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## Vitamin D and Effects on Fractures, Falls and Bone Mineral Density

*Osteoporosis Canada's overall position statement in response to this study:*

*This study did not specifically address the vitamin D requirements of individuals with osteoporosis, those with risk factors for osteoporotic fractures, or those with risk factors for vitamin D deficiency. Vitamin D is needed for optimal calcium absorption from the gut, and plays an important role in calcium balance and bone mineralization. Osteoporosis Canada recommends that individuals with osteoporosis or with risk factors for fractures receive adequate vitamin D, as recommended at 800-2,000 IU per day.*

A recent article on the effect of vitamin D supplementation on fractures, falls and bone mineral density was published in the journal *Lancet Diabetes Endocrinology* by Bolland and colleagues (October 4, 2018). This research reviewed the available literature as part of a systematic review and meta-analysis. A systematic review is a research method used to thoroughly locate and synthesize all the information (evidence) related to a specific topic. A meta-analysis uses statistical tools to combine data from the studies included in the review to provide an overall finding. During the systematic review process, it is important that the researchers combine studies that are clinically and statistically similar. This research summarized and combined the results of 81 randomized controlled trials, in which more than 50,000 people were enrolled.

There are some noteworthy characteristics of the included 81 studies. For example, the majority of studies were done in community-dwelling women age 65 years or older, and the only "intervention" was vitamin D in doses of more than 800 IU/day. There were also studies of higher dose vs. lower dose vitamin D, as well as studies that included calcium and vitamin D given together. The studies in the review were based on participants taking vitamin D for one year, or less. The main focus of the systematic review was to look at the effect of vitamin D on fractures and falls. However, there was also a summary of the effect of vitamin D on the change in bone mineral density [from the start of the study (baseline) to the final assessment] (1).

Based on the results of the meta-analysis, the authors reported that vitamin D supplementation did not have an effect on the risk of fractures or falls, and that there were no meaningful effects on participants' bone mineral density. The authors also concluded that there were no differences between the effects of taking higher and lower doses of vitamin D (1) for these health outcomes.

There are several factors that should be considered when reviewing these results. First, in more than half of the studies, participants had a baseline vitamin D level (25OHD - the blood test used to measure Vitamin D levels in the blood) of less than 50 nmol/L (a cutoff considered by

many (2) to indicate a low level of vitamin D). Almost all of the participants had a baseline 25OHD that was less than 75 nmol/L, which is considered an adequate level. Only four trials (6%) studied people with vitamin D deficiency (25OHD <25 nmol/L), in whom vitamin D supplementation may produce different results. In addition, there can be individual differences in how the body's level of vitamin D responds to the administration of a fixed dose of Vitamin D. Most studies used 1,000 IU per day or less, and so the 25OHD levels after treatment (used as the intervention) may not have been high enough to make a difference in the health outcomes studied (fractures and falls).

Second, the finding that vitamin D alone (without calcium) may not prevent fractures, falls or improve bone mineral density is consistent with other published reviews. However, a review of studies of calcium and vitamin D for people living in long-term care showed benefit (3) but the current meta-analysis by Bolland and colleagues included only 20 trials (25%) that compared vitamin D and calcium to calcium alone. They also did not include studies that compared vitamin D and calcium with no treatment.

Third, although the major strength of the current review lies in the large number of studies included in the analysis, it is important to recognize there are potential limitations. For example, there were differences in the participants enrolled between studies, the study designs, and the results of the studies in the meta-analysis. Importantly, this review did not specifically address the vitamin D requirements of people with osteoporosis, those with risk factors for low trauma fractures, or those with risk factors for vitamin D deficiency. Although this systematic review suggests that routine vitamin D supplementation, in particular, high dose vitamin D, may not be necessary for healthy individuals in the general population, these findings cannot be applied to people with osteoporosis, or to those with risk factors for fractures or vitamin D deficiency.

Fourth, it must be highlighted that falls have many causes. Even specific fall prevention exercise programs are not always effective, and the relative benefit of any intervention on falls is individual.

It is important to remember that vitamin D is needed to optimize calcium absorption from the gut, and plays an important role in calcium balance and bone mineralization. Inadequate vitamin D can result in poor bone mineralization, as well as bone loss due to a rise in parathyroid hormone levels.

Osteoporosis Canada recommends that individuals with osteoporosis or with risk factors for fractures receive adequate vitamin D, as recommended at 800-2,000 IU per day (4); however, vitamin D dosing may require adjustment in order to achieve the adequate 25OHD level needed for optimal calcium homeostasis. Further studies are needed to clarify the optimal 25OHD level for those with osteoporosis or with risk factors for fracture. High dose vitamin D supplementation should be avoided due to potential harms (5). There are large randomized

trials currently ongoing to help answer questions about effects of vitamin D supplementation on other aspects of health (6).

Appropriate osteoporosis medication may be required for those at high fracture risk. It is important to note that clinical trials showing the effectiveness of osteoporosis medications all included vitamin D and calcium as part of the treatment regimen.

#### References:

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6. Pradhan AD, Manson JE Update on the Vitamin D and Omega-3 trial (VITAL). Study J Steroid Biochem Mol Biol. 2016 Jan;155(Pt B):252-6.