Vitamin D deficiency in the elderly: How can we improve rates of screening and supplementation in General Practice?

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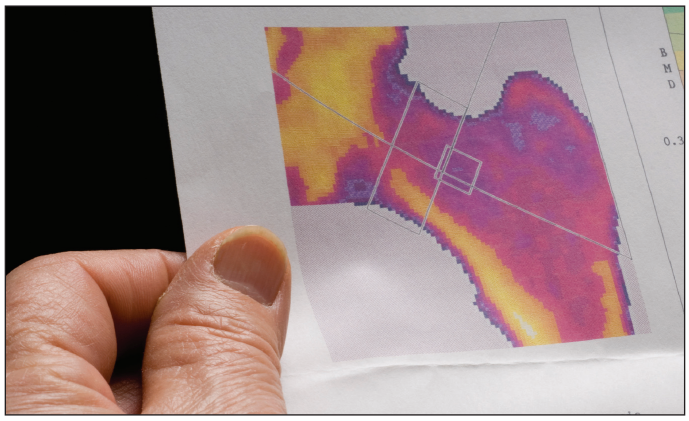
Aim: Vitamin D supplementation reduces falls and fractures in the elderly, yet screening and supplementation rates are generally inadequate. We therefore investigated whether rates of screening and supplementation could be improved through a brief, general practitioner (GP)-focussed, educational intervention. **Methods:** Clinical audits of vitamin D screening and supplementation in elderly patients attending a rural general practice were conducted before and after a GP educational intervention. **Results:** The simple GP educational intervention resulted in both vitamin D screening (11.1% versus 5% - 2 year period: and 6.11% versus 3.38% - 3 month period) and supplementation rates ≥ 700IU cholecalciferol daily (10% versus 5%- 2 year period; and 4.44% versus 0.97% - 3 month period) approximately doubling in elderly patients. **Discussion:** This preliminary study suggests that simple, cost-effective GP-focussed interventions can significantly improve vitamin D screening and supplementation rates in elderly patients, thereby potentially improving health outcomes in terms of falls and fractures in this 'at risk' population.

Introduction

Over 30% of the elderly population fall annually, and many suffer from multiple falls. [1] Falls result in decreased physical activity, possible loss of independence and a fear of falling, as well as being the leading cause of hospitalisation and death in the elderly. [1] Healthcare costs for fall-related injuries are expected to double over the next few years due to the ageing population. [1]

Recent studies have linked vitamin D deficiency to an increased risk of falls and fractures in the elderly. [2, 3] It is thought that vitamin D decreases falls by increasing muscle strength and balance, and reduces fractures by increasing bone strength. [2, 3] This is an important finding given that between 45% and 75% of Australian elderly patients have been diagnosed as vitamin D deficient. [4] Many of these patients have become vitamin D deficient because of reduced sunlight exposure or a reduced ability to synthesise vitamin D from ultraviolet exposure. [1] Other contributing factors include diet [5], malabsorption, medications, renal and/or liver impairment. [5, 6]

Vitamin D deficiency can be detected using the 25-hydroxy vitamin D radioimmunoassay. Although target ranges are debated, concentrations of serum 25-hydroxy vitamin D above 75nmol/L are considered sufficient; 50-75 nmol/L suboptimal; 25-50 nmol/L insufficient; 15-25 nmol/L deficient and < 15 nmol/L severely deficient. [7] Daily requirements for vitamin D are around 800-1000IU to prevent falls,



but larger doses are needed for those who are deficient. [7] Deficiency should be treated with 3000 to 5000 IU cholecalciferol daily for four to twelve weeks, reducing to 1000-2000 IU daily for maintenance therapy. [7,8] No evidence of toxicity has been found in doses of up to 4000 IU daily. [7]

A recent meta-analysis of eight randomised controlled trials (RCTs) involving 2426 patients with a mean age ≥ 65 years showed that supplemental vitamin D in the range of 700-1000IU elevated vitamin D levels to 60-95nmol/L and reduced falls by nineteen percent within two to five months of commencement of treatment. [9] Similarly, these larger doses were found to reduce the incidence of fractures in the elderly, as shown in a meta-analysis of twelve double-blinded trials involving 83165 patients (> 65 years of age), receiving doses of between 482-770IU of cholecalciferol daily, which reduced hip fractures by eighteen percent and non-vertebral fractures by twenty percent. [10] Notably however, in some studies where patients were given approximately 700IU vitamin D supplementation without initially recording their serum vitamin D level, they did not gain sufficient vitamin D levels [9,11,12], potentially because they were initially vitamin D deficient. [11] This is supported by a study that found vitamin D deficient patients with a mean baseline of 25nmol/L, when given suboptimal therapy with either 600IU daily, 4200IU weekly or 18000IU monthly, had vitamin D levels below 75nmol/L after a four month follow-up (63% of the daily group versus 72% of the weekly group versus 96% of the monthly group). [13] It seems logical therefore to measure vitamin D levels before prescribing appropriate vitamin D supplementation, even though current recommendations suggest that elderly patients should be given vitamin D supplementation with or without screening. [4,6,14] Interestingly, a RCT comparing vitamin D

supplementation with and without baseline Vitamin D screening has never been performed. [15]

While the above literature indicates a growing problem with vitamin D deficiency in elderly Australian patients, [4] which is linked to morbidity and mortality, [1] there is currently a lack of research examining the feasibility of improving rates of vitamin D screening and supplementation in general practice. The aims of this study were therefore: 1) To evaluate documented vitamin D screening and supplementation rates of elderly patients (≥70 years) attending a rural general practice, and 2) To evaluate the impact of a brief intervention aimed at increasing GP's knowledge about vitamin D screening and supplementation at doses ≥ 700IU cholecalciferol daily to prevent falls and fractures in the elderly. [9,10]

Methods

The research protocol was reviewed and approved by the University of Wollongong Human Research Ethics Committee. Relevant de-identified data were collected from the medical records of 387 patients, aged ≥70 years, who had recently attended a rural health practice in western New South Wales. All five GPs working in the practice volunteered to participate in the study.

Pre-intervention

A pre-intervention audit was conducted on the medical records of all elderly patients (> 70 years of age) attending the practice from the 1st September to 1st December 2009, determining documented rates of 1) Measurement of serum vitamin D and 2) Vitamin D supplementation.

Intervention

The student researcher (the primary author) delivered a one hour education session to the GPs about the importance of vitamin D in preventing falls and fractures in the elderly, and discussed best practice guidelines for treating vitamin D deficiencies (Table 1). [8] Following the education session, a reminder was attached to individual GP computer screens, stating: *'Is your patient over 70? Have you checked their serum vitamin D level lately?'*

Table 1. *Key messages delivered in the GP educational session which formed part of the current intervention.*

Key Messages	Details
1) The role of vitamin D in maintaining health and wellbeing.	Adequate vitamin D levels help to decrease falls by increasing muscle strength and balance, and reduce fractures by increasing bone strength. [2,3] Vitamin D also protects against cardiovascular problems, oncogenesis, autoimmune disease, neuro-degeneration and cognitive decline. [5]
2) Risk factors for vitamin D deficiency.	Age >65 years, dark skin, obesity, insufficient sunlight exposure, medication use (e.g. anticonvulsants, glucocorticoids). [21]
3) Signs and symptoms of vitamin D deficiency.	Bone pain in lower extremities, muscle pain and weakness, increased risk of falls. [22]
4) Classification of vitamin D deficiency.	Sufficient >75nmol/L 25-OH; Suboptimal=50-75 nmol/L 25-OH; Insufficient=25-50 nmol/L 25-OH; Deficient=15-25 nmol/L 25-OH; Severely deficient < 15 nmol/L 25-OH [7]
5) How to treat vitamin D deficiency.	Cholecalciferol 125 micrograms (5000IU) orally, daily for four weeks, then reduce to 25 to 50 micrograms (1000 to 2000IU) daily, as long as required. [8]

Post-intervention

A post-intervention audit of the medical records was conducted examining the same dependent variables, on all elderly patients (> 70 years) who attended the practice during the three month post-intervention period (18 January-18 April 2010).

Analysis

Two year rates of documented screening for vitamin D levels, and rates of supplementation at ≥ 700IU cholecalciferol daily were compared between patients attending the practice in the three month period pre-intervention and those attending in the three month period post-intervention. Two year rates were chosen as these data were easily accessible from the medical records, and the majority of previous studies have considered similar time periods. [9,10,11] Additionally, because the two year rates for the post-intervention sample overlapped with the pre-intervention period, a second comparison was made for three month rates of screening and supplementation rates pre and post-intervention. Chi-squared tests were used to examine statistical significance.

Results

In the three month pre-intervention period, 207 elderly patients (≥70 years of age) attended the practice, and their records were used for the pre-intervention audit. During the three month post-intervention period, 180 patients (>70 years of age) attended the practice, and their records were used for the post-intervention audit. In the pre and post-intervention audits, two year rates, as well as three month only rates of vitamin D screening and supplementation were calculated. The rates for screening of vitamin D deficiency approximately doubled in both the two year, and three month measures, with a 5% (11) two year screening rate before the intervention and an 11.1% (20) rate after the intervention; as well as a 3.38% (7) three month screening rate before the intervention and a 6.11% (11) after the intervention (Figures 1 and 2). Similarly, two year rates of supplementation at ≥700IU cholecalciferol doubled from pre to post-intervention audit (5% (11) pre versus 10% (18) post), and three month rates increased fourfold (0.97% pre versus 4.44% post) (Figures 1 and 2).

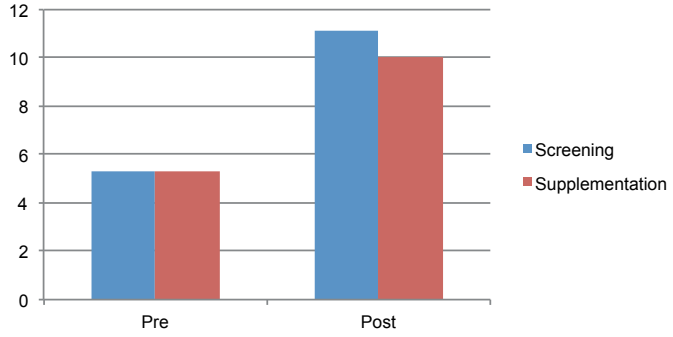


Figure 1. *Two year rates (percentages) of elderly patients' records indicating screening and supplementation at ≥700IU cholecalciferol in the pre and post-intervention audits.*

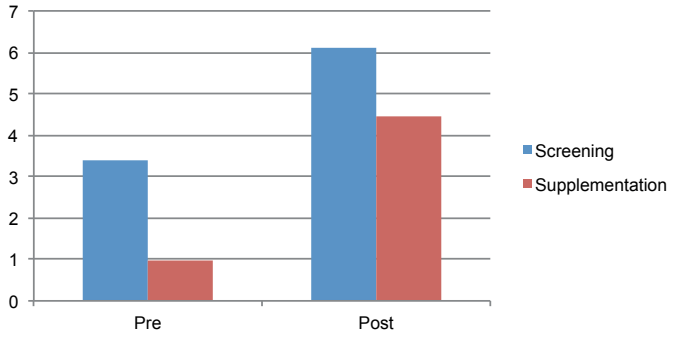


Figure 2. *Three month rates (percentages) of elderly patients' records indicating screening and supplementation at ≥700IU cholecalciferol in the pre and post-intervention audits.*

Chi-square analyses of these results found that the difference was statistically significant for two year rates of screening, χ^2 (1) = 5.05, p <0.05, and for supplementation at ≥ 700IU cholecalciferol daily χ^2 (1) = 4.39, p <0.05, suggesting that improvements are unlikely to have occurred by chance. In the three month pre-post comparison, there were non-significant trends towards improvements in screening and supplementation in the post compared to pre-intervention group. The lack of significance was probably due to small participant numbers in the three month comparison.

Tables 2 and 3 show vitamin D levels and supplementation doses for screened patients in the pre and post-intervention audits. In the pre-intervention audit, no screened patients were taking ≥ 700IU cholecalciferol doses daily. In the post-intervention audit, both two year (Table 2) and three month (Table 3) rates of documented ≥ 700IU cholecalciferol doses had increased to 35% and 63% respectively of screened patients.

Discussion

This preliminary study clearly indicates that simple interventions such as increasing GP awareness of the importance of screening and supplementation for vitamin D deficiency in elderly patients, and reminders, can help to improve clinical practice and potentially the health outcomes for elderly patients. The majority of elderly patients (71-82% pre and 90-91% post-intervention) screened had suboptimal-deficient levels of vitamin D according to clinical guidelines, [7] supporting the importance of screening and supplementation in this 'at risk' elderly patient population. Following the intervention, documented rates of screening and supplementation at doses of ≥ 700IU cholecalciferol daily in elderly patients increased significantly in this small study. The intervention may have worked through increasing GPs' knowledge base regarding the importance of vitamin D screening and supplementation, optimal rates of supplementation, and through the ongoing reminder to check these in elderly patients. Busy clinicians are likely to find it difficult to keep up to date with research and treatment developments, and the current study highlights the potential benefits of medical student projects to GPs and communities. Simple interventions, such as those used here, therefore show promise as they are inexpensive, brief and highly effective, approximately doubling the rates of documented screening and recommended dosing of vitamin D supplementation at ≥700IU cholecalciferol daily in a brief (three month) period.

The results of this preliminary study also highlight the need for further improvement. Although documented screening rates and doses of ≥ 700IU cholecalciferol daily doubled post-intervention, only 6.11-11.1% of elderly patients were being screened and 4.44-10% were receiving doses demonstrated to prevent falls in the elderly. Further research is needed to help determine barriers to adequate vitamin D screening and supplementation rates. These may include time constraints on busy GPs, the expense of vitamin D assay or elderly patients not being able to afford vitamin D supplements which are not subsidised by the Pharmaceutical Benefits Scheme (PBS). It must also be noted that in the present study, many elderly patients did not have their vitamin D levels tested, making it impossible to determine whether ≥ 700IU cholecalciferol daily was an effective therapeutic dose, because those who are vitamin D deficient require larger doses. [8,9,10,16] It is also possible, given the increased rates of supplmentation post-intervention, that GPs moved straight to supplementation without screening. It may be that the low risk of toxicity with vitamin D supplementation and the serious health implications of deficiency in the elderly led GPs to begin supplementation without any inconvenience or expense associated with the blood test. Further research could examine GPs' views about these issues.

In addition to the simple, cost effective intervention piloted in this study, broader strategies that may be useful in increasing screening and supplementation could include the addition of serum vitamin D measurement to the Medicare funded 'over 75 health' assessment, [17] and adding vitamin D supplements to the PBS. Further investigations would need to be carried out to evaluate whether these additional measures could also help to improve rates of screening and supplementation, thereby potentially preventing falls and fractures in the elderly.

Limitations of the study include the small number of records audited from a single medical practice, a short data collection period, reliance on documentation in patient records and the possible use of over-the-counter vitamin D supplements which were not documented in the patient notes. Further, rates of calcium supplementation were not assessed. A recommended daily 1300mg calcium supplementation, [8] together with vitamin D, has a combined effect on preventing falls and fractures in the elderly. [18,19,20] These factors warrant further research.

In conclusion, the results of this preliminary study indicate that a brief GP-targeted educational intervention is an effective way of improving

Table 2. *Two year Vitamin D and supplementation levels in screened patients in the pre and post-intervention audits.*

	Pre-intervention		Post-intervention	
Serum vitamin D levels	**Number of patients (% of those screened)**	**Taking ≥ 700IU cholecalciferol daily**	**Number of patients (% of those screened)**	**Taking ≥ 700IU cholecalciferol daily**
Sufficient	2 (17%)	0	2 (10%)	0
Sub-optimal	5 (42%)	0	12 (60%)	6 (30%)
Insufficient	4 (33%)	0	6 (30%)	1 (5%)
Deficient	1(8%)	0	0	-
Total	12	0	20	7 (35%)

Table 3. *Three month Vitamin D and supplementation levels in screened patients in the pre and post-intervention audits.*

	Pre-intervention		Post-intervention	
Serum vitamin D levels	**Number of patients (% of those screened)**	**Taking ≥ 700IU cholecalciferol daily**	**Number of patients (% of those screened)**	**Taking ≥ 700IU cholecalciferol daily**
Sufficient	2 (29%)	0	1 (9%)	0
Sub-optimal	2 (29%)	0	7 (64%)	4 (36%)
Insufficient	3 (42%)	0	3 (27%)	3 (27%)
Deficient	0	0	0	0
Total	7	0	11	7 (63%)

documented rates of vitamin D screening and supplementation in the elderly.

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Conflicts of interest

None declared.

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Key points:

- Vitamin D deficiency, which can increase the number of falls and fractures, is common amongst older people
- Vitamin D screening and supplementation rates for older patients are often poorly documented by General Practitioners
- A simple education intervention targeted toward GPs can help improve the vitamin D screening and supplementation rates of older people

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