

## Fall Prevention Bibliography

### National Patient Safety Goals. Joint Commission on Accreditation of Healthcare Organizations.

Adkin, A.L., J.S. Frank, et al. (2003) "Fear of falling and postural control in Parkinson's disease." Mov Disord. **18**: 496-502.

**Abstract:** This study investigated the relationship between fear of falling (FOF) and qualitative and quantitative postural control in Parkinson's disease (PD). Fifty-eight nondemented PD patients were studied along with age-matched healthy controls. The degree of FOF was estimated using the Activities-specific Balance Confidence scale. Qualitative postural control was evaluated using a component of the Unified Parkinson Disease Rating Scale. Postural control was quantified, using centre of pressure measures obtained from a force plate, for eight standing balance tests of different challenges. The results showed that FOF was more evident for PD patients when compared with healthy individuals of similar age. Furthermore, FOF was significantly associated with a qualitative estimate of postural control in PD; individuals with PD who had a greater degree of posture impairment reported greater FOF. The results also showed that an estimate of FOF may help to explain quantitative postural instability in PD. FOF, when coupled with a qualitative estimate of postural control, was able to explain a greater amount of variation in quantitative balance performance for five of the eight balance tests. When considered independently, the qualitative measure of postural control, in general, could not well predict quantitative balance performance. The greater degree of FOF and its possible association with altered postural control suggests that FOF should be considered as an important, independent risk factor in the assessment and treatment of postural instability in patients with PD.

American Geriatrics Society, B.G.S., and American Academy of Orthopedic Surgeons Panel on Falls Prevention. "Guideline for the prevention of falls in older persons." J Am Geriatr Soc. **49**: 664-672.

Arfken, C.L., H.W. Lach, et al. (1994). "The prevalence and correlates of fear of falling in elderly persons living in the community." Am J Public Health **84**: 565-570.

*Objectives.* Fear of falling has been recognized as a potentially debilitating consequence of falling in elderly persons. However, the prevalence and the correlates of this fear are unknown. *Methods.* Prevalence of fear of falling was calculated from the 1-year follow-up of an age- and gender-stratified random sample of community-dwelling elderly persons. Cross-sectional associations of fear of falling with quality of life, frailty, and falling were assessed. *Results.* The prevalence of fear increased with age and was greater in women. After adjustment for age and gender, being moderately fearful of falling was associated with decreased satisfaction with life, increased frailty and depressed mood, and recent experience with falls. Being very fearful of falling was associated with all of the above plus decreased mobility and social activities. *Conclusions.* Fear of falling is common in elderly persons and is associated with decreased quality of life, increased frailty, and recent experience with falls.

Borouwer, P., L. Messelman, et al. (2004). "Physical function and health status among seniors with and without a fear of falling." Gerontology **50**: 135-141.

**BACKGROUND** Fear of falling (FF) is pervasive among older people and is an independent risk factor for decreased mobility and loss of quality of life. Although it is a serious health concern, little is known about the severity of the physical and health-related deficits in high-functioning fearful seniors. **OBJECTIVE:** This study examined the physical correlates of FF in community-dwelling seniors in relation to their non-fearful counterparts and also explored the relevance of recent fall history. **SUBJECTS:** Twenty-five volunteers who stated that they had curtailed their activities due to a FF and who reported themselves to be healthy participated. Non-fearful, age- and gender-matched subjects were also recruited and served as a comparison group. **METHODS:** This cross-sectional study had participants come to the laboratory on one occasion for about 1.5 h. Limits of balance stability, walking speed, and lower limb muscle strength were measured in random order. In addition, the SF-36, the Activities-specific Balance Confidence (ABC) scale and the Human Activity Profile questionnaires were completed to provide measures of health status, FF and activity levels, respectively. **RESULTS:** Subjects with a FF had lower ABC scores (69.8 +/- 10.2) than controls (90.2 +/- 7.9;  $p < 0.001$ ), and although they reported activity curtailment, the groups presented similar activity profiles ( $p > 0.05$ ). Balance ability was not compromised in seniors with a FF, although their walking speed was slower than that of control subjects ( $p < 0.004$ ). Lower limb weakness was significant in the FF group, which also reported low physical health. Perceived physical health, activity and hip flexor torque in combination accounted for almost 62% of the variance in ABC scores. Secondary analysis of the data from the FF group revealed a tendency for those who had fallen in the past year to restrict their limits of stability compared to those who had not fallen; though generally the effect sizes were small to moderate. **CONCLUSIONS:**

The marked deficits in strength and health status found among living independently in the community, who are in good health, but report being fearful of falling underscores the seriousness of FF as a potential health risk factor in the well elderly.

Brown, L.A., J.B. Doan, et al. (2006). "Anxiety-mediated gait adaptations reduce errors of obstacle negotiation among younger and older adults: implications for fall risk." Gait Posture **24**: 418-423.

The purpose of this study was to determine if anxiety-mediated gait adaptations can reduce the risk for falling among younger and older adults. Fourteen younger adults (23.14 ± 3.08 years) and 14 older adults (69.28 ± 5.41 years) participated in this study. Participants were asked to walk the length of a 7.20 m walkway and avoid contact with an obstacle that appeared suddenly underfoot at either 25% or 75% of the gait cycle duration. Testing was conducted in four conditions of postural threat. The obstacle was presented as a light beam and did not jeopardize balance when contacted. Fall risk was inferred from the frequency of obstacle contacts. Our findings indicated that obstacle contact frequency decreased when conservative gait patterns emerged. These findings imply that anxiety-mediated gait adaptations are beneficial in reducing the risk for falling among older adults and present the possibility that fear of falling may offer protective benefits for postural control. One possibility is that the beneficial effects of anxiety can only be realized among older adults who do not fear falling.

Burker, E.J., H. Wong, et al. (1995). "Predictions of fear of falling in dizzy and non-dizzy elderly." Psych Aging **10**: 104-110.

**Background** Approximately 30 per cent of people over 65 years of age and living in the community fall each year; the number is higher in institutions. Although less than one fall in 10 results in a fracture, a fifth of fall incidents require medical attention. **Objectives** To assess the effects of interventions designed to reduce the incidence of falls in elderly people (living in the community, or in institutional or hospital care).

Campbell, A.J., M.J. Borrie, et al. (1990). "Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study." Age Ageing **19**: 136-141.

A sample of 761 subjects 70 years and over was drawn from general-practice records of a rural township. Each subject was assessed and followed for 1 year to determine the incidence of and factors related to falls. The fall rate (number of falls per 100 person-years) increased from 47 for those aged 70-74 years to 121 for those 80 years and over. There was no sex difference in fall rate but men were more likely than women to fall outside and at greater levels of activity. Twenty per cent of falls were associated with trips and slips but we found no evidence that inspection of homes and installation of safety features would have decreased the fall rate. Ten per cent of falls resulted in significant injury. Men who fell had an increased subsequent risk of death compared with those who did not fall (relative risk 3.2, 95% CI 1.7-6.0). Subsequent mortality was increased among women who fell but not to significant levels (relative risk 1.6, 95% CI 0.9-2.7).

Chang, J.T., S.C. Morton, et al. (2004). "Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomized controlled trials." BMJ **328**: 680-686.

**Objective** To assess the relative effectiveness of interventions to prevent falls in older adults to either a usual care group or control group. **Design** Systematic review and meta-analyses. **Data sources** Medline, HealthSTAR, Embase, the Cochrane Library, other health related databases, and the reference lists from review articles and systematic reviews. **Data extraction** Components of falls intervention: multifactorial falls risk assessment with management programme, exercise, environmental modifications, or education. **Results** 40 trials were identified. A random effects analysis combining trials with risk ratio data showed a reduction in the risk of falling (risk ratio 0.88, 95% confidence interval 0.82 to 0.95), whereas combining trials with incidence rate data showed a reduction in the monthly rate of falling (incidence rate ratio 0.80, 0.72 to 0.88). The effect of individual components was assessed by meta-regression. A multifactorial falls risk assessment and management programme was the most effective component on risk of falling (0.82, 0.72 to 0.94, number needed to treat 11) and monthly fall rate (0.63, 0.49 to 0.83; 11.8 fewer falls in treatment group per 100 patients per month). Exercise interventions also had a beneficial effect on the risk of falling (0.86, 0.75 to 0.99, number needed to treat 16) and monthly fall rate (0.86, 0.73 to 1.01; 2.7). **Conclusions** Interventions to prevent falls in older adults are effective in reducing both the risk of falling and the monthly rate of falling. The most effective intervention was a multifactorial falls risk assessment and management programme. Exercise programmes were also effective in reducing the risk of falling.

Cooper, C., G. Campion, et al. (1992). "Hip fractures in the elderly: a world-wide projection." Osteoporosis Int. **2**: 285-289.

Hip fractures are recognized to be a major public health problem in many Western nations, most notably those in North America, Europe and Oceania. Incidence rates for hip fracture in other parts of the world are generally lower than those reported for these predominantly Caucasian populations, and this has led to the belief that osteoporosis represents less of a problem to the nations of Asia, South American and Africa. Demographic changes in the next 60 years, however, will lead to huge increases in the elderly populations of those countries. We have applied available incidence rates for hip fracture from various parts of the world to projected populations in 1990, 2025 and 2050 in order to estimate the numbers of hip fractures which might occur in each of the major continental regions. The projections indicate that the number of hip fractures occurring in the world each year will rise from 1.66 million in 1990 to 6.26 million by 2050. While Europe and North America account for about half of all hip fractures among elderly people today, this proportion will fall to around one quarter in 2050, by which time steep increases will be observed throughout Asia and Latin America. The results suggest that osteoporosis will truly become a global problem over the next half century, and that preventive strategies will be required in parts of the world where they are not currently felt to be necessary

Cooper, C. (1997). "The crippling consequences of fractures and their impact on quality of life." Am J Med **103 (suppl 2A)**: 12S-17S.

Around 40% of white women and 13% of white men in the United States have at least one fragility fracture after the age of 50 years. The risk of fracture increases with advancing age and progressive loss of bone mass, and varies with the population being considered. The age-adjusted incidence of fragility fractures in both sexes is 25% lower in Britain and many areas of Europe than in the United States. Mortality 5 years after hip or vertebral fracture is about 20% in excess of that expected; mortality rate is highest in men > 75 years suffering from a variety of chronic diseases. Most excess deaths occur in the first 6 months after hip fracture. One year after hip fracture, 40% of patients are still unable to walk independently, 60% have difficulty with at least one essential activity of daily living, and 80% are restricted in other activities, such as driving and grocery shopping. Moreover, 27% of these patients enter a nursing home for the first time. Less is known of the epidemiology of vertebral fractures and of the associated mortality and morbidity. Although an estimated 30% of postmenopausal U.S. white women have osteoporosis, and 1 in 4 has at least one vertebral deformity, two thirds of vertebral fractures remain undiagnosed. After a clinically diagnosed vertebral fracture, survival rate decreases gradually from that expected without fracture. Women with severe vertebral deformities have a consistently higher risk of back pain and height loss. An accurate assessment of the risk of fractures associated with osteoporosis and of their impact on quality of life is essential if appropriate and cost-effective interventions are to be designed for different populations.

Cumming, R.G., G. Salkeld, et al. (2000). "Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission." J Gerontol A Biol Sci Med Sci **55A**: M299-M305.

**Background.** The aim of this study was to assess the impact of fear of falling on the health of older people.  
**Methods.** A total of 528 subjects (mean age 77 years) were recruited from two hospitals in Sydney, Australia, and followed for approximately 12 months. Eighty-five subjects died during follow-up, and 31 were admitted to an aged care institution. Tinetti's Falls Efficacy Scale (FES) was successfully administered to 418 subjects as part of the baseline assessment. Among those with baseline FES scores, ability to perform 10 activities of daily living (ADLs) was assessed at baseline and follow-up in 307 subjects, and SF-36 scores were assessed at baseline and follow-up in 90 subjects recruited during the latter part of the study. Falls during follow-up were identified using a monthly falls calendar. **Results.** Compared with those with a high fall-related self-efficacy (FES score 5-100), those with a low fall-related self-efficacy (FES score # 75) had an increased risk of falling (adjusted relative risk 2.09, 95% confidence interval [CI] 1.31-3.33). Those with poorer fall-related self-efficacy had greater declines in ability to perform ADLs ( $p < .001$ ): the total ADL score decreased by 0.69 activities among persons with low FES scores (# 75) but decreased by only 0.04 activities among persons with FES scores of 100. Decline in ADLs was not explained by the higher frequency of falls among persons with low FES scores. SF-36 scores (particularly scores on the Physical Function and Bodily Pain subscales) tended to decline more among persons with poor fall-related self-efficacy. Nonfallers who said they were afraid of falling had an increased risk of admission to an aged care institution. **Conclusions.** Fear of falling has serious consequences for older people. Interventions that successfully reduce fear of falling and improve fall-related self-efficacy are likely to have major health benefits.

Evitt, C.P. and P.A. Quigley (2004). "Fear of falling in older adults: a guide to its prevalence, risk factors, and consequences." Rehabil Nurs **29**: 207-210.

Fear of falling, defined as a lack of self-confidence that one may avoid falls while doing everyday activities, may have serious consequences for elderly people. This article examines the prevalence, risk factors, and consequences of fear of falling in the elderly population; methods for assessing those fears; and suggests evidence-based interventions.

Incorporating successful strategies into programs to reduce falling can result in improved patient outcomes as well as decreased healthcare utilization and costs.

Friedman, S.M., B. Munoz, et al. (2002). "Falls and fear of falling: which comes first? A longitudinal prediction model suggest strategies for primary and secondary prevention." J Am Geriatr Soc. **50**: 1329-1335.

*Objective.* To identify correlates of falling and fear of falling, and to examine how fear of falling affects activities among adults with rheumatoid arthritis (RA). *Methods.* Adults (mean age 54.2 years; SD 9.1) with RA (n = 128) responded to questions related to falls, fear of falling, and activities modified. Other measures included the Profile of Mood States Short Form, the McGill Pain Questionnaire Short Form, walk time, grip strength, predicted maximum oxygen uptake, and joint count. *Results.* Thirty-five percent of participants fell during the previous year. Subjects who fell had more comorbid conditions than subjects who did not fall. Almost 60% were fearful of falling. Compared with subjects who denied fear of falling, fearful subjects had longer walk times, more comorbid conditions, and more intense pain. Activities affected most by fear of falling involved heavy work and climbing. *Conclusions.* The number of comorbid conditions plays an important role in falling and fear of falling in adults with RA. Knowledge of this and other factors, such as pain intensity and functional status, can facilitate appropriate interventions.

Gillespie, L.D., W.J. Gillespie, et al. (2003). "Interventions for preventing falls in elderly people." Cochrane Database Syst Rev **4**: CD000340.

**Background** Approximately 30 per cent of people over 65 years of age and living in the community fall each year; the number is higher in institutions. Although less than one fall in 10 results in a fracture, a fifth of fall incidents require medical attention. **Objectives** To assess the effects of interventions designed to reduce the incidence of falls in elderly people (living in the community, or in institutional or hospital care). Included in this updated review are 62 trials reporting a variety of settings, participants, and interventions. Seventy one percent of the studies are in two categories: 23 trials studied exercise or physical therapy interventions and 21 trials examined multidisciplinary, multifactorial risk factor screening and intervention.

Hausdorff, J.M., D.A. Rios, et al. (2001). "Gait variability and fall risk in community living older adults: a 1-year prospective study." Arch Phys Med Rehabil. **82**: 1050-1056.

**OBJECTIVE:** To test the hypothesis that increased gait variability predicts falls among community-living older adults attending an outpatient clinic. **DESIGN:** Prospective, cohort study. **SETTING:** Three outpatient geriatric clinics. **PARTICIPANTS:** Fifty-two community-living, ambulatory men and women aged  $\geq 70$  years. **INTERVENTIONS:** Not applicable. **MAIN OUTCOME MEASURES:** Subjects walked at a normal pace for up to 6 minutes wearing force-sensitive insoles that measured the gait rhythm on a stride-to-stride basis. Afterward, subjects reported fall status on a weekly basis for 1 year. The primary outcomes were the association between measures of the stride-to-stride fluctuations in gait rhythm and (1) subsequent falls during a 12-month follow-up period and (2) potential contributing factors. **RESULTS:** Almost 40% of the subjects reported falling during the 12-month follow-up period. Stride time variability was  $106 \pm 30$  ms in subjects who subsequently fell (n = 20) and  $49 \pm 4$  ms in those who did not experience a fall (n = 32) during the 12-month follow-up period (p < .04). Logistic regression also showed that stride time variability predicted falls (p < .05). Stride time variability correlated significantly with multiple factors including strength, balance, gait speed, functional status, and even mental health, but these other measures did not discriminate future fallers from non fallers. **CONCLUSIONS:** These findings show both the feasibility of obtaining stride-to-stride measures of gait timing in the ambulatory setting and the potential use of gait variability measures in augmenting the prospective evaluation of fall risk in community-living older adults.

He, W., M. Sengupta, et al. (2005). 65+ in the United States. Census Bureau, Current Population Reports. Washington, D.C., U.S. Government Printing Office.

Hornbrook, M. C., V.J. Stevens, et al. (1994). "Preventing Falls among community dwelling elderly adults." Gerontologist **34**: 16-23.

A randomized trial of falls prevention program that addressed home safety, exercise, and behavioral risks was conducted with 3,182 independently living HMO members age 65 and older. The intervention decreased the odds of falling by 0.85, but only reduced the average number of falls among those who fell by 7%. The effect was strongest among men age 75 and older. The likelihood of avoiding falls requiring medical treatment was not significantly affected by the intervention. We

conclude that the intervention dose was not of sufficient intensity or duration to have a marked protective effect on older persons. Future research should focus on more intensive intervention approaches because serious falls do not appear to be amenable to low-intensity environment/behavioral efforts.

Jamison, M., G.B. Neuberger, et al. (2003). "Correlates of fear of falling and activity limitation among persons with rheumatoid arthritis." Arthritis Rheum **49**: 673-680.

*Objective.* To identify correlates of falling and fear of falling, and to examine how fear of falling affects activities among adults with rheumatoid arthritis (RA). *Methods.* Adults (mean age 54.2 years; SD 9.1) with RA (n = 128) responded to questions related to falls, fear of falling, and activities modified. Other measures included the Profile of Mood States Short Form, the McGill Pain Questionnaire Short Form, walk time, grip strength, predicted maximum oxygen uptake, and joint count. *Results.* Thirty-five percent of participants fell during the previous year. Subjects who fell had more comorbid conditions than subjects who did not fall. Almost 60% were fearful of falling. Compared with subjects who denied fear of falling, fearful subjects had longer walk times, more comorbid conditions, and more intense pain. Activities affected most by fear of falling involved heavy work and climbing. *Conclusions.* The number of comorbid conditions plays an important role in falling and fear of falling in adults with RA. Knowledge of this and other factors, such as pain intensity and functional status, can facilitate appropriate interventions.

Leape, L.L. and D.M. Berwick (2005). "Five years after "To Err Is Human: what we have learned"." JAMA **293**: 2384-2390.

Five years ago, the Institute of Medicine (IOM) called for a national effort to make health care safe. Although progress since then has been slow, the IOM report truly "changed the conversation" to a focus on changing systems, stimulated a broad array of stakeholders to engage in patient safety, and motivated hospitals to adopt new safe practices. The pace of change is likely to accelerate, particularly in implementation of electronic health records, diffusion of safe practices, team training, and full disclosure to patients following injury. If directed toward hospitals that actually achieve high levels of safety, pay for performance could provide additional incentives. But improvement of the magnitude envisioned by the IOM requires a national commitment to strict, ambitious, quantitative, and well-tracked national goals. The Agency for Healthcare Research and Quality should bring together all stakeholders, including payers, to agree on a set of explicit and ambitious goals for patient safety to be reached by 2010.

Li, F., K.J. Fisher, et al. (2003). "Fear of falling in elderly persons: association with falls, functional ability, and quality of life." J Gerontol B Psychol Sci Soc Sci **58**: P283-P290.

This study examined heterogeneity in response patterns of the participants of the Survey of Activities and Fear of Falling in the Elderly (SAFFE) and their relationships to falls, functional ability, quality of life, and activity restriction measures in a cohort of 256 older people (mean age 77.5 years). Participants recruited from local primary care clinics were administered the SAFFE instrument, an activity restriction measure, a combination of self-reported and performance-based functional ability tests, and quality-of-life measures. Latent class analyses identified two classes: Class 1 (n = 209), which had a low SAFFE fear of falling, and Class 2 (n = 47), which had a high SAFFE fear of falling. Subsequent analyses of variance indicated that the two-class (low fear and high fear) SAFFE fear of falling profiles discriminated fallers from nonfallers, and low and high levels of functional ability, activity restriction, and quality of life. The findings from this study suggest that variations in the SAFFE response patterns on a single dimension of fear of falling and that high levels of fear of falling measured by the SAFFE are linked to a range of adverse health consequences.

Lord, S.R. (2006). "Visual risk factors for falls in older people." Age Ageing **35 (suppl 2)**: ii42-ii45.

Poor vision reduces postural stability and significantly increases the risk of falls and fractures in older people. Most studies have found that poor visual acuity increases the risk of falls. However, studies that have included multiple visual measures have found that reduced contrast sensitivity and depth perception are the most important visual risk factors for falls. Multifocal glasses may add to this risk because their near-vision lenses impair distance contrast sensitivity and depth perception in the lower visual field. This reduces the ability of an older person to detect environmental hazards. There is now evidence that maximizing vision through cataract surgery is an effective strategy for preventing falls. Further randomized controlled trials are required to determine whether individual strategies (such as restriction of use of multifocal glasses) or multi-strategy visual improvement interventions can significantly reduce falls in older people. Public health initiatives are required to raise awareness in older people and their caregivers of the importance of regular eye examinations and use of appropriate prescription glasses.

LT Kohn, C.J., Donaldson MS, eds (1999). To err is human: Building a safer health system. Washington D.C., Institute of Medicine, National Academy Press.

Magaziner, J., W. Hawkes, et al. (2000). "Recovery from hip fracture in eight areas of function." J Gerontol A Biol Sci Med Sci **55A**: M498-M507.

**Background.** This report describes changes in eight areas of functioning after a hip fracture, identifies the point at which maximal levels of recovery are reached in each area, and evaluates the sequence of recuperation across multiple functional domains. **Methods .** Community-residing hip fracture patients (n = 674) admitted to eight hospitals in Baltimore, Maryland, 1990–1991, were followed prospectively for 2 years from the time of hospitalization. Eight areas of function (i.e., upper and lower extremity physical and instrumental activities of daily living; gait and balance; social, cognitive, and affective function) were measured by personal interview and direct observation during hospitalization at 2, 6, 12, 18, and 24 months. Levels of recovery are described in each area, and time to reach maximal recovery was estimated using Generalized Estimating Equations and longitudinal data. **Results.** Most areas of functioning showed progressive lessening of dependence over the first postfracture year, with different levels of recovery and time to maximum levels observed for each area. New dependency in physical and instrumental tasks for those not requiring equipment or human assistance prefracture ranged from as low as 20.3% for putting on pants to as high as 89.9% for climbing five stairs. Recuperation times were specific to area of function, ranging from approximately 4 months for depressive symptoms (3.9 months), upper extremity function (4.3 months), and cognition (4.4 months) to almost a year for lower extremity function (11.2 months). **Conclusions .** Functional disability following hip fracture is significant, patterns of recovery differ by area of function, and there appears to be an orderly sequence by which areas of function reach their maximal levels.

McKee, J.J., S. Orvell, et al. (2002). "Fear of falling, falls efficacy, and health outcomes in older people following hip fracture." Disabil Rehabil. **24**: 327-333.

**Purpose:** This study sought to determine whether fear of falling and falls efficacy independently contribute to the prediction of health outcomes after a fall, controlling for length of stay in hospital, prefall activity problems, and history of falls. **Method:** Eighty-two older people (565 years) admitted to hospital as a result of a fall, with proximal femoral fracture, were interviewed to assess variables of interest. At two months after initial interview, participants (n=57) were re-interviewed in their own home, and their functional limitation and further fall events were assessed. Regression analyses were carried out to determine the ability of the variables assessed in hospital to predict functional limitation and further falls post discharge. **Results:** Perceived risk of falling and falls efficacy did not explain variance in functional limitation when added to a model containing biomedical factors. In the prediction of further falls, addition of falls efficacy and worry over further falls to a model containing biomedical factors resulted in a statistically reliable improvement, although falls efficacy was not independently associated with outcome. **Conclusions:** Assessing worry over further falls in hospital may help to identify older people with hip fracture at risk of poor health outcomes.

Murphy, S.L.. (2000). Deaths: final data for 1998. Natl Vital Stat Rep. **48**:1-15.

Murphy, S.L., C.S. Williams, et al. (2002). "Characteristics associated with fear of falling and activity restriction in community-living older persons." J Am Geriatr Soc. **50**: 516-520.

**OBJECTIVES:** To identify the characteristics associated with restricting activity because of fear of falling (activity restriction) and to determine which characteristics distinguish older persons who restrict activity from those who have fear of falling but do not restrict their activities (fear of falling alone). **DESIGN:** Population-based cross-sectional study. **SETTING:** General community. **PARTICIPANTS:** One thousand sixty-four community-living persons aged 72 and older. **MEASUREMENTS:** Candidate predictors were identified from the following domains: demographic, health status, physical, psychosocial, and fall-related. The outcome measure was the report of no fear of falling, fear of falling alone, or activity restriction. **RESULTS:** Fifty-seven percent of the cohort reported no fear of falling, 24% reported fear of falling alone, and 19% reported restricting activity. The proportion of participants with poor health status, slow timed physical performance, activities of daily living disability, and poor psychosocial function was highest in those with activity restriction, intermediate in those with fear of falling alone, and lowest in those with no fear of falling. Of participants with fear of falling, characteristics independently associated with activity restriction were history of an injurious fall, slow timed physical performance, two or more chronic conditions, and depressive symptoms. **CONCLUSION:** Older persons who restrict activity are more physically frail and have a greater burden of chronic conditions and depressive symptoms than those who have fear of falling alone. These differences between persons with fear of falling may guide the refinement of clinical interventions and preventative programs.

Prevention, C.f.D.C.a. (2004). Web-based Injury Statistics Query and Reporting System (WISQRS) Leading causes of death reports.

Rubenstein, L.Z., K.R. Josephson, et al. (1994). "Falls in the nursing home." Ann Intern Med **121**: 442-451.

OBJECTIVE: To review the epidemiology and causes of falls and fall-related injuries in nursing homes and to provide clinicians with a structured framework to evaluate and treat nursing home residents at risk for falls. DATA SOURCES: All large-scale published studies documenting incidence, causes, risk factors, and preventive strategies for falls in nursing homes were reviewed. RESULTS: The mean incidence of falls in nursing homes is 1.5 falls per bed per year (range, 0.2 to 3.6 falls). The most common precipitating causes include gait and balance disorders, weakness, dizziness, environmental hazards, confusion, visual impairment, and postural hypotension. The most important underlying risk factors for falls and injuries include some of these same items and others, such as lower-extremity weakness, gait and balance instability, poor vision, cognitive and functional impairment, and sedating and psychoactive medications. Many strategies for the prevention of falls have been tried, with mixed success. The most successful consider the multifactorial causes of falls and include interventions to improve strength and functional status, reduce environmental hazards, and allow staff to identify and monitor high-risk residents. Strategies that reduce mobility through use of restraints have been shown to be more harmful than beneficial and should be avoided. CONCLUSIONS: A focused history and physical examination after a fall can usually determine both the immediate underlying causes of the fall and contributing risk factors. In addition, regular evaluations in the nursing home can help identify patients at high risk who can then be targeted for specific treatment and prevention strategies.

Stalenhoef, P.A., J.P. Diederiks, et al. (2002). "A risk model for the prediction of recurrent falls in community-dwelling elderly: a prospective cohort study." J Clin Epidemiol **55**: 1088-1094.

The object of this article was to determine the predictive value of risk factors for recurrent falls and the construction of a fall risk model as a contribution to a mobility assessment for the identification of community-dwelling elderly at risk for recurrent falling in general practice. The design was a prospective cohort study (n = 311). There were four primary health care centers. A sample stratified on previous falls, age, and gender of community-dwelling elderly persons aged 70 years or over (n = 311) was taken from the respondents to a mail questionnaire (n = 1660). They were visited at home to assess physical and mental health, balance and gait, mobility and strength. A 36-week follow-up with telephone calls every 6 weeks was conducted. Falls and fall injuries were measured. During follow-up 197 falls were reported by 33% of the participants: one fall by 17% and two or more falls by 16%. Injury due to a fall was reported by 45% of the fallers: 2% hip fractures, 4% other fractures, and 39% minor injuries. A fall risk model for the prediction of recurrent falls with an area under the curve (AUC) of 0.79, based on logistic regression analysis, showed that the main determinants for recurrent falls were: an abnormal postural sway (OR 3.9; 95% CI 1.3-12.1), two or more falls in the previous year (OR 3.1; 95% CI 1.5-6.7), low scores for hand grip strength (OR 3.1; 95% CI 1.5-6.6), and a depressive state of mind (OR 2.2; 95% CI 1.1-4.5). To facilitate the use of the model for clinical practice, the model was converted to a "desk model" with three risk categories: low risk (0-1 predictor), moderate risk (two predictors), and high risk (> or =3 predictors). A fall risk model converted to a "desk model," consisting of the predictors postural sway, fall history, hand dynamometry, and depression, provides added value in the identification of community-dwelling elderly at risk for recurrent falling and facilitates the prediction of recurrent falls.

Sterling, D.A., J.A. O'Connor, et al. (2001). "Geriatric falls: injury severity is high and disproportionate to mechanism." J Trauma **50**: 116-119.

OBJECTIVE: Falls are a well-known source of morbidity and mortality in the elderly. Fall-related injury severity in this group, however, is less clear, particularly as it relates to type of fall. Our purpose is to explore the relationship between mechanism of fall and both pattern and severity of injury in geriatric patients as compared with a younger cohort. METHODS: Our trauma registry was queried for all patients evaluated by the trauma service over a 412-year period (1994-1998). Two cohorts were formed on the basis of age greater than 65 or less than or equal to 65 years and compared as to mechanism, Injury Severity Score (ISS), Abbreviated Injury Scale score, and mortality. RESULTS: Over the study period, 1,512 patients were evaluated, 333 greater than 65 years and 1,179 less than or equal to 65 years of age. Falls were the injury mechanism in 48% of the older group and 7% of the younger group (p < 0.05). Falls in the older group constituted 65% of patients with ISS >15, with 32% of all falls resulting in serious injury (ISS >15). In contrast, falls in the younger group constituted only 11% of ISS >15 patients, with falls causing serious injury only 15% of the time (both p < 0.05). Notably, same-level falls resulted in serious injury 30% of the time in the older group versus 4% in the younger group (p < 0.05), and were responsible for an ISS >15 30-fold more in the older group (31% vs. <1%; p < 0.05). Abbreviated Injury Scale evaluation revealed more frequent head/neck (47% vs. 22%), chest (23% vs. 9%), and pelvic/extremity (27% vs. 15%) injuries in the older group for all falls (all p < 0.05). The mean ISS for same-level falls in the older group was twice that for the younger group (9.28 vs. 4.64, p < 0.05), whereas there was no difference in mean ISS between multilevel and

same-level falls within the older group itself (10.12 vs. 9.28,  $p > 0.05$ ). The fall-related death rate was higher in the older group (7% vs. 4%), with falls seven times more likely to be the cause of death compared with the younger group (55% vs. 7.5%) (both  $p < 0.05$ ). Same-level falls as a cause of death was 10 times more common in the elderly (25% vs. 2.5%,  $p < 0.05$ ). CONCLUSION: Falls among the elderly, including same-level falls, are a common source of both high injury severity and mortality, much more so than in younger patients. A different pattern of injury between older and younger fall patients also exists.

Stevens, J.A. and S. Olson (2000). "Reducing falls and resulting hip fractures among older women." MMWR Recomm Rep **49**: 3-12.

SCOPE OF THE PROBLEM: Fall-related injuries are the leading cause of injury deaths and disabilities among older adults (i.e., persons aged  $\geq 65$  years). The most serious fall injury is hip fracture; one half of all older adults hospitalized for hip fracture never regain their former level of function. In 1996, a total of 340,000 hospitalizations for hip fracture occurred among persons aged  $\geq 65$  years, and 80% of these admissions occurred among women. From 1988 to 1996, hip fracture hospitalization rates for women aged  $\geq 65$  years increased 23%. ETIOLOGIC OR RISK FACTORS: Risk factors for falls include increasing age, muscle weakness, functional limitations, environmental hazards, use of psychoactive medications, and a history of falls. Age is also a risk factor for hip fracture. Women aged  $\geq 85$  years are nearly eight times more likely than women aged 65-74 years to be hospitalized for hip fracture. White women aged  $\geq 65$  years are at higher risk for hip fracture than black women. Other risk factors for hip fracture include lack of physical activity, osteoporosis, low body mass index, and a previous hip fracture. RECOMMENDATIONS FOR PREVENTION: Because approximately 95% of hip fractures result from falls, minimizing fall risk is a practical approach to reducing these serious injuries. Research demonstrates that effective fall prevention strategies require a multifaceted approach with both behavioral and environmental components. Important elements include education and skill building to increase knowledge about fall risk factors, exercise to improve strength and balance, home modifications to reduce fall hazards, and medication assessment to minimize side effects (e.g., dizziness and grogginess). PROGRAM AND RESEARCH NEEDS: Coordination needs to be improved among the diverse Federal, state, and local organizations that conduct fall prevention activities. The effectiveness of existing fall prevention programs among specific groups of women (e.g., those aged  $\geq 85$  years or living with functional limitations) needs careful evaluation. New primary fall prevention approaches are needed (e.g., characterizing footwear that promotes stability), as well as secondary prevention strategies (e.g., protective hip pads) that can prevent injuries when falls occur. Finally, efforts are needed to increase collaboration among national experts from various disciplines, to reach consensus regarding priority research areas and program issues, and to work toward long-term strategies for reducing falls and fall-related injuries among older adults. CONCLUSION: Persons aged  $\geq 65$  years constitute the fastest-growing segment of the U.S. population. Without effective intervention strategies, the number of hip fractures will increase as the U.S. population ages. Fall prevention programs have reduced falls and fall-related injuries among high-risk populations using multifaceted approaches that include education, exercise, environmental modifications, and medication review. These programs need to be evaluated among older adults aged  $\geq 65$  years who are living independently in the community. In addition, secondary prevention strategies are needed to prevent hip fractures when falls occur. Effective public health strategies need to be implemented to promote behavioral changes, improve current interventions, and develop new fall prevention strategies to reduce future morbidity and mortality associated with hip fractures among older adults.

Stevens, J.A and E.D. Sogolow (2005). "Gender differences for non-fatal unintentional fall-related injuries among older adults." Injury Prev **11**: 115-119.

Objectives: To quantify gender differences for non-fatal unintentional fall related injuries among US adults age 65 years and older treated in hospital emergency departments (EDs). Methods: The authors analyzed data from a nationally representative sample of ED visits for January 2001 through December 2001, available through the National Electronic Injury Surveillance System All Injury Program (NEISS-AIP). For each initial ED visit, coders record one principal diagnosis (usually the most severe) and one primary part of the body affected. Results: Based on 22 560 cases, an estimated 1.64 million older adults were treated in EDs for unintentional fall injuries. Of these, approximately 1.16 million, or 70.5%, were women. Fractures, contusions/abrasions, and lacerations accounted for more than three quarters of all injuries. Rates for injury diagnoses were generally higher among women, most notably for fractures which were 2.2 times higher than for men. For all parts of the body, women's injury rates exceeded those of men. Rate ratios were greatest for injuries of the leg/foot (2.3), arm/hand (2.0), and lower trunk (2.0). The hospitalization rate for women was 1.8 times that for men. Conclusions: Among older adults, non-fatal fall related injuries disproportionately affected women. Much is known about effective fall prevention strategies. We need to refine, promote, and implement these interventions. Additional research is needed to tailor interventions for different populations and to determine gender differences in the underlying causes and/or circumstances of falls. This information is vital for developing and implementing targeted fall prevention strategies.

Stevens, J.A., G. Ryan, et al. (2006). "Fatalities and injuries from falls among older adults: United States, 1993-2003 and 2001-2005." MMWR **55**: 1221-1224.

Unintentional falls are a common occurrence among older adults, affecting approximately 30% of persons aged  $\geq 65$  years each year. The injuries received from a fall can result in death, disability, nursing-home admission, and direct

medical costs. In 2003, a total of 13,700 persons aged > or =65 years died from falls, and 1.8 million were treated in emergency departments (EDs) for nonfatal injuries from falls. Falls cause the majority of hip fractures, which often result in long-term functional impairments that might require admission to a nursing home for a year or more. To examine trends in fatal and nonfatal falls among older persons, CDC analyzed U.S. rates of 1) fatalities from falls (during 1993-2003), 2) hospitalizations for hip fractures (1993-2003), and 3) nonfatal injuries resulting from falls in persons treated in EDs (2001-2005). This report summarizes the results of those analyses, which indicated that, during 1993-2003, the overall rate of fatal falls among persons aged > or =65 years increased, and the rate of hospitalizations for hip fractures decreased; during 2001-2005, the change in the overall rate of nonfatal injuries from falls was not statistically significant. However, disparities by sex existed for all three measures. Certain interventions can reduce falls (e.g., exercising regularly or having medicines reviewed to reduce side effects and interactions), but implementation at the community level remains limited, and additional measures are needed to promote widespread adoption.

Suzuki, M., N. Ohyama, et al. (2002). "The relationship between fear of falling, activities of daily living, and quality of life among elderly individuals." Nurs health Sci **4**: 155-161.

The purpose of the present study was to examine the relationship between functional disability and fear of falling during daily activities. Also examined was the relationship between fear of falling and health-related Quality of Life (QOL). Health-related QOL concepts were measured using the Short Form 36 Health Survey (SF-36) within an elderly day services sample. Eligible subjects were elderly persons using Day Service (type B) who were capable of independently answering a questionnaire and had no memory problems. Forty-three males and 92 females were eligible for this study. Forty-nine (36.3%) subjects expressed no fear of falling, whereas 22 (16.3%) reported that they were very fearful of falling. Among females, walking and bathing had a highly significant relationship with the fear of falling. The fear of falling can contribute to psychological conditions such as depression, and also impacts on the health-related QOL of frail elderly people. Thus, it is critical to provide integrated health care activities for these individuals that address both psychological well-being and physical functioning.

Tideiksaar, R. (1997). *Falling in Old Age: Prevention and Management*. New York, Springer Publishing Co.

Tinetti, M.E., M. Speechley, et al. (1988). "Risk factors for falls among elderly persons living in the community." N Engl J Med **319**: 1701-1707.

To study risk factors for falling, we conducted a one-year prospective investigation, using a sample of 336 persons at least 75 years of age who were living in the community. All subjects underwent detailed clinical evaluation, including standardized measures of mental status, strength, reflexes, balance, and gait; in addition, we inspected their homes for environmental hazards. Falls and their circumstances were identified during bimonthly telephone calls. During one year of follow-up, 108 subjects (32 percent) fell at least once; 24 percent of those who fell had serious injuries and 6 percent had fractures. Predisposing factors for falls were identified in linear-logistic models. The adjusted odds ratio for sedative use was 28.3; for cognitive impairment, 5.0; for disability of the lower extremities, 3.8; for palmomental reflex, 3.0; for abnormalities of balance and gait, 1.9; and for foot problems, 1.8; the lower bounds of the 95 percent confidence intervals were 1 or more for all variables. The risk of falling increased linearly with the number of risk factors, from 8 percent with none to 78 percent with four or more risk factors (P less than 0.0001). About 10 percent of the falls occurred during acute illness, 5 percent during hazardous activity, and 44 percent in the presence of environmental hazards. We conclude that falls among older persons living in the community are common and that a simple clinical assessment can identify the elderly persons who are at the greatest risk of falling.

Tinetti, M.E. and L. Powell (1993). "Fear of falling and low self-efficacy: a case of dependence in elderly person." J Gerontol **48**: 35-38.

VanSchoor, N.M., J.H. Smit, et al. (2003). "Prevention of hip fractures by external hip protectors: a randomized controlled trial." JAMA **289**: 1957-1962.

Vellas, B.J., S.J. Wayne, et al. (1997). "Fear of falling and restriction of mobility in elderly fallers." Age Ageing **26**: 189-193.

**Objectives:** to identify the characteristics of elderly persons who develop a fear of falling after experiencing a fall and to investigate the association of this fear with changes in health status over time. **Design:** a prospective study of falls over a 2-year period (1991-92). Falls were ascertained using bimonthly postcards plus telephone interview with a standardized

(World Health Organisation) questionnaire for circumstances, fear of falling and consequences of each reported fall. Each participant underwent a physical exam and subjective health assessment each year from 1990 to 1993- **Setting:** New-Mexico Aging Process Study, USA **Subjects:** 487 elderly subjects (> 60 years) living independently in the community. **Main outcome measures:** fear of falling after experiencing a fall. **Results:** 70 (32%) of 219 subjects who experienced a fall during the 2 year study period reported a fear of falling. Women were more likely than men to report fear of falling (74% vs 26%). Fallers who were afraid of falling again had significantly more balance (31.9% vs 12.8%) and gait disorders (31.9% vs 7.4%) at entry in the study in 1990. Among sex, age, mental status, balance and gait abnormalities, economic resource and physical health, logistic regression analysis show gait abnormalities and poor self-perception of physical health, cognitive status and economic resources to be significantly associated with fear of falling. Subjects who reported a fear of falling experienced a greater increase in balance ( $P = 0.08$ ), gait ( $JP < 0.01$ ) and cognitive disorders ( $P = 0.09$ ) over time, resulting in a decrease in mobility level. **Conclusion:** the study indicated that about one-third of elderly people develop a fear of falling after an incident fall and this issue should be specifically addressed in any rehabilitation program.

Vellas, B.J., S.J. Wayne et al. (1998). "A two-year longitudinal study of falls in 482 community-dwelling elderly adults." J Gerontol A Biol Sci Med Sci **53**: M264-M274.

Yardley, L. and H. Smith (2002). "A prospective study of the relationship between feared consequences of falling and avoidance of activity in community-living older people" Gerontologist **2002**(42)

**Purpose:** To identify the most common beliefs concerning the negative consequences of falling and determine whether these motivate avoidance of activity. **Design and Methods:** A questionnaire assessing feared consequences of falling was completed by 224 community-living people aged older than 75. Beliefs about the consequences of falling were related to demographic characteristics, falling history, and avoidance of activity. The questionnaires were completed again by 166 participants 6 months later. **Results:** Commonly feared consequences of falling were loss of functional independence and damage to identity. These fears were correlated with avoidance of activity (after adjusting for age, sex, and recent falling history) and predicted avoidance in activity 6 months later (after adjusting for baseline levels of avoidance). **Implications:** Concerns about damage to social identity, as well as functional incapacity, are common and may motivate avoidance of activity.