

90th Anniversary Commentary: Setting the Standard for Monitoring Dietary Supplement Use in the United States

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It is a special privilege for us to pen this commentary on an article that, although not a particularly old one, has already had a large impact on how we think about nutrient intake in the United States (1). It is also a chance for us to recognize the prescience and insight of our colleagues in the Office of Dietary Supplements at the NIH when they conceived this study. Finally, it is an opportunity for us to recognize and honor one of our most cherished friends, Mary Frances Picciano, who wisely (and sometimes adamantly) encouraged the US Federal nutrition community to address the impact of dietary supplement use on total nutrient intakes in the population.

It is now evident that dietary supplement use, as reported by participants in the NHANES and other cohorts, can contribute substantially to the total intake of nutrients by Americans. This is true in other countries as well.

There is mounting evidence that dietary supplement use can improve the measured micronutrient status of some people, and this is particularly true for nutrients that may not be readily obtained from the diet for some individuals (e.g., vitamin D). On the other hand, further research from this group and others has served as a reminder that it is possible to get too much, and that the intake of some nutrients from foods and dietary supplements can take people over the Tolerable Upper Intake Level (UL).

The NHANES has been collecting data on dietary supplement use by participants since 1971, and a review article describing the prevalence of use covered the periods 1971–1974 and 1976–1980, 1988–1994, and 1999–2000 (2). Over these 30 y, dietary supplement use increased among men and women, decreased among children aged 1–5 y, and did not change for other children and adolescents. These early NHANES cycles queried vitamin or mineral supplement use and whether it was regular or irregular use.

Dietary supplement use has been included as a permanent component of the continuous NHANES since 1999. Changes in the continuous survey included asking for vitamin, mineral, or other (herbal or botanical) supplements used during the past month. Some other changes included the following: more accurate documentation of supplements used, having herbal dietary supplements specifically queried, and hand cards given to participants listing supplements other than multivitamin-multimineral (MVMM) products. Information is now also

captured about consumption frequency, as well as duration and amount taken for each supplement. In addition, the nutrient database linking to the data collected was established as a separate entity with more time-sensitive updates for the formulations being reported. The first main article from the continuous NHANES to assess intake of MVMMs and single-vitamin dietary supplements in adults was published in 2004 for the period 1999–2000 (3). This was followed by an evaluation in children in this same period (4). The article by Bailey et al. (1) is an update to those studies with data from NHANES 2003–2006.

There are some differences in the prevalence estimates across publications due to differences in the types of question being asked and age groups included. Most of the earlier articles reported on the prevalence of use of particular products, such as vitamin E supplements, whereas this article also added information about the prevalence of use of particular nutrients from any supplement. In addition, the authors recalculated their prevalence estimates using an earlier definition of MVMM products (3) for proper comparisons in the 2 time periods. They documented an increase in use over time (35% in 1999–2000 to 40% in 2003–2006) and increases with age throughout adulthood. A similar comparison in children (4) showed an increase in MVMM use in children aged 1–8 y but not in older children. Such attention to detail sets the standard by which subsequent analyses should be performed.

This article (1) presents data on children and adults together, as well as use by age group comparable to those used for the DRIs. These smaller age categories for children help evaluate groups with increased needs and the prevalence of dietary supplement use. As in other studies, these authors found that the majority of the population took only 1 supplement; however, 10% reported the regular use of >5 dietary supplements and there were differences in use by race/ethnicity, education, and BMI. This was the first study, to our knowledge, to document botanical dietary supplement use, with 20% of the population consuming a supplement containing these ingredients, which suggests further work should be pursued to evaluate any impact of these botanicals. The high prevalence of use in general, and in specific subgroups, clearly identified a need to evaluate total nutrient intakes in studies; not including dietary supplements could lead to erroneous results.

Over the past 7 y since the article was published, it has been cited in >300 unique articles. The large majority are nutrition- or dietetics-related (39%), with substantial numbers in the public, environmental, and occupational health fields;

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FIGURE 1 Numbers by disciplines of the 308 citations of the article (1). Data from Web of Science, accessed 30 March 2018 (Reprinted with permission from Clarivate Analytics, Boston, MA). All rights reserved.

oncology; general and internal medicine; pharmacology and pharmacy; and more (Figure 1). With the reported use of dietary supplements by 49% of adults in the United States, it has been cited in methodologic studies, observational studies assessing dietary intakes and health outcomes, and clinical trials. In addition, it has been used for comparisons of prevalence of reported use among specific subgroups and with other countries (5–10).

The high prevalence of use among adults, particularly older adults, spurred further work on the impact of dietary supplements to total nutrient intake and inquiries into reasons for use. Some important articles that followed the standard set by Bailey et al. evaluated the impact of supplements to nutrient adequacy in the population. Blumberg et al. (11) showed that, compared with food alone, the intake of food plus supplements reduced rates of inadequacy for 8 of 17 nutrients in non-Hispanic whites, but for many fewer nutrients in other racial/ethnic groups. Not surprisingly, the prevalence of intakes above the UL was seen for as many as 9 or 13 nutrients evaluated, although this was in only 5% of the population studied. Similarly, it was shown that with food plus supplements, the rates of inadequacy were reduced for 10 of 17 nutrients in the highest socioeconomic group, but for only 5 of 17 nutrients among lower socioeconomic groups (12). Although such data improve our understanding of the impact of supplements on nutritional status in the population, they also show the need for the inclusion of dietary supplements in studies linking nutritional status with a variety of health outcomes. The demonstration that there are subgroups with continued needs for adequate nutrient intakes would permit targeted public health programs and interventions. The large number of nutrients above the UL in a subset of the population is of concern and also should be addressed by researchers and the public health community. These findings all followed the remarkable lead shown by Dr. Bailey and colleagues (1) in their major publication on nutrient-based dietary supplement intakes and the attention to addressing total nutrient intake in a population with such a high prevalence of dietary supplement use.

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