MVMS-HealthProfessional

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Multivitamin/mineral Supplements  
Fact Sheet for Health Professionals  
  
This is a fact sheet intended for health professionals. For a general overview, see our consumer fact sheet.  
  
Introduction  
People in the United States have taken multivitamin/mineral (MVM) and multivitamin (MV) dietary supplements since the early 1940s, when the first such products became available [1]. MVMs, in particular, are popular supplements, currently taken by an estimated one-third of all adults in the United States, and one-quarter of children and adolescents take an MVM or MV [2,3]. MVMs and MVs accounted for 14% of all purchases of supplements and 38% of all sales of vitamin and mineral supplements in the United States in 2019 [4]. U.S. sales of all dietary supplements totaled an estimated $55.7 billion in 2020, including $21.2 billion for all supplements containing vitamins, minerals, or both, of which $8.0 billion was for MVMs and MVs [4].  
  
MVM and MV supplements have no standard or regulatory definition, such as what nutrients they must contain or in what amounts. Therefore, these terms refer to products that have widely varying compositions [5]. These products go by various names, including multis and multiples, and manufacturers determine the combinations and levels of vitamins, minerals, and other ingredients in them.  
  
Many types of MVMs, the focus of this fact sheet, are available in the marketplace. One way to group them is as follows (Table 1).  
  
Table 1: Types of MVMs  
Basic (broad spectrum) MVMs taken once a day that contain all or most vitamins and minerals, most in amounts that do not exceed the Daily Values (DVs), Recommended Dietary Allowances (RDAs), or Adequate Intakes (AIs) for these nutrients.\* This fact sheet focuses primarily on these basic, broad-spectrum MVMs. Formulations for children, adult men and women, pregnant people, and older adults typically provide different amounts of the same vitamins and minerals to meet the needs of these populations.  
High potency Some MVMs contain amounts of some vitamins and minerals that are substantially higher than the DV, RDA, AI, or even, in some cases, the established Tolerable Upper Intake Level (UL).\*\* These MVMs might also include other nutrients and botanical ingredients. Manufacturers sometimes offer these MVMs in packs of two or more pills for users to take daily.  
Specialized (condition specific) MVMs such as those for energy, enhanced athletic performance, weight control, improved immune function, or eye health often combine several vitamins and minerals with botanical and specialty ingredients, such as coenzyme Q10, probiotics, or glucosamine. Some of these products might contain amounts of nutrients that are substantially above the DV, RDA, AI, or even UL.\*The Food and Nutrition Board (FNB) at the National Academies of Sciences, Engineering, and Medicine establishes RDAs and AIs. RDAs are the average daily level of intake of essential nutrients sufficient to meet the requirements of nearly all (97 98%) healthy individuals. These values vary by age, sex, and nutrient. The FNB establishes AIs for nutrients when evidence is insufficient to develop an RDA; intakes at this level are assumed to ensure nutritional adequacy [6]. The U.S. Food and Drug Administration (FDA) develops DVs to help consumers compare the nutrient contents of foods and dietary supplements within the context of a total diet. The FDA establishes a single DV for each nutrient for adults and children from age 4 years, and the DV is usually one of the highest RDAs or AIs for that nutrient.  
\*\* ULs, which the FNB establishes for many nutrients, are the maximum daily intakes unlikely to cause adverse health effects. When intakes exceed the UL, the potential risk of adverse effects increases.  
An additional complication for this product category is that many dietary supplements are not labeled as MVMs even though they contain a variety of vitamins and minerals [1]. For example, a manufacturer might label a product containing vitamins C and E, selenium, zinc, and beta-carotene as an antioxidant formula rather than an MVM.  
  
Furthermore, investigators define MVMs differently (or sometimes not at all) in their studies to evaluate the potential health effects of these products. For example, the Agency for Healthcare Research and Quality, in an evidence-based review of the role of MVMs in chronic disease prevention, defined MVMs as products containing at least three vitamins and minerals in amounts below the UL but no herbs, hormones, or drugs [7]. One team of researchers categorized MVMs more ambiguously as stress-tab-type, therapeutic type, and one-a-day type, so these products probably included MVs as well [8]. Another team defined MVMs as full-spectrum products providing all 12 vitamins plus 10 minerals [9]. Some published reports of studies of dietary supplements use the generic term multivitamins to include products with and without minerals. Various government surveys of dietary supplements and popular food-frequency questionnaires also define MVs and MVMs differently, include different examples, or ask about different products.  
  
Varying definitions of MVMs and the ability of manufacturers to change the composition of their products at will further complicate the study of MVMs potential health impacts because different studies do not use products of similar composition. Whether studies find any benefits (or risks) of MVMs depends in large part on the combinations and amounts of nutrients in the MVMs used, and these studies results are not generalizable to the enormous variety of MVMs available in the marketplace.  
  
Extent of Multivitamin/mineral Use  
An analysis of dietary supplement use in the United States from the 2017 2018 National Health and Nutrition Examination Survey (NHANES) found that MVMs (defined as products containing three or more vitamins and at least one mineral) were the most commonly consumed supplement. MVMs were taken in the past 30 days by 24.0% of men and women age 20 39 years, 29.8% of those age 40 59 years, and 39.4% of those age 60 and over [10]. Among children and adolescents, MVM use rates were 11.0% for up to 2 years of age, 34.6% for age 2 5 years, 29.5% for age 6 11 years, and 17.3% for age 12 19 years [11]. An earlier analysis of 2011 2014 NHANES data found that 31.2% of the U.S. adult population age 19 years and older reported taking an MVM in the past 30 days [2].  
  
Overall, women are more likely (34.0%) to take an MVM than men (28.3%) [2]. Use rates by sex and age are 19.5% for men and 26.1% for women age 19 30 years, 25.1% for men and 33.0% for women age 31 50 years, 34.5% for men and 36.2% for women age 51 70 years, and 40.9% for men and 44.0% for women age 71 years and older.  
  
MVM use is also more common among the children of women who take supplements; older adults; individuals with more education, a higher income, a healthier lifestyle and diet, and lower body-mass index (BMI); and residents of the western United States [1,2]. MVM use is less common among smokers and members of certain ethnic and racial groups, such as African Americans, Hispanics, and Native Americans, than among Whites.  
  
Multivitamin/minerals and Health  
People take MVMs for various reasons. This section summarizes the evidence on the use of MVMs to increase nutrient intakes and to improve health or prevent chronic disease.  
  
Increase nutrient intakes  
Taking an MVM increases nutrient intakes and helps people obtain recommended amounts of vitamins and minerals when they do not meet these needs from food alone [9,12].  
  
The FNB notes that RDAs and AIs for nutrients are levels of intake to ingest, on average, each day from the diet [6]. The FNB does not address whether or to what extent nutrient supplements can compensate for dietary inadequacies. Nevertheless, some users consider use of an MVM as a form of dietary or nutritional insurance, a concept first introduced by Miles Laboratories to market its One-A-Day line of nutrient supplements in the 1940s [13].  
  
MVMs can also increase the likelihood that users will have intakes of some nutrients that are higher than the ULs [14]. Excess nutrient intakes are even more likely among MVM users who also take single vitamin and mineral supplements [15].  
  
Results from several studies demonstrate both the use of MVMs for nutritional insurance by some individuals and the potential of MVMs to lead to excessive intakes for others.  
  
In one study, for example, investigators assessed the diets and use of MVMs in a large multiethnic cohort of 90,771 men and women age 45 and older from Los Angeles and Hawaii [16]. The investigators calculated nutrient intakes from participants diets using a food frequency questionnaire and from MVMs (taken by 23%) using the nutrient composition of two commonly used MVMs. Approximately 74% 76% of the men and 72% 75% of the women had adequate intakes on average from food alone of the 17 nutrients examined, but use of MVMs increased the prevalence of adequacy to 84% for the men and 83% for the women. The greatest improvements in intake were for vitamins A and E and zinc. However, MVM users had excessive intakes of several nutrients; 10% 15% had excessive intakes of vitamin A, iron, and zinc, and 48% 61% had excessive intakes of niacin.  
  
Several studies have found that MVM users tend to have higher micronutrient intakes from their diet alone than nonusers [15]. Ironically, the populations at highest risk of nutritional inadequacy who might benefit the most from MVMs are the least likely to take them [1]. Pregnant and breastfeeding people, adult women, non-Hispanic Blacks, people of low socioeconomic status, and individuals who are underweight or overweight are among the groups with the greatest risk of deficient intakes of one or more nutrients [9].  
  
A cross-sectional analysis of a nationally representative sample of 1,003 pregnant U.S. people age 20 to 40 years from the 2001 2014 NHANES found that many consumed less than recommended amounts of many nutrients from diet alone [17]. Among the 69.8% who took a dietary supplement (most likely a prenatal MVM supplement), the risk of inadequate intakes of many nutrients was lower. For example, 27.7% had inadequate intakes of vitamin A from foods alone, but this rate dropped to 15.5% when supplements were included. However, supplement use increased the proportion of pregnant people with some intakes of iron (27.9%) and folic acid (33.4%) above the UL.  
  
In Canada, almost all prenatal MVM supplements provide 1,000 mcg/day of folic acid. Therefore, the folic acid intakes of pregnant people who take these supplements and consume any foods fortified with this nutrient exceed the UL for this nutrient (1,000 mcg), even though many do not consume recommended amounts of folate from dietary sources alone [18]. Even in the United States, the amount of folic acid in prenatal MVM supplements is typically 800 or 1,000 mcg, which is much higher than the recommended amount (400 mcg) to reduce the risk of neural tube defects in babies [19].  
  
Improve health or prevent chronic disease  
Most studies of the potential value of MVMs to enhance health and prevent disease have been observational and compared individuals who chose to take MVM supplements with others who did not take supplements. Because people with healthier diets and lifestyles are more likely to use dietary supplements, attributing health benefits that are distinct from the benefits of healthy behaviors to the use of supplements is difficult [13]. Some studies have suggested potential health benefits or harms from the use of MVMs, but others have found none. Participants in these studies used a wide variety of MVMs containing different combinations and amounts of nutrients.  
  
Clinical trials, where individuals are randomly assigned to take the dietary supplement or a placebo, are better than observational studies for determining whether MVMs might affect disease risk. However, few randomized controlled trials (RCTs) have been conducted because these studies need to be long enough to show effects on disease risk that go beyond simply identifying intermediate biomarkers that might suggest such risk. As with some observational studies, some RCTs have suggested that MVM use has potential health benefits, but others have found no such benefits. However, no two RCTs have used MVMs with the same combinations and amounts of nutrients.  
  
Cancer  
Some experts have hypothesized that MVM use might reduce cancer risk or improve cancer outcomes, possibly because certain nutrients in MVMs might inhibit carcinogenesis or tumor progression. Studies of MVMs that have focused on cancer have been observational. They have examined associations between MVM use and overall cancer risk or risk of various types of cancer (including breast, prostate, and colon cancer) as well as associations with cancer-related death.  
  
Evidence on the link between MVM use and cancer risk includes a meta-analysis of eight cohort and case-control studies published before August 2010 that evaluated the association between consumption of MVs and MVMs and breast cancer risk [20]. The studies (which were of low quality overall) included a total of 355,034 women age 20 79; those taking MVs and MVMs took them for at least 3 years. Even after using MVs and MVMs daily for at least 10 years, the women had the same risk of breast cancer as the nonusers. However, one study in this meta-analysis found a 19% higher risk of breast cancer in 25.5% of 35,329 Swedish women who reported taking an MV or MVM (in most cases nutrients in amounts close to RDA levels) than in women who did not take these supplements over an average of 9.5 years [21].  
  
Another large prospective study investigated the association between use of MVs and MVMs (mostly MVMs described as therapeutic or theragran, one-a-day, or stress-tab) and risk of cancer by following 489,640 men and women age 50 71 years for 16 years [8]. Men and women who reported taking more than one MV or MVM daily at the beginning of the study had an 18% lower risk of developing colon cancer than nonusers. Men who took a daily MV or MVM had a 2% higher overall risk of cancer, including a 3% higher risk of prostate cancer, 8% higher risk of lung cancer, and a 16% higher risk of leukemia (which increased to 26% higher if they took more than one MV or MVM daily). Among women, taking a daily MV or MVM did not affect their overall risk of developing cancer except for oropharyngeal cancer, which increased by 46%. Women who took more than one MV or MVM daily had a 53% higher risk of oropharyngeal cancer but a 35% lower risk of leukemia. All results were adjusted to exclude potential confounders, such as the use of single vitamin or mineral supplements.  
  
Studies on the association between MVM use and cancer-related deaths include one that followed 7,728 women in the Women s Health Initiative who had invasive breast cancer for an average of 7.1 years after their diagnosis [22]. At baseline, 37.8% reported taking an MVM (typically containing 20 30 vitamins and minerals). The rate of death from breast cancer (6.7% of the cohort) was 30% lower among the MVM users than nonusers. In addition, a study examined the association between daily MV or MVM use and colon cancer mortality over 16 years in 776,902 men and women, most of whom were White and middle-age or older [23]. During the study, 4,517 died of colon cancer. Use of MVs or MVMs (not further defined) was associated with an 11% lower risk of colon cancer mortality than among nonusers. However, use of MVs or MVMs conferred no protection among participants consuming less than two alcoholic beverages per day, whereas use among those consuming more was associated with a 29% lower risk of colon cancer mortality.  
  
Cardiovascular disease  
Some experts have hypothesized that MVM use might reduce the incidence of cardiovascular disease (CVD) or rates of deaths from this disease, possibly because certain nutrients in these products might reduce blood pressure or affect vascular function. Both observational studies and clinical trials have examined this possibility.  
  
Observational studies  
Studies that have examined associations of MVMs with CVD risk include the Physicians Health Study I. This study prospectively followed 18,530 male physicians age 40 years and older, of whom 20% reported taking an MV or MVM for an average of 12.2 years [24]. The results showed no significant associations between MV or MVM use and risk of major CVD events, including myocardial infarction (MI), stroke, and CVD death. However, the supplement users had a 14% lower risk of undergoing cardiac revascularization (coronary angioplasty or coronary artery bypass grafting). Furthermore, men who reported using MVs or MVMs for 20 years or more had a lower risk of major CVD events, stroke, ischemic heart disease, and cardiac revascularization than men who did not take MVs or MVMs.  
  
Studies of the association between MVM use and CVD outcomes have focused on several outcomes, including cardiovascular events and mortality. For example, a 2018 meta-analysis of 16 prospective cohort studies (including the study described above and the two below) and two RCTs evaluated the association between use of MVMs (defined as containing more than three vitamins and minerals) and risk of various CVD outcomes, including coronary heart disease and stroke [25]. The studies included a total of 2,019,862 participants with a mean age of 57.8 years and had a mean duration of 11.6 years. Overall, MVM supplementation was not associated with better cardiovascular outcomes, including lower risk of mortality from CVD and coronary heart disease, or of stroke incidence and mortality.  
  
Another study of CVD outcomes in MVM users matched use of MVMs (defined as products containing three or more vitamins and one or more minerals) and MVs among 8,678 adults from NHANES III (1988 1994) with mortality data reported through 2011 [26]. After adjustment for potentially confounding variables (e.g., age, race, BMI, serum lipids, and blood pressure), the use of MVMs for more than 3 years was associated with a substantial 44% reduction in CVD mortality rates among women but not men.  
  
A third CVD outcomes study prospectively followed a cohort of 37,193 women age 45 and older (mean age 54 years) participating in the Women s Health Study who were users (38%) or nonusers (62%) of MVMs (including a wide range of lower-dose vitamins and minerals) for an average of 16.2 years. The study measured rates of major CVD events, including MI, stroke, and CVD death [27]. Neither baseline use nor changes in use of MVMs over time was associated with changes in the long-term risk of major CVD events, MI, stroke, cardiac revascularizations, or death from CVD.  
  
Randomized controlled trials  
RCTs have focused primarily on the link between MVM use and CVD (or all-cause mortality) outcomes. One RCT randomized 1,708 participants age 50 years and older who had had an MI at least 6 weeks earlier to take a daily MVM containing 27 nutrients (many in doses higher than recommended amounts) for a median of 31 months (range 13 to 60 months) or a placebo as well as their standard medications. The study s goal was to determine whether the supplement reduced the risk of additional cardiovascular events or death [28]. Participants receiving the supplement did not have significantly fewer cardiovascular events, but this finding should be interpreted with caution because many participants did not take the supplement or placebo as directed, and others withdrew from the study early.  
  
A 2021 meta-analysis of nine RCTs (not including the study described above) evaluated the use of MVMs (defined as products that included most vitamins and minerals) by 22,773 individuals and a variety of CVD outcomes including total CVD incidence and mortality, MI incidence and mortality, and stroke incidence and mortality and all-cause mortality [29]. MVM use did not alter the risk of any of these outcomes.  
  
Cataracts and age-related macular degeneration  
Several epidemiological studies and small RCTs have suggested associations between higher intakes of antioxidants or zinc and reduced risk of age-related macular degneration (AMD), although not consistently [30].  
  
In the Age-Related Eye Disease Study (AREDS), investigators randomized 4,757 individuals age 55 80 years who had varying degrees of AMD, cataract, or both conditions to receive a placebo or a daily supplement containing high doses of vitamin C (500 mg), vitamin E (400 International Units [IU]), beta-carotene (15 mg), zinc (80 mg), and copper (2 mg) [30,31]. Over an average follow-up period of 6.3 years, the supplements significantly reduced the risk of progression from intermediate to advanced AMD by 28% and reduced rates of loss of visual acuity by 27%. The supplements did not prevent AMD onset or affect cataract risk. A subsequent study, AREDS2, tested whether adding omega-3 fatty acids (containing 650 mg eicosapentaenoic acid [EPA] and 350 mg docosahexaenoic acid [DHA]) or lutein (10 mg) and zeaxanthin (2 mg) to the AREDS formula would make it more effective [32]. This study included 4,203 participants age 50 85 years who had intermediate AMD in both eyes or intermediate AMD in one eye and advanced AMD in the other eye. Adding omega-3 fatty acids, lutein and zeaxanthin, or both to the AREDS formulation did not further reduce the risk of progression to advanced AMD. However, the study showed that beta-carotene was not a required ingredient; the original AREDS formulation without beta-carotene provided the same protective effect on reducing the risk of advanced AMD as the AREDS2 formulation.  
  
Pregnancy and birth outcomes  
Dietary supplements are commonly taken during pregnancy to increase nutrient intakes, especially of key nutrients such as iron and folic acid. Some experts have hypothesized that MVM use might increase the chance of a healthy birth outcome.  
  
A meta-analysis of 20 RCTs investigated whether supplementation with MVMs (whose composition varied by study but that contained multiple nutrients including iron and folic acid) by pregnant people led to better birth outcomes than use of supplements containing only iron with or without folic acid or, in one study, a placebo [33]. The trials included 141,849 pregnant people from low- or middle-income countries in Africa and Asia as well as in Mexico (where malnutrition and micronutrient deficiencies are not uncommon); only one of the studies was conducted in a high-income country, the United Kingdom. The use of MVMs resulted in lower odds of low birth weight (less than 2,500 g) by 12%, birth at a smaller size than normal for gestational age by 8%, and premature births (before week 37 of pregnancy) by 10% than use of supplements containing iron with or without folic acid alone or placebo. MVM supplementation did not have a beneficial or harmful effect on risk of stillbirths or of perinatal and neonatal mortality in comparison with iron and folic acid supplementation. The trial in the United Kingdom that compared an MVM to a placebo found no beneficial or harmful effect of the MVM on preterm births, birth at a smaller size than normal gestational age, or low birth weight.  
  
A similar meta-analysis of 13 RCTs investigated whether use by pregnant adolescents and young adults age 10 19 years of an MVM (containing multiple nutrients) led to better birth outcomes than supplementation with only iron and folic acid [34]. The trials included a total of 15,283 pregnant adolescents and young adults from low- or middle-income countries in Africa and Asia. MVM supplementation resulted in 13% lower odds of low birth weight, 12% lower odds of preterm birth, and 14% lower odds of small size for gestational age than iron and folic acid supplementation alone.  
  
Multiple outcomes  
Several studies have evaluated the link between MVM use and many different health outcomes, including cancer, heart disease, osteoporosis, pulmonary diseases, psychiatric disorders, and mortality. Most have not found an effect of MVM use on any of the health outcomes measured.  
  
Observational studies  
One of the largest prospective studies of MVM use was the Women s Health Initiative, which evaluated the health of 161,808 postmenopausal women age 50 79 years and their risk factors for cancer, heart disease, and osteoporosis. A total of 41.5% of the women took an MVM (containing 20 30 vitamins and minerals in amounts not exceeding the RDAs), an MV (10 or more vitamins in amounts of 100% or more of the RDA), or a stress multisupplement (containing at least 10 nutrients, some in amounts more than twice the RDA) at least once a week. When the investigators compared the outcomes of supplement users and nonusers, they found no association between use of these products for a median of 8 years and an increased risk of any common cancer or total cancers, CVD, or total mortality [35]. Investigators who followed a multiethnic cohort of 182,099 men and women age 45 75 years living in Hawaii and California for an average 11 years found similar results [36]. Approximately 48% of the men and 52% of the women in this study reported taking an MV or MVM.  
  
Other observational data on multiple outcomes come from a cross-sectional analysis of data from participants in the 2012 National Health Interview Survey. This analysis included 4,933 adults who reported taking an MV or MVM during the previous 12 months and 16,670 nonusers [37]. The supplement users reported better overall health than the nonusers, but the results showed no differences in various psychological, physical, or functional health outcomes [37].  
  
Randomized controlled trials  
Some evidence from RCTs has focused on the use of MVMs to reduce the risk of various chronic diseases. In 2006, researchers reviewed 63 published RCTs between 1966 and early 2006 that evaluated the potential impacts of MVs and MVMs and individual nutrient supplements on health and on the risk of certain medical conditions (cancer; age-related sensory loss; and cardiovascular, endocrine, neurologic, musculoskeletal, gastroenterologic, renal, and pulmonary diseases) [7]. Use of MVs and MVMs (products containing three or more vitamins and/or minerals in amounts below the ULs and no herbs) did not reduce the risk of any chronic disease. An expert panel that reviewed this report and participated in a state-of-the-science conference on the use of MVs and MVMs for chronic disease prevention at the National Institutes of Health in 2006 concluded that the evidence was insufficient for them to recommend for or against the use of MVs or MVMs to prevent chronic disease [1].  
  
The Physicians Health Study II was the longest clinical trial to investigate whether MVMs might help prevent chronic disease. The study randomly assigned 14,641 male physicians in the United States age 50 and older to take a daily MVM (Centrum Silver) or placebo for a median of 11.2 years. Participants who took the MVM did not have fewer major cardiovascular events, myocardial infarctions, strokes, or cardiovascular-related deaths than nonusers [38]. MVM supplementation modestly but significantly reduced users risk of developing cancer by 8% but did not reduce the risk of any type of cancer (e.g., of the prostate or colon) or overall cancer mortality [39]. The supplement also had no effect on cognitive decline with age [40]. In addition, the supplement reduced the risk of cataracts by 9% but did not help prevent AMD [41].  
  
The COcoa Supplement and Multivitamin Outcomes Study (COSMOS) was a subsequent clinical trial to investigate whether MVMs might help prevent cancer and CVD in both men and women [42]. This study randomly assigned 8,776 men age 60 years and older and 12,666 women age 65 years and older to take one of the following for a median of 3.6 years: a daily MVM (Centrum Silver, with small differences in ingredients and amounts from the supplement used in the Physicians Health Study II), a cocoa extract containing 500 mg of cocoa flavanols, both Centrum Silver and the cocoa extract, or both placebos. Participants who took the MVM supplement did not show a reduction in total invasive cancers but did have a 38% lower incidence of lung cancer. MVM supplementation did not reduce any cardiovascular events (such as heart attacks or strokes), death from CVD, or all-cause mortality.  
  
An ancillary study to COSMOS, known as COSMOS-Mind, enrolled 2,262 of the older COSMOS participants (mean age 73 years) to investigate whether the cocoa extract, MVM, or both supplements might improve cognition compared with placebo over 3 years of daily use [43]. Participants completed standardized cognitive tests administered over the telephone at baseline and annually for 3 years. Participants who took the MVM supplement, with or without the cocoa extract, showed improved global cognition, which reflects overall ability across multiple cognitive domains, such as recall, recognition, and learning. The improvement was most pronounced in participants with a history of CVD. Participants who took the MVM also showed improved memory and executive function.  
  
Similar findings were reported from COSMOS-Web, another ancillary study to COSMOS that included 3,562 participants (mean age 71 years) who completed computer-based cognitive assessments [44]. In this study, participants who took the MVM had significantly better memory at both 1 year and across 3 years of follow-up, on average, compared with those who took placebo. A third ancillary study, COSMOS-Clinic, included 573 participants (mean age 69 years) who completed in-person, detailed neuropsychological assessments at baseline and year 2 [45]. Compared with participants who took placebo, those who took the MVM showed an improvement in episodic memory over 2 years, but not executive function or attention. In addition, a meta-analysis of the three ancillary studies (COSMOS-Mind, Web, and Clinic) that included more than 5,000 participants showed that MVM use improved global cognition and episodic memory over time [45]. These findings suggest that MVM supplementation can help maintain or enhance cognitive function in older adults.  
  
Other RCTs have evaluated the effects of MVMs on outcomes in individuals with a range of chronic diseases. One RCT conducted in Linxian, China, randomized 3,318 persons age 40 69 years who had precancerous lesions in the esophagus (a relatively common condition in this population, which had a low dietary intake of several nutrients) to receive a daily MVM containing 14 vitamins and 12 minerals in doses two to three times recommended amounts or a placebo for 6 years [46]. The supplement did not reduce incidence or mortality rates for esophageal cancer or the rate of mortality from any cause. After the investigators followed participants for up to 20 additional years, when participants were no longer taking the study supplement, the use of the MVMs during the RCT did not result in lower rates of total mortality or mortality from any cause of death examined, including cancer, heart disease, and stroke [47].  
  
One meta-analysis of 21 RCTs investigated whether daily use of MVs and MVMs (products containing three or more nutrients) for at least 1 year affected mortality risk [48]. The studies included a total of 91,074 healthy adults (average age 62 years) taking the MVs or MVMs for an average of 43 months, and the investigators reported 8,794 deaths. The products provided an average of 14 nutrients, although the products with three nutrients in five trials did not contain a mineral. The use of MVs or MVMs had no effect on all-cause mortality or on mortality due to CVD or cancer.  
  
A review of 16 RCTs of MVs and MVMs (containing more than four nutrients including, in most cases, at least one mineral) in 1,719 participants who had at least one of six types of psychiatric symptoms (depression, post-disaster stress, antisocial behavior, behavioral deficits in dementia, attention-deficit/hyperactivity disorder, or autism) found that the supplements provided no clear reduction in symptoms [49]. However, the quality of the studies was generally poor, most had small samples (as few as 20 participants), and they used different MVs and MVMs and outcome measures.  
  
One well-known trial of the impact of MVMs on both chronic disease risk and mortality used combinations of antioxidant nutrients. In the French Suppl mentation en Vitamines et Min raux Antioxydants (SU.VI.MAX) study, investigators randomly assigned 13,017 adults age 35 60 years to receive a placebo or a daily supplement containing moderate amounts of vitamin C (120 mg), vitamin E (30 mg), beta-carotene (6 mg), selenium (100 mcg), and zinc (20 mg) [50]. After 7.5 years of use, the supplements lowered total cancer incidence by 31% and all-cause mortality rates by 37% in men but not women. The supplements provided no protection from CVD.  
  
Multivitamins/minerals and Use of Supplements Containing Individual Nutrients Found in Multivitamins/minerals  
Overall, MVMs do not appear to reliably reduce the risk of chronic diseases when people choose to take these products for up to a decade (or more) or when studies randomize people to take them as part of a clinical trial. An evidence review commissioned by the U.S. Preventive Services Task Force (USPSTF) included 78 RCTs with 324,837 participants and six cohort studies with 390,689 participants [51]. It concluded that vitamin and mineral supplements had little or no benefit in preventing cancer, CVD, and death, except that MVMs may provide a small benefit against cancer. Based on this review, the USPSTF concluded there was insufficient evidence to determine the balance of benefits and harms in taking MVMs to prevent CVD or cancer [52]. The American Institute for Cancer Research recommends against taking dietary supplements for cancer prevention because supplements do not provide the same benefits as eating whole foods [53]. Similarly, the American Heart Association advises against the use of MVMs to prevent CVD because scientific studies have found them to be of no value for this purpose [54].  
  
Although MVM use might not reduce overall chronic disease risk, these supplements or several nutrients they contain might benefit certain groups of people. Examples of these populations are described below.  
  
People who could become pregnant  
The Centers for Disease Control and Prevention (CDC) recommends that people capable of becoming pregnant consume 400 mcg/day of folic acid from fortified foods, dietary supplements, or both [6,55]. Obtaining sufficient amounts of folic acid in the periconceptual period reduces the risk of neural tube defects in newborns. The Dietary Guidelines for Americans 2020 2025 (DGA) notes that the critical period for folic acid supplementation to prevent neural tube defects starts at least 1 month before conception and continues through the first 2 to 3 months of pregnancy [56]. The USPSTF advises people who are planning to become or capable of becoming pregnant to take a dietary supplement providing 400 to 800 mcg/day of folic acid daily [56].  
  
Pregnant people  
The American College of Obstetricians and Gynecologists recommends that pregnant people take a daily prenatal vitamin [58]. Acknowledging that most health care providers recommend that pregnant people take a daily prenatal MVM, the DGA states that this practice may be necessary to meet the needs for folate or folic acid, iron, iodine, and vitamin D during pregnancy [56]. The DGA also states that pregnant people might need to take separate supplements of iodine and choline when their health care provider recommends that they do so because many prenatal MVMs do not contain these nutrients or contain only small amounts. The report recommends that people following a vegetarian or vegan diet consult their health care provider about whether they need supplementation with iron, vitamin B12, and other nutrients (e.g., choline, iodine, EPA, and DHA). The World Health Organization recommends iron and folic acid supplementation throughout pregnancy [59].  
  
Infants and children  
Because breastmilk provides little vitamin D, the American Academy of Pediatrics recommends that exclusively and partially breastfed infants receive supplements of 400 IU (10 mcg)/day of vitamin D beginning in the first few days after birth and continued until the infant is weaned and drinks at least 1 liter or 1 quart of vitamin D-fortified formula or whole milk daily [60]. The academy also recommends that non-breastfed infants and older children who consume less than 1 liter of vitamin D-fortified formula or milk receive 400 IU (10 mcg) supplemental vitamin D daily. The FNB and DGA agree that fully and partially breastfed infants should receive a supplement containing approximately 400 IU (10 mcg)/day vitamin D beginning in the first week of life [56,61]. The American Academy of Pediatrics adds that all non-breastfed infants ingesting less than 1,000 mL/day of vitamin D fortified formula or milk should receive a supplement containing 400 IU (10 mcg)/day vitamin D [60]. The DGA, noting the difficulty of obtaining sufficient vitamin D from foods, advises that young children might need to continue taking a vitamin D supplement after age 12 months [56]. The DGA adds that infants fed human milk might also require a vitamin B12 supplement if the mother s vitamin B12 status is inadequate, which might occur, for example, if she follows a vegan diet [56].  
  
Adults age 50 and older  
The FNB advises people older than 50 years to obtain recommended amounts of vitamin B12, mainly from fortified foods or dietary supplements. Adults in this age group might not be able to absorb enough of the protein-bound, naturally occurring vitamin B12 in food because gastric acidity tends to decline and atrophic gastritis tends to become more common with age [6]. The DGA also recommends obtaining recommended amounts of vitamin B12 primarily from fortified foods or dietary supplements, but only for people age 60 and older. The DGA adds that the use of some medications (such as proton pump inhibitors) can decrease absorption of vitamin B12 in foods [56].  
  
Findings from three ancillary studies to the COSMOS clinical trial that included more than 5,000 older adults (mean age 69 to 73 years) suggest that taking an MVM for 1 to 3 years can help maintain or enhance cognitive function [45].  
  
Others  
Individuals who have poor nutrient intakes from diet alone, consume low-calorie diets, or avoid certain foods (such as strict vegetarians and vegans) might benefit from taking an MVM [62]. Health care providers sometimes prescribe MVMs for people who have medical conditions and diseases that impair digestion, absorption, or use of nutrients.  
  
No U.S. government health agency, private health group, or health professional organization promotes regular use of MVMs. In general, MVMs might help people who do not eat a variety of nutritious foods to obtain adequate amounts of essential nutrients. However, MVMs cannot take the place of the variety of foods that are important to a healthy diet, because foods provide other nutrients and components that have benefits for health.  
  
Safety Issues  
Taking a basic MVM that provides nutrients in amounts that are approximately the same as recommended intakes should be safe for healthy people. Studies of MVM users reveal no adverse effects, except that both treatment and placebo groups in some studies experienced some minor gastrointestinal issues [63]. However, individuals who take MVMs and other supplements and who consume fortified foods and beverages might obtain some nutrients in amounts exceeding the UL, increasing the possibility of adverse effects [64]. Excess intakes can also be a concern for people taking MVMs that contain some vitamins or minerals in amounts approaching or exceeding the UL.  
  
Smokers and, possibly, former smokers should avoid MVM products providing large amounts of beta-carotene or vitamin A because two studies have linked these nutrients to an increased risk of lung cancer in smokers [65]. In one RCT of 29,133 male Finnish smokers, those who took supplemental beta-carotene (20 mg/day), with or without vitamin E (50 mg/day as dl-alpha tocopheryl acetate), had an 18% higher incidence of lung cancer during 5 8 years of follow-up than smokers who took a placebo or vitamin E [66]. In another RCT of 18,314, smokers, former smokers, and asbestos-exposed persons, participants who took a combination of 30 mg/day of beta-carotene plus 25,000 IU/day of vitamin A (as retinol) had a 28% higher lung cancer risk than those taking a placebo after an average 4-year follow-up period [67]. Based on these two trials, the USPSTF warned that beta-carotene supplementation may increase the risk of lung cancer in people who smoke, have smoked, or have occupational exposure to asbestos [52]. The USPSTF also noted that beta-carotene supplementation may increase the risk of mortality from CVD.  
  
Taking excess vitamin A (as retinol or other preformed forms of vitamin A but not beta-carotene) during pregnancy can increase the risk of birth defects in infants. The UL for vitamin A during pregnancy is 2,800 mcg/day for adolescents and 3,000 mcg/day for women [68].  
  
Interactions with Medications  
MVMs providing nutrients in recommended amounts do not ordinarily interact with medications, with one important exception. People who take certain blood thinners, such as warfarin (Coumadin, Jantoven), should talk with their health care providers before taking any MVM or dietary supplement containing vitamin K [69,70]. Vitamin K is involved in blood clotting and decreases the effectiveness of warfarin and similar drugs. Health care providers determine the dose of this medication for a given patient in part by assessing the amount of vitamin K that the patient routinely consumes.  
  
Choosing a Multivitamin/mineral  
Basic MVMs contain both vitamins and minerals, most in amounts that do not exceed the DVs. However, MVMs often have small amounts of certain nutrients, such as calcium, magnesium, and potassium, so supplement users should check product labels. When choosing an MVM product, consumers should consider taking a product designed for people of their age, sex, and life stage (e.g., pregnancy). MVMs for older adults (sometimes called senior or 50+ formulations), for example, often contain little or no iron and more calcium, vitamin D, and vitamin B12 than MVMs for younger adults [71]. Prenatal supplements generally provide no vitamin A in the form of retinol, and most children s MVMs provide age-appropriate amounts of nutrients.  
  
Multivitamins/minerals and Healthful Diets  
According to the federal government s 2020 2025 DGA, Because foods provide an array of nutrients and other components that have benefits for health, nutritional needs should be met primarily through foods. In some cases, fortified foods and dietary supplements are useful when it is not possible otherwise to meet needs for one or more nutrients (e.g., during specific life stages such as pregnancy [56].  
  
The DGA does not mention MVMs, but it does recommend that Americans choose healthy, nutrient-dense food and beverages. The DGA lists nutrients of special public health concern in American diets, such as calcium, potassium, dietary fiber, and vitamin D in both adults and children. Iron is also a nutrient of public health concern for infants age 6 11 months who are fed primarily human milk and do not consume enough iron from complementary foods, adolescent females, and people who are pregnant. Depending on their formulations, MVMs can help individuals obtain adequate amounts of these nutrients, except for potassium (because MVMs contain only very small amounts of this mineral) and dietary fiber.  
  
For more information about building a healthy dietary pattern refer to the Dietary Guidelines for Americansexternal link disclaimer and the U.S. Department of Agriculture s MyPlateexternal link disclaimer.  
  
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