Vitamin D testing
Production of vitamin D

Sunlight

Skin

7-Dehydrocholesterol

Cholecalciferol (vitamin D₃)

Liver

25-hydroxyvitamin D₃

Kidney

1,25-dihydroxyvitamin D₃

Maintains calcium balance in the body

dietary intake

Vitamin D₃ (fish, meat)
Vitamin D₂ (supplements)
Why is vitamin D important?

- Maintains calcium homeostasis
  - Increases Ca absorption in gut, reduces Ca loss in urine, if low Ca diet – resorption from bone
  - Severe vitamin D deficiency causes rickets in children and osteomalacia in adults
How much vitamin D is enough?

Most of any protective effect occurs with levels $\geq 50\text{nmol/L}$ (i.e. little evidence for a need for very high levels)
5 QUESTIONS TO ASK YOUR DOCTOR BEFORE YOU GET ANY TEST, TREATMENT OR PROCEDURE
DO I REALLY NEED THIS TEST OR PROCEDURE?

• Vitamin D insufficiency has been linked with increased risk of a wide range of diseases

BUT

• It is not clear that this is a causal association
• Convincing evidence that risk of rickets and osteomalacia is increased with severe vitamin D deficiency (<30nmol/L)

What is the probability of the patient having severe vitamin D deficiency?
Vitamin D status of adult Australians

Proportion in different categories of 25(OH)D level (nmol/L)

- 6.5% <30nmol/L
- 7.0% >100nmol/L

Male
Female

Australian Health Survey, Biomedical results, 2011-12
Australian Health Survey

Vitamin D deficiency (<50nmol/L) by state and territory, 2011-12

Summer

Winter

Source: Australian Health Survey: Biomedical Results for Nutrients
Australian resident population: Vitamin D deficiency by region of birth, 2011-12

Source: Australian Health Survey: Biomedical Results for Nutrients
Medicare guidelines for vitamin D testing

- Limited sun exposure due to skin pigmentation
- Limited sun exposure due to sun avoidance, including residential care, or other occupational, medical or cultural reasons
- Signs or symptoms of osteoporosis or osteomalacia
- Isolated increased in alkaline phosphatase (ALP) on liver function tests
- Hyperparathyroidism, low serum phosphate or abnormal serum calcium
- Patients with malabsorption, e.g. cystic fibrosis, short bowel disease etc
- Use of anticonvulsants and other medications known to lower vitamin D levels
- Chronic renal failure or renal transplant recipients
- Children under 16 yrs with signs or symptoms of rickets
- Infants whose mother has established vitamin D deficiency
- Patients with a sibling under 16 yrs with vitamin D deficiency.
WHAT ARE THE RISKS (of vitamin D testing)?

• Will there be side effects?
• What are the chances of getting results that aren’t accurate?
• Could that lead to unnecessary or inappropriate treatment?
DEQAS sample 417 (July 2012)
ALTM 47.1 nmol/L

Results sorted in ascending order: range from <20 to >100

Slide courtesy of Dr Graham Carter
Variation in vitamin D assays
Misclassification of vitamin D status by assay....

Lab A=LCMS/MS; Lab B=LCMS/MS; Lab C=immunoassay
Benefits of vitamin D supplementation

• Benefits for severe deficiency

BUT

• No consistent evidence that vitamin D supplementation decreases disease risks except to treat severe vitamin D deficiency (rickets, osteomalacia, falls)
Vitamin D and disease - Is more always better?

Odds of prostate cancer\(^1\) in relation to serum 25(OH)D level

Mortality rate adjusted for age, sex, race/ethnicity and season by 25(OH)D concentration. 15-year follow-up of NHANES III (n=15 099)\(^3\)

Hazard ratios for cardiovascular disease mortality in relation to 25(OH)D level\(^3\)

ARE THERE SIMPLER, SAFER OPTIONS?

- Most vitamin D is UV-induced

UVR

UVA + UVB

DNA damage

Vitamin D

Nitric oxide

PGE2

α-MSH

Cis-UCA

Others, e.g. cytokines

Skin cancers
Is sun exposure a “safer” method to vitamin D sufficiency than supplementation?

- Australia has the highest skin cancer incidence in the world
- Possible non-vitamin D benefits of sun exposure
- Is there a safe pattern of sun exposure that still allows vitamin D production?

Fig 2. Melanoma incidence (blue) & mortality (red), 2012
WHAT HAPPENS IF I DON’T DO ANYTHING?

Will my condition get worse — or better — if I don’t have the test right away?

• Ask about sun exposure to the skin
• Is a behaviour change possible/likely?
• Think about location and season (many people will be mildly insufficient in late winter, but it will get better in summer)
Sun exposure and vitamin D

- Low UVR: southern location, winter
- Low time outdoors
- Little skin exposed when outdoors
- Dark skin

Variation in 25(OH)D level with time outdoors

Variation in seasonal pattern according to latitude
WHAT ARE THE COSTS?

Increase in costs: from $1.02 million in 2000 to >$145 million in 2013 (down to $124 million in 2014)
5 QUESTIONS TO ASK YOUR DOCTOR BEFORE YOU GET ANY TEST, TREATMENT OR PROCEDURE

1. **DO I REALLY NEED THIS TEST OR PROCEDURE?**
   Medical tests help you and your doctor or other health care provider decide how to treat a problem. And medical procedures help to actually treat it.

2. **WHAT ARE THE RISKS?**
   Will there be side effects? What are the chances of getting results that aren’t accurate? Could that lead to more testing or another procedure?

3. **ARE THERE SIMPLER, SAFER OPTIONS?**
   Sometimes all you need to do is make lifestyle changes, such as eating healthier foods or exercising more.

4. **WHAT HAPPENS IF I DON’T DO ANYTHING?**
   Ask if your condition might get worse — or better — if you don’t have the test or procedure right away.

5. **WHAT ARE THE COSTS?**
   Costs can be financial, emotional or a cost of your time. Where there is a cost to the community, is the cost reasonable or is there a cheaper alternative?