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Psychosocial risk factors associated with falls among Chinese community-dwelling older adults in Hong Kong

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Psychosocial factors and falls

Running heading: psychosocial factors and falls

Psychosocial risk factors associated with falls among Chinese community-dwelling older adults in Hong Kong
Abstract

This study examined the relationship between psychosocial factors and falls among community-dwelling older adults in the Hong Kong Special Administrative Region of China. The study included 1,573 **adults aged 60 or above** who lived at home and who were applying for long term care services. These participants were part of a large cross-sectional survey carried out between 2003 and 2004 in which they completed the Hong Kong Chinese version of the Resident Assessment Instrument-Home Care (RAI-HC) assessment. Of those persons who were surveyed, 516 (32.8%, **95% CI 30.5% to 35.2%**) had fallen **in the previous 90 days**. Bivariate analyses showed that **five** psychosocial factors (depressive symptoms, fear of falling, a decline in social activities, the number of hours of informal care support during weekdays and living alone) were significantly associated with falls (**P <0.05**). **Logistic regression analysis** showed living alone (odds ratio (OR) = 0.62; **95% CI 0.44 to 0.86**) was the only psychosocial factor significantly associated with falls, after adjusting for the known significant factors related to falls. It was also found that more elders who lived with others had environmental hazards than those who lived alone (71.0% vs 29.0%, **χ² = 4.80, p=0.028**). These findings suggested that living with others may not be as safe as we assume. Interventions to increase awareness of home safety and to seek cooperation with family members in falls prevention are recommended. Fall
preventive strategies should be educated to family members who are living with frail older adults. On the other hand, Chinese older adults who live alone often receive supports from relatives or friends. Social support seems to be crucial to prevent them from falls and this measure is recommended to be continued in the community.

Keywords: falls, Chinese, psychosocial factors, living alone
Introduction

Falls are a serious and frequent problem for older adults that often result in morbidity and mortality. A fall was defined as “an event which resulted in a person coming to rest unintentionally on the ground or other lower level, not due to any intentional movement, a major intrinsic event, or extrinsic force” (Chu et al. 2005, p.60). The prevalence of falls among Caucasian community-dwelling older adults is about 35%-40% (American Geriatric Society et al. 2001, Cesari et al. 2002, Lehtola et al. 2006) while the figure in the Hong Kong Special Administrative Region of China is 26.4% (Chu et al. 2008). Falls result in significant declines in balance, gait and activities of daily living function (Cesari et al. 2002, Chu et al. 2006), major soft tissue injuries, and fractures (Salva et al. 2004). In 2000, there were 2.6 million non-fatal fall-related injuries in U.S.A. and these accounted for US$19 billion as the direct medical cost (Stevens et al. 2006). Similarly, older Chinese community–dwelling adults who fall had a significantly greater number of hospitalizations, visits to specialty clinics and emergency departments than non-fallers, and the estimated public health care cost is US$71 million (HK$552 million) more than non-fallers consumed in health care annually (Chu et al. 2008). Falling is also a crucial factor contributing to the premature death of older adults (Ho et al. 1996).
Given the negative effects of falls on older adults’ health, it is important for health care practitioners to identify factors leading to falls and to develop ways to prevent community-dwelling older adults from falling.

Fall risk factors can be classified as intrinsic, extrinsic and iatrogenic factors (Ebersole et al. 2004). Intrinsic factors are related to clients’ functional and health status, such as status of activity of daily living (ADL) or instrumental activity of daily living (IADL), visual impairment, balance disorders, foot problems, insomnia, hypotension, hypoglycemia, dizziness, presence of cardiovascular disease and perceived general health (Miller & Pantel 2003, Zijlstral et al. 2007). Extrinsic factors are related to environment, such as poor lighting, slippery floors, lack of handrails in corridors, and uneven and obstructed walking surfaces (Ebersole et al. 2004, Avidan et al. 2005, Berry & Kiel 2008). It was found that 44% of falls among community-dwellers were associated with environmental hazards, and an unsafe walking surface is a precipitating factor to falls (Mahoney et al. 1994). Iatrogenic factors are related to treatment and these include adverse drug reactions, use of restraints, use of wheelchairs, hypnotic drugs and use of local skin preparations (Ebersole et al. 2004, Avidan et al. 2005). Previous studies have shown that the risk of falls increases proportionally as the number of risk factors increases (Berry & Kiel 2008). There are also gender differences in the prevalence rates of falls: female clients
experienced a higher prevalence rate than their male counterparts in western countries (Luukinen et al. 1994); however, gender was not significantly associated with falls in the Hong Kong Chinese population, after adjusting for the other explanatory variables (Ho et al. 1996).

According to the above literature review, many of the known risk factors for falls are clinical-related or physical-related factors. Little attention has been paid to the psychosocial factors related to falls (Gillespie 2004). Depression seems to be the most commonly known psychosocial risk factor related to falls: a depressive state of mind can increase the risk of falls (odds ratio (OR) = 2.2; 95% CI 1.1 to 4.5) (Stanlehoef et al. 2002). A similar finding was noted by Cesari et al. (2002), Miller & Pantel (2003) and Russell et al. (2006). Fear is another psychological factor, found to be associated with falls (Cwikel et al. 1989, Friedman et al. 2002, Miller & Pantel 2003, Zijlstra et al. 2007). Falls and fear of falling were share predictors. That is, falls could predict fear of falling while fear of falling can also predict falls at 20 months, and eventually individuals who had a fear of falling developed a spiralling risk of falls, fear of falling, and functional decline (Friedman et al. 2002). In contrast, Miller & Pantel (2003) found that worry about falling had no association with the actual number of falls but was associated with the number of near-falls in the prior year. Persons who worry about falling tend to avoid social activities or change their
behaviour such as refraining from outdoor activities although they used to enjoy these activities (Miller & Pantell 2003, Zijlstra et al. 2007).

Social support, in terms of informal care support and living arrangement, was associated with falls (Cwikel et al. 1989, Cwikel 1992, Chen et al. 2009). A higher level of social contact with family and friends resulted in a lower fall incidence (Cwikel et al. 1989). A similar finding was noted in a recent study in Chinese society: family members’ company in the hospital (OR= 0.51; 95% CI 0.33 to 0.78) was found to be a protective factor and may reduce in-hospital falls (Chen et al. 2009). Cwikel (1992) concluded that the frequency of social interaction was inversely related to reported falls. On the other hand, living alone was also identified as a risk factor to falls (Cwikel et al. 1989, Cwikel 1992; Fallon et al. 2002, Kharicha et al. 2007).

Single persons, particularly women who lived alone, reported falls at a higher rate than males and their married counterparts (Cwikel et al. 1989, Cwikel 1992, Fallon et al. 2002).

Investigation of the relationship between psychosocial factors and falls is still in its early stage. In the current study, a number of psychosocial factors were identified for investigation: depressive symptoms, fear of falling, decline in social activities, decline in behaviour, number of hours of informal care support during weekdays, and living alone. This study explored the relationship between psychosocial factors and
falls among community-dwelling Hong Kong Chinese elders who were requesting long term care services.

Methods

This was a cross-sectional survey which was conducted in 2003-2004. Ethical approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster. The survey originally assessed people who were applying for long term care (LTC) services in Hong Kong. Although the older persons were applying for LTC services, it did not mean they all qualified for the services and therefore their physical functioning varied. This sample represented a majority of frail older adults living in Hong Kong regardless of their financial status. Since Hong Kong has no means test for applying for long term care services, applicants from all socioeconomic classes are eligible to apply.

The original dataset consisted of 10,663 subjects who were applying for long term care service in Hong Kong from October 2003 to September 2004. Among these, 4331 subjects were living at home with no formal community support services (that is, no home care service or community nursing care service was being provided), 2621 were living at home with formal community support services, 3156 were living at home with maids, 555 were living in nursing homes or hospitals. Since our goal
was to assess frail community dwellers who had minimal support, we deliberately chose the group with no formal community support services. This group was a vulnerable group due to the limited support and professional care available to them. Those who were given formal community support services were periodically monitored and supported by health professionals and thus their health risks could be observed earlier. With these 4331 subjects, data cleaning was performed with reference to age and missing data. Those aged 59 or below and those cases with missing values in activity of daily living (ADL) or instrumental activity of daily living (IADL) (the well known risk factors of falls) or falls (the dependent variable) were excluded. Finally, a total of 1,573 subjects were included in the analysis. Secondary data analysis approach was adopted and personal particulars (such as names and addresses) were removed before analysis to protect confidentiality of personal particulars. Data collection was conducted by trained interviewers (who were nurses or social workers) and the quality of data collection was guaranteed by stringent data quality monitoring system. The questionnaires were completed both by directing the questions to the older adults and by exercising professional judgment during observation. If the older adult was not able to understand the questions, questions were directed to the primary caregiver who had frequent contacts with the older adult. Consents were obtained from older adults to
complete this questionnaire.

The conceptual framework of the current study is shown in Figure 1. Intrinsic factors (such as ADL, IADL, cognitive impairment, pain, visual impairment, unsteady gait, chronic illnesses, nutritional problems or oral problems, poor self-rated health, dizziness, skin problem), extrinsic factors (such as environmental hazards) and iatrogenic factors (such as number of medications used, frequency of drugs checked by doctors in the last 180 days, use of physical restraints, use of assisted devices including wheelchairs and crutches when the subject was doing indoor activities or doing outdoor activities) of falls were assessed. The identified significant intrinsic-extrinsic-iatrogenic factors were controlled when identifying the independent psychosocial factors associated with falls. The presence of multicollinearity was explored by variance inflation factors (VIF), and there was no evidence of high inter-correlations between independent variables as all the VIFs were not high (Myers 1990, Stevens 2002).

[Insert Figure 1 here]

Measurement

The instrument used in this study was the Hong Kong Chinese version of the Resident Assessment Instrument-Home Care (RAI-HC) which has been validated in previous studies (Kwan & Chi 2000). The original English version of RAI-HC was
also referenced whenever it was necessary (InterRAI Overview Committee 1999).

Trained assessors evaluated the subjects’ conditions. Fall prevalence, the dependent variable, was assessed by the question: In the past 90 days, how many times did you have a fall? If the number of falls was **one or more**, the subject was considered **to be a faller**.

*Intrinsic factors.* The ADL items include: dressing, hygiene, transfer, locomotion, toileting, bed mobility, eating, etc. Each item was rated from 0 to 4. A rating of 0 means the person can do this item independently; 1 the person can do this with supervision, 2 the person can do this with limited assistance; 3 requires extensive assistance to do this; and a person rated as 4 is **totally** dependent. Seven IADL items including ordinary housework, meal preparation, financial management, drug management, phone use, shopping and transportation were used to measure the elders’ capacity. The IADL scores ranged from 0 to 3 with 0 being independent and 3 **meaning** the activities were performed by others. Cognitive impairment was measured by the Cognitive Performance Scale which ranges from 0 (intact cognition) to 5 (very severe impairment) (Morris *et al.* 1994). Pain was measured by the Pain Scale which ranges from 0 (no pain) to 3 (severe or horrible/ excruciating pain) (Fries *et al.* 2001). Visual impairment was measured with 0 being adequate vision and 1 being impaired. Unsteady gait was scored as 1 while steady gait was scored 0.
Presence of chronic illnesses (such as cardiovascular or musculo-skeletal disease) was retrieved from the elders’ medical record with 0 being no such disease and 1 being have such disease. Perceived general health was rated by the subjects with 1 being poor health and 0 being good health (InterRAI Overview Committee 1999).

Nutritional, oral and skin problems were assessed with 1 meaning that a problem exists and 0 being no problem exists.

**Extrinsic factors.** Assessment of the environmental hazards at home was conducted by trained assessors through field observation. The trained assessors evaluated lighting, flooring, bathroom and toilet, kitchen, heating and cooling, personal safety (concerns about violence, potential danger when going to the mail box or walking to neighbours’ homes, busy traffic in the neighbourhood). The scores ranged from 1 meaning that hazards were present and 0 being free from hazards.

**Iatrogenic factors.** The number of medications taken by the subjects per day was recorded. Whether the drugs were checked by a physician in the last 180 days was recorded with 1 being no physician checking and 0 being checked. Use of physical restraint was recorded with 1 being yes and 0 being no. Use of wheelchair or crutch was also assessed during indoor activities or outdoor activities, with 1 being yes and 0 being no.
Psychosocial factors. Depressive symptoms were observed and reported by family members or caregivers with 1 being symptoms appeared in the last 3 days and 0 being no symptoms in the past 3 days (Burrows et al. 2000). Fear of falling was self-reported by the subjects with 1 being yes and 0 being no. “Decline in social activities” was self-reported by the subjects and this was compared with the status in the last 90 days, with 2 referring to decreasing in social activities and feeling frustrated, 1 for decreases in social activities but no feeling of frustration, and 0 referring to no change in social activities. “Decline in behaviour” was assessed by trained assessors with 1 being yes and 0 being no change. Informal care support during weekdays was reported by the subjects. Before analysis, this variable was grouped into 4 categories: 0-5 hours, 6-15 hours, 16-25 hours and >25 hours. Living arrangement was asked with 1 being living alone and 0 being living with others (including spouse, children, relatives and others).

Factors correlated with the variable ‘living alone’. Primary helpers were first identified and then asked whether they had offered help to the subjects in “providing emotional support”, “providing activity of daily living (ADL) care”, or “providing instrumental activity of daily living (IADL) care”, with 0 being yes and 1 being no. The primary helpers were also asked whether they were willing to provide offer help
if the subjects needed ADL or IADL care, with 0 being willing to provide and 1 being cannot provide care.

Data Analysis

Descriptive analyses were performed for demographic and potential risk factors. The prevalence of falls was calculated. The number of subjects encountering environmental hazards was small: hazards due to lighting in the evening (n=5), flooring and carpeting (n=10), bathroom and toilet (n=38), kitchen (n=5), heating and cooling (n=4), personal safety (n=21), access to home (n=7) and access to rooms (n=77). A dummy variable “environmental hazards” was set up to represent the presence of at least one of the above hazards with 1 being the presence of environmental hazards and 0 being the absence of hazard. Independent samples t test and Chi-square tests were used to assess the relationships between potential risk factors (including the known intrinsic, extrinsic and iatrogenic factors as well as the psychosocial factors) and falls. Multiple logistic regression analyses for psychosocial factors associated with falls were performed for variables which were significant in the bivariate analyses, using a stepwise backward elimination method. P<0.05 (2-tailed) was considered statistically significant. Chi-square tests were performed to further investigate the possible relationship between environmental hazards and living
alone, and the relationship between social support and living arrangement respectively.

The statistical package SPSS version 16 for Windows was used for data analysis.

Results

A total of 1,573 older adults who were living at home with no formal community support were included in the analysis. About sixty percent were female. The mean age of all subjects was 78.3 (SD 7.4) years. About forty-five percent were married and half of the participants (52%) had no formal education. Five hundred and sixteen (32.8%, 95% CI 30.5% to 35.2%) of the participants had falls. Table 1 shows the demographic data for the subjects.

[Insert Table 1 here]

Intrinsic factors.

Ten intrinsic factors were significantly associated with falls in this sample: the level of ADL ($P < 0.001$), IADL ($P < 0.001$), cognitive impairment ($P = 0.019$), and pain ($P = 0.013$), visual impairment, unsteady gait, hip fracture, other fractures (such as wrist, vertebral fractures), nutritional problems (all $P < 0.001$) and oral problems ($P = 0.006$). The commonly reported medical diagnoses, including cerebrovascular accident (27.7% vs 23.2%), congestive heart failure (7.2% vs 6.9%), coronary heart failure (11.4% vs 11.3%), hypertension (60.5% vs 58.5%), irregularly irregular pulse
(5.0% vs 5.7%), peripheral vascular disease (1.4% vs 2.0%), arthritis (18.8% vs 23.1%), osteoporosis (9.1% vs 8.5%), dizziness (30.6% vs 26.2%) and skin problem (17.6% vs 15.4%), had no significant relationships with falls ($P > 0.05$).

**Extrinsic and iatrogenic factors.**

A total of 145 (9.2%) subjects had at least one environmental hazard; however, there was no significant difference between the fallers (9.3%) and non-fallers (9.2%) in terms of environmental hazards. No significant relationship was found between medications and falls or between regular check-up of medications and falls. The average number of medications taken by the fallers and non-fallers were $5.0$ (SD 2.5) and $4.7$ (SD 2.6) respectively ($P = 0.065$). About 6% of the fallers had no regular check-up of their medications by the physicians in the last 180 days and this was comparable to the non-fallers. Three iatrogenic factors were found to be significantly associated with falls: use of physical restraints ($P = 0.004$), use of a wheelchair when the subjects were doing outdoor activities ($P < 0.001$), and use of crutches when the subjects were doing indoor activities ($P < 0.001$). However, the use of wheelchairs in indoor activities and use of crutches in outdoor activities were not related to falls.

**Psychosocial factors.**

Five psychosocial factors had significant bivariate relationships with falls and they were depressive symptoms ($P = 0.016$), fear of falling ($P < 0.001$), decline in
social activities \( (P = 0.001) \), informal care support given to the subjects during
weekdays \( (P < 0.001) \) and living alone \( (P < 0.001) \). Change in behaviour had no
relationship with falls (Table 2).

[Insert Table 2 here]

Logistic regression analyses of all significant intrinsic factors revealed that IADL
\( (OR = 1.03, P = 0.034) \), visual impairment \( (OR = 1.30, P = 0.028) \), unsteady gait
\( (OR= 3.33, P<0.001) \), hip fracture \( (OR = 2.09, P = 0.005) \), and other fractures \( OR=
1.93, P = 0.013) \) were independent factors associated with falls (Model 1). Controlling
for the intrinsic factors, use of crutches during indoor activities \( OR = 1.54, P =
0.001) \) was the only independent factor associated with falls (Model 2).

After controlling for socio-demographic factors and all the significant intrinsic,
etrinsic and iatrogenic factors, living alone \( (OR = 0.62, P = 0.005) \) was found to be
the only psychosocial factor significantly associated with falls (Table 3). The other
four psychosocial factors (depressive symptoms, fear of falling, decline in social
activities, and informal care support during weekdays) were eliminated from the final
model.

[Insert Table 3 here]

Since the incidence of environmental hazards was low in this sample and living
alone was found to be inversely associated with falls, further analyses were made to
identify the possible relationship between environmental hazards and living alone.

More elders who were living with others had at least one additional type of environmental hazard than those living alone (71.0% vs 29.0%, $\chi^2 = 4.80$, $p = 0.028$).

On the other hand, significant associations were found between living alone and primary helpers’ (including relatives and friends) support to elders in terms of providing emotional support (yes/no) (81.3% vs 3.2%, $\chi^2 = 134.28$, $p<0.001$), providing IADL care (yes/no) (61.5% vs 23.0%, $\chi^2 = 195.70$, $p<0.001$), providing ADL care (yes/no) (33.5% vs 51.9%, $\chi^2 = 200.76$, $p<0.001$), and willing to increase IADL care (yes/no) (69.7% vs 8.7%, $\chi^2 = 84.21$, $p<0.001$) or to increase ADL care (yes/no) (70.0% vs 8.2%, $\chi^2 = 70.15$, $p<0.001$).

**Discussion**

This was the first study investigating the association between psychosocial factors and falls in a sample of community-dwelling frail older adults in Hong Kong Chinese society. The prevalence of falls in this sample was 32.8%. This was comparable to a prevalence of 35% to 40% in Caucasian populations (American Geriatric Society et al. 2001, Cesari et al. 2002, Lehtola et al. 2006) but it was slightly higher than the finding of a previous study in Hong Kong of 26.4% (Chu et al. 2008). The subjects of the current study were frailer than the general elderly
Psychosocial factors and falls

population in Hong Kong as they were applicants for long term care services. Unfortunately, this population was living at home with no formal community support at the time when they were assessed. The high prevalence rate of falls in this population indicated that they were at higher risk of falls, and more attention would be needed to prevent falls in this group compared to other community-dwelling elders.

Most of the intrinsic factors for falls identified in this study were known risk factors, and they were similar to the findings of previous studies. Some of the intrinsic factors (such as ADL, IADL, cognitive impairment, pain, nutritional problems and oral problems) were initially found to be related to falls but these relationships became insignificant in the final model of regression analysis. This finding indicates that these factors have less association with falls when compared to visual impairment, unsteady gait, hip fracture and other fractures. However, appropriate measures should be developed to prevent elders with these disabilities or illnesses from falling.

Our sample showed that 9.2% of the subjects had at least one type of environmental hazard (hazard due to lighting, flooring, in bathroom, etc.) however environmental hazards (as the extrinsic factor) had no significant relationship with falls in this population. This was an unexpected finding since environmental hazards are a well known significant factor associated with falls and they may contribute to
15-50% of fall injuries (Verma & Pickett 2001). A lack of training for the assessors may have affected the low proportion of the sample being assessed as having environmental hazards. After more closely examining the relationship between environmental hazards and living arrangement, it was found that more elders who were living with others had environmental hazards than those who were living alone. This suggested that living with others may not be as safe as we assume. In some occasions, adult children are not aware of the environmental hazards that were imposed by fashion designs of the furniture, such as being too high for elders to reach or having a sharp corner. Living with older adults may demand some adjustments in daily activities to meet their needs, for example, turning on lights at dusk or dawn or leaving them on at night if the elder gets out of bed, having furniture with simple designs, and avoiding small rugs on the floor that might slip. To reduce the risk of falls, home modification using universal barrier-free design and architectural accessibility can be adopted (McCullagh, 2006) and health professionals such as nurses and occupational therapists could help to assess the living environment and suggest specific modifications. On the other hand, this interesting finding may support the argument that a risk factor to falls may interact with other risk factors and alter one’s effect on falls (Cesari et al. 2002). As shown in the recent extensive review of the relationship between environmental hazards and falls,
environmental hazards are not solely responsible for the risk for falls,
individual’s risk-taking behaviour and mobility level also play some parts and
they interact with each other (Feldman & Chaudhury (2008). From the collected
data, we were unable to draw any firm conclusion about the interaction between
different types of environmental hazards or among different risk factors. Further
investigation on the effect of these interactions is warranted.

Among the identified iatrogenic factors, the use of crutches during indoor
activities had a significant association with falls after controlling for the known
intrinsic factors. This finding indicates that using crutches during indoor activities is
not providing a protective effect on falls but instilling higher risk: the odds of
having a fall among those using crutches indoors were 1.54 times higher than the
odds among their counterparts. The size of living spaces in Hong Kong is small.
Thus the use of assisted devices at home should be correctly prescribed, and elders
should be trained in their correct use and the devices should be maintained by
qualified professionals (Bateni & Maki 2005).

Five psychosocial factors (depressive symptoms, fear of falling, decline in social
activities, informal care support during weekdays and living alone) were found to be
related to falls in bivariate analysis. After controlling all the known
intrinsic-extrinsic-iatrogenic factors, living alone was found to be the sole
Psychosocial factors and falls

independent psychosocial factor inversely associated with falls while the rest of the
psychosocial factors (depressive symptoms, fear of falling, decline in social activities
and informal care support) were not significant. These findings contribute to a better
understanding of psychosocial risk factors for falls, in addition to the known
relationship between depression and falls (Cesari et al. 2002, Stanlenhoef et al. 2002,
Miller & Pantel 2003, Russell et al. 2006) and the relationship between fear of
falling and falls (Cwikel et al. 1989, Friedman et al. 2002, Miller & Pantel 2003,
Zijlstra et al. 2007).

The relationship between living alone and falls has been discussed by other
researchers. Some studies have found that older adults who lived alone were more
likely to have falls than those who lived with others \( P<0.05 \) (Fallon et al. 2002) and
living alone was associated with multiple falls after adjusting for age, gender, income,
and educational attainment (Kharicha et al. 2007). Other studies have found that
living alone was not a predictor of falls (Sheahan et al. 1995) and that living alone
was not associated with falls (Tromp et al. 1998). The current study found that the
odds of a fall among those living alone were 0.62 times the odds of a fall among
those not living alone, which supports the latter argument.

The current findings should be understood in the cultural context of Chinese
elders in Hong Kong. The literature about the Chinese population (Lai & Leonenko
2007, Cheng et al. 2008) points out that older adults who live alone should not be labelled as the most vulnerable ones. “Those who live alone are probably the ones who have the resources and related capacity to do so” (Lai & Leonenko 2007, p. 141).

Evidence points out that Chinese older adults who have higher levels of social support and lower limitations in IADL have a greater chance of living alone (Lai & Leonenko 2007). Therefore, the general assumption that living alone means social isolation and health disadvantage may not be completely true in the Hong Kong Chinese community. Many of the Chinese elders in Hong Kong actually prefer to live independently rather than co-reside with their adult children (Chan & Lee 2003, So 2008). This phenomenon has been explained by the socio-cultural value changes and adjustments in Chinese society in which older adults enjoy the freedom of doing things they prefer (for example, singing Chinese Opera songs aloud) or demonstrating their capability to be independent in old age (Lai 2005, Lai & Leonenko 2007, So 2008).

To further understand the phenomenon, the research team assessed the relationship between living arrangement and social support with this sample. Further analyses showed that living arrangement was significantly associated with primary helpers’ actual actions and willingness to provide ADL, IADL and emotional support to Chinese elders. This corresponds to the findings of a recent international population
report prepared by He and colleagues (2007) for the Chinese population. Chinese older people especially women who live alone often have adult children in their neighbourhood, and these children frequently provide some degree of physical assistance or in-kind financial support (Bian et al. 1998, Knodel & Ofstedal, 2003, He et al. 2007). In fact, Chinese adult children often are willing to offer assistance to their parents, and become the primary helpers although they are living apart (He et al. 2007). Social networking is naturally built up in Chinese society and strategies (such as frequent telephone calls or home visits) are implemented to support older adults who are living alone in the community.

The findings of the current study would be useful for health and community care service providers to identify the needs and the required area of support in falls prevention for the elderly Chinese in Hong Kong. Living alone not only indicates individual’s living arrangement, but also implies the level of social support and their capacity to remain independent in old age. Although elders who live alone in Hong Kong were found to have lower risk of falls, measures should be taken to continuously support them from injury. On one hand, family members, although living apart, are encouraged to continuously provide social support to these older adults. Social support seems to be crucial to prevent them from falls. On the other hand, these elders are the self-motivated ones who are more cautious about their
health and are most willing to learn survival skills including falls prevention (Leung et al. 2008). Perhaps this is one of the possible reasons why Chinese elders living alone did better in falls prevention and thus have fewer falls than those who live with others. Thus, it is important to support these older adults through health education. Geragogy-based approaches should be adopted in the design of health education so as to meet the special needs of older adults (Leung et al. 2007). The suggested strategies of health education in falls prevention should not be restricted to those who live alone, but also extended to those who live with other family members. Both older adults and members in the community (including adult children who are living with older adults) should be educated about falls prevention strategies and issues related to psychological factors and falls.

The findings of this study are subject to at least two limitations. First, data were collected from older adults who were applying for long term care services and excludes healthy older adults, so the results here may only represent a specific group of older adults who are living at home with no formal community services. Second, the dependent variable and some psychosocial factors are self-reported and subject to recall bias; therefore the prevalence of falls and psychosocial problems might be overestimated or underestimated. Older adults or family members who were seeking long term care services might over-report the incidence of falls while some
older adults might under-report the incidence of falls due to recall bias.

**Conclusions**

In conclusion, the present findings suggest that psychosocial factors have some relationship to falls. Therefore, it is important to take these factors into account in the development of preventive measures for falls. As recommended by Gillespie (2004), psychosocial issues related to falls should not be neglected. Our research suggests further investigation into the effect of psychosocial factors on falls and the development of measures to prevent falls from various dimensions including the psychosocial perspective.

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Psychosocial factors and falls

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Psychosocial factors and falls


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Psychosocial factors and falls


Psychosocial factors and falls


Table 1 Demographics and fall prevalence for Chinese community-dwelling older adults in Hong Kong (N=1573)

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<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>619</td>
<td>39.4</td>
</tr>
<tr>
<td>Female</td>
<td>954</td>
<td>60.4</td>
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<tr>
<td><strong>Age (mean, SD)</strong></td>
<td>78.3</td>
<td>7.37</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
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<td></td>
</tr>
<tr>
<td>Never married</td>
<td>64</td>
<td>4.1</td>
</tr>
<tr>
<td>Married</td>
<td>695</td>
<td>44.2</td>
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<tr>
<td>Widowed</td>
<td>745</td>
<td>47.4</td>
</tr>
<tr>
<td>Divorced</td>
<td>38</td>
<td>2.4</td>
</tr>
<tr>
<td>Others</td>
<td>31</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Educational Background</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>827</td>
<td>52.6</td>
</tr>
<tr>
<td>Attended primary school (grade 1-6)</td>
<td>547</td>
<td>34.8</td>
</tr>
<tr>
<td>Completed primary education</td>
<td>110</td>
<td>7.0</td>
</tr>
<tr>
<td>Junior secondary (grade 7-9)</td>
<td>55</td>
<td>3.5</td>
</tr>
<tr>
<td>Senior secondary (grade 10-12)</td>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>College or university</td>
<td>31</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Falls</strong></td>
<td>516</td>
<td>32.8</td>
</tr>
</tbody>
</table>
Table 2 Factors significantly associated with falls among Chinese community-dwelling older adults in Hong Kong (N=1573)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Fallers (n=516)</th>
<th>Non-fallers (n=1057)</th>
<th>Test statistics</th>
<th>d.f.</th>
<th>P-value</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intrinsic factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADL (range 0 – 39), mean (S.D.)</td>
<td>4.10 (4.87)</td>
<td>2.77 (4.74)</td>
<td>t=5.12</td>
<td>996</td>
<td>&lt;0.001</td>
<td>1.907</td>
</tr>
<tr>
<td>IADL (range 0 – 21), mean (S.D.)</td>
<td>10.81 (5.75)</td>
<td>8.65 (6.01)</td>
<td>t=6.77</td>
<td>1571</td>
<td>&lt;0.001</td>
<td>2.354</td>
</tr>
<tr>
<td>Cognitive impairment (range 0 - 5), mean (S.D.)</td>
<td>1.34 (0.82)</td>
<td>1.23 (0.88)</td>
<td>t=2.34</td>
<td>1571</td>
<td>0.019</td>
<td>1.314</td>
</tr>
<tr>
<td>Pain (range 0 - 3), mean (S.D.)</td>
<td>1.47 (1.30)</td>
<td>1.30 (1.30)</td>
<td>t=2.50</td>
<td>1571</td>
<td>0.013</td>
<td>1.166</td>
</tr>
<tr>
<td>Visual impairment %</td>
<td>58.1</td>
<td>47.5</td>
<td>χ²=15.73</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.074</td>
</tr>
<tr>
<td>Unsteady gait %</td>
<td>84.7</td>
<td>57.7</td>
<td>χ²=113.39</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.677</td>
</tr>
<tr>
<td>Hip fracture %</td>
<td>8.1</td>
<td>3.0</td>
<td>χ²=20.21</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.050</td>
</tr>
<tr>
<td>Other fracture, e.g. wrist, vertebral %</td>
<td>7.0</td>
<td>2.9</td>
<td>χ²=13.90</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.038</td>
</tr>
<tr>
<td>Nutritional problem %</td>
<td>17.6</td>
<td>11.7</td>
<td>χ²=10.24</td>
<td>1</td>
<td>0.001</td>
<td>1.054</td>
</tr>
<tr>
<td>Oral problem %</td>
<td>27.3</td>
<td>21.1</td>
<td>χ²=7.56</td>
<td>1</td>
<td>0.006</td>
<td>1.074</td>
</tr>
<tr>
<td><strong>Extrinsic / Iatrogenic factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of physical restraints %</td>
<td>1.4</td>
<td>0.2</td>
<td>χ²=8.31</td>
<td>1</td>
<td>0.004</td>
<td>1.065</td>
</tr>
<tr>
<td>Use of wheelchair (outdoor) %</td>
<td>25.6</td>
<td>15.6</td>
<td>χ²=22.51</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.596</td>
</tr>
<tr>
<td>Use of crutches (indoor) %</td>
<td>47.3</td>
<td>27.5</td>
<td>χ²=60.30</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.410</td>
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<tr>
<td><strong>Psychosocial factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive symptoms %</td>
<td>46.3</td>
<td>39.9</td>
<td>χ²=5.82</td>
<td>1</td>
<td>0.016</td>
<td>1.133</td>
</tr>
<tr>
<td>Fear of falling %</td>
<td>67.1</td>
<td>47.2</td>
<td>χ²=54.93</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.857</td>
</tr>
<tr>
<td>Decline in social activities (range 0-2), mean (S.D.)</td>
<td>0.34 (0.61)</td>
<td>0.24 (0.53)</td>
<td>t=3.42</td>
<td>907</td>
<td>0.001</td>
<td>1.116</td>
</tr>
<tr>
<td>Informal care support during weekdays¹ %</td>
<td></td>
<td></td>
<td>χ²=14.81</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.629</td>
</tr>
<tr>
<td>0-5 hours</td>
<td>35.5</td>
<td>45.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-15 hours</td>
<td>31.5</td>
<td>29.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-25 hours</td>
<td>21.4</td>
<td>16.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;25 hours</td>
<td>11.6</td>
<td>8.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living alone %</td>
<td>16.3</td>
<td>24.5</td>
<td>χ²=13.75</td>
<td>1</td>
<td>&lt;0.001</td>
<td>1.224</td>
</tr>
</tbody>
</table>

Note. ¹ The chi-square test for trend statistic was used and linear-by-linear association was reported. N=1506.
Table 3 Independent factors associated with falls among Chinese community-dwelling older adults in Hong Kong (N=1506)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds ratio</td>
<td>Odds ratio</td>
<td>Odds ratio</td>
</tr>
<tr>
<td></td>
<td>(95% confidence interval)</td>
<td>(95% confidence interval)</td>
<td>(95% confidence interval)</td>
</tr>
<tr>
<td>ADL</td>
<td>1.00 (0.97-1.02)</td>
<td>0.99 (0.96-1.02)</td>
<td>0.99 (0.96-1.02)</td>
</tr>
<tr>
<td>IADL</td>
<td>1.03 (1.00-1.05) *</td>
<td>1.02 (0.99-1.05)</td>
<td>1.01 (0.98-1.03)</td>
</tr>
<tr>
<td>Cognitive impairment</td>
<td>1.04 (0.90-1.19)</td>
<td>1.09 (0.94-1.26)</td>
<td>1.12 (0.96-1.30)</td>
</tr>
<tr>
<td>Pain</td>
<td>1.04 (0.95-1.13)</td>
<td>1.03 (0.94-1.13)</td>
<td>1.04 (0.95-1.14)</td>
</tr>
<tr>
<td>Visual impairment</td>
<td>3.33 (2.47-4.49) **</td>
<td>3.07 (2.27-4.16) ***</td>
<td>3.19 (2.35-4.33) ***</td>
</tr>
<tr>
<td>Unsteady gait</td>
<td>2.09 (1.26-3.47) **</td>
<td>1.94 (1.16-3.25) *</td>
<td>2.03 (1.21-3.41) **</td>
</tr>
<tr>
<td>Hip fracture</td>
<td>1.93 (1.15-3.24) *</td>
<td>1.81 (1.07-3.06) *</td>
<td>1.81 (1.07-3.06) *</td>
</tr>
<tr>
<td>Other fractures</td>
<td>1.24 (0.91-1.70)</td>
<td>1.27 (0.92-1.74)</td>
<td>1.31 (0.96-1.81)</td>
</tr>
<tr>
<td>Nutritional problem</td>
<td>1.19 (0.92-1.55)</td>
<td>1.17 (0.90-1.52)</td>
<td>1.17 (0.90-1.53)</td>
</tr>
<tr>
<td>Use of physical restraints</td>
<td>3.88 (0.74-20.40)</td>
<td>4.00 (0.76-21.00)</td>
<td></td>
</tr>
<tr>
<td>Use of wheelchair (outdoor)</td>
<td>1.00 (0.72-1.40)</td>
<td>1.00 (0.72-1.39)</td>
<td></td>
</tr>
<tr>
<td>Use of crutches (indoor)</td>
<td>1.54 (1.18-2.00) **</td>
<td>1.53 (1.17-1.98) **</td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td>0.62 (0.44-0.86) **</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P<0.05, **P<0.01, ***P<0.001
**Figure 1** Conceptual framework of the current study

**Intrinsic factors**
- Activity of Daily Living (ADL)
- Instrumental Activity of Daily Living (IADL)
- Cognitive impairment
- Pain
- Visual impairment
- Unsteady gait
- Chronic illnesses
  - Cerebrovascular accident
  - Congestive heart failure
  - Coronary heart failure
  - Hypertension
  - Irregularly irregular pulse
  - Peripheral vascular disease
  - Arthritis
  - Osteoporosis
- Fractures
  - Hip fracture
  - Other fracture, e.g. wrist, vertebral
- Nutritional problem
- Oral problem
- Perceived poor general health
- Dizziness
- Skin problem

**Extrinsic factors**
- Environmental hazards

**Iatrogenic factors**
- Number of medications
- No drug check by doctors in last 180 days
- Use of physical restraints
- Use of wheelchair
- Use of crutches

**Psychosocial factors**
- Depressive symptoms
- Fear of falling
- Decline in social activities
- Decline in behaviour
- Informal care support during weekdays
- Living alone

**Falls**