The role of Vitamin D and Calcium in preventing falls in the older population

John Senior
CNC Clinical Practice
Auburn Hospital
Guidebook for Preventing Falls and Harm From Falls in Older People: Australian Hospitals
(short version; in the full version it is section 18)

Section 5.2

Vitamin D and Calcium supplementation
This lady typifies many people's conception of “old” she is

- in pain,
- unsteady on her feet
- shorter and kyphotic
- has multiple chronic health care problems

Image on www.beat-menopause-weight-gain.com
The aim of this talk is to challenge perceptions showing how, through a greater understanding of our environment, nutrition and lifestyle changes we can improve our wellbeing.
Objectives:

To understand why vitamin D and calcium deficiency are important Public Health issues

Discuss the recommendations specified in this guidebook
Some definitions:

Vitamin D supplements come in two distinct forms, the strength is usually given as International Units (IU)

- Vitamin D2 (ergocalciferol) is synthesised from yeast
- Vitamin D3 (cholecalciferol) is synthesised from lanolin

25(OH)D
- Is the most accurate blood test to determine vitamin D status
- Is the main storage of vitamin D
- Is a fat soluble pro-hormone that is essential for the production of 1,25(OH)$_2$D$_3$ (the activated form of vitamin D)
Recommendations

Patient assessment

“...hospitalisation should be viewed as an opportunity to identify and address falls risk factors, including adequacy of calcium and vitamin D.”
Recommendations

Intervention

Vitamin D and calcium supplementation should be recommended as an intervention strategy to prevent falls in older people.

Benefits are most likely to be seen when 25(OH)D is:

- < 50 nmol/L  (Insufficiency)
- < 25 nmol/L  (Deficiency)
Low vitamin D levels have been associated with reduced bone mineral density, high bone turnover and increased risk of hip fracture.

It is unlikely that patient benefits from vitamin D and calcium supplementation will be seen in hospital - but there is evidence to support dietary supplementation in the longer term.
Discharge Planning

Continuing care
Any introduction of vitamin D and calcium supplementation should be conveyed to the person’s general practitioner or health provider.

Patient education
Why they are taking vitamin D and or calcium supplementation.
Foods rich in calcium
Foods that contain vitamin D
5.2.1 Assessing vitamin D adequacy

“...vitamin D may prevent falls by improving muscle strength and psychomotor performance, independently of any role in maintaining bone mineral density.”
Bone continually remodels itself through a process of breaking down (or resorption) by osteoclasts and rebuilding (or formation) by osteoblasts.

NB: “Calcium and vitamin D need to be replete in patients prior to commencing osteoporosis treatment “ (eg bisphosphonates)

References:
www.coe-stemcell.keio.ac.jp/member/matsuo.html
ACI. The Orthogeriatric Model of Care. Clinical Practice Guide 2010
Low vitamin D slows the reformation of bone resulting in osteomalacia (lack of bone hardening) and/or osteoporosis (loss of bone formation).
Prevalence of osteoporosis

Approximately 50% of persons 65 years and older in North America and 66% of persons internationally (all ages) failed to maintain healthy bone density.


Separations from Australian hospitals 2005-6 'due to falls' was 145,340

Relationship between calcium and vitamin D

Insufficient calcium absorption

↑ Absorption of calcium in the small intestine

↑ 1,25(OH)$_2$D$_3$ by synthesising more [from 25(OH)D] in the kidney

i.e., Vitamin D enables calcium absorption

Fall in ECF calcium

Increased PTH

↑ Raised PTH is an indicator of Vitamin D deficiency

Absorption of calcium in the small intestine enables calcium absorption.
5.2.2 Ensure minimum sun exposure to prevent vitamin D deficiency

“...5 - 15 minutes exposure of the face and upper limbs to sunlight four to six times a week, although deliberate sunlight exposure between 10am and 3pm in the summer months for more than 15 minutes is not advised...

If this modest sunlight exposure is not possible, a vitamin D supplement of at least 800 IU per day is recommended”
Why is vitamin D deficiency an issue for the older adult?

• As we age our skin loses its ability to synthesize vitamin D

• Elderly people may not like, or have the ability, to receive adequate UVB radiation (ie sunlight)

• Malnourishment is common in the elderly

• Concern about developing skin cancers
5.2.3 Assessing the need for vitamin D and calcium supplementation

For confirmed cases of vitamin D deficiency, supplementation with 3,000 - 5,000 IU per day for at least a month is required to replenish body stores.

For most older adults in long-term care in Australia, it is appropriate to supplement with 1,000 IU vitamin D without measuring 25(OH)D.
Response of Serum Vitamin D Levels to Supplementation

Effect of dose and duration of vitamin D supplementation on the mean serum 25-hydroxyvitamin D [25(OH)D] concentration achieved

5.2.4 Encourage patients to include high-calcium foods in their diet

Referral to a dietitian may be appropriate if a person is having trouble consuming adequate calcium, has lactose intolerance, does not include calcium as a normal part of their diet...

Recommendation for calcium
- 800mg per day for men
- 1,000mg per day for women

“However, this level may be too low, with other sources recommending daily intake of 1,500mg for both men and women.”
5.2.5 Discourage patients from consuming foods that prevent calcium adsorption.

Patients should be discouraged from consuming too many foodstuffs that lower or prevent calcium adsorption:

- caffeine
- soft drinks containing phosphoric acid
People at a higher risk of vitamin D deficiency:

- People who spend most time indoors getting little sun
- Have dark skin
- Wear clothing that covers most of the body
- Use sunscreen whenever they go outside
- Elderly
- Overweight
- Take anticonvulsants
“Vitamin D deficiency is significantly more common among people with dementia and people from culturally and linguistically diverse groups”

“Furthermore, vitamin D deficiency has been associated with osteoporosis, cognitive decline and macular degeneration”
...Vitamin D supplementation is effective in reducing the rate of falls in nursing care facilities...

Reference: The Cochrane Collaboration 2010

Let’s consider some of the reasons why this is so...
Maintenance of: BALANCE

25(OH)D receptors are present in **skeletal muscle**, deficiency leads to: Proximal muscle weakness

Because in the event of tripping or sudden movement people with proximal muscle weakness are not able to correct their sudden balance disturbance
Other musculoskeletal factors to consider

The global bone discomfort and muscle aches of vitamin D deficiency often lead to a misdiagnosis of:

• Fibromyalgia
• Chronic fatigue syndrome
• Arthritis...

Reference Cited Bordelon P. et al American Family Physician October 2009
We have concentrated on the musculoskeletal aspects of vitamin D & calcium deficiency and falls in the older adult now let us consider some other issues.

Firstly cardiovascular effects.
Multivariate adjusted hazard ratios for major adverse CV events

23% of American women (n=1,961) over 20 years old had a pelvic floor disorder, often leading to urinary incontinence.

Low vitamin D levels predicted pelvic floor disorders; urinary incontinence was twice as likely in vitamin D deficient women.

The authors concluded: “Our findings suggest that treatment of vitamin D insufficiency and deficiency in both premenopausal and postmenopausal women could improve pelvic muscle strength, with a possible reduction in the prevalence of pelvic floor disorders, including urinary incontinence.”
Can excessive vitamin D be toxic?
Adverse events from vitamin D₃ plotted against 25(OH)D status and daily intake.
Contraindications to vitamin D supplementation:

Granulomatous diseases (e.g., tuberculosis)

Metastatic bone disease

Sarcoidosis
Intermittent high dose therapy, 2 studies

A study in South Australia (Royal Adelaide Hospital) gave elderly residents of aged care vitamin D3 every three months, there were no cases of toxicity. Concluded," Vitamin D$_3$ 100,000 IU given orally 3 monthly is a practical, safe, effective and inexpensive way to meet the vitamin D3 requirements of aged-care residents"


“Among older community-dwelling women, annual oral administration (500,000 IU) of high-dose cholecalciferol resulted in an increased risk of falls and fractures”

Reference: Saunders et al Annual High-Dose Oral Vitamin D and Falls and Fractures in Older Women. JAMA, May 12, 2010
Suggested recommendations:

People identified as higher risk of vitamin D deficiency should have a baseline serum 25(OH)D, the best time to test is in late Winter or early Spring.

Hospitalisation of an older person provides an opportunity to screen for vitamin D status as part of a comprehensive health care assessment.
Thank you

John_Senior@wsahs.nsw.gov.au