JAMA | US Preventive Services Task Force | RECOMMENDATION STATEMENT

Interventions to Prevent Falls in Community-Dwelling Older Adults

US Preventive Services Task Force Recommendation Statement

US Preventive Services Task Force

IMPORTANCE Falls are the leading cause of injury-related morbidity and mortality among older adults in the United States. In 2014, 28.7% of community-dwelling adults 65 years or older reported falling, resulting in 29 million falls (37.5% of which needed medical treatment or restricted activity for a day or longer) and an estimated 33 000 deaths in 2015.

OBJECTIVE To update the 2012 US Preventive Services Task Force (USPSTF) recommendation on the prevention of falls in community-dwelling older adults.

EVIDENCE REVIEW The USPSTF reviewed the evidence on the effectiveness and harms of primary care–relevant interventions to prevent falls and fall-related morbidity and mortality in community-dwelling older adults 65 years or older who are not known to have osteoporosis or vitamin D deficiency.

FINDINGS The USPSTF found adequate evidence that exercise interventions have a moderate benefit in preventing falls in older adults at increased risk for falls and that multifactorial interventions have a small benefit. The USPSTF found adequate evidence that vitamin D supplementation has no benefit in preventing falls in older adults. The USPSTF found adequate evidence to bound the harms of exercise and multifactorial interventions as no greater than small. The USPSTF found adequate evidence that the overall harms of vitamin D supplementation are small to moderate.

CONCLUSIONS AND RECOMMENDATION The USPSTF recommends exercise interventions to prevent falls in community-dwelling adults 65 years or older who are at increased risk for falls. (B recommendation) The USPSTF recommends that clinicians selectively offer multifactorial interventions to prevent falls in community-dwelling adults 65 years or older who are at increased risk for falls. Existing evidence indicates that the overall net benefit of routinely offering multifactorial interventions to prevent falls is small. When determining whether this service is appropriate for an individual, patients and clinicians should consider the balance of benefits and harms based on the circumstances of prior falls, presence of comorbid medical conditions, and the patient's values and preferences. (C recommendation) The USPSTF recommends against vitamin D supplementation to prevent falls in community-dwelling adults 65 years or older. (D recommendation) These recommendations apply to community-dwelling adults who are not known to have osteoporosis or vitamin D deficiency.

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Related article

Author/Group Information: The US Preventive Services Task Force (USPSTF) members are listed at the end of this article.

Corresponding Author: David C. Grossman, MD, MPH (chair@uspstf.net)

The US Preventive Services Task Force (USPSTF) makes recommendations about the effectiveness of specific preventive care services for patients without obvious related signs or symptoms.

It bases its recommendations on the evidence of both the benefits and harms of the service and an assessment of the balance. The USPSTF does not consider the costs of providing a service in this assessment.

The USPSTF recognizes that clinical decisions involve more considerations than evidence alone. Clinicians should understand the evidence but individualize decision making to the specific patient or situation. Similarly, the USPSTF notes that policy and coverage decisions involve considerations in addition to the evidence of clinical benefits and harms.

Summary of Recommendations and Evidence

The USPSTF recommends exercise interventions to prevent falls in community-dwelling adults 65 years or older who are at increased risk for falls (B recommendation) (**Figure 1**).

The USPSTF recommends that clinicians selectively offer multifactorial interventions to prevent falls to community-dwelling adults 65 years or older who are at increased risk for falls. Existing evidence indicates that the overall net benefit of routinely offering multifactorial interventions to prevent falls is small. When determining whether this service is appropriate for an individual, patients and clinicians should consider the balance of benefits and harms based on the circumstances of prior falls, presence of comorbid medical conditions, and the patient's values and preferences. (C recommendation)

See the Clinical Considerations section for information on risk assessment for falls.

The USPSTF recommends against vitamin D supplementation to prevent falls in community-dwelling adults 65 years or older. (D recommendation)

These recommendations apply to community-dwelling adults not known to have osteoporosis or vitamin D deficiency.

Rationale

Importance

Falls are the leading cause of injury-related morbidity and mortality among older adults in the United States.[1] In 2014, 28.7% of community-dwelling adults 65 years or older reported falling, resulting in 29 million falls (37.5% of which needed medical treatment or restricted activity for a day or longer)[2] and an estimated 33 000 deaths in 2015.[1-4]

Detection

Effective primary care interventions to prevent falls use various approaches to identify persons at increased risk. However, no instrument has been clearly identified as accurate and feasible for identifying older adults at increased risk for falls. Although many studies used a variety of risk factors, functional tests, or both involving gait, balance, or mobility to identify study participants, history of falls was the most commonly used factor that consistently identified persons at high risk for falls.

Benefits of Early Intervention

The USPSTF found adequate evidence that exercise interventions have a moderate benefit in preventing falls in older adults at increased risk for falls. The USPSTF found adequate evidence that multifactorial interventions have a small benefit in preventing falls in older adults at increased risk for falls. The USPSTF found adequate evidence that vitamin D supplementation has no benefit in preventing falls in older adults.

Harms of Early Intervention

Based on the noninvasive nature of most of the interventions, the low likelihood of serious harms, and the available information from studies reporting few serious harms, the USPSTF found adequate evidence to bound the harms of exercise and multifactorial interventions as no greater than small. The USPSTF found adequate evidence that the overall harms of vitamin D supplementation are small to moderate; evidence suggests that the harms of vitamin D supplementation at very high dosages may be moderate.

USPSTF Assessment

The USPSTF concludes with moderate certainty that exercise interventions provide a moderate net benefit in preventing falls in older adults at increased risk for falls.

The USPSTF concludes with moderate certainty that multifactorial interventions provide a small net benefit in preventing falls in older adults at increased risk for falls.

The USPSTF concludes with moderate certainty that vitamin D supplementation has no net benefit in preventing falls in older adults.

Clinical Considerations

Patient Population Under Consideration

This recommendation applies to community-dwelling adults 65 years or older who are not known to have osteoporosis or vitamin D deficiency (**Figure 2**).

Brief Risk Assessment

When determining to whom these recommendations apply, primary care clinicians can reasonably consider a small number of risk factors to identify older adults who are at increased risk for falls. Age is strongly related to risk for falls. Studies most commonly used a history of falls to identify increased risk for future falls; history of falls is generally considered together or sequentially with other key risk factors, particularly impairments in mobility, gait, and balance. A pragmatic approach to identifying persons at high risk for falls, consistent with the enrollment criteria for intervention trials, would be to assess for a history of falls or for problems in physical functioning and limited mobility. Clinicians could also use assessments of gait and mobility, such as the Timed Up and Go test.[5-7]

Interventions

Exercise Interventions

Effective exercise interventions include supervised individual and group classes and physical therapy, although most studies reviewed by the USPSTF included group exercise. Given the heterogeneity of interventions reviewed by the USPSTF, it is difficult to identify specific components of exercise that are particularly

Figure 1. US Preventive Services Task Force (USPSTF) Grades and Levels of Certainty

What the USPSTF Grades Mean and Suggestions for Practice

Grade	Definition	Suggestions for Practice
A	The USPSTF recommends the service. There is high certainty that the net benefit is substantial.	Offer or provide this service.
B	The USPSTF recommends the service. There is high certainty that the net benefit is moderate, or there is moderate certainty that the net benefit is moderate to substantial.	Offer or provide this service.
C	The USPSTF recommends selectively offering or providing this service to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer or provide this service for selected patients depending on individual circumstances.
D	The USPSTF recommends against the service. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I statement	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the Clinical Considerations section of the USPSTF Recommendation Statement. If the service is offered, patients should understand the uncertainty about the balance of benefits and harms.

USPSTF Levels of Certainty Regarding Net Benefit

Level of Certainty	Description
High	The available evidence usually includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects of the preventive service on health outcomes. This conclusion is therefore unlikely to be strongly affected by the results of future studies.
Moderate	The available evidence is sufficient to determine the effects of the preventive service on health outcomes, but confidence in the estimate is constrained by such factors as the number, size, or quality of individual studies. inconsistency of findings across individual studies. limited generalizability of findings to routine primary care practice. lack of coherence in the chain of evidence. As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion.
Low	The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of the limited number or size of studies. important flaws in study design or methods. inconsistency of findings across individual studies. gaps in the chain of evidence. findings not generalizable to routine primary care practice. lack of information on important health outcomes. More information may allow estimation of effects on health outcomes.
The USPSTF defines certainty as "likelihood that the USPSTF assessment of the net benefit of a preventive service is correct." The net benefit is defined as benefit minus harm of the preventive service as implemented in a general, primary care population. The USPSTF assigns a certainty level based on the nature of the overall evidence available to assess the net benefit of a preventive service.	

efficacious. The most common exercise component was gait, balance, and functional training (17 trials), followed by resistance training (13 trials), flexibility (8 trials), and endurance training (5 trials). Three studies included tai chi, and 5 studies included general physical activity. The most common frequency and duration for exercise interventions was 3 sessions per week for 12 months, although duration of exercise interventions ranged from 2 to 42 months.[8] The 2008 US Department of Health and Human Services guidelines recommended that older adults get at least 150 minutes per week of moderate-intensity or 75 minutes per week of vigorous-intensity aerobic physical activity, as well as muscle-strengthening activities twice per week.[9] It also recommended performing balance training on 3 or more days per week for older adults at risk for falls because of a recent fall or difficulty walking.[9]

Multifactorial Interventions

Multifactorial interventions include an initial assessment of modifiable risk factors for falls and subsequent customized interventions for each patient based on issues identified in the initial assessment. The initial assessment could include a multidisciplinary comprehensive geriatric assessment or an assessment using a combination of various components, such as balance, gait, vision, postural blood pressure, medication, environment, cognition, and psychological health. In studies, nursing staff usually performed the assessment,

Figure 2. Clinical Summary: Interventions to Prevent Falls in Community-Dwelling Older Adults

Population	Community-dwelling adults 65 years or older at increased risk for falls, without osteoporosis or vitamin D deficiency		
Recommendation	Recommend exercise interventions to prevent falls. Grade: B	Selectively offer multifactorial interventions to prevent falls. Grade: C	Do not recommend vitamin D supplementation to prevent falls. Grade: D

Risk Assessment	Age is strongly related to risk for falls. A pragmatic approach to identifying older persons at high risk for falls would be to assess for a history of falls or physical function/mobility limitation problems. Clinicians could also use assessments of gait and mobility, such as the Timed Up and Go test.
Interventions	Effective exercise interventions include supervised individual and group classes and physical therapy. Given the heterogeneity of these interventions, it is difficult to identify specific components of exercise that are particularly efficacious. Multifactorial interventions include an initial assessment of modifiable risk factors for falls and subsequent customized interventions for each patient based on issues identified in the initial assessment. The initial assessment could include a multidisciplinary comprehensive geriatric assessment or an assessment using a combination of various components, such as balance, gait, vision, postural blood pressure, medication, environment, cognition, and psychological health.
Other Relevant USPSTF Recommendations	The USPSTF found insufficient evidence on vitamin D or calcium supplementation to prevent fractures in men, premenopausal women at any dose, and in postmenopausal women at doses >400 IU of vitamin D and >1000 mg of calcium. The USPSTF recommends against supplementation with ≤400 IU of vitamin D or ≤1000 mg of calcium in postmenopausal women. The USPSTF recommends screening for osteoporosis in women 65 years or older and in younger women at increased risk.

For a summary of the evidence systematically reviewed in making this recommendation, the full recommendation statement, and supporting documents, please go to https://www.uspreventiveservicestaskforce.org.

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and a number of different professionals performed subsequent interventions, including nurses, clinicians, physical therapists, exercise instructors, occupational therapists, dieticians, or nutritionists. Intervention components vary based on the initial assessment and could include group or individual exercise, psychological interventions (cognitive behavioral therapy), nutrition therapy, education, medication management, urinary incontinence management, environmental modification, physical or occupational therapy, social or community services, and referral to specialists (eg, ophthalmologist, neurologist, or cardiologist). For additional details on multifactorial interventions reviewed by the USPSTF, please see the full evidence report.[8,10]

Other Interventions

The following single interventions lack sufficient evidence for or against their use to prevent falls in community-dwelling older adults when offered alone and not in the context of a multifactorial intervention: environmental modification, medication management, psychological interventions, and combination interventions not customized to an individual risk profile.

Useful Resources

Fractures are an important injury associated with falls, and the USPSTF has issued 2 related recommendation statements on the prevention of fractures. The USPSTF recommends screening for osteoporosis in all women 65 years or older and in younger women at increased risk.[11] In its recommendation on vitamin D and calcium supplementation to prevent fractures, the USPSTF states that it found insufficient evidence on vitamin D or calcium supplementation to prevent fractures in men, premenopausal women at any dose, and in postmenopausal women at doses greater than 400 IU of vitamin D and greater than 1000 mg of calcium; the USPSTF recommends against supplementation with 400 IU or less of vitamin D or 1000 mg or less of calcium in postmenopausal women.[12]

The Centers for Disease Control and Prevention has published guidance on implementing community-based interventions to prevent falls.[13]

Other Considerations

Implementation

Although the evidence does not support routinely performing an in-depth multifactorial risk assessment with comprehensive risk management in all older adults, there may be reasons for providing this service to certain patients. Important items in the patient's medical history could include the circumstances of prior falls and the presence of comorbid medical conditions. The American Geriatric Society (AGS) recommends multifactorial risk assessment with multicomponent interventions in older adults who have had 2 falls in the past year (1 fall if combined with gait or balance problems), have gait or balance problems, or present with an acute fall.[14] According to the AGS, evaluation of balance and mobility, vision, and orthostatic or postural hypotension are effective components of multifactorial risk assessment with

comprehensive management, as well as review of medication use and home environment.[14] Follow-up and comprehensive management of identified risk factors are essential to the effectiveness of this strategy.

The burden of falls on patients and the health care system is large. Reducing the incidence of falls would also improve the socialization and functioning of older adults who have previously fallen and fear falling again. Many other interventions could potentially be useful to prevent falls, but because of the heterogeneity in the target patient population, heterogeneity (ie, multiplicity) of predisposing factors, and their additive or synergistic nature, the effectiveness of other interventions is not known. However, many interventions with insufficient evidence to support their use to prevent falls have other arguments that support their use.

Research Needs and Gaps

Studies are needed on the clinical validation of primary care tools to identify older adults at increased risk for falls. More efficacy trials are needed on how the following interventions may help prevent falls if offered alone and not as part of multifactorial interventions: environmental modification, medication management, and psychological interventions. Additional research is needed on the effectiveness of interventions in different age groups, in particular adults older than 85 years. Additional research to identify effective components of exercise interventions would also be useful.

Discussion

Burden of Disease

In 2014, approximately 2.8 million older adults sought treatment in emergency departments for falls; approximately 800 000 older adults experiencing a fall were hospitalized, and more than 27 000 older adults died from a fall.[1,15] More than 90% of hip fractures are caused by falls, and 25% of older adults who sustain a hip fracture die within 6 months.[16,17] Risk for falls increases with age; in 2014, 27% of adults aged 65 to 74 years and 37% of adults 85 years or older reported a fall.[1]

Scope of Review

The USPSTF commissioned a systematic evidence review on the effectiveness and harms of primary care–relevant interventions to prevent falls and fall-related morbidity and mortality in community-dwelling older adults 65 years or older.[8,10] Although the review evaluated risk-assessment approaches used in studies to identify patients at increased risk for falls, it did not evaluate the evidence on the benefits and harms of screening all patients for falls risk factors (ie, did not compare health outcomes in screened vs unscreened groups). Studies conducted solely in populations with specific medical diagnoses that could affect fall-related outcomes or for which interventions could be considered disease management (eg, osteoporosis, vitamin D deficiency, visual impairment, and neurocognitive disorders) were excluded. This systematic evidence review updates the 2010 review and varies from the previous review in a few ways: additional falls outcomes, such as number of falls and injurious falls, were included, and studies of vitamin D supplementation conducted in populations known to be vitamin D deficient were excluded.

Brief Risk Assessment

The majority of intervention studies (40/62) reviewed by the USPSTF targeted patients at high risk for falls.[8,10] However, studies used variable approaches to identify high-risk patients. Most commonly, studies used history of prior falls to identify persons at high risk for future falls (16 studies).[8] Other trials evaluated 2 or more risk factors, such as history of prior falls, difficulty with mobility, and use of health care, and included participants with any of these risk factors. Studies that evaluated exercise interventions most commonly used physical function or mobility limitation problems to identify high-risk populations. Therefore, history of prior falls or physical function or mobility limitation problems may be adequate and appropriate factors for determining high risk.

Effectiveness of Preventive Measures

The USPSTF reviewed the evidence from 62 trials on the use of multifactorial interventions, exercise, vitamin D supplementation, environmental modifications, psychological interventions, and multiple interventions to prevent falls and fall-related morbidity and mortality.[8,10] The USPSTF focused on the outcomes of reductions in falls, number of persons experiencing a fall, reductions in injurious falls, and number of persons experiencing an injurious fall. Although many studies reported on mortality, they were generally underpowered to detect changes in mortality, and results were not statistically significant. The most commonly reported outcomes were falls and number of persons experiencing a fall; half (31/62) of the trials were powered to detect clinically meaningful differences in these 2 outcomes. The most commonly reported interventions included multifactorial interventions (26 trials), exercise (21 trials), and vitamin D supplementation (7 trials).

Exercise Interventions

The USPSTF found 5 good-quality and 16 fair-quality studies (n = 7297) reporting on various exercise interventions to prevent falls.[8,10] A little more than half of studies (12/21) recruited populations at high risk for falls. Physical function/mobility limitation problems, measured objectively or self-reported by participants, was the most common risk factor used to identify persons at high risk. The number of study participants ranged from 55 to 1635, and the mean age ranged from 68 to 88 years. Six studies were conducted exclusively in women; women comprised the majority of participants in the other studies, except for 1 study in which 42% of participants were women. Only 3 studies reported the race/ethnicity of study participants, who were almost exclusively white. Three studies were conducted in the United States, 1 study in the United Kingdom, 8 studies in other parts of Europe, 7 studies in Australia or New Zealand, and 2 studies in Asia.

Studies found that exercise improved several fall-related outcomes. Based on pooled analyses of 15 studies (n = 4926), exercise interventions reduced the number of persons experiencing a fall (relative risk [RR], 0.89 [95% CI, 0.81 to 0.97]).[8] Pooled analyses from 10 studies (n = 4622) found a reduction in the number of injurious falls experienced by participants undergoing exercise interventions (incidence rate ratio [IRR], 0.81 [95% CI, 0.73 to 0.90]).[8] Although not statistically significant, pooled analyses of 14 studies (n = 4663) revealed a reduction in the number of falls experienced by participants undergoing exercise interventions

(IRR, 0.87 [95% CI, 0.75 to 1.00]).[8] Some initial, exploratory analyses suggest that group-based exercise (vs individual-based exercise), multiple exercise components (vs single exercise component), and interventions including strength or resistance exercises (vs interventions without those components) were more likely to be associated with a greater reduction in falls and number of persons experiencing a fall. However, given that these findings were only exploratory analyses to evaluate causes of heterogeneity, they should be interpreted with caution.[8] Additional details about specific exercise interventions reviewed by the USPSTF can be found in the full evidence report.[8]

Multifactorial Interventions

Seven good-quality and 19 fair-quality studies (n = 15 506) reported on multifactorial interventions.[8,10] Most studies (19/26) recruited participants at high risk for falls. Although studies used various assessment approaches, history of falls was the most common risk factor used to identify persons at high risk. The number of participants ranged from 100 to 5310, and the mean age ranged from 71.9 to 85.0 years. The percentage of women ranged from 53.2% to 94.0%. Race/ethnicity of study participants was reported in only 1 study, in which 94% of participants were white. Three studies were conducted in the United States; the remaining studies were conducted in the United Kingdom, Australia, the Netherlands, Canada, Spain, Finland, Denmark, Switzerland, Sweden, and New Zealand.

While studies found that multifactorial interventions reduced the number of falls, these interventions did not appear to improve other fall-related outcomes. Pooled analyses found reductions in the number of falls among participants who received multifactorial interventions (IRR, 0.79 [95% CI, 0.68 to 0.91]; 17 studies; n = 9737) but not in the number of persons experiencing a fall (RR, 0.95 [95% CI, 0.89 to 1.01]; 24 studies; n = 12 490) or experiencing an injurious fall (RR, 0.94 [95% CI, 0.85 to 1.03]; 16 studies; n = 9445).[8] Of 9 studies (n = 4306) reporting the number of injurious falls, only 1 reported a statistically significant reduction among participants receiving multifactorial interventions.[8] Given that studies used heterogeneous multifactorial interventions, it is difficult to identify specific components that may be effective. The initial assessment to screen for modifiable falls risk factors used either a multidisciplinary comprehensive geriatric assessment or a specific falls risk assessment that evaluated any of the following: balance, gait, vision, cardiovascular health, medication, environment, cognition, and psychological health. Treatment interventions varied substantially across studies and included targeted combinations of any of the following components: exercise, psychological interventions, nutrition therapy, knowledge, medication management, urinary incontinence management, environmental modification, and referrals to physical or occupational therapy, social or community services, or specialists (eg, ophthalmologist, neurologist, or cardiologist). Most studies referred participants to or offered an exercise or physical therapy intervention. The majority of studies included home visits for the initial assessment, environmental modification, or physical therapy or exercise interventions; other services were conducted in outpatient settings. Total contact time was rarely reported, precluding quantification of intervention intensity.

Vitamin D Supplementation

Four good-quality and 3 fair-quality studies (n = 7531) reported on the effect of vitamin D supplementation on the prevention of falls in community-dwelling older adults.[8,10] Three studies recruited participants at high risk for falls, most commonly based on a history of falls. Baseline mean serum 25-hydroxyvitamin D levels ranged from 26.4 to 31.8 ng/mL, which correspond with National Health and Nutrition Examination Survey data on vitamin D levels in adults 60 years or older. The number of participants ranged from 204 to 3314, and the mean age ranged from 71.0 to 76.8 years. Five studies were conducted exclusively in women; women comprised approximately half of the study population in the other 2 studies. Only 3 studies reported the race/ethnicity of participants, who were almost exclusively white. Two trials were conducted in the United States, 2 in Australia, and 1 each in the United Kingdom, Switzerland, and Finland.

Five trials (n = 3496) reported mixed findings.[8] Only 1 trial showed a statistically significant reduction in falls[8,18]; however, another study using high doses of vitamin D (500 000 IU per year) showed a statistically significant increase in falls.[8,19] Pooled analyses showed neither a significant reduction in falls (IRR, 0.97 [95% CI, 0.79 to 1.20]; 5 studies; n = 3496) nor a significant effect on the number of persons experiencing a fall with vitamin D supplementation (RR, 0.97 [95% CI, 0.88 to 1.08]).[8] Only 2 trials reported on the number of injurious falls; 1 trial using an annual high dose of vitamin D reported an increase in injurious falls (IRR, 1.15 [95% CI, 1.02 to 1.29]),[8,19] and the other trial reported no statistically significant difference (IRR, 0.84 [95% CI, 0.45 to 1.57]).[8,20] Only 1 trial reported on fractures and found a nonsignificant increase in fractures with vitamin D supplementation (IRR, 1.25 [95% CI, 0.97 to 1.61]).[19] Four trials reported mixed results on the number of persons experiencing a fracture.[8] Vitamin D formulations and dosages varied among trials. Five trials used cholecalciferol at doses of 700 IU per day, 800 IU per day, 150 000 IU every 3 months, or 500 000 IU per year; 1 trial used 1-hydroxycholecalciferol (1 µg per day) and another used calcitriol (0.25 µg twice per day).[8]

Other Interventions

The USPSTF found evidence on other interventions, including environmental modification (3 studies; n = 2175), medication management (2 studies; n = 266), psychological interventions (2 studies; n = 929), and multiple interventions (6 studies; n = 1770).[8] Multiple interventions provided at least 2 intervention components but were not customized to individual participants. Studies of these other interventions were too few, too small, and too heterogeneous for the USPSTF to draw any definitive conclusions.

Other Outcomes

The effect of interventions to prevent falls on functional status or quality of life remains uncertain. The few trials reporting quality of life, activities of daily living, or independent activities of daily living showed no benefit, but these studies used different scales, and few were adequately powered to detect differences in these outcomes.

Potential Harms of Preventive Measures

Evidence on harms was reported in a subset of trials reporting on the effectiveness of interventions. Eight studies (n = 4107) evaluating exercise interventions reported on harms; in general, adverse

events were minor.[8,10] The most common adverse events included pain or bruising related to exercise. One study reported 1 wrist fracture in the intervention group[21] and another study reported a rate of 2.6 serious fall injuries per 100 000 physical activity sessions.[22] Only 2 trials reported on harms in control groups for comparison and found no between-group difference in the rate of serious injuries.[8] For multifactorial interventions, 4 studies (n = 1466) reported on harms.[8] In general, reported harms were rare, minor, and associated with the exercise component of the intervention. Five studies (n = 3955) on vitamin D supplementation reported no difference in the frequency of harms between intervention and control groups.[8] However, as mentioned previously, the study using the highest dose of vitamin D (500 000 IU per year) reported an increase in falls, injurious falls, and the number of persons experiencing falls.[19] Other reported harms were rare and included kidney stones, diabetes, transient hypercalcemia, and hypercalciuria; it was unclear if these rare harms were attributable to vitamin D supplementation. However, in a separate evidence review commissioned by the USPSTF on vitamin D supplementation to prevent fractures, the incidence of kidney stones increased with combined vitamin D and calcium supplementation (based on evidence from 3 studies, including the large Women's Health Initiative trial).[23,24] Three studies (n = 810) on multiple interventions reported no adverse or severe adverse events, although ascertainment of adverse events was unclear.[8] One study on a single psychological intervention reported no adverse events.[25] The remaining studies did not report on harms or adverse events.

Estimate of Magnitude of Net Benefit

The USPSTF found adequate evidence that exercise reduces the risk for falls by a moderate amount. Studies found reductions across several fall-related outcomes. The USPSTF found adequate evidence to bound the harms of exercise as no greater than small. Potential harms include pain and bruising from exercise or a paradoxical increase in falls. The USPSTF concludes with moderate certainty that exercise confers a moderate net benefit in the reduction of falls.

The USPSTF found adequate evidence that multifactorial interventions reduce the risk for falls by a small amount. Pooled analyses revealed statistically significant reductions in 1 fall-related outcome (number of falls) but not others (eg, number of persons experiencing a fall). The USPSTF found adequate evidence to bound the harms of multifactorial interventions as no greater than small. Most reported harms seem to arise from the exercise components of interventions. The USPSTF concludes with moderate certainty that multifactorial interventions confer a small net benefit in the reduction of falls.

The USPSTF found adequate evidence that vitamin D supplementation does not prevent falls. Pooled analyses show no effect of vitamin D supplementation on the number of falls or the number of persons experiencing a fall. The USPSTF found adequate evidence that the harms of vitamin D supplementation are small to moderate. A study of annual high-dose vitamin D supplementation showed an increase in falls. Adequate evidence from a separate evidence review on vitamin D supplementation found an increase in the incidence of kidney stones with combined vitamin D and calcium supplementation. The USPSTF concludes with moderate certainty that vitamin D supplementation offers no net benefit in the reduction of falls.

How Does Evidence Fit With Biological Understanding?

Muscle weakness, gait disturbances, and imbalance are important factors that contribute to increased risk for falls in older persons. Exercise and physical therapy may improve strength and balance and therefore may result in fewer falls. Many interrelated variables affect the health status of older adults, some of which probably have additive effects and may explain why multifactorial risk assessment with comprehensive management is effective in preventing falls. Vitamin D receptors have been identified in various cell types, including skeletal muscle, and stimulation of these receptors promotes protein synthesis.[26,27] Although it has been previously demonstrated that vitamin D or its metabolites may have a beneficial effect on muscle strength and balance,[28] the current evidence shows no benefit in preventing falls. In addition, the Institute of Medicine (now the National Academy of Medicine) concluded that there may be a potential U-shaped relationship between 25-hydroxyvitamin D serum levels and health outcomes, with serum levels greater than 125 nmol/L being associated with worse health outcomes.[29]

Response to Public Comment

A draft version of this recommendation statement was posted for public comment on the USPSTF website from September 26, 2017, to October 24, 2017. In response to public comment, the USPSTF clarified that physical therapy, which was described separately from exercise interventions in the 2012 recommendation, is now included among "exercise interventions" in the current recommendation. Additionally, the USPSTF clarified that these recommendations apply to older adults not known to be vitamin D deficient. The USPSTF added findings on additional outcomes, such as quality of life, as well. A few comments requested additional details about effective exercise and multifactorial interventions. Given the heterogeneity of included interventions, it is difficult for the USPSTF to identify specific components that it found to be particularly effective; however, the USPSTF included results from some exploratory analyses. A few comments also requested a recommendation on other interventions, such as reducing medication prescriptions and comprehensive eye examination. The USPSTF can only recommend the use of an intervention when it finds adequate evidence that the benefits outweigh the harms. Although the USPSTF may have reviewed additional interventions, it did not find adequate evidence to issue a recommendation on all of the reviewed interventions. Interventions that target health conditions that may affect falls risk but have other reasons for assessment and treatment (such as visual impairment or neurologic disorders) were considered to be out of scope for the current review. Information on all the interventions reviewed by the USPSTF can be found in the full evidence report.[8]

Update of Previous USPSTF Recommendation

The USPSTF last issued a recommendation on interventions to prevent falls in older adults in 2012. At that time, consistent with the current recommendation statement, the USPSTF recommended exercise (B recommendation) and selectively offering multifactorial interventions (C recommendation) to prevent falls in community-dwelling older adults at increased risk for falls. At that time, the

USPSTF also recommended vitamin D supplementation to prevent falls (B recommendation), based on previous evidence that found a reduction in the number of persons experiencing a fall. The current review excluded studies considered in the previous review that enrolled persons with vitamin D deficiency or insufficiency because, on further consideration, vitamin D supplementation in these populations would be considered treatment rather than prevention. In addition, the current review examined additional fall-related outcomes, including incident falls (in addition to the number of persons experiencing a fall, which was considered in the previous review). With this revised scope of review, as well as newer evidence from trials reporting no benefit, the USPSTF found that vitamin D supplementation has no benefit in falls prevention in community-dwelling older adults not known to have vitamin D deficiency or insufficiency. Thus, the USPSTF now recommends against vitamin D supplementation for the prevention of falls in community-dwelling older adults.

Recommendations of Others

The National Institute on Aging outlines similar interventions for the prevention of falls: exercise for strength and balance, monitoring for environmental hazards, regular medical care to ensure optimized hearing and vision, and medication management.[30] According to the AGS, detecting a history of falls is fundamental to a falls reduction program, and the AGS recommends asking all older adults once a year about falls.[14] The AGS further recommends that older persons who have experienced a fall should have their gait and balance assessed using one of the available evaluations; those who cannot perform or perform poorly on a standardized gait and balance test should be given a multifactorial falls risk assessment that includes a focused medical history, physical examination, functional assessment, and an environmental assessment. The AGS also recommends the following interventions for falls prevention: adaptation or modification of home environment; withdrawal or minimization of psychoactive or other medications; management of postural hypotension; management of foot problems and footwear; exercise (particularly balance), strength, and gait training; and vitamin D supplementation of at least 800 IU per day for persons with vitamin D deficiency or who are at increased risk for falls. The AGS found insufficient evidence to recommend vision screening alone as a single intervention for falls prevention. The Centers for Disease Control and Prevention recommends STEADI, a coordinated approach to implementing the AGS clinical practice guidelines for falls prevention that consists of 3 core elements: screen to identify fall risk, assess modifiable risk factors, and intervene using effective clinical and community strategies to reduce the identified risk. Clinical strategies include but are not limited to physical therapy and medication management. Community strategies include but are not limited to evidence-based exercise programs and home modification.[31] Similar to the 2012 USPSTF recommendation, the American Academy of Family Physicians recommends exercise or physical therapy and vitamin D supplementation to prevent falls in community-dwelling adults 65 years or older who are at increased risk for falls. It does not recommend automatically performing an in-depth multifactorial risk assessment in conjunction with comprehensive management of identified risks.[32]

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The US Preventive Services Task Force (USPSTF) members: David C. Grossman, MD, MPH; Susan J. Curry, PhD; Douglas K. Owens, MD, MS; Michael J. Barry, MD; Aaron B. Caughey, MD, PhD; Karina W. Davidson, PhD, MASc; Chyke A. Doubeni, MD, MPH; John W. Epling Jr, MD, MSEd; Alex R. Kemper, MD, MPH, MS; Alex H. Krist, MD, MPH; Martha Kubik, PhD, RN; Seth Landefeld, MD; Carol M. Mangione, MD, MSPH; Michael Pignone, MD, MPH; Michael Silverstein, MD, MPH; Melissa A. Simon, MD, MPH; Chien-Wen Tseng, MD, MPH, MSEE.

Affiliations of The US Preventive Services Task Force (USPSTF) members: Kaiser Permanente Washington Health Research Institute, Seattle (Grossman); University of Iowa, Iowa City (Curry); Veterans Affairs Palo Alto Health Care System, Palo Alto, California (Owens); Stanford University, Stanford, California (Owens); Harvard Medical School, Boston, Massachusetts (Barry); Oregon Health & Science University, Portland (Caughey); Columbia University, New York, New York (Davidson); University of Pennsylvania, Philadelphia (Doubeni); Virginia Tech Carilion School of Medicine, Roanoke (Epling); Nationwide Children's Hospital, Columbus, Ohio (Kemper); Fairfax Family Practice Residency, Fairfax, Virginia (Krist); Virginia Commonwealth University, Richmond (Krist); Temple University, Philadelphia, Pennsylvania (Kubik); University of Alabama at Birmingham (Landefeld); University of California, Los Angeles (Mangione); University of Texas at Austin (Pignone); Boston University, Boston, Massachusetts (Silverstein); Northwestern University, Evanston, Illinois (Simon); University of Hawaii, Honolulu (Tseng); Pacific Health Research and Education Institute, Honolulu, Hawaii (Tseng).

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