The Incidence and Identification of Risk Factors for Falls among Filipino Elderly Persons in a Nursing Home Facility and at the Rehabilitation Medicine Out-Patient Department of the Philippine General Hospital

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ABSTRACT

Objectives. This prospective cohort study was undertaken to determine the incidence of falls and the identification of risk factors in elderly persons in a nursing home facility and those seen at the Rehabilitation Medicine Out-Patient Department (OPD) of the Philippine General Hospital (PGH), and to propose interventions to reduce or prevent falls in both populations.

Methods. Filipino elderly aged 60 years old and above, male or female, who consulted at the Rehabilitation Medicine - OPD of the PGH in Manila, and the elderly aged 60 and above in a nursing home facility for religious sisters in Rizal were included. The following data that may present as risk factors for falls were collected: socio-demographic characteristics, health status, medications, and chronic illness. Environmental hazards were checked. Physical examinations were conducted to test for cognitive function, balance, and visual acuity. Follow-up interviews were done every two months for 10 months to monitor incidence of falls and their causes. Data were analyzed to identify the significant risk factors for falling.

Results. A total of 156 subjects were included, 116 subjects from the OPD and 40 subjects from the nursing home. At the end of the study, a total of 50 out of 156 subjects (32.1%) from both populations had falls within 10 months. Twenty-seven (27) out of 116 subjects (23.3%) in the OPD elderly and 23 out of 40 elderly (57.5%) in the nursing home had falls. Significant risk factors that contributed to falls in the elderly seen at the OPD were poor vision and history of falls. In the nursing home population, significant risk factors identified were cognitive impairment and presence of chronic diseases. Major cause of falls for both populations was presence of slippery floors in the bathroom or bedroom in the homes of the OPD elderly (67%) and presence of slippery areas in the nursing home (65%).

Conclusion. Falls in the elderly are considered to be one of the main causes for morbidity, decline in function, and death. Among the Rehabilitation Medicine OPD elderly, it is important to identify those with visual problems and those with history of previous falls as likely candidates for falling within the year or so. Elderly with cognitive impairment and chronic disease in the nursing home population should be closely monitored because of greater risk of falling. In both populations, interventions should include the provision of a safe environment to prevent or reduce the incidence of future falls.

Key Words: falls, falls risk factors, fall in the elderly, rehabilitation medicine

Introduction

Falls are considered one of the most serious health concerns encountered by the elderly. About 30 to 40% of individuals living in the community aged 65 and above fall each year.[1,2,3] These accidents are associated with increased morbidity and mortality, and as much as 20 to 30% of those who fall suffer from serious hip fracture and head trauma.[4] Current data show that falls comprise the single largest cause of death due to injury in the elderly. Pneumonia or pulmonary embolism often follow after a period of immobility due to a fall.[5] Recovery from falls is often poor because of restricted mobility and functional decline. Most falls have multiple causes, and are usually due to dynamic interplay of predisposing and precipitating factors.

Some proponents have divided the risks for falls into extrinsic and intrinsic factors. Intrinsic risk factors include poor vision, chronic diseases, arthritis, diabetes, lower extremity weakness, drug toxicity, a history of falls, depression, age older than 80 years, and impairments in gait, balance, cognition, and activities of daily living. Extrinsic risk factors include environmental hazards, such as unsatisfactory footwear, slippery floors, poorly lit stairs, and the improper use of assistive device. Causes of falls differ between males and females. Males have a higher prevalence of other impairments, such as poor vision, unsteady gait, and chronic medical conditions. Healthcare professionals should be aware of each of these risk factors, and when deemed present in an individual, appropriate interventions can be made to prevent falling and, ultimately, death.

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Numerous studies indicate that impaired vision is an important and independent risk factor for falls. Ivers et al. in their Blue Mountains Eye Study in Australia, confirmed that visual impairment is strongly associated with an increased risk of falls. Having poor visual acuity, posterior subcapsular cataract or a visual field deficit were all associated with increased risk of both falls and hip fracture.[6,7] In other studies, subjects who had multiple falls in the past had decreased vision, as indicated by visual tests, with impaired depth perception and contrast sensitivity, and low contrast visual acuity being the strongest risk factors. Subjects with good vision in both eyes had the lowest rate of falls, whereas those with good vision in one eye and only moderate to poor vision in the other eye had elevated fall rates, equivalent to those with moderate or poor vision in both eyes.[8,9] While there are many factors associated with falls in the elderly, it has been stipulated that good vision is essential for maintaining postural stability, and effective mobility within the environment.[10] Black and Wood have demonstrated in their study that falls can be reduced using cataract surgery as a visual intervention.[10] A home safety program for aged people with severe visual impairment has also been found to be effective.[11,12]

Chronic diseases may increase the risk of falls through direct effects of the disease and indirect effects, such as reduced physical activity, muscle weakness, and poor balance.[10, 13] There was a marked linear trend of increasing odds of falling with an increasing number of chronic diseases. The chronic diseases noted among fallers include coronary heart disease, circulatory disease, chronic obstructive pulmonary disease, depression, and arthritis.[10]

Lower extremity muscle weakness is a significant risk factor for falls, increasing the odds of falling fourfold.[14] Subjects who had deficits in muscular strength, particularly lower leg strength and lower muscle mass were those who had fallen within one year.[15]

History of fall and gait or balance deficits increase the risk threefold.[16] There is a direct relationship between the number of falls an individual had in the past year and the risk for falling; thus, a history of previous fall is a good predictor for future falls.[17] Deficits in balance, whether due to impairment in cognition and vision, postural hypotension, chronic disease, and environmental factors, is a significant indirect risk factor for falls. Improvement of balance by using structured, group exercise programs was shown to decrease the frequency of fall among subjects.[18, 19]

Arthritis, particularly lower limb arthritis, is one of the established risk factors for falls, mainly due to deficits in the neuromuscular system. Results in various studies have been consistent in showing that the elderly with lower limb arthritis, as compared with the normal population, have deficits in muscular strength, knee proprioception, and standing balance.[20] Pandya et al. reported that painful knee osteoarthritis increases the tendency to trip on obstacle, thereby causing falls.[21]

Use of four or more medications has been strongly associated with an increased risk of fall.[22] Leipzig et al. in their two meta-analysis studies on the association of drugs and falls in older people reported that there is a small but consistent association between the use of most psychotropic drugs and falls.[23] Psychotropic drugs were implicated as medications increasing the risk of falls. Cardiac drugs including class 1A antiarrhythmic agents, digoxin, and diuretics, were associated with, to a weaker extent, the occurrence of falls. In a recent study on nursing home residents followed for one year, starting a new benzodiazepine or antipsychotic medication was associated with a very high risk (odds ratio = 11) for falls.[24] Careful selection in prescribing, continual review, and withdrawal of unnecessary medications may reduce the risk of falls. Trials have shown that gradual withdrawal of psychotropic drugs is associated with a decreased number of falls.[25] In one study, withdrawal of psychotropic medications such as benzodiazepines, other sedatives or hypnotics, neuroleptic agents, or antidepressants over 14 weeks resulted in a 66% reduction in risk of fall.[26]

Impaired cognition is considered a risk factor for fall. A population-based study by Kallin et al. conducted in Sweden reported that 9.4% of cognitively-impaired elderly people fell at least once a week.[27] In elderly people living in nursing homes, dementia is an independent risk factor for fall. Residents with dementia fall more often than their counterparts without dementia and leave them with a higher overall risk of sustaining injurious falls over time.[28]

Diabetes mellitus is suggested to be an independent risk factor for falls. Maurer et al. reported that as much as 35% of subjects in their study diagnosed with diabetes mellitus experienced a fall in one year. The authors concluded that diabetes, along with impairments in balance and gait, were significant factors.[29]

Of all the established extrinsic causes of falls, environmental hazards have been found to be the leading cause, accounting for about 25 to 45% in most studies.[10] One half to two thirds of falls occur in or around the patient's home, and are usually caused by slippery floors and poorly lit hallways and stairs.[3,4] Many of the falls occurred during non-threatening activities such as walking, often under sensory or environmental conditions. A comprehensive individual home assessment with specific safety recommendations targeting environmental and personal safety (e.g., improvement in room lighting, flooring, or footwear) will lessen the risk of unnecessary falls.

There is also a positive correlation between increased risk of fall and the number of risk factors. Among a cohort of community-dwelling older adults, during one year of follow-up, the risk of falling increased from 8% for persons

with no risk factor to 78% for persons with four or more risk factors.[3]

Given these factors, it is of utmost importance to understand that the key to the prevention of falls in the elderly and, consequently, morbidity and mortality, is multifactorial intervention. Once risk factors have been identified, interventions proven to be successful can be administered.

In the Philippines, it has been found that roughly 19% of the Philippine population as of 2002 belongs to the geriatric age group. There have been numerous studies done in different countries and populations that identify the risk factors of elderly individuals, but none so far conducted in the Philippines based on review of local and international publications. It is essential to determine the incidence of falls of the elderly in the Philippines and to identify their risk factors for falls.

Prevention of falls is critical to the health of all older persons, including those without a history of falls. Falls cannot be prevented unless risk factors can be identified. If this study can identify the risk for falls in a population of elderly individuals in the Philippines, measures and interventions can be made to prevent falls, and, ultimately, prevent untimely disability and death.

Methods

This prospective cohort study was conducted from January 2005 to December 2006. The participants for this study included the elderly, both male and female, aged 60 and above in two populations: the nursing home for retired nuns or religious sisters in Rizal and the Rehabilitation Medicine Out-Patient Department (OPD) of the Philippine General Hospital (PGH) in Manila.

Interview and Physical Examination
- **Preliminary Interview**
  a. Before the preliminary interview, each subject was oriented to the study and asked to voluntarily sign a consent form. Then, data on health history, medications currently taken, history of vestibular problems, past and current illness, history of seizures, gait problems, history of psychiatric illness, foot problems, balance problems, and vision problems were collected. For subjects who had impaired cognition, a guardian, usually the primary caregiver, was asked to give consent, to provide the data regarding the subject, and was tasked to report during the follow-up period on the number of falls, if any.
  b. Presence of history of fall in the past was obtained.

- **Interview**
  Each subject was asked to fill out the standard Environmental Assessment Checklist,[4,6,12] which included possible environmental hazards present in the subject's residence which are known to cause increased risk for falls among elderly persons. For those subjects from the OPD population and living within Metro Manila, a visual inspection of the house and its environment (home visit) was done either by the researcher or research assistant, to validate information written in the Environmental Assessment Checklist. In the nursing home population, the Environmental Assessment Checklist result was similar for all subjects since all of them lived within the confines of the nursing home.

- **Physical Examination**
  During the first meeting with each subject, the following physical examination tests were done to assess for risk factors for fall:
  a. Blood pressure check to assess for hypertension and postural hypotension, in both supine and standing positions.
  b. Visual assessment using the Snellen Chart,[6,7,8,9,10] a standardized test for visual acuity.
  c. Cardiovascular assessment to test for presence of arrhythmias, murmurs and vertebrobasilar dysfunction.
  d. Physical examination of the extremities: range of motion, foot problems, deformities, quality of footwear.
  e. Neurologic assessment to determine presence of motor and sensory deficits, movement disorders, assessment of position sense.
  f. Test for cognition using the Mini-Mental State Examination.[30]
  g. Test for balance using the Berg Balance Scale.[16] This test was the most powerful in discriminating fallers from non-fallers.[26]

- Follow-up interview every two months for 10 months for the occurrence of fall, if any. Subjects who had falls within the follow-up period were asked to report the number of times they had fallen as well as the reasons of falling.

Description of Outcome Measurements

Outcome measures included deviations from normal values of the Berg Balance Scale, blood pressure, foot problems, visual acuity test, type and number of medication taken, cognitive impairment, and environmental risk or modifications.

A subject is considered a drop-out if he or she and his/her primary caregiver were not able to follow up with the researcher after the initial interview and physical examination, or, for whatever reason, did not correspond with the researcher for two consecutive follow ups.

Data Management

Data collected from the two populations were tabulated and analyzed separately to identify the significant risk factors for fall using the chi-square test. P values less than 0.05 were considered as significant difference. The relative risk (RR) was computed for the identified significant factors for each population using the SPSS (Statistical Package for Social Sciences). Descriptive statistics were also used in the analysis of patient demographic data.

Results

There were a total of 168 subjects from the two populations: 128 were elderly patients who consulted at the Rehabilitation Medicine Out-Patient Department of the Philippine General Hospital in Manila, and the remaining 40 subjects were elderly religious sisters in a nursing home (Table 1). Of the 168 subjects, 12 were considered drop-outs, all from the OPD population. At the end of the study, a total number of 116 subjects from the OPD population were included. The OPD population was predominantly female (69.8%); more than 90% were 60 to 80 years old; and more than three-fourths of the subjects lived within Manila. On other hand, all 40 subjects from the nursing home population were female, representing the total number of subjects aged 60 and above living in that institution. The nursing home facility specifically caters to retired nuns belonging to a religious congregation.

After the ten-month follow-up period, of the 156 subjects included in this study, in both the OPD and nursing home populations, a total of 50 subjects (32.1%) reported an occurrence of fall within 10 months (Figure 1).

As shown in Table 2, 27 out of 116 subjects (23.3%) in the OPD population reported an occurrence of fall within

Table 1. Socio-demographic characteristics of subjects between the Nursing Home Facility and at the Rehabilitation Medicine Out-Patient Department of the Philippine General Hospital

Variable	OPD SERVICE n = 116		NURSING HOME n = 40	
	Number of Subjects	Percentage	Number of Subjects	Percentage
Gender				
Male	35	30.2	0	0.0
Female	81	69.8	40	100.0
Age Group				
60-80 years old	108	93.1	32	80.0
>80 years old	8	6.90	8	20.0
Address				
Within Metro Manila	91	78.4	40	100.0
Outside Metro Manila	25	21.6	0	0.0

Table 2. Percentage distribution of the incidence of falls in both the OPD and Nursing Home populations after the 10 month follow-up period

| Number of Falls	OPD SERVICE n = 116		NURSING HOME n = 40	
	Number of Subjects	Percentage	Number of Subjects	Percentage
NO falls	89	76.7	17	42.5
1-2 falls	25	21.5	21	52.5
>2 falls	2	0.02	2	0.05
Total number of falls	27	23.3	23	57.5
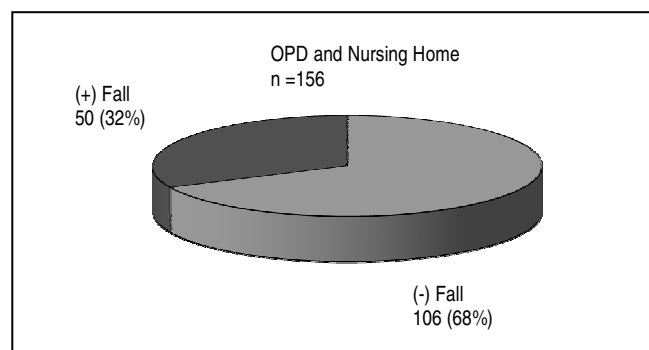
Figure 1. Percentage distribution of falls during the study period

the 10-month study period, with most of the subjects (25 out of 27) reporting one or two falls.

In the nursing home population, on the other hand, there was a greater incidence of fall within 10 months: 23 out of 40 subjects (57.5%) had falls, 21 out of 23 also reported one or two falls (Figure 2).

In the OPD population, 23.3% of the respondents fell within the 10-month follow-up period (Figure 3).

Of the risk factors for fall identified in the OPD population, two risk factors were found to be significant: history of falls (RR 3.64, 95% CI 1.98, 6.70), and the presence of eye problems which led to poor vision (RR 2.64, 95% CI 1.30, 5.37). There was no association between the severity of impairment of visual acuity and the incidence of falls (RR 0.94, 95% CI 0.71,1.23).
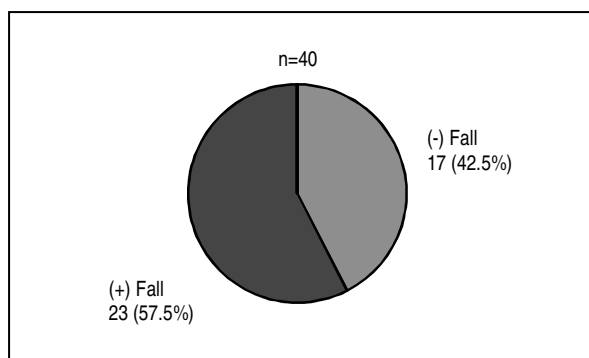
Figure 2. Percentage distribution of falls in Nursing Home Population
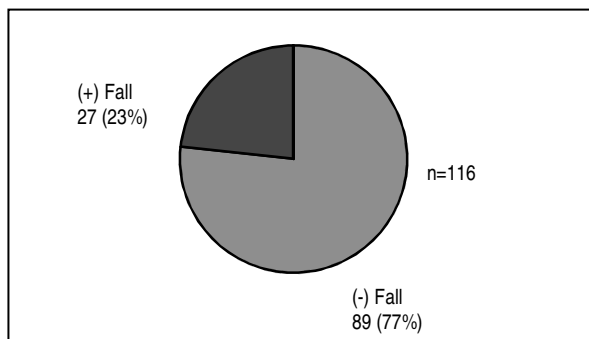
Figure 3. Percentage distribution of falls in Out-Patient Department Population

Majority of the subjects in both populations had history of fall (Table 3). Eighty eight (88) of 116 subjects (75.81%) of the OPD population had a previous fall, with 78 subjects reporting one or two falls in the past and 10 subjects having two or more previous falls.

Of the 78 OPD subjects who reported one or two previous falls prior to this study, 20 (25%) subjects fell within the 10-month follow-up period. Those respondents who had more than two falls in the past had a higher incidence of fall. Of the 10 subjects with more than two previous falls, seven (70%) fell within 10-month follow-up period. History of previous fall was found to be a significant factor for fall in this population (RR 3.64, 95% CI 1.98, 6.70).

The subjects in the nursing home showed a higher percentage of previous falls (67.5%) compared with the

Table 3. Percentage distribution of previous falls among subjects in the Nursing Home Facility and at the Rehabilitation Medicine Out-Patient Department of the Philippine General Hospital

Number of Previous Falls Variable	OPD SERVICE n = 116		NURSING HOME n = 40	
	Number of Subjects	Percentage	Number of Subjects	Percentage
No history of previous falls	28	24.13	13	32.50
1-2 previous falls	78	97.24	15	37.50
>2 previous falls	10	8.60	12	30.00
Total number of falls	88	75.81	27	67.50

hospital population, with 37.5% reporting one or two falls in the past and 30% reporting more than two falls.

In the OPD population, 50 out of 116 subjects (43%) reported the presence of eye disease during the course of the study, such as cataracts and glaucoma, wherein visual acuity was impaired.

Of the 50 subjects with presence of eye disease, 18 (32%) fell within the 10-month follow-up period. Thus, the presence of eye disease was a significant risk factor for fall in the OPD population (RR 2.64, 95% CI 1.30, 5.37).

Two subjects in the nursing home population were not available to undergo the test for cognition during the study. A total of 38 subjects were evaluated for cognition, and 20 out of 38 subjects in the nursing home (52%) were found to be cognitively impaired. After 10 months of follow-up, six of the 20 (30%) cognitively impaired subjects had falls. Cognitive impairment was a significant risk factor for fall among the nursing home subjects in this study (RR 2.38, 95% CI 1.27, 4.48).

Seventy-nine percent (79%) of those subjects with greater than three chronic diseases fell within the 10-month follow-up period, while 46% with one or two chronic diseases fell within 10 months. There was significant difference in the number of falls between the group with greater than three chronic diseases and the group with one or two chronic diseases (RR 1.70, 95% CI 1.04, 2.80).

The major cause of falls for both populations was the presence of slippery floors in the bathroom or bedroom (67%) in the homes of the OPD elderly and the presence of slippery hallways, corridors, stairs or bedroom (65%) in the nursing home.

Discussion

Data from this prospective cohort study was analyzed separately for the two populations as there may be a distortion in the association of risk factors if the data were to be analyzed together. Moreover, the subjects in the nursing home were all females; many were non-ambulatory and cognitively impaired with dementia. The OPD population

comprised of males and females, ambulatory but of similar age group as the population in the nursing home.

The incidence of fall was higher in the nursing home population. This finding concurs with the conclusion of other studies that there is a greater frequency of falls among elderly in nursing homes compared with their counterparts living in the community.

One significant risk factor for falls among the patients of the Rehabilitation Medicine OPD population was the presence of vision problems. In this study, a subject in the OPD population with a history of eye problems is 2.64 times more likely to fall in the future. There was no increased risk of falls between subjects who had near-normal or moderate visual acuity compared to a severely impaired visual acuity score, although both are, in general, significantly predisposed to falls, as shown in this study.

Another significant risk factor for falls in the elderly OPD population evident in this study is the presence of history of falls. Subjects who had history of fall were 3.64 times more likely to fall, compared with subjects who had not fallen in the past. The history of previous falls belies the presence of risk factors which were most likely unrecognized and had persisted, and would have led to the repeat falls. The history of previous falls may also have resulted in decreased mobilization and would have led to more weakness and bone demineralization.

In the nursing home population, one of two significant risk factors which contributed to falls among the subjects was cognitive impairment. This finding is consistent with previous studies that impairment of cognitive function among nursing home residents is a definitive risk factor for fall.

Another risk factor for falls found to be significant in the nursing home population was the presence of chronic diseases. The data showed a direct relationship between the number of chronic diseases and the incidence of fall in this population. Subjects who had a greater number of chronic diseases had more falls.

Major cause of falls for the subjects in both populations is the presence of slippery floors in the bathroom or bedroom in the homes of the elderly OPD population (67%) and presence of slippery hallways, corridors, stairs or bedroom in the nursing home (65%).

Studies have shown that lower extremity arthritis is one of the risk factors for falls. In the OPD population, almost 60% of the subjects have lower extremity arthritis. However, arthritis was not as a significant risk factor in this study. This is probably because falls attributed to arthritis in past studies were those falls reported only during the painful phase of arthritis, leading to musculoskeletal imbalances, and increased risk for tripping and falling.

In both populations, some of the falls happened during the rainy season; thus, wet flooring causing slips and falls may be an important factor.

Conclusion

The incidence and prevalence of falls in the elderly unfortunately continues to be high due to lack of awareness of the risk factors. The key to effective prevention of falls in the elderly is the identification of risk factors for falls and the implementation of interventions aimed at modifying or eliminating the risk factors present.

In the elderly Filipino population seen at the Rehabilitation Medicine Outpatient Department, it was found that the significant factors which contributed to falls were history of falls and presence of impairment in visual acuity. Patients with history of falls should be identified and interviewed thoroughly. The reasons for falls in the past should be carefully evaluated, so interventions can be implemented based on the reasons identified. For persons with cataracts, it has been shown that cataract surgery decreased the frequency of falls. Close and regular monitoring of visual function is ideal and important.

In the elderly living in a nursing home facility for retired religious sisters, significant factors that contributed to falls were cognitive impairment and presence of chronic disease. It is thus of utmost importance that patients with cognitive impairments be given more attention and more thorough monitoring, because of their increased propensity to fall. The elderly with chronic diseases may have a reduced incidence of falling if these diseases are adequately managed and adverse effects are minimized.

It is important that the environment remains safe for the ambulatory elderly, and that additional interventions during the rainy season be instituted to ensure reduction or elimination of future falls. Guide- and hand-rails should be installed at slip-prone floors and hallways. During rainy weather, shoes with firm rubber, anti-slip soles should be worn by the elderly.

Falls is the result of the additive and dynamic interplay of physical, psychological, environmental, extrinsic and intrinsic factors. Interventions to prevent falls should therefore also be timely, dynamic and varied.

Recommendations

The study was limited by the 10 month study period and inclusion of subjects only from the two populations, from Rehabilitation Medicine Out-Patient Department and from the nursing home facility. A larger and clearer picture of the risk factors for falls in the Filipino elderly could be seen from a longer study period, and a larger sample size and data from various Filipino elderly populations. Lifestyle, diet, body size and other relevant factors should also be investigated in future studies.

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