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Vitamin D Status and Supplementation in Employer-Sponsored Wellness Program

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Abstract

Purpose: To assess the response to information about vitamin D status by participants enrolled in employer-sponsored wellness programs.

Design: A self-reported health risk assessment questionnaire was used to categorize vitamin D supplementation.

Participants: A total of 50 209 participants of 12 employer-sponsored wellness programs that included vitamin D testing and services provided by Quest Diagnostics in 2014 and 2015.

Measures: Vitamin D status based on laboratory testing results and responses to vitamin D supplementation in a health risk assessment questionnaire for initial and subsequent years.

Results: Among 50 209 participants, 29% had deficient and 37% had suboptimal levels of vitamin D. Many participants appeared to act counter to their informed vitamin D status by starting supplements when vitamin D level was initially optimal (20%) or discontinuing supplements when vitamin D level was initially deficient (36%). Three-quarters of participants who had deficient or suboptimal vitamin D levels and were not taking supplements in 2014 continued not taking supplements in 2015.

Conclusion: Deficient and suboptimal vitamin D levels remain prevalent in a working-age population. Many participants do not seem to be taking appropriate actions after receiving vitamin D testing results. Accordingly, employer-sponsored wellness programs have an opportunity to better educate participants.

Keywords
vitamin D, vitamin D supplementation, employer-sponsored wellness program

Purpose

Participants in employer-sponsored wellness programs receive results that can inform actions. In this study, we examined the response of those participants to information about their levels of vitamin D, an essential hormone. Vitamin D deficiency, defined as 25-hydroxyvitamin D (25(OH)D) concentration <20 ng/mL,[1] is common in the population and has been associated with a wide spectrum of medical conditions including bone disease, diabetes, heart disease, multiple types of cancer, and Alzheimer disease.[2,3] Vitamin D is among the most commonly purchased vitamin supplement.[4] However, there is a lack of published data in describing the relationship between laboratory vitamin D test results and vitamin supplementation in a working-age population. Here, we assessed vitamin D status, prevalence of supplementation, and the mutual impact of vitamin D test results and supplementation among 50 209 participants. To our knowledge, this is the first study to describe the impact of reporting vitamin D levels in employer-sponsored wellness programs.

Methods

This study is part of Quest Diagnostics Health Trends, a series of reports designed to identify and track disease and wellness trends to inform patients, health-care professionals, and policymakers. For this study, we included all participants of 12 employer-sponsored wellness programs in 2014 and 2015. These programs included vitamin D testing and services provided by Quest Diagnostics. The study was deemed to be exempt by the Western institutional review board.

Starting in 2014, 12 employers began to include testing of 25(OH)D (vitamin D) as one of their laboratory tests in the wellness programs that were offered to employees and often their spouses/partners. A self-reported health risk assessment questionnaire, which included questions about vitamin D supplementation, was also administered.

The population characteristics were described based on the initial vitamin D result recorded for each participant; that is, vitamin D results for 2014 were used for dual-year and 2014-only participants, and vitamin D results for 2015 were for 2015-

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only participants. Detailed analysis of associations between supplementation and vitamin D status was limited to the dual-year participants.

Vitamin D testing was performed using either liquid chromatography–tandem mass spectrometry (ThermoFisher, San Jose, California) or immunoassay (Diasorin, Stillwater, Minnesota). Both assays were calibrated based upon National Institutes of Standards and Technology, Standard Reference Material 972.

Vitamin D level was analyzed as a numeric measurement and categorized as deficient (<20 ng/mL), suboptimal (20-29 ng/mL), optimal (30-100 ng/mL), or high (>100 ng/mL).[4]

Pearson's χ^2 test was used to compare proportions and paired *t* test to compare 2 means. Analyses were performed in SAS 9.4 (SAS Institute Inc, Cary, North Carolina).

Results

A total of 50 209 individuals participated in the employer-sponsored wellness programs of 12 companies in 2014 only (8144, 16.2%), 2015 only (11 803, 23.5%), or both years (30 262, 60.3%). Participants were from all 50 states in the United States and District of Columbia. The mean age was 44.7 years (standard deviation [SD] = 11.8 years). There were more women (60.5%) than men.

Among 50 209 participants based on initial vitamin D results, 47 434 (94.5%) responded to the question of vitamin D supplementation, and of these responders, 14 937 (31.5%) stated they took supplements at initial screening. Among 30 262 dual-year participants, 28 709 (94.9%) responded to the question in both years, 9593 (33.4%) took vitamin D supplements in 2014, and 11 999 (41.8%) took supplements in 2015, a relative increase of 25.1%.

At initial screening, 14 363 (28.6%) participants had vitamin D deficiency and 18 701 (37.3%) participants had suboptimal levels of vitamin D. Only 29 (0.1%) participants had high levels of vitamin D, of whom, 27 participants stated they were taking supplements, and 2 participants did not respond. About 58% of participants with optimal vitamin D levels were seen among those who took vitamin D supplements, compared to 24% of those who did not take supplements ($P < .0001$).

Among dual-year participants whose supplementation status did not change from 2014 to 2015, their mean vitamin D levels did not change as well. For instance, among 610 participants who took supplements in both years and were vitamin D deficient in 2014, 286 (47%) remained deficient 1 year later, 231 (38%) moved to suboptimal levels, and only 93 (15%) moved to optimal levels of vitamin D. Vitamin D levels increased significantly among participants who initiated vitamin D supplementation in 2015, an increase of 7.3 ng/mL (95% confidence interval [CI]: 6.9-7.6 ng/mL, n = 4507, $P < .0001$). For participants who discontinued vitamin D supplementation in 2015, there was a significant decrease of 3.7 ng/mL (95% CI: −4.1 to −3.3 ng/mL, n = 2101, $P < .0001$).

Based on dual-year participants' vitamin D status in 2014, we compared the proportions of participants who discontinued or initiated supplements in 2015. Among those who were taking supplements in 2014, 348 (36%) of 958 participants had deficient vitamin D levels in 2014, 741 (26%) of 2852 participants had suboptimal vitamin D levels in 2014, and only 1012 (18%) of 5770 participants had optimal vitamin D levels in 2014 discontinued supplementation in 2015. Among those who were not taking supplements in 2014, 1654 (25%) of 6593 participants who had deficient vitamin D levels in 2014, 1926 (25%) of 7799 participants who had suboptimal vitamin D levels in 2014, and 927 (20%) of 4724 participants who had optimal vitamin D levels in 2014 initiated vitamin D supplements in 2015. Thus, 75% of participants who had deficient or suboptimal vitamin D levels and were not taking supplements in 2014 continued not taking supplements in 2015.

Discussion

Among 50 209 participants in employer-sponsored wellness programs, 66% had low (deficient or suboptimal) vitamin D levels. This proportion is similar to that found in a study of 2 274 884 vitamin D results (mean [SD] age: 59.9 [16.0] years) based on tests requested by physicians for patients: 60% of patients were low in vitamin D level.[5] For dual-year participants, the proportion of those using supplements increased from 33.4% in 2014 to 41.8% in 2015. This increase speaks to the high and likely growing prevalence of vitamin D supplementation in the United States. Few foods naturally contain vitamin D, especially at levels that are adequate to maintain sufficient levels for most of the population.[1] Vitamin D supplement users are more likely to have optimal vitamin D levels. However, our data show that 42% of supplement users still have deficient or suboptimal vitamin D levels. This gap may be due to taking supplements irregularly or beginning supplementation recently. It is also known that supplementation alone is not always sufficient to raise levels to optimal levels.[6-9]

The mean vitamin D levels changed in dual-year participants who initiated (+7.3 ng/mL) or discontinued (−3.7 ng/mL) supplements in the following year. These changes are consistent with a change in dosing of approximately 400 to1200 IU/d.[6,7,10] The recommended dosage of 600 to 800 IU/d is in the middle of this range; thus, the observed change is consistent with the range predicated for recommended supplement dosage.

A key element of this study is what participants do with information provided. Participants were encouraged to share results with their health-care providers. Thus, actions based on the 2014 results may have involved recommendations by the physicians of participants. In addition, many participants may have received additional vitamin D testing, which is routinely ordered by many physicians. Given their informed vitamin D status, however, 36% of participants who had deficient vitamin D levels and were taking supplements in 2014 chose to stop supplements in 2015; similarly, 26% of participants with suboptimal vitamin D levels in 2014 discontinued supplements in 2015. Those participants acted counter to their received 2014

SO WHAT?

Deficient and suboptimal vitamin D levels are prevalent in a working-age population even with a remarkable proportion of individuals taking vitamin D supplements. Many employer-sponsored wellness program participants do not appear to be taking appropriate actions based on vitamin D testing results. Those who are taking supplements may be taking suboptimal supplementation or have yet to achieve the desired levels. Accordingly, employer-sponsored wellness programs have an opportunity to better direct participants regarding the important role of vitamin D and appropriate supplementation. Physicians have the opportunity to recommend appropriate vitamin D supplementation to patients who will benefit and to monitor response to such interventions. Since laboratory-confirmed vitamin D test results may not be enough of a reason to take corrective actions, more studies are needed to identify what factors motivate participants to respond.

Employer-sponsored wellness programs (essentially screening programs) are effective at identifying disease and disease risk.[11] However, previous studies found that population-level screening program benefits may be modest. For instance, spirometry screening has mixed results as an independent adjunct to smoking cessation,[12] and ambulatory ultrasound screening for carotid plaque is not impactful.[13] The challenge is to engage both consumers and health-care professionals to respond appropriately to results obtained outside of the traditional health-care setting. This challenge increases as the amount of information gathered by consumers expands, including consumers' self-monitoring diets and activities.

results because they should have continued or increased their supplements instead of stopping. In contrast, only 18% of participants who had optimal vitamin D levels in 2014 discontinued supplements in 2015. Surprisingly, the participants who would have most benefited from supplementation were more likely to discontinue supplementation than those for whom it was unclear if continuing supplementation was beneficial. This suggests a large gap in response to information and an opportunity to better inform both the participants and their health-care providers. Among the participants who were not taking supplements in 2014, only 25% of participants who had deficient or suboptimal vitamin D levels in 2014 initiated supplements in 2015; this proportion was only slightly higher than the 20% of participants who had optimal vitamin D levels in 2014 and initiated supplements in 2015. Again, this speaks to a gap between knowing vitamin D status and taking proper actions to improve vitamin D status. The limitation of this study is that the amount, duration, and consistency of vitamin D supplementation are unknown.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Harvey Kaufman and Zhen Chen are both employed by Quest Diagnostics and own stock in Quest Diagnostics.

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