The impact of a literature consult service on geriatric clinical care and training in falls prevention

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INTRODUCTION

The importance of developing effective health care programs and services for elderly persons in the United States is increasing at warp speed due to significant projected growth in the size of this demographic in the near future. According to the US Census Bureau, the number of persons aged 65 years and older is expected to rise from an estimated 35 million people in 2000 to 55 million by the year 2020 [1]. The rapid growth in this age group can be explained in part by a considerable rise in the number of older people projected for 2011, when the Baby Boom generation (persons born between 1946 and 1964) begins to turn 65 years old. The number of oldest old (persons aged 85 years and older) is projected to double from 4.7 million in 2000 to 9.6 million by 2030 [2]. The growth in the number of persons aged 65 years and older is expected to rise from an estimated 35 million people in 2000 to 55 million by the year 2020 [1].

The rapid growth in this age group can be explained in part by a considerable rise in the number of older people projected for 2011, when the Baby Boom generation (persons born between 1946 and 1964) begins to turn 65 years old. The number of oldest old (persons aged 85 years and older) is projected to double from 4.7 million in 2000 to 9.6 million by 2030 [2]. The growth in the number of persons aged 65 years and older is expected to rise from an estimated 35 million people in 2000 to 55 million by the year 2020 [1].

Providing appropriate health care services for this age group is also gaining prominence in the United States [5, 6]. Geriatrics is the branch of medicine that focuses on prevention, diagnosis, and treatment of diseases in the aged and on the socioeconomic matters that affect health care services for elderly persons. Geriatrics research and clinical practice encompass both persons residing with or without caregivers at home and those receiving clinical care at hospitals and nursing facilities [7]. In addition to managing the care of aged patients, the key goals of geriatric medicine include training medical students, physicians, and other health care professionals in geriatric issues as well as researching the aging process and the accompanying conditions affecting the elderly [8].

One of the major issues targeted by geriatric medicine is the prevention of accidental falls [9]. Falls are a common health risk, can occur in virtually any setting, and can be fatal, particularly among individuals sixty-five years and older [10]. Complications due to falls are the leading cause of death due to injury in this age group in the United States. Falls are also one of the primary causes prompting emergency care and hospitalizations among the elderly [10]. These disturbing statistics have brought this issue under significant scrutiny by geriatric clinicians and researchers in medicine.

THE CASE

You frequently collaborate with a geriatrician in the adult primary care clinic of your large academic medical center. On a routine visit to his office to discuss his current needs for clinical evidence, he requests that you analyze the literature on effective interventions to reduce accidental falls in older persons. As he also provides geriatric care at the local Veterans Administration hospital and is the medical director at several local nursing homes and home health agencies, he notes that he is interested in literature describing interventions for use in private homes as well as those implemented in institutional settings. Figure 1 provides further clinical commentary on this question.

THE QUESTION

In patients over age sixty-five, what strategies have been shown to reduce the risk of accidental falls?

UNDERSTANDING THE CONCEPTS

You decide that medical textbooks on geriatric care and basic journal articles providing an overview of accidental falls are appropriate background resources to gain a clear understanding of the issues surrounding the geriatrician’s question. As you skim this material, you realize that the literature distinguishes between two main types of patient populations, persons living in the community and those temporarily or permanently residing in health care institutions. Frailty or “frail elderly” is another concept that you frequently see discussed in the literature in relation to falls. An internal medicine textbook [15] reveals that frailty is a high-risk clinical syndrome characterized by multiple signs and symptoms that increase with age, such as weakness, fatigue, decreased muscle mass, decreased food intake, balance and gait abnormalities, and weakened bones (osteopenia).

You also learn from reading a general review article [14] that the interaction of multiple intrinsic and extrinsic risk factors predisposes elderly patients to fall. Intrinsic factors involve characteristics of the individual, such as acute illness, lower extremity weakness, gait and balance deficits, or psychotropic medication use (e.g., benzodiazepines prescribed for anxiety or insomnia). Extrinsic factors include factors outside the individual, such as restraints, poor footwear, or environmental hazards (e.g., clutter, poor lighting) [14].

Understanding patient population characteristics, risk factors, and other core concepts related to falls gives you a clearer sense of some of the main issues surrounding the prevention of falls and increases your vocabulary for brainstorming keywords that are useful for a comprehensive literature search. Table 1 provides brief definitions for these and other important concepts related to falls in the elderly.

Based on your background reading, you realize that some studies you find in your literature search focus primarily on specific patient populations who are at an increased risk for falls, such as the frail elderly or...
Figure 1
Clinician commentary

Accidental falls are a serious problem that constitutes one of the most common events threatening the independence of older adults. Falls can occur in older persons who are living at home and those who are receiving medical care or assistance in institutions such as acute hospitals, nursing homes, and rehabilitation facilities.

Accidental falls are the leading cause of unintentional injurious deaths in the elderly population in the United States, and mortality rates due to accidental falls are rising. The Centers for Disease Control and Prevention reports that in 1999 approximately 10,097 of 54,797,847 (29 per 100,000) total deaths from unintentional injury in persons 65 years and older were related to accidental falls. This figure rose to approximately 14,900 of 36,333,025 (39 per 100,000) in 2004 [11]. Persons who survive an accidental fall may sustain serious injury, including bruises, fractures, or brain injury. They may also develop an increased fear of falling, causing them to reduce normal daily activities, which in turn lowers their physical and mental health and consequently their overall quality of life [12, 13].

Accidental falls are caused by a complex interaction of risk factors related to the individual (intrinsic factors)—such as acute illness, chronic disease, certain medications, and age-related decline—or risk factors outside the individual (extrinsic factors) that may challenge postural control—such as environment, daily activities, and changing body position. Other risk factors such as risk-taking behavior and underlying mobility level may also induce an accidental fall. Additionally, some medical conditions such as diabetes mellitus, stroke, Parkinson’s disease, arthritis, and dementia are associated with an increased fall risk, and attention should be given to patients with one or more of these conditions, particularly if they are on four or more different types of medication, psychotropic medication, or medications with a narrow therapeutic range. Some research has shown that a geriatric person’s risk of falling increases dramatically as the number of risk factors increases, and recurrence may be an ongoing problem for persons more prone to falling, such as the frail elderly [14].

Effective primary prevention of accidental falls in the elderly is multifactorial and begins with a clinical assessment program that can accurately detect persons at risk for falls so that a personalized prevention program can be put in place to reduce their likelihood of falling. Preventive strategies may include physical therapy or exercise programs, medication and dietary supplement review, vision testing, fitting of assistive walking devices and/or protective equipment, patient and family education, and environmental modifications, such as improved lighting, elimination of uneven walking surfaces, or installation of handrails.

Because accidental falls can occur in community-dwelling patients and across multiple health care settings, a comprehensive synthesis of the literature will include each of these environments. Given the vast amount of research that has been published on assessment, prevention, and management of falls in older persons, collaboration with a clinical librarian is invaluable for obtaining a concise synopsis of the available evidence and expert recommendations in order to inform patient care decision making and fall prevention program development and to enhance medical student and resident training on an important issue in geriatric medicine.

Contraindications

Contraindications are key issues in geriatric medicine, this case will focus on search and synthesis of the literature on preventing first-time falls for the sake of brevity.

CONSTRUCTING A LITERATURE SEARCH

Armed with background knowledge, your next step is to begin constructing a literature search. You decide to focus first on clinical practice guidelines on the prevention of falls in the elderly to gain a sense of the current standard of care, to acquire additional core vocabulary or related key words for use in your search, and to review any relevant articles commonly cited among the guidelines.

Clinical practice guidelines

While guideline clearinghouses and biomedical literature databases are comprehensive one-stop resources that can be searched quickly, a brief time lag may exist between the guideline date of publication and its availability via these resources. Moreover, the National Guidelines Clearinghouse (NGC) periodically withdraws guidelines that have not been developed, reviewed, or revised in the last five years and places them in an electronic archive of citations only that must be searched separately [27]. In contrast, professional and government organizations (e.g., American College of Physicians, United States Preventive Services Task Force) often post their guidelines on their websites immediately after publication. A thorough search for current guidelines on this case’s topic will therefore include clearinghouses like NGC, bibliographic databases that index medical literature, and individual websites from geriatrics-related professional organizations.

You recall from your background reading that the American Geriatrics Society (AGS) is the primary professional association for geriatrics in the United States. A quick browse of the AGS website reveals joint practice guidelines on the prevention of accidental falls in older persons, published in conjunction with the Academy of Orthopaedic Surgeons and the British Geriatrics Society [25].

You also consult the NGC database to locate any additional guidelines on accidental falls from other organizations. Using the term “falls” in the Disease/Condition field of the NGC detailed search page, with limits set to persons sixty-five years and older in the Age of Target Population field, returns approximately thirty results sorted by relevance. Of these, you see seven guidelines on falls that were developed or adapted by nonprofit organizations, professional associations, and academic institutions from the United States and other countries [26, 28–33].

Upon further review of the results, you immediately eliminate one guideline [31] that was adapted from guidelines already included in your search results and then consider the authority, purpose, and scope of the remaining six documents. Using the NGC guideline comparison tool, you see that four are from the United States [28–30, 32], one is from the Canadian Task Force on Preventive Health Care [32], and another is from the Collaborating Centre for Nursing and Supportive
Care in United Kingdom, developed for the National Institute for Health and Clinical Excellence (NICE) [26]. You realize that health disparities and life expectancy can vary significantly among countries [34] due to a wide range of reasons, such as differences in lifestyle choices (e.g., diet, exercise), genetic makeup, and available health care resources; therefore, determining the country of origin for each guideline is important and will be a significant piece of information to include in your overall written synthesis of guidelines recommendations. The guidelines authored in the United States are likely to be closest to practice at your institution, while the other guidelines may serve well in the country of origin for each guideline is important and will be a significant piece of information to include in your overall written synthesis of guidelines recommendations. The guidelines authored in the United States are likely to be closest to practice at your institution, while the other guidelines may serve well available health care resources; therefore, determining the country of origin for each guideline is important and will be a significant piece of information to include in your overall written synthesis of guidelines recommendations. The guidelines authored in the United States are likely to be closest to practice at your institution, while the other guidelines may serve well as supplemental information.

Comparing the targeted settings among guidelines shows that three documents specifically address long-term-care residents, two address both community-dwelling patients and institutionalized patients, and one addresses hospitalized patients only. As noted previously, your clinician is interested in all of these populations. You also note that different search methods (i.e., hand searching, electronic database searching, or both) were used to locate evidence to support guideline development, giving you a sense of the level of rigor and thoroughness with which the authors surveyed the published literature. Furthermore, three guidelines judged the quality and strength of the evidence and/or the recommendations via rating schemes, while two utilized expert consensus. Reviewing the method of evidence appraisal for guideline development gives you a sense of the level of authority and objectivity with which the recommendations were developed. All guidelines underwent an internal or external peer-review process before publication. Thus, you have a strong pool of guidelines to consider as you select items to provide to the geriatrician.

**Table 1**

Brief concept definitions with references to sources of information

| Medical concept | Definition |
|-----------------|------------|
| Accidental fall | An event, reported either by the faller or a witness, resulting in a person inadvertently coming to rest on the ground or another lower level, with or without loss of consciousness or injury [16]. |
| Geriatrics | Medical specialty that serves older persons in later life, usually ages 65 years and older (American Geriatrics Society Foundation for Health in Aging, 2007). The term geriatrics was proposed in 1909 by an Austrian physician, Ignatz Leo Nascher, combining the Greek “geras” meaning “old age” and “iatros,” a combining form pertaining to “physician” or “healing” [17, 18]. |
| Geriatrician | A geriatrician is a primary care or internal medicine physician, often with board certification in the field of geriatrics, who provides primary medical care to older persons, particularly those with complicated medical and social problems, such as frailty, multiple disabilities, or cognitive impairment [7, 8]. Board certification in geriatrics by the American Board of Family Practice or the American Board of Internal Medicine is considered the gold standard credential for clinical expertise in geriatrics by the US medical community [19]. |
| Interdisciplinary geriatrics care | Medical care provided by an interdisciplinary team of health professionals working together to evaluate and treat the whole patient. In addition to geriatricians, the team may consist of nurses, social workers, nutritionists, physical therapists, occupational therapists, speech pathologists, pharmacists, geriatric physiatrists, and geropsychiatrists. Patients and their caregivers are also involved in decision making as well as ongoing prevention and health management activities [20]. |
| Community-dwelling versus institutionalized patients | “Community-dwelling” refers to persons who reside in their own homes. They are not hospitalized and do not live in long-term-care facilities. Corresponds with the Medical Subject Headings (MeSH) term, “Deinstitutionalization,” which is defined as, “the practice of caring for individuals in the community, rather than in an institutional environment with resultant effects on the individual, the individual’s family, the community, and the health care system” [21]. Institutionalized refers to persons temporarily or permanently residing in a health care facility, such as a hospital or nursing home, and corresponds with the MeSH term, “Institutionalization,” which is defined as, “the caring for individuals in institutions and their adaptation to routines characteristic of the institutional environment, and/or their loss of adaptation to life outside the institution” [21]. |
| Frailty | Defined as “a state of decreased reserve and increased vulnerability to all kinds of stress, from acute infection or injury to hospitalization, and may identify individuals who cannot tolerate invasive therapies” [22]. May include weight loss, weakness, fatigue, inactivity, or decreased food intake, as well as decreased muscle mass, balance and gait problems, deconditioning, and decreased bone mass [23]. Shown to be an independent predictor of risk for falls, hospitalizations, disability, and death [15], most common in the elderly population. |
| Fall recurrence | The occurrence of subsequent accidental fall(s) after a first fall. Risk of recurrence is particularly high in persons with a history of falls [24]; recurrence is the focus of secondary prevention strategies. |
| Fall risk assessment | Assessment is a multicomponent examination of a patient’s risk for accidental falls that may be conducted by a physician or trained nursing care staff. The essential elements of any fall-related assessment include identification of the subject’s risk factors for falls, any medical comorbidities, functional status, and environmental risks. A comprehensive assessment may necessitate referral to a specialist (e.g., geriatrician) [25]. |
| Risk factors | A risk factor is “a characteristic that is found significantly more often in individuals who subsequently experience an adverse event than in individuals who do not experience the event” [14]. |
| Management strategies | Primary prevention consists of interventions that are targeted at persons at risk or high risk of a fall. Rehabilitation refers to interventions targeted at persons who have sustained an injury from a fall. Secondary intervention refers to interventions targeted at persons with a history of falls [26]. |

Next, you turn to PubMed to begin a search of the research studies literature and to locate any additional practice guidelines. Given the potential length of the guideline development and publication process, you may particularly wish to consider literature published since approximately 2000, around the time of the AGS 2001 guidelines mentioned previously. Selecting such a date range will help you avoid duplicating the effort already embodied in the guidelines. Using the Medical Subject Heading (MeSH) database in PubMed, you see that “Accidental Falls” is the most relevant MeSH term that relates to the concept of falls. Next, you begin a search to locate the MeSH...
term for the concept of preventing falls. From your background reading, you know that these strategies may be described in the literature as “prevention,” “interventions,” or “programs.” You also know that effectiveness of the preventive strategies can be assessed by measuring a variety of outcomes, such as a reduction in the number of falls and falls risk (i.e., the likelihood that an individual will experience a fall). A search of the MeSH database using key words (e.g., “Prevention”) yields a number of related terms including “Accident Prevention” (which also includes “safety Management’’), “Program Evaluation,” “Rehabilitation,” “Treatment Outcome,” and the subheading “Prevention and Control.” You also note that the MeSH term, “Aged”—including the narrower terms “Aged, 80 and Over” and “Frail Elderly”—may be very useful in restricting to articles on this specific age group.

Given the size of the literature on falls, you decide to limit the search using the “NOT” Boolean operator and append a string of publication types to the strategy that eliminates weaker literature, such as letters to the editor, case reports, news, editorials, comments, and records supplied by publishers. A basic search string with these additional terms looks like:

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accidental falls/prevention and control[majr] AND aged[mh] AND (accident prevention[mh] OR program evaluation[mh] OR rehabilitation OR treatment outcome[mh]) NOT (case reports[pt] OR letter[pt] OR comment[pt] OR news[pt] OR editorial[pt] OR publisher[sh]).
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Limiting the search to citations published in English since 2000 yields approximately 305 citations.

While this strategy serves as a strong starting point, as you browse the citation titles in the retrieval, you recall from your background reading that several individual interventions have been developed to help reduce the risk of falls, such as exercise, environment modification, dietary supplements, assistive devices, psychotropic medication withdrawal, and physical therapy for balance and gait training. You realize that a more thorough search will therefore include MeSH terms and keywords for interventions commonly examined either as a single strategy or as individual components of a multifaceted prevention program. A search of the MeSH database using keywords and related concepts for each of these strategies yields the terms “Exercise,” “Environment Design,” “Health Facility Environment,” “Dietary Supplements,” “Self-Help Devices,” “Protective Devices” (e.g., hip protectors), “Psychotropic Drugs/Administration and Dosage,” and “Physical Therapy Modalities,” which also includes the narrower term “Exercise Therapy.” A search string with these terms looks like:

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accidental falls/narrower term for prevention and control[majr] AND aged[mh] AND (“Exercise”[Mesh] OR “Environment Design”[Mesh] OR “Health Facility Environment”[Mesh] OR “Dietary Supplements”[Mesh] OR “Self-Help Devices”[Mesh] OR “Protective Devices”[Mesh] OR “Psychotropic Drugs/Administration and dosage”[Mesh] OR “Physical Therapy Modalities”[Mesh]) NOT (case reports[pt] OR letter[pt] OR comment[pt] OR news[pt] OR editorial[pt] OR publisher[sh]).
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Limiting the search to citations published in English since 2000 yields approximately 190 citations, all of which do not appear in the results of the first search, highlighting the utility of this separate search strategy.

To locate clinical practice guidelines and other evidence-based recommendations indexed in PubMed that may not be indexed in the NGC, you may try a strategy such as this, retrieving approximately 175 items in PubMed:

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Accidental falls[majr] AND aged[mh] AND ((evidence based AND (guideline [tiab] OR guidelines [tiab] OR recommendations OR recommendation*)) OR practice guidelines[mh] OR practice guideline[pt] OR guidelines[mh] OR guideline[pt] OR consensus development conference OR consensus statement[tiab] OR consensus workshop[tiab] OR standards[sh] OR “standard of care”[tiab] OR “standards of care”[tiab] OR clinical advisory[tiab]).
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This strategy includes terms related to evidence-based medicine, including those drawn from your own personal knowledgebase and training in evidence-based medicine concepts, from previous experience searching for clinical practice guidelines, and from reviewing the search methodologies published by expert appraisal groups such as the Cochrane Collaboration, the United States Preventive Services Task Force, and the National Institute for Clinical Excellence.

To ensure a thorough review of the literature for this clinical question, other bibliographic databases to consult may include CINAHL for nursing research and Web of Knowledge for professional meeting abstracts and other scientific studies. In addition, keyword searching in prominent search engines such as Google can yield the names of professional organizations or government agencies and relevant literature that may not be indexed by the above sources, such as evidence-based reports or white papers, clinical practice guidelines, and clinical advisories (e.g., professional committee opinions).

**SELECTING THE ARTICLES**

**Clinical guidelines**

As you skim the PubMed records, you see several reports that summarize or cite previous recommendations but few that are original practice statements. One guideline statement that looks useful is an evidence-based statement from Canada that uses a template from the Agency for Healthcare Research and Quality to develop guidance on risk factors that contribute to falls [35]. Viewing full-text of the Canadian guideline, you note that it may be useful only as supplementary information because its primary focus is on risk factors for preventing repeat falls (secondary prevention), rather than interventions for preventing an initial fall.

After surveying your entire list of guidelines for possible inclusion, you select the Canadian Task Force on Preventive Health Care guidelines [32], the NICE guidelines [26], and the AGS joint guidelines [25] that...
you located earlier via the NGC (Table 1) for their comprehensiveness, methodological rigor and assessment of the literature, and/or coverage of a unique aspect of falls, such as a specific patient population (e.g., frail elderly, persons 85, and older) or health care setting (e.g., hospital, nursing home, extended care).

Research studies

Given the immense amount of literature, you decide to focus primarily on the stronger levels of evidence, such as larger (e.g., ≥300 subjects) randomized clinical trials, systematic reviews, and meta-analyses.

As you scan through the records, you look for articles published in top geriatrics or peer-reviewed medicine journals as gauged by impact factor listed in the Journal Citation Reports database, as well as those published by reputable expert appraisal groups, such as the Cochrane Collaboration, and authors (e.g., Laurence Z. Rubenstein, A. John Campbell, M. Clare Robertson, and Mary E. Tinetti) who appear to be experts in the study of falls prevention, as gleaned from noting their affiliation with expert geriatric groups and/or authoring of multiple published studies, systematic reviews, or clinical practice guidelines.

You also see that the Cochrane Collaboration has published three systematic reviews of the literature in the Cochrane Database of Systematic Reviews regarding interventions for preventing falls. The first is a review on the effectiveness of any intervention type that reports outcomes according to community-dwelling versus nursing home setting [36]. The second Cochrane review focuses on the broader public health perspective by examining population-based interventions for preventing fall-related injuries in older people through public health programs administered in the community [37]. While somewhat relevant, this review focuses on city-wide or community-wide interventions, likely broader in scope than the need prompting the current question from the geriatrician. The third Cochrane review examines studies published between 1979 and 2004 that assess home environment modifications to prevent injuries [38]. From the abstract, you see that this article includes five studies involving children and fourteen studies on older people. All of the fourteen geriatric studies contain falls data; however, comparison with the studies examined in Gillespie et al. [36] reveals some overlap, and none of the fourteen were published more recently than those examined by Gillespie et al. You therefore select the Gillespie review for its focus solely on randomized clinical trials, coverage of both community-dwelling and institutionalized patients, comprehensive search methodology, and rigorous analysis of the evidence. You prefer this item over the review by Lyons et al. [38], because the latter focuses solely on home modification, contains some of the same research, and presents little new overall information on geriatric falls since the time of Gillespie's review.

In addition to the Cochrane reviews, you see several other systematic reviews but rule out many due to one or more characteristics that weakens the results, such as small sample size [39]; narrow scope, such as secondary prevention only [40]; focus on one intervention type [41, 42]; or lack of unique or significantly new data [42] compared to more comprehensive studies (e.g., Gillespie et al. [36], Chang et al. [44], Oliver et al. [44]).

After browsing the abstracts and full text of the retrieval of systematic reviews and meta-analyses, you select three systematic reviews [36, 43, 44] that share key characteristics of strength, such as a broad scope (e.g., multiple intervention types, multiple settings); comprehensive literature search; selection of strong study designs (e.g., randomized controlled trials, prospective cohort studies); large sample size (>40 studies); independent review of study methodological quality; and selection of meaningful outcomes, such as number, rate, or risk of falls, rather than intermediate outcomes such as muscle strength, balance, and gait. Two also included meta regression analyses of pooled studies to assess change in risk of falling [43] and the impact of dementia on effect size for rate of falls, fractures, and number of fallers [44].

You also note that these reviews possess other key characteristics individual to each. For example, one
| Author (date) | Purpose/study design | Methods | Results/outcomes | Comments |
|--------------|----------------------|---------|-----------------|----------|
| Gillespie et al. [36], Cochrane systematic review update, United Kingdom | Systematic review to determine the effectiveness of interventions for preventing falls in persons 65 years and older | Review and assessment of the literature through 2003: Examined 62 randomized controlled trials on fall prevention interventions (47 community-dwelling studies) yielding data on 21,668 total patients | Primary outcome: Number of fallers or falls | Pooled analyses showed that multidimensional risk assessment plus interventions aimed at reducing those risks decreased the risk for falling by 18% and reduced the average number of falls by 43%. Targeted exercise to improve balance, strength, flexibility, or endurance was the next most effective intervention. Exercise programs such as tai chi, balance and gait training, and strength building were also effective. Pooled data on number of fallers from 9 studies did not confirm benefit foruntargeted exercise in community-dwelling older people (pooled RR 0.89, 95% CI: 0.78–1.01). Risk walking in women with upper limb fracture ≤2 years previously was judged unlikely to be beneficial based on the results of 1 trial (n=165). Interventions with unknown effectiveness | Authors noted that the definition of a fall among the studies examined varied (e.g., (or was undefined) as did the duration of recording and follow-up periods. The dropout rate ranged from 2%–41% and was not reported in 9 studies. 27 studies either relied on participant recall of falls or did not report how falls were ascertained. |
| Chang et al. [44], United States | Systematic review and meta-analysis of 61 randomized clinical trials to determine the effectiveness of multifactorial falls risk assessment; prevention, exercise, environmental modifications; and/or education of nursing home and community-living patients on risk for accidental falls | Review and assessment of the biomedical literature through 2002: Meta-analysis examined 40 randomized controlled trials on selected fall prevention interventions for community-dwelling and institutionalized patients 60 years and older | Risk of falling at least once during a specified follow-up period; monthly fall rate | Use of multifactorial falls risk assessment and management, exercise, environmental modifications, and/or education resulted in a significant reduction in risk of falls for patients who fell at least once (n=22 trials, risk ratio 0.98, 95% CI: 0.82–0.95; P=0.03). The monthly rate of falling also decreased significantly (n=27 studies, incidence rate ratio 0.80, 0.72–0.86; P=0.03). Indirect comparisons via meta-regression analysis of individual components versus usual care control group showed a statistically significant beneficial effect on risk of falling (adjusted risk ratio 0.82, 0.72–0.94) and monthly fall rate (adjusted incidence rate ratio 0.63, 0.49–0.83) when multifactorial risk assessment and prevention were used. Exercise alone also showed a statistically significant beneficial effect on the risk of falls (ARR 0.86, 0.75–0.99) but not on monthly rate of falling (AIRR 0.86, 0.73 to 1.01). | Type of risks assessed in multifactorial risk assessment varied (e.g., balance/gait, drugs, vision, environmental hazards, orthostatic blood pressure) varied somewhat among studies. Assumed same underlying fall risk across studies. No use of publication bias noted via funnel plots of meta-analysis studies regarding the risk ratio of falling at least once and for the falls incidence rate ratio. |
| Oliver et al. [14] | 1. Systematic review of clinical trials, cohort studies, and case-control studies that addressed both single and multifaceted strategies developed to prevent falls and fractures in hospitals and nursing facilities 2. Meta-analysis on the impact of cognitive impairment on intervention effectiveness | Review and assessment of the literature through 2005: Examined 43 studies on selected fall prevention interventions for community-dwelling and institutionalized patients | Primary outcomes: Falls per person year; fractures per 1,000 person year; percentage of people falling | Multifaceted interventions Analysis of 13 in-hospital studies on multifactorial interventions on hospital patients showed wide heterogeneity in intervention type, population, and setting among studies. Study design and quality were also variable. Meta-analysis of 2 high-quality randomized trials and 1 prospective study showed an 18% reduction in fall rate but no comparable effect on fractures or fallers. Meta-regression showed that effect size and presence of dementia or cognitive impairment were not significantly associated. Of 8 high-quality randomized trials in nursing homes, no significant effects were noted, though some individual trials showed a large effect size on falls but not on fractures or fallers. Results on fracture rates in nursing homes were inconclusive due to insufficient power to detect a difference. Single interventions Analysis of 11 studies on hip protectors showed some evidence that use in care homes prevents hip fractures (rate ratio 0.67; 95% CI: 0.46–0.98), but no significant effect was noted for falls or fallers. Despite positive results in some individual studies, there was insufficient evidence to determine effects for other single interventions in either setting—such as physical restraint removal, fall alarm devices, environment modification, calcium or vitamin D, or exercise in nursing homes—and hospital medication review. | Only 1 study examined included solely dementia patients, and only 1 study reported dementia in subgroup analyses. |
Table 3
Literature summary: prevention of accidental falls in the elderly population: clinical practice guidelines

| Author/organization (date) | Purpose | Evidence and recommendation grading | Recommendations | Comments |
|----------------------------|---------|-------------------------------------|-----------------|----------|
| Developed by the National Collaborating Centre for Nursing and Supportive Care, sponsored by the National Institute for Health and Clinical Excellence (NICE) [26], United Kingdom | British guideline summarizing evidence from effectiveness studies and risk factor studies published from 1966–2003 on older adults residing at home in the community or in extended care (excluding bed-ridden patients) who have a history of falling or an increased risk of falling | Evidence quality I. evidence from meta-analysis of randomized controlled trials or at least 1 randomized controlled trial II. evidence from at least 1 controlled trial without randomization or at least 1 other type of quasi-experimental study III. evidence from nonexperimental descriptive studies, such as comparative studies, correlation studies, and case-control studies IV. evidence from expert committee reports or opinions and/or clinical experience of respected authorities | 1. Patients with recurrent falls or at increased risk of falling should receive an individualized, multifactorial intervention program that includes strength and balance training, home hazard assessment and management, vision assessment and referral, and medication review with modification or withdrawal (level 1A). 2. Following an injurious fall, patients should undergo multifactorial assessment for future risk to establish individualized interventions geared to promote independence and improved physical and psychological function (level 1A). 3. Brisk walking programs were not recommended due to one study that showed an increased risk for falls in postmenopausal women with previous limb fracture (level 1). | Used the Cochrane systematic review by Gillespie et al. [36] as the basis for their recommendations on best intervention practices. |
| Norris et al./Canadian Task Force on Preventive Health Care* [32], Canada | Canadian guideline summarizing evidence from 10 randomized controlled trials published from 1982 through April 2003 where ≥50% of the study population resided in long-term care institutions | Evidence quality Good: Study meets all design-specific criteria well Fair: Study that does not meet (or it is not clear that it meets) at least 1 design-specific criterion but has no known “fatal flaw” Poor: Study has at least 1 design-specific “fatal flaw” or an accumulation of lesser flaws to the extent that the results of the study are not deemed able to inform recommendations | Recommendation strength for specific clinical preventive actions A. Good evidence to recommend the clinical preventive action B. Fair evidence to recommend the clinical preventive action C. Existing evidence is conflicting and does not allow making a recommendation for or against use of the clinical preventive action; however, other factors may influence decision making D. Fair evidence to recommend against the clinical preventive action E. Good evidence to recommend against the clinical preventive action I. Insufficient evidence to make a recommendation; however, other factors may influence decision making | All long-term care residents 1. Fair evidence to recommend multifactorial assessment and individualized intervention programs to prevent falls and reduce hip fractures in long-term care settings (level B). 2. Fair evidence to conduct risk assessment on admission to a facility and reassessment following a fall (level B). Higher-risk long-term care residents Insufficient evidence to recommend targeted prevention programs for higher-risk patients, including multifaceted interventions (level I). Interventions to reduce specific risk factors Insufficient evidence to recommend single domain interventions, such as exercise or physical therapy alone, to reduce fall incidence in long-term care residents due to the additive nature of individual risk (level I). | Guideline did not include patients in acute care, chronic care, or psychiatric hospitals; did not include elderly residents in retirement homes who are independent in most activities of daily living. |

[44] was published recently and included studies on hospitalized patients, whereas the other two addressed only community-dwelling patients and/or those in nursing facilities. The review by Gillespie et al. [36] was conducted by the Cochrane Collaboration, an organization well known for its thorough, expert critical appraisals of research literature. The third [43] conducted sensitivity analyses to determine the robustness of its findings for possible publication bias. Additionally, using Web of Science, you note that one selected review has been cited more than ninety times [42], while another [36] was cited more than eighty-five times, adding objective data to your sense that the reviews are strong selections. After a quick scan of the citing authors, you realize that some of the best-known researchers on falls (e.g., A. John Campbell, M. Clare Robertson, Laurence Z. Rubenstein, Mary E. Tinet) cited these reviews in their subsequent research.
Table 3
Continued

| Author/organization (date) | Purpose | Evidence and recommendation grading | Recommendations | Comments |
|----------------------------|---------|-------------------------------------|-----------------|---------|
| American Geriatrics Society, British Geriatrics Society, and American Academy of Orthopaedic Surgeons† [25], United Kingdom and United States | Joint American-British practice guideline that outlines evidence-based recommendations for assessment and prevention of accidental falls for persons residing in the community or in long-term care facilities and hospitals; based on 11 community-based randomized trials and 2 long-term care trials | Evidence quality | Multifactorial interventions: Community-dwelling persons Recommends a multifactorial intervention that includes: gait training and appropriate use of assistive device training (level B), review and modification of medications (level B), exercise programs with balance as a component (level B), posture and tension management (level B), environmental hazard modification (level B), and treatment of cardiovascular disorders (level D). | Most current version of these practice guidelines; see the comments about each of the single interventions on page 669 of the original article. |
|                           |         | Class I: Evidence from at least 1 randomized controlled trial or meta-analysis of randomized controlled trials | Class I: Evidence from at least 1 controlled study without randomization or evidence or evidence from at least one other type of quasi-experimental study |         |
|                           |         | Class II: Evidence from nonexperimental studies, such as comparative studies, correlation studies, and case-controlled studies | Class II: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities |         |
|                           |         | Class III: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities | Class I evidence or extrapolated recommendation from class I evidence |         |
|                           |         | Class IV: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities | Class II evidence or extrapolated recommendation from class II evidence |         |
|                           |         | Class V: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities | Class III evidence or extrapolated recommendation from class III evidence |         |
|                           |         | Class VI: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities | Class IV evidence or extrapolated recommendation from class IV evidence |         |

* See also Norris MA, Walton RE, Patterson CJS, Feighner JW, Canadian Task Force on Preventive Health Care. Prevention of falls in long-term care facilities: systematic review and recommendations. CTFPHC Technical Report Jun 2003 [web document]. London, ON: Canadian Task Force on Preventive Health Care, 2003. [cited 18 Dec 2007]. <http://www.ctfphc.org/FullText/CTF_FallsPrevTR_Jun03.pdf>.

† See also American Geriatrics Society. Evidence tables associated with interventions and recommendations in “the prevention of falls in older persons” May 2001 [web document]. 2001. [cited 18 Dec 2007]. <http://www.americangeriatrics.org/news/pdf/InterventionFailable.pdf>.

D: Directly based on class IV evidence
C: Directly based on class III evidence
B: Directly based on class II evidence or extrapolated recommendation from class I evidence
A: Directly based on class I evidence

Evidence quality:
Class I: Evidence from at least 1 randomized controlled trial or meta-analysis of randomized controlled trials
Class II: Evidence from at least 1 controlled study without randomization or evidence or evidence from at least one other type of quasi-experimental study
Class III: Evidence from nonexperimental studies, such as comparative studies, correlation studies, and case-controlled studies
Class IV: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities
Class V: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities
Class VI: Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Recommendation strength:
A: Directly based on class I evidence
B: Directly based on class II evidence or extrapolated recommendation from class I evidence
C: Directly based on class III evidence or extrapolated recommendation from class I or II evidence
D: Directly based on class IV evidence or extrapolated recommendation from class I, II, or III evidence

Recommended interventions:
- Multifactorial interventions: Community-dwelling persons
  - Recommends a multifactorial intervention that includes: gait training and appropriate use of assistive device training (level B), review and modification of medications (level B), exercise programs with balance as a component (level B), posture and tension management (level B), environmental hazard modification (level B), and treatment of cardiovascular disorders (level D).
- Long-term care and assisted living settings
  - Multifactorial intervention recommended that includes the above plus: staff education programs (level B), gait training and assistive advice training (level B), and medication review and modification (level B).
- Acute hospitals
  - Insufficient evidence available to make recommendations for or against multifactorial interventions in acute hospital settings.
- Single interventions:
  1. Optimum type, duration, and intensity of exercise to prevent falls remain unclear (level B).
  2. Persons with recurrent falls should be offered physical therapy, exercise, and balance training (level B).
  3. Older persons living at home who are at increased risk for falls should have an environmental assessment performed by an occupational therapist or other qualified professional (level B).
  4. Patients with a history of falls should have their medications reviewed, especially persons taking 4 or more prescribed drugs or psychotropic medications (level C).
  5. Isolated use of assistive devices such as bed alarms, canes, and walkers without attention to other risk factors cannot be recommended (level C).
  6. Hip protectors do not appear to reduce the risk of falls (class I), but may be effective in preventing fractures in high-risk individuals.
  7. Behavioral and educational programs when used as an isolated intervention do not reduce falls (level B).

Single interventions with insufficient evidence:
- Bone strengthening medications
- Cardiovascular medication changes
- and cardiac pacing for syncope
- Visual assessment and management
- Footwear
- Physical restraints

* See also Norris MA, Walton RE, Patterson CJS, Feighner JW, Canadian Task Force on Preventive Health Care. Prevention of falls in long-term care facilities: systematic review and recommendations. CTFPHC Technical Report Jun 2003 [web document]. London, ON: Canadian Task Force on Preventive Health Care, 2003. [cited 18 Dec 2007]. <http://www.ctfphc.org/FullText/CTF_FallsPrevTR_Jun03.pdf>.

† See also American Geriatrics Society. Evidence tables associated with interventions and recommendations in “the prevention of falls in older persons” May 2001 [web document]. 2001. [cited 18 Dec 2007]. <http://www.americangeriatrics.org/news/pdf/InterventionFailable.pdf>.
| Author (date)          | Purpose/study design                                                                 | Methods                        | Results/outcomes                                                                 | Comments                                                                 |
|-----------------------|--------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Campbell et al. [46]  | Randomized controlled trial (2×2 factorial design) to examine the effects of 2 home-based falls intervention strategies (single or combined) in persons 75 years and older persons living in the community with severe visual impairment | 391 participants randomized to 1 of 4 falls intervention programs |
|                       | Interventions                                                                      |                                | Compliance                                                                      |                                                                          |
|                       | 1. Home safety assessment and modification program design for persons with poor vision and implemented by an occupational therapist (n=100) |                                | ■ Home safety program: Mean age of participants was 83.6 (SD4.8) years; range 75 to 96 years; 50% (152/3169) of subjects with follow-up data complied partially or completely with 1 or more home safety recommendations by the occupational therapist. |
|                       | 2. Home exercise program for leg muscle strengthening and balance retraining prescribed by a physical therapist plus vitamin D supplementation (n=97) |                                | ■ Home exercise program: 18% (36/195) of all subjects who completed the program complied with exercises 3 times per week; 36% complied at least 2 times per week during their participation in the trial; 44% (85/195) walked at least 2 times per week; 69% (199/195) took vitamin D supplements for 1 year. |
|                       | 3. Both interventions (n=98)                                                       |                                | Number of falls and falls injuries                                              |                                                                          |
|                       | Controls                                                                            |                                | ■ Home safety program resulted in 41% fewer falls compared to those who did not receive the program (e.g., home exercise program only, social visits); no significant difference in reduction of falls at home versus outside the home (incidence rate ratios 0.60, 0.31 to 1.17). |
|                       | 1 Two-hour social visits by research staff during first 6 months (n=96)             |                                | ■ Exercise program resulted in 15% more falls compared to those who did not receive it (e.g., home safety program only, social visits) (incidence rate ratio 1.15, 0.82 to 1.61), however the difference was not significant; rate of falls was 77% lower in participants who exercised at least 3 times per week compared with those who exercised less than once per week (P=0.001). |
|                       | Duration 12 months                                                                  |                                | Economic analysis                                                              |                                                                          |
| Faber et al. [48]     | Multicenter (n=15) randomized controlled trial to assess the effect of 2 falls prevention exercise programs versus control group on 278 pre-frail and frail elderly persons in long-term care centers (self-care residences and nursing care facilities) | Examine modifiability per fall event of each intervention in New Zealand dollars (SNZ) at 2004 prices compared to control participants | Incremental cost of implementing the home safety program per fall prevented was SNZ2650 (range SNZ460 to SNZ16569); equivalent to US$432 at 2004 prices; results reported for home safety program only because exercise program was not found effective in reducing falls. |
|                       | Participants                                                                        |                                | Participants                                                                     |                                                                          |
|                       | Mean age was 84.9 years (range 63–98); 79.0% were female; 51.1% (n=120) of participants were classified as pre-frail; 48.9% (n=115) were classified as frail. |                                | ■ More participants in the FW group suffered at least 1 fall (82.5%) compared to the IB (57.7%) and control (53.3%) groups, but the difference was not statistically significant (P=0.524). |
|                       | Fall incidence                                                                       |                                | Fall incidence                                                                  |                                                                          |
|                       | ■ More participants in the FW group suffered at least 1 fall (82.5%) compared to the IB (57.7%) and control (53.3%) groups, but the difference was not statistically significant (P=0.524). |                                | ■ Fall incidence rate was highest in FW group (3.3±5.6 falls) compared to the IB group (2.3±4.6) and the control group (2.5±4.6), but there was no statistical difference (P=0.278). |
|                       | Time to first fall                                                                  |                                | Time to first fall                                                              |                                                                          |
|                       | ■ No significant differences were found among groups in the time to first fall, however, per Kaplan-Meier curves, both intervention groups showed a pattern change in proportion of falls around week 11. Adjusted hazard ratios (HR) for the FW and IB groups relative to the control group were 1.59 (95% CI, 1.04–2.44) and 1.09 (95% CI, 0.72–1.64), respectively. |                                | ■ Both interventions combined as 1 exercise group showed an adjusted HR of 1.36 (95% CI, 0.94–1.98) when compared to controls, a nonsignificant difference in regard to time to first fall. |
|                       | Physical performance and disability                                                |                                | Physical performance and disability                                             |                                                                          |
|                       | ■ Both exercise groups showed a comparable intervention effect on physical performance and mobility, when combined and compared to controls, they showed a small but significant positive effect on mobility compared to control. |                                | ■ Post hoc analysis showed significant improvement in physical performance and mobility in pre-frail participants only. |
|                       | Post hoc analysis showed frailty to be a strong effect modifier (P<0.002). A nonsignificant fall risk-reducing effect was noted in the pre-frail subgroup, while a significant fall risk-increasing effect was noted in the frail subgroup. |                                | Exclude: persons who could not walk independently in their own home, were receiving physical therapy at recruitment, or could not understand the study requirements. |
|                       | Study was powered at 80% with a P-value of 0.05 and allowed for a 20% dropout rate. |                                | Study was powered at 80% with a P-value of 0.05 and allowed for a 20% dropout rate. |
|                       | Possible recall bias during data collection                                          |                                | Possible recall bias during data collection                                      |                                                                          |
|                       | Home safety program participants were telephoned once after 6 months and asked to report on completion of each recommendation for home modification and behavior change; call completion rate was 85%. Exercise program participants were asked to report adherence via monthly postcard calendars. |                                | Exclude: persons with impaired cognition and those who could not walk independently (walking aid or assistive device was allowed). |
|                       | Authors reported that inclusion criteria resulted in a heterogeneous sample with a wide range of medical conditions and functional limitations. |                                | Authors reported that inclusion criteria resulted in a heterogeneous sample with a wide range of medical conditions and functional limitations. |
|                       | Randomization was by center but not stratified; frail and pre-frail subgroups were distributed evenly across intervention groups. |                                | Randomization was by center but not stratified; frail and pre-frail subgroups were distributed evenly across intervention groups. |
|                       | Median relative compliance with intervention sessions was 88% for the FW and 84% for IB groups. |                                | Median relative compliance with intervention sessions was 88% for the FW and 84% for IB groups. |
|                       | Study may be underpowered due to randomization by center; percentage of fallers in control groups between centers ranged 0 to 83%; authors noted that recalculated power was 55% due to intercluster variability, which increased the needed sample size to 290 participants; only 232 participants were included in falls rate and risk analyses, however. |                                | Study may be underpowered due to randomization by center; percentage of fallers in control groups between centers ranged 0 to 83%; authors noted that recalculated power was 55% due to intercluster variability, which increased the needed sample size to 290 participants; only 232 participants were included in falls rate and risk analyses, however. |
These observations affirm your decision to include these reviews in your final pool of articles.

Turning next to the retrieval on individual clinical trials, you look for large, recent, well-designed studies with a patient population or setting that complements the selected systematic reviews. You note for your own background knowledge that most trials report the effectiveness of one or a combination of intervention strategies included in the reviews, such as group exercise, muscle strength and balance training, environmental modifications, psychotropic medication withdrawal or adjustment, nutritional supplementation, visual deficiency correction, home hazard modification, and tai chi. You also observe that a variety of trials assess the effectiveness of targeted and untargeted exercise programs ranging in duration from five to more than twenty weeks as an intervention to prevent or reduce the occurrence of falls in either community-dwelling or institutionalized patients [45-53]. Realizing that various intervention strategies exist and are examined for effectiveness individually or in combination (e.g., multifaceted) alerts you that you will need to select studies that incorporate both approaches to adequately represent the preventive options described in the literature.

After browsing through the PubMed records for randomized trials, you select 2 recent studies [46, 48] that appear to possess several key characteristics of a strong publication and that complement your selection of systematic reviews, given their unique focus. Two are large, multicenter, randomized controlled trials that involve patients >75 years old. One assesses the effects of either a home modification program, an exercise program plus vitamin supplements, both interventions, or social visits on the rate of falls in 391 community-dwelling patients with severe visual impairment [46]. The other examines the effect of an exercise program consisting of either walking or balance training on falls rate, physical performance, and disability in 278 pre-frail (1–2 frailty indicators) or frail (3+ frailty indicators) older adults in long-term care centers [48]. Looking more closely at the full text of the two studies, you select them for their strong study design, their assessment of individual interventions, and the uniqueness of the subject populations involved compared to the research covered by the guidelines and systematic reviews that you have already selected.

In addition to systematic reviews and individual randomized trials, you also browse the PubMed retrieval for recent general reviews of the literature that appear comprehensive, authoritative, and well written, such as the review by experts Rubenstein and Josephson [14] on the evidence for preventing falls in the elderly. You also skim the references in these articles for commonly cited studies described as important research as a strategy to locate studies not returned in your search retrieval. In this instance, this process contributes no unique material and confirms the selection of guidelines, systematic reviews, and studies that you have already made.

SUMMARIZING THE REFERENCES

The vast amount of research that has been conducted on accidental falls in the geriatric population, more specifically the myriad interventions examined, presents a challenge when considering the most effective way to summarize the evidence for this topic in a comprehensive yet concise manner. To organize your synthesis of the literature, the summary may contain an overall summary and table with three major sections: (1) systematic reviews, (2) practice guidelines, and (3) primary studies.

Key features to consider in summarizing individual research studies and systematic reviews include:

- **purpose of the study**: the primary objectives of the study
- **study design and sample size (including number of studies in systematic review)**: the strength and power of the study to produce statistically significant results from which to make meaningful conclusions
- **subjects and setting (including inclusion/exclusion criteria)**: scope and volume of the patient population examined and the environment in which the intervention(s) were administered
- **core methods or procedures (including search methodology of systematic review)**: information on the conditions under which the subjects were assessed and the duration of the study
- **intervention(s) and control group**: definition of the treatment group and whether or not a control was used as a comparison and the nature of the control (e.g., placebo, current standard of care)
- **salient results and outcomes**: significant findings that can then be translated into effective intervention strategies to prevent falls
- **study weaknesses and limitations**: supplementary data to readers to aid interpreting the study’s results and conclusions
- **financial sponsor of the research**: funding source and any financial stakeholders involved.

When summarizing the clinical practice guidelines, key features to consider may differ slightly from the features for research studies. They include:

- **authors and/or sponsoring organization(s)**: authority under which the guidelines were developed
- **publication date**: currency of the guideline
- **purpose and objectives**: scope of the guidelines regarding the patient population and setting as well as the intervention types and target outcomes
- **search methodology and publication date range**: comprehensiveness and consistency of the evidence on which the guidelines were based
- **primary recommendations**: suggested current standard of practice
- **evidence and recommendation grading use**: quality and sufficiency of the available research and the strength of the subsequent recommendations
- **brief comments on limitations or contextual details**: parameters under which the guideline recommendations do or do not apply.

In addition to including these key features, arranging the research and guidelines data into a tabular for-
such as study results and practice recommendations. After summarizing the selected systematic reviews and practice guidelines, you also develop a brief overview paragraph to describe to the clinician the findings from your overall search and synthesis of the literature on falls prevention strategies. This summary also brings together your general impressions of the current consensus on falls prevention strategies based on your background reading and data from the studies and guidelines you reviewed. Key elements contained in the overview paragraph may include:

- **broad lead and general consistency of the research literature (e.g., publication types and study designs):** quantity and quality of evidence available
- **subject and settings:** patient populations and settings to which the research applies
- **type and results of intervention strategies:** most effective strategies available and strategies shown to be ineffective or for which the evidence is inconclusive
- **scope, currency, and country of origin of related clinical practice guidelines:** the health care system under which the guidelines were developed and the authority and relevance of the practice recommendations to the clinical question at hand.

Figure 2 and Tables 2, 3, and 4 give an example of what each of these components of the literature summary for this question might look like.

**CONCLUDING REMARKS**

By identifying and synthesizing the literature on this topic, you are making an important contribution to clinical practice and medical staff training in the care of geriatric patients across multiple teaching settings and health care institutions. Your search and synthesis of the literature on accidental falls in the elderly provides your geriatrician colleague with a broad view of existing research and clinical recommendations that he can apply to all aspects of his practice as a geriatrician. Moving forward, he will use the evidence to inform clinical decision making and patient education in his primary care clinic at your medical center and at the other institutions for which he consults. For medical education, he will incorporate the findings into his teaching and training for medical students and medicine residents. He also comments that your summary will be useful during his assessment of the relevance and currency of the geriatrics-related curriculum for the medical school as it systematically increases geriatrics coverage in its courses and clerkships. Furthermore, he will use the evidence-based recommendations to augment professional or institutional committee meetings, as well as staff training related to patient safety and physical rehabilitation at affiliated nursing homes and home health agencies.

The impact of your work also will likely extend beyond solely the geriatrician’s activities. By applying the research evidence and guideline recommendations you provided, your medical center and its patients will benefit tremendously from improved quality of care. For example, the medical center may benefit through increased patient safety, as the evidence and recommendations are used to develop more effective falls reduction programs, staff training, safety protocols, and patient education. Instituting proven intervention strategies during patient encounters at outpatient clinics, such as the medical center’s adult primary care center and the nearby Veterans Administration hospital, will facilitate fewer accidental falls in the community, which has a growing population of elderly patients. Furthermore, applying the strategies outlined in your summary that have been shown to decrease the risk or rate of falls can translate into reduced costs to both the medical center and its patients by preventing the occurrence of severe health consequences commonly sustained during falls, such as death, fracture, lacerations, and head injury [54] and their subsequently high direct medical costs [55]. Finally, applying evidence-based falls prevention strategies to the clinical care of patients residing in the community as well as at the medical center and affiliated health care institutions can promote a reduction in the risk of mortality, pain, personal suffering, and loss of independence, thereby helping patients to maintain a better overall quality of life.

It is clear from these benefits that your expertise in searching the biomedical literature and synthesizing the available research evidence has made a valuable contribution that will substantially impact geriatric clinical care at your medical institution and the lives of the many patients it serves.

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**REFERENCES**

1. U.S. interim projections by age, sex, race, and Hispanic origin [web document]. Washington, DC: US Census Bureau, 2004. [rev. 18 Mar 2004; cited 1 Oct 2007].<http://www.census.gov/ipc/www/usinterimproj/>.

2. He W, Sengupta M, Velkoff V, DeBarros KA. 65+ in the United States [web document]. Washington, DC: US Government Printing Office, 2005. [rev. 5 Dec 2005; cited 1 Oct 2007].<http://www.census.gov/prod/2006pubs/p23-209.pdf>.

3. Kung HC, Hoyert DL, Xu J, Murphy SL. Deaths: preliminary data for 2005 [web document]. Atlanta, GA: Centers for Disease Control and Prevention, 2007. [rev. 12 Sept 2007; cited 11 Oct 2007].<http://www.cdc.gov/nchs/products/pubs/pubd/hestats/prelimdeaths05/prelimdeaths05.htm>.

4. Glover J. United States life tables 1890, 1901, 1910, and 1901–1910: explanatory text, mathematical theory, computations, graphs, and original statistics tables of United States life annuities life tables of foreign countries mortality tables of life insurance companies [web document]. Washington, DC: Government Printing Office, 1921. [cited 01 Oct 2007].<http://www.cdc.gov/nchs/products/pubs/pubd/lftbls/life/1890.htm>.

5. Institute of Medicine. The future health care workforce for...
older Americans [web document]. New York, NY: The National Academies, 2007. [rev. 1 May 2007; cited 19 Nov 2007].
6. Wenger NS, Roth CP, Shekelle P. Introduction to the assessing care of vulnerable elders—3 quality indicator measurement set. J Am Geriatr Soc 2007 Oct;55(suppl 2):S247–S252.
7. American Geriatrics Society Foundation for Health in Aging. What is geriatrics?: an introduction to health care for older adults [web document]. New York, NY: American Geriatrics Society, 1998. [rev. 1 Jan 1998; cited 08 Nov 2007].
8. Duthie EH. Practice of geriatrics. St Louis, MO: WB Saunders, 1998.
9. Areas of basic competency for the care of older patients for medical and osteopathic schools [web document]. New York, NY: American Geriatrics Society, 1998. [rev. 1 Jan 1998; cited 08 Nov 2007].
10. Fatalities and injuries from falls among older adults—United States, 1993–2003 and 2001–2005. MMWR Morb Mortal Wkly Rep 2006 Nov 17;55(45):1221–4.
11. WISQARS injury mortality reports, 1999–2004 [web document]. Atlanta, GA: Centers for Disease Control and Prevention, 2007. [cited 11 Oct 2007].
12. Walker JE, Howland J. Falls and fear of falling among elderly persons living in the community: occupational therapy interventions. Am J Occup Ther 1991 Feb;45(2):119–22.
13. Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, et al. The effect of an exercise-and balance training programme to reduce fall risk factors: a randomised controlled trial. Lancet 2003 Jul 19;362(9383):700–6.
14. Rubenstein LZ, Josephson KR. Falls and their prevention in elderly people: what does the evidence show? Med Clin North Am 2006 Sep;90(5):807–24.
15. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gooch B, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001 Mar;56(3):M146–M156.
16. Rubenstein LZ, Robbins AS, Josephson KR, Schulman BL, Osterweil DL. The value of assessing falls in an elderly population. a randomized clinical trial. Ann Intern Med 1990 Aug;113(4):308–16.
17. Naschir IL. Geriatrics. N Y Med J 1999;70(9):358–9.
18. Koenigsberg R, ed. Churchill’s illustrated medical dictionary. New York, NY: Churchill Livingstone, 1989.
19. The value of verifying board certification [web document]. Evanston, IL: American Board of Medical Specialties, 2007. [cited 08 Nov 2007] <http://www.abms.org/Who _WeHelp/ProfessionaLOrganizations/value.aspx>.
20. Reichek W, Gallo J. Essential principles in the care of the elderly. In: Reichek’s care of the elderly: clinical aspects of aging. Philadelphia, PA: Lippincott, Williams, and Wilkins, 1999.
21. PubMed MeSH database [web document]. Bethesda, MD: National Library of Medicine, 2007. [cited 13 Oct 2007].
22. Fried L. Epidemiology in aging: implications of an aging society. In: Goldstein L, Avisiello D, eds. Cecil textbook of medicine. 23rd ed. Philadelphia, PA: WB Saunders, 2004.
23. Fried LP, Walseen J. Frailty and failure to thrive. In: Hazzard WR, Blass JP, Ettinger WH, Halter JB, Ouslander J, eds. Principles of geriatric medicine and gerontology. 4th ed. New York, NY: McGraw Hill, 1999:1387–402.
24. Kiely DK, Kiel DP, Burrows AB, Lipsitz LA. Identifying nursing home residents at risk for falling. J Am Geriatr Soc 1998 May;46(5):551–5.
25. American Geriatrics Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the prevention of falls in older persons. J Am Geriatr Soc 2001 May;49(5):664–72.
26. National Institute for Health and Clinical Excellence. Clinical practice guideline for the assessment and prevention of falls in older people [web document]. London, UK: Royal College of Nursing, 2005. [rev. 2004 Nov; cited 19 Oct 2007].
27. National Guideline Clearinghouse (NGC) [web document]. Rockville, MD: Agency for Healthcare Research and Quality, 2007. [rev. 26 Nov 2007; cited 29 Nov 2007].
28. Falls and fall risk [web document]. Columbia, MD: American Medical Directors Association, 1998. National Guideline Clearinghouse. [cited 19 Oct 2007].
29. Resnick B. Preventing falls in acute care. In: Mezey M, Fulmer T, Abraham I, Zwicker DA, eds. Geriatric nursing protocols for best practice. 2nd ed. New York, NY: Springer Publishing Company, 2003:141–64.
30. Lyons SS. Fall prevention for older adults [web document]. Iowa City, IA: University of Iowa Gerontological Nursing Interventions Research Center, Research Dissemination Core, 2004. National Guideline Clearinghouse. [rev. Feb 2004; cited 19 Oct 2007].
31. Prevention of falls and fall injuries in the older adult [web document]. Toronto, ON: Registered Nurses Association of Ontario, 2005. National Guideline Clearinghouse. [rev 2004 Mar; cited 29 Nov 2007].
32. Norris MA, Walton RE, Patterson CSJ, Feightron JW. Prevention of falls in long-term care facilities [web document]. London, ON: Canadian Task Force on Preventive Health Care, 2005. [cited 19 Oct 2007].
33. Best Practice Committee, Health Care Association of New Jersey. Fall management guideline [web document]. Hamilton, NJ: The Association, 2007. [rev. Mar 2007; cited 19 Oct 2007].
34. Health statistics 2007 [web document]. Geneva, Switzerland: World Health Organization Press, 2007. [cited 26 Nov 2007].
35. Moreland J, Richardson J, Chan DH, O’Neill J, Bellisimo A, Grum RM, Shanks L. Evidence-based guidelines for the secondary prevention of falls in older adults. Gerontology 2003 Mar;49(2):93–116.
36. Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG, Rowe BH. Interventions for preventing falls in elderly people. Cochrane Database Syst Rev 2003;(4):CD000340.
37. McClure R, Turner C, Peel N, Spinks A, Eakin E, Hughes K. Population-based interventions for the prevention of fall-related injuries in older people. Cochrane Database Syst Rev 2005;(1):CD004441.
38. Lyons RA, John A, Brophy S, Jones SJ, Johansen A, Kemp A, Lannon S, Patterson J, Rolfe B, Sander I, Weightman A. Modification of the home environment for the reduction of injuries. Cochrane Database Syst Rev 2006;(4):CD003600.
39. O’Driscoll ND, Khoo KM, Pettit MA, Hulmnen A, Waterman C, Donaldson MC, Janssen PA, Mallinson A, Riddell L, Kruse K, Prior JC, Flicker L, McKay HA. Results of a 10-week community based strength and balance training programme to reduce fall risk factors: a randomised controlled
trial in 65–75 year old women with osteoporosis. Br J Sports Med 2001 Oct;35(5):348–51.
39. Shaw FE, Bond J, Richardson DA, Dawson P, Steen IN, McKeith IG, Kenny RA. Multifactorial intervention after a fall in older people with cognitive impairment and dementia presenting to the accident and emergency department: randomised controlled trial. BMJ 2003 Jan 11;326(7380):73.
40. Verhagen AP, Immink M, van der Meulen A, Bierma-Zeinstra SM. The efficacy of tai chi chuan in older adults: a systematic review. Fam Fract 2004 Feb;21(1):107–13.
41. Robertson MC, Campbell AJ, Gardner MM, Devlin N. Preventing injuries in older people by preventing falls: a meta-analysis of individual-level data. J Am Geriatr Soc 2002 May;50(5):905–11.
42. Chang JT, Morton SC, Rubenstein LZ, Mojica W A, Maglione M, Suttor MP, Roth EA, Shekelle PG. Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomised clinical trials. BMJ 2004 Mar 20;328(7441):680.
43. Oliver D, Connelly JB, Victor CR, Shaw FE, Whitehead A, Genc Y, Vanoli A, Martin FC, Gosney MA. Strategies to prevent falls and fractures in hospitals and care homes and effect of cognitive impairment: systematic review and meta-analyses. BMJ 2007 Jan 13;334(7584):82.
44. Ballard JE, McFarland C, Wallace LS, Holiday DB, Robertson G. The effect of 15 weeks of exercise on balance, leg strength, and reduction in falls in 40 women aged 65 to 89 years. J Am Med Womens Assoc 2004 Fall;59(4):255–61.
45. Campbell AJ, Robertson MC, La Grow SJ, Kerse NM, Sanderson GF, Jacobs RJ, Sharp DM, Hale LA. Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial. BMJ 2005 Oct 8;331(7520):817.
46. Delbaere K, Bourgois J, Van Den Noortgate N, Vanderstraeten G, Willems T, Cambier D. A home-based multidimensional exercise program reduced physical impairment and fear of falling. Acta Clin Belg 2006 Nov–Dec;61(6):340–50.
47. Faber MJ, Bosscher RJ, Chin A, Paw MJ, van Wieringen PC. Effects of exercise programs on falls and mobility in frail and pre-frail older adults: a multicenter randomized controlled trial. Arch Phys Med Rehabil 2006 Jul;87(7):885–96.
48. Luukinen H, Lehtola S, Jokelainen J, Vaananen-Sainio R, Lotvonen S, Koistinen P. Pragmatic exercise-oriented prevention of falls among the elderly: a population-based, randomised, controlled trial. Prev Med 2007 Mar;44(3):265–71.
49. Means RM, Rodell DE, O’Sullivan PS. Balance, mobility, and falls among community-dwelling elderly persons: effects of a rehabilitation exercise program. Am J Phys Med Rehabil 2005 Apr;84(4):238–50.
50. Morgan RO, Vink RG, Duque M, Abdel-Moty E, Devito CA. Low-intensity exercise and reduction of the risk for falls among at-risk elders. J Gerontol A Biol Sci Med Sci 2004 Oct;59(10):1062–7.
51. Skelton D, Dinan S, Campbell M, Rutherford O. Tailored group exercise (falls management exercise—FaME) reduces falls in community-dwelling older frequent fallers (an RCT). Age Ageing 2005 Nov;34(6):636–9.
52. Stevens JA, Corso PS, Finkelstein EA, Miller TR. The costs of fatal and non-fatal falls among older adults. Inj Prev 2006 Oct;12(5):290–5.

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