In the Name of GOD

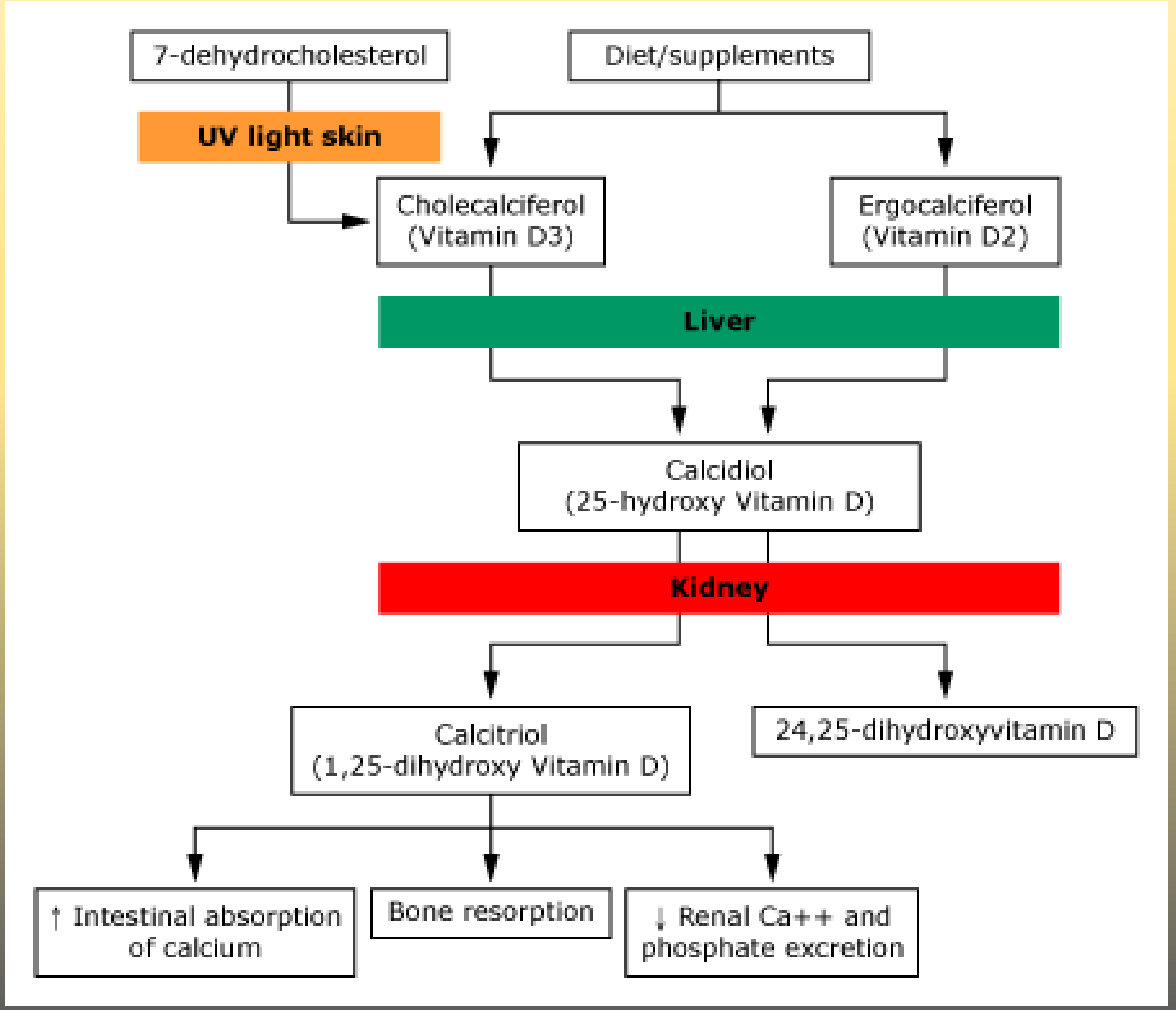
Rickets and Vitamin D Deficiency

A. AMIRHAKIMI MD
PEDIATRIC ENDOCRINOLOGY AND METABOLISM
SHIRAZ UNIVERSITY OF MEDICAL SCIENCES

Forms of Vitamin D

- Cholecalciferol (Vitamin D3)
  - Cutaneous synthesis
  - Animal products
  - Vitamin D supplements
- Ergocalciferol (Vitamin D2)
  - Plant dietary sources
  - Vitamin D supplements
- Calcidiol: 25(OH)D
  - Storage form
- Calcitriol: $1,25(OH0)^2D$
  - Active form

Metabolism of Vitamin D



Sources of Vitamin D

1. Exposure to Sunlight
2. Sardines, Salmon, Mackerel, Tuna
3. Cod liver oil
4. Raw milk
5. Caviar
6. Eggs
7. Mushrooms
8. Fortified food

Targets for Vitamin D Intake (RDA)

- Term Infants: 400 IU/day vitamin D3
- Healthy children 1-18 y/o: 600 IU/day
- Preterm infants:
  - Very low birth weight (<1500 g): 200-400 IU/day
  - >1500 g: 400 IU/day
- Higher doses in:
  - Obese children
  - Medical conditions (malabsorption ,…)
  - Children on mentioned medication

National Protocol for Vitamin D Supplementation

دستورالعمل کشوری
مکمل یاری با مگادوز ویتامین د

- < 2 y/o: 400 IU/day
- 2-18 y/o: 50,000 units every 2 months
- 18-60 y/o: 50,000 units every 1 month
- > 60 y/o: 50,000 units every 1 month
- Pregnancy: 1000 IU/day
  - ? any previous vitamin consumptions ?
  - **No need** to check 25(OH)D
  - Sunlight exposure recommended
  - Signs of toxicity should be mentioned

Prevalence

Vitamin D deficiency prevalence is increasing globally.

- Increasing frequency since the mid 1980s
  - 15 % (overall), 1-2 % severe deficiency (United States)
  - 60% (even up to 80%) in different areas of Iran
  - Higher prevalence in females

Causes of Vitamin D Deficiency

- Decreased nutritional intake
- Decreased synthesis
- Latitude
- Sunlight
  - Midday
  - Season
  - Arms+ legs Or
  - Hands+ arms + face
  - No sunblock
- Light skinned: 10-15 min
- Dark skinned: 3-10 times more

Causes of Vitamin D Deficiency (cont'd)

- Obesity
- Liver & kidney diseases
- Perinatal factors
  - Maternal vit D deficiency
  - Prematurity
  - Exclusivle breastfeeding
- Malabsorption
  - Celiac
  - CF
  - IBD
  - Surgery

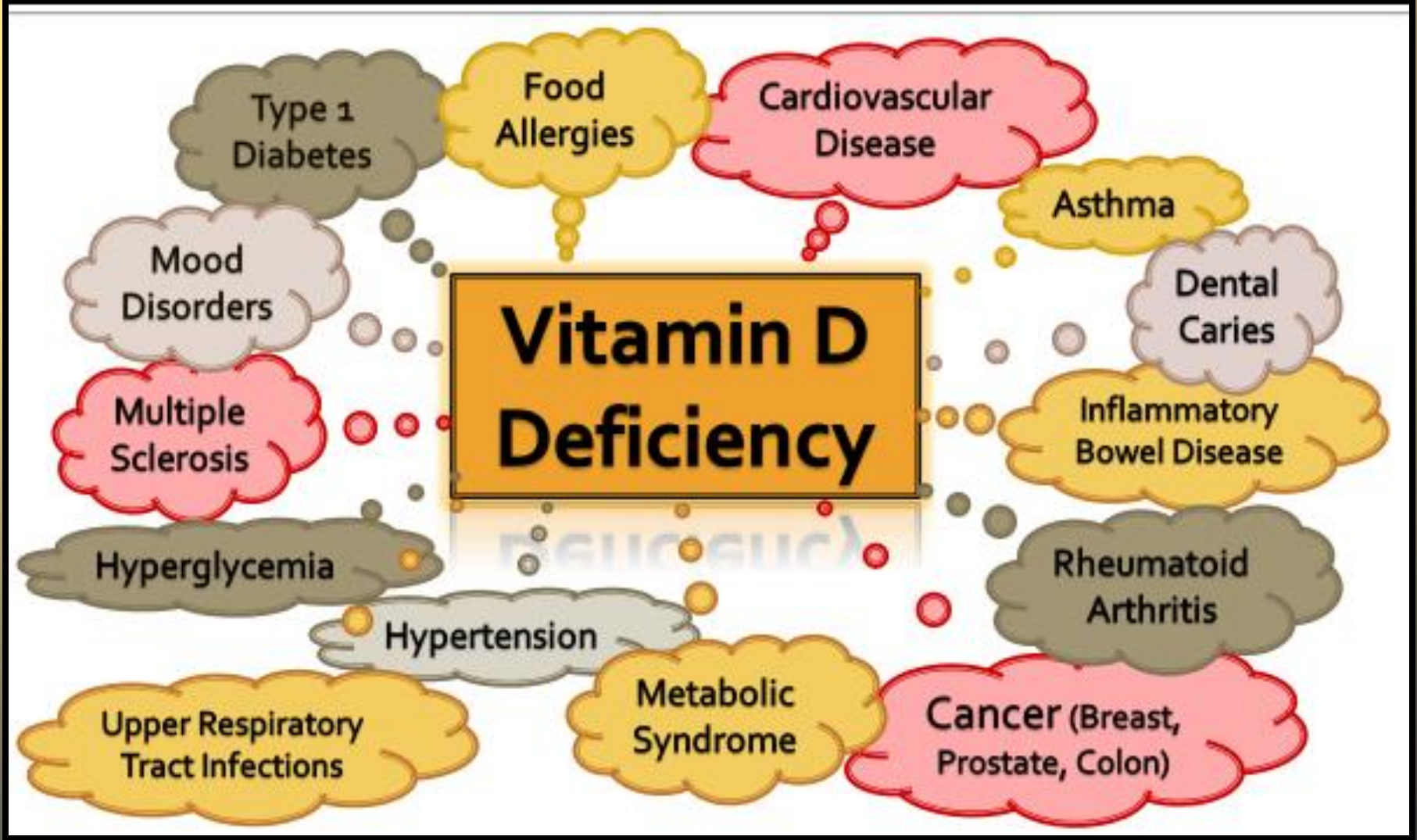
Causes of Vitamin D Deficiency (cont'd)

- Genetic disorders
  - 1-alpha-hydroxylase deficiency or vitamin D-dependent rickets type I A
  - 25-hydroxylase deficiency or vitamin D-dependent rickets type 1B
  - Hereditary resistance to vitamin D or vitamin D-dependent rickets type II
    - mutations in the vitamin D receptor gene
- Medication
  - Anti Epileptic Drugs (AEDs)
  - Antiretrovirals
  - Glucocorticoids
  - Antifungals

Why is Vitamin D Important?

- An essential nutrient that plays an important role in calcium homeostasis and bone health.
- Can **reduce cancer cell growth**, help control infections and reduce inflammation.
- Covid-19 infection & Vitamin D:
  - Reduced vitamin D values resulted in a **higher infection risk**, **mortality** and **severity COVID-19 infection**. Supplementation may be considered as **preventive and therapeutic measure**.

Associations

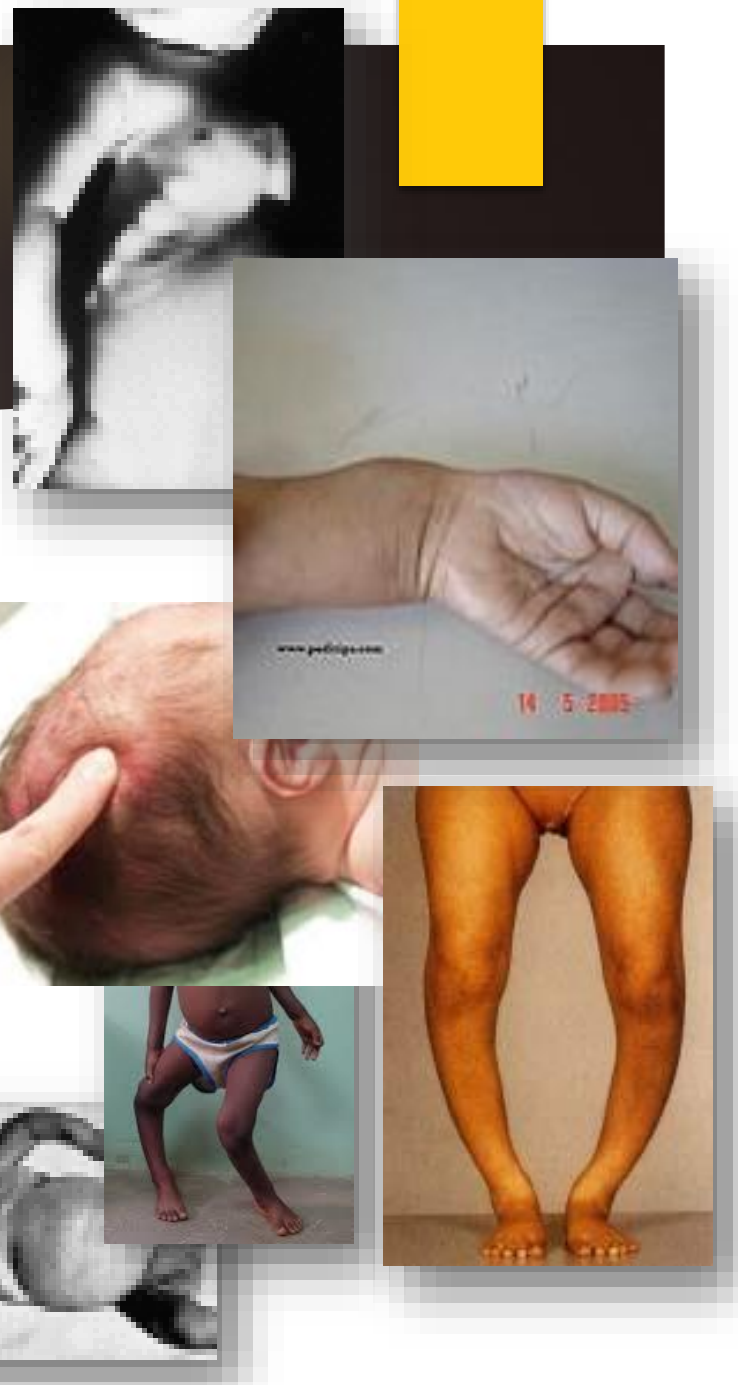


SIGNS
You May Have a

VITAMIN D
DEFICIENCY

Rickets & Vitamin D Deficiency

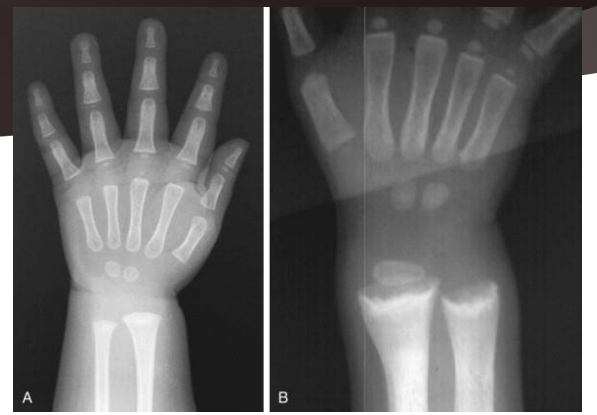
- Rickets is the **principle manifestation** of vitamin D deficiency in infants and young children
  - Asymptomatic, pain and irritability, motor delays, and poor growth
  - Younger children: delayed closure of fontanelles, craniotabes, frontal bossing, prominence of costochondral junctions, widening of wrists and ankles, and bow legs or knock knees
  - Muscle weakness and discomfort, difficulty standing or walking



Rickets & Vitamin D Deficiency (cont'd)

- Advanced vitamin D-deficient rickets:
  - seizures, tetany or apneic spells, stridor, wheezing, hypotonia, and hyperreflexia, particularly in very young children.
- These are a consequence of **severe hypocalcemia**, more likely during periods of very rapid growth (infancy and adolescence)
- Osteomalacia
  - Principle manifestation of vitamin D deficiency in older adolescents and adults
  - Asymptomatic
  - Isolated or generalized muscle & bone pain

What to test?



- 25(OH)D level
  - Gold standard: HPLC & LC-MS
  - Radioimmunoassay (?)
  - Significant controversy in determining standards

- Suspicious to rickets if:
  - Growing child with 25(OH)D < 20 ng/mL
  - Very young age (< 3 y/o)
  - Physical signs of rickets

Check :
- Ca
- P
- Alk ph
- PTH
- Radiographs

Definition (children & adolescents)

- Vitamin D **sufficiency**:
  - 20-100 ng/mL
- Vitamin D **insufficiency**:
  - 12-20 ng/mL
- Vitamin D **deficiency**:
  - < 12 ng/mL
- Vitamin D **intoxication**:
  - > 150 ng/mL

Treatment


upSpring
wellbaby
IRON + VITAMINS
supports nutrition for growth & development


VITAMIN 1000
D3
100 TABLETS


Vita optimum
Vitamin D3
5000 IU
Promotes A Healthy Heart
Strengthens Bones & Teeth
Supports Immune Health
Supports Muscle Energy
ORGANIC
DIETARY SUPPLEMENT
360 SOFTGELS


Ddrops
liquid vitamin D3
1000 IU
180


Stérogyl 15 "H"
Stérogyl 15 "A"


CALCITRIOL


PRESCRIPTION MEDICINE (NZ)
One-Alpha
drops
2 mcg/ml
20 ml

Treatment

- If 25(OH)D: 20-30 ng/mL and NO symptoms & NO risk factors:
  - Review the diet
  - Vitamin D supplements
  - Monitor 25(OH)D periodically and treat if < 20 ng/mL

Treatment

- If 25(OH)D < 20 ng/mL or Rickets → Treat
  - Infants < 12 m/o:
    - 2000 IU/day for 6-12 wks
    - Followed by maintenance: 400 IU/day
  - Children > 12 m/o:
    - 2000 IU/day for 6-12 wks or 50,000 IU/wk for 6 wks
    - Followed by maintenance: 600-1000 IU/day
  - Need for higher doses in:
    - Obesity, malabsorption, on medication
    - 6000 IU/day for 6-12 wks & higher maintenance

Treatment of Rickets

- 2000-5000 IU/day for 4-6wks

OR

- Stoss therapy:
  - <12 m/o: 300,000 IU in 5cc olive oil / 6 hrs
  - >12 m/o: 600,000 IU in 5cc olive oil / 6 hrs

AED-Induced Vitamin D Deficiency

- Preventive Dose: 400-2000 IU/day
- Monitor 25(OH)D yearly
- If 25(OH)D < 20 ng/mL :
  - Treat
    - 2000 IU/day for 6-12 wks or 50,000 IU/wk for 6 wks
  - Monthly measurement of 25(OH)D
  - Increase the dose accordingly (upto 5,000-15,000 IU/day)

AED: Anti Epileptic Drugs

Treatment of Vitamin D Deficiency in Adults

- 25(OH)D< 10 ng/mL:
  - 50,000 IU/wk for 6-8 wks then 800 IU/day
- 25(OH)D 10-20 ng/mL:
  - 800-1000 IU/day then repeat test 3-4 m later
- 25(OH)D 20-30 ng/mL:
  - 600-800 IU/day
- Vit D deficiency in pregnancy:
  - 600-800 (1000-2000) IU/day is safe
  - Maintain 25(OH)D > 30 ng/mL
  - Urinary Ca excretion should be monitored

Follow-Up

- Individual variation in response can be seen → therapy might need to be repeated.

- Low 25(OH)D:
  - Check 25(OH)D levels after 2-3 m
- Low 25(OH)D & biochemical changes:
  - Check 25(OH)D & other chemistries 6-8 wks later, then 6 m later, then annually
- Rickets:
  - Close follow up after 1-2 wks, then every month until Alk Ph normalizes

Thank You For Your Attention