Health & Social Care in the community

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

Journal:	*Health & Social Care in the Community*
Manuscript ID:	HSCC-OA-08-0163.R3
Manuscript Type:	Original Article
Keywords:	falls, Chinese, psychosocial factors, living alone

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 r**egression 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%, $\chi 2$ = **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 hospitalization**s,** 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 preparation**s** (**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**) (Stanlenhoef *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 wheelchair**s** 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, extrinsic 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

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 problem**s** and oral problem**s**) 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 t**hat 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

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.

References

American Geriatric Society, British Geriatric Society & American Academy of Orthopaedic Surgeons Panel on Falls Prevention (2001) Guidelines for the prevention of falls in older persons. *Journal of American Geriatric Society* **49**, 664-671.

Avidan A.Y., Fries B.E., James M.L., Szafara K.L., Wright G.T. & Chervin R.D.. (2005) Insomnia and hypnotic use, recorded in minimum data set, as predictors of falls and hip fractures in Michigan nursing homes. *Journal of the American*

Geriatrics Society **53** (6)**,** 955-962.

Bateni H. & Maki B.E. (2005) Canes and walkers: benefits and adverse consequences of use. *Rehabilitation and Community Care Medicine* **14** (1), 22-24.

Berry S.D. & Kiel D.P. (2008) Falls as risk factors for fracture. In R. Marcus, D. Feldman, D. A. Nelson & C. Rosen, eds. *Osteoporosis.* 3rd ed. Elsevier, Inc. Ch. 35.

Bian F., Logan J.R. & Bian Y. (1998) Intergenerational Relations in Urban China: Proximity, Contact, and Help to Parents. *Demography* **35** (1),115–24.

Burrows A.B., Morris J.N., Simon S.E., Hirdes J.P. & Phillips C. (2000) Development of a Minimum Data Set-based Depression Rating Scale for use in Nursing Homes. *Age and Ageing* **29** (2), 165 – 172.

Cesari M., Landi F., Torre S., Onder G., Lattanzio F. & Bernabei R. (2002) Prevalence and risk factors in an older community-dwelling population. *The Journal of Gerontology* **57A** (11), M722-M726.

Chan K.W. & Lee J. (2003) Autonomy or dependence? Housing and living arrangements of the elderly in Hong Kong. *Indian Journal of Gerontology* **17**, 59-76.

Chen Y.C., Chien S.F. & Chen L.K. (2009) Risk factors associated with falls among Chinese hospital inpatients in Taiwan. *Archives of Gerontology and Geriatrics* **48**

(2), 132-136.

Chu L.W., Chi I. & Chiu A.Y.Y. (2005) Incidence and predictors of falls in the Chinese elderly. *Annals of the Academy of Medicine, Singapore* **34** (1), 60-72.

Chu L.W., Chiu A.Y.Y. & Chi I. (2006) Impact of falls on the balance, gait, and activities of daily living functioning in community-dwelling Chinese older adults. *The Journal of Gerontology* **61A** (4), 399-404.

Chu L.W., Chiu A.Y.Y. & Chi I. (2008) Falls and subsequent health service utilization in community-dwelling Chinese older adults. *Archive of Gerontology and Geriatrics* **46** (2), 125-135.

Cwikel J., Fried A.V. & Galinsky D. (1989) Falls and psychosocial factors among community-dwelling elderly persons: a review and integration of findings from Israel. *Public Health Reviews* **17** (1), 39-50.

Cwikel J. (1992) Falls among elderly people living at home: medical and social factors in a national sample. *Israel Journal of Medical Sciences* **28** (7), 446-453.

Ebersole P., Hess P. & Luggen A.S. (2004) Mobility. *Toward Healthy Aging.* St. Louis: Mosby.

Fallon L.F.Jr., Awosika-Olumno A. & Fulks J.S. (2002) Factors Related to Accidents and Falls among Older Individuals. *Traumatology* **8** (4), 205-210.

Feldman F. & Chaudhury H. (2008) Falls and the physical environment: a review and

a new multifactorial falls-risk conceptual framework. *Canadian Journal of Occupational Therapy* **75**(2):82-95.

Friedman S.M., Munoz B., West S.K., Rubin G.S. & Fried L.P. (2002) Falls and fear of falling: which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. *Journal of the American Geriatric Society* **50**, 1329–1335.

Fries B.E., Simon S.E., Morris J.N., Flodstrom C. & Bookstein F.L. (2001) Pain in US Nursing Homes: Validating a Pain Scale for Minimum Data Set. *Gerontologist* **41** (2), 173 – 179.

Gillespie L. (2004) Preventing falls in elderly people. *British Medical Journal* **328**, 653-654.

He W., Sengupta M., Zhang K. & Guo P. (2007) P95/07-2 *Health and Health Care of the Older Population in Urban and Rural China: 2000 - U. S. Census Bureau, International Population Reports.*. Washington, D. C.: U. S. Government Printing Office. [WWW document.] URL http://www.census.gov/prod/2007pubs/p95-07-2.pdf

Ho S.C., Woo J., Chan S.S.G., Yuen Y.K. & Sham A. (1996) Risk factors for falls in the Chinese elderly population. *Journal of Gerontology A: Biological Science and Medical Science* **51**, M195-198.

InterRAI Overview Committee (1999) *RAI-Home Care (RAI-HC) assessment manual for version 2.0.* Washington, DC: InterRAI Corporation.

Kharicha K., Iliffe S., Harari D., Swift C., Gillmann G. & Stuck A.E. (2007) Health risk appraisal in older people 1: are older people living alone an "at risk" group? *British Journal of General Practice* **57** (537), 271-276.

Knodel J. & Ofstedal M.B. (2003) Gender and Aging in the Developing World: Where Are the Men? *Population and Development Review* **29** (4), 677–98.

Kwan C.W. & Chi I. (2000) Validation of Minimum Data Set for Home Care (MDS-HC) assessment instrument for Hong Kong Chinese. *Clinical Gerontologist* **21** (4), 35-48.

Lai D.W.L. (2005) Cultural factors and preferred living arrangements of aging Chinese Canadians. *Journal of Housing for the Elderly* **19** (2), 71-86.

Lai D.W.L. & Leonenko W.L. (2007) Correlates of living alone among single elderly Chinese immigrants in Canada. *International Journal of Aging and Human Development* **65** (2), 121-148.

Lehtola S., Koistinen P. & Luukinen H. (2006) Falls and injurious falls late in home-dwelling life. *Archives of Gerontology and Geriatrics* **42**, 217–224.

Leung A., Ko P., Chan K.S., Chi I. & Chow N. (2007) Searching Health Information Via Web: Hong Kong Chinese Older Adults' Experience. *Public Health Nursing*

24 (2), 169-175.

Leung A., Chi I. & Chiang V. (2008) Chinese Retirees' Learning Desire: A Qualitative Analysis. *Educational Gerontology* **34** (12), 1105-1121.

Luukinen H., Koski K., Hiltunen L. & Kivela S.L. (1994) Incidence rate of falls in an aged population in northern Finland. *Journal of Clinical Epidemiology* **47**, 843-850.

Mahoney J., Sager M. & Dunham N.C. (1994) Risk of falls after hospital discharge. *Journal of the American Geriatrics Society* **42** (3), 269-274.

McCullagh M. C. (2006) Home modification. *American Journal of Nursing* **106**(10), 54-63.

Miller P.A. & Pantel E.S. (2003) Toward a more comprehensive understanding of the etiology of falls. *Topics in Geriatric Rehabilitation* **19** (3), 212-219.

Morris J.N., Fries B.E., Mehr D.R. et al. (1994) MDS Cognitive Performance Scale. *The Journal of Gerontology* **49** (4), M174 – 182.

Myers R. (1990) *Classical and modern regression with applications* (2nd ed). Boston, MA: Duxbury Press.

Russell M.A., Hill K.D., Blackberry I., Day L.L. & Dharmage S.C. (2006) Falls risk and functional decline in older fallers discharged directly from emergency department. *The Journal of Gerontology* **61A** (10), 1090-1095.

Salva A., Bolibar I., Pera G.. & Arias C. (2004) Incidence and consequences of falls among elderly people living in the community. *Medicina Clínica* **122**, 172-176.

Sheahan S.L., Coons S.J., Robbins C.A., Martin S.S., Hendricks J. & Latimer M. (1995) Psychoactive medication, alcohol use, and falls among older adults. *Journal of Behavioral Medicine* **18** (2), 127-140.

Stanlenhoef P.A., Diederiksb J.P.M., Knottnerusa J.A., Kesterc A.D.M. & Creboldera H.F.J.M. (2002) A risk model for the prediction of recurrent falls in community-dwelling elderly: A prospective cohort study. *Journal of Clinical Epidemiology* **55** (11), 1088-1094.

Stevens J. (2002) *Applied Multivariate Statistics for the Social Sciences*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Stevens J.A., Corso P.S., Finkelstein E.A. & Miller T.R. (2006) The cost of fatal and non-fatal falls among older adults. *Injury Prevention* **12** (5), 290-295.

So F.H. (2008) Living alone – A comparison between Hong Kong and Sweden. *The Hong Kong Athropologist* **2**, 94-126.

Tromp A.M., Smit J.H., Deeg D.J.H., Bouter L.M. & Lips P. (1998) Predictors for falls and fractures in the Longitudinal Aging Study Amsterdam. *Journal of Bone and Mineral Research* **13**, 1932-1939**.**

Verma S. & Pickett W. (2001) Falls in the elderly: review articles. *Journal of*

Canadian Geriatric Society **41** (1), 28-31.

Zijlstra G.A.R., van Haastregt J.C.M., van Eijk J.T.M., van Rossum E., Stanlenhoef, P.A. & Kempen, G.I. (2007) Prevalence and correlates of fear of falling, and associated avoidance of activity in the general population of community-living older people. *Age and Ageing* **36** (3), 304-309.

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

Variables	n	%
Gender		
Male	619	39.4
Female	954	60.4
Age (mean, SD)	78.3	7.37
Marital status		
Never married	64	4.1
Married	695	44.2
Widowed	745	47.4
Divorced	38	2.4
Others	31	2.0
Educational Background		
No formal education	827	52.6
Attended primary school (grade 1-6)	547	34.8
Completed primary education	110	7.0
Junior secondary (grade 7-9)	55	3.5
Senior secondary (grade 10-12)	3	0.2
College or university	31	1.9
Falls	516	32.8

Table 2 Factors significantly associated with falls among Chinese community-dwelling older adults in Hong Kong (N=1573)

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

Note. [a] 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)

	Model 1		Model 2		Model 3	
	Odds ratio (95% confidence interval)		odds ratio (95% confidence interval)		odds ratio (95% confidence interval)	
ADL	1.00 (0.97-1.02)		0.99 (0.96-1.02)		0.99 (0.96-1.02)	
IADL	1.03 (1.00-1.05)	*	1.02 (0.99-1.05)		1.01 (0.98-1.03)	
cognitive impairment	1.04 (0.90-1.19)		1.09 (0.94-1.26)		1.12 (0.96-1.30)	
pain	1.04 (0.95-1.13)		1.03 (0.94-1.13)		1.04 (0.95-1.14)	
visual impairment	1.30 (1.03-1.64)	*	1.29 (1.02-1.63)	*	1.29 (10.2-1.62)	*
unsteady gait	3.33 (2.47-4.49)	**	3.07 (2.27-4.16)	***	3.19 (2.35-4.33)	***
hip fracture	2.09 (1.26-3.47)	**	1.94 (1.16-3.25)	*	2.03 (1.21-3.41)	**
other fractures	1.93 (1.15-3.24)	*	1.81 (1.07-3.06)	*	1.81 (1.07-3.06)	*
nutritional problem	1.24 (0.91-1.70)		1.27 (0.92-1.74)		1.31 (0.96-1.81)	
oral problem	1.19 (0.92-1.55)		1.17 (0.90-1.52)		1.17 (0.90-1.53)	
use of physical restraints			3.88 (0.74-20.40)		4.00 (0.76-21.00)	
use of wheelchair (outdoor)			1.00 (0.72-1.40)		1.00 (0.72-1.39)	
use of crutches (indoor)			1.54 (1.18-2.00)	**	1.53 (1.17-1.98)	**
living alone					0.62 (0.44-0.86)	**

*P<0.05, **P<0.01,*** P<0.001

Figure 1 Conceptual framework of the current study