

## RESEARCH LETTERS

### Vitamin D<sub>2</sub> Treatment for Vitamin D Deficiency and Insufficiency for Up to 6 Years

The worldwide prevalence of vitamin D deficiency is striking, and more than 40% of the population may be vitamin D deficient.<sup>1</sup> Despite this, to our knowledge there are no long-term studies of the safety and efficacy of giving pharmacologic doses of vitamin D (50 000 IU of ergocalciferol [vitamin D<sub>2</sub>]) to treat and prevent vitamin D deficiency. Furthermore, there is a concern that ergocalciferol, the only pharmaceutical vitamin D available in the United States, may be less effective than cholecalciferol (vitamin D<sub>3</sub>).<sup>2</sup> In our clinic, which specializes in metabolic bone disease, we routinely treat vitamin D deficiency (serum 25-hydroxyvitamin D [25(OH)D] levels <20 ng/mL [to convert to nanomoles per liter, multiply by 2.496]) with 50 000 IU of ergocalciferol once a week for 8 weeks.<sup>1,3</sup> The efficacy of this regimen has been previously described.<sup>1</sup> To prevent recurrent vitamin D deficiency and also to maintain adequate levels in patients who are vitamin D sufficient, we treat with 50 000 IU of ergocalciferol every other week indefinitely, a regimen that, to our knowledge, has not been published to date.

**Methods.** We conducted a retrospective medical record review of visits from January 1, 2001, to May 1, 2007. Approximately 200 medical records were reviewed. We included patients 18 years or older with 2 or more measurements of 25(OH)D level, who received maintenance therapy with 50 000 IU of ergocalciferol every other week. All 25(OH)D samples were analyzed at Quest Diagnostics, Madison, New Jersey. Eighty-six patients (mean [range] age, 61 [18-91] years; 79% female) had a mean (range) treatment duration of 26 (5-72) months.

**Results.** Prior to treatment, 79 patients (92%) had 25(OH)D levels lower than 30 ng/mL. The mean (SD) 25(OH)D level prior to treatment was 23.4 (9.5) ng/mL, while the mean (SD) level at the end of the review was 47.0 (18.2) ng/mL ( $P < .001$ ) (Figure, A). At the last review, 14 patients (16%) had 25(OH)D levels lower than 30 ng/mL.

We treated some patients with vitamin D deficiency or insufficiency (levels <30 ng/mL) first with 50 000 IU of ergocalciferol weekly prior to maintenance therapy. Of the 86 patients studied, 41 who were vitamin D deficient or insufficient received 8 weeks of 50 000 IU of ergocalciferol weekly prior to starting maintenance therapy. For those patients, the mean (SD) pretreatment 25(OH)D level was 19.3 (6.2) ng/mL, which increased to 37.2 (13.0) ng/mL after 8 weeks of weekly therapy ( $P < .001$ ). These patients were then treated with

50 000 IU of ergocalciferol every other week and had a mean (SD) final 25(OH)D level of 46.9 (18.6) ng/mL ( $P < .001$ ).

For the 45 patients who received only maintenance therapy of 50 000 IU of ergocalciferol every 2 weeks, the mean (SD) pretreatment 25(OH)D level was 26.9 (10.6) ng/mL, and the mean (SD) final level was 47.1 (18.0) ng/mL ( $P < .001$ ) (Figure, B). Mean (SD) serum calcium levels did not change (pretreatment, 9.5 [0.7] mg/dL; final, 9.6 [0.6] mg/dL [to convert to millimoles per liter, multiply by 0.25];  $P = .20$  [Figure, C]). There were no incidents of kidney stones or evidence of vitamin D intoxication.<sup>1</sup>

**Comment.** There have been several strategies to treat vitamin D deficiency, including 600 IU of cholecalciferol daily, 4200 IU weekly, and 18 000 IU monthly.<sup>4</sup> These studies have shown only partial efficacy and have been short in duration. No studies have been longer than 1 year. Little is known as to whether pharmacologic doses of ergocalciferol either become ineffective over time or accumulate in body fat stores, producing vitamin D intoxication.

Our experience shows that 50 000 IU of ergocalciferol weekly for 8 weeks effectively treats vitamin D deficiency, and continued treatment with 50 000 IU of ergocalciferol every other week for up to 6 years prevents recurrent vitamin D deficiency in most patients. However, 16% of our patients remained vitamin D deficient or insufficient. Results from further investigation showed that 6 of those patients either were not taking their medication or were taking corticosteroids or antiepileptic medications, which can affect vitamin D metabolism. We did not find a reason for persistent vitamin D deficiency in the remaining 8 patients, although we suspect it may be due to medication nonadherence.

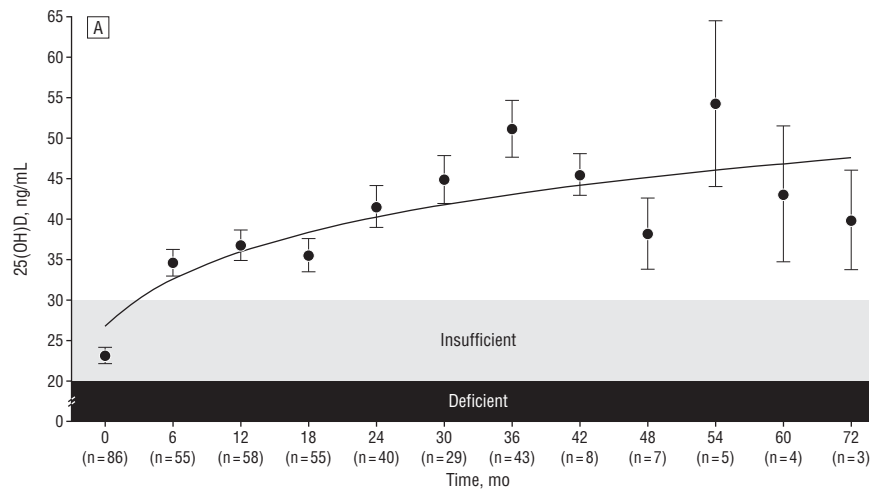
It bears mention that the cost of this therapy is low; pills can be purchased without insurance for as little as \$66 per year for maintenance therapy. The cost of testing is \$40 by Medicare payment schedules, though some commercial laboratories charge as much as \$200 per test. Insurance companies generally consider ergocalciferol a tier 1 medication. Ergocalciferol is therefore effective in raising serum 25(OH)D level when given in physiologic<sup>5</sup> and pharmacologic doses and is a simple method to treat and prevent vitamin D deficiency.

Sara M. Pietras, MD  
 Busayo K. Obayan, BA  
 Mona H. Cai, BS, MPH  
 Michael F. Holick, PhD, MD

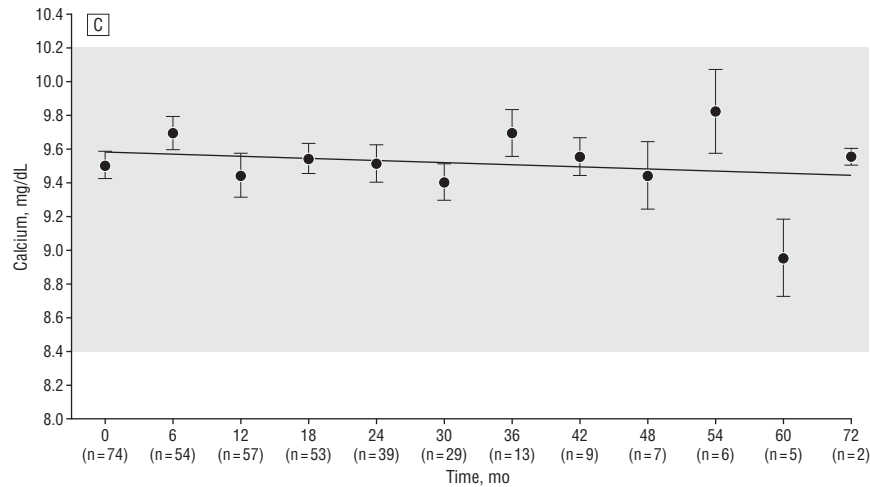
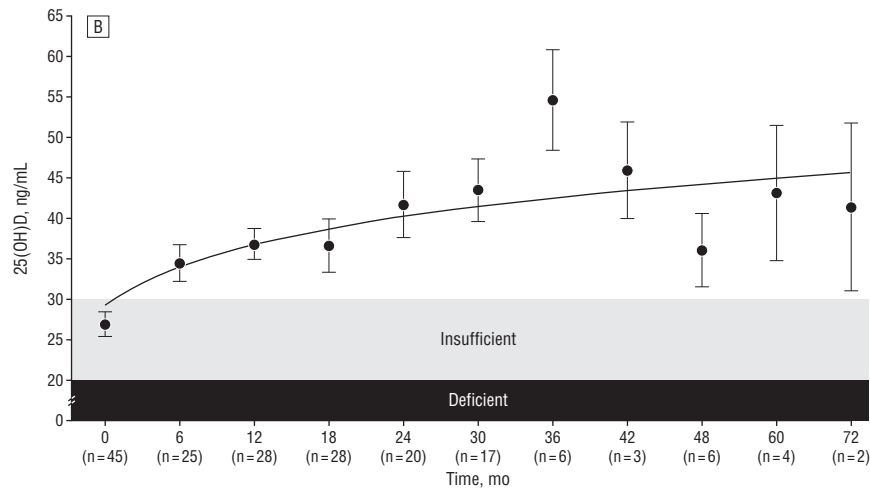
**Correspondence:** Dr Holick, Division of Endocrinology, Diabetes & Nutrition, Boston Medical Center, 85 E Newton St, Room 1013, Boston, MA 02118 (mfholick@bu.edu).

**Author Contributions:** Study concept and design: Holick. Acquisition of data: Pietras, Obayan, and Holick. Analysis and interpretation of data: Pietras, Obayan, Cai, and Holick. Drafting of the manuscript: Pietras, Obayan, Cai,

50,000 weekly  
for 8 weeks  
then every 2 weeks



50,000 every 2 weeks



**Figure.** Mean serum 25-hydroxyvitamin D (25[OH]D) and calcium levels. Results are given as mean (SEM) values averaged over 6-month intervals. Time 0 is initiation of treatment. **A**, Mean 25 (OH) D levels in all patients treated with 50 000 IU of ergocalciferol (vitamin D<sub>2</sub>) every 2 weeks (maintenance therapy, n=86). Forty-one of the patients were vitamin D insufficient or deficient and first received 50 000-IU ergocalciferol weekly for 8 weeks before being placed on maintenance therapy of 50 000 IU of ergocalciferol every 2 weeks. The mean 25(OH)D level of each 6-month interval was compared with initial mean 25(OH)D level and showed a significant difference of  $P < .001$  for all time points. To convert 25(OH)D to nanomoles per liter, multiply by 2.496. **B**, Mean serum 25(OH)D levels in patients receiving maintenance therapy only. There were 38 patients who were vitamin D insufficient (25[OH]D levels <21-29 ng/mL and 7 patients who were vitamin D sufficient (25[OH]D levels  $\geq 30$  ng/mL) who were treated only with maintenance therapy of 50 000 IU of ergocalciferol (vitamin D<sub>2</sub>) every 2 weeks. The mean 25(OH)D levels in each 6-month interval were compared with mean initial 25(OH)D levels and showed a significant difference of  $P < .001$  for all time points up to 48 months. The data for interval months 60 and 72 were pooled, and there was a significant difference of  $P < .01$  compared with the baseline value. **C**, Serum calcium levels. Results for all 86 patients who were treated with 50 000 IU of ergocalciferol (vitamin D<sub>2</sub>). The reference range for serum calcium level is 8.5 to 10.2 mg/dL (to convert to millimoles per liter, multiply by 0.25).

and Holick. *Critical revision of the manuscript for important intellectual content*: Pietras and Holick. *Statistical analysis*: Obayan and Cai. *Obtained funding*: Obayan and Holick. *Administrative, technical, and material support*: Holick. *Study supervision*: Pietras and Holick. **Financial Disclosure**: None reported.

1. Holick MF. Vitamin D deficiency. *N Engl J Med*. 2007;357(3):266-281.
2. Armas LA, Hollis BW, Heaney RP. Vitamin D<sub>2</sub> is much less effective than vitamin D<sub>3</sub> in humans. *J Clin Endocrinol Metab*. 2004;89(11):5387-5391.
3. Malabanan A, Veronikis IE, Holick MF. Redefining vitamin D insufficiency. *Lancet*. 1998;351(9105):805-806.
4. Chel V, Wijnhoven HA, Smit JH, Ooms M, Lips P. Efficacy of different doses and time intervals of oral vitamin D supplementation with or without calcium in elderly nursing home residents. *Osteoporos Int*. 2008;19(5):663-671.
5. Holick MF, Biancuzzo RM, Chen TC, et al. Vitamin D<sub>2</sub> is as effective as vitamin D<sub>3</sub> in maintaining circulating concentrations of 25-hydroxyvitamin D. *J Clin Endocrinol Metab*. 2008;93(3):677-681.

## Physicians' Experience and Satisfaction With Chaplains: A National Survey

Religion and spirituality (R/S) are important resources for coping with serious illnesses, but research indicates that patients' R/S needs often go unmet.<sup>1</sup> Professional chaplains help patients make effective use of R/S resources in the context of illness,<sup>2</sup> but one-third of US hospitals do not have chaplains.<sup>3</sup> Even hospitals with chaplaincy programs rarely have sufficient staff to address the needs of all patients. Given these constraints, physicians and other clinical staff play critical roles in directing chaplains to patients who will benefit from their services.<sup>4</sup> Unfortunately, little is known about physicians' experience with and impressions of chaplains.

Most physicians have little training to guide referrals to chaplains. Some evidence suggests that in the absence of such training, physicians' referral patterns are shaped by their own R/S values and experiences.<sup>5,6</sup> Physicians' referrals may also be shaped by their understanding, or misunderstanding, of chaplains. One study found that physicians with no experience with chaplains feared that chaplains would ignore patients' concerns and disrespect patients' beliefs.<sup>7</sup> Using data from a national survey, we examined physicians' self-reported experience and satisfaction with chaplains. Based on earlier findings, we focused specifically on the relationship between physicians' practice context<sup>3</sup> and R/S views<sup>5,6</sup> and their experience and satisfaction with chaplains.

**Methods.** The methods of this national survey have been reported elsewhere.<sup>8</sup> We surveyed 1144 US physicians of all specialties younger than 65 years, who were selected from the American Medical Association Physician Masterfile. We examined physicians' reports of prior experience with chaplains (yes/no) and satisfaction with chaplains (satisfied/dissatisfied). Predictor variables included physician demographics, training about R/S in medicine, practice setting, personal R/S, opinions about addressing R/S in the clinical setting, and the frequency (range, 0 "never" to 4 "always") of observing R/S to have 3 different positive and 3 different negative effects on patients.

**Results.** Among eligible physicians, the survey response rate was 63%. The present analysis includes the 1102 physicians actively involved in patient care. Respondents were predominantly male (74%) and came from diverse specialties, 31% worked at teaching hospitals, 12% worked at faith-based hospitals or clinics, and 64% reported caring for high numbers of critically ill patients. Of the respondents, 10% reported no religious affiliation, 59% reported being Christian, 16% reported being Jewish, and 14% reported other affiliations; 41% agreed with the statement, "My whole approach to life is based on my religion." Forty-one percent of the physicians believed it was appropriate for them to talk about their own R/S with patients when the patient asked about it. Fifty percent of the physicians believed it was appropriate for them to pray with patients when the patient requested it. The physicians reported that R/S "often" had a positive impact on their patients (mean [SD] score, 2.8 [0.5]) and "rarely" had a negative impact (mean [SD] score, 1.3 [0.5]).

Most physicians (89%) reported experience with chaplains. Among these, most (90%) reported being satisfied or very satisfied with chaplains. In a multivariate logistic regression model, experience with chaplains was associated with training about R/S in medicine, seeing large numbers of critically ill patients, practicing psychiatry or obstetrics and gynecology, endorsing positive effects of R/S on patients, and believing that it is appropriate to talk with patients about R/S whenever the physician senses it would be appropriate (**Table**). In similar models, higher levels of satisfaction were associated with practicing medical or other subspecialties, working in teaching hospitals, endorsing positive effects of R/S on patients, and believing it is appropriate to pray with patients whenever the physician senses it would be appropriate (**Table**). Physicians from the Northeast and those who endorsed more negative effects of R/S on patients were less likely to be satisfied with chaplains.

**Comment.** On the whole, physicians appear both experienced and satisfied with chaplains. Factors influencing physicians' experience and satisfaction included training in R/S, practice context, observations of positive and negative effects of R/S on patients, and beliefs about when it is appropriate to pray or talk with patients about R/S issues.

This study asked physicians about "experience with chaplains and other pastoral care professionals." In most hospitals the pastoral care professional is the chaplain, but in future research this wording should be more specific. In addition, the term *chaplain* may refer to people with diverse training and experience, from clergy who volunteer on occasion to board-certified chaplains with years of clinical experience.<sup>2</sup> Unfortunately, this study could not assess any chaplain-specific factors. Nor did we have information about the contexts of physician-chaplain encounters (eg, around patients who are anxious, terminally ill, or who have religious objections to treatment). Other research<sup>4</sup> suggests that physicians value some chaplain services, such as providing support around death, more than others. Future studies should examine the situations in which chaplains and physicians interact, the effect of physician training in R/S on such in-