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Assessing Risk of Falling in Older Adults

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Abstract Falls by older people present serious problems in every society. The purpose of this study was to investigate the role of a checklist in estimation and reduction of the risk for falls for older adults in Taiwan. Following literature review, a purposive sample was used in a cross-sectional design to assess risk factors using a checklist. Older adults ($N = 103$) were recruited from three sheltered housing projects (elderly apartments in Taipei County); 52 individuals had fallen within the past year. A set of significant risk factors was identified, including physiological, psychological, environmental, and social dimensions. Members of the fall group had shorter Functional Reach and took more time to complete the Get-up and Go test than the control group. Some illnesses and drugs were associated with an increased risk of fall.

Key words: older adults, falls, risk factor, checklist, Functional Reach, Get-up and Go.

With the general increase in life expectancy, the population of older adults is increasing throughout the developed word (World Health Organization, 1998). Although this may be taken to be a positive development, there are a number of implications for health, including an increase in rates of falling, which have been associated with the natural decline in physical activity (Martin & Grabiner, 1999; Owings, Pavol, Foley, Grabiner, & Grabiner, 1999; Tinetti & Williams, 1998). The biological aging process also includes certain changes in the musculoskeletal and neuromuscular systems that can affect complex motor performance, and these changes also tend to increase the incidence of falls.

When older people fall and have to be admitted to the hospital, they may subsequently become bed-bound. All those who suffer a fall face the fear of falling again and tend to limit daily activities such as shopping or walking. Thus, falls have detrimental effects on the well-being and quality of life of older adults and their family caregivers (Owings et al., 1999). It is important to address such causes of ill health associated with aging.

Environmental factors, such as rugs or clutter, and restricted daily activities play an important role in predisposing older adults to falls (Tinetti, Richman, & Powell, 1990). Moreover, accidents are ranked fifth in mortality rates, and death from falling has been reported to be the primary cause of accident mortality in older people in the United States (Tinetti, Doucette, Claus, & Marottoli, 1995). In a European review, the percentage of older adults who had a fall at least once a year varied from 17% to 57% in different research reports (Stalenhoef, Crebolder, Knottnerus, & Van Der Horst, 1997). Falls are frequent events experienced by everyone, throughout life, regardless of age. The reason falls have become a major health hazard in persons over age 65 is a result of the complex interaction of biomedical, physiological (Huda & Wise, 1998), psychosocial, and environmental factors (Tinetti & Williams, 1998). According to the report of Tinnetti & Speechley (1989), two-thirds of falls in older adults are potentially

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preventable; thus, identification of significant risk factors is an important step toward fall prevention (Gill, Williams, deLeon, & Tinetti, 1997; Gill, Williams, & Tinetti, 2000).

PURPOSE

Falls are associated with many risk factors. It is proposed to identify the high-risk group for possible prevention or protection measures. A checklist has been developed using the Delphi technique (Huang, 2000). The purpose of this study was to estimate the risk factors for falls of older adults using the checklist.

TWO DEFINITIONS

A characteristic of clients or their environments that can affect the likelihood of them suffering an adverse response is termed a risk factor. Risk factors reflect the multidimensionality of the construct of risk. The interplay of these factors, and their outcomes, depends on actions and decisions made by clients, caregivers, and health care professionals as they respond to potential threats to personal safety (Kendra & George, 2001). A fall is a sudden, unintentional change in position causing an individual to land at a lower level (on an object, the floor, or the ground) other than as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force (Feder, Cryer, & Donovan, 2000; Tinetti, Baker, Dutcher, Vincent, & Rozett, 1997). Risk factors combine to increase the likelihood of a fall.

LITERATURE REVIEW

This review included reports of risk factors and risk prevention strategies of falls in older adults from Web of Science and CINAHL. In summary, many authors have identified various risks associated with falls and have concluded that there is no single preventative method. (Campbell, Robertson, & Gardner, 1995; Clemson, Cumming, & Roland, 1996; Oakley, France-Dawson, Fullerton, Holland, & Arnold, 1995; Simpson, Marsh, & Harrington, 1998).

Increasing age brings several physical changes that may cause falls, such as biological transformations that cause loss of balance and muscle-ortho-sensory coordination (Gill et al., 1997). Mathias, Nayak, and Isaacs (1986) pointed out that older adults walk slowly because they have impaired balance. Other age-related conditions, such as arthritis or cardiorespiratory disorders also contribute to the slow gait of older adults. Wet inside or outside environments, disturbances in consciousness, urinary frequency, bowel disorders, and failing vision may also lead to increased rates of falls. Medication such as thiazide or diuretics may also contribute to falls in older adults (Weiland, Rückmann, Keil, Lewis, Dennler, & Welzel, 1997).

The U.S. Health Care Financing Administration and Connecticut Long-Term Care Registry have monitored health care costs for older adults after a fall. Adding the costs of hospital stay, nursing home, emergency room, and home health care gave a mean total of $19,440 (1998 figures). If falls can be prevented at a cost less than this amount, the cost to society will be reduced and the quality of life in older adults improved (Rizzo, Friedkin, Williams, Nabors, Acampora, & Tinetti, 1998). From the above data and other literature reviews (Braun, 1998; Campbell et al., 1995; Clemson et al., 1996), it is clear that there is a high cost of care for older adults after a fall. From a purely economic viewpoint, the risk factors of falls are worth serious examination.

It is axiomatic that a healthy lifestyle provides positive health outcomes for older adults. Indeed, careful health practice (such as hypertension controlled by medication and lower salt diet) may help control certain chronic illnesses. Falls may occur as the result of a trip or slip during activities of daily living, so one of the most important issues for health maintenance and promotion is eliminating particular risk factors to prevent associated falls by older adults. Identified risk factors may then become the target for fall prevention (Downie, Tannahill, & Tannahill, 1996).

Physical Function

The reported prevalence of dizziness in older adults ranges from 13% to 38% (Braun, 1998; Tinetti, Williams, & Gill, 2000). Dizziness, syncope, and functional disability such as gait impairments have been associated with increased risk of falls (Grimby & Rosenhall, 1995). Thus, medical conditions associated with dizziness, such as hypertension, hypotension, or diabetes, must be assessed and managed as well as possible.

The potential for dizziness to lead to falls indicates the possible value in a measurement of balance that is reliable and easily administered. Two clinical measures of balance have been described in older adults: Functional Reach and the Get-up and Go test. The former evaluates how far one can reach forward beyond arm's length while maintaining a fixed base of support in the standing position (Duncan, Weiner, Chandler, & Studenski, 1990). Older adults should be able to move the fist forward a distance of at least 15 cm (Dennis, 1999). Lesser distances may indicate a significant risk of falling. The Get-up and Go test is recommended as a simple practical guide to functional balance (Mathias et al., 1986). The participant is asked to rise from a seat, walk 10 meters, and return to the seat. It is also useful to measure the total time to

complete the test. A score less than 1 meter per second may alert health care workers to the risk of falls. The higher the scores on the Get-up and Go, the higher the risk of falling.

Campbell, Robertson, Gardner, Norton, Tilyard, & Buchner (1997) set up an individual program for strength and balance retraining exercise in a randomized controlled trial that provided evidence of improved physical function and reduced severity of potential injuries from falls.

Cognitive Status

Franssen, Souren, Torossian, & Reisberg (1999) examined the significant differences in balance and limb coordination between normal aging, mild cognitive impairment, and moderate cognitive impairment. They found that maintenance of equilibrium and limb coordination were changed along with mild cognitive impairment or mild Alzheimer's disease and identified these older adults as potential fallers. Clemson et al. (1996) reported that people with cognitive impairment are more at risk of falling than those with no cognitive impairment.

According to Welch and West (1999), the mental status measures may predict cognitive function. The Mini-Mental State Examination (MMSE) can assess levels of cognitive dysfunction using cutoff points (Tombaugh & McIntyre, 1992). It tests orientation (10 points), registration (3 points), attention and calculation (7 points), recall (3 points), and language (9 points). The top score is 32.

Social Support

In a person with moderately impaired mobility, the risk of a fall may be modified if they have help from family or friends with riskier tasks such as shopping (Tinetti, Speechley, & Ginteer, 1988). Macdonald (1998) developed these concepts within the Scales of Perceived Social Support, having 56 items, each rated on a five-point Likert Scale. The scale was found to have good internal consistency, and factor analysis provided corroborating evidence for the scale. The most significant support was that from family and friends. Hence, the term and direction of social support can be provided using support from social relationships. In this way, Macdonald was concerned not only with available support, but also its actual use.

Andrew (1993) pointed out that the greater the social support, the less the risk of falling, because the support of family or friends (such as moving a rug from the door or drying the wet floor) often decreases risk factors. Logan and Spitze (1994) showed that the most important social support is family, followed by that of neighbors and then that of friends.

Inside and Outside Environments

Not all falls are associated with impaired balance. For example, they may occur as the result of a trip or slip during normal walking activities and can be attributed to environmental hazards (Mathias et al., 1986). According to Campbell, Borri, and Speaars (1989), the main risk factor for falls in a community-based population is the state of environment, such as bed height or dim light in the toilet.

Clemson, Fitzgerald, Heard, and Cumming (1999) selected a sample of older adults who had fallen in the previous year. They produced and tested the interrater reliability of a Home Fall Hazard Assessment Tool for use by occupational therapists and listed potential hazards in and around the home. These included external traffic-ways (e.g., lawns, garage, external ramp, and garden), general indoor environment (e.g., lights and tidiness), internal traffic-ways (e.g., floor mats, doorways, and steps or stairs), living area, seating, bedroom, footwear, bathroom, toilet, kitchen, laundry, medication management, and safety call system. Occupational therapists agreed on the following risk factors related to falls: edges of lawns, garage steps, external ramp, clutter, poor lighting indoors, and inadequate footwear.

Footwear

Robbins, Gouw, and McClaran (1992) tested sway frequency in various compositions of shoes and found footwear with thin, hard soles to be preferable for older adults. These had a heel flare of 20 ° and an outer sole 5 mm thick. There was a full-length fiberboard layer composed of thin, soft, bonded fiber fabric under the insole. The outer sole (0.5 cm carbon rubber) was identical in all experiments, as was the upper. Shoes with A15, A33, and A50 mid-sole hardness were used, where A15 equals the softest and A50 the hardest, and thickness of 15 mm, 33 mm, and 50 mm. It was found that mid-sole leather thickness had effects on stability. They recommended thin, A50, and 15 mm mid-soles as the most effective in promoting stability. Arnadottir and Mercer (2000) found that the type of ridges on soles of older adults had an effect on ambulatory balance. Footwear characteristics influence the risk of falling.

Physical -Mental Disturbances

Tinetti et al. (1990) developed a Falls Efficacy Scale (including nightmares and fear of falling or re-falls) for physical-mental disturbances, which tests reactions and fear after falls. The physical aspect is related to the locomotion components, such as muscle strength or bone density. The mental aspect is fear and anxiety,

versus self-confidence and self-efficacy. These two facets form two sides of the one coin. Fear of falling is increasingly recognized as a factor that may affect activity, function, and physical sequelae in older adults (Tinetti & Williams, 1998). For example, when older adults worry about falling, it may indicate that their physical condition is affected, possibly because of imbalance or weak muscle strength and power. Because of this concern, older adults may limit inside and outside activities. This generates a kind of "vicious circle," in which falling creates fear, fear creates further physical and mental weakness leading to further falling, further fear, and so on (Fig. 1).

The Falls Efficiency Scale (Tinetti et al., 1990) showed good test-retest reliability (Pearson's correlation 0.7). In general, participants reported low confidence (high score) in taking a bath or shower and high confidence in getting on and off the toilet and in personal grooming. Confidence was related to the condition of the environment, which influences gait balance and limits daily activities. These outcomes change musculoskeletal and neuromuscular function and can result in falls in older adults.

METHODS

The research methodology describes how, when, and where data are to be collected and analyzed. It comprises the approach, whether quantitative with a research framework; the method of data collection; the place and source of the data; and the method of data analysis (Polit & Hungler, 1999). This study was a cross-sectional nonexperimental research design (Burns & Grove, 2001; Polit & Hungler, 1999). A research framework was developed from literature review and researchers' ideas.

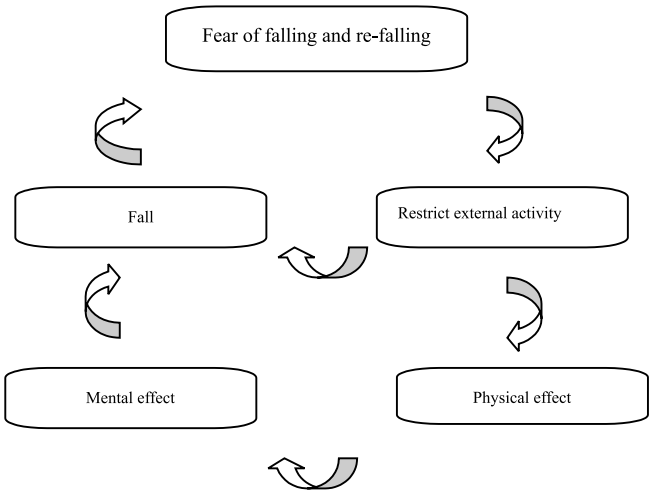

Figure 1. Presenting a vicious circle of falling, fear of falling, and re-falling.

Research Framework

It was possible to identify a set of significant risk factors from the literature and Delphi technique (Huang, 2000), which included physiological, psychological, environmental, and psychosocial dimensions, and then to develop a research framework for this study (Fig. 2). Health protection reduces hazards that people encounter in the environment (such as wet floor), while increasing their chances of living in a positive, healthy environment and having a positive, healthy lifestyle (Downie et al., 1996). The intrinsic risk factors are demographics, physical function, and cognitive status. The extrinsic factors of environment are widely referred to as environmental, social, and footwear. The risk factors affected the incidence of falls in older adults. Physical-mental disturbances and falls in older adults both affected each other, like the vicious circle of fear of falling and re-falling mentioned above.

Sample

Older adults (≥65) were recruited from four sheltered housing projects in Taipei County: one pilot site and three main study sites. They were included if able to walk, sit, and stand without any assistance (a stick or walker was allowed). Participants were divided into two groups according to whether they had fallen within the past year. In a pilot study of 15 fallers and 15 nonfallers (from one of the sheltered housing projects), age, blood pressure, Functional Reach, and Get-up and Go test were all significantly related to falls. By requiring a significance of 5% and power of 90% to distinguish groups, the sample size for each group was calculated to be 50 (Fayers, Cuschieri, Fielding, Craven, Uscinska, & Freedman, 2000). Hence, a purposive sample, which met the study criteria, was drawn from three sheltered houses projects. The total valid sample size was 103 (52 in the fall group and 51 in the nonfall group).

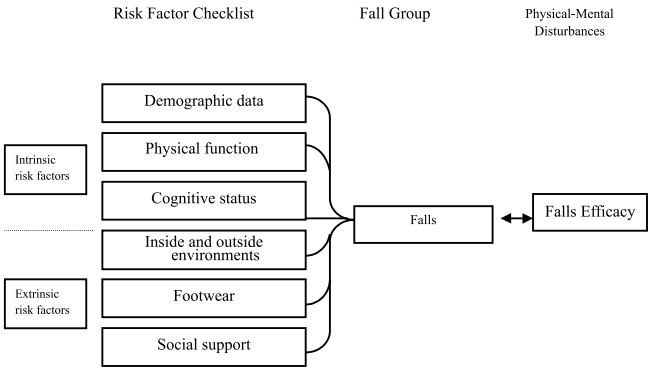

Figure 2. Research framework of risk factors of older adults falls based on literature review and the Delphi technique (Huang, 2000).

Instruments

The researchers developed and modified a draft checklist for risk factors of falls based on the literature review. According to Goodman (1987), the Delphi technique performs well as a means of structuring group communication and a decision-making process. Therefore, based on the literature and consultation with experts, the checklist for this study was developed using the Delphi technique (Huang, 2000). Two gerontological nursing specialists, two nurses working in the community, one gerontological physician, and one environment designer gave the suggestions for the instruments and their improvement.

This checklist (Appendix 1) was used to identify the risk factors for falls in older people. It contains a range of data types, including nominal, ordinal, and ratio data and a Likert scale. Data collected from participants included demographic data, physical function, MMSE, inside and outside environmental condition, footwear, social support, and physical-mental disturbances (falls efficacy).

The researchers and three assistants asked questions and collected respondents' answers on demographic data, illness and medicine, MMSE scales, social support, and physical-mental disturbances. They examined or measured Functional Reach, Get-up and Go test, footwear, and inside and outside environments.

Validity and Reliability

To control interrater bias, the researchers and assistants were trained in the measurement of Functional Reach and Get-up and Go, the examination of inside and outside environments, and fall efficacy. During training, the researchers and assistants examined and checked the risk factors checklist at the same time and from the same older adults each time. In this way, after discussions and adjustments, the interrater reliability between researchers and assistants was controlled near 0.9–1.0, and then data collected using the checklist. Details of demographics, illness, environment, social support, and falls efficacy were recorded. Another worker examined Functional Reach, Get-up and Go test, and MMSE.

The test-retest correlation coefficient for the checklist was 0.87. Cronbach's alphas for internal consistency reliability of the instruments were cognitive status (0.89), social support (0.88), and falls efficacy (0.78).

Data Analysis

Data was analyzed using SPSS 9.0, using descriptive statistics, chi-square test, independent t test and logistic regression analysis to compare the nonfall and fall groups (Field, 2000). A comparison of the demographics of the three sheltered housing projects showed no significant differences. The data on these three were treated as one for the purposes of statistical analysis (Polit & Hungler, 1999).

FINDINGS

Demographics

The mean age was 79 in the fall group ($n = 52$) and 78 in the nonfallers ($n = 51$) (χ^2 = not significant (NS)). More than half of the fall group and three quarters of the nonfall group were men, with a significant difference favoring male sex ($p < 0.05$, Table 1). More than 90% of the fall group and 76.5% of the nonfall group did not drink alcohol, with significantly different proportions in the two groups ($p < 0.01$). Twenty-eight of the fall group and 10 of the nonfall group used a walker or stick ($p < 0.001$). Thus, there were demographic differences between fall and nonfall groups in sex, alcohol consumption, and assistance provision.

Mean Differences Between the Two Groups

For continuous variables, the independent t test was used to test the differences in mean values of variables between the fall and nonfall groups (Table 2). The fall group drank less alcohol and had no regular exercise and reduced distance of Functional Reach than the nonfall group

TABLE 1. *Demographic Data of the Nonfall and Fall Groups ($N = 103$)*

	n (%)			
Variable	Non-fall Group ($n = 51$)	Fall Group ($n = 52$)	Chi-Square*	Missing
Age			NS	1
65–70	0 (0)	0 (0)		
71–75	10 (19.6)	13 (25.5)		
76–80	11 (21.6)	12 (23.5)		
81–85	18 (35.3)	17 (33.3)		
≥85	12 (23.5)	9 (17.6)		
Sex			6.87†	3
Female	14 (27.5)	24 (49.0)		
Male	37 (74.5)	25 (51.0)		
Alcohol consumption			7.17‡	0
Yes	13 (25.5)	4 (7.7)		
No	39 (76.5)	48 (92.3)		
Assistance provision			11.54§	0
None	41 (80.4)	24 (46.2)		
Walker/stick	10 (19.6)	28 (53.8)		

*Excludes missing data.
†$p < .05$; ‡$p < .01$; §$p < .001$.
NS = not significant.

TABLE 2. *Mean Differences of Factors Between the Fall and Nonfall Groups (N = 103)*

Variable	Mean ± Standard Deviation*	*t*	*P*-value
Alcohol consumption (cc/day)		−2.5	0.015
Nonfall group	148.5 ± 343.3		
Fall group	20.3 ± 139.8		
No regular exercise		−2.4	0.020
Nonfall group	1.3 ± 1.0		
Fall group	0.9 ± 0.6		
Functional Reach (cm) (functional reach ending position; subtract standing position)		−2.0	0.047
Nonfall group	21.4 ± 8.0		
Fall group	13.0 ± 28.6		
Get-up and Go (seconds)		2.3	0.022
Nonfall group	21.4 ± 9.0		
Fall group	30.0 ± 25.0		

*Scaled according to a coding schedule.

($p < 0.05$). The time for the Get-up and Go test was longer in the fall group than for nonfall group ($p < 0.05$). There were no significant differences in frequency of exercise, duration of exercise, total number of illness, total number of medication, MMSE scores, inside and outside environments, or total score of social support.

Mean Differences in the Fall Group

A one-sample *t* test evaluates whether the mean on a test is significantly different from a constant (Green, Salkind, & Akey, 2000). One-sample *t*-test was used to test physical and mental disturbances in the fall group. There was significant difference in all the items of fall efficacy (test fear of falling).

The Occurrence of Risk Factors in the Fall Group

Logistic regression is a special type of regression used when the dependent variable is categorical, such as dichotomous. It is chosen for its flexibility, ease of use, and meaningful interpretation (Field, 2000). Dichotomous data, such as nonfall and fall, were coded as 0 and 1, respectively.

Participants who had arthritis had more than nine times the risk of falling as those without arthritis (Table 3). Participants who had hearing impairments had seven times the risk of falling. Older adults who had previously suffered cerebral vascular accidents were 23 times more likely to fall ($p < 0.08$). People who took sleeping tablets had nearly 22 times an increased risk for falls. When participants took longer than 1 second to complete the Get-up and Go test, this added 5% risk for falls (odds = 1.05).

TABLE 3. *Logistic Regression by the Enter Method for the Risk Rate of Falls (N = 103)*

Variable	B*	Standard Error	Odds	*P*-value†
Arthritis	2.21	1.15	9.15	0.05
Hearing impairments	1.93	0.94	6.89	0.04
Cardiovascular accidents per year	3.13	1.78	22.77	0.08
Sleeping tables	3.08	1.26	21.83	0.01
Get-up and Go test (seconds)	0.05	0.02	1.05	0.03

Note: Recorded data, such as no arthritis = 0, arthritis = 1; dependent variable was nonfall and fall group, recorded data as nonfall = 0, fall = 1.
*Unstandardized coefficients;
†*P*-values show borderline significance and are included to indicate possible difference and trends.

DISCUSSION AND RECOMMENDATIONS

Older adults with arthritis, with a hearing impairment, who had suffered a stroke, or who regularly took sleeping tablets were found to have a seven to 23 times increased risk of falls. The results are similar to those reported by Campbell et al. (1995), who developed a checklist to prevent falls in association with a clinical physical retraining program. The high-risk factors of their checklist were arthritis of the hips and knees, vision impairments, stroke, and sedative use. Health care evaluations in older adults should include functional capacity as well as diagnoses of illness and medicine taken. Personal mobility is essential for effective functioning and daily activities. Furthermore, early detection of physical dysfunctions can help to identify potential fall situations and potential risks. Falls are a prime target for prevention, being the most common cause of injury for older adults. Many adults fall as a result of preventable or controllable illness and side effects of medications.

Those who fell tended to exercise less than other adults, although it is unclear whether this was a contributory cause of falling or a subsequent effect. In a study by Speechley and Tinetti (1991), it was shown that vigorous exercise could cause injury rather then prevent it in frail older adults. On the other hand, Biegel (1984) and Gill et al. (1997) pointed out that muscles remain healthy and strong only if used regularly; otherwise, they become soft and flabby and lose strength and elasticity. Although strength decreases with age, this effect can be reduced though regular exercise that keeps the muscles toned. Lower muscle weakness in the older adults is consistently related

to impaired mobility and fall risk factors. For older adults to maintain a satisfactory quality of life, it is important for health professionals to encourage them to exercise.

Those older adults who fell tended to perform a shorter functional reach than the nonfall group did (mean 13.0 and 21.4 cm, respectively). The fall group took longer to finish the Get-up and Go than the nonfall group (mean 30 and 21.4 s, respectively). The quantitative and informative measurements of Functional Reach and Get-up and Go are easily arranged and inexpensive and have the advantage of providing some balance movement training for older adults. Campbell et al. (1997) provided further evidence that exercise can improve physical function and reduce severity of injuries from falls. Nurses are in a good position to set up these tests for baseline references to estimate the high-risk factors for falls in older adults, but an even more useable checklist needs to be developed for nurses to use to help to identify the high-risk group and then decrease the incidence of such falls.

More then three times as many older adults in the nonfall group drank alcohol as in the fall group. The mean amount of alcohol consumed daily in the nonfall group was seven times higher than in the fall group (148.5 cc and 20.3 cc, respectively, $p < 0.05$). Older adults who had experienced a fall in the past year had lower alcohol consumption or did not drink alcohol. It is likely that older adults who had fallen would have had some input from health or social care professional that would have altered their risk of re-falls, but retrospective studies are unable to show causation; for example, the experience of falls may influence subsequent alcohol consumption. Thus, retrospective data collection can cause results to be confounded just like the research design of Tinetti and Williams (1998). Therefore, further studies need to use a prospective approach to test the predictors of falls. A prospective study may answer the question of whether older adults who experience falls limit their activities voluntarily or whether alcohol consumption limits falling.

LIMITATIONS

The sex ratio (male/female) of older adults was 105/100 in Taiwan (Anon. 2002). There were 75% men in nonfall group and 51% in fall group ($p < 0.05$). Because purposive sampling was used in our study, further study is needed to examine sex effects.

Some aspects of the questionnaire were somewhat difficult for older people to answer, because the units did not always parallel daily experience. These included, for example, number of cigarettes smoked per week, alcohol consumption in cc per day, precise frequency and duration of exercise, frequency of bath per week, and travel per half year. MMSE was also not easy to test and was time consuming. For these practical reasons, and to improve compliance, the questionnaire needs to be further revised to allow ease of use for nurses in the community (Higgs, Bayne, & Murphy, 2001).

During the process of study, some new buildings in the sheltered housing projects had bath or toilet rails fitted and no high door saddle. There were no kitchens, personal living rooms, front doors, or back yards in their houses. Thus, further study in this area would benefit from the inclusion of older adults not only living in institutions but also in their own homes in the community. This may also result in closer support of other studies (Clemson et al., 1996, 1999) that have found that risk of falling is correlated with environmental factors. The retrospective design may not show causation and is a key limitation.

CONCLUSIONS

An increased number of falls and re-falls in older adults were noted during researchers home visiting in Taipei communities. This study attempted to test multiple aspects of risk factors for falls on older adults. It demonstrated the value of combining risk factors of physical function, environment, footwear, social support, cognitive status, and falls efficacy. To achieve the goals of quality of life and health promotion, a risk assessment checklist is required for health care workers to predict falls in older adults. Findings suggest that some parts of the checklist require further examination.

In this area, prospective design should be considered to avoid the ambiguity of cause and effect. The scale of fall efficacy, the poor confidence in performing daily tasks, could be used for older adults, whether they had fall experiences in the past year or not. This is a determinant of balance and gait that may contribute to a fall. According to the findings of Campbell et al. (1997), exercises improved physical function and can be effective in reducing falls and injuries in older women. The potential benefits of education programs that include exercise require elucidation.

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APPENDIX 1

Number:

Sheltered housing: A B C

Living on _ floor

Researcher and assistants complete the questionnaire, cheick the appropriate box or number in the space provided, and follow the instructions in bold.

Please check <u>one</u> box or number unless otherwise indicated.

Fall experiences within the **past year**

1.None 2.Fall

Demographic Data

Age				
	1. ≥ 65 years	2. ≥ 70 years	3. ≥75years	4. ≥80years
	5. ≥ 85years			
Gender				
	1.Male	2.Female		
Education				
	1.Illiterate	2.Primary	3.Junior high	4.Senior high
	5.University	6.Postgraduate		
Marital Status				
	1.Unmarried	2.Married	3.Divorced	4.Widowed
	5.Other			
Income				
	1.Under NT$14,000 (< £311/month)	2.Under NT$30,000 (<£667/month)	3.Over NT$30000 (>£667/month)	_ NT$ 45 = £1_
Cigarette smoking:				
	1.No	2.Yes		
	The number of cigarettes/week_____.			
Drinking (Alcohol)				
	1.No	2. Yes		
	The amount of alcohol drinking/day ___ cc			
Type of Exercise:				
	1.None	2.Light (e.g., Walking)	3.Moderate (e.g., Bowling)	4.Strenuous (e.g. Golf)
	The number of exercise ___ time/week			
	The duration of exercise ___ hour/time			
The way of washing				
	1.Sit Bath	2.Shower	3.Sponge bath	
	The number of washing ___ time/week			
Assistance provision				
	1.None	2.Zimmer frame, walker, or stick		

Subjective Physical Function

Do you have the following illness?	No	Yes	If "yes" how many years you have had it?	If "yes" how many tablets do you take?
Hypertension (high blood pressure)	1	2		
Diabetes mellitus	1	2		
Cardiovascular disease (heart disease)	1	2		
Arthritis	1	2		
Cerebral vascular accident	1	2		
Vision impairments (Glasses)	1	2		
Hearing impairments	1	2		
Tumor	1	2		
Sleep disturbances	1	2		
Disorientation	1	2		
Depression	1	2		
Chronic obstructive pulmonary disease	1	2		
Incontinence	1	2		
Other illness	1	2		
Total illness				

Do you take other tablets (drug from doctor)?	No	Yes	If "yes," how many tablets do you take?
Tranquilizers	1	2	
Laxative/diuretic (bowel medicine/water tablets)	1	2	
Pain relief	1	2	
Others medication	1	2	

Objective Physical Function

Functional Reach

Standing position: _____ cm.

Functional reach ending position: _____ cm.

Get-up and Go: stand up from straight-backed high seat, walk 10m, turn around, return, and sit again.

_____ second.

Footwear:

1. Ridged soles 2. Non-ridged soles

Assessment of Environment Living Conditions:

Total environment

a. Total inside environment:

Kitchen:

1.Light dim 2.Wet floor 3.Floor mats 4.Clutter

Bathroom:

1.Light dim 2.Wet floor 3.Bath/Toilet mats 4.Clutter
5.No bath/toilet railing 6.High door saddle 7.No night light

Living room:

1.Light dim 2.Polished floor 3. Floor mats 4. Clutter

Dining room:

1.Light dim 2.Polished floor 3. Floor mats 4. Clutter

Bedroom:

1.Light dim 2.Polished floor 3. Floor mats 4. Clutter
5.No night lights

b. Total outside environment:

Front door/ Back yard:

1. Light dim 2.Slippery surface 3. Doormats 4. Clutter

External ramp:

1. Light dim 2.Slippery surface 3. Doormats 4. Clutter

Path:

1. Light dim 2.Slippery surface 3. Doormats 4. Clutter

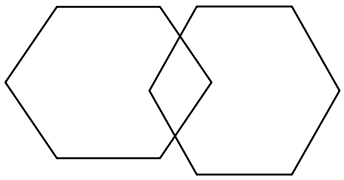
External steps:

1. Light dim 2.Slippery surface 3. Doormats 4. Clutter

Cognitive Function

Mini-Mental State Examination: test of cognitive function. Score 1 point for each correct. (Total score = 32)

Title	Maximum	Participants	Question
Orientation (10)	5 5		What is the year season date day month? Where are we: state county town hospital floor?
Registration (3)	3		Name 3 objects glasses red honesty
Attention and Calculation (7)	2 5		2 + 4 = 7 – 3 = 100 – 7 = 93 – 7 = 86 – 7 = 79 – 7 = 72 – 7 =
Recall (3)	3		Ask for 3 objects: glasses red honesty
Language (9)	2 1 3 1 1 1		Name a (pencil) (watch) Repeat "No ifs, ands, or buts" Take a paper in your **right hand (not used to),** fold it in half, and put it on the floor Close your eyes Write a sentence Copy a design



Social Support:

The following questions are a prompt to answer for older people.
Please ask the questions in the following order. If older people do not understand the first question, then ask the next one.
Who helps you in your daily life? How often do they help you?
(Prompt if necessary)
Who often speaks to you on the phone, visits, comes for a chat, cooks, and helps you financially?
Check all that apply

Social Support	No	Yes	The frequency of phoning, visiting in a month
Brother	1	2	
Sister	1	2	
Son	1	2	
Daughter	1	2	
Spouse	1	2	
Friend	1	2	
Neighbor	1	2	
Pastor/Father	1	2	
Total social support			
Number of journeys per half year?			

Physical-Mental Disturbances

Has fear of falling made you be careful or decrease or avoid doing the following activities?
Please continue to answer the degree that you are careful or decrease or avoid doing the following activities (e.g., never afraid of falling, check 1; afraid and absolutely avoid doing, check 10; and so on).

Taking a bath or shower	1 2 3 4 5 6 7 8 9 10
Reaching into cabinets or closets	1 2 3 4 5 6 7 8 9 10
Preparing meals not required carrying heavy or hot objects	1 2 3 4 5 6 7 8 9 10
Walking around the house	1 2 3 4 5 6 7 8 9 10
Getting in and out of bed	1 2 3 4 5 6 7 8 9 10
Answering the door or telephone	1 2 3 4 5 6 7 8 9 10
Getting in and out of a chair	1 2 3 4 5 6 7 8 9 10
Getting dressed and undressed	1 2 3 4 5 6 7 8 9 10
Light housekeeping	1 2 3 4 5 6 7 8 9 10
Simple shopping	1 2 3 4 5 6 7 8 9 10