Special Article

FALLS, INJURIES DUE TO FALLS, AND THE RISK OF ADMISSION TO A NURSING HOME

MARY E. TINETTI, M.D., AND CHRISTIANNA S. WILLIAMS, M.P.H.

ABSTRACT

Background Falls warrant investigation as a risk factor for nursing home admission because falls are common and are associated with functional disability and because they may be preventable.

Methods We conducted a prospective study of a probability sample of 1103 people over 71 years of age who were living in the community. Data on demographic and medical characteristics, use of health care, and cognitive, functional, psychological, and social functioning were obtained at base line and one year later during assessments in the participants' homes. The primary outcome studied was the number of days from the initial assessment to a first long-term admission to a skilled-nursing facility during three years of follow-up. Patients were assigned to four categories during follow-up: those who had no falls, those who had one fall without serious injury, those who had two or more falls without serious injury, and those who had at least one fall causing serious injury.

Results A total of 133 participants (12.1 percent) had long-term admissions to nursing homes. In an unadjusted model, the risk of admission increased progressively, as compared with that for the patients with no falls, for those with a single noninjurious fall (relative risk, 4.9; 95 percent confidence interval, 3.2 to 7.5), those with multiple noninjurious falls (relative risk, 8.5; 95 percent confidence interval, 3.4 to 21.2), and those with at least one fall causing serious injury (relative risk, 19.9; 95 percent confidence interval, 12.2 to 32.6). Adjustment for other risk factors lowered these ratios to 3.1 (95 percent confidence interval, 1.9 to 4.9) for one noninjurious fall, 5.5 (95 percent confidence interval, 2.1 to 14.2) for two or more noninjurious falls, and 10.2 (95 percent confidence interval, 5.8 to 17.9) for at least one fall causing serious injury, but the association between falls and admission to a nursing home remained strong and significant. The population attributable risk of long-term admission to a nursing home for these three groups (the proportion of admissions directly attributable to the three categories of falls) was 13 percent, 3 percent, and 10 percent, respectively.

Conclusions Among older people living in the community falls are a strong predictor of placement in a skilled-nursing facility; interventions that prevent falls and their sequelae may therefore delay or reduce the frequency of nursing home admissions. (N Engl J Med 1997;337:1279-84.)

BETWEEN 3 percent and 5 percent of persons over the age of 65 years are admitted to a skilled-nursing facility in this country each year.[1,2] The lifetime risk of admission to a nursing home for people who are 65 years old is about 45 percent for women and 28 percent for men.[3,4] Older age, female sex, white race, living alone, lack of social support, physical and mental impairment, limitations on the ability to perform activities of daily living, and the presence of specific medical conditions have all been identified as predictors of placement in a skilled-nursing facility.[1-7] Falls and injuries caused by falls are another group of risk factors for institutionalization that warrant further investigation, particularly since they are potentially modifiable.

Thirty percent of people over the age of 65 years who live in the community fall each year; this proportion increases to 50 percent by the age of 80 years.[8-10] Each year, at least 10 percent of older people have a serious injury caused by a fall, such as a fracture, joint dislocation, or severe head injury.[11-13] Such falls and the injuries they cause are associated with pain, loss of confidence, and restricted activity.[8,11,12,14] Although in earlier studies, interventions targeted to nursing home residents[15,16] or nonspecific interventions[17-19] proved ineffective in reducing the rate of falls, several recent programs have been more successful.[20-23] Indeed, in three clinical studies among older persons living in the community, the rate of falling in the group assigned to the intervention was 25 to 40 percent lower than that in the control group.[20-22]

Falling has been found in previous studies to be associated with subsequent admission to a nursing home.[24-26] Important factors that might confound the relation between falling and institutionalization have not always been controlled for in these studies. Indeed, the relation between falls and subsequent placement in a skilled-nursing facility was less strong after adjustment for the ability to perform activities of daily living in one study.[26] Only falls that had oc-

From the Department of Internal Medicine, Yale University School of Medicine, 333 Cedar St., P.O. Box 208025, New Haven, CT 06520-8025, where reprint requests should be addressed to Dr. Tinetti.

curred before the base-line interview — up to four years before placement in a skilled-nursing facility — were considered in this study, however, and there was no differentiation between injurious and noninjurious falls.[26] We undertook the present study to determine whether, and to what extent, falls and injuries due to falls are independently associated with the risk of admission to a skilled-nursing facility.

METHODS

Participants

The participants represented a probability sample of residents of New Haven, Connecticut, who were at least 72 years of age and living in the community. To recruit participants, we conducted a census of all 2483 age-restricted housing units in the city (i.e., those designed for older persons), as described previously.[13,27] In addition, every 62nd non–age-restricted housing unit, identified through utility listings, was sampled, along with the next 12 addresses, to be screened for the possible inclusion of residents in the study. Of the 1436 persons 72 years of age or older who were identified in these households during the base-line interviews, conducted from October 1989 through August 1990, only 44 (3 percent) were deemed ineligible because they did not speak English, Spanish, or Italian; could not follow simple commands; or were not ambulatory within their own households. Among the 1392 eligible participants, 1103 (79 percent) agreed to be enrolled.

Base-Line Data Collection

Base-line interviews and assessments were completed in participants' homes by trained nurses, who obtained information on each participant's age, sex, race, marital status, living situation, type of housing (public age-restricted, private age-restricted, or non–age-restricted), previous admissions to nursing homes, and history of falls and injuries due to falls. Chronic conditions were identified from the participants' statements about whether a doctor had ever told them that they had a myocardial infarction, stroke, cancer, diabetes mellitus, arthritis, or Parkinson's disease, and whether they had ever had a hip fracture, other fracture since they reached 50 years of age, or amputation.

The Folstein Mini–Mental State Examination, the depression scale of the Center for Epidemiologic Study (CES-D), and the Spielberger State–Trait Anxiety Inventory were administered to assess mental status, depressive symptoms, and anxiety, respectively.[28-30] Participants were asked about their ability to perform seven "basic" activities of daily living (eating, grooming, bathing, dressing, transferring from bed to chair, using the toilet, and walking across a room) and four "instrumental" activities of daily living (shopping, light housework, heavy housework, and using transportation) without the help of another person.[31,32] The questions about the perceived availability of instrumental social support (i.e., help with instrumental activities of daily living) and emotional social support were adapted from the New Haven Established Populations for Epidemiologic Studies of the Elderly questionnaire.[33] Each participant completed the Falls Efficacy Scale, rating on a 10-point scale how confident he or she felt about carrying out each of 10 activities of daily living without falling (total score, 0 to 100).[34]

Hearing was assessed by the whisper test.[35] Corrected near visual acuity was assessed with the Rosenbaum card; visual impairment was calculated as a percentage.[36] Body-mass index was calculated as the weight in kilograms divided by the square of the height in meters, on the basis of the values reported by the participants. The participants were grouped according to whether their body-mass index was low, intermediate, or high, as follows: for men, <23.0, 23.0 through 26.3, and ≥ 26.4; for women, <22.4, 22.4 through 26.3, and ≥ 26.4. Each participant completed a battery of six timed physical-performance tasks — foot taps, standing up from a chair three times, turning in a full circle, bending over, completing a 6-m (20-ft) rapid-pace walk, and signing his or her name. These six measures were rescaled and summed so that the final score on the physical-performance battery ranged from 0 (indicating the worst level of physical function) to 6 (indicating the best).

A second face-to-face assessment, during which the questionnaires and physical assessments were repeated, was conducted a median of 12 months after the base-line interview.

Assessment of Falls

Falls, defined as unintentional movements to the floor or ground, were ascertained by means of monthly "fall calendars" completed daily by the participants.[13] Calendars were mailed back at the end of each month; participants were contacted by telephone if the calendars were not returned or if a fall was recorded. Serious injuries incurred in falls included fractures and joint dislocations; head injuries resulting in the loss of consciousness and hospitalization; joint injuries, other than dislocations, that resulted in hospitalization or decreased activity; and internal injuries resulting in hospitalization. These injuries were ascertained from a combination of hospital records, emergency department records, and participants' reports, with use of a previously described algorithm.[13] Patients were assigned to four categories according to their status with respect to falls: those with no falls, those with one fall without serious injury, those with at least two falls without serious injury, and those with one or more falls causing serious injury.

Admission to a Skilled-Nursing Facility

Connecticut has a long-term care registry to which, since 1977, all skilled-nursing facilities have been required to report admissions. Information on the length of stay, admitting diagnosis, and payer status are reported for all residents. We submitted identifying data on all members of the study cohort (Social Security number, name, date of birth, sex, and race) to the registry, which identified matches with residents listed. One questionable match that could not be confirmed with additional information available in the cohort files was considered a nonmatch. Registry data were obtained for the period from October 1985 through September 1993, thus giving us complete data on nursing home admissions for the entire follow-up period as well as four years before the beginning of the study. The outcome was defined as the first admission to a skilled-nursing facility during study follow-up (defined as the time from the base-line interview through 30 days after the 3-year assessment, or 37 months if the participant was not reassessed) for which Medicare was not the sole payer. We excluded stays that were entirely covered by Medicare in order to eliminate admissions for short-term restorative or rehabilitative care after surgery or medical illnesses or for rehabilitation after falls resulting in injuries such as a hip fracture. We further stipulated that the stay must be of at least two weeks' duration.

Statistical Analysis

The covariates were selected because of their potential association either with the fall-related variables or with admission to a skilled-nursing facility. For modeling purposes, the covariates were grouped into several categories. The demographic variables included age, sex, race, education level, living arrangements, and type of housing. The psychosocial–cognitive variables included the scores on the CES-D, the Spielberger State–Trait Anxiety Inventory, the Falls Efficacy scale, the Folstein Mini–Mental State Examination, and the perceived amount of instrumental and emotional support received. The health-related and functional variables included the number of chronic conditions, body-mass index, degree of visual impairment, degree of hearing deficit, number of hospitalizations for reasons other than injury during the follow-up period (based on continuous review of discharges from the two local acute care hospitals), history of previous nurs-

ing home stays, the seven-item basic-activities-of-daily-living scale, the four-item instrumental-activities-of-daily-living scale, and the summed score on the physical-performance battery.

Bivariate associations between each of the base-line covariates and admission to a skilled-nursing facility were assessed with use of the chi-square test for categorical variables and t-tests for continuous variables. To test the crude association between the participant's status with regard to falls and admission to a skilled-nursing facility, we classified each participant according to the most serious category that he or she had been in at any time before admission to a skilled-nursing facility (or the end of study follow-up or death, for those without a stay in a skilled-nursing facility).

We examined the overall distribution of each continuous variable and the pattern of its association with both status with respect to falls and placement in a nursing home in order to determine whether there was an obvious threshold value or whether the variable should be treated continuously. We also considered accepted clinical cutoffs for a given variable (e.g., a score $\geq$16 on the CES-D). We then constructed proportional-hazards models including only fall status and a single covariate, in order to test which type of measurement of the covariate had the greatest effect on the regression coefficients for fall status. For all continuous variables, we also tested for higher-order effects by examining a model that included both a linear and a quadratic term. The quadratic term was maintained if the P value for its association with admission to a skilled-nursing facility was less than 0.1 or if it produced a marked reduction in the coefficients for fall status as compared with the linear term alone. For variables with a substantial amount of missing data (>5 percent), we categorized the variable so as to adjust as well as possible for confounding and then included "missing" as an additional category. The score on the CES-D, the State–Trait Anxiety Inventory, and body-mass index were treated in this way. The categories for body-mass index were established separately for men and women.

Multivariate analysis was carried out with use of proportional-hazards regression with time-dependent covariates. The outcome was the number of days from the base-line interview to a first admission to a skilled-nursing facility that met our criteria; data on participants without an admission were censored at the time of death or at the end of study follow-up, as appropriate. In constructing the time-dependent covariates for fall status, we assumed that the effect of a fall would last three months; thus, when a fall occurred, the participant was counted in the appropriate category with respect to falls from the date of the fall until three months later. At that point, unless another fall had occurred, the participant was recategorized as having no falls until another fall occurred or until the end of follow-up. The number of hospitalizations for reasons other than injury was also updated continuously, according to the dates of hospital admission; thus, this time-dependent covariate represented the cumulative total of non–injury-related hospitalizations. The other covariates, which were assessed at base line and at the one-year follow-up interview, were updated at the time of the one-year interview. If participants had missing data at the one-year follow-up interview, base-line values of the covariates were maintained. Because there is no software currently available to compute weighted proportional hazards with time-dependent covariates, we instead added dummy variables for the type of housing to account for the stratified sampling design.

A series of hierarchical proportional-hazards models was constructed, in which each category of covariates was successively added. The first model included only the dummy variables for fall status, and the final model included all three groups of covariates. The population attributable risk of placement in a nursing home associated with fall status (i.e., the proportion of the admissions that were directly attributable to each category of fall) was calculated from this final model according to the following formula: $(100 \times \text{prevalence} \times (\text{hazard ratio} - 1)) \div (\text{prevalence} \times (\text{hazard ratio} - 1) + 1)$. Prevalence was calculated as the number of person-years of observation with the risk factor, divided by the total number of person-years of observation. The final model was repeated with participants assigned to their most serious category with respect to falls throughout the remainder of follow-up, rather than reverting to the "no-falls" category after three months.

RESULTS

Nursing Home Admissions

Of the 1103 members of the cohort, 165 (15.0 percent) had at least one stay in a skilled-nursing facility during follow-up. Twenty-nine participants had stays that were covered completely by Medicare, and three had stays of less than two weeks. Thus, a total of 133 participants (12.1 percent) had stays in skilled-nursing facilities that met our criteria for long-term care. Of these 133, 12 had an earlier nursing home stay that was entirely covered by Medicare. The median time from base line to admission was 601 days (range, 10 to 1151). Forty-seven participants remained in a skilled-nursing facility at the end of follow-up. For the remaining 86 participants, who either died in the nursing home (12 patients) or were discharged (74), the median length of stay was 135 days.

Bivariate Analyses

As shown in Table 1, several characteristics were associated with admission to a skilled-nursing facility in bivariate analyses. Many of these characteristics were also associated with the participants' status with respect to falls. When the data were analyzed according to participants' most serious fall status before admission to a skilled-nursing facility or censoring of data, fall status was significantly associated with nursing home placement ($P<0.001$). The bivariate relation between the category with respect to falls and the risk of admission to a skilled-nursing facility during each of the three years of follow-up was similar to that shown in Table 1 for the entire follow-up period.

Among the 137 participants with a serious injury due to a fall during follow-up, 95 had fractures (33 of the hip, 7 of the pelvis, 13 of other sites in the leg or foot, 7 of the humerus, 15 of other sites in the arm or hand, 17 of ribs or vertebrae, 2 of facial bones, and 1 of unknown type); 12 had serious joint injuries; 2 had intracranial injuries; and 28 had other serious injuries necessitating medical care and a reduction in activity.

Table 2 shows the results of the series of proportional-hazards models. In the unadjusted model, even a single, noninjurious fall was associated with an elevated risk of placement in a nursing home. Participants with multiple noninjurious falls had a higher risk than those with a single fall, whereas those with one or more falls that caused serious injury were at the highest risk of placement in a skilled-nursing facility. The sequential adjustment for the covariates lowered the hazard ratios associated with falling, but for each category of status with respect to falls the relation remained statistically significant. The population attributable risk of placement in a skilled-nurs-

TABLE 1. BASE-LINE CHARACTERISTICS AND STATUS WITH RESPECT TO FALLS OF 1103 PARTICIPANTS WITH AND WITHOUT A STAY IN A SKILLED-NURSING FACILITY.*

CHARACTERISTIC	STAY IN SKILLED-NURSING FACILITY		P VALUE
	YES (N=133)	NO (N=970)	
Age (yr)†	83.3±5.8	79.1±5.0	<0.001
Female sex (%)†	75.2	72.6	0.525
White race (%)	89.5	83.2	0.064
Education (yr)	9.3±3.5	9.6±3.6	0.354
Type of housing (%)			0.003
Private, age-restricted	69.9	55.2	
Public, age-restricted	9.8	10.6	
Non–age-restricted	20.3	34.2	
Living situation (%)			0.071
Married	17.3	24.0	
Living with others	6.0	9.2	
Living alone	76.7	66.8	
No. of chronic conditions†‡	1.3±1.0	1.4±1.1	0.746
No. of medications†	4.1±2.6	3.7±2.7	0.156
Score on Folstein MMSE <20 (%)†§	30.2	10.3	<0.001
Score on CES-D scale (%)†¶			<0.001
≥16	26.3	19.0	
0–15	50.4	68.9	
Missing	23.3	12.2	
Spielberger State–Trait Anxiety Inventory (%)†‖			0.002
≥32	48.9	42.6	
0–31	32.3	46.7	
Missing	18.8	10.7	
Instrumental social support‡			0.008
Not needed	8.0	18.0	
Available	80.8	75.2	
Not available	11.2	6.9	
Emotional social support†‡			0.088
Not needed	16.9	17.2	
Available	68.5	74.3	
Not available	14.5	8.5	
Body-mass index (%)†‡			<0.001
Low	42.9	30.1	
Intermediate	24.8	31.8	
High	21.8	32.6	
Missing	10.5	5.6	
Visual impairment (%)†‡			<0.001
<40	37.8	62.0	
40–75	37.8	24.9	
>75	24.4	13.1	
No. of words missed on whisper test‡	4.8±4.7	2.7±3.9	<0.001
Urinary incontinence ≥1 time/wk (%)†	23.7	13.1	<0.001
No previous stay in skilled-nursing facility (%)†	87.2	96.3	<0.001
Score on physical-performance battery†‡**	3.9±1.2	4.6±0.9	<0.001
Falls Efficacy score †††	73.2±27.7	86.1±19.6	<0.001
Any disability in ADL (%)†‡	28.6	10.8	<0.001
No. with disabilities in instrumental ADL†‡	1.8±1.4	1.1±1.2	<0.001
No. of non–injury-related hospitalizations (%)†‡‡			<0.001
0	44.4	67.2	
1	27.8	19.0	
≥2	27.8	13.8	
Status with respect to falls§§			<0.001
No falls	24.8	50.6	
1 Fall without serious injury	23.3	22.3	
≥2 Falls without serious injury	22.6	17.0	
≥1 Fall with serious injury	29.3	10.1	

*Plus–minus values are means ±SD. P values are from chi-square tests in the case of categorical variables and t-tests in the case of continuous variables. The characteristics are presented in the form used in the models. A "missing" category is shown if one was included in the models (see the Methods section).

†This characteristic was significantly associated with status with respect to falls ($P<0.05$ by the chi-square test for categorical variables, and by analyses of variance for continuous variables). MMSE denotes Mini–Mental State Examination, and ADL activities of daily living.

‡See the Methods section for definitions.

§Scores on the Folstein Mini–Mental State Examination[28] range from 0 to 30, with higher scores indicating better cognitive status.

¶Scores on the Center for Epidemiologic Study — Depression scale[29] (CES-D) range from 0 to 60, with higher scores indicating more depressive symptoms.

‖Scores on the Spielberger State–Trait Anxiety Inventory[30] range from 20 to 80, with higher scores indicating greater anxiety.

**On this battery of tests, higher summary scores indicate faster performance of tasks.

††On this scale, higher scores indicate greater confidence.

‡‡Non–injury-related hospitalizations were defined as admissions for reasons other than the treatment of fall-related injuries at any time from the base-line interview until admission to a skilled-nursing facility, death, or the end of follow-up.

§§In this tabulation, participants were assigned to the highest (worst) category for which they met the criteria during follow-up.

ing facility for each category of fall was calculated on the basis of the full proportional-hazards model (model 4 in Table 2). The population attributable risks were 13 percent for one noninjurious fall, 3 percent for two or more noninjurious falls, and 10 percent for at least one fall causing serious injury. The cumulative attributable risk for the three categories of falls was thus 26 percent. The adjusted relative risks from the final model, in which participants maintained their worst fall status from the time of the fall until the end of follow-up, were 3.1 (95 percent confidence interval, 1.7 to 5.4) for one noninjurious fall, 5.0 (95 percent confidence interval, 2.7 to 9.2) for two or more noninjurious falls,

TABLE 2. HAZARD RATIOS FOR ADMISSION TO A SKILLED-NURSING FACILITY ASSOCIATED WITH FALLS AND INJURY DUE TO FALLS.*

MODEL NO.	COVARIATES	1 FALL WITHOUT SERIOUS INJURY	≥2 FALLS WITHOUT SERIOUS INJURY	≥1 FALL WITH SERIOUS INJURY
		hazard ratio (95% confidence interval)		
1	Fall status only	4.9 (3.2–7.5)	8.5 (3.4–21.2)	19.9 (12.2–32.6)
2	Fall status and demographic characteristics	4.2 (2.7–6.6)	7.1 (2.8–17.7)	16.6 (10.0–27.6)
3	Fall status, demographic characteristics, and psychosocial and cognitive characteristics	3.7 (2.4–5.8)	5.3 (2.1–13.5)	12.3 (7.2–21.1)
4	Fall status, demographic characteristics, psychosocial and cognitive characteristics, and health-related and functional characteristics	3.1 (1.9–4.9)	5.5 (2.1–14.2)	10.2 (5.8–17.9)

*Fall status was maintained for three months after a fall; the participant was then considered to have no falls until another event occurred. Demographic characteristics included in the models were age (in years), sex, race (white, as compared with other), years of education, type of housing (public, age-restricted or non–age-restricted, as compared with private, age-restricted), and living situation (married or living with others, as compared with living alone). Psychosocial and cognitive characteristics included were the score on the CES-D (≥16 or unknown, as compared with 0 to 15), the score on the State–Trait Anxiety Inventory (≥32 or unknown, as compared with 0 to 31), Falls Efficacy score (0 through 100), emotional and instrumental social support (not available or not needed, as compared with available), and the score on the Folstein Mini–Mental State Examination (<20 as compared with 20 to 30). Health-related and functional characteristics included were the number of chronic conditions, body-mass index (low, high, or missing, as compared with intermediate), degree of visual impairment (<40 percent, 40 to 75 percent, or >75 percent), degree of hearing impairment (number of words missed on the whisper test), number of non–injury-related hospitalizations (0, 1, or ≥2), urinary incontinence (≥1 time per week), number of medications, previous nursing home admissions, any impairment in activities of daily living, instrumental-activities-of-daily-living score (0 through 4), and score on the physical-performance battery (linear and quadratic terms).

and 11.6 (95 percent confidence interval, 6.6 to 20.5) for one or more falls causing serious injury. The attributable risks were 25 percent, 27 percent, and 38 percent, respectively.

DISCUSSION

In this prospective study of a representative cohort of older persons living in the community, we found an independent relation between falls and long-term placement in a skilled-nursing facility. The relation between falls and nursing home admission remained strong even after sequential adjustments for the other factors known to be associated either with falls or with placement in a skilled-nursing facility.

From this observational study, we cannot establish a direct cause-and-effect relation between falls and placement in a skilled-nursing facility. Our methods and analyses were designed, however, to assess the evidence of an association in an unbiased manner. First, both falls and admissions were ascertained prospectively. Short stays in a skilled-nursing facility and stays that might have occurred only for rehabilitation after a fall were excluded from the analysis. The matching between the cohort and the long-term care registry data sets was performed with use of a carefully designed and validated algorithm by personnel unaware of the status of participants with respect to falls. Second, the fact that in each case the fall preceded admission to a nursing home was ensured by prospective and continuous monitoring of both risk factors and outcomes. Third, we ensured a close temporal relation between falls and admissions by limiting the duration of a particular status with respect to falls to the three months after the event. Fourth, we adjusted for a large number of potential confounders through our hierarchical, multivariate models. In order to provide a conservative estimate of the risk associated with falls, we selected the measurement strategy for each confounder (continuous or categorical with the cutoff set at the best threshold) that most strongly affected the coefficients for fall status. As expected, because the covariates were known to be associated both with falling and with placement in a skilled-nursing facility, the strength of the relation was lessened somewhat by these adjustments. It is possible that additional unmeasured factors confounded the relation between status with respect to falls and placement in a skilled-nursing facility even though we adjusted for data on a wealth of physical, psychological, cognitive, and social factors measured at base line and during follow-up.

The mechanisms by which falls and injuries due to falls lead to placement in a skilled-nursing facility are plausible and readily apparent. Falls have been shown to result in a decline in function as a result both of physical injury and of a loss of confidence with regard to the ability to perform functional activities.[37] Indeed, the reduction in the hazard ratios for each category of status with respect to falls when physical performance and functional disability were added to the model suggests that decline in function might partially, albeit not totally, explain the increased risk of placement in a skilled-nursing facility among elderly people who fall. Furthermore, the inability to get up after a fall, reported by up to half of people who fall, was previously found to be associated with placement in a skilled-nursing facility.[27] Although we cannot exclude the possibility that falling is merely a marker for frailty in persons already at risk of institutionalization, another plausible interpretation of our findings is that falls, particularly frequent and injurious falls, contribute, along with physical, psychological, functional, and social factors, to the decision by older persons and their families to pursue placement in a skilled-nursing facility. Falls may precipitate admission to a nursing home among older persons with cognitive, physical, and social risk factors. Indeed, patients and their families often tell their health care providers that this has occurred.

Given the loss of autonomy and privacy and the financial costs associated with institutionalization, the identification of potentially preventable or modifiable risk factors should be a high priority. In randomized, controlled intervention trials, the rate of falling has been reduced by up to 40 percent among older persons living in the community.[20-23] The preventive strategies tested in these trials, including adjustments in medications, exercise regimens, and behavioral recommendations, are feasible and relatively cost effective, and they could readily be incorporated into the care of older persons living in the community. The evidence suggests that preventing falls and their sequelae may delay or reduce admissions to nursing homes.

Supported by a grant (RO1 AG07447) and a Claude D. Pepper Older Americans Independence Center grant (P60AG10487) from the National Institute on Aging.

REFERENCES

1. Liu K, Coughlin T, McBride T. Predicting nursing-home admission and length of stay: a duration analysis. Med Care 1991;29:125-41.
2. Foley DJ, Ostfeld AM, Branch LG, Wallace RB, McGloin J, Cornoni-Huntley JC. The risk of nursing home admission in three communities. J Aging Health 1992;4:155-73.
3. Murtaugh CM, Kemper P, Spillman BC. The risk of nursing home use in later life. Med Care 1990;28:952-62.
4. Kemper P, Murtaugh CM. Lifetime use of nursing home care. N Engl J Med 1991;324:595-600.
5. Wolinsky FD, Callahan CM, Fitzgerald JF, Johnson RJ. Changes in functional status and the risks of subsequent nursing home placement and death. J Gerontol B Psychol Sci Soc Sci 1993;48:S94-S101.
6. Greene VL, Ondrich JI. Risk factors for nursing home admissions and exits: a discrete-time hazard function approach. J Gerontol B Psychol Sci Soc Sci 1990;45:S250-S258.
7. Jette AM, Branch LG, Sleeper LA, Feldman H, Sullivan LM. High-risk profiles for nursing home admission. Gerontologist 1992;32:634-40.
8. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. N Engl J Med 1988;319:1701-7.
9. O'Loughlin JL, Robitaille Y, Boivin JF, Suissa S. Incidence of and risk factors for falls and injurious falls among the community-dwelling elderly. Am J Epidemiol 1993;137:342-54.
10. Blake AJ, Morgan K, Bendall MJ, et al. Falls by elderly people at home: prevalence and associated factors. Age Ageing 1988;17:365-72.
11. Sattin RW, Lambert Huber DA, DeVito CA, et al. The incidence of fall injury events among the elderly in a defined population. Am J Epidemiol 1990;131:1028-37.
12. Nevitt MC, Cummings SR, Hudes ES. Risk factors for injurious falls: a prospective study. J Gerontol A Biol Sci Med Sci 1991;46:M164-M170.
13. Tinetti ME, Doucette J, Claus E, Marottoli RA. Risk factors for serious injury during falls by older persons in the community. J Am Geriatr Soc 1995;43:1214-21.
14. Kosorok MR, Omenn GS, Diehr P, Koepsell TD, Patrick DL. Restricted activity days among older adults. Am J Public Health 1992;82:1263-7.
15. Rubenstein LZ, Robbins AS, Josephson KR, Schulman BL, Osterweil D. The value of assessing falls in an elderly population: a randomized clinical trial. Ann Intern Med 1990;113:308-16.
16. Mulrow CD, Gerety MB, Kanten D, et al. A randomized trial of physical rehabilitation for very frail nursing home residents. JAMA 1994;271:519-24.
17. Reinsch S, MacRae P, Lachenbruch PA, Tobis JS. Attempts to prevent falls and injury: a prospective community study. Gerontologist 1992;32:450-6.
18. Vetter NJ, Lewis PA, Ford D. Can health visitors prevent fractures in elderly people? BMJ 1992;304:888-90.
19. Hornbrook MC, Stevens VJ, Wingfield DJ, Hollis JF, Greenlick MR, Ory MG. Preventing falls among community-dwelling older persons: results from a randomized trial. Gerontologist 1994;34:16-23.
20. Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med 1994;331:821-7.
21. Wolf SL, Barnhart HX, Kutner NG, et al. Reducing frailty and falls in older persons: an investigation of tai chi and computerized balance training. J Am Geriatr Soc 1996;44:489-97.
22. Wagner EH, LaCroix AZ, Grothaus L, et al. Preventing disability and falls in older adults: a population-based randomized trial. Am J Public Health 1994;84:1800-6.
23. Province MA, Hadley EC, Hornbrook MC, et al. The effects of exercise on falls in elderly patients: a preplanned meta-analysis of the FICSIT trials. JAMA 1995;273:1341-7.
24. Wolinsky FD, Johnson RJ, Fitzgerald JF. Falling, health status, and the use of health services by older adults: a prospective study. Med Care 1992; 30:587-97.
25. Kiel DP, O'Sullivan PO, Teno JM, Mor V. Health care utilization and functional status in the aged following a fall. Med Care 1991;29:221-8.
26. Dunn JE, Furner SE, Miles TP. Do falls predict institutionalization in older persons? An analysis of data from the Longitudinal Study of Aging. J Aging Health 1993;5:194-207.
27. Tinetti ME, Liu WL, Claus EB. Predictors and prognosis of inability to get up after falls among elderly persons. JAMA 1993;269:65-70.
28. Folstein ML, Folstein SE, McHugh PR. Mini–Mental State: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-98.
29. Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. Appl Psychol Meas 1977;1:385-401.
30. Spielberger CD, Gorsuch RI, Lushene RE. The STAI manual for the State–Trait Anxiety Inventory. Palo Alto, Calif.: Consulting Psychologists Press, 1970.
31. Branch LG, Katz S, Kneipmann K, Papsidero JA. A prospective study of functional status among community elders. Am J Public Health 1984; 74:266-8.
32. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist 1969;9:179-86.
33. Seeman TE, Rodin J, Albert MS. Self-efficacy and cognitive performance in high functioning older individuals: MacArthur Studies of Successful Aging. J Aging Health 1993;5:455-74.
34. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. J Gerontol B Psychol Sci Soc Sci 1990;45:P239-P243.
35. MacPhee GJA, Crowther JA, McAlpine CH. A simple screening test for hearing impairment in elderly patients. Age Ageing 1988;17:347-51.
36. Spaeth EB, Fralick FB, Hughes WF Jr. Estimation of loss of visual efficiency. Arch Ophthalmol 1955;54:462-8.
37. Tinetti ME, Mendes de Leon CF, Doucette JT, Baker DI. Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. J Gerontol A Biol Sci Med Sci 1994;49:M140-M147.