Abstract

**Objective:** To review fall epidemiology, risk factors, assessments and intervention methods, and outcomes in order to provide guidance to pharmacists.

**Data sources:** Recently published articles listed in Medline and resources on the Agency for Healthcare Research and Quality website (www.ahrq.gov) identified using the search terms falls, medications and falls, fall risk factors, and falls interventions and outcomes; personal data in preparation for publication consideration by the authors; and bibliographies from gathered articles.

**Data synthesis:** Falls may result from multiple risk factors that should be considered to both prevent falls and intervene when a fall has occurred. Careful consideration of the total psychoactive drug load, especially psychotropic drugs, and well-planned recommendations for tapering, discontinuing, and/or replacing drugs implicated in increasing fall risk are presented. A fall risk assessment method that incorporates fall history and risk factors, current disease states and conditions, and medications that may increase fall risk is provided. Two cases with interventions and outcomes are detailed. Because anemia may increase fall risk, adequate assessment of the cause(s) of anemia and conservative recommendations to correct it may decrease fall risk. Adequate vitamin D and calcium intake also may be essential to both decrease falls and fall-related fracture risk. Suggested alternatives and tapering for drugs implicated in increasing falls are considered. Osteoporosis risk assessment is a further area requiring delineation for possible pharmacist assistance to the patient and prescriber to reduce the risk of both fall-related and nontrauma fractures. Interventions to change medications may reduce falls by up to 70%. Additional fall-related resources on the Internet are provided.

**Conclusion:** Pharmacists can play an important role by identifying patients who may have fall risk factors and history and by providing information for drug changes that may reduce fall risk.

**Keywords:** Falls, medications, psychoactive medications, interventions.

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Falls are the leading cause of injury-related deaths and the most common cause of nonfatal injuries and hospital trauma admissions among older adults. The injuries and secondary effects sustained in and after a fall can considerably affect elder patients’ mobility and independence long after they leave the hospital. More than one-third of adults age 65 years or older fall every year. As the population ages, the rate of occurrence of falls will increase unless strategies are implemented to reduce the number of falls and their cumulative adverse effects.1-3

To assess the causes of falls and compile recommended actions that pharmacists can take to decrease patients’ risks of falling, we searched Medline and the Agency for Healthcare Research and Quality’s website (www.ahrq.gov) using the search terms falls, medications and falls, fall risk factors, and falls interventions and outcomes. Additional resources were identified from personal data in preparation for publication consideration by the authors and bibliographies from gathered articles.

Causes of falls
Research indicates that falls are caused by multiple factors that are both internal and external to elder patients.1-3 The following four areas of risk have been identified:

1. Physical mobility and ability to accomplish activities of daily living (ADLs). Fall risk can be increased by the deconditioning that can occur with normal aging (e.g., “if you do not use it, you lose it”) and by the loss of muscle strength that can occur with multiple conditions, such as stroke, heart failure, and osteoarthritis. The best example of this loss is the ability to transfer between bed and walker or wheelchair to do ADLs of toileting, bathing, meals, and social interaction within the older adult’s living environment. Physical therapy aimed at maintaining and improving muscle strength with daily exercise is the cornerstone of this area of risk reduction. Routine encouragement of exercises such as partial deep knee bends and arm dips that use muscles that enable movement from bed or wheelchair for transfers to the walker or tripod cane and walking as permitted with assistance can help to “retrain” deconditioned leg and arm muscles. An elevated toilet seat or plastic piece that fits on the seat and elevates the seat 8 to 12 inches can help to increase the safety of transfers for toileting. (For references and resources to address this area, see Appendix 1 in the electronic version of this article, available online at www.japha.org.)

2. Medication management. The need for a comprehensive evaluation of all medications both before and especially after each fall is the main emphasis of this article.4-5

3. Home/room safety. A simple evaluation is required of the areas contacted by patients in their homes or in long-term care facilities to ensure safe transit and support. Loose rugs should be removed, and handrails to support the patient in bathrooms and walking around quarters and beds should be installed. Adequate lighting and floors that allow good traction with shoes or slippers are also important to home/room safety (online Appendix 1).

4. Environmental (community) safety. The patient and caregiver must have a means of contact with the outside world. This could be achieved with a call button or radio

At a Glance

Synopsis: Pharmacists can identify elderly patients at risk for falls and minimize fall risk by assessing current medications both prescribed and possibly needed to reduce fall risk. A comprehensive fall-reduction strategy should address physical mobility and ability to accomplish activities of daily living, medication management, home/room safety, and environmental (community) safety. Total psychoactive drug load, particularly psychotropic drugs, must be considered carefully, and efforts should be made to taper, discontinue, and/or replace drugs implicated in increasing fall risk. A fall risk assessment method that incorporates fall history and risk factors, current disease states and conditions, and medications that may increase fall risk is presented in the current work.

Analysis: Efforts to correct anemia in elderly patients may decrease fall risk. Falls and fall-related fracture risk can also be decreased by ensuring adequate vitamin D and calcium intake. Evidence suggests that buspirone intervention in place of benzodiazepines and/or antipsychotics, careful drug withdrawal by stepwise discontinuance with tapering of 10% to 25% of the dose per week, or both interventions can reduce falls by up to 70%.

Learning objectives
- State the causes and risk factors for falls.
- List medications implicated in both increasing and reducing fall risk.
- Describe a fall risk assessment method.
- List approaches and medication alternatives for reducing fall risk.
- Describe how the pharmacist may offer medication assessment to assist prescribers and patients in determining whether their prescription and nonprescription drugs may be increasing or decreasing fall risk.

ACPE Activity Type: Knowledge-Based
device that summons help when one is unable to ambulate or needs assistance. A cell phone kept on the patient is another simple method for letting caregivers know that help is needed (online Appendix 1).

Comprehensive strategy
A comprehensive fall-reduction strategy that addresses all four of the above areas can be effective. However, many previous efforts have been hampered by several factors:

(1) Failure to consider all possible causes of falls, especially medications and the need for physical assistance to improve strength and ambulation ability.
(2) Failure to translate research into practice, especially when medications are concerned. (This article concentrates on remedying this apparent failure.)
(3) Lack of coordination among interested but disparate organizations that support the older adult and their caregivers.
(4) Minimization and trivialization of the issue, sometimes through media images casting older people as powerless and pathetic (e.g., the “I’ve fallen and I can’t get up” commercials).
(5) Scarcity of approaches that are culturally sensitive and appropriate for older adults of all literacy levels. Adult day-care and senior centers, as well as assisted-living and personal care facilities, are ideal locations for training both patients and caregivers to decrease fall risk. Online Appendix 1 has numerous resources that document these factors and can aide educational efforts.

Numerous studies show the benefit of multifactorial fall risk interventions and improved outcomes with comprehensive strategy implementation, and guidelines for fall prevention have been published.35–43

Psychoactive drug medication interventions are limited by the lack of validation of currently available assessment instruments; most falls are caused by multiple risk factors that also should be taken into account but are not covered in this review (e.g., gait assessment, strength training, environmental assessment and changes). Online Appendix 1 lists resources that may be of value in fall risk-reduction educational programs.

Fall risk assessment methods
Falls in the older patient clearly lead to increased health care use and decreased functional status.1 A fall risk index based on the number of chronic disabilities has been advocated.2 Earlier studies of fall factors, incidence, and morbidity found that those who sustained falls were more likely to be suffering from dementia, were prescribed more sedating drugs, and had abnormal balance and gait compared with age- and sex-matched control patients. In addition, orthostasis, arthritides, incontinence, and strokes were more prevalent in these patients.3,5 A fall risk assessment that incorporates psychotropic and other psychoactive medications has been developed (Figure 1).6 and medications implicated in falls have been described.7 A multifactorial intervention to reduce the risk of falling among the elderly living in the community has been developed.8

Basic patient assessment method for pharmacists
The pharmacist may benefit from using a universal problem-oriented medical record (POMR) or medication therapy management (MTM) method to assess and recommend changes in the patients’ drug regimen51 as well as physical and laboratory assessments that may be needed to optimize drug therapy. We developed an online 15-hour (1.5–continuing education unit) course on physical and laboratory assessment of the older adult; it is available at www.rxugace.com or www.shca-ga.org.

The POMR method has four steps:

(1) Perform a history of patients’ problems, including past and current diagnoses, conditions, all medications, past operations, immunizations, and adverse drug reactions, as well as abnormal physical and lab findings that need to be addressed. Some practitioners prefer to group problems by organ system (e.g., cardiovascular, endocrine, pulmonary, gastrointestinal, genitourinary, neuropsychiatric, dermatologic).
(2) Match the medications found with the problems list; action may be needed if there are medications or problems that do not match or are not addressed.
(3) Assess how adequately each problem is being addressed by using the SOAP method for each problem: subjective (S) or complaints of the patient; objective (O) or things that can be assigned numerical values such as physical findings of the vital signs of blood pressure, pulse, respiration, and temperature and lab values; assessment (A) of S and O findings for each problem; and plan (P) for communication of the assessment of each problem.
(4) Communication of the problems that need to be addressed to the appropriate prescriber, patients and their caregivers, and administrators responsible for the patient is the most important step of the process.

The POMR process may be thought of as a part of the MTM process. The American Pharmacists Association (APhA) and National Association of Chain Drug Stores released version 2.0 of an MTM service model, which can be downloaded at www.nacdsfoundation.org, and a certificate training program developed by APhA and the American Society of Consultant Pharmacists is available at www.pharmacist.com.

Definitions
Psychoactives are defined as anxiolytics, hypnotics, antipsychotics, and antidepressants. Psychoactives or central nervous system (CNS)-active agents include psychotropics and the prokinetic agent metoclopramide, narcotic or opioid analgesics, antiparkinson agents, anticonvulsants, muscle relaxants, antihistamines, and centrally acting antihypertensives.7

A patient’s total psychoactive drug load is best defined as the total number of psychotropic and other psychoactive medications given on a regular (i.e., at least weekly) basis. As-needed medications given on a less-than-weekly basis may be considered relevant if their usage occurred within 1 week of a fall and the drugs involved were antipsychotics or longer-acting benzodiazepines (BZs).7
**Fall Prevention in Older Adults**

**Patient**  
Dates  
Dr.  

Circle appropriate numbers and repeat this assessment every 6 months or after each fall. If total is more than 7, state interventions planned and med change(s).

**History of falls:**

<table>
<thead>
<tr>
<th>Ambulation status</th>
<th>Up, Bed, Walker, Wheelchair</th>
</tr>
</thead>
</table>
| One to two falls in a month/quarter | 2  
| More than two falls in a month/quarter | 8  
| Fall-related facture (date) | 5  

**Conditions:**

- Postural hypotension (orthostasis): 2  
- Syncope/dizziness: 1  
- Sensory deficits: decreased hearing (1), vision (1), aphasia (1): SUBTOTAL=  
- Unsteady or shuffling gait: 2  
- Confusion/delirium/disorientation/impaired cognition: 2  
- Agitation/increased anxiety: 2  
- Chronic pain state: 3  

**Medications:**

- Cardiac (1), Antihypertensives (1), Diuretic (1), Antipsychotics or metoclopramide (2), Hypnotics (2), Antidepressant or antihistamine (H-1 or H-2 blockers) (2), Antianxiety except buspirone (2), NSAID (1), Narcotic analgesic: mild (1), moderate (2), Anticonvulsant (1), Muscle relaxants (1): SUBTOTAL=  

**Diagnoses:**

- Incontinence: bowel (2), bladder (2); anemia (2): SUBTOTAL=  
- Cardiac diseases: Dysrhythmia (1) CHF (1): SUBTOTAL=  
- Neurologic/psychiatric diseases: Dementia (1), Parkinsonism (1), Seizures (1), Stroke (1): SUBTOTAL=  
- Musculoskeletal disease: Arthritis (1) Casts/splints/slings (1), Prosthesis (1): SUBTOTAL=  

**Risk ranges:** Minimal: 0–3, Moderate: 4–7, High: 8 or more  

Signature of assessor:  
Date:  

Describe interventions below and reassess every quarter if above score of 7 or more  

Med changes:  
Fracture sites:  
Hospital date(s) and reasons:  

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**Figure 1.** Fall risk assessment instrument  
Abbreviations used: CHF, congestive heart failure; NSAID, nonsteroidal anti-inflammatory drug.  
Original work not copyrighted; please copy and use in your practice.
Falls are defined as a patient found on the floor with no other explanation for position or unintentionally coming to the ground or some lower level and other than as a consequence of sustaining a violent blow, loss of consciousness, or sudden onset of paralysis as in stroke or epileptic seizure. Falls may be noted by the caregiver or from the charts and periodic reports of the quality-assurance department of the facility. A multifactorial fall risk assessment instrument that emphasizes medications helps to quantify the risk of falls (Figure 1).1–35

**Case 1 and self-assessment questions**

**Case 1**

A 77-year-old patient and her caregiver in your home care and assisted-living practice has concerns about falling. She has a history of high blood pressure, depression, and osteoarthritis. You use Figure 1 to assess her fall risk (points per Figure 1). From questioning her and her caregiver, she has no history of falls but gets dizzy when she changes position from lying down to sitting and sitting to standing. You take her blood pressure and note that both systolic and diastolic pressure drop after position change (124–130/70–74 to 105–110/55–60 mm Hg). Both of these are evidence for orthostasis and dizziness (2 points for orthostasis and 1 point for dizziness on position change; 3 points total).

You notice that she smells of urinary incontinence and caution her and her caregiver about adequate fluid intake and not getting up abruptly when she feels dizzy and waiting 10 to 15 seconds to get over dizziness and holding onto her bed or chair until the dizziness subsides. Her forearm skin “tents” when the skin is held and pulled outward gently between two fingers and does not go down for 10 to 20 seconds; this poor skin turgor and the urine “sniff” test give a suspicion of urinary incontinence (2 points that contributes to the orthostasis/dizziness problem.

If you have lab data available and a recent urinalysis has been done, checking the urine specific gravity (N = 1.005–1.030) and seeing recent values greater than 1.015 may indicate relative dehydration and personal as well as caregiver fluid deprivation. Simply put, both the patient and her caregivers learn that fluid taken in orally may leak without warning because of incontinence. The patient may be concerned that she cannot afford the incontinence underpads that prevent embarrassing leakage into the outer garments. She uses a walker to access the toilet, which is in the next room. You recommend a closer placement of the bed to the toilet and a bedside toilet or bedpan for use when the patient feels she cannot make it to the toilet “in time.”

The patient is also taking hydrochlorothiazide 25 mg daily (1 point) for high blood pressure and propoxyphene napsylate/acetaminophen (2 points) 10 to 15 doses per week for chronic osteoarthritis pain. The diuretic may contribute to the patient’s incontinence, orthostasis, and dizziness, which she says occurs several times per day. Safer alternatives for her high blood pressure may be an angiotensin-converting enzyme inhibitor such as lisinopril 5 to 20 mg/day or an angiotensin receptor blocker such as valsartan 80 to 120 mg/day. Propoxyphene is inappropriate for pain in the older adult30 because of increased risk of falls, abnormal heart rhythms, emergency room visits, hospitalizations, and deaths in the older adult.17–31 Plain acetaminophen 500 mg every 4 hours as needed or on an every-4-hour schedule (e.g., 6:00 am, 10:00 am, 2:00 pm, 6:00 pm, 10:00 pm) for pain may be a much safer alternative for this patient’s pain.31 Regular use of acetaminophen 3.0 g/day also has been shown to decrease behavioral symptoms by 63% and allow 75% of psychotropic medications to be stopped in patients with cognitive impairment.32 Further anecdotal evidence for acetaminophen intervention in frequent fallers given psychotropics with cognitive impairment found that up to three of five (60%) of these patients exhibited less agitation when given acetaminophen on a regular basis in place of the stepwise (i.e., one-drug-at-a-time) and carefully tapered (Table 3) schedule for each psychotropic drug(s).33

A check for any other conditions, drugs, and diagnoses reveals that she does have a new prescription for zolpidem 5 mg as needed for sleep (2 points) that you dispensed the previous week. You ask about her sleep patterns and learn that she takes a 1- to 2-hour nap after each meal and discover that neither she nor her caregiver understand that this may be the reason she can not sleep well at night. She has only taken two doses in the previous week but felt very weak and groggy and unstable on her feet the morning after each dose and almost fell each time she got up during the night and on awakening in the morning. Past research also has shown that medications given for sleep more than once or twice a week may increase fall risk markedly.13

You counsel her and her caregiver on changing her daytime sleep patterns and staying out of bed until she is ready to go to sleep at night. A recent study suggests that by avoiding long daytime naps and giving hypnotics no sooner than 11:00 pm to midnight, patients may request fewer doses of hypnotics.34 Her depression is not being currently treated with medications, and she has signs and symptoms consistent with depression. This assessment will not be addressed until all other medications changes are made.

According to the fall assessment (Figure 1), the patient has a total of 10 points, which places her at high risk for falling. Which of the following changes in her medications would you recommend?

**Self-assessment questions**

1. In place of her hydrochlorothiazide, you recommend which of the following?
   a. An angiotensin-converting enzyme inhibitor such as lisinopril
   b. An angiotensin II receptor blocker such as valsartan
   c. A calcium channel blocker (e.g., diltiazem) or a beta blocker (e.g., atenolol)
   d. Alternative a or b is correct.

2. In place of her propoxyphene/acetaminophen, you recommend which of the following?
a. Acetaminophen alone on a regular or as-needed schedule
b. Hydrocodone
c. Tramadol
d. Fentanyl

3. In place of her zolpidem, you recommend which of the following?
a. No naps after meals
b. Activities to prevent sleep after meals
c. If zolpidem is needed, hold until 11:00 pm to midnight
d. All of the above alternatives are correct.

Answer key: 1. d; 2. a; 3. d; 4. d

Evidence for medication association with falls and fractures

A study of physical and pharmacologic “restraint” of 307 nursing home patients with dementia showed that 43% to 45% of residents received medications that could be viewed as pharmacologic restraints. Residents with physically abusive behavior, infrequent family visits, and severe cognitive impairment (i.e., lack of recall or orientation to time, place, or person) were more likely to receive pharmacologic restraints. An earlier 1-year study of 33,351 Illinois nursing home residents found that 60% received at least one psychotropic medication during that year. In 4,501 cases of hip fracture among ambulatory patients 65 years of age or older, BZs with a longer half-life have been associated with a greater risk of falls and hip fracture compared with BZs with a shorter half-life.

Self-assessment questions

5. The nursing home patient with which of the following may be more likely to receive pharmacologic “restraints” with psychotropics?
a. Physically abusive behavior
b. Infrequent family visits
c. Severe cognitive impairment
d. All of the above alternatives are correct.

Answer key: 7. a; 8. d; 9. d; 10. b

6. Severe cognitive impairment may involve lack of patient recall or orientation to which of the following?
a. Time
b. Place
c. Person
d. All of the above alternatives are correct.

Answer key: 5. d; 6. d

Both long- and shorter-acting BZs markedly increase the risk of falls. Serum diazepam blood levels have been directly correlated with the incidence of falls. Even shorter-acting BZs (e.g., triazolam, oxazepam) given more often than one to two times per week have been associated with increased fall risk. A study of the sensitivity of elderly individuals to triazolam found that pharmacokinetic rather than pharmacodynamic differences between older and younger patients explained the greater sensitivity to the drug. Peak serum triazolam concentration was approximately 50% higher and triazolam clearance 50% lower in the elderly versus the younger group of patients.

Both antipsychotics and antidepressants also have been shown to increase fall risk. An association between antihistamines, narcotic analgesics, anticonvulsants, metoclopramide, antihypertensives, and falls in those taking other multiple psychoactive (i.e., both with and without psychotropics) medications also has been reported. The risk of falls is doubled for each psychotropic added to the patient’s drug regimen, both with and without other psychoactive medications (e.g., antihistamines, narcotic analgesics, anticonvulsants, metoclopramide, antihypertensives).

Fall risk increases by roughly how much for each psychotropic added to a patient’s drug regimen?
a. One-half
b. Two times
c. Three times
d. Four times

Answer key: 7. a; 8. d; 9. d; 10. b

Medication interventions and falls

Beneficial changes in psychotropic medications and the multidisciplinary interventions of nurses, consultant pharmacists, and attending clinicians to reduce falls, injuries, and
costs\textsuperscript{18–20} are also important means of fall prevention. In one study, buspirone intervention in place of BZs and/or antipsychotics, careful drug withdrawal by stepwise discontinuance with tapering of 10% to 25% of the dose per week, or both also have been shown to decrease falls by 70% and improve cognition compared with similar patients.\textsuperscript{17} The provisions of the Omnibus Budget Reconciliation Acts of 1987 and 1990 on appropriate use of psychotropic drugs in the United States mandate at least two to three tapering attempts of anxiolytics and antipsychotic psychotropics within the first 6 to 12 months of placement within a nursing facility. Effective October 1, 2008, Medicare no longer reimburses for falls occurring in acute care settings, as a “hospital-acquired condition.”\textsuperscript{21} The newest Centers for Medicare & Medicaid Services (CMS) guidelines stress the need for gradual reduction of all psychotropic medication doses, including buspirone, unless patient dementia or other neuropsychiatric illness worsens during attempts at tapering. Examples of the concept of adverse effects on rapid or sudden versus gradual drug withdrawal include seizures with BZs, tardive dyskinesia or return of schizophrenia signs and symptoms with antipsychotics, and serotonin syndrome and worsening of depression with rapid withdrawal of antidepressants. See www.cms.hhs.gov for the latest CMS guidelines for medications.

A meta-analysis of 57 studies on the contribution of psychotropic drugs to falls in older patients concluded that a small but consistent association exists between the use of most classes of drugs and falls. The meta-analysis did not consider or define inappropriate polypharmacy.\textsuperscript{22} Falls were second only to nonsteroidal anti-inflammatory drug (NSAID) adverse drug reactions as causes for adverse drug reaction hospitalizations from the long-term care facility.\textsuperscript{23} A 1966–1999 review of psychotropics and falls suggested that all psychotropics may increase the risk of falls and that each additional agent may increase the overall risk by a factor of 2.0 per psychotropic.\textsuperscript{24} A community-based 6-month study of 305 male veterans (age 70–104 years) using psychoactive CNS-active medications were screened at study entry for mobility, cognition, and depression. CNS-active medications were categorized as BZs, other sedative–hypnotics, neuroleptics, tricyclic antidepressants, and opioid analgesics. Patients were prospectively followed for 6 months to monitor falls; at the end of this time period, patients were classified as fallers (at least one fall) or nonfallers. The relationship between CNS-active drug use and falls was examined using multivariable analyses. The risk of falls was significantly greater in CNS-active medication users compared with nonusers. Adjusted odds ratio (OR) was 1.54 (95% CI 1.07–2.22) for one CNS-active drug and 2.37 (1.14–4.94) for two or more agents. In community-dwelling elderly, use of multiple CNS-active medications is associated with enhanced fall liability compared with use of one CNS-active drug.\textsuperscript{25}

**Inappropriate polypharmacy and multiple psychoactive drugs**

Multiple psychotropic and psychoactive drugs should be taken into account when fall interventions are evaluated, and reduction in total psychotropic and psychoactive drug load may reduce fall occurrence and recurrence.\textsuperscript{26–28} Simply put, each additional psychotropic doubled the rate of falls, as suggested by an earlier review\textsuperscript{24} and research.\textsuperscript{26–28} An earlier study in this population indicated that those who had psychotropic drugs tapered, changed to other agents, and/or discontinued had fewer falls and injuries and less cognitive decline over 1 year.\textsuperscript{17} A difference was observed in the mean Reisberg global deterioration scale\textsuperscript{20} in those with a diagnosis of dementia between users of psychotropic drugs (5.8 on 7-point scale) and those tapered to nonuse of psychotropic drugs (4.7) in the groups at the beginning of the study.\textsuperscript{17}

The most recent finding is that all causes of hospitalization of the older adult from long-term care are directly proportional to the total psychoactive drug load.\textsuperscript{28} The recent black box warning relabeling of all antipsychotics states that this class of medications should not be used for long periods in patients with dementia because of greater risk of death—more evidence that these drugs have high risk for the older adult. Pharmacists should review these black box warnings on antipsychotic package inserts and patient education materials or at the Food and Drug Administration drug safety website (www.fda.gov/medwatch/safety).

**Anemia and vitamin D deficiency and falls**

In community-dwelling elderly, anemia is associated with a number of health-related functional declines, such as frailty, disability, and muscle weakness. These may contribute to falls, which, in the elderly, result in serious injuries in perhaps 10% of cases. Whether anemia increased the risk of injurious falls in an elderly population was investigated using health insurance claims and laboratory test results data from January 1999 to April 2004 for 47,530 individuals 65 years of age or older enrolled in more than 30 managed care plans.\textsuperscript{45}

Anemia in nursing home residents appears to be underrecognized. For residents older than 70 years, the prevalence of anemia in one study for both men (Hb <13 g/L) and women (<12 g/L) residents was approximately four times the rate reported in a study of older community dwellers. Both anemia and use of psychoactive medications are potentially modifiable factors strongly associated with falling. Because falls and related fractures are events associated with high morbidity and mortality, each factor deserves special consideration for potentially reducing the risk of such events in the nursing home.\textsuperscript{44} Whether attaining nonanemic states in those with anemia and falls can reduce falls in the nursing home remains to be determined.

In another study, one that used an open-cohort design, anemia increased the risk of injurious falls by 1.66 times (95% CI 1.41–1.95) compared with no anemia. The incidence of injurious falls increased from 6.5 to 15.8 per 1,000 person-years when Hb levels decreased from 13 g/dL or more to less than 10 g/dL (trend test: P < 0.001). Multivariate analysis confirmed that Hb levels were significantly associated with risk of injurious falls (rate ratio = 1.47, 1.39, and 1.14 for Hb levels of <10, 10–11.9, and 12–12.9 g/dL, respectively, compared with Hb ≥13 g/dL; P < 0.001). Even stronger negative linear trends were observed in the subsets of hip and head injurious falls.
Anemia was significantly and independently associated with an increased risk for injurious falls. Furthermore, the risk of injurious falls increased as the degree of anemia worsened. Correction of anemia, which is a modifiable risk factor, warrants further investigation as a means of preventing falls in the elderly.43

After a cause of anemia has been determined, perhaps the best assessment and intervention by the pharmacist is to recommend iron 325 mg not more than once daily with vitamin C 500 mg to facilitate absorption if Hb is less than 10 g/L and the anemia is normochromic and normocytic (i.e., hematocrit-to-Hb ratio [H/H] of 3:1) or microcytic (H/H <3:1). Iron more often than once a day is considered inappropriate because it does not correct anemia any better than once a day and, more often, administration increases the risk of constipation.40 Oral folic acid and B₁₂ may be added if folate or B₁₂ levels are low and macrocytosis is present (H/H >3:1). Adding a proton pump inhibitor (PPI) to low-dose aspirin (ASA), which is used to lower heart attack and stroke risk, may help prevent anemia from use of ASA or other NSAIDs and decrease iron and calcium absorption.

To assess the effects of vitamin D on falls and fractures, a systematic review was conducted on the benefits and harms of calcitriol and alfalcacidol in reducing fracture and fall risk.46 Randomized controlled trials comparing these agents with placebo or calcium and reporting fracture and fall incidence were retrieved from Medline, Embase, and the Cochrane Central Register of Controlled Trials. Two reviewers independently determined study eligibility, assessed trial quality, and extracted data. A total of 23 randomized controlled trials were included (2,139 participants), and 16 trials had sufficient data for meta-analysis. Vertebral fractures were not significantly reduced based on the combined results of 13 trials; however, subgroup analyses demonstrated a significant reduction with alfalcacidol (OR 0.50 [95% CI 0.25–0.98]) but not with calcitriol. A significant reduction in nonvertebral fractures (six trials; 0.51 [0.30–0.88]) and falls (two trials; 0.66 [0.44–0.98]) was observed. An increased risk of hypercalcemia (3.63 [1.51–8.73]) and a trend toward an increased risk of hypercalciciuria were also seen. Evidence suggests that vitamins D agents may reduce the incidence of nonvertebral fractures and falls; however, their benefit on vertebral fracture reduction may depend on the type of active vitamin D. Hypercalcemia and hypercalciciuria are potential adverse effects.46

The practical assessment of vitamin D status is to examine a current vitamin D level. If the level is less than 30 ng/mL (80 mmol/L), vitamin D 1,000 to 1,200 units/day may be recommended, although some prescribers are now using vitamin D₂ doses as high as 50,000 units/week for 8 weeks.46 Inadequate vitamin D levels and inadequate calcium supplementation also have been implicated in increasing fall risk; vitamin D supplementation when serum levels are low may decrease fall risk.47,48

The salt form of calcium is very important in the older adult. The citrate form is better absorbed and less likely to cause constipation compared with carbonate, gluconate, or glucobionate salts because of the high frequency of gastric achlorhydria and gastroesophageal reflux disease (GERD) in the older adult. Therefore, use of histamine-2 (H₂) blockers (e.g., ranitidine) or PPIs (e.g., omeprazole), which further decrease calcium absorption when salts other than the citrate are used, is mandated. At least 1,000 to 1,500 mg/day elemental calcium is recommended in divided doses with meals to improve absorption along with adequate vitamin D to improve bone density and decrease fracture risk, especially if the patient does not like or use dairy products.49 If constipation is noted on starting any calcium supplement, recommend adding a polyethylene glycol (PEG) or sorbitol laxative rather than a fiber-based laxative, which can worsen constipation because of the inadequate fluid intake frequently seen in older adults.50

**Intervention strategies**

Table 1 lists intervention approaches for medications implicated in falls.1,55

### Case 2 and self-assessment questions

**Case 2**

An 80-year-old male patient with a history of stroke, moderate to severe dementia, osteoarthritis, and numerous falls presents to your nursing home on February 14, 2009, from an assisted-living facility that had admitted him on February 1, 2009. His admission medication orders (date of order) include ASA 81 mg/day (December 15, 2008), olanzapine 5 mg twice daily (January 6, 2009), quetiapine 50 mg at bedtime (January 31, 2009), oxycodone 10 mg/acetaminophen 325 mg once every 6 hours as needed for pain (January 10, 2009; 27 doses in previous month), methylphenidate 20 mg every morning (January 24, 2009), memantine 10 mg twice daily (February 6, 2009), and phenytoin 300 mg every morning (January 14, 2009). He has an ataxic, drunken-like gait on walking; has nystagmus; has fallen six times with bruising but has no fractures on repeat emergency department visits and X-rays; is not oriented to time, place, or person; and is alert only in the morning for a few hours after methylphenidate is given. He sleeps most of the day, especially after meals. He has had four impactions during the previous 2 months that resolved with enemas. He had grand mal seizure activity after methylphenidate and memantine were started. Seizures were no longer present after his phenytoin was started, but he is toxic on 300 mg/day. His vital signs (temperature, pulse, and blood pressure) are all within normal limits, and he does not get dizzy or have considerable blood pressure decrease on arising from a prone position. His lab work shows a low Hb (9 g/L) and hematocrit (27%) and a vitamin D level of 21 ng/ml. His phenytoin level is very high at 28 µg/mL (normal 5–12 µg/mL) with normal serum albumin. His stool is positive for occult blood and his serum chemistries for electrolytes, renal, thyroid, parathyroid, and hepatic function are all within normal limits, except for an elevated blood urea nitrogen-to-serum creatinine ratio that further indicates occult gastrointestinal bleeding. His creatinine clearance was also calculated to be 42 mL/min, which mandated a decrease in
his memantine dose from 20 to 10 mg/day.

Self-assessment questions

11. You recommend what changes in his olanzapine?
   a. Leave as is
   b. Taper dose by 25% every week until discontinued
   c. Alternative b and reevaluate his methylphenidate after stopping olanzapine
   d. Alternatives b and c and decrease his quetiapine

12. His quetiapine needs to be
   a. Cut in dose.
   b. Held until 11:00 pm to midnight if not asleep.
   c. Not given more than once or twice a week after methylphenidate is changed and preferably stopped because no indication for this use of quetiapine exists.
   d. All of the above alternatives are correct.

13. His low H/H may be due to his ASA. He has a history of stroke, which may be prevented by the ASA. You see the positive occult blood in his stool and recommend which of the following?
   a. Iron 325 mg daily
   b. A PPI
   c. Recheck his H/H in 1 month
   d. All of the above alternatives are correct.

14. His methylphenidate appears to have been given to counteract the excessive sedation caused by his antipsychotics and oxycodone. You recommend which of the following for his methylphenidate?
   a. Stop it immediately
   b. Taper the dose as the changes olanzapine, oxycodone, and quetiapine are made
   c. Alternative b and discontinue when tapering of other drugs is complete
   d. Continue present dose

15. His phenytoin is at a toxic level and appears to have been started for seizure activity resulting from which of the following drug(s)?
   a. ASA
   b. Methylphenidate
   c. Memantine
   d. Alternatives b and c are correct.

16. After one or more drugs above are tapered to discontinuance what do you recommend for his phenytoin?
   a. Decrease dose to 150 mg every morning now and
   b. Hold until 11:00 pm to midnight if not asleep.
   c. Not given more than once or twice a week after methylphenidate is changed and preferably stopped because no indication for this use of quetiapine exists.
   d. All of the above alternatives are correct.

Table 1. Intervention approaches for medications implicated in falls

<table>
<thead>
<tr>
<th>Drug(s)</th>
<th>Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple psychoactive medications</td>
<td>Carefully evaluate need and taper to discontinuance as possible by 10%–25% of dose per week. Goal is to minimize total psychoactive load by stepwise tapering for each drug suspected of contributing to falls without adverse drug withdrawal effects.</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>Change to buspirone or SSRI and taper benzodiazepine.</td>
</tr>
<tr>
<td>Antidepressants</td>
<td>Avoid older agents (e.g., tricyclics) and use lower doses of newer SSRIs.</td>
</tr>
<tr>
<td>Antipsychotics</td>
<td>Taper to discontinuance as above and use for shortest period 1–10 days, if no history of schizophrenia or schizoaffective disorders.</td>
</tr>
<tr>
<td>Narcotic/opioid analgesics</td>
<td>Use topical route (e.g., fentanyl) for opioids in terminal pain and consider topical NSAIDs (e.g., ketoprofen 5% gel for localized pain). Be sure that patient has acetaminophen up to 3 g/day and is not suffering if in terminal pain.</td>
</tr>
<tr>
<td>Antihistamines</td>
<td>Use relatively nonsedating agents if chronic need. Avoid older, more sedating, and anticholinergic agents (e.g., diphenhydramine).</td>
</tr>
<tr>
<td>Anticonvulsants</td>
<td>Titrate carefully to appropriate serum levels, if for seizures or pain management based on renal and hepatic function.</td>
</tr>
<tr>
<td>Antiparkinson agents</td>
<td>Ensure that medications (e.g., metoclopramide) are not the cause of EPSs; careful addition of any antiparkinson agent with neurologic evaluation documentation of benefit/risk.</td>
</tr>
<tr>
<td>Antihypertensives</td>
<td>Avoid centrally acting sympatholytics (e.g., clonidine, methyldopa) and prefer ACE inhibitors or ARBs. Watch for orthostasis (i.e., dizziness on change in position, dehydration resulting from incontinence); if it occurs, reduce dose if resting BP is less than 110–120/70–80 mm Hg.</td>
</tr>
<tr>
<td>Anemia (hemoglobin &lt;12 g/L in either sex after cause[s] established)</td>
<td>Recommend iron sulfate 325 mg with ascorbic acid 500 mg daily to improve absorption and consider PPI if on low-dose ASA therapy and low hemoglobin has developed. Check folate and B₁₂ levels if macrocytic anemia present and supplement orally.</td>
</tr>
<tr>
<td>Inadequate calcium and vitamin D intake/levels</td>
<td>Check dairy product intake and ensure 1,000–1,500 mg elemental calcium daily, preferably as citrate, and 800–1,200 units daily if serum vitamin D is less than 30 ng/mL.</td>
</tr>
</tbody>
</table>

Abbreviations used: ACE: angiotensin-converting enzyme; ARB, angiotensin II receptor blocker; ASA, aspirin; BP, blood pressure; EPS, extrapyramidal side effect; NSAID, nonsteroidal anti-inflammatory drug; PPI, proton pump inhibitor; SSRI, selective serotonin reuptake inhibitor.
repeat drug level in 2 weeks
b. Alternative a and taper phenytoin by 50 mg/day each week after the other drugs are tapered to discontinuance if no further seizures occur
c. Alternatives a and b are correct.
d. Leave dose as is

17. His vitamin D level is low. Does any evidence exist that vitamin D supplementation may prevent falls and injuries from falls?
a. Yes
b. No

18. What dose of daily vitamin D is recommended for low vitamin D levels?
a. 400–600 units
b. 600–800 units
c. 800–1,000 units
d. 1,000–1,200 units

19. You also note that he is not taking any calcium supplement and does not like dairy products. Which calcium salt is preferred in the older adult?
a. Citrate
b. Carbonate
c. Gluconate
d. Glucobionate

20. How much elemental calcium needs to be taken daily?
a. 500 mg
b. 500–750 mg
c. 750–1,000 mg
d. 1,000–1,500 mg

21. The patient received 27 doses of oxycodone/acetaminophen the past month or roughly one dose per day. What first-line drug could have been given on a

Table 2. Medications that increase the risk of falls for patients 65 years of age or older

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Generic Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alprazolam (Xanax)</td>
<td>Fentanyl (Dura)</td>
<td>Paroxetine (Paxil)</td>
</tr>
<tr>
<td>Amitriptyline (Elavil)</td>
<td>Fluoxetine (Prozac)</td>
<td>Pentobarbital (Nembutal)</td>
</tr>
<tr>
<td>Amobarbital (Amytal)</td>
<td>Fluphenazine (Permitil, Prolix)</td>
<td>Perphenazine (Trilafon)</td>
</tr>
<tr>
<td>Amoxapine (Asendin)</td>
<td>Fluoxetine (Dalfane)</td>
<td>Phenelzine (Nardil)</td>
</tr>
<tr>
<td>Aripiprazole (Abilify)</td>
<td>Fluvoramine (Luvox)</td>
<td>Phenobarbital</td>
</tr>
<tr>
<td>Baclofen (Lioresal)</td>
<td>Gabapentin (Neurontin)</td>
<td>Phenytoin (Dilantin)</td>
</tr>
<tr>
<td>Bupropion (Wellbutrin, Wellbutrin SR)</td>
<td>Halazepam (Paxipam)</td>
<td>Pimoaze (Orap)</td>
</tr>
<tr>
<td>Buspirone (Busrar)</td>
<td>Haloperidol (Haldol)</td>
<td>Pregabal (Lyrica)</td>
</tr>
<tr>
<td>Butarabital</td>
<td>Hydrocodone (Vicadin)</td>
<td>Prinidone (Mysole)</td>
</tr>
<tr>
<td>Carbamazepine (Tegretol, Tegretol XR, Carbatrol)</td>
<td>Hydromorphone (Dilaudid)</td>
<td>Propoxyphene (Darvon, Darvocet)</td>
</tr>
<tr>
<td>Chloral hydrate</td>
<td>Imipramine (Tofrani)</td>
<td>Protriptyline (Vivactil)</td>
</tr>
<tr>
<td>Chlorzepate (Tranxene)</td>
<td>Isocarboxazid (Marplan)</td>
<td>Quazepam (Doral)</td>
</tr>
<tr>
<td>Chloridiazepoxide (Librium, Libitril, Librax)</td>
<td>Levetracan (Keppra)</td>
<td>Quetiapine (Seroquel)</td>
</tr>
<tr>
<td>Chlorpromazine (Thorazine)</td>
<td>Levorphanol (Levo-Droman)</td>
<td>Risperdione (Risperdal)</td>
</tr>
<tr>
<td>Citalopram (Celexa)</td>
<td>Lorazepam (Ativan)</td>
<td>Sarcobartil (Sedonal)</td>
</tr>
<tr>
<td>Clidinium-chlordiazepoxide (Librax)</td>
<td>Loxapine (Lixtane, Loxtane C)</td>
<td>Sertraline (Zoloft)</td>
</tr>
<tr>
<td>Clomipramine (Anafranil)</td>
<td>Maproteline (Ludomil)</td>
<td>Temazepam (Restoril)</td>
</tr>
<tr>
<td>Clonazepam (Klonopin)</td>
<td>Mephotarbarital</td>
<td>Thioridazine (Mellari)</td>
</tr>
<tr>
<td>Clozapine (Clorazil)</td>
<td>Meprodamate (Miltown, Equanil)</td>
<td>Thiottixene (Navane)</td>
</tr>
<tr>
<td>Codeine (Tylend with Codeine)</td>
<td>Mesoridazine (Serenil)</td>
<td>Tiagabine (Gabatril)</td>
</tr>
<tr>
<td>Desipramine (Norpramin)</td>
<td>Methadone (Dolophine)</td>
<td>Topiramate (Topamax)</td>
</tr>
<tr>
<td>Diazepam (Valium)</td>
<td>Methsuximide (Celontin)</td>
<td>Tranylcypromine (Parnate)</td>
</tr>
<tr>
<td>Doxigen (Lanoxin)</td>
<td>Mirtazapine (Remeron)</td>
<td>Trazodone (Desyrel)</td>
</tr>
<tr>
<td>Disopyramide (Norpace)</td>
<td>Molindone (Mobil)</td>
<td>Triazolam (Halcion)</td>
</tr>
<tr>
<td>Divalproex sodium (Depakote, Depakote ER)</td>
<td>Morphine (MS Contin)</td>
<td>Trifluoroperazine (Stelazine)</td>
</tr>
<tr>
<td>Doxipine (Sinequan, Zonalon, Prudoxin)</td>
<td>Nefazodone (Serzone)</td>
<td>Trimeprazine (Surmontil)</td>
</tr>
<tr>
<td>Duloxetine (Cymbalta)</td>
<td>Oxazepam (Zyprex, Zyprex Zydise)</td>
<td>Venlafaxine (Effexor, Effexor XR)</td>
</tr>
<tr>
<td>Escitalopram (Lexapro)</td>
<td>Oxazepam (Sera)</td>
<td>Ziprasidone (Geodon)</td>
</tr>
<tr>
<td>Estazolam (Prosom)</td>
<td>Oxydine (Perococet)</td>
<td>Zolpidem (Ambien)</td>
</tr>
<tr>
<td>Ethosuximide (Zarontin)</td>
<td>Oxymorphine (Numorphan)</td>
<td>Zonisamide (Zonegran)</td>
</tr>
</tbody>
</table>

Listed as generic name (brand name).
regular basis to possibly decrease the need for the oxycodone?
   a. Acetaminophen
   b. Propoxyphene
   c. Tramadol
   d. Alternative a and topical NSAID

22. What laxative may need to be given on a regular basis for this patient to decrease the need for enemas?
   a. Fiber
   b. PEG
   c. Sorbitol
   d. Alternative b or c is correct.

23. What drug may need to be added to prevent occult gastrointestinal bleeding from the ASA?
   a. Antacids
   b. H₂ blockers
   c. A PPI
   d. None of the above alternatives is effective in decreasing ASA bleeding.

   Answer key: 11–13. d; 14. c; 15. d; 16. c; 17. a; 18. d; 19. a; 20. d; 21. a; 22. d; 23. c

Case discussion. This patient illustrates the complexity of an older patient’s drug regimen and the sequence of events that can occur. This patient was being treated by five different physicians during the course of his home care, assisted-living placement, and subsequent nursing home placement. After reviewing the prescribing sequence, dates, and suspected adverse drug events that occurred in this patient, the pharmacist can discuss these findings with the attending prescribers and hopefully ensure that the primary care clinician is knowledgeable about and agrees with the changes suggested. This team intervention can improve the quality of the patient’s overall health care. Careful tapering to discontinuance or lower dose of the medications that contributed to falls and fracture risk (antipsychotics, oxycodone and phenytoin, and memantine) is appropriate in this patient. His seizures were attributed to his stroke, use of the CNS stimulant methylphenidate, and a higher dose of memantine that was subsequently decreased because of his renal function. He had some suspected seizure activity at phenytoin 100 mg, and his dose was increased back to 150 mg/day. His cognitive impairment was ascribed to the total psychoactive load, especially olanzapine, quetiapine, and oxycodone and phenytoin toxicity. His anemia was thought to result from a history of GERD and taking ASA without gastroprotection, and a PPI was added. His constipation was considered to result from inadequate fluid intake, the antipsychotics, and oxycodone, and a PEG laxative was started. His daytime sleeping and nighttime insomnia were considered to be caused by the adverse drug reaction sequence of the olanzapine leading to oversedation, then methylphenidate was started to “perk him up” according to one prescriber, which led to the need for quetiapine from another prescriber taking call over the weekend. All of the mentioned medication changes have led to an improvement in his cognition (he now recognizes family and friends), constipation (no impactions, formed stool daily), anemia (Hb 12.8 g/dL), and phenytoin (8 μg/mL), and no falls or seizures have occurred on the following regimen:

   Activity. The patient was up on a walker with assistance three times a day, before meals, and before bed, was not napping more than 15 to 20 minutes after meals, and was engaging in craft activities in the morning and afternoon. He was using a bedside urinal and shaving and showering daily.

   Medications. Acetaminophen 500 mg was given every 4 hours (6:00 am, 10:00 am, 2:00 pm, 6:00 pm, and 10:00 pm), and the patient could have a sixth dose as a “sleep aid” if he awoke during the night no sooner than 2:00 am; 5% ketoprofen gel was applied in “pencil eraser size” to knees and shoulders twice daily.

   ■ PEG powder (Miralax): one capful with full glass of water every morning
   ■ Memantine: 10 mg every morning
   ■ Phenytoin: 150 mg daily at bedtime
   ■ ASA: 81 mg daily
   ■ Iron sulfate: 325 mg with ascorbic acid 500 mg every morning
   ■ Calcium citrate: 630 mg with vitamin D 400 units with

Table 3. Key points of current article assessing fall prevention in older adult patients

| Multifactorial risk assessment is a helpful tool to evaluate fall risk. |
| Psychoactive/psychotropic polypharmacy greatly increases fall risk; carefully inventory and reduce, taper, and/or discontinue medications that may be associated with falls and that do not cause adverse drug withdrawal events. |
| Do not abruptly stop medications; tapering doses drug by drug, one at a time is recommended. A rule of thumb is 10%–25% of the daily dose every week to 2 weeks depending on the half-life of the drug. The longer the half-life, the longer the tapering period may be (e.g., diazepam and fluoxetine have half-lives of the parent drug and active metabolite that exceed 150 hours). |
| Consider PRN medications as a possible cause if a fall occurred within 1 week of use and the medications were longer-acting BZs (e.g., diazepam) or antipsychotics. |
| OBRA ’90 mandates two to three tapering attempts of anxiolytics and antipsychotics within the first 6–12 months of long-term care facility placement in the United States. |
| Falls may be reduced by at least 70% by psychoactive medication interventions. Recommend treatment of anemia and calcium citrate/vitamin D supplements in every older adult. |

Abbreviations used: BZ, benzodiazepine; OBRA ’90, Omnibus Budget Reconciliation Act of 1990; PRN, as needed.
breakfast and supper meals

- Omeprazole: 20 mg every morning

**Intervention outcome.** The patient and his family are now considering his return to assisted living with one attending prescriber, medication supervision, and monthly medication review by the pharmacist at a savings of $3,500 to $4,000 per month in care costs versus the skilled nursing facility.

Table 2 lists some psychoactive medications that increase the risk of falls for patients 65 years of age or older. Please also see the related University of North Carolina at Chapel Hill news release (available at http://unchnews.unc.edu/news/health-and-medicine/some-drugs-increase-risk-of-falling-unc-researchers.html). Table 2 does not include antihistamines, all anticonvulsants and opioids, and centrally acting sympatholytic antihypertensives. The complete list can be downloaded at http://unchnews.unc.edu/images/stories/news/health/2008/drugslist.pdf.

**Summary**

This article has reviewed the effects of medications on falls and offers suggestions to minimize fall risk by assessing all medications both prescribed and possibly needed to reduce fall risk. The recommendations that can be made are summarized in Table 3. References 1 through 54 and online Appendix 1 give further evidence for the need and effectiveness of multimodality interventions.

**References**


26. Cooper JW. Drugs may have reduced effect of falls intervention. BMJ. 2001;322:675.


Assessment Questions

Instructions: The assessment test for this activity must be taken online; please see “CPE Processing” below for further instructions. There is only one correct answer to each question. This CPE will be available online at www.pharmacist.com no later than May 31, 2009.

1. Falls are the leading cause of injury-related deaths and the most common cause of nonfatal injuries and hospital trauma admissions among older adults.
   a. True
   b. False

2. Fall risk may involve which of the following?
   a. Physical mobility issues
   b. Medications
   c. Home and environmental safety
   d. All of the above alternatives are correct.

3. A comprehensive fall-reduction strategy that addresses physical mobility and ability to accomplish activities of daily living, medication management, home/room safety, and environmental (community) safety can be effective. However, failure of the strategy results from which of the following?
   a. Single cause
   b. Multiple causes
   c. Not considering drugs
   d. Alternatives b and c are correct.

4. In addition to the four areas noted in question 3, most falls result from multiple risk factors that should also be taken into account.
   a. True
   b. False

5. Psychotropics are defined as
   a. Anxiolytics and hypnotics.
   b. Antipsychotics.
   c. Antidepressants.
   d. All of the above alternatives are correct.

6. Psychoactives or central nervous system–active agents are considered psychotropics and
   a. Metoclopramide and narcotic or opioid analgesics and antiparkinson agents.
   b. Anticonvulsants and muscle relaxants.
   c. Antihistamines and centrally acting antihypertensives.
   d. All of the above alternatives are correct.

7. According to the risk assessment for falls shown in Figure 1, what point total is considered high risk for falls?
   a. 2–5
   b. 5–7
   c. ≥8
   d. ≥10

8. Regular use of acetaminophen 3.0 g/day in patients with dementia has been shown to
   a. Decrease behavioral symptoms by 63%.
   b. Allow 75% of psychotropic medications to be tapered and stopped in patients with cognitive impairment.
   c. Alternatives a and b are correct.
   d. Have no effect.

9. Giving hypnotics more often than how many times per week has been shown to increase fall risk?
   a. Once or twice
   b. Two to three times
   c. Three to five times
   d. Nightly

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10. For each psychotropic added to a patient’s drug regimen, the risk of falls is
   a. The same.
   b. Doubled.
   c. Tripled.
   d. Quadrupled.

11. Buspirone conversion and discontinuance of psychotropics has been shown to decrease falls by what percentage?
   a. 20%
   b. 40%
   c. 70%
   d. 90%

12. Medicare will no longer pay for falls that occur in which care setting?
   a. Acute care
   b. Skilled care
   c. Assisted living
   d. Personal care

13. Recent literature indicates that the number of hospitalizations of residents of long-term care facilities is directly proportional to
   a. The number of adverse drug reactions and falls they experience.
   b. The number of adverse drug reactions they experience.
   c. The number of falls they experience.
   d. None of the above alternatives is correct.

14. Which psychotropic class has been found to increase the death risk for older adults with dementia?
   a. Anxiolytics
   b. Antidepressants
   c. Antipsychotics
   d. Anticonvulsants

15. The nursing home patient with which of the following may be more likely to receive pharmacologic “restraints” with psychotropics?
   a. Physically abusive behavior
   b. Infrequent family visits
   c. Severe cognitive impairment
   d. All of the above alternatives are correct.

16. Anemia increases fall risk in which of the following?
   a. Long-term care
   b. The community
   c. Alternatives a and b are correct.
   d. Neither alternative a nor b is correct.

17. Which may decrease fall and fracture risk?
   a. Vitamin D
   b. Calcium
   c. Alternatives a and b are correct.
   d. Neither alternative a nor b is correct.

18. The best way to decrease psychoactive load is to
   a. Abruptly stop all psychoactives.
   b. Carefully taper to lower dose or stop one agent at a time.
   c. Taper slowly and watch for adverse drug withdrawal effects.
   d. Alternatives b and c are correct.

19. As a general rule, the half-life of a drug has what effect on the tapering schedule?
   a. The shorter the half-life, the longer it takes to taper.
   b. The longer the half-life, the longer it takes to taper.
   c. The longer the half-life, the shorter the tapering time.
   d. The half-life has no effect on the tapering.

20. Fall risk prevention and intervention should be the responsibility of the
   a. Prescriber.
   b. Pharmacist
   c. Nurse and caregivers.
   d. All of the above alternatives are correct.

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