

Impact of frequency of vitamin and mineral supplement consumption on nutrient adequacy and biomarkers of nutrient status in U.S. adults

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ABSTRACT

We assessed the impact of multivitamin/mineral supplements (MVMS) and single nutrient supplements (SNS) on nutrient adequacy and biomarkers of nutrient status in U.S. adults (19+ years) using data from the National Health and Nutrition Examination Survey (NHANES), 2009-2012 (n=10,698). Individuals were categorized based on frequency of MVMS consumption: 1) 1-10 days/month; 2) 11-20 days/month; 3) 21-30 days/month; and 4) no MVMS. SNS were defined as having any level of one and only one nutrient. Usual intakes were determined for food plus dietary supplements using the National Cancer Institute methods and the percentage of the population below the Estimated Average Requirement was used to assess nutrient adequacy. We focused on six underconsumed nutrients: calcium, magnesium, vitamins A, C, D, and E. The odds ratio of being in the lower 15th percentile of the population for various biomarkers (folate and vitamins A, C, D and E) was also assessed. Those with any consumption of MVMS had significantly fewer nutrient inadequacies as compared to those in the no MVMS group. Except for calcium, those in more frequent consumption group had better nutrient adequacy as compared to the lowest frequency group. Similar effects on micronutrient intakes were found with SNS. More frequent use of MVMS was associated with better nutrient status for biomarkers of folate and vitamin A, C, D, and E.

BACKGROUND

Numerous studies as well as the most recent *2015-2020 Dietary Guidelines for Americans* (1) show that most Americans do not obtain required levels of a number of vitamins and minerals in their diets, and are at higher risk for nutrient inadequacies:

- ... "some nutrients are consumed by many individuals in amounts below the Estimated Average Requirement or Adequate Intake levels. These include potassium, dietary fiber, choline, magnesium, calcium, and vitamins A, D, E, and C. Iron also is underconsumed by adolescent girls and women ages 19 to 50 years."
- "Of the underconsumed nutrients, calcium, potassium, dietary fiber, and vitamin D are considered nutrients of public health concern because low intakes are associated with health concerns."

While the impact of dietary supplement consumption on nutrient adequacy has been evaluated (2), the effect of multivitamin/mineral supplement (MVMS) consumption frequency and the role of single nutrient supplements (SNS) have not been reported.

PURPOSE

To determine the impact of MVMS consumption frequency and the role of SNS on nutrient adequacy and biomarkers of nutrient status in U.S. adults.

METHODS

Description of Dataset

- The current National Health and Nutrition Examination Survey (NHANES) is a continuous survey conducted by the National Center for Health Statistics.
- The present analysis combined 2 NHANES datasets (NHANES 2009-2010, 2011-2012).

Subjects and Definition of MVMS and SNS

- Participants included were adults 19+ years of age (N = 10,698) with reliable dietary records; those pregnant and lactating were excluded.
- An important part to this project was to evaluate the impact of frequency of use of MVMS which was defined as any dietary supplement that contained at least 9 of the 21 nutrients evaluated at 100% of the RDA or AI. Frequency of MVMS use was evaluated by grouping consumption into four groups: 1) no MVMS; 2) 1-10; 3) 11-20; and 4) 21-30 of 30 days based on feedback on the dietary supplement questionnaire.
- Also of interest was an evaluation of the impact of SNS which were defined as a dietary supplement that contained one and only one nutrient at any level. Given the lower frequency of use of SNS, analyses were limited to only those nutrients that had 100 or more subjects.

Nutrient Intake Assessment

- Food intake data were obtained from What We Eat In America 2009-2012, the dietary intake component of NHANES. Dietary supplement intake was obtained from the dietary supplement questionnaire which asked about dietary supplement use over the last 30 days with information about the content of each dietary supplement, frequency of use, and quantity consumed.
- Usual intake from food was determined using the National Cancer Institute method with and without the addition of dietary supplements. Percentage of the population below the estimated Average Requirement (EAR) was the key variable used to assess nutrient adequacy. For this report we focused on six underconsumed nutrients: calcium, magnesium, vitamins A, C, D, and E.

Analysis

- SAS 9.2 and SUDAAN 11 were used for all analyses, and NHANES survey weights, strata, and primary sampling units were used in all calculations, thus providing nationally representative estimates.
- Differences in percentage of the population below the EAR were assessed using Z-scores.
- Logistic regression was used to 1) assess likelihood of being in the lower 15th percentile of various nutrition biomarkers; and 2) to assess likelihood of being below well-defined cut-offs to indicate nutrient deficiency.

RESULTS

Table 1a. Multi-Vitamin and Mineral Usage

Dietary Supplement Usage	N	% of Population
No MVMS	8,075	72.3
MVMS 1-10 days/30 days	349	3.6
MVMS 11-20 days/30 days	404	4.1
MVMS 21-30 days/30 days	1,870	20.0

MVMS: Multi-vitamin and mineral dietary supplement; defined as any dietary supplement that contained at least 9 of the 21 nutrients evaluated at 100% of the RDA or AI.

Table 1b. Single Vitamin/Mineral Usage

Single Dietary Supplement Usage	N	% of Population
Calcium	346	3.3
Magnesium	114	1.6
Vitamin C	661	7.1
Vitamin D	804	9.1
Vitamin E	286	2.8

Single dietary supplement defined as any dietary supplement that contained one and only one nutrient at any level

Figure 1. Nutrient Inadequacy Based on Food Alone in Adults (19+ yrs)

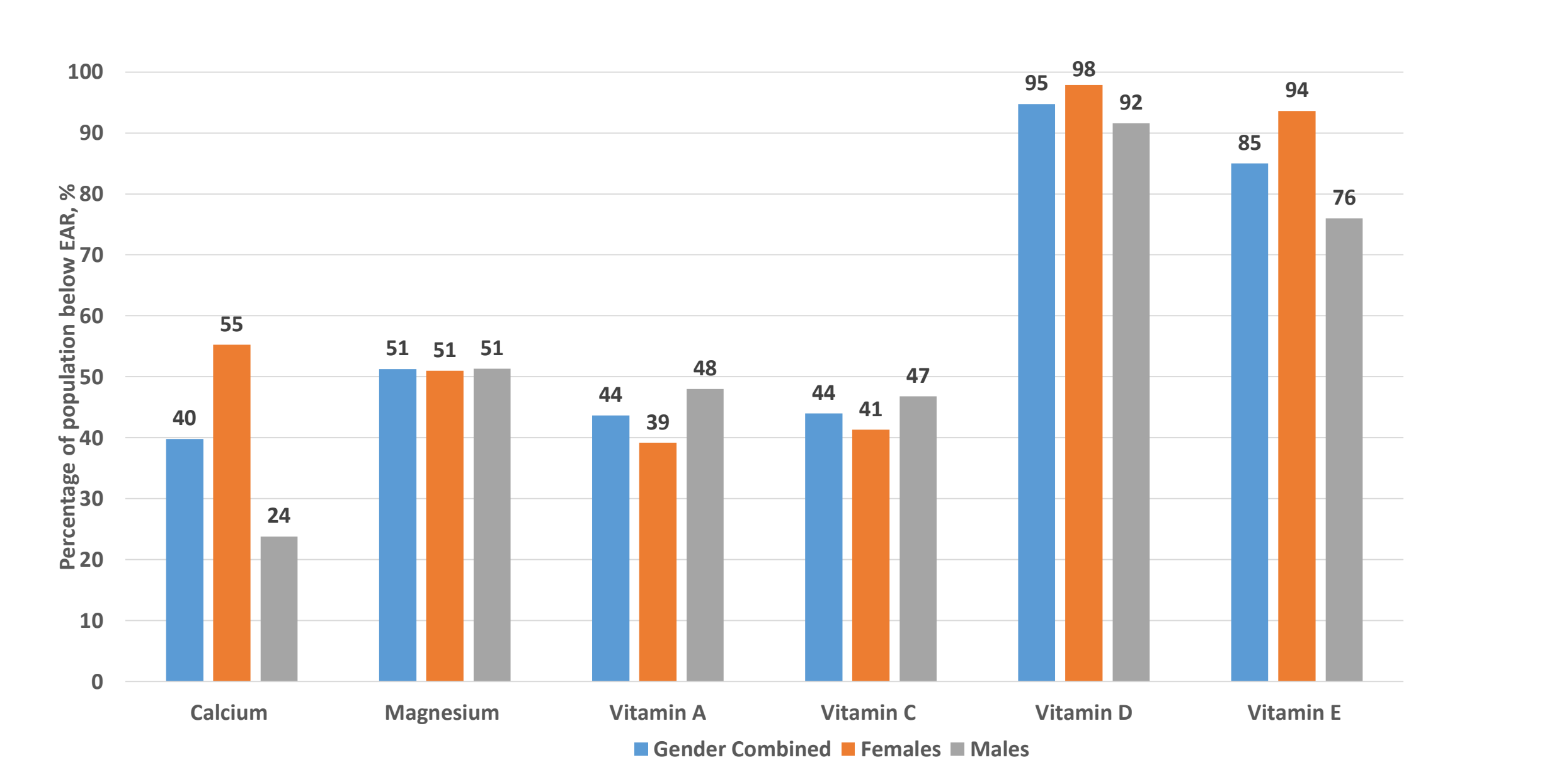


Figure 2. Nutrient Inadequacy Based on Multi-Vitamin/Mineral Dietary Supplement Use in Adults (19+ yrs)

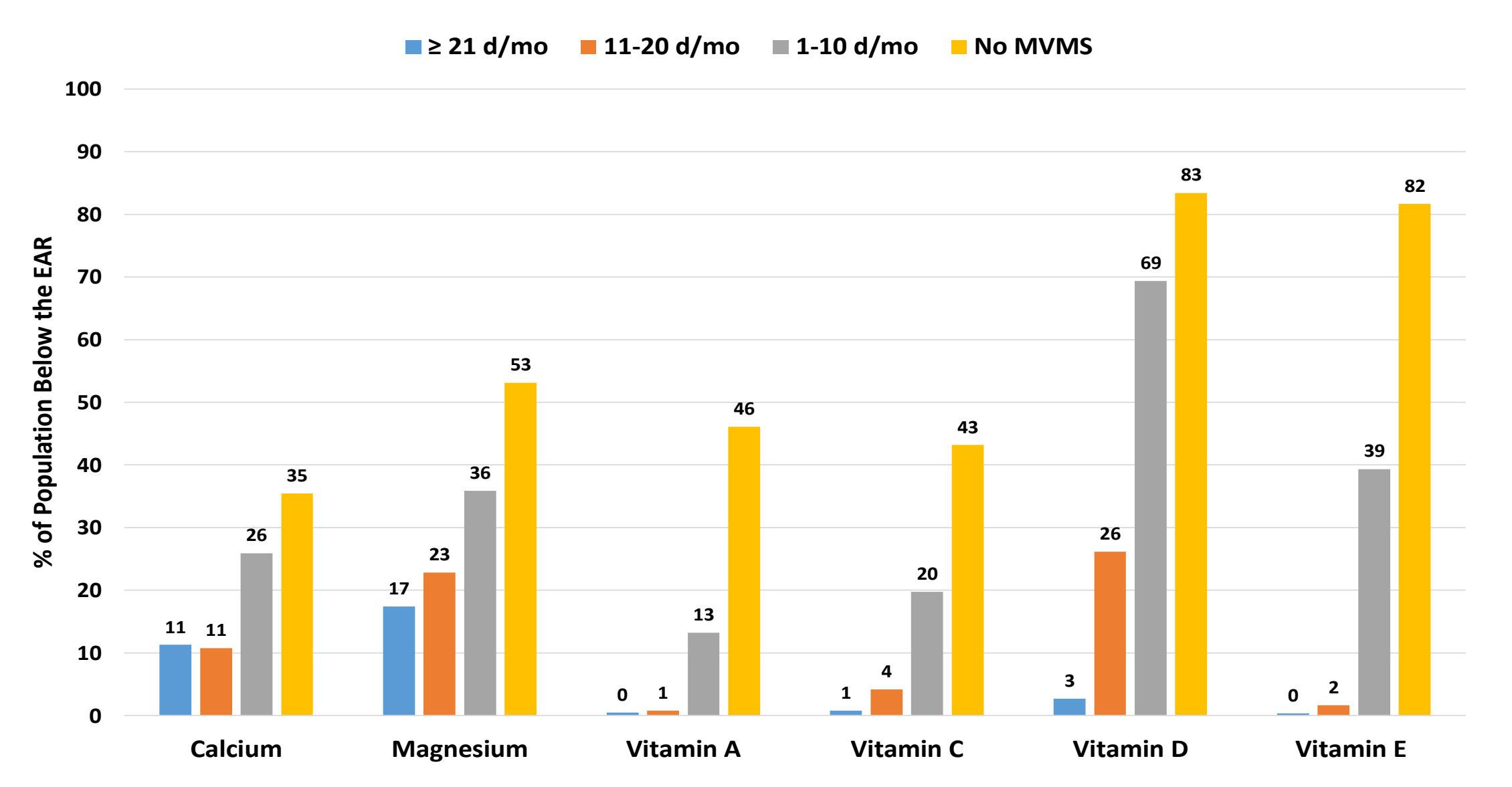


Figure 4. Nutrition Status Assessment (Percentiles) Based on Multi-Vitamin/Mineral Dietary Supplement Use in Adults (19+ yrs)

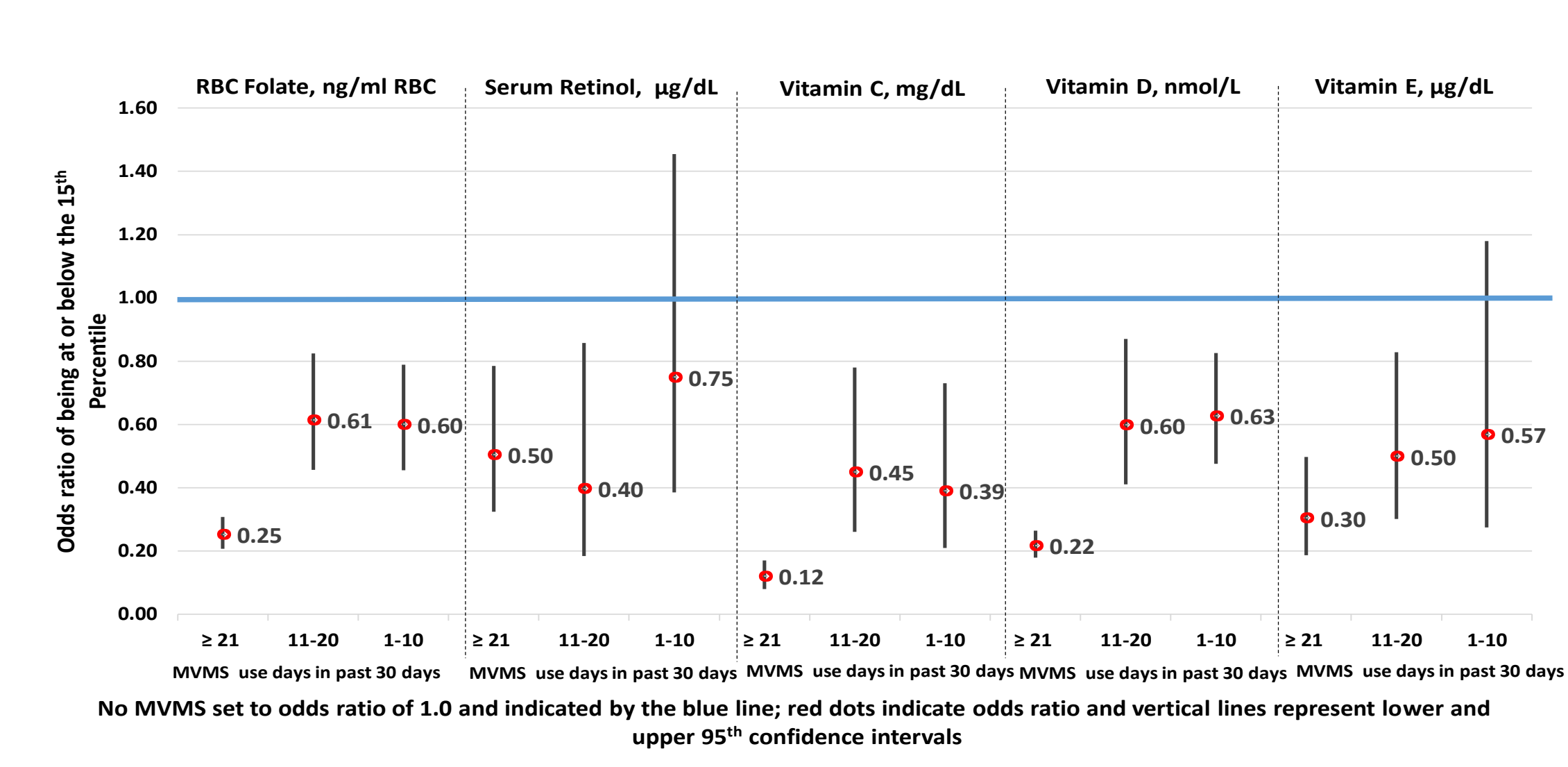


Figure 3. Nutrient Inadequacy Based on Single Nutrient Dietary Supplement (SNS) Use in Adults (19+ yrs)

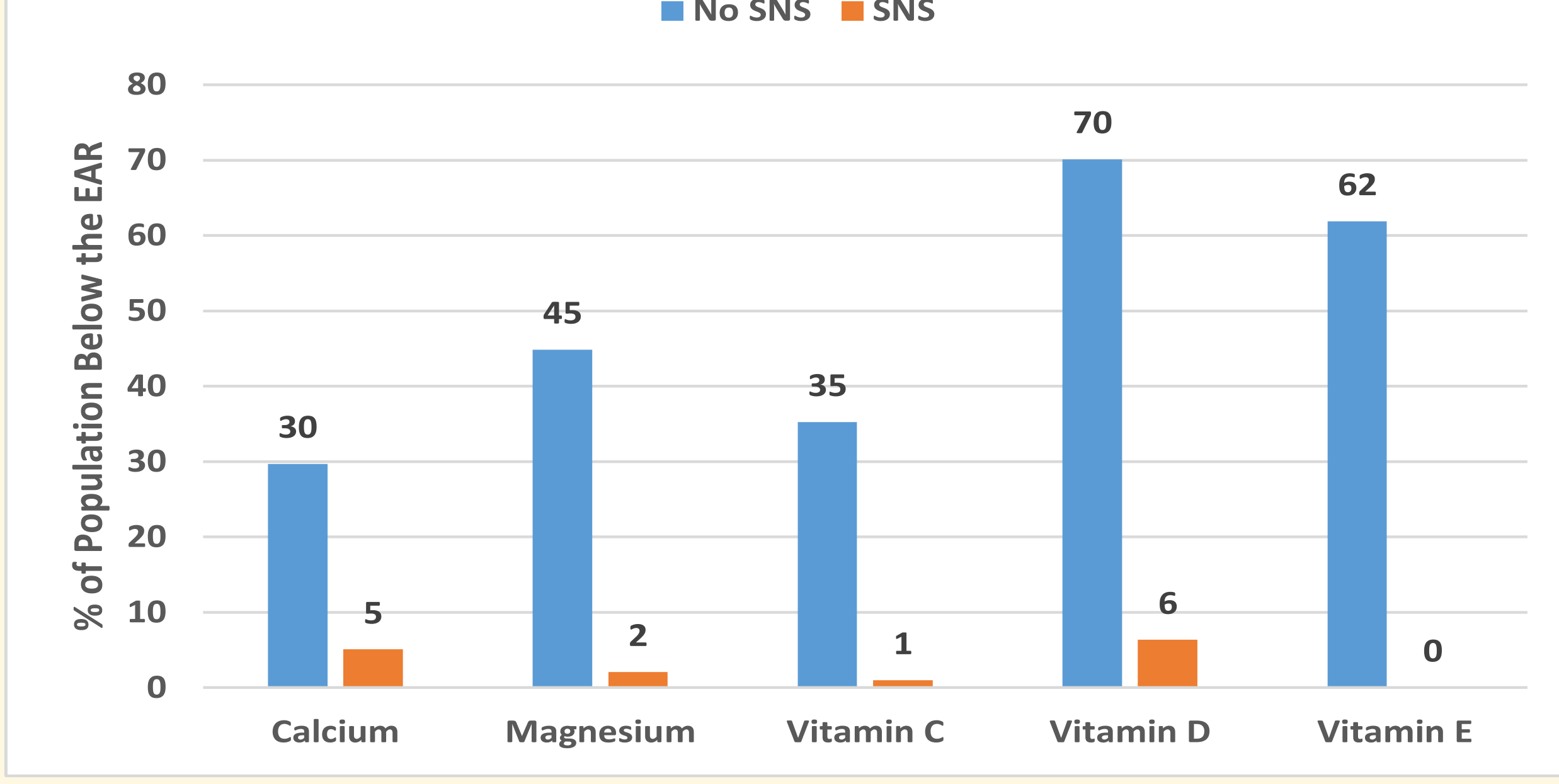
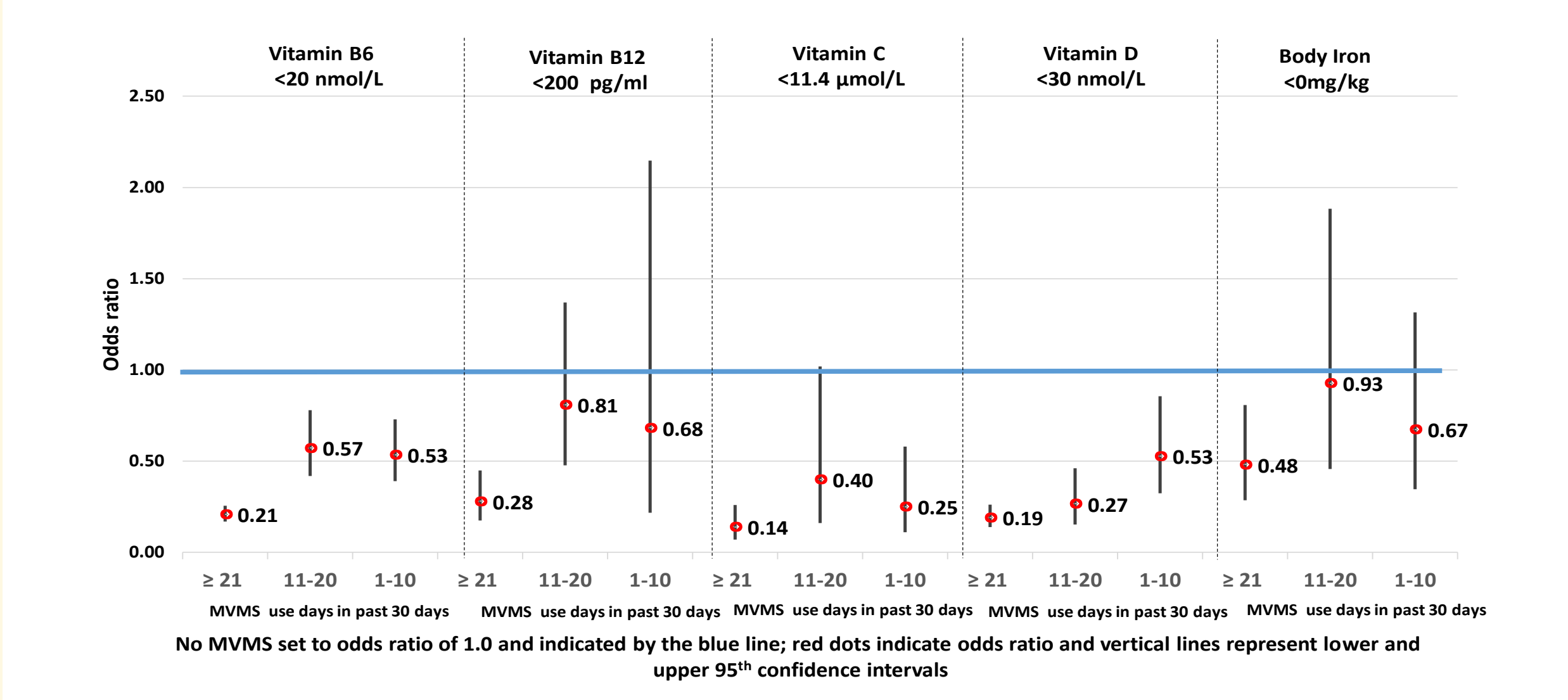


Figure 5. Nutrition Status Assessment (Deficiency Levels) Based on Multi-Vitamin/Mineral Dietary Supplement Use in Adults (19+ yrs)



RESULTS

Nutrient Intake Assessment

- Only 27.7% (n=2,623) of the adult population reported taking a MVMS as defined for this study (at least 9 of 21 nutrients at 100% of the current recommendation) (Table 1a). A much lower percentage of the population reported taking a SNS as defined in this study (containing one and only one nutrient at any level) (Table 1b).
- Large percentages of the adult population have intakes from foods below the EAR for calcium, magnesium, vitamins A, C, D, and E (Figure 1). Males have lower percentages of the population below the EAR than females for most nutrients examined, but still have large percentages of the population with nutrient inadequacy for nutrients examined from food alone.
- More frequent MVMS use was strongly associated with more adults achieving recommended micronutrient intakes (Figure 2). Those with any consumption of MVMS had significantly fewer inadequacies for all nutrients examined as compared to those in the no MVMS group. For all nutrients examined except calcium, those in the 21-30 days/month consumption group had better nutrient adequacies than those in the 1-10 days/month consumption group.
- Similar effects on micronutrient intakes were found with SNS (Figure 3).

Nutrition Status Assessment

- More frequent use of MVMS was associated with better nutrient status as represented by lower odds ratio of being at or below the 15th percentile for biomarkers of folate and vitamin A, C, D, and E (Figure 4). For folate, vitamin C, and vitamin D, nutrient status was better than "No MVMS" group for all MVMS frequency groups. Frequent use of MVMS (21+ days/30 days) lead to odds ratios of being at or below the 15th percentile of 0.12 to 0.50.
- More frequent use of MVMS was associated with better nutrient status as represented by lower odds ratio of being at or below deficiency levels of vitamin B6, B12, C, D, and iron (Figure 5). For vitamin B6 and vitamin D, nutrient status was better than "No MVMS" group for all MVMS frequency groups. Frequent use of MVMS (21+ days/30 days) lead to odds ratios of having nutrient status below deficiency levels of 0.14 to 0.48.

LIMITATIONS

- Given NHANES are cross sectional observational data, we cannot draw cause-effect relationships
- Given 24-h recall data rely on participant memory, data are subject to potential under- and over-reporting

SIGNIFICANCE

MVMS consumption was associated with significantly improved nutrient adequacy/lower inadequacy of vitamins A, C, D, and E, calcium, and magnesium, and with reduced risks for low levels of biomarkers for folate and vitamins A, C, D, and E and reduced risks of having deficiency levels of vitamins B6, B12, C, D and iron. More frequent consumption of an MVMS (21-30 days/month) significantly improved adequacy as compared to infrequent consumption (1-10 days/month). SNS consumption also significantly improved nutrient adequacy. MVMS and SNS could help millions of American adults obtain recommended levels of key nutrients and likely have a positive impact on nutrient status.

REFERENCES

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This research was supported by Bayer Consumer Healthcare, DSM and Pharmavite, which are members of the Campaign for Essential Nutrients. The sponsors did not direct the analysis or the interpretation of the data.