

ORIGINAL ARTICLE: EPIDEMIOLOGY,
CLINICAL PRACTICE AND HEALTH

Home ownership and fall-related outcomes among older adults in South Korea

Young Kyung Do¹ and Cheong-Seok Kim²

¹Program in Health Services and Systems Research, Duke-NUS Graduate Medical School Singapore, Singapore, and ²Department of Sociology, Dongguk University-Seoul, Seoul, Korea

Aim: Many of the previously identified environmental risk factors for fall-related outcomes (e.g. flooring, stairs and steps, kitchen, and bathrooms) are amenable to change, but the extent of the changes on these home-related risk factors are conditional on home ownership of the elderly. This study aims to test whether lack of home ownership is associated with a higher risk of falls, and a higher likelihood of reporting fear of falling and activity limitations due to fear of falling among older adults in South Korea.

Methods: Using data from the first two waves (2006 and 2008) of the Korean Longitudinal Study of Aging, the associations between home ownership variables and three fall-related outcomes were examined in two regression models. A logistic regression model of any falls in the past 2 years was estimated to examine whether older adults living in short-term rental homes based on monthly rent have an increased risk of falls. A probit model accounting for sample selection was estimated to examine whether the two related outcomes, fear of falling and limiting activities due to fear of falling, are associated with home ownership status.

Results: Compared with owned home, short-term rental home predicted a higher likelihood of incident of falls and activity limitation due to fear of falling.

Conclusions: The study findings suggest that the lack of home ownership with unstable housing tenure is an important risk factor for fall-related outcomes among older adults in South Korea. *Geriatr Gerontol Int* 2013; 13: 867–873.

Keywords: aging in place, elderly falls, fall-related outcomes, housing for the elderly, residence characteristics/living arrangements.

Introduction

Falls present a major clinical and public health concern among older adults, placing a substantial health and economic burden on the affected individuals and their families, and society. In the USA, falls occur yearly in roughly 33% of older adults aged at least 65 years, half of whom report falling more than once.¹ The health consequences of falls range from minor injuries to severe fractures requiring hospitalization. Between 10% and 15% of falls result in serious injuries, such as hip fractures, but just 25% of these patients fully recover.¹ Other serious consequences of falls involve depression and social isolation, head injuries, limiting movement

and fear of recurring falls. These consequences correspond to considerable healthcare costs. In the USA alone, direct medical costs for fatal and non-fatal falls amounted to \$0.2 billion USD and \$19 billion USD, respectively.^{2,3} As the prevalence of falls and their associated complications increase progressively with age,⁴ the costs associated with fall injuries double with increasing age (i.e. from \$4 billion USD in the 65–74 years age group to \$8 billion USD in the 75–84 years age group in 2002).²

As a major health-promoting factor, physical activity should be encouraged particularly in an aging population.⁵ Physical activity among older adults does not only benefit the maintenance and improvement of mental and functional health,⁶ it also increases mobility and relieves the pain of chronic pain sufferers.⁷ Promoting mobility and physical activity without increasing the risk of falling is important among older adults. Fear of recurring falls is a major activity-restricting factor for older adults, which can have further negative effects on their physical and psychological health.^{8–11}

Accepted for publication 28 October 2012.

Correspondence: Dr Young Kyung Do MD MPH PhD, Program in Health Services and Systems Research, Duke-NUS Graduate Medical School Singapore, 8 College Road, Singapore 169857. Email: young.do@duke-nus.edu.sg

Individual risk factors for falls among older adults include demographics and anthropometrics (i.e. increasing age, gait and balance problems), geriatric conditions (i.e. cognitive impairment and sensory deficits, age-associated impairments of vision, hearing and memory), medication use, physical function (i.e. functional impairment, muscle weakness, postural hypotension), and lifestyle.^{4,12-17} In addition to these well-established risk factors, tripping or slipping hazards, the absence of stair railings or grab poles, and having unstable furniture, uneven flooring and poor lighting are several environmental risk factors that are often regarded as fall hazards at home.¹⁸⁻²⁰ These risk factors serve as useful indicators for recognizing hazards in the home environment; properly addressing these hazards can potentially prevent falls. Despite being modifiable risk factors, the changes that can be made and the extent of modifications to these environmental factors depend, in part, on home ownership. Home ownership might influence not only the overall quality of the home environment, but also the occupants' attitudes and willingness to improve their housing conditions. Yet, research on the potential effects of home ownership on fall-related outcomes is limited to Western populations.^{21,22}

Among developed countries, South Korea has one of the highest rates of elderly poverty.^{23,24} Comprising the poorest age groups, a substantial number of older adults live in short-term rental homes paying relatively small amounts of monthly rent. In contrast, wealthier older adults could well afford having their own homes or living in long-term rental homes that require a substantial deposit. Against this backdrop, South Korea provides a good setting for investigating the role of housing type in fall-related outcomes among older adults. The present study aimed to examine whether home ownership predicts fall-related outcomes among older adults in South Korea. Specifically, the study tests the following hypothesis: compared with home owners, older adults living in short-term rental homes based on monthly rent have an increased risk of falls, and a higher likelihood of reporting fear of falling and limiting activity due to the fear of falling.

Methods

Data

The present study used data from the first two waves (2006 and 2008) of the Korean Longitudinal Study of Aging (KLoSA), a panel survey on a nationally representative sample of adults aged 45 years and older with a study design comparable with the USA Health and Retirement Study. The KLoSA was designed to provide basic information on South Korea's rapidly increasing older adult population and their health and socioeco-

nomically well-being, which include data on labor force participation and retirement, income and assets, health status and health care, family relations, and intergenerational transfers.²⁵ Of the 10 254 individuals surveyed in the first wave (2006), 187 were confirmed dead and 1379 individuals were lost to follow up in the second wave (2008). Of the remaining 18 942 (=10 254 × 2 – 187 – 1379) observations from both waves, 1728 observations were excluded from the current analysis because of missing values for the variables of interest, leaving the final sample of 17 214 observations. The present study was exempted from full review by the National University of Singapore Institutional Review Board.

Fall-related outcomes

Three fall-related outcome variables were constructed from the relevant survey questions in the KLoSA. A binary variable of any falls in the past 2 years was derived from the question, "Have you fallen down in the last 2 years?" (1 = Yes, 0 = No). Another binary variable of fear of falling was defined based on responses to the question, "Do you worry about falling down?" (1 = A little bit or A lot, 0 = Not at all). Respondents who reported worrying about falling down were subsequently asked the additional question, "Are there any activities that you refrain from due to the fear of falling down?" Based on responses to this question, a binary variable of limiting activities due to fear of falling was defined (1 = Yes, 0 = No).

Home ownership

A set of dummy variables for home ownership was generated, each indicating the respondent's home ownership status: (i) home owner (the omitted reference category); (ii) lease on a deposit basis without monthly rent; and (iii) rental homes based on monthly rent or other.

Covariates

To account for the potential influence of confounding factors, the estimated models controlled for a rich set of demographic, socioeconomic and health-related variables. These included age (in years), sex, marital status (currently married *vs* otherwise), coresidence status (coresiding with an adult child *vs* otherwise), education level (elementary school, middle school, high school, and college), quintile of total assets, place of residence (Seoul, other metropolitan area, and non-metropolitan), self-reported health (very good, good, fair, poor and very poor), grip strength (in kilograms), eyesight (good, fair, poor), and any experience of falls in the past 2 years.

Statistical analysis

Two statistical models were estimated. First, a logistic regression model of any falls in the past 2 years was estimated to examine whether older adults living in short-term rental homes based on monthly rent have an increased risk of falls. In this model (Model 1), the outcome variable of any falls in the past 2 years was derived from the second wave of KLoSA, whereas all explanatory variables, including the home ownership variables, were drawn from the same individual in the first wave. Despite using a reduced number of observations ($n = 8016$) from those who were surveyed in both waves, this helped in avoiding the possibility of reverse causality. For example, although the model aims to estimate the influence of previous health status on the incident falls, recent falls can cause and exacerbate negative health outcomes and changes in wealth and home ownership.

Subsequently, a probit model accounting for sample selection was estimated to examine whether the two related outcomes, fear of falling and limiting activities due to fear of falling, are associated with home ownership status and other explanatory variables. The Stata command `heckprob` (version 12.0; StataCorp LP, College Station, TX, USA) accounts for the structure of the KLoSA questionnaire where limiting activities due to fear of falling was only asked among those who had a positive value for the outcome of fear of falling. Compared with the fall-risk model (Model 1), this model (Model 2) does not pose the issue of reverse causality, because self-reports of fear of falling and activity limitations due to fear of falling were given for the time-point of the survey. Therefore, the estimation used the entire sample of observations from both waves while accounting for individual-level clustering to obtain cluster-robust standard errors.

Two sensitivity analyses were carried out. First, Model 1 used a further restricted sample of individuals who had not experienced falls during the 2-year period before the first wave of the survey. For this analysis, the variable of any falls in the past 2 years was dropped from the set of explanatory variables. Second, the binary outcome of fear of falling in Model 2 was redefined as 1 only for the response of worrying about falling down “a lot”, which led to assigning 0 to worrying “a little” along with worrying “not at all.” None of these sensitivity checks changed the key results qualitatively. The sampling weights and complex survey design in the KLoSA were adjusted. A two-tailed P -value of less than 0.05 was considered statistically significant.

Results

Summary statistics of the study variables are presented for Models 1 and 2 (Table 1). Among the sample of

older adults surveyed in both waves, 3.4% and 2.4% reported any falls in the past 2 years in wave 1 and wave 2, respectively. Although the majority (77.5%) of older adults in Model 1 were home owners, 11.4% lived in short-term rental homes based on monthly rent. The remaining 11.1% lived in houses leased on a deposit basis without a monthly rent. Approximately 41% had elementary school education only, followed by high school education (30.5%). More than half of older adults in Model 1 reported that their health status was fair, poor or very poor.

Compared with older adults who owned their home, those who lived in a home rented on a monthly basis were more likely to report any falls in the past 2 years (odds ratio: 2.24, 95% confidence interval [1.05, 4.79]; Table 2). Older age, female sex and self-report of falls in the preceding 2 years were found to increase the risk of experiencing any new falls.

While the home ownership variables did not show statistically significant associations with the likelihood of reporting fear of falling, the probability of reporting fear of falling was estimated to be higher among individuals with lower education and assets levels as well as poorer self-reported health, poorer eyesight, and weaker grip strength (left column, Table 3). Not surprisingly, self-report of any falls in the past 2 years was also associated with an increased fear of falling. Older adults living in homes rented on a monthly basis were more likely to report limiting their activity due to fear of falling, as suggested by the positive and statistically significant coefficient, 0.14 (right column, Table 3). This coefficient translates into a 3.3-percentage point increase in the probability of having activity limitations due to fear of falling (i.e. 24.1% vs 20.8%) among older adults who lived in short-term rental homes. Poorer self-reported health and previous falls were also found to increase the older adults' tendency to limit activity because of fear of falling.

Discussion

The analysis shows that, compared with home owners, those who rented a house on a monthly basis are more likely to report having experienced falls and limiting activity due to fear of falling. There are several reasons for considering the relationship between housing type and the incidence of falls. First, a tenant on a short-term contract might be less able and willing to modify factors that are likely to increase the risk of falls, such as dangerous stairs and poor lighting, as they would often have to obtain agreement from the owner and pay for the repairs themselves. More importantly, continued lack of investment in amending the housing environment by successive tenants might deprive the rental home of the opportunity that risk factors for falls can be addressed. Second, the monthly rent housing type is a more

Table 1 Summary statistics of study variables

Variables	Model 1 (<i>n</i> = 8016)	Model 2 (<i>n</i> = 17 214)
Fall-related outcomes		
Any falls in past 2 years (wave 2)	2.4%	–
Fear of falling	–	44.9%
Limiting activity due to fear of falling (<i>n</i> = 7,729)	–	33.1%
Home ownership		
Home owner	77.5%	78.9%
Lease on deposit basis	11.1%	10.8%
Monthly rent and other	11.4%	10.2%
Demographic and socioeconomic variables		
Age (years)	59.0	61.8
Female	52.4%	55.8%
Currently married	82.5%	79.2%
Coresiding with adult child	57.8%	52.8%
Education level		
Elementary school	40.6%	45.1%
Middle school	17.5%	16.7%
High school	30.5%	27.8%
College	11.4%	10.4%
Total assets quintile [†]		
1 (poorest)	18.2%	18.7%
2	19.1%	20.1%
3	20.4%	20.7%
4	21.1%	20.5%
5 (richest)	21.1%	11.0%
Place of residence		
Seoul	19.0%	16.4%
Other metropolitan area	25.8%	29.3%
Non-metropolitan area	55.1%	54.3%
Health variables		
Self-reported health		
Very good	4.2%	3.4%
Good	39.0%	35.1%
Fair	31.6%	34.9%
Poor	21.0%	22.5%
Very poor	4.2%	4.1%
Grip strength (kg)	26.5	25.0
Eyesight		
Good	36.6%	31.6%
Fair	41.8%	44.4%
Poor	21.6%	24.0%
Any falls in past 2 years (wave 1 only)	3.4%	–
Any falls in past 2 years (waves 1 and 2)	–	3.1%

Model 1 predicts any falls in the past 2 years in wave 2 as a function of explanatory variables from wave 1 (sampling weights are applied to summary statistics). Model 2 predicts limiting activity due to fear of falling using explanatory variables derived from respective waves (sample means are presented). [†]Total assets quintile do not exactly account for 20% because the quintile was defined for the original sample before removing observations with missing values.

sensitive proxy indicator for poverty even among very poor older adults,²⁶ thereby revealing socioeconomic inequalities that are not evident by crude wealth standards, such as household assets. In addition, the homes

of very poor older adults might be located in a more disadvantaged environment (i.e. steeper stairs and less well-lit streets), which poses greater risks for falls, reflecting area-level deprivation. Third, a short contract

Table 2 Logistic regression of any falls in the past 2 years

Variables	Odds ratio (95% CI)
Home ownership	
Home owner (ref.)	1
Lease on deposit basis	0.96 (0.53, 1.74)
Monthly rent and other	2.24* (1.05, 4.79)
Demographic and socioeconomic	
Age (years)	1.03** (1.02, 1.04)
Female	2.39** (1.36, 4.19)
Currently married (<i>vs</i> not)	0.73 (0.49, 1.09)
Coresiding with adult child	0.82 (0.63, 1.08)
Education level	
Elementary school	1.28 (0.67, 2.43)
Middle school	0.80 (0.37, 1.72)
High school	1.11 (0.52, 2.36)
College (ref.)	1
Total assets quintile	
1st quintile (poorest)	0.68 (0.40, 1.14)
2nd quintile	0.91 (0.56, 1.47)
3rd quintile	0.65 (0.40, 1.06)
4th quintile	1.08 (0.75, 1.56)
5th quintile (richest, ref.)	1
Apartment (<i>vs</i> house)	1.21 (0.95, 1.54)
Place of residence	
Seoul (ref.)	1
Other metropolitan area	0.99 (0.77, 1.27)
Non-metropolitan area	0.90 (0.73, 1.10)
Health variables	
Self-reported health	
Very good (ref.)	1
Good	0.84 (0.40, 1.74)
Fair	1.29 (0.47, 3.52)
Poor	2.13 (0.88, 5.14)
Very poor	1.37 (0.52, 3.65)
Eyesight	
Good (ref.)	1
Fair	0.73* (0.58, 0.91)
Poor	1.04 (0.83, 1.31)
Grip strength (kg)	1.00 (0.97, 1.03)
Any falls in past 2 years (wave 1)	3.28** (1.90, 5.68)
Constant	0.002** (0.00, 0.01)

The analytical sample consisted of 8016 participants who were observed in both wave 1 (2006) and wave 2 (2008). The outcome variable of any falls in past 2 years comes from wave 2, and all explanatory variables from wave 1. The complex survey design was accounted for. ** $P < 0.01$, * $P < 0.05$.

period also suggests that tenants have to move homes quite often resulting in having less familiarity with their rented homes and the residential area where they reside, compared with those who have their own homes and are long-time dwellers in the neighborhood.

The present results corroborate and enrich previous findings on socioeconomic disparities in falls,²⁷ from the unique socioeconomic setting of housing for older adults in South Korea. Lower education, especially the two lowest education levels, and lower household wealth were also found to be statistically significant predictors of reporting fear of falling. The present findings are also generally consistent with previous research on risk factors for fall-related outcomes including previous history of falls, and other health risk factors, such as poorer general health, poorer eyesight and muscle weakness. We did not find that fear of falling is more likely to be reported among older adults renting on a short-term basis. This finding could reflect the lack of awareness of the higher risk of falls among older adults living in rental homes, given that the present results do suggest that they are indeed exposed to an increased risk of falling. However, interpretation of these findings requires caution, as our data provides information that is limited to the survey question on fear of falling.

The main strength of the present study lies in the use of detailed information on individual and household characteristics from a large, nationally representative sample of older adults and exploiting its longitudinal nature to avoid the issue of reverse causality. However, the present study had several limitations. First, the data did not provide information on where and how the fall happened. In addition, all fall-related outcomes were self-reported; memory and education level might have affected reporting of these fall-related outcomes.²⁸ To the extent that the control variables of wealth and health variables are insufficient in adjusting for the unobserved differences by housing arrangement, our estimates might have overestimated the true impact of home ownership on fall-related outcomes. Furthermore, the population data available did not provide information on specific clinical outcomes, such as hip fractures and healthcare use attributable to falls. Future research investigating the relationship between home ownership and falls should consider using alternative data sources that provide rich clinical data on fall-related medical outcomes. Finally, there is concern for non-random attrition. In fact, slightly older adults from lower assets levels were dropped from the analysis of fall incidence, probably because of death, loss to follow up and missing values for the study variables. Therefore, the results of the present study could underestimate the risk of fall-related outcomes associated with a less-stable housing contract type among older adults.

Despite these limitations, the present study identified a specific risk factor for falls and activity limitation due to fear of falling among older adults of lower socioeconomic status in South Korea: the lack of home ownership, particularly living in a short-term rental home based on monthly rent. Geriatricians as well as public

Table 3 Probit model of limiting activity due to fear of falling, accounting for sample selection

Variables	Selection equation: Fear of falling	Main equation: Limiting activity due to fear of falling
	Coefficient (95% CI)	Coefficient (95% CI)
Home ownership		
Home owner (ref.)	0	0
Lease on deposit basis	-0.08 (-0.18, 0.01)	0.08 (-0.06, 0.21)
Monthly rent and other	-0.09 (-0.20, 0.02)	0.14* (0.00, 0.28)
Demographic and socioeconomic		
Age (years)	0.04** (0.04, 0.04)	0.03** (0.02, 0.04)
Female	0.17** (0.10, 0.25)	-0.04 (-0.15, 0.07)
Currently married (<i>vs</i> not)	0.06 (-0.00, 0.13)	-0.06 (-0.15, 0.03)
Coresiding with adult child	0.07** (0.02, 0.12)	0.04 (-0.03, 0.11)
Education level		
Elementary school	0.28** (0.19, 0.37)	0.09 (-0.10, 0.28)
Middle school	0.17** (0.08, 0.27)	-0.08 (-0.27, 0.11)
High school	0.05 (-0.04, 0.14)	-0.02 (-0.20, 0.16)
College (ref.)	0	0
Total assets quintile		
1st quintile (poorest)	0.24** (0.13, 0.34)	0.10 (-0.05, 0.26)
2nd quintile	0.05 (-0.03, 0.13)	0.05 (-0.07, 0.17)
3rd quintile	0.08* (0.00, 0.15)	0.01 (-0.11, 0.13)
4th quintile	0.05 (-0.03, 0.12)	-0.01 (-0.13, 0.11)
5th quintile (richest, ref.)	0	0
Apartment (<i>vs</i> house)	0.07** (0.02, 0.12)	0.00 (-0.07, 0.08)
Place of residence		
Seoul (ref.)	0	0
Other metropolitan area	-0.33** (-0.40, -0.25)	0.07 (-0.06, 0.20)
Non-metropolitan area	-0.28** (-0.35, -0.21)	-0.18** (-0.30, -0.07)
Health variables		
Self-reported health		
Very good (ref.)	0	0
Good	0.07 (-0.06, 0.21)	-0.31 (-0.64, 0.02)
Fair	0.43** (0.30, 0.57)	-0.04 (-0.40, 0.33)
Poor	0.91** (0.76, 1.05)	0.71** (0.28, 1.13)
Very poor	1.43** (1.23, 1.63)	1.21** (0.72, 1.70)
Eyesight		
Good (ref.)	0	0
Fair	0.14** (0.09, 0.20)	-0.20** (-0.31, -0.10)
Poor	0.32** (0.26, 0.39)	-0.13 (-0.26, 0.00)
Grip strength (kg)	-0.02** (-0.03, -0.02)	-0.02** (-0.03, -0.01)
Any falls in past 2 years	1.13** (0.95, 1.31)	0.64** (0.40, 0.88)
Survey in 2008 (<i>vs</i> 2006)	0.12** (0.08, 0.16)	0.01 (-0.06, 0.07)
Constant	-2.90** (-3.25, -2.55)	-2.04** (-3.36, -0.71)

The entire sample consisted of 17 214 observations, of which 7729 had a positive outcome for fear of falling and were used for estimation in the main equation. Confidence intervals are based on cluster-robust standard errors. *** $P < 0.01$, ** $P < 0.05$.

health and social welfare practitioners working for older adults could take into account home ownership in improving the assessment of the risk of falls and limited physical activity. The present study also suggests that

community-based fall prevention efforts can incorporate improving the housing environment among older adults, especially those living in a short-term rental home.

Acknowledgments

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2010-330-B00138). YKD was supported by an A*STAR infrastructure grant to the Duke-NUS Graduate Medical School Singapore, Program in Health Services and Systems Research.

Disclosure statement

No potential conflicts of interest were disclosed.

References

- Moylan KC, Binder EF. Falls in older adults: risk assessment, management and prevention. *Am J Med* 2007; **120**: 493.e1–493.e6.
- Dellinger AM, Stevens JA. The injury problem among older adults: mortality, morbidity and costs. *J Safety Res* 2006; **37**: 519–522.
- Stevens JA, Corso PS, Finkelstein EA, Miller TR. The costs of fatal and non-fatal falls among older adults. *Inj Prev* 2006; **12**: 290–295.
- Rubenstein LZ. Falls in older people: epidemiology, risk factors and strategies for prevention. *Age Ageing* 2006; **35**: ii37–ii41.
- Gulsvik AK, Thelle DS, Samuelsen SO, Myrstad M, Mowé M, Wyller TB. Ageing, physical activity and mortality – a 42-year follow-up study. *Int J Epidemiol* 2011; **41**: 521–530.
- Wang C-Y, Yeh C-J, Wang C-W, Wang C-F, Lin Y-L. The health benefits following regular ongoing exercise lifestyle in independent community-dwelling older Taiwanese adults. *Australas J Ageing* 2011; **30**: 22–26.
- Tse MMY, Wan VTC, Ho SSK. Physical exercise: does it help in relieving pain and increasing mobility among older adults with chronic pain? *J Clin Nurs* 2011; **20**: 635–644.
- Andresen EM, Wolinsky FD, Miller JP, Wilson MM, Malmstrom TK, Miller DK. Cross-sectional and longitudinal risk factors for falls, fear of falling, and falls efficacy in a cohort of middle-aged African Americans. *Gerontologist* 2006; **46**: 249–257.
- Lim J-Y, Jang S-N, Park W-B, Oh MK, Kang EK, Paik N-J. Association between exercise and fear of falling in community-dwelling elderly Koreans: results of a cross-sectional public opinion survey. *Arch Phys Med Rehabil* 2011; **92**: 954–959.
- Visschedijk J, Achterberg W, Van Balen R, Hertogh C. Fear of falling after hip fracture: a systematic review of measurement instruments, prevalence, interventions, and related factors. *J Am Geriatr Soc* 2010; **58**: 1739–1748.
- Wert DM, Talkowski JB, Brach J, VanSwearingen J. Characteristics of walking, activity, fear of falling, and falls in community-dwelling older adults by residence. *J Geriatr Phys Ther* 2010; **33**: 41–45.
- Leung A, Chi I, Lou VWQ, Chan KS. Psychosocial risk factors associated with falls among Chinese community-dwelling older adults in Hong Kong. *Health Soc Care Community* 2010; **18**: 272–281.
- Woo J, Leung J, Lau E. Prevalence and correlates of musculoskeletal pain in Chinese elderly and the impact on 4-year physical function and quality of life. *Public Health* 2009; **123**: 549–556.
- Faulkner K, Cauley J, Studenski S *et al*. Lifestyle predicts falls independent of physical risk factors. *Osteoporos Int* 2009; **20**: 2025–2034.
- Fuller GF. Falls in the elderly. *Am Fam Physician* 2000; **61**: 2159–2168.
- Leveille SG, Jones RN, Kiely DK *et al*. Chronic musculoskeletal pain and the occurrence of falls in an older population. *JAMA* 2009; **302**: 2214–2221.
- Deandrea S, Lucenteforte E, Bravi F, Foschi R, La Vecchia C, Negri E. Risk factors for falls in community-dwelling older people: a systematic review and meta-analysis. *Epidemiology* 2010; **21**: 658–668.
- Stevens JA. Falls among older adults – risk factors and prevention strategies. *J Safety Res* 2005; **36**: 409–411.
- Lord SR, Menz HB, Sherrington C. Home environment risk factors for falls in older people and the efficacy of home modifications. *Age Ageing* 2006; **35**: ii55–ii59.
- Letts L, Moreland J, Richardson J *et al*. The physical environment as a fall risk factor in older adults: systematic review and meta-analysis of cross-sectional and cohort studies. *Aust Occup Ther J* 2010; **57**: 51–64.
- Engelhardt GV, Greenhalgh-Stanley N. Home health care and the housing and living arrangements of the elderly. *J Urban Econ* 2010; **67**: 226–238.
- Pynoos J, Caraviello R, Cicero C. Lifelong housing: the anchor in aging-friendly communities. *Generations* 2009; **33**: 26–32.
- Lee J, Phillips D. Income and poverty among older Koreans: relative contributions of and relationship between public and family transfers. *Working Paper*, 2011; **30**.
- Tai T-O, Treas J. Does household composition explain welfare regime poverty risks for older adults and other household members? *J Gerontol B Psychol Sci Soc Sci* 2009; **64B**: 777–787.
- Korea Labor Institute. *Korean Longitudinal Study of Ageing (Klosa) User Guide*. Seoul: Korea Labor Institute, 2009.
- Galobardes B, Shaw M, Lawlor DA, Lynch JW, Davey Smith G. Indicators of socioeconomic position (part 1). *J Epidemiol Community Health* 2006; **60**: 7–12.
- Syddall H, Evandrou M, Cooper C, Sayer AA. Social inequalities in grip strength, physical function, and falls among community dwelling older men and women: findings from the Hertfordshire Cohort Study. *J Aging Health* 2009; **21**: 913–939.
- Delbaere K, Close JC, Kochan NA, Sachdev PS, Lord SR. Good memory as a predictor of falls: fact or artefact. *Age Ageing* 2012; **41**: 404–408.