# The risk factors of fall and their correlation with balance, depression, cognitive impairment and mobility skills in elderly nursing home residents

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## ABSTRACT

**Objectives:** The purpose of this study was to investigate risk factors of fall and to examine their correlations with balance, depression, cognitive impairment and mobility skills in elderly nursing home residents.

**Methods:** This study included 30 elderly people living in Seyranbaglari Nursing Home in Ankara City Centre, Turkey and was carried out in 2004. Risk factors for fall were obtained through individual interviews and observation. Cognitive function was assessed by Mini Mental State Examination (MMSE). The Geriatric Depression Scale (GDS) was used for determining the depression status of the elderly. Balance of the subjects was evaluated by the Berg Balance Scale (BBS) and the Get Up and Go Test (GUGT). In addition, mobility skills were assessed by Rivermead Mobility Index (RMI). The correlation analysis was used for establishing the correlations of the total number of risk factors with the other parameters. In addition, the correlations among all parameters were evaluated.

**Results:** At the end of the study, it was found that the correlation among all parameters was significant ($p<0.01$, $p<0.05$). For example, there was a significant correlation of MMSE score with the total number of risk factor for falls, GDS, BBS, GUGT and RMI. The RMI score was also correlated with GDS, MMSE, BBS and GUGT scores.

**Conclusion:** The results of the present study confirm that impairment of cognitive function, balance and mobility skills, and depression increases the risk of falling. In addition, all the parameters affect each other, too. There is a vicious circle among these parameters. If this vicious circle is not broken, an increasing risk of fall will be inevitable. That is why this information will be useful for patients' therapy, and for development of fall prevention programs for elderly people.

**Saudi Med J 2005; Vol. 26 (6): 978-981**

**F**alls in the elderly community represent a major problem in general practice, because of their high incidence, the involvement of many risk factors, and the considerable post-fall morbidity and mortality.[1-4] Approximately one-third of community-dwelling people over 65 years of age will experience one or more falls each year. Fall related injuries are the leading cause of nonfatal injury.[1,2,4,5] In 15% of cases, the injuries suffered include fractures and bruises, as well as soft tissue injuries and loss of independence. Serious injury occurs in 6% of the elderly population, resulting in some instances in accidental death. Approximately 40-50% of fallers admitted to hospital will be admitted to nursing homes.[4] Of those who do not suffer serious injury, many may experience

significant restrictions in daily activities. As a result, the elderly populations develop a fear of falling, social isolation and a decrease in their confidence to accomplish normal activities of daily living, and adopt an inactive lifestyle.[2,4,6,7] Falls in elderly people are multifactorial events: intrinsic and extrinsic risk factors contribute to the risk. Extrinsic factors are a direct result of ones environment, such as unsuitable footwear and unstable living conditions, whereas intrinsic factors consist of those related to the physiological changes associated with aging. Intrinsic factors have been identified as medication use, loss of balance, syncope, postural instability, visual and hearing impairment, neurological disability, mobility problems, cognitive impairment and depression, as well as sensory-motor deficiencies, and so forth.[1-4,7-11] Many studies have indicated that risk factors are associated with falls among elderly people in community residences and nursing homes. There have been few studies, however, focusing on the correlations among these risk factors.[5,8,9,12]

The present study investigates risk factors for falling and examines their correlation with balance, depression, cognitive impairment and mobility skills in elderly nursing home residents.

**Methods.** This study comprised 30 elderly people (11 women and 19 men) living in Seyranbaglari Nursing Home in Ankara City Centre, Turkey and was carried out during 2004. The subjects were between 70 and 82 years old, the average age being 75.86±5.54 years. History of falling, use of a cane, hypertension, postural hypotension, medication use, visual impairment, difficulty in standing up from a chair, feet problems, vertigo and neurological disability were obtained through individual interviews and observation. In addition, cognitive function was assessed by Mini Mental State Examination (MMSE). Subjects whose MMSE scores were 23/30 or lower were categorized as cognitively impaired.[13,14] Depressive symptoms were evaluated using the Geriatric Depression Score (GDS), which consists of 30 items. Those patients with GDS scores 10/30 were considered to be depressed, while those with scores <10 were considered to be nondepressed.[15-19] Subjects' balance was evaluated by means of Berg Balance Scale (BBS) and Get Up and Go Test (GUGT). The BBS grades 14 tasks on a scale from 0-4 for each, with zero indicating a total inability to complete the task.[20,21] Scores can range from 0-56. The GUGT was developed to be a satisfactory clinical measure of balance in elderly people. This test requires subjects to stand up from a chair, walk a short distance, turn around, return and sit down again. Balance function was scored on a 5-point scale: 1=normal; 2=very slightly abnormal; 3=mildly abnormal; 4=moderately abnormal; 5=severely abnormal. Patients with scores of 3+ are at risk of falling.[22,23] In addition, mobility skills were assessed by Rivermead Mobility Index (RMI), which rates the patient's mobility (turning over in bed, standing, walking outside, and so forth). Scores range from zero (paralysis) to 15 (no impairment disability).[24,25]

*Statistical Analysis.* Spearman's correlation coefficient was used for the assessment of the total number of risk factors' correlation with the other parameters. In addition, correlation among all other parameters was evaluated. The software program SPSS for Windows 11.0 was used for the statistical analysis. The level of significance was set at $p<0.05$ and $p<0.01$.

**Table 1 -** The fall risk factors of subjects.

| The risk factors of fall | Present | | Absent | |
|---|---|---|---|---|
| | n | (%) | n | (%) |
| History of falling | 16 | (53.3) | 14 | (46.7) |
| Use of cane | 13 | (43.3) | 17 | (56.7) |
| Hypertension | 20 | (66.7) | 10 | (33.3) |
| Hearing impairment | 11 | (36.7) | 19 | (63.3) |
| Postural hypotension | 9 | (30) | 21 | (70) |
| Medication use | 5 | (16.7) | 25 | (83.3) |
| Visual impairment | 8 | (26.7) | 22 | (73.3) |
| Difficulty in standing up from chair | 7 | (23.3) | 23 | (76.7) |
| Vitigo | 2 | (6.1) | 28 | (93.9) |

**Table 2 -** Correlations among all parameters

| Parameters | Total N of fall risks r | GUGT r | BBS r | GDS r | MMSE r | RMI r |
|---|---|---|---|---|---|---|
| Total N of fall risks | - | 0.522† | -0.439* | 0.621† | -0.612† | -0.385* |
| GUGT | 0.522+ | - | -0.757† | 0.666† | -0.576† | -0.736† |
| BBS | -0.439* | -0.757† | - | -0.623† | 0.537† | 0.719† |
| GDS | 0.621+ | 0.666† | -0.623† | - | -0.647† | -0.560† |
| MMSE | -0.612+ | -0.576 | 0.537† | -0.647† | - | 0.528† |
| RMI | -0.385* | -0.736† | 0.719† | -0.560† | 0.528† | - |

GUGT - get up and go test, BBS - berg balance scale, GDS - geriatric depression scale, MMSE - mini mental state examination, RMI - rivermead mobility index, r - spearman's correlation coefficient, *Correlation is significant at the 0.05 level, †correlation is significant at the 0.01 level

**Results.** In our study, the risk factors for falls of all subjects were determined. It was found that each subject had more than one fall risk factor. Nobody has fracture or serious injury owing to fall. The risk factors of subjects are shown with their percentage values in **Table 1**. A correlation analyses among all the parameters were performed. Those results found to be statistically significant are shown in **Table 2.**

**Discussion.** Falls and the resultant injuries are common reasons for medical intervention in elderly people, especially in nursing home residents. Most falls among elderly people appear to be caused by multiple factors.[2,3,10] First, the risk factors for falls of all subjects were determined. It was found that each subject in this study had more than one risk factor. Then, the number of total risk factors for each subject was calculated. Next, the significant relations of the total number of risk factors among the MMSE, GDS, BBS, GUGT and RMI results were determined. In addition, the relations of the other parameters to each other were analyzed. It was found that cognitive impairment and the total number of risk factor for falls are significantly correlated. Tinetti et al[1] and Gostynski et al[7] also stated that mild and serious cognitive impairments are risk factors for falls. We also observed that there was a significant correlation of MMSE test scores among GDS, BBS, GUGT and RMI. This means that if cognitive function regresses, depression and impairment of balance and mobility skills will increase. The BBS and GUGT scores, which were used to evaluate balance problems, were correlated to the total number of risk factors for falls. The literature also indicates that balance problems constitute a high risk for falls.[2,4,8,10] In addition, we determined that balance problems resulted in depression and deficient mobility.

The elderly develop a fear of falling, social isolation, a reduction in their confidence to accomplish normal activities of daily living, and mobility problems in particular, and adopt an inactive lifestyle.[2-4,6,7,25-27] Significant relations among RMI, the total number of risk factors, BBS and GUGT, which were observed in our study, support the relevant literature results. In a previous study, it also indicated that patients with low daily BBS scores and functional impairment measurement scales fall frequently.[28]

In our study, RMI scores were correlated with GDS and MMSE scores. These correlations are parallel to the results in the literature. Depressive symptoms, which are commonly seen in the elderly, become a chronic disease with increasing age. Stalenhoef et al[2] showed that depression, an abnormal postural sway, poor handgrip dynamometer scores, and a history of 2 or more falls in the previous year in elderly people are the best predictors of falls.[2] Nakamura et al[10] also indicated that depressive symptoms constitute a high risk for falls in nursing home residents. In addition, falls increase depression, and this causes a vicious circle.

The results of this study indicate that depressive and cognitive symptoms, insufficient mobility, balance impairment and the total number of other risk factors are related to each other. There is a vicious circle among these parameters. In further studies, in order to decrease the risk of falls in the elderly, risk factors should be investigated in detail, and it should be remembered that risk factors are correlated with each other. If the vicious circle that is constituted among all these parameters is not broken, an increasing risk of falling will be inevitable. In addition, this information may therefore be useful for patient's medical and physical therapy and rehabilitation, and for the development of fall prevention programs for elderly people.

## References

1. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med* 1988; 319: 1701-1707.
2. Stalenhoef PA, Diederiks JP, Knottnerus JA, Kester AD, Crebolder HF. A risk model for the prediction of recurrent falls in community-dwelling elderly: a prospective cohort study. *J Clin Epidemiol* 2002; 55: 1088-1094.
3. Donmez L, Gokkoca Z. Accident profile of older people in Antalya City Center, Turkey. *Arch Gerontol Geriatr* 2003; 37: 99-108.
4. Lajoie Y, Gallagher SP. Predicting falls within the elderly community: comparison of postural sway, reaction time, the Berg balance scale and the Activities-specific Balance Confidence (ABC) scale for comparing fallers and non-fallers. *Arch Gerontol Geriatr* 2004; 38: 11-26.
5. Allander E, Gullberg B, Johnell O, Kanis J A, Ranstam J, Elffors L. Circumstances around the fall in a multinational hip fracture risk study: a diverse pattern for prevention. (MEDOS Study Group). Mediterranean Osteoporosis Study. *Accid Anal Prev* 1998; 30: 607-616.
6. Vellas BJ, Wayne SJ, Romero LJ, Baumgartner RN, Garry PJ. Fear of falling and restriction of mobility in elderly fallers. *Age Ageing* 1997; 26: 189-193.
7. Gostynski M, Ajdacic-Gross V, Heusser-Gretler R, Gutzwiller F, Michel JP, Herrmann F. [Dementia, depression and activity of daily living as risk factors for falls in elderly patients. *Soz Praventivmed* 2001; 46: 123-130. German.
8. Lord SR, Ward JA, Williams P, Anstey KJ. Physiological factors associated with falls in older community-dwelling women. *J Am Geriatr Soc* 1994; 42: 1110-1107.
9. Monane M, Avorn J. Medications and falls. Causation, correlation, and prevention. *Clin Geriatr Med* 1996; 12: 847-858.
10. Nakamura T, Kagawa K, Kakizawa T, Seo M, Iketani N, Ono H, et al. Risk factors for falls among blind elderly in a nursing home for the blind. *Arch Gerontol Geriatr* 1998; 27: 9-17.
11. Herrmann R, Meier-Baumgartner HP. Accidental fall-induced, proximal femoral fracture in the elderly--etiology and rehabilitation]. *Z Gerontol Geriatr* 1999; 32: 52-57.

12. Arfken CL, Lach HW, Birge SJ, Miller JP. The prevalence and correlates of fear of falling in elderly persons living in the community. *Am J Public Health* 1994; 84: 565-570.
13. Folstein MF, Folstein SE, McHung PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; 12: 189-98.
14. Grigoletto F, Zappala G, Anderson DW, Lebowitz B D. Norms for the Mini-Mental State Examination in a healthy population. *Neurology* 1999; 53: 315-320.
15. Meldon SW, Emerman CL, Schubert DS, Moffa DA, Etheart RG. Depression in geriatric ED patients: Prevalence and recognition. *Ann Emerg Med* 1997; 30: 141-145.
16. Meldon SW, Emerman CL, Moffa DA, Schubert DS. Utility of clinical characteristics in identifying depression in geriatric ED patients. *Am J Emerg Med* 1999; 17: 522-525.
17. Ertan T, Eker E. Reliability, validity, and factor structure of the geriatric depression scale in Turkish elderly: are there different factor structures for different cultures? *Int Psychogeriatr* 2000; 12: 163-172.
18. Paterniti S, Verdier-Taillefer MH, Dufouil C, Alperovitch A. Depressive symptoms and cognitive decline in elderly people. Longitudinal study. *Br J Psychiatry* 2002; 181: 406-410.
19. Raccio-Robak N, McErlean MA, Fabacher DA, Milano PM, Verdile VP. Socioeconomic and health status differences between depressed and nondepressed ED elders. *Am J Emerg Med* 2002; 20: 71-73.
20. Berg K, Wood-Dauphinee S, Williams JI, Gayton D. Measuring balance in the elderly: Preliminary development of an instrument. *Physiother Can* 1989; 41: 304-311.
21. Berg KO, Wood-Dauphinee S, Williams JI, Maki B. Measuring balance in the elderly: validation of an instrument. *Can J Public Health* 1992; 83 Suppl 2: S7-S11.
22. Mathias S, Nayak US, Isaacs B. Balance in elderly patients: the "get-up and go" test. *Arch Phys Med Rehabil* 1986; 67: 387-389.
23. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1991; 39: 142-148.
24. Wade DT. Measurement in neurological rehabilitation. 1st ed. Oxford: Oxford University Press; 1992.
25. Cattaneo D, De Nuzzo C, Fascia T, Macalli M, Pisoni I, Cardini R. Risks of falls in subjects with multiple sclerosis. *Arch Phys Med Rehabil* 2002; 83: 864-867.
26. Bergland A, Pettersen AM, Laake K. Functional status among elderly Norwegian fallers living at home. *Physiother Res Int* 2000; 5: 33-45.
27. Friedman SM, Munoz B, West SK, Rubin GS, Fried LP. Falls and fear of falling: which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. *J Am Geriatr Soc* 2002; 50: 1329-1335.
28. Teasell R, McRae M, Foley N, Bhardwaj A. The incidence and consequence of falls in stroke patients during inpatient rehabilitation: factors associated with high risk. *Arch Phys Med Rehabil* 2002; 83: 329-333.