Iranian J Publ Health, Vol. 42, No.2, Feb 2013, pp.120-128

Original Article

Domestic Environmental Risk Factors Associated with Falling in Elderly

Neslihan LÖK, Belgin AKIN

1. Dept. of Public Health Nursing, Faculty of Health Sciences, Selçuk University Selçuklu-Konya 42100, Turkey

***Corresponding Author:** Tel: +0905335119662 Email: neslihanlok@akdeniz.edu.tr

(Received 15 Aug 2012; accepted 19 Jan 2013)

Abstract

Background: This is a cross-sectional study aiming at analyzing the relation between falling and domestic environmental –risk factors in community-dwelling elderly.

Methods: The study consisted of 243 randomly chosen community-dwelling elderly over 65 years of age living around a health care center in Central Selcuklu, Konya. Data were collected with a questionnaire form including socio-demographic and other characteristics, with the Rivermead Mobility Index for evaluating mobility condition and an Evaluation Form of Domestic Environmental Risk Factors of Falling (EFDERF), which is developed by the researcher to assess domestic environmental risk factors of falling.

Results: Based on (EFDERF) high number of problems lived in bathroom/restroom, kitchen, bedroom, sitting room/saloon and in all other areas was a risk factor in terms of domestic falling characteristics while the number of problems lived in hall and stairs was not a significant risk factor.

Conclusion: EFDERF may be used by the nurses and health professionals to evaluate risk of falling and collecting data after visits in primary-care of elderly.

Keywords: Elderly, Falling, Fear, Risk Factor, Turkey

Introduction

World population is gradually getting older with the prolonged life expectancy at-birth and decreased birth rate. The gradual increase in elderly population will lead to serious problems especially in terms of social, insurance and health expenditures (1, 2). Most elderly prefer to live alone all around the world (3) and in Turkey (4), as well.

Among all the fractures caused by falling, femur fractures are the most serious ones which result in either serious health problems or death (5, 6). Accident-related death rates have tripled in the society for people aged 65 and older compared to the whole population; besides, six of the 10 accidents resulting in death are reported to be falling cases (7, 8). Risk factors causing falling cases are classified as internal and external factors. Age, gender, living alone, walking and balance problems, functional and cognitive disorders, and vision-related problems are among the internal factors (9). Making domestic arrangements so as to provide elders with comfort has a significant role in preventing falling. However, individuals do not pay enough attention to these arrangements (10, 11).

Health professionals, especially nurses, have great responsibilities in preventing falling cases. Nurses should observe elderly people by doing regular home-visits (12). Factors causing domestic accidents for elderly can stem from their living environment and individual characteristics (13, 14). The studies of domestic accidents regarding el-

derly show that the most frequently encountered type of accident was falling (15, 16).
This study was conducted to determine the domestic environment risk factors related to falling in community-dwelling elderly.

Materials and Methods

Design

This research was planned to be a cross-sectional study aiming at analyzing the relation between falling and domestic environmental risk factors in community-dwelling elderly and was carried out in a town of Konya, the Central Selçuklu, around 14th Healthcare Center

Sample, Setting and Data Collection

The population of the research constituted of 1653 people aged 65 years and older who were determined by the 2008 records of 14th Healthcare Center in Central Selçuklu, Konya. According to the study of Taşkıran (17), the frequency of falling in elderly was 33%. This frequency has been used during the calculation of the sample size. Besides, considering confidence level as 95% and precision as 6%, the sample size was found to be 243. While choosing sample, a systematic sampling method, which is a randomly choosing method, was used by referring to the ETF records of elderly people. The sample of the research consisted of elderly aged 65 years and older, who were living at their homes, were not confined to bed/, did not have a cognitive ability loss, and had agreed to participate in the study.
During the data collection, a questionnaire form that was developed by the researcher was used in order to assess characteristics regarding socio-demographic, health and falling story of the individuals. In addition, a Rivermead Mobility Index-RMI (18) was used to assess the ability loss in mobility. Moreover two different Mini-Mental Tests according to the education level were used to assess the cognitive condition of the elderly. A "Standardized Mini-Mental Test" (SMMT) (19-21) was performed in elderly who were graduates of elementary school and further. A "Mini-Test for Illiterates" (MT-I) was performed in those who were not graduates of primary school. Additionally, an Evaluation Form of Domestic Environmental Risk Factors of Falling (EFDERF), developed by the researchers, was used to assess domestic environmental risk factors of falling.
An information form was prepared by the researchers based on the technical literature (9-16, 22-24). This form consists of the information that will help determine socio-demographic and health characteristics and taking falling story of the individual.

Evaluation Form of Domestic Environmental Risk Factors of Falling (EFDERF)

It was prepared according to the literature (15, 18, 24-32) and it aimed to determine the domestic environmental features of the elderly. EFDERF consists of six categories. The questions numbered 2, 5, 7, 9, 12, 17, 24, 26, 33, 34 and 35 require an objective evaluation, and they are evaluated by using a constant assessment instrument (meter). Likewise, while answering the 4th, 16th, 27th, 36th, and 39th questions, the observer checked how many watts the light bulb used and evaluated accordingly. The EFDERF which has been developed after the validity and credibility studies included 39 observational questions and they were graded "0" or "1". "0" points means there is not a risk of falling while "1" point means there is a risk of falling. If the total score is high, it means domestic environmental conditions of the elderly poses a high risk of falling. EFDERF is an observational evaluation instrument for heath professionals.
Experts in their fields were asked for their views regarding the content validity. Internal consistency and consistency between interviewers were examined in order to maintain the credibility of the form. To examine Internal Consistency, the credibility of KR 21 was calculated for the total and sub-scales of EFDERF. The total credibility coefficient of EFDERF was 0.75; and in domestic areas it was as follows: sitting room (0.54), kitchen (0.31), bedroom (0.34), bathroom/restroom (0.60), stairs (0.84) and hall (0.20). Kappa adjustment analysis is carried out in the examination of consistency between interviewers. Kappa adjust-

ment coefficient was found to be very low in sitting room (0.01) "existence of furniture and stuff narrowing down the walking space" and in hall (0.01) "existence of furniture and stuff narrowing down the walking space". In the rest, Kappa coefficient ranged from 0.17 and 1.00. Based on these data, two points above whose credibility between interviewers came out very low were excluded, and the analysis was carried out with 39 points. The data was collected by the researchers by home visits between 1st of October, 2009 and 15th of January, 2010 by a face-to-face interview and observation. Elderly with cognitive ability loss were excluded during the study process; it was aimed to exclude elderly people with cognitive ability loss. Therefore, SMMT and SMMT-I were used, and no elderly people with cognitive ability loss was detected.

Independent Variables of the Research; Gender, age, marital status, education level, having social security, regular income of his/her own, perceived income, people he/she lives within the house with, condition of the house, size of the house (m^2), ownership of the house, walking-related problems, balance-related problems, usage of walking aids, vision-related problems, history of chronic disease, perceived health condition, history of chronic continuous medication, having mobility problem, point of domestic environmental risk situation in terms of falling (sitting room, kitchen, bedroom, bathroom/restroom, stairs, hall).

Dependent Variables of the Research; Experience of falling within the last one year, fear of falling. Research findings were limited to people aged 65 years and older who were not confined to bed and who were not mentally disordered. The findings cannot be generalized for all elderly people. The evaluation of domestic falling in elderly people was confined to the data obtained from the evaluation form of domestic environmental risk factors.

Research Questions

1. Which areas pose a domestic environmental risk in terms of falling in elderly people living around the 14th Healthcare Center?
2. Is experiencing a falling case within the last one year related to socio-demographic, health, falling characteristics and mobility condition?
3. Is having a fear of falling related to socio-demographic, health, falling characteristics and mobility condition?
4. Is experiencing a falling case within the last one year related to domestic environmental features in terms of falling?

Is fear of falling related to domestic environmental characteristics in terms of falling?

Ethical issues

Prior to the research, Ethics Committee approval was received from Meram Medical Faculty of Selçuk University. Written permissions for performing the research were received from Konya Local Health Authority. Oral consent from elderly people was received prior to the study. By clearly explaining the aim, duration and the procedures that would be carried out during the research, the "Informed Consent" principle was fulfilled. Besides, "Self-determination" principle was accomplished by pointing out that they could withdraw from the research whenever they wanted. Lastly, "Privacy and Protection of Privacy" principle was fulfilled by pointing out that all the personal information would be kept confidential when shared with the researchers.

Data Analysis

Statistical Package for Social Sciences version 15.0 software was used for the statistical analysis of the data. Kolmogrov-Smirnov test, Histogram graphic and Q-Q Plots were used while testing the normality of the data. Since data have not shown a normal distribution, nonparametric tests were used. Also digit, percentage, mean, standard deviation, chi-square and Mann-Whitney U tests were used.

Results

Mean age of the participants was 71.30±4.47 years. Of the elderly, 43.6% were women, 42.8% have lost their partners, 46.9% have graduated from

elementary school and further level of education, 25.5% were still deprived of a social security. The mean monthly income of the elderly was 482.63±128.20 **TL**, 77.0% had a regular income, and 67.0% perceived their economic condition as middle/low. 92.2% of the individuals owned their house, 62.6% lived in a detached house, and 21.4% lived alone. 2.1% of them experienced problems related with balance, 18.5% had vision-related problems, and 31.7% had a chronic disease.

Table 1: The score of elderly from different areas of the house and distribution of the total score based on EFDERF

Areas of House	Mean±SD	Min-Max	Median	Mode
Bathroom/Restroom	7.36±1.305	4-10	8.00	8
Kitchen	3.01±0.916	1-5	3.00	3
Bedroom	2.35±1.151	0-6	2.00	2
Sitting room/Saloon	1.97±1.102	1-5	2.00	2
Hall	1.10±0.325	0-2	1.00	1
Stairs	0.11±0.647	1-7	1.00	1
Total Score	15.79±3.547	8-30	15.00	15

The scores of elderly from different areas of the house and distribution of the total score in terms of falling risk are analyzed in Table 1 and Fig. 1. The areas of the house in which the most dangerous situations occurred were bathroom/restroom (7.36±1.305), bedroom (2.35±1.151), sitting room/saloon (1.97±1.102), hall (1.10±0.325), and stairs (2.89±1.902). And the mean total risk score of all areas in the house was found as 15.79±3.547. The analysis of distribution of socio-demographic characteristics of elderly people by falling and surviving showed that the majority of women (82.1%) and widows (63.5%) experienced falling and the difference was statistically significant (P<0.05). While 86.0% of illiterate people experienced falling, this rate was 31.6% for those with primary school and further education. Additionally, the rate of falling was significantly higher in people without social security (71.0%) than those with social security (39.8%), (P<0.05). The rate of falling was also higher in elderly without a regular income (71.4%), in those perceiving their income as middle/low (52.8%), and in those with a lower income which was significantly different (P<0.05). Elderly people living in detached houses (53.9%) compared to those living in apartment flats (37.4%), elderly with a mean house area of 103.68±19.010 compared to those with larger areas, those living alone (85.5%) compared to others experienced more falling cases being statistically significant (P<0.05). Those having a falling experience were older compared to those who have not experienced and the difference were statistically significant. Although those living on rent have experienced more falling cases (57.9%) than those living in their own houses, this difference was not found statistically significant.

After analyzing socio-demographic characteristics in elderly people in terms of fear of falling, these results were found; while women (99.1%) were found to experience more fear of falling compared to men, the statistical analysis could not be carried out due to the small values in the cells. It was seen that the majority of the widows (87.5%) had fear of falling, being statistically significant (P<0.05). Whereas it was seen that 68.4% of those with primary school and further level of education had fear of falling, however statistical analysis could not be carried out due to the small values in the cells. The rate of the fear was higher in those without social security (93.5%) compared to those with social security (75.1%), (P<0.05). Those with a low monthly income (477.48±135.407 TL) and those without a regular income (91.1%) had more fear of falling which was statistically significant (P<0.05). Those perceiving their income as middle/low (82.2%) had more fear of falling compared to those perceiving their income as very

good/good. Those with a small mean area in the house (108.90±19.268 m^2) compared to those with larger mean area in the house had more fear of falling, being statistically significant (P<0.05). Whereas it was found that those living alone had more fear of falling (98.2%) than others, however statistical analysis could not be carried out due to the small values in the cells. Mean age of those who have experienced a falling case was higher (71.52±4.652 years) compared to those who have not experienced one, and this difference is not considered statistically significant.

The analysis of the distribution of health related characteristics of elderly people by falling and surviving showed that those with a chronic disease (58.4%) compared to those without, those living on a regular medication (60.3%) compared to those not using regular medication, and those perceiving their health condition as moderate (65.5%) compared to those perceiving as very well/well have experienced more falling cases, being statistically significant (P<0.05). Those having a balance-related problem have experienced more falling cases (100.0%) than those who did not live such a problem, however statistical analysis could not be carried out due to the small values in the cells. It was seen that those having a vision-related problem experienced more falling (49.0%) than those who did not have such a problem, despite being statistically insignificant (P<0.05). It was also found that 61.8% of elderly people with diabetes and 57.1% of those who have stayed at hospital for any reason within the last one year have experienced falling, however the difference was not statistically significant.

Analysis of the distribution of health related characteristics of the elderly people by fear of falling showed that those with a vision-related problem had more fear of falling (84.3) than those who did not have such a problem, and this difference was found as statistically significant (P<0.05). All of the elderly people having a balance-related problem (100.0%), 84.5% of those living on regular medication, 86.2% of those perceiving their health condition as moderate, 78.6% of those who have stayed at hospital within last one year had fear of falling. It was also found that those with a chronic disease had more fear of falling (85.7%) than those who did not have one, despite being statistically insignificant.

Table 2: The scores of elderly from different areas of the house and distribution of the total score by falling and surviving according to EFDERF

Areas of House	Living and Surviving		Significance Test
	Yes Mean±SD	No Mean±SD	
Bathroom /Restroom	7.50±1.261	7.10±1.402	z=-2.318 *P*=0.020
Kitchen	3.22±0.979	2.88±0.813	z=-2.776 *P*=0.005
Bedroom	2.53±1.212	2.08±1.095	z=-3.103 *P*=0.002
Sitting room /Saloon	2.23±1.254	1.72±0.879	z=-3.037 *P*=0.000
Hall	1.13±0.362	1.07±0.287	z=-1.412 *P*=0.158
Stairs	0.10±0.750	0.11±0.538	z=-0.863 *P*=0.388
Total score	16.69±3.800	14.97±3.091	z=-3.800 *P*=0.000

In Table 4, the total scores of elderly people from different areas of the house and distribution of this total score by falling and surviving according to EFDERF were analyzed. Those who have experienced a falling case, according to EFDERF, had negative scores out of bathroom/restroom, kitchen, bedroom, sitting room/saloon, and out of the total score obtained from the scale. And the difference was considered as statistically significant (P<0.05). However, it was found that there was no significant difference in stairs and hall, (Table 2).

The total scores of the elderly from different areas of the house and distribution of this total score by fear of falling according to EFDERF were analyzed (Table 5). Those who have experienced a falling case, according to EFDERF, had negative scores out of bathroom/restroom, bedroom, sitting room/saloon, and out of the total score ob-

tained from the scale. However the difference was not found statistically significant (Table 3).

Table 3: The scores of elderly people from different areas of the house and distribution of the total score by fear of falling according to EFDERF

Areas of House	Fear of Falling		Significance Test
	Yes Mean±SD	No Mean±SD	
Bathroom /Restroom	7.36±1.305	7.04±1.499	z=-1.477 *P*=0.140
Kitchen	3.01±0.916	3.18±0.882	z=-1.448 *P*=0.148
Bedroom	2.35±1.151	2.10±1.246	z=-1.669 *P*=0.095
Sitting room /Saloon	1.97±1.110	1.96±1.079	z=-0.013 *P*=0.989
Hall	1.10±0.321	1.08±0.344	z=-0.386 *P*=0.699
Stairs	0.09±0.617	0.18±0.755	z=-1.018 *P*=0.308
Total score	15.85±3.601	15.55±3.348	z=-0.510 *P*=0.610

Discussion

While the rate of elderly people who have experienced a falling case within last one year was 47.7%, the rate of those who have experienced falling only once was 90.5%. Fisher et al. (32) has stated that one-year frequency of falling in elderly was 55.0%. Whereas Akın and Emiroğlu (18) have found the rate of falling within last one year as 41.3% and they stated that the rate of those who have experienced falling only once was 39.6% (33). Atman et al. (34) (49.2%) and Keskinoğlu et al. (35) (67.0%) have stated that falling ranked the first among the accident factors at home for elderly people. These findings obtained from our study are in parallel with the studies carried out in our country and in other countries. These findings indicate that falling is a widespread problem for elderly people. It can be concluded that falling in elderly people and falling-related problems constitute an important and indispensible aspect of health condition of the elderly in our country.

It was seen that elderly people experienced falling mostly in bathroom (63.8%), then in kitchen, bedroom, sitting room, and hall, respectively. According to the study of Clemson et al. (36) in which they analyzed home accidents and fallings in people aged 65 years and older, elderly people experienced falling mostly in bathroom and restroom. That most of the falling cases which occur in bathrooms can be connected to that bathroom is the place the individual uses his independency at most and consequently stays alone due to the feeling of privacy. Therefore it can be said that bathroom/restroom is the most dangerous place for elderly people in terms of falling.

A study shows that 78.0% of the sitting rooms had slippery floor, 71.9% of the carpets and rugs on the floor carried falling risk (30). These findings show that sitting rooms are risky in terms of features causing falling (having a door sill, non-fixed stuff that may cause slipping in walking space, etc.). Since bedroom is the place where elderly people spend most of their time, arranging this area so as to control the risks of falling is significant especially in controlling falling cases (37, 38).

The present study has shown that height of 11.1% of the wash-basins was unsuitable and that the illumination of the light bulb was insufficient. Northridge et al. (kaynak no) have defined inexistence of grab-bars in bathrooms (84.7%) as a high risk factor in terms of falling (25). Based on these findings, it can be said that especially bathroom/restroom needs to be considered as primary in terms of falling due to the feeling of privacy and as a result, the need to spend their time alone. In our study and in the others (18, 19, 39, 40), it was found that falling cases occurred mostly in bathrooms/restrooms, which increased the rate of this finding.

When the total scores of elderly from different areas of the house and distribution of this total score by falling and surviving based on EFDERF were analyzed, it was found that the most dangerous area for those who have experienced falling was bathroom/restroom, the second one was

kitchen, and the rest of the risky areas were as follows; bedroom, sitting room, hall and stairs ($P<0.05$). Another study which supports this study has defined the inexistence of grab-bars in bathroom (77.8%) as a high risk factor (41).

Conclusion

1. The risk group in terms of falling and fear of falling is as follows; women, widows and illiterates, those living in a detached house and living on a rented house, and those living alone.
2. The risk factors in terms of falling and fear of falling are as follows; problems related with balance and vision, chronic disease and mobility problem.

Recommendations

1. A more closed monitorization of those risk groups in terms of falling should be kept: Women, widows and illiterates, those without social security and regular income, those with a low income average, those perceiving their income as middle/low, those living in a detached house and living on a rented house, and those living alone.
2. Data regarding falling at home and in terms domestic characteristics for evaluating the risks of falling in monitoring elderly people should be collected and elderly people and their family members should be educated about all risky areas, especially bathroom/restroom, in terms of falling and arrangement of these areas.
3. Houses peculiar to elderly people should be planned and the needs of elderly people should be taken into consideration in interior decoration arrangements.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

Acknowledgements

This study is a portion of Master of Science dissertation and was supported by Selçuk University Research Projects Coordinator (SUBAPK, 09-102064). The authors declare no conflict of interest.

References

1. Bilir N, Subaşı Paksoy N (2006). Yaşlılık Sorunları ve Bulaşıcı olmayan Hastalıkların Kontrolü. In: *Halk Sağlığı Temel Bilgiler*. Eds, Güler Ç, Akın L. Hacettepe Üniversitesi Yayınları. Inc. Ankara, pp.1020-1024.
2. Güler Ç, Akın L (2006). *Halk Sağlığı Temel Bilgiler*. Hacettepe Üniversitesi Yayınları. pp.1026-1034.
3. Pegg J (2005). *Care Home Mixed Category Majority Older People. Making Social Care Better for People*. İnspection Report. pp.12-27.
4. Kutsal Gökçe Y (2007). Yaşlanan Dünyanın Yaşlanan İnsanları. In: *Yaşlılıkta Kaliteli Yaşam*. Eds, Kutsal YG. HÜGEBAM Yayınları. Ankara. pp.7-8.
5. Sürmen Ş (1995). *Özürlü ve Yaşlılarla İlgili Mimari Ölçütler, Standartlar, Uygulamalar*. İTÜ Çevre ve Şehircilik Uygulama-Araştırma Merkezi Yayınları. İstanbul. pp.46-63.
6. DPT (2007). *Türkiye'de Yaşlıların Durumu ve Yaşlanma Ulusal Eylem Planı*. Sosyal Sektörler ve Koordinasyon Genel Müdürlüğü. pp.75-114.
7. Tremblay KR, Barber CE. Preventing falls in the elderly. [PhD thesis]. Consumer Series. Colorade State University of Medical Sciences, USA;2005
8. Kirby SD (1992). *Safe, comfortable housing for the elderly. Service in Action*. Colorado State University Cooperative Extension.pp.1-5.
9. Işık AT, Cankurtaran M, Doruk H, Mas MR (2006). Geriatrik olgularda düşmelerin değerlendirmesi. *Turk Geriatr Derg,* 9(1): 45-50.
10. Kannus P, Sievanen H, Palvanen M, Jarvinen T, Parkkari J (2005). Preventian of falls and

consequent injuries in elderly people. *Lance,* 366(26): 1885-1893.
11. Turaman C (2001). Yaşlı sağlığı hizmetlerinin birinci basamakta planlanması. *Turk Geriatr Derg,* 4(1): 22-27.
12. Kehinde JO (2009). Instruments for measuring fall risk in older adults living in long-term care facilities. *J Gerontol Nur,* 35(10): 46,55.
13. Naharcı Mİ, Doruk H (2009). Yaşlı popülasyonda düşmeye yaklaşım. *TAF Prev Med Bull,* 8(5): 437-444.
14. Güner P, Güler Ç (2002). Yaşlıların Ev Güvenliği ve Denetim Listesi. *Turk Geriatr Derg,* 5(4); 150-154.
15. Erkal S. Ev Kazalarına Neden Olan Konut Faktörlerinin İncelenmesi. [Yüksek Lisans Tezi]. Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü, Ankara;1992.
16. Erkal S (2005). Kırıkkale Ovacık mahallesinde yaşayan 65 yaş ve üzeri kişilerin ev kazaları ile karşılaşma durumlarının ve kaza nedenlerinin incelenmesi. *Turk Geriatr Derg,* 8(1): 17-21.
17. Taşkıran ÖÖ. Yaşlılarda düşme ve düşmeye yol açabilecek risk faktörlerinin değerlendirilmesi. [Doktora Tezi]. Gazi Üniversitesi Sağlık Bilimleri Enstitüsü. Ankara; 2005.
18. Akın B, Emiroğlu ON (2007). Rivermead mobilite indeksi (RMI) Türkçe formunun geçerlilik ve güvenirliği. *Turk Geriatr Derg,* 10(3): 124-130.
19. Folstein MF, Folstein S, McHugh PR (1975). "Mini Mental State" A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res,* 12(3): 189-198.
20. Güngen C, Ertan T, Eker E, Yaşar R, Engin F (2002). Standardize mini mental testin Türk toplumunda hafif demans tanısında geçerlilik ve güvenilirliği. *Turk Psikiyatr Derg,* 13(4); 273-281.
21. Cartens DY (1985). *Site Plaining and Design for the Elderly.* Van Nostrand reinhold Company Press. Newyork. pp.64-73.
22. Gill TM, Williams CS, Tinetti ME (2000). Environmental hazards and the risk of nonsyncopal falls in the homes of community-living older persons. *Med Care,* 38(12): 1174-83.
23. Huang TT (2005). Home environmental hazards among community dwelling elderly in Taiwan. *J Nurs Res,* 13 (1): 49-56.
24. Bıyıklı K. Huzurevinde yaşayan bir grup yaşlıda düşme ile ilişkili faktörler: Demografik özellikler, sağlık sorunları ve kullanılan ilaçlar. [Yüksek Lisans Tezi]. İstanbul Üniversitesi Sağlık Bilimleri Enstitüsü. İstanbul; 2006
25. Northridge ME, Nevitt MC, Kelsey JL, Link B (1995). Home hazards and falls in the elderly: The role of health and functional status. *Am J Public Health,* 85(4): 509-515.
26. Carter SE, Campbell EM, Sanson-Fisher RW, Redman S, Gillespe WJ (1997). Environmental hazards in the homes of older people. *Age Ageing,* 26(3): 195-202.
27. Akın G. (2001). *Antropometri ve Ergonomi.* İnkansa Ofset. Ankara. pp.85-92
28. Huang TT, Acton GJ (2004). Effectiveness of home visit falls prevention strategy for taiwanese community-dwelling elders: Randomized trial. *Public Health Nurs,* 21(3): 247-256.
29. Morgan RO, Devito CA, Stevens JA, Branche CM, Virnig BA, Wingo PA, Sattin RW (2005). A self-assessment tool was reliable in identifying hazards in the homes of elders. *J Clin Epidemiol,* 58(12): 1252-1259.
30. Emiroğlu ON, Aslan GK (2007). Huzurevlerinin düşmeyle ilişkili çevresel risk faktörleri yönünden değerlendirilmesi. *Turk Geriatr Derg,* 10(1): 24-36.
31. Büker N, Altuğ F, Kitiş A, Cavlak U (2008). Şehirde ve kırsal kesimde yaşlıların ev güvenliğinin incelenmesi. *TAF Prev Med Bul,* 7(4): 297-300.
32. Fisher AA, Davis MW, McLEan AJ, Couteur DGL (2005). Epidemiology of falls in elderly semi-independent resident in residential care. *Australas J Ageing,* 24(2): 98-102.
33. Akın B, Emiroğlu ON (2003). Evde yaşayan yaşlılarda mobilitede yeti yitimi ve ilişkili faktörlerin incelenmesi. *Turk Geriatr Derg,* 6(2): 59-67.
34. Atman ÜC, Dinç G, Oruçoğlu A, Oğurlu H, Ecebay A (2007). Manisa Muradiye Sağlık Ocağı bölgesinde yaşlılarda kaza sıklığı ve

kaza ile ilişkili faktörler. *Turk Geriatr Derg,* 10(2): 83-87.
35. Keskinoğlu P, Giray H, Pıçakcıefe M, Bilgiç N, Uçku R (2004). İnönü Sağlık Ocağı bölgesindeki yaşlılarda ev içi kazalar. *Turk Geriatr Derg,*7(2): 89-94.
36. Clemson L, Cumming RG, Roland M (1996). Case-control study of hazards in the home and risk of falls and hip fracture. *Age Ageing,* 25(2): 97-101.
37. Jenkyn BKM. Fall-Related Health Service Utilization, Costs, and Costeffectivenes of a Multi-Factorial Falls Prevention Program Delivered to Community-Dwelling Older Adults. [Doctoral Thesis]. The University of Western Ontario. London;2009
38. Deprey SM (2009). Descriptive analysis of fatal falls of older adults in a Midwestern County in the year 2005. *J Geriatr Phys Ther,* 32(2): 23-28.
39. Lee VMS, Wong TW, Lau CC (1999). Home accidents in elderly patients presenting to an emergency department. *Accident&Emerg Nurs,* 7(2): 96-102.
40. You L, Deans C, Liu K, Zhang MF, Zhang J (2004). Raising awareness at fall risk among Chinese older adults. *J Gerontol Nurs,* 30(6): 35-42.
41. Greenspan SL, Myers ER, Kiel DP, Parker RA, Hayes WC, Resnick NM (1998). Fall direction, bone mineral density, and function: Risk factors for hip fracture in frail nursing home elderly. *The J Am Med,* 104(6): 539-545.