**Review: The 2011 Report on Dietary Reference Intake for Vitamin D: Where Do We Go From Here?**

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**Context:** The Institute of Medicine (IOM) report on dietary reference intakes (DRI) for vitamin D is reviewed, along with its implications.

**Evidence Acquisition:** Evidence-based reviews were completed; the IOM committee conducted its own literature search, an open public workshop, and two open sessions, and maintained a public web site for stakeholder input. The consensus report of the 14 scientists on the committee was reviewed by a panel of experts.

**Evidence Synthesis:** Only bone health could be used as an indicator for DRI development. Evidence for extraskeletal outcomes was inadequate, inconsistent, or insufficient to develop DRI. The recommended dietary allowance was found to be 600 IU/d for ages 1–70 yr, corresponding on average to a serum 25-hydroxyvitamin D (25OHD) level of at least 50 nmol/liter (20 ng/ml), and 800 IU/d for those older than 70 yr. Comparison with current levels of 25OHD in the National Health and Nutrition Examination Survey population survey revealed that the vitamin D intake in the United States and Canada is adequate. An upper limit was set at 4000 IU/d for adults, corresponding to an average serum 25OHD level of 125 nmol/liter (50 ng/ml).

**Conclusion:** Previous reports of an epidemic of vitamin D deficiency in North America were based on an overestimation of adequacy. Population screening with serum 25OHD is therefore not warranted. Current laboratory reference ranges for serum 25OHD are overestimated and should be revised. Practice guidelines to treat disease should not be applied to the healthy American population where use of the DRI is appropriate. (*J Clin Endocrinol Metab* 96: 0000–0000, 2011)

In 1994, the Institute of Medicine (IOM) initiated the development of dietary reference intakes (DRI) (1). This effort is supported by the governments of the United States and Canada. In 2008, The North American governments decided that sufficient new evidence for vitamin D had been developed that a new study of the DRI should be conducted. The IOM appointed a committee of 14 scientists with a broad background; they were assisted by experienced IOM staff. The scientists were fully vetted by the IOM for conflicts of interest. The IOM committee’s report was critiqued by an independent panel of experts, and the responses were adjudicated by a monitor before their submission. The purpose of this review is to briefly summarize the DRI process and background information concerning vitamin D, followed by a summary of the committee’s findings and the reviewer’s opinions about the next steps.

**The Dietary Reference Framework**

The first set of recommended dietary allowances (RDA) was issued in 1941. Starting in 1994, a new paradigm was developed that replaced and expanded upon the RDA. The DRI use a risk characterization, probability model. Emphasis is placed on the distribution of nutrient requirements in a population, rather than on a single value like the former RDA. Understanding and applying the DRI is dependent on understanding of this new paradigm (Table 1). The RDA is a value that is above the intake required for

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**Abbreviations:** DRI, Dietary reference intake; EAR, estimated average requirement; 25-OHD, 25-hydroxyvitamin D; RCT, randomized controlled trial; RDA, recommended dietary allowance; UL, tolerable upper intake level.
The committee concluded that there was sufficient evidence for DRI development from the composite indicator of bone health. Brief comments on deliberations on bone health and some proposed (but not chosen) indicators follow (Table 2). The proposed extraskeletal indicators were rejected for the purpose of DRI development because of insufficient evidence of causality, inconsistency in the evidence, or inability to develop a dose-response relationship.

**TABLE 1. DRI components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Definition</th>
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<tbody>
<tr>
<td>EAR</td>
<td>Reflects the estimated median requirement and is particularly appropriate for applications related to planning and assessing intake for groups of persons.</td>
</tr>
<tr>
<td>RDA</td>
<td>Derived from the EAR; covers the requirement for 97.5% of the population.</td>
</tr>
<tr>
<td>AI</td>
<td>Used when an EAR/RDA cannot be developed; average intake concentration based on observed or experimental intakes.</td>
</tr>
<tr>
<td>UL</td>
<td>Highest average intake that is likely to pose no risk.</td>
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</table>

97.5% of the population. Although it is useful in planning intakes for individuals, the RDA is not appropriate to use for assessing adequacy of intake by an individual because it is likely to overestimate the need for any particular individual. Rather, the estimated average requirement (EAR) should be used in assessing the adequacy of intake by an individual (2). The RDA is also not appropriate to use when working with groups of persons, whereas the EAR and tolerable upper intake level (UL) are more useful values (3–5). The EAR concept considers that there is a distribution of requirements in the population and that the model should be a probability model. When applied to a population, the EAR is the landmark where half the population meets its needs for a nutrient, progressing to the RDA, where the intake of almost the entire population is adequate. The lack of understanding of the DRI paradigm has led to “controversy” concerning the IOM report and misapplication of the RDA.

The committee’s approach to potential indicators and development of DRI was evidence-based (3, 6). Two comprehensive evidence-based reviews on vitamin D were carried out by the Agency for Health Care Research and Quality (AHRQ) (7, 8). The committee conducted its own literature searches and encouraged public input. After the DRI process, the committee selected the best indicators to use as a basis for setting the DRI. It then considered dose (intake)–response based on available literature to set the DRI for adequacy, then the values for UL. Serum 25-hydroxyvitamin D (25OHD), the best indicator for vitamin D exposure, was also considered. Due to variations in sunlight exposure and the variable response to that exposure, as well as the concern about skin cancer, the DRI for vitamin D were based on the assumption of minimal or no sunlight exposure. These recommendations were then compared with national survey data from the United States and Canada to determine sufficiency in the general population. The committee report and several summaries have been published (2, 9, 10).

**Vitamin D background**

Vitamin D has been postulated to have a role not only in calcium/phosphate homeostasis but in the prevention of cancer, autoimmune conditions, cardiovascular disease, infections, and a number of other conditions (11).

Serum 25OHD is the best measure of vitamin D exposure indicating both the effects of diet and sunlight. Melanin in the epidermal layer of the skin reduces synthesis of provitamin D, resulting in less substrate availability for formation of 25OHD so that darker skin is associated with lower 25OHD levels (12). Obesity is also associated with low 25OHD levels, mostly because vitamin D is sequestered in adipose tissue (13).

Several types of assays are available for measurement of serum 25OHD, but the two most common are antibody type methods and liquid chromatography-based methods (14, 15). There is concern about the performance of these assays (16, 17). It is generally thought that the “gold standard” is liquid chromatography–mass spectrometric detection (9). However, these methods both measure physiological relevant parameters, i.e. the total serum 25OH D. There is concern about the accuracy of serum 25OHD measurement in individual laboratories (18, 19). The recent introduction of an internal standard by the National Institute of Standards and Technology should help improve the accuracy of these assays (17). An international organization, Vitamin D External Quality Assessment Scheme (DEQAS), seeks to identify issues in individual laboratories and help with their correction (20).

Below we review select areas from the IOM report, followed by a discussion of what actions should be taken in 2011 now that the DRI have been released by the IOM (2, 9).
TABLE 2. Potential indicators of health outcomes for nutrient adequacy and excess for vitamin D

<table>
<thead>
<tr>
<th>Adequacy</th>
<th>Excess</th>
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<tbody>
<tr>
<td>Cancer/neoplasms</td>
<td>Intoxication and related hypercalcemia</td>
</tr>
<tr>
<td>All cancers: breast cancer/colorectal cancer/colon polyps/prostate cancer</td>
<td>and hypercalciuria</td>
</tr>
<tr>
<td>Cardiovascular diseases and hypertension</td>
<td>Serum calcium</td>
</tr>
<tr>
<td>Diabetes (type 2) and metabolic syndrome (obesity)</td>
<td>Measures in infants: retarded growth, hypercalcemia</td>
</tr>
<tr>
<td>Falls</td>
<td>All-cause mortality, cancer, cardiovascular risk, falls, and fractures</td>
</tr>
<tr>
<td>Immune response functioning</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
</tr>
<tr>
<td>Autoimmune disease: diabetes (type 1)/inflammatory bowel and Crohn’s disease/multiple sclerosis/rheumatoid arthritis/systemic lupus erythematosus</td>
<td></td>
</tr>
<tr>
<td>Infectious diseases: tuberculosis/influenza/upper respiratory infections</td>
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<tr>
<td>Neuropsychological functioning: autism/cognitive function/depression</td>
<td></td>
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<tr>
<td>Physical performance</td>
<td></td>
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<tr>
<td>Preeclampsia of pregnancy and other nonskeletal reproductive outcomes</td>
<td></td>
</tr>
<tr>
<td>Skeletal health (commonly bone health): (serum 25OHD, as intermediate)/PTH, as intermediate)/calcium absorption/calcium balance/bone mineral content/bone mineral density/fracture risk/rickets/osteomalacia</td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td></td>
</tr>
<tr>
<td>Intoxication and related hypercalcemia and hypercalciuria</td>
<td></td>
</tr>
<tr>
<td>Serum calcium</td>
<td></td>
</tr>
<tr>
<td>Measures in infants: retarded growth, hypercalcemia</td>
<td></td>
</tr>
<tr>
<td>All-cause mortality, cancer, cardiovascular risk, falls, and fractures</td>
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</tbody>
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Bone health

Bone health was selected as a composite indicator for development of the DRI for vitamin D (7, 8). Importantly, the committee was able to identify concentrations of serum 25OHD that are associated with indicators of bone health. The studies that were considered include calcium absorption, calcium retention, bone mineral density, rickets, osteomalacia, and fracture.

There have been ongoing debates concerning concentrations of serum 25OHD that are “optimal” for bone health, with most experts recommending either 50 or 75 nmol/liter (and higher) (21). Early evidence supporting the higher levels came from two threshold constructs: the concentration of 25OHD at which serum PTH is no longer suppressed and the concentration that is associated with maximal intestinal calcium absorption. The IOM committee concluded that the inconsistency in reports made the first construct inconclusive, and no evidence was found for an effect on calcium absorption above 50 nmol/liter in children or adults (22).

Calcium absorption doubles in pregnancy, but this increase is independent of vitamin D. There is not good evidence that maternal vitamin D supplementation benefits the newborn (23–28). Neonatal rickets occurs weeks or months after birth, after the infants’ intestine becomes responsive to calcitriol. Animal studies suggest that calcium homeostasis and skeletal development occur independently of vitamin D. After weaning, hypocalcemia and rickets may occur from vitamin D deficiency. Infants of vitamin D-deficient mothers are more susceptible and require supplementation. There does not appear to be an increased need for vitamin D in lactation despite accelerated bone loss.

During bone accretion, maximal calcium absorption occurs with serum 25OHD concentrations above 30–50 nmol/liter and does not increase with higher levels (2). Serum 25OHD levels below 30 nmol/liter may be associated with rickets (29–34). In adults, an analysis of post-mortem bone biopsies in 675 patients was recently reported (35). This study could not be used to establish an EAR because many individuals with low 25OHD did not have osteomalacia (presumably because of adequate calcium intake).

When considering bone mineral density and fracture risk in the elderly, most studies are difficult to interpret because calcium supplements were included in the treatment arm. The AHRQ–Ottawa review concluded that supplementation with calcium and vitamin D reduced fractures in older, institutionalized patients (7). Several meta-analyses confirmed the efficacy of calcium with vitamin D (36, 37). Since the AHRQ reports, two new fracture RCT were published. Mean attained 25OHD was 75 vs. 55 nmol/liter in controls in one trial, and no benefit was found in the treatment group (38). Of concern is the other trial where 500,000 IU was given once yearly for 3 yr. There was an alarming 25% higher risk of fracture in the treatment group and a higher incidence of falls (39).

Falls and physical performance

Although cross-sectional studies are more supportive of an association between high serum 25OHD and reduced risk for falls, evidence from RCT in particular showed inconsistent outcomes (7, 8). A problem in most of the falls RCT is that falls rather than fallers were analyzed. Critical review of one meta-analysis of fall prevention studies that had a positive conclusion found the meta-analysis problematic (40).

A review of observational data not included in the AHRQ reviews found some support for an association between serum 25OHD concentration and physical performance (7, 8, 41, 42). However, high-quality observational evidence from large cohort studies was lacking. Overall, data from RCT suggest that vitamin D dosages of at least 800 IU/d, either alone or in combination with calcium, may confer benefits for physical performance measures (7, 8). Evidence was insufficient, however, to
define the shape of the dose-response curve for higher levels of intake.

Cancer
The systematic reviews by AHRQ-Tufts, World Cancer Research Fund, and Australian Research Center revealed that it cannot be concluded that cancer risk is reduced by vitamin D (8, 43, 44). Both retrospective and prospective studies are limited in consistency in association between estimated vitamin D intake (or 25OHD status) and breast cancer risk (45–47). The paucity of RCT of vitamin D with breast cancer as a primary outcome was further limiting. Associational studies of vitamin D status and risk of prostate cancer have provided mixed results, and RCT of substantial quality examining incidence or mortality have not been reported.

Observational studies examining associations between vitamin D status and colorectal cancer incidence generally support an inverse association between the two, although the dose-response relationship and shape of the curve over a wide range of vitamin D intake is speculative (43, 48, 49). There is a paucity of prospective randomized intervention studies, and those available have not shown a significant relationship (50).

Cardiovascular diseases and hypertension
Both retrospective and prospective studies of cardiovascular disease and hypertension are limited in their interpretation because of the small number of studies and lack of consistency in associations between vitamin D intake or serum 25OHD concentrations and outcomes (7, 8, 51–65). Interpretation is further complicated by the absence of large-scale RCT examining cardiovascular disease as a prespecified primary outcome.

Diabetes (type 2) and metabolic syndrome
Whereas both retrospective and prospective studies tend to support an inverse association between serum 25OHD concentrations and type 2 diabetes, these studies are limited by the study design and cannot show a causal relationship. Evidence from RCT on the effect of vitamin D supplements on incident diabetes or markers of glucose homeostasis show inconsistent results (66–75).

Hazard Identification (Hazards of Inadequacy and Excess)
Because of the interaction of calcium intake and vitamin D status on bone health, it was necessary to assume that the requirement for vitamin D presumes that the dietary requirement for calcium is being met. The selection of bone health as the indicator was in accordance with the previous IOM panel, which had also selected bone health (76). A major difference, however, is that sufficient evidence has accumulated to allow abandoning the AI reference values and replacing them with EAR and RDA.

The committee concluded that a dose-response relationship can be simulated based on serum 25OHD measures. The intake response curve of vitamin D to serum 25OHD is nonlinear. The dose response to vitamin D intake was determined using total intake in studies where sunlight was negligible. A mixed effect model preceded by log transformation was used (22).

Although the AI should not be compared with the RDA, the new RDA values are higher than the AI values of 1997 (76). The serum 25OHD level corresponding to the EAR was found to be 40 nmol/liter (satisfying the needs of half of the population). The serum 25OHD level corresponding to 600 IU/d is 50 nmol/liter. The AI was set at 400 IU/d for infants, and the RDA was set at 600 IU/d for children and adults and 800 IU/d for those over 70 yr of age. The higher intake was recommended in the elderly because of heterogeneity in this population as well as the impact of inadequacy. It should be appreciated that this higher intake (800 IU/d) in the elderly is predicted to result in a serum 25OHD concentration of 73 nmol/liter!

The UL is the highest average intake that is likely to pose no risk. The committee found that hypercalcemia could be used as an indicator for toxicity. An intake of 10,000 IU/d was supported as the NOAEL (no observed adverse event concentration) (2). The IOM committee considered other adverse effects of vitamin D: all cause—mortality, cardiovascular disease, cancer, and falls and fracture. A recent review of the literature suggested higher risk for prostate, breast, pancreas, and esophageal cancer (77). Several studies suggest a reverse J curve or a U-shaped curve for overall mortality, with risk from low vitamin D (<30 nmol/liter) progressing to benefit with risk again increasing at higher concentrations (>75 nmol/liter) in whites and above 60 nmol/liter in African-Americans (55, 78, 79) (Fig. 1). There is a confluence among the studies (which are admittedly limited) in adverse outcomes above serum

<table>
<thead>
<tr>
<th>Status</th>
<th>Serum 25OHD</th>
<th>ng/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased risk of deficiency</td>
<td>&lt;30</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Increased risk of inadequacy</td>
<td>&lt;40</td>
<td>&lt;16</td>
</tr>
<tr>
<td>Adequacy</td>
<td>&gt;50</td>
<td>&gt;20</td>
</tr>
<tr>
<td>Increased risk of excess (UL)</td>
<td>&gt;125</td>
<td>&gt;50</td>
</tr>
</tbody>
</table>

TABLE 3. Cut-point values for serum 25OHD based on DRI
25OHD of 125 nmol/liter. Few data are available on long-term adverse effects of high doses of vitamin D, which dictates that caution should be applied in setting an UL for chronic intake. The UL was set lower than the NOAEL at 4000 IU/d, which corresponds to a serum 25OHD concentration of 125 nmol/liter.

**Survey Data—Population Adequacy (NHANES 2003–2006)**

Current U.S. survey data (NHANES 2003–2006) included dietary supplements of vitamin D as well as intake from foods. The Canadian survey did not account for supplementation use. Most age groups have an AI of vitamin D based on their serum 25OHD concentration, using the EAR approach (2). Vitamin D from food alone in these surveys is below requirements, whereas serum 25OHD concentrations are not. This is presumably a result of the background contribution of sunlight exposure. By definition, the DRI approach using the EAR has half the population with inadequate concentrations of serum 25OHD. From a public health consideration, this approach takes into consideration variation in individual requirements for nutrient intake and is a risk characterization model. A clinical (patient-centric) approach to nutritional adequacy is to have each individual in the population exceed the RDA. This approach overestimates the likelihood of inadequacy, because by definition the RDA meets the requirements of 97.5% of the population. For example, Looker et al. (80) reported the following percentages applying an RDA-linked 25OHD concentration to NHANES: 67% AI, 24% at increased risk of inadequacy, 8% at risk for deficiency, and 1% at risk for excess. Although this exercise is of interest, it would be inappropriate for setting nutritional policy.

**Special Concerns**

Obesity is associated with low 25OHD in part due to sequestration in fat. African-Americans have lower 25OHD because of reduced skin synthesis of previtamin D in response to sunlight exposure as well. However, a supplementation study in African-American women in midlife found no effect of increasing vitamin D intake on...
bone density (81). In addition to the evidence that African-Americans may require less vitamin D for bone health, they may also experience adverse effects at lower concentrations of serum 25OHD compared with other ethnic groups (82).

Groups with reduced sunlight exposure, including the use of sunscreen and cultural clothing cover-ups, do not require vitamin D in excess of the RDA because it was set with the assumption of needs being met by dietary intake alone. Dark-skinned breast-fed infants are at risk for rickets, and all breast-fed infants in the first week of life should begin D supplementation at 400 IU/d. The IOM committee recommended monitoring the institutionalized elderly rather than a fortification or supplement strategy.

Where Do We Go from Here?

The IOM report establishes public policy as of 2011. It reflects comprehensive evidence-based reviews and literature searches that informed the recommendations of a 14-member expert consensus panel. It used the DRI approach, which is the accepted method in nutritional science to establish dietary intake recommendations (22). The report is considered authoritative and will be used in nutritional planning and regulation for the North American population by the government agencies that commissioned it. But where do we go from here? What are the implications of this report for clinicians? What is its public health impact? How can this report inform our practice?

There is not an epidemic of vitamin D deficiency in North America

An artificial “epidemic” of vitamin D inadequacy has been created by accepting the opinion of some experts that the cut-point for serum vitamin D adequacy is over 75 nmol/liter (83). The IOM Committee, following a comprehensive evidence-based approach, could not substantiate that recommendation, but rather set an RDA-linked value of 50 nmol/liter based on the literature for skeletal health. By accepting the higher cut-points, numerous scientific articles have reported a vitamin D “epidemic” in North America. However, using the current NHANES population survey, it is now clear that the North American population is sufficient in vitamin D when an EAR-linked serum 25OHD concentration of 40 nmol/liter is used for vitamin D adequacy.

Controversy in the literature concerning the IOM report in part reflects misunderstanding of the DRI framework. It is incorrect to use the RDA for assessing the prevalence of inadequacy. For those whose intakes meet the EAR, there is a 50% likelihood that their intake is adequate. As the intake increases up to the RDA, there is a 97.5% chance that the intake is adequate. It is inappropriate (and contrary to a risk characterization model) to consider the RDA as a minimum value that is to be exceeded. The EAR (40 nmol/liter) is the reference point assessing the adequacy of intake for groups and for planning intakes for groups.

Moreover, the DRI are intended for normal healthy persons, not for individuals with specific disease states or for special populations. For example, the practice guideline recently released by The Endocrine Society appropriately addresses high-risk subpopulations and disease states (84). The recommendations published in the guideline are contrasted with those in the IOM report and are identified as suggestions for patient care (not recommendations for the healthy population). However, the guidelines may be confused with recommendations for healthy Americans, which is inappropriate and may be hazardous. This distinction is critical for clinicians to understand.

Correct the laboratory ranges for serum 25OHD adequacy and toxicity

Commercial laboratories influence prescribing behavior of physicians through their reference ranges, with results flagged as “L” or “H” (low or high). For example, the range given by Labcorp (DiaSorin method) is 32–100 ng/ml, whereas the range given by Quest Laboratories (liquid chromatography-tandem mass spectrometry) is 20–100 ng/ml.

The IOM committee was not asked to determine cut-point values for sufficiency. However, they recognized that there is no official body that sets normal ranges for laboratory values. Thus, they recommend that a consensus panel should determine appropriate cut-points based on the IOM report. This could be accomplished by a combination of government and professional societies. A range could be given from adequacy to the UL as 50–125 nmol/liter. However, this does not convey that the target is 50 nmol/liter and the UL is 125 nmol/liter. My preference, which incorporates the DRI report, would be to list values as indicated in Table 3. It should be emphasized that the DRI are meant to apply only to healthy Americans.

Screening and supplements

Median dietary intake from food alone in the NHANES population varies from 272–396 IU/d depending on life stage. As an example, in women over 70 yr of age, the median intake increase from supplements is 196 IU/d. If one assumes an intake from food of 300 IU/d, the additional intake may be incorporated into the diet through eating fatty fish, fortified milk, cereal, and juice. Alter-
nately, supplementation of 500 IU/d would be needed to achieve the RDA.

The elderly, especially those institutionalized, are targets for vitamin D supplementation (or measurement of serum 25OHD). One could suggest that those with reduced sunlight exposure (northern latitudes, sunscreen use, and cultural cover-up with clothing) or obesity might take a supplement. Those with reduced sunlight exposure do not need to take in excess of 600–800 IU/d because the RDA was set with the assumption of minimal sunlight exposure.

Although African-Americans have lower serum 25OHD, they have a superior calcium economy and do not benefit from vitamin D supplementation in midlife (81, 85). Moreover, there is a suggestion that the mortality curve for African-Americans may increase at a lower concentration of 25OHD than other ethnic groups and that cardiovascular events and hip fracture risk may be directly related to serum 25OHD in this population (2, 82, 86). Until further research is conducted, African-Americans should have the same intake of vitamin D as other groups.

A consensus panel that determines cut-points for vitamin D adequacy could also make recommendations about laboratory reference ranges and address the issue of when it is appropriate to order a serum 25OHD concentration. It is not cost-effective to measure serum 25OHD as a population screening test (particularly in a population that is considered to have an adequate intake). The question of selective screening of subgroups should be addressed, and this is related to the question of who should take vitamin D supplements.

Inform health practitioners and the public of possible hazards of excess

The list of possible extraskeletal indicators for vitamin D adequacy ranges from autism to death (11). These possible benefits have received a great deal of attention in the press and in professional meetings. The adage of “too much of a good thing” should be applied to vitamin D. It is critical that it is understood that the goal for an individual is 600–800 IU/d (depending on age). Exceeding a serum concentration of 50 nmol/liter was not found to be beneficial by the IOM committee, except perhaps for the elderly. According to the curvilinear dose-response curve developed by the IOM committee, the 800 IU/d recommended for the elderly is predicted to result in serum 25OHD concentrations of 73 nmol/liter (22).

The possibility of an increased incidence of certain cancers as well as a J-shaped curve for mortality is concerning, although not definitively established. However, public safety requires less of a burden of proof for harms than possible benefit. A recent report of the use of megadoses of vitamin D possibly resulting in an increase in falls and fracture has resulted in the recommendation that megadoses of vitamin D be avoided (39, 87).

Anticipate Research Advances That May Change the DRI

Extraskeletal effects of vitamin D are supported by biological plausibility and, in some instances, by many observational studies. It is, therefore, disappointing to some that only bone health had the supporting evidence to be used as a biomarker of sufficiency. Future evidence from well-designed RCT will establish or reject the proposed extraskeletal indicators. The public should be cautioned that although we pursue optimal health and longevity, “more is not necessarily better.”

Until convincing data to the contrary are found, at the present we should follow the RDA of the IOM committee: 600 IU/d for adults up to 70 yr of age, and 800 IU/d for those 70 yr and older. These values assume calcium sufficiency and minimal sunlight exposure.

Acknowledgments

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References

1. IOM 1994 How should the recommended dietary allowances be revised? Washington, DC: The National Academies Press


17. Primary K, Methods development and standard reference materials for 25(OH)D. Presented at the committee to review dietary reference intakes for vitamin D and calcium information-gathering workshop, Washington, DC, 2009


27. Hollis BW, Wagner CL 2004 Vitamin D requirements during lactation: high-dose maternal supplementation as therapy to prevent hypovitaminosis D for both the mother and the nursing infant. Am J Clin Nutr 80:1752S–1758S


39. Sanders KM, Stuart AL, Williamson EF, Simpson J, Kachoria MA, Young D, Nicholson GC 2010 Annual high-dose oral vitamin D and falls and fractures in older women: a randomized controlled trial. JAMA 303:1815–1822


45. Rossi M, McLaughlin JK, Lagiou P, Bosetti C, Talamini R, Lip-


77. Visser M, Deeg DJ, Puts MT, Seidell JC, Lips P 2006 Low serum
concentrations of 25-hydroxyvitamin D in older persons and the risk of nursing home admission. Am J Clin Nutr 84:616–622; quiz 671–672


