/chestfeeding is the normal infant feeding method and should be preserved and supported with few exceptions as guided by evidence.
- I welcome recommendations and feedback which will assist me in developing a sharper equity lens within the framework of a safe and supportive space.

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Objectives

At the end of the session participants will be able to …

- Define 'what' Vitamin D is and state why it is important
- Identify symptoms of Vitamin D deficiency and toxicity in infants and across the lifespan
- Discuss dosages of Vitamin D supplementation for adults and their breastfeeding infant(s).

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Limitations in Research

- While I attempted to complete a thorough literature search on Vitamin D supplementation, not all articles on this issue are in English (my language), nor is every journal made available through the resources to which I have access.
- I will mention anecdotal experiences and will try to make it clear when that occurs.

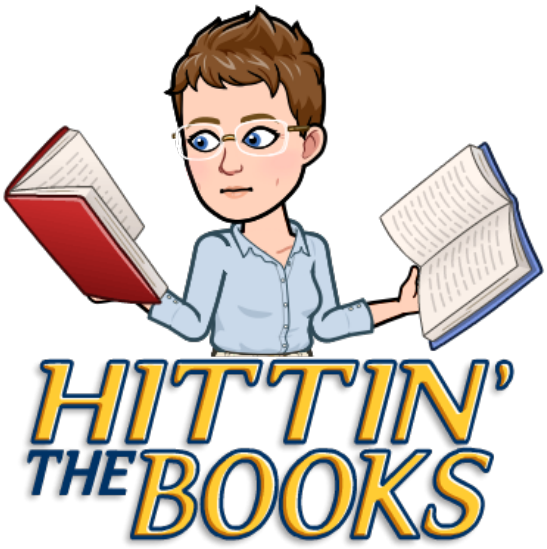
7

The Great Vitamin D Debate

8

Where Do We Get Info on Vitamin D?

9



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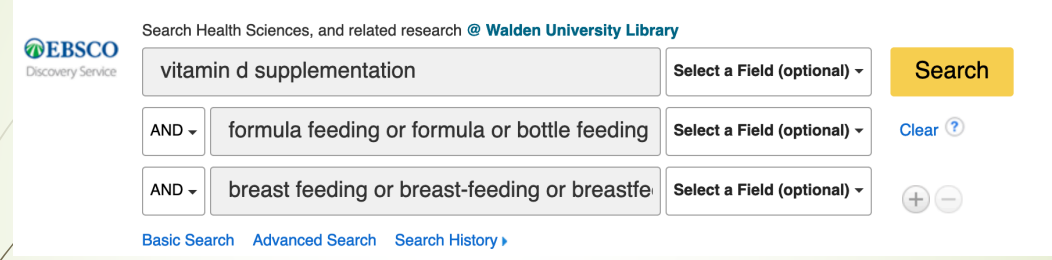
Sources of Information … Scholarly



- 2010 or later; peer-reviewed/scholarly journal
- Earlier than 2010, for information/published research in/about Alaskan populations (Gessner, Plotnik, & Muth, 2003)
- Earlier than 2010, i.e. for information from 'expert bodies' such as the AAP (Wagner, Greer, & the Section on Breastfeeding and Committee on Nutrition, 2008).

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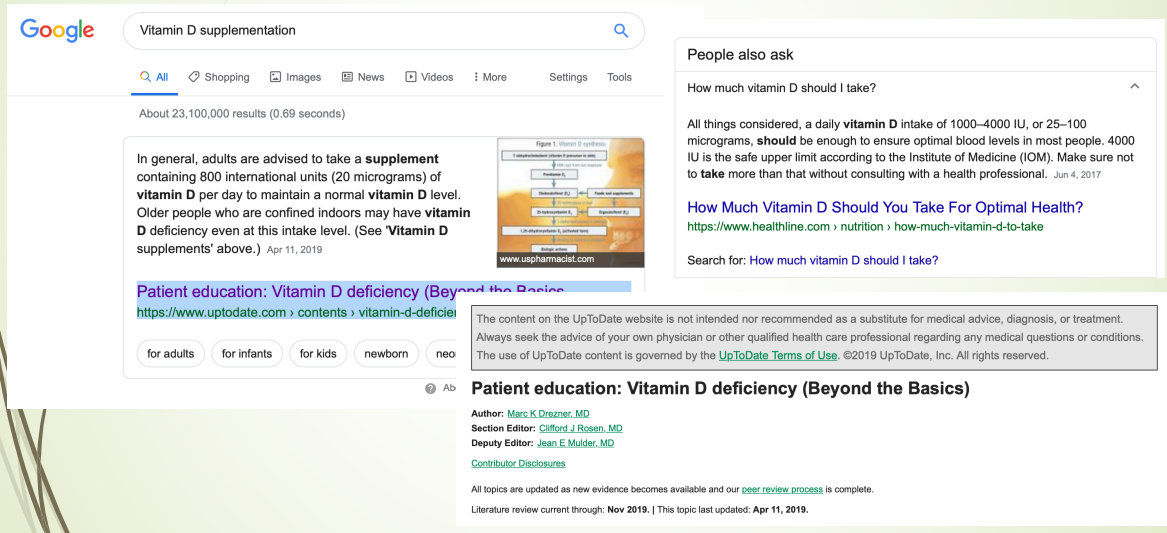
… and not so scholarly … Dr. Google … 23,100,000 results



12


... and even less so: Susie
Groups
Understanding Vitamin D Deficiency and Treatment
Group · 21K members
Vitamin D Wellness
Group · 20K members
Vitamin d deficiency support
Group · 82 members
Vitamin D Deficiency
Page · 5.8K like this
Vitamin D Society
Page · 3.4K like this
Videos
Top 10 Vitamin D Rich Foods
Medscape
698K like this · Medical & Health
Vitamin D + Calcium combo associated in some trials with a 16% reduction in the risk of hip
7 Comments 160 Shares
High Doses of Vitamin D for Autoimmune Diseases - Coimbra Protocol
Page · 12K like this
The Coimbra Protocol is a therapeutic approach that relies on high doses of vitamin D to treat multiple sclerosis as well as...
Like
I HATE MYSELF

13


Confused?

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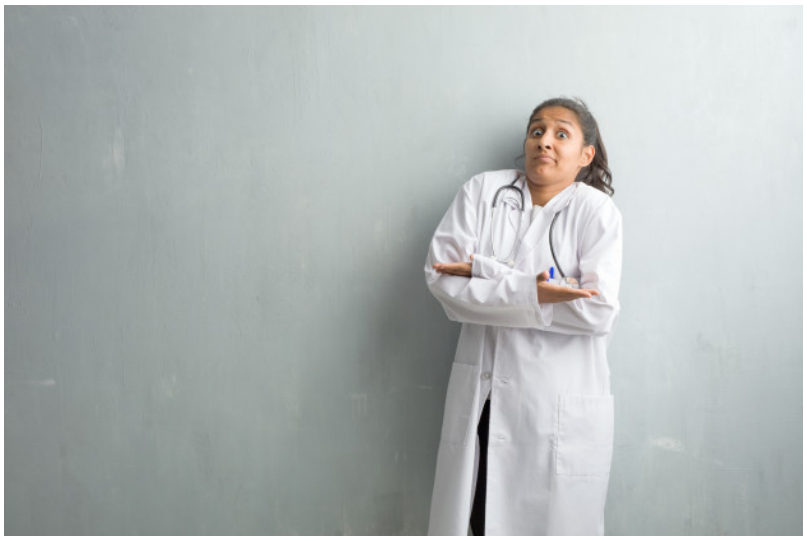
So are Providers …



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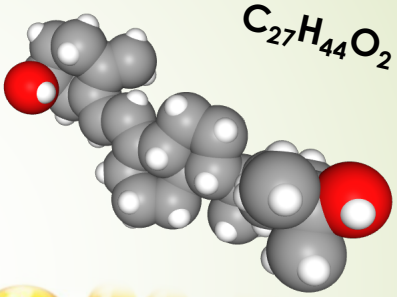
What is Vitamin D?

"… a prohormone that is synthesized in the skin after exposure to ultraviolet radiation or absorbed from food sources or supplements …. then serially converted to the metabolically active form in the liver and subsequently the kidneys" (Pazirandeh & Burns, 2019).



(Images from: https://pubchem.ncbi.nlm.nih.gov/compound/Calcifediol)

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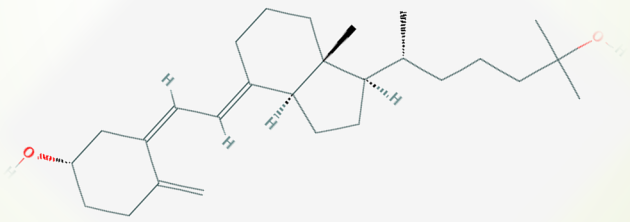
What is Vitamin D?

"Vitamin D, or calciferol, is a generic term and refers to a group of lipid soluble compounds with a four-ringed cholesterol backbone" (Pazirandeh & Burns, 2019) and is considered a secosteroid, or steroid with a broken ring (NIH, 2020).



(Image from: https://pubchem.ncbi.nlm.nih.gov/compound/Calcifediol)

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Synthesis of Vitamin D

- Dermal synthesis (sunlight exposure)
  - "Previtamin D3 is synthesized nonenzymatically in skin from 7-dehydrocholesterol during exposure to the ultraviolet (UV) rays in sunlight"
  - Brief (approx. 10 mins) daily sunlight exposure to the arms/face is estimated to be the equivalent of 200 IU
- Cholecalciferol (D3) – 'animal form'
  - Sun exposure
  - Diet
  - Supplements
- Ergocalciferol (D2) – 'plant form' – derived from radiation of ergosterol found in plants, the mold ergot, and plankton.

(Pazirandeh & Burns, 2019)

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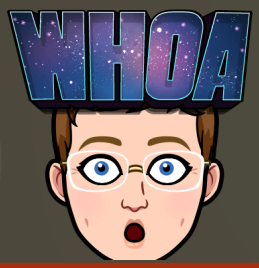
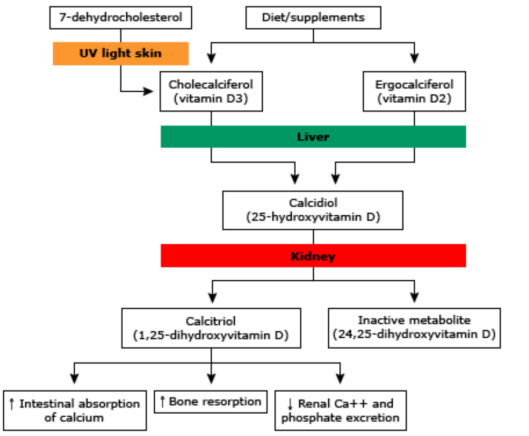


How Does Vitamin D Work?

Pathways of vitamin D synthesis



Metabolic activation of vitamin D to calcitriol and its effects on calcium and phosphate homeostasis. The result is an increase in the serum calcium and phosphate concentrations.

UV: ultraviolet; Ca: calcium.

Graphic 65360 Version 6.0

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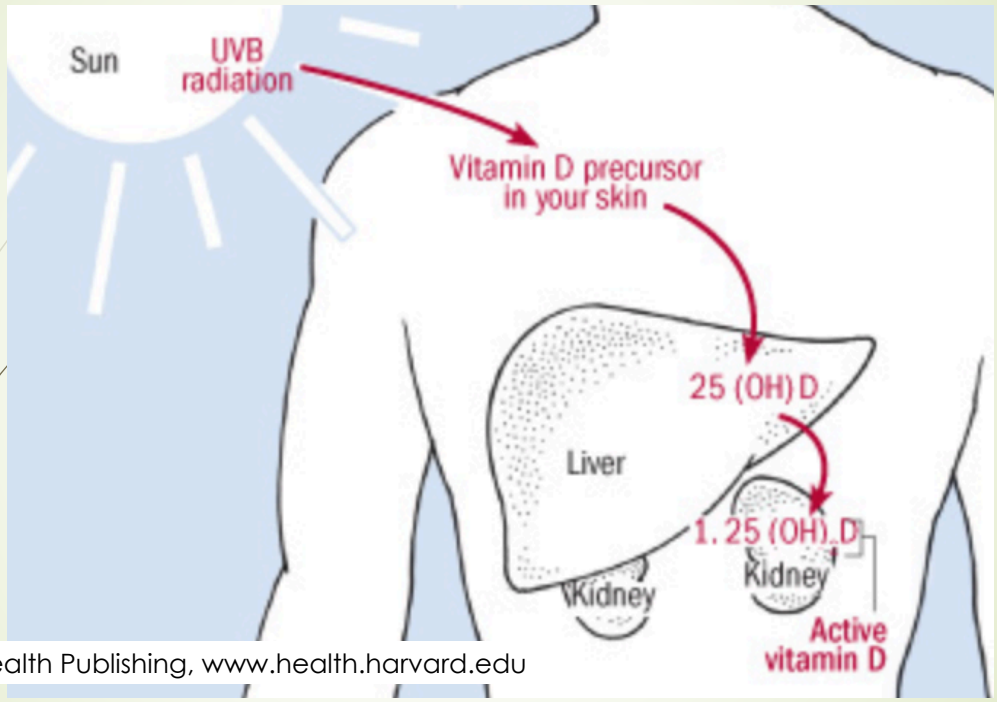

Harvard Health Publishing, www.health.harvard.edu

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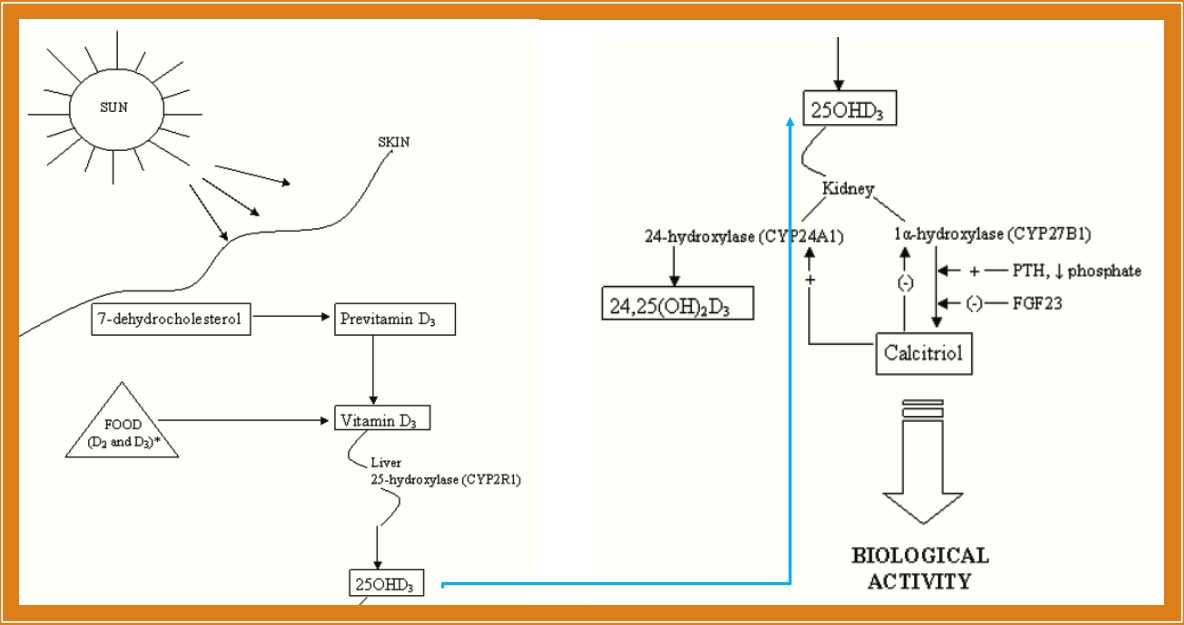

(IOM, 2011)

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What Does Vitamin D *Do*?

- Otherwise stated as "Why do we need Vitamin D?"
  - Promotes calcium absorption … enabling normal bone mineralization and preventing muscle cramps and spasms
  - Needed for bone growth and bone remodeling, including prevention of osteoporosis
  - Reduction of inflammation
  - Cell growth modulation
  - Neuromuscular and immune function
  - Glucose metabolism
  - Genetic functions/gene encoding
  - Things we are still learning about …

(NIH, 2020)

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Deficiency … Insufficiency … What are the Parameters?

United States Endocrine Society/Others

- Deficiency – Values $\leq 20\ ng/ml$
- Insufficiency – Values 21 to $29\ ng/ml$
- Sufficiency – Values $> 29\ ng/ml$
- 30 ng/ml will prevent rickets, but 50 ng/ml may help reduce incidence/occurrence of other diseases/disorders
- However, there is STILL NO CONSENSUS!

(Abrams, Weaver, & Pittaway, 2012; Almeida et al., 2018; Ariganjoye, 2017)

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Parameters: Lack of Consensus

The Endocrine Society	The Institute of Medicine (Health and Medicine Division of the National Academies)	The Mayo Clinic	The American Association of Clinical Endocrinologists
Deficiency: ≤ 20 ng/ml	Deficiency: < 12 ng/ml	Severe deficiency: <10 ng/ml	Deficiency: < 30 ng/ml
Insufficiency: 21-29 ng/ml	Insufficiency: 12-20 ng/ml	Mild to moderate Deficiency: 10-24 ng/ml	Optimal: 30-50 ng/ml
Optimal: ≥ 30 ng/ml	Optimal: ≥ 20 ng/ml	Optimal: 25-80 ng/ml	

(AACE, 2019)

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Dilemma

Primary cause of Vitamin D deficiency is … lack of exposure to sunlight. A secondary cause is breastfeeding without supplementation Almeida et al., 2018).

Chesney (2012) reminds us that sun exposure increases the risk of skin cancer.

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But I (my Kids) Get A LOT of Sun!

- Southern Louisiana (Ponnapakkam, Bradford, & Gensure, 2010).
  - No good evidence for universal supplementation of breastfed infants (n < 100)
  - Participants were considered breastfed as long as they received less than 50% of their diet from infant formula
  - The 'target goal' was the equivalent of 20 ng/mL, which may not be considered ideal (AACE, 2019).
- Darker skinned individuals require nearly 6 times the amount of sun exposure that light-skinned individuals require. Direct exposure needed (Di Marco, Kaufman, & Rodda, 2019).

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Associated with Vitamin D Deficiency

- Infants/Children
  - Rickets (NIH, 2020)
  - Osteomalacia/osteomalacic myopathy (Ariganjoye, 2017)
  - Hypocalcemic seizures/tetany (NIH, 2020)
  - Growth restriction
  - Fractures
  - Elevation of serum parathyroid hormone (Anderson-Berry et al., 2017)
  - T1DM/T2DM/Metabolic Syndrome (Ariganjoye, 2017)

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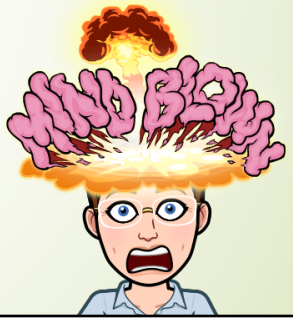
Associated with Vitamin D Deficiency, cont.

- Infants/Children
  - Infectious diseases/decreased immunity (Ariganjoye, 2017)
  - Autism (Ariganjoye, 2017)
  - Developmental Delay (NIH, 2020)
  - Hashimoto's Thyroiditis (Ariganjoye, 2017)
- Adults
  - Osteomalacia/osteoporosis (NIH, 2020)
  - Cardiomyopathy (NIH, 2020)
  - Unexplained fatigue & difficulty thinking clearly (Nguyen, 2017)
- Dental abnormalities (NIH, 2020)

Some of these are *PERMANENT* consequences



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Rickets … A Closer Look

- There are multiple types of Rickets and nutritional intake is not the only consideration (Ariganjoye, 2017)
  - Nutritional or privational
  - Pseudovitamin D deficiency rickets
  - Vitamin D–resistant rickets
  - Vitamin D–dependent rickets types III and autosomal dominant or X-linked dominant hypophosphatemic rickets
- Consider inborn errors of metabolism when dealing with rickets (Khokhar, Castells, & Perez-Colon, 2015)

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Hypocalcemic Seizures/Tetany

- Symptoms often appear during periods of rapid growth
  - Laryngospasm
  - Parasthesia
  - Numbness
  - Muscle cramps/spasms
  - Chvostek's and Trousseau's signs
  - Tetany
- Seizure
  - most serious result of Vit D deficiency and hypocalcemia

(Ariganjoye, 2017; NIH, 2020)

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Infectious Disease

- Low D levels (including found in cord blood at birth) associated with increased risk of respiratory disease
  - Tuberculosis
  - Respiratory Syncytial Virus (RSV) – especially with VDR/Type II Rickets
  - Acute Otitis Media (AOM) – i.e. ear infections
  - SARS-Cov-2 – higher Vit D levels might be protective against our most recent respiratory/inflammatory disease related to the COVID-19 pandemic

(Ariganjoye, 2017; D'Avolio, et al., 2020; Grant et al., 2020 [2 studies])

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- Vit D deficiency is prevalent in AK; breastfeeding without D3 supplementation is the greatest risk factor (Gessner, Plotnik, & Muth, 2003)
- In some Native populations, a shift away from traditional diet contributes to Vit D deficiency (Luick, Bersamin, & Stern, 2014)
- (O'Brien et al., 2016) Decreased intake of traditional marine foods by Alaska Native women (from the 1960s to 1990s) associated with decline in vitamin D concentrations
  - Promotion of traditional marine foods
  - Routine vitamin D supplementation during pregnancy
- (Pachoe, 2017) Alaska Native children experience almost double the rate of rickets compared to the general U.S. pediatric population

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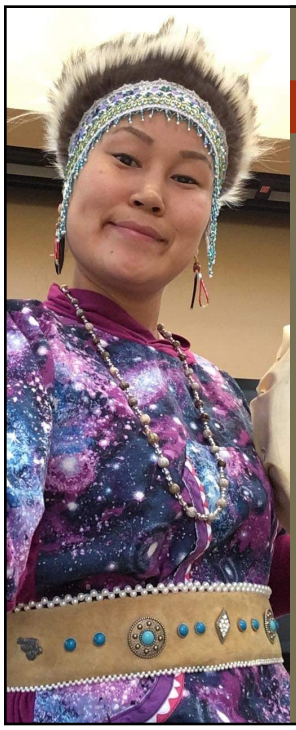

Additional AK Considerations

- (Singleton et al., 2015)
  - Importance of northern latitude and malnutrition as potential contributors to vitamin D deficiency/rickets
  - Importance of vitamin D supplementation in both breast-fed and formula-fed infants. Evaluation of optimal vitamin D supplementation, including contribution of traditional Native diet to healthy vitamin D levels.
- (Singleton et al., 2019)
  - Severe vitamin D deficiency in pregnancy may strongly influence primary dentition, resulting in higher incidence of severe early childhood caries in AN children.

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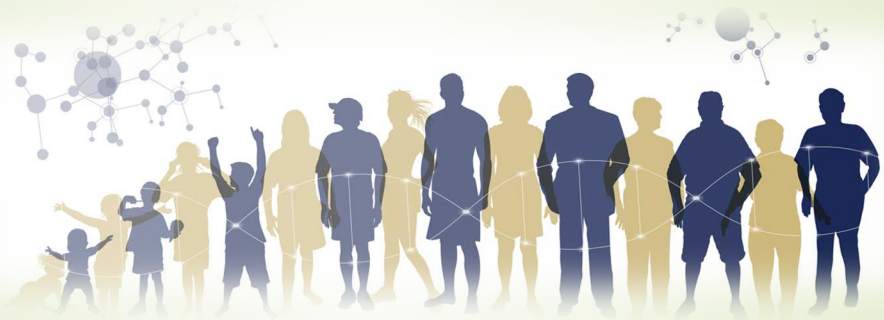

Special Concerns Across the Lifespan …

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Pregnancy

- (Erick, 2017)
  - Human breast milk has been found to be low in certain nutrients in developed countries: Vit D, iodine, iron, & Vit K.
  - Additional nutrient deficiencies / resource-poor countries: Vit A, Vit B12, zinc, and Vit B1/thiamin.
  - Women should know that breastmilk is not "always perfect" so that they can concentrate on targeted dietary improvements → paid forward to the neonate → may lead to improved pre-conceptual nutritional status.
- "Low Vit D levels during pregnancy has been linked to recurrent wheezing in early childhood" (Ariganjoye, 2017, p. 5)
- Pre-eclampsia risk for mom; asthma and T1DM risk for babies of Vit D deficient mothers (DiMarco, Kaufman, & Rodda, 2019).

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Premature Infants

- Higher risk group for insufficiency/deficiency at birth - < 32 week (Anderson-Berry et al., 2017)
- Rickets in preterm infants is usually attributed to decreased calcium and phosphorus absorption d/t low intake or low absorption rates (Abrams & the AAP Committee on Nutrition, 2013)
- SPECIAL SUB-GROUP – those with Williams Syndrome (hypercalcemia of infancy) – should NOT be supplemented (Anderson-Berry et al., 2017)

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TABLE 4 Recommendations for Enteral Nutrition for VLBW Infants

	Calcium, mg/kg per day	Phosphorus, mg/kg per day	Vitamin D, IU/day
Tsang et al (2005)[32]	100–220	60–140	150–400[a]
Klein (2002)[33]	150–220	100–130	135–338[b]
Agostoni[c] (2010)[5]	120–140	65–90	800–1000
This AAP clinical report	150–220	75–140	200–400

[a] Text says "aim to deliver 400 IU/daily."
[b] 90–125 IU/kg (total amount shown is for 1.5-kg infant).
[c] Reflects European recommendations.

(Abrams & the AAP Committee on Nutrition, 2013, page e1682)

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Toddlers/Adolescents/Teens/Adults

- Per NIH (2020) higher risk for:
  - Rickets/osteomalacia/weak bones
  - Bone deformities and pain
  - Hypocalcemic seizures
  - Tetanic spasms
  - Dental abnormalities

Adulthood through Old Age

- Grant & Boucher (2011): Sufficient Vit D levels = health benefits for chronic and infectious diseases
- Implications of low Vit D *may* include DM, CVD, increased frequency of falls, cognitive impairment (Bennett, Frisby, Young, & Murray, 2014); Osteoporosis, fracture risk increase, cancer incidence, [PCOS tx?] (Bohon & Goolsby, 2013)

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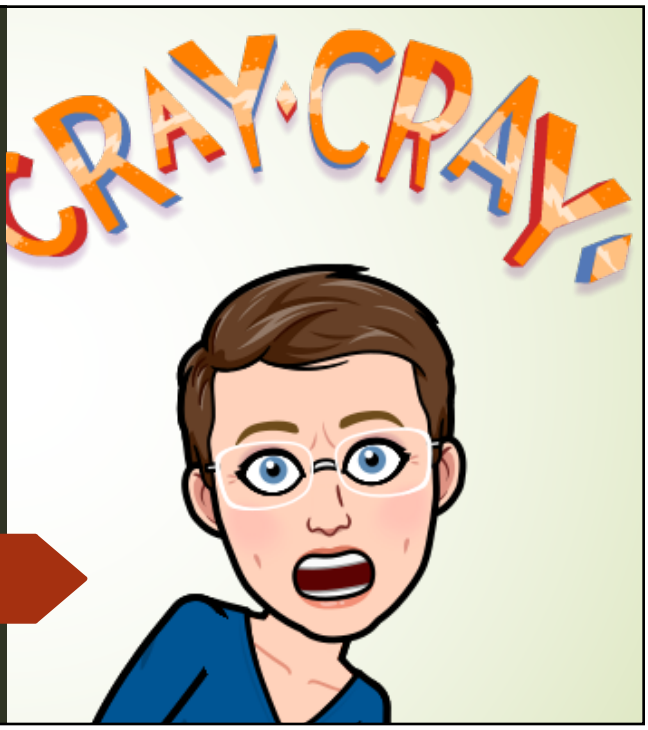
Can I Get TOO Much Vitamin D?



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Is it Difficult to Overdose?

True Vitamin D toxicity is rare –

- Large doses for prolonged periods needed
- > 10,000 IU daily
  - Normal gut absorption
  - Excess calcium intake
- Toxicity is usually associated with serum levels in excess of 150ng/mL
  - Exceptions include hyperparathyroidism, abnormal renal function (80ng/mL)

(AACE, 2019)

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Causes of Vitamin D Toxicity

- Megadosing
  - Adult
    - 60,000 IU daily for several months
  - Infants/Children
    - 20,000 IU daily for several months
    - 66,000 to 800,000 IU daily for up to 2 months – no adverse effect with hospitalization and IV therapy (Anderson-Berry et al., 2017 from Kara et al's case study report of 7 children age 7 mos to 4.2 years)
- Improperly produced/labeled supplements

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Symptoms of Vitamin D Toxicity

- Resulting from hypercalcemia and hypercalciuria
  - Nausea/vomiting
  - Abdominal pain
  - Nephrolithiasis
  - Central nervous system depression
  - Fever
  - Anorexia (Failure to Thrive – FTT)
  - Weakness
  - Constipation
  - Fatigue

(Almeida et al., 2018; Anderson-Berry et al., 2017; Bilbao, 2017; Rajakumar, Reis, & Holick, 2012)

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Case Studies of Toxicity: Breastfed Infants

- 2 infants (both under 3 months) presented multiple times to the ER for decreased feeding, lethargy, inconsolable crying, and dehydration.
- Both received OTC Vit D supplement: 2,000 IU and 20,000 IU/day respectively over the course of months. Parents gave 1 mL rather than dosing by IU
- What happened to the babies?

(Bilbao, 2017)

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Preventing Accidental Overdose

- It is essential that medication reconciliation occur:
  - Clarifying what brand/type of Vitamin D has been utilized.
  - Dosages should be written/documented in the chart in IU's, not in mL's.
  - This should be done *at least* at the newborn/2-week well-visit, and the 2- and 4-month well-visits (ideally it is done at every patient encounter).
  - Special attention should be paid to OTC purchases of concentrated drops (parents do seem to prefer them because it is less liquid to get the same amount of supplement).

(Bilbao, 2017)

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Absorption Concerns

- NIH, 2020 – Certain disorders may affect Vitamin D levels
  - Fat malabsorption is associated with medical conditions that include some forms of liver disease, cystic fibrosis, celiac disease, Crohn's disease, and ulcerative colitis
  - Obesity (d/t sequestration)
  - h/o gastric bypass surgery
- Statin medications reduce absorption (Pachoe, 2017)
- Abrams, S. A., Weaver, C. M., & Pittaway, M. (2012) – Antiseizure and glucocorticoid meds are known to negatively affect bone health; HIV meds (Nguyen, 2017)
  - Acceleration of bone turnover and/or impaired conversion of vitamin D in the liver.

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Vitamin D is in food … right?

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How Much Vitamin D is in milk?

67-128 IU per 8-ounce serving of fortified whole cow's milk

USDA, 2014

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Breakin' it Down

Nutrition Facts Servings: about 16, **Serv. size: 1 cup (240mL),** Amount per serving: **Calories 150,** **Total Fat** 8g (10% DV), Sat. Fat 4.5g (23% DV), Trans Fat 0g, **Cholest.** 25mg (8% DV), **Sodium** 115mg (5% DV), **Total Carb.** 12g (4% DV), Fiber 0g (0% DV), Total Sugars 12g (Incl. 0g Added Sugars, 0% DV), **Protein** 8g, Vit. D (15% DV), Calcium (20% DV), Iron (0% DV), Potas. (6% DV), Vit. A (10% DV). *% DV = % Daily Value

Nutrition Facts Servings: 16, **Serv. size: 1 cup (236mL),** Amount per serving: **Calories 160, Total Fat** 8g (10% DV), Sat. Fat 4.5g (23% DV), Trans Fat 0g, **Cholest.** 30mg (10% DV), **Sodium** 85mg (4% DV), **Total Carb.** 11g (4% DV), Fiber 0g (0% DV), Total Sugars 10g (Incl. 0g Added Sugars, 0% DV), **Protein** 8g, Vit. D (10% DV) Calcium (25% DV), Iron (0% DV), Potas. (8% DV).

Between 1 and 3 years of age, AAP recommends approximately 16-24 ounces of whole milk daily (Porto & Drake, 2017).

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Comparison of Common Unflavored Milk Alternatives

	Whole Milk (1 cup)	Rice Milk (1 Cup)	Soy Milk (1 cup)	Coconut Milk (1 cup)	Almond Milk (1 cup)	Oat Milk (1 cup)	Hemp Milk (1 cup)
Energy (kcal)	149	115	105	76	37	130	70
Protein (g)	7.69	0.68	6.34	0.51	1.44	4	3
Total fat (g)	7.93	2.37	3.59	5.08	2.68	2.5	5
Saturated fat (g)	4.55	0	0.5	5.083	0	0	0.5
Cholesterol (mg)	24	0	0	0	0	0	0
Carbohydrate (g)	11.71	22.37	12	7.12	1.42	24	1
Calcium (mg)	276	288	300	459	481	350	300
Iron (mg)	0.07	0.49	1.02	0.73	0.85	1.8	1.8
Vitamin D (IU)	128	96	108	96	96	100	100

Note: Homemade almond milk or other homemade milk alternatives do not contain the same number of vitamins, because they are not fortified.

Cow's Milk 'Alternatives'

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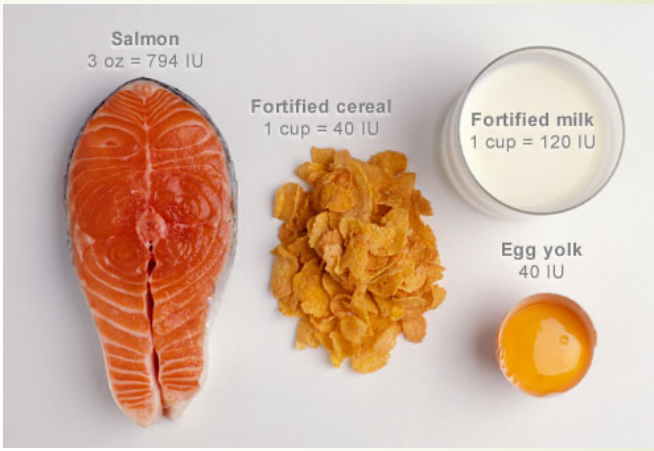
Food Sources?

Few foods naturally contain Vitamin D …



Fatty fish, fish liver oil, egg yolk (IOM, 2011); fatty fish (salmon, herring & whitefish), fish roe, wild game (Luick, Bersamin, & Stern, 2014).

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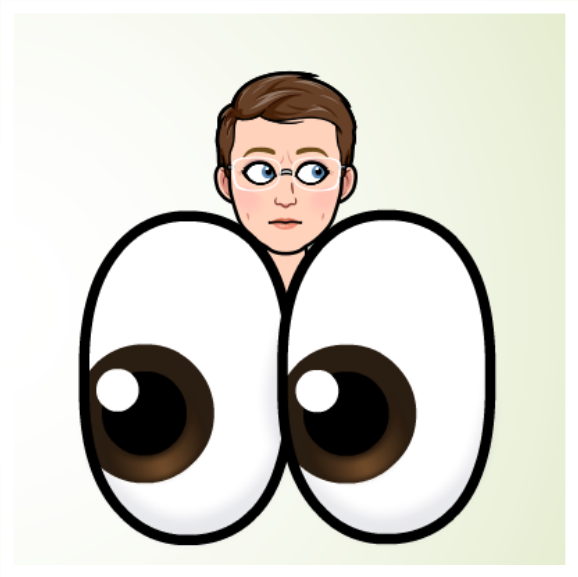
Table 3: Vitamin D Content of Selected Foods [25]

Food*	Micrograms (mcg) per serving	International Units (IU) per serving	Percent DV*
Cod liver oil, 1 tablespoon	34.0	1,360	170
Trout (rainbow), farmed, cooked, 3 ounces	16.2	645	81
Salmon (sockeye), cooked, 3 ounces	14.2	570	71
Mushrooms, white, raw, sliced, exposed to UV light, ½ cup	9.2	366	46
Milk, 2% milkfat, vitamin D fortified, 1 cup	2.9	120	15
Soy, almond, and oat milks, vitamin D fortified, various brands, 1 cup	2.5-3.6	100-144	13-18
Ready-to-eat cereal, fortified with 10% of the DV for vitamin D, 1 serving	2.0	80	10
Sardines (Atlantic), canned in oil, drained, 2 sardines	1.2	46	6
Egg, 1 large, scrambled**	1.1	44	6
Liver, beef, braised, 3 ounces	1.0	42	5
Tuna fish (light), canned in water, drained, 3 ounces	1.0	40	5
Cheese, cheddar, 1 ounce	0.3	12	2
Mushrooms, portabella, raw, diced, ½ cup	0.1	4	1
Chicken breast, roasted, 3 ounces	0.1	4	1
Beef, ground, 90% lean, broiled, 3 ounces	0	1.7	0
Broccoli, raw, chopped, ½ cup	0	0	0
Carrots, raw, chopped, ½ cup	0	0	0
Almonds, dry roasted, 1 ounce	0	0	0
Apple, large	0	0	0
Banana, large	0	0	0
Rice, brown, long-grain, cooked, 1 cup	0	0	0
Whole wheat bread, 1 slice	0	0	0
Lentils, boiled, ½ cup	0	0	0
Sunflower seeds, roasted, ½ cup	0	0	0
Edamame, shelled, cooked, ½ cup	0	0	0



(NIH, 2020)

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Nutrition Information

Powder / 1.45 lb

Serving size: 100 Cal (5 fl oz, prepared as directed)

Amount per serving	
Calories:	100
Volume, mL:	148
Protein, g:	2.07
Fat, g:	5.6
Carbohydrate, g:	10.5
Water, g:	134
Linoleic Acid, mg:	1000
Vitamins & Minerals	–
Vitamins	
Vitamin A, IU:	300
Vitamin D, IU:	60

Infants – Formula-fed

- A baby will need to drink approximately 34 ounces total/day of formula to get the recommended minimum 400 IU of Vitamin D
- Most infants are not taking 34 ounces of fluid daily until they are older – some infants NEVER take 34 ounces

Image: https://similac.com/baby-formula/pro-advance

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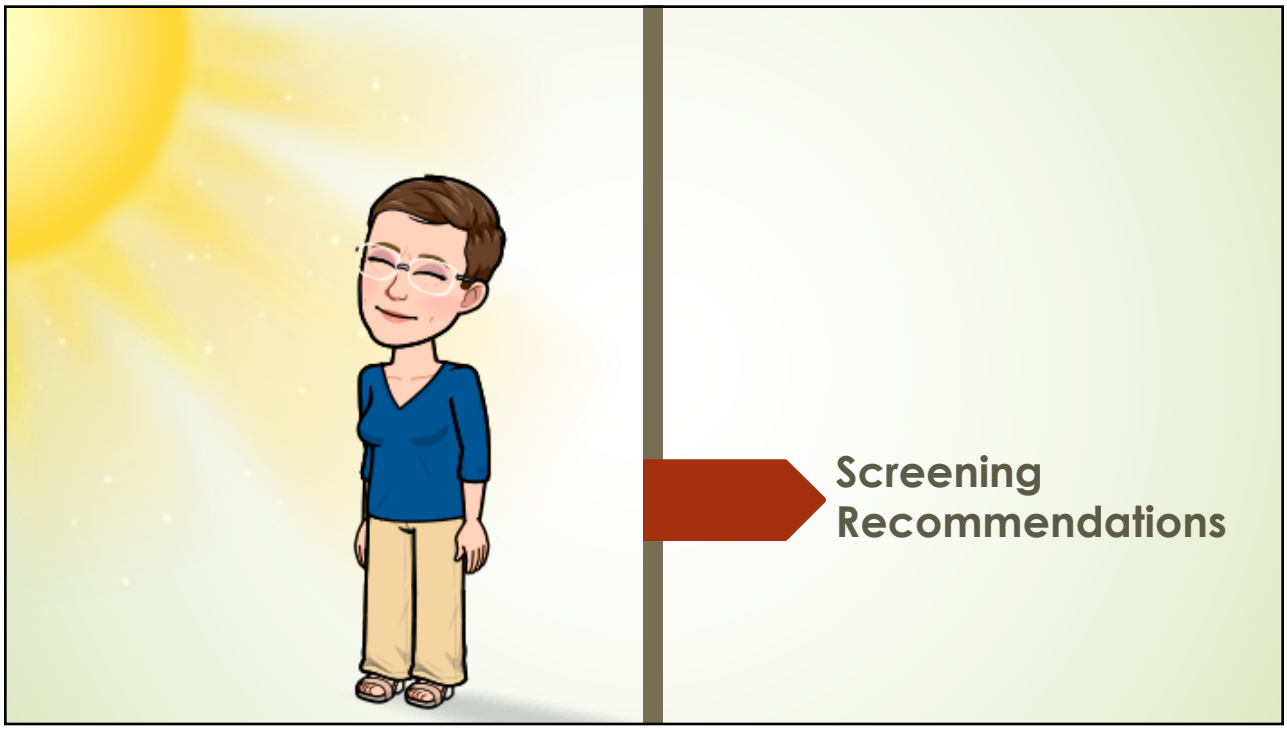

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- Haddow (2011): Recommended consideration of screening in certain populations, including BF mothers/infants.
  - Neither the Endocrine Society, the Mayo Clinic, the U.S. Preventive Services Task Force, nor the American Association of Clinical Endocrinologists recommends universal screening for vitamin D deficiency among the general population or asymptomatic individuals. However, they do recommend screening in individuals with risk factors for vitamin D deficiency. These include the following:
    - Malnutrition
    - Sedentary Lifestyle
    - Limited sun exposure
    - Obesity
    - Dark skin
    - Age ≥ 65
    - Conditions causing gastrointestinal malabsorption, including short bowel syndrome, pancreatitis, inflammatory bowel disease, amyloidosis, celiac sprue, and bariatric surgery.
    - Liver disease or failure
    - Renal insufficiency or nephrotic syndrome
    - Cystic Fibrosis
    - Medications that alter vitamin D metabolism, including anticonvulsants and glucocorticoids

(AACE, 2019)

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Supplementation Recommendations

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Recommendations of Health Organizations

- World Health Organization (WHO) – "Further research is needed before specific recommendations can be made" (2019)
- Institute of Medicine (IOM) – For all age groups, minimum of 400 IU to a maximum of 4000 IU upper intake limit, depending on age (2011)
- Centers for Disease Control & Prevention (CDC, 2018) –
  - 400 IU daily for infants 0-12 months
  - 600 IU daily for children 12-24 months
- U.S. Preventive Services Task Force (USPSTF) –
  - No universal population-based screening

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Recommendations of Professional Bodies

- American Academy of Pediatrics (AAP) –
  - Infants: About 400 IU to a maximum of 1000 IU daily (Abrams & the American Academy of Pediatrics Committee on Nutrition, 2013)
  - Teenagers and adults: At least 2000 IU daily (Abrams, Weaver, & Pittaway, 2012)
- Academy of Breastfeeding Medicine (ABM) –
  - Breastfeeding infants: 400 to 800 IU daily from Vit D3 supplement
  - Breastfeeding mother: 6400 IU daily if there is no direct infant supplementation (Taylor & the ABM, 2018)

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Supplement the Mother?

- Thiel, Senti, & Anderson (2013)
  - When maternal vitamin D intake is sufficient, vitamin D transfer via breast milk is adequate to meet infant needs
  - Up to 10 times the current RDI of vitamin D was needed to produce sufficient transfer from mother to breastfed infant
  - SAFETY: Monitoring lactating mothers' vitamin D status
- Czech-Kowalska et al. (2014): Dosing at 1200 IU/day was insufficient to meet infant needs (this was a RCT).
- Furman (2015): Who advises/pays?

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… Supplement the Mother, cont.?

- Gellert et al. (2016): BF women more likely to be Vit D deficient.
- Darmawikarta et al. (2016): Beyond 1-year of age if breastfeeding continues, then supplementation of Vit D should continue (no recommended dosage)
- * Dawodu et al. (2019): 6000IU/day for the breastfeeding mother was equivalent to 400IU/day/baby and 600IU/day/mother (RCT).
- O'Callaghan et al. (2020) performed a meta-analysis of the literature – Maternal dosing versus higher infant-interval dosing
  - 2 most recent trials found the 2 dosing regimens to be comparable/Limited by the small number of eligible trials/ variable quality of data/Inconsistent reporting of safety issues
  - Plausible substitutes, but the evidence is still too weak

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Parent & Provider Confusion

Day, Krishnarao, Sahota and Christian (2019)

- Parents were not aware of the importance of Vit D, dietary requirements, or fortified foods
- Effective promotion of Vit D information to parents needed

Per Bennett, Frisby, Young, and Murray (2014)

- Uncertainty in Vit D knowledge & supplement recs: both providers & parents
- Patients attempt to discuss the issue with providers, but become frustrated and distrust that providers understand
- Providers feels the same consulting experts/ professional societies

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Are We Meeting Recommendations?

- In a review of NHANES[1] data, under 28% of infants 0-12 months met recommendations to get 400IU Vitamin D daily (Ahrens, Rossen, & Simon, 2015).
- Crocker et al. (2011): BC Canada – 80% of infants got proper supp.
- Among healthy, term, breastfed infants, vitamin D supplement dosage of 1600 IU/d increased concentrations in serum to [30-60 ng/ml] or greater at 3 months. This dosage also increased hypercalcemia although no AE were observed. (Gallo et al., 2013).
  - 400, 800, 1200, or 1600 IU, all in 2 mL – double-blind RCT involving 132 term infants starting at less than 1 month of age.

[1]NHANES: National Health and Nutrition Examination Survey (parent recall)

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Recommended Dietary Allowances

Table 2: Recommended Dietary Allowances (RDAs) for Vitamin D [1]

Age	Male	Female	Pregnancy	Lactation
0-12 months*	10 mcg (400 IU)	10 mcg (400 IU)		
1–13 years	15 mcg (600 IU)	15 mcg (600 IU)		
14–18 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
19–50 years	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)	15 mcg (600 IU)
51–70 years	15 mcg (600 IU)	15 mcg (600 IU)		
>70 years	20 mcg (800 IU)	20 mcg (800 IU)		

*Adequate Intake (AI)

(NIH, 2020)

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Tolerable Upper Intake Levels

Table 4: Tolerable Upper Intake Levels (ULs) for Vitamin D [1]

Age	Male	Female	Pregnancy	Lactation
0-6 months	25 mcg (1,000 IU)	25 mcg (1,000 IU)		
7–12 months	38 mcg (1,500 IU)	38 mcg (1,500 IU)		
1–3 years	63 mcg (2,500 IU)	63 mcg (2,500 IU)		
4–8 years	75 mcg (3,000 IU)	75 mcg (3,000 IU)		
9–18 years	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)
19+ years	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)	100 mcg (4,000 IU)

(NIH, 2020)

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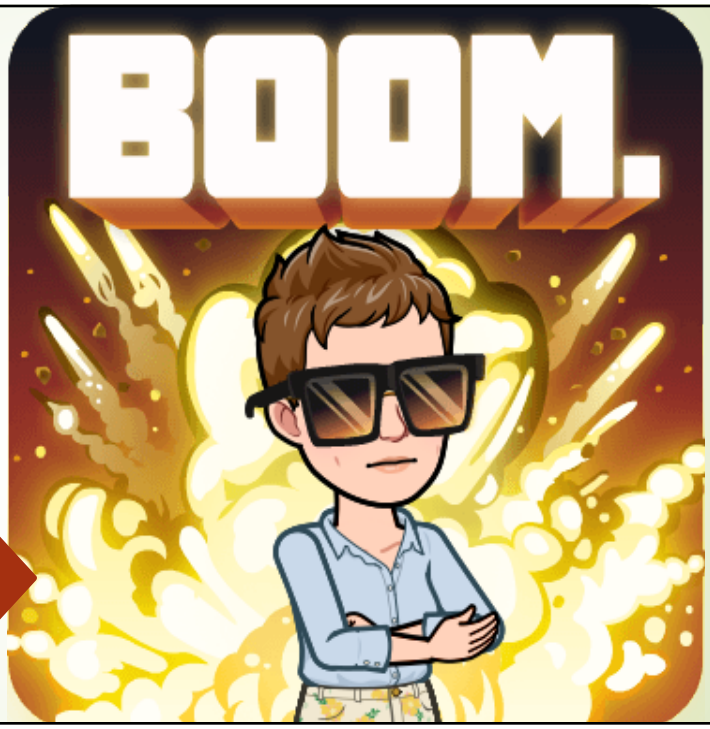
My Conclusion



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Prevention: Endocrine Society Recommendations

- The Endocrine Society recommends the following daily intakes of vitamin D to prevent deficiency and maximize bone health.
  - Children age 0-1: at least 400 IU/day. May require 1,000 IU/day to achieve > 30ng/ml
  - Children age 1-18: at least 600 IU/day. May require 1,000 IU/day to achieve > 30ng/ml
  - Adults age 19-70: at least 600 IU/day. May require 1,500-2,000 IU/day to achieve > 30ng/ml
  - Adults older than 70: at least 800 IU/day. May require 1,500-2,000 IU/day to achieve > 30ng/ml
- Obese children and adults; those on anticonvulsant medications, glucocorticoids, and antifungals such as ketoconazole; and those taking medications for AIDS should be given at least two to three times more vitamin D for their age group to satisfy their body's requirement.

(AACE, 2019)

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Treatment: Endocrine Society Recommendations

- Age 0-1
  2,000 IU per dInfants and Toddlers ay or 50,000 IU once weekly for 6 weeks to achieve a blood level 25(OH)D above 30 ng/ml. Followed by maintenance therapy of 400-1,000 IU/day.
- Children Age 1-18
  2,000 IU per day for at least 6 weeks or 50,000 IU once weekly for at least 6 weeks to achieve a blood level 25(OH)D above 30 ng/ml. Followed by maintenance therapy of 600-1,000 IU/day.
- Adults
  6,000 IU per day or 50,000 IU per week for 8 weeks to achieve a blood level 25(OH)D above 30 ng/ml. Followed by maintenance therapy of 1,500-2,000 IU/day.
- Special Cases
  Obese patients, those with malabsorption syndromes, and those on medications affecting vitamin D metabolism should receive a higher dose of 6,000 to 10,000 IU/day to achieve levels above 30 ng/ml. Followed by a maintenance dose of 3,000-6,000 IU/day.

(AACE, 2019)

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Bibliography Provided Separately

Questions?

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Acknowledgements:
My JBER Pediatric colleagues
Terriann Shell

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Please remember to complete your survey for continuing education for this session!

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