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Accidental falls, health-related quality of life and life satisfaction: A prospective study of the general elderly population

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Abstract

As the physical consequences of accidental falls in the elderly are well-researched, the long-term associations between falls and quality of life and related concepts are less known. The aim of this study was to prospectively examine the long-term relations between falls and health-related quality of life (HRQoL) and life satisfaction (LS) over six years in the general elderly population.

One thousand three hundred and twenty-one subjects (aged 60–93 years), from the general population in the south of Sweden, were included in a baseline assessment and a follow-up after six years. HRQoL was measured with the SF-12 and LS with the life satisfaction index A (LSI-A). The differences in mean scores between fallers at baseline (n = 113) and non-fallers were statistical analyzed. Furthermore, the prediction of falls on the outcomes was analyzed using a multivariate linear regression model adjusted for multiple confounding factors.

Fallers scored significant lower in HRQoL and LS at baseline and after six years, compared to non-fallers, especially in the SF-12 physical component ($p = <0.001$). In the linear regression analysis, one or more falls at the baseline predicted a significant reduction in the SF-12 physical component at the follow-up assessment (B-Coefficient −1.8, 95% CI −3.4 to −0.2). In conclusion, falls predict a long-term reduction in the physical component of HRQoL in the general elderly population. Over six years, fallers had a notable chronic lowered score in both HRQoL and LS, compared to non-fallers. This long-term depression of elderly fallers in these aspects may be more extent than previous assumed.

Keywords

Accidental falls; Quality of life; Life satisfaction; Elderly; Prospective studies; Longitudinal studies

1. Introduction

Accidental falls in the elderly continue to be a major health problem, despite extensive research and preventive efforts (Anonymous, 2001, Hausdorff et al., 2001 and Kannus et al., 2005). Unintentional injury is one of the foremost causes of death and ill-health in the western world, and in Sweden, fall-related mortality has risen since the mid-1990s (Björkenstam and Johansson, 2011 and Sjogren and Bjornstig, 1989). Besides physical injuries, the consequences of falls in the elderly are broad with additional psychological and social consequences (Akyol, 2007, Gillespie et al., 2012 and von Heideken Wagert et al., 2009). Falls can also affect the family and relatives and are a contributing factor for nursing home admissions (Anonymous, 2011, Tinetti, 2003 and Tinetti and Williams, 1997). Falls in the elderly and their physical consequences have been well-researched: A fracture is estimated to occur in about 1–5% of the falls among the elderly residing in the community (Nevitt et al., 1991 and Tinetti et al., 1994). Additionally, about 30–50% results in minor soft tissue injuries that do not receive medical attention (Nevitt et al., 1991). Although a majority of falls results in no severe physical injury, the psychological and functional consequences can be severe (Rubenstein, Josephson, & Robbins, 1994). A fall can cause fear of falling, where anxiety, loss of self-confidence and activity avoidance result in self-imposed functional limitations (Cumming et al., 2000, Oliver et al., 2004, Scheffer et al., 2008 and Suzuki et al., 2002). This concept was introduced by Murphy and Isaacs' description of a post-fall syndrome in 1982 (Murphy & Isaacs, 1982).

As the concept fear of falling is established in the literature, the concept of health-related quality of life (HRQoL) have increasingly gained recognition as an important tool for evaluating effects on medical treatment (Lin, Wolf, Hwang, Gong, & Chen, 2007). Improved quality of life can be seen as one of the most desirable outcomes of all health polices

(Farquhar, 1995). In a large study of the elderly, fear of falling was identified as a major factor related to reduced HRQoL (Chang, Chi, Yang, & Chou, 2010). Fear of falling is even suggested to be the main impact on reduced HRQoL after a fall, rather than the actual fall or its sequelae (Iglesias, Manca, & Torgerson, 2009).

Although lacking a clear definition, the broad concept of quality of life is frequently used to describe ‘the good life’ within several disciplines with a range of various aspects (Berg, 2008). HRQoL refers to how health impacts an individual's ability to function and the perceived well-being in physical, mental and social domains of life. As many studies have focused on the physical consequences of falls, there is an explicit need for comprehensive studies of societal impact of falls in the elderly focusing on HRQoL and similar instruments (Hartholt et al., 2011). These measurement can be useful in evaluating the elderly with potential chronic multimorbidity, where perceived health and well-being can be more adequate apposed medically defined diagnoses and status. A literature review from 2012, assessing the scientific knowledge related to quality of life and falls in the elderly, revealed gaps in knowledge, unclear definition of the concept and a predominance of descriptive studies (Nicolussi et al., 2012).

Although overlapping the term quality of life, the concept of life satisfaction (LS) can be defined as a ‘cognitive judgmental global evaluation of one's life’, or ‘not just an absence of disease or disability but also includes the satisfaction of social and psychological needs’ (Diener, 1984 and Enkvist et al., 2011). In comparison, HRQoL can be seen as measuring present health and health past month, while LS is more of a global instrument measuring life satisfaction in a life perspective (Ekström, 2009). Although LS is widely used measuring well-being in later life, no other study have, to our knowledge, analyzed the association between falls and LS in the general elderly population (Berg, 2008).

The aim of this study was to prospective examine the long-term relations between falls and HRQoL and LS over six years in the general elderly population.

2. Methods

2.1. General

This is a prospective study with data from the Swedish epidemiological population study 'Good Ageing in Skåne' (Ekstrom and Elmstahl, 2006 and Lagergren et al., 2004). At the baseline assessment, 2931 subjects, aged 60–93 years, were randomly recruited from both urban and rural areas, in the county Region Skåne in the south of Sweden, using the National Population Register. Home visits were offered to those who were unable to meet up at the research center. The only exclusion criterion was the inability to speak Swedish. 1709 subjects participated in a 6-year follow-up assessment, and 1321 of these met the inclusion criteria with recorded fall history and complete data on HRQoL and LS (Fig. 1). The incidence of falls was based on oral questioning by purposed-trained physicians at the baseline and follow-up assessments, using a structured questionnaire. Those with the incidence of one more falls six months prior the baseline assessment were dichotomized as fallers. Recurrent fallers six months prior the follow-up were also included in this group. Debut fallers at the follow-up were excluded.

Social factors included the prevalence of higher education, co-habiting and urban/rural living and were based on questionnaires at the baseline. Walking speed was recorded by timing the subject's maximum walking speed over 15 m without running at the baseline assessment. Slow walking speed was defined as recording a time above the median value of the study population.

The categorization of co-morbidity was based on the International Classifications of Diseases (ICD-10) criteria in a medical examination by a physician at the baseline assessment. Co-morbidity included the prevalence of one or more of the following conditions: heart disease, heart failure with symptoms, chronic obstructive pulmonary disease, osteoporosis-related fracture, cancer and cognitive impairment. Heart disease comprised angina, myocardial infarction and arrhythmia. Heart failure with symptoms was categorized by the New York Heart Association (NYHA) Functional Classification, and included subjects in NYHA class II–IV (American Heart Association, Accessed June 2013). Cognitive impairment was defined as scoring below 24 points on the cognitive Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975). All variables were coded in dichotomized values, except age sorted in decades.

2.2. Health-related quality of life

HRQoL was evaluated using the SF-12, Short Form Health Survey, at the baseline assessment and the follow-up after six years. This is a shorter version of the established SF-36 Survey, which can be useful in testing the geriatric patient. High consistency between this short form version and SF-36 is demonstrated (Sullivan, Karlsson, & Taft, 1997). SF-12 is a generic instrument including 12 items finalized into a physical and mental component summery (PCS, MCS). SF-12 PCS includes the components general health, physical function, physical role limitation and bodily pain, while SF-12 MCS includes mental role limitation, vitality, social functioning and mental health. The total score for SF-12 PCS/MCS range from 0 to 100 respectively, with a higher number indicating a higher HRQoL (Sullivan et al., 1997 and Ware et al., 1996). SF-12 is well documented and it has been evaluated for both reliability and validity (Gandek et al., 1998, Sullivan et al., 1995 and Ware et al., 1996).

2.3. Life satisfaction

LS was measured using the life satisfaction index A (LSI-A), used in a questionnaire form of 20 questions at the baseline and follow-up assessment. The origin of the index was developed by Neugarten, Havighurst and Tobin (1961) aimed at measuring general mental well-being in an elderly population (Neugarten et al., 1961). At its core, LSI-A is multidimensional in character covering five components of life satisfaction: (1) Zest (vs. apathy); take pleasure of activities that constitutes normal life. (2) Resolution and fortitude; consider the life as meaningful and accepts how life has been. (3) Congruence between desired and achieved goals; feels successful in achieving major goals. (4) Self-concept; holds a positive image of self. (5) Mood tone; maintains a positive, optimistic attitude and mood. The total score range from 0 to 40 with a higher number indicating a greater LS (Neugarten et al., 1961). As Neugarten et al. (1961) initially tested the index' internal consistency, its validity and reliability have been evaluated throughout the years (Neugarten et al., 1961, Shmotkin, 1991 and Wallace and Wheeler, 2002).

2.4. Statistical analyses

Initially, the statistical differences in the categories age, sex, social factors, prevalence of slow walking speed and co-morbidity, between non-fallers and fallers at the baseline assessment, were analyzed using chi-squared tests and ANOVA. Furthermore, the differences between mean scores of SF-12 PCS/MCS and LSI-A at the follow-up assessment, with the prevalence of the mentioned categories at baseline, were analyzed using independent sample T-tests and ANOVA. Additionally, the differences in mean scores of the instruments between non-fallers and fallers, at the baseline and follow-up assessments, and the changes over time (the value of Delta), were analyzed using independent sample T-tests. Finally, a multivariate linear regression model adjusted for age, sex, social factors, the baseline score of SF-12 PCS/MCS and LSI-A and the prevalence of slow walking speed and co-morbidity was used to predict the outcome of accidental falls at baseline on the variables SF-12 PCS/MCS and LSI-A at the follow-up assessment. Throughout the study, SPSS version 20 was used for statistical analyzes and a 95% Confidence Interval (CI) and a p-value <0.05 defined statistical significance.

2.5. Ethics

The study was approved by the Ethical Committee of Lund University and all subjects gave their written informed consent.

3. Results

A majority of the study population was in the age between 60 and 79 years at the baseline assessment. Slightly above 15% were in their eighties or nineties (Table 1). Almost one in ten reported one or more falls at baseline (8.6%). The study population was almost evenly distributed between the sexes, with a majority living in an urban area. More than three in five were co-habiting, and one in five had a higher education. Slightly above two in five filled the criteria for co-morbidity. At the baseline assessment, falls were relative more common in women and those in their eighties and nineties ($p = <0.001$ to 0.001). Falls were also significant more common in subjects living alone, and those with the prevalence of slow walking speed and co-morbidity ($p = <0.001$ to 0.001).

At the follow-up assessment, the male population had a general higher mean score in SF-12 PCS/MCS and LSI-A than the female population ($p = <0.001$) (Table 2). All mean scores decreased with advancing age, but SF-12 MCS had a less pronounced decline. Place of residence had no significant difference in the mean scores of SF-12 MCS/PCS and LSI-A. Subjects with prevalence of co-morbidity, slow walking speed and absence of co-habiting and higher education had significant reduced mean scores in all outcomes (p = <0.001), except in SF-12 MSC with the absence of higher education (p = 0.159).

Fallers scored significant lower in mean SF-12 MCS/PCS and LSI-A in the baseline assessment, compared to non-fallers (Table 3). In SF-12 PCS at the follow-up, fallers had a slightly above seven point lower mean score compared to non-fallers (p = <0.001). The difference where less in SF-12 MCS, with a lower mean of almost three points (p = 0.004). Fallers also scored a three point lower mean LSI-A at the follow-up than non-fallers (p = <0.001). The values of Delta, the differences in mean scores between the baseline and follow-up assessments, were minimal in the SF-12 MCS and LSI-A instruments for both fallers and non-fallers. In SF-12 PCS, the Delta values were notable different between the groups, with a reduction of 2.5 in fallers compared to 1.6 in non-fallers, although the difference was not statistical significant.

In the adjusted multivariate linear regression analysis, one or more falls at baseline predicted a significant reduction in the SF-12 PCS score at the follow-up assessment (B-Coefficient −1.8, 95% CI −3.4 to −0.2) (Table 4).

4. Discussion

4.1. Main findings and clinical relevance

Our result implies that one or more falls predict a long-term reduction in the physical component of HRQoL in the general elderly population. In the measurement of HRQoL, using SF-12 at both the baseline and follow-up assessment, the reduction was more severe in the SF-12 PCS than in the SF-12 MCS. These results differ from the theory that the mental consequences and fear of falling, rather than physical sequelae, dominates the reduction of HRQoL after a fall (Iglesias et al., 2009). A physical reduction can be seen as logical as a fall assumes to cause physical trauma. Nonetheless, as mentioned earlier, severe injury after a fall is rather rare even if some incidences can be fatal (Nevitt et al., 1991 and Tinetti et al., 1994). Instead of actual physical harm, the long-term reduction in SF-12 PCS may depend on insecurity and activity avoidance with a future decline in the individual physical function.

Furthermore, the dynamics of the mean scores in SF-12 PCS/MCS and LSI-A were limited and rigid over six years. Fallers scored significantly lower in HRQoL and LS at the baseline assessment, than non-fallers, and continued to do so after six years. In line with this, fallers at baseline seem to be at a prospective continuous, chronic deprived state of both HRQoL and the more global concept of LS, compared to non-fallers. More research is indicated on fallers' seemingly long-term depression in these aspects and its intimate association to general frailty, physical and functional decline and co-morbidity. As the need for prevention of falls is well-establish, one clinical implication of our findings may be the need of a more continuous, physical-oriented follow-up of elderly individuals with experience of one or more falls.

4.2. Methods

There are to our knowledge no previous studies on the prediction of accidental falls on HRQoL and LS in the elderly. Combine with a rather lengthy longitudinal design of six years, this study may be unique in its kind investigating the long-term relation between falls and these aspects. Additionally, the study population was a relative large sample of the general elderly population, which can be seen as a methodological strength. The baseline and follow-up examinations were supervised by health professionals and home visits were made to those who were unable to meet up at the research center. Despite this, there may be a significant number of drop outs of the more frail and elderly throughout the study. This possible selection bias may have introduced an underestimation of the incidence of falls, with noted effects on the measurements of HRQoL and LS.

The outcome variables were based on well-established instruments tested for both reliability and validity. The mean scores of HRQoL throughout the study population conformed well the findings of a large Swedish population-based study of the instrument (Sullivan et al., 1997). As our analysis showed statistical significant lowered HRQoL and LS being a faller, the clinical significance and the individuals perception of these findings in everyday life is harder to evaluate in this quantitative approach.

The incidence of one or more falls six months prior the assessments, was based on oral questioning by a physician. A standardized, scientific definition of a fall, recommended by the Prevention of Falls Network in Europe, was not used (Hauer et al., 2006 and Lamb et al., 2005). This may affected the variable's reliability and validity, although many elderly may intuitive recall a fall in the span of six months. This potential bias may generate an underreporting of the incidence of falls throughout the study, diluting the results. Additionally, this study's design with a 6-year follow-up generates a relative long period of unknown incidence of falls or other adverse events.

Measuring factors as complex as accidental falls, HRQoL and LS generates a number of methodological challenges, including confounding factors and collinearity. Falls may be a symptom of underlying disease or a general deterioration of health, affecting the perception of these measurements. To reduce confounding factors we used a multivariate linear regression analysis, adjusted for several social, physical and medical factors. To adjust for deteriorating in physical performance and functional ability we used the measurement of walking speed. This is an established clinical evaluation of older people at risk for major health-related events, functional dependence and frailty (Castell et al., 2013, Cesari et al., 2005 and Shinkai et al., 2000). Furthermore, the baseline scores of SF-12 PCS/MCS and LSI-A were included in the regression analysis to adjust for poor performance in these measurements. Although multiple adjustments for potential confounding factors and collinearity were made in the statistical analyzes, the mentioned methodological biases cannot be ruled out in this study.

Although prospective in its design, there were limitations in this study's ability to interpret the causality of falls. Due to possible floor effects and regression to the mean, the dynamics over time (value of Delta), in our instruments were limited and non-significant in the statistical analyzes. Despite this limitation, the results can be clinical useful: Fallers with low HRQoL and LS seems to be in the same state in the long-term, highlighting the challenges of a clinical successful physical- and mental rehabilitation of this group.

4.3. Conclusions

Falls predict a long-term reduction in the physical component of HRQoL in the general elderly population. Over six years, fallers had a notable chronic lowered score in both HRQoL and the more global concept of LS, compared to non-fallers. The long-term depression of elderly fallers in these aspects may be more extent than previous assumed. A more continuous, long-term follow-up of these individuals and intervention studies may be indicated.

Conflict of interest statement

The authors declare that they have no conflict of interest.

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Figure1

Flow chart of the inclusion of the study population, n = 1321

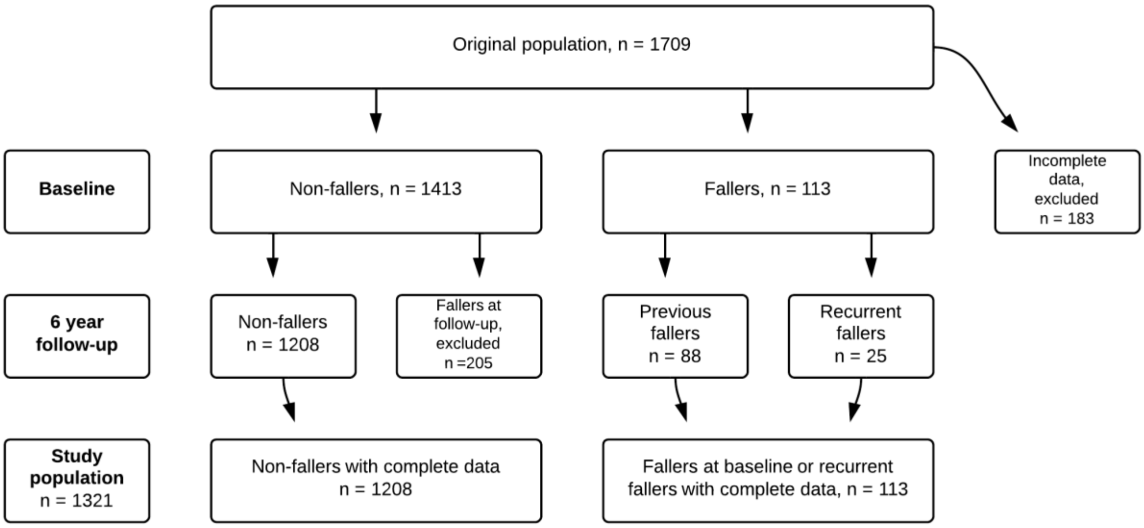

Table 1

Descriptive data of the study population at the baseline assessment, with comparison of non-fallers and fallers. Statistical differences between non-fallers and fallers analyzed with the chi-squared test and ANOVA.

	Total, *n* = 1321	**Non-fallers, *n* = 1208**	**Fallers, *n* = 113**	***p***
	***n* (%)**	***n* (%)**	***n* (%)**	
Sex				
Male	626 (47.4)	590 (48.8)	36 (31.9)	0.001
Female	695 (52.6)	618 (51.2)	77 (68.1)	
Age, in decade				
60	855 (64.7)	807 (66.8)	48 (42.5)	
70	262 (19.8)	237 (19.6)	25 (22.1)	
80	181 (13.7)	153 (12.7)	28 (24.8)	
90	23 (1.7)	11 (0.9)	12 (10.6)	<0.001
Higher education				
Yes	289 (21.9)	271 (22.4)	18 (15.9)	ns
No	1032 (78.1)	937 (77.6)	95 (84.1)	
Co-habiting				
Yes	841 (63.7)	792 (65.6)	49 (43.4)	0.001
No	480 (36.3)	416 (34.4)	64 (56.6)	
Place of residence				
Urban	1187 (89.9)	1087 (90.0)	100 (88.5)	ns
Rural	134 (10.1)	121 (10.0)	13 (11.5)	
Slow walking speed				
Yes	638 (49.6)	562 (47.4)	76 (75.2)	<0.001
No	648 (50.4)	623 (52.6)	25 (24.8)	
Co-morbidity[a]				
Yes	535 (42.5)	474 (41.1)	61 (58.1)	0.001
No	724 (57.5)	680 (58.9)	44 (41.9)	

[a] Prevalence of one or more of the following diagnoses: heart disease, heart failure with symptoms, chronic obstructive pulmonary disease, osteoporosis-related fracture, cancer and cognitive impairment.

Table 2

Descriptive data of mean scores at the follow-up assessment in the SF-12, physical component summery (PCS, 0–100), mental component summery (MCS, 0–100) and Life Satisfaction index A (LSI-A, 0–40). Statistical differences analyzed with Independent sample T-test and ANOVA, n = 1321.

	SF-12 PCS	***p***	**SF-12 MCS**	***p***	**LSI-A**	***p***
Population	46.0		55.0		28.0	
Sex						
Male	47.6		55.8		29.0	
Female	44.6	<0.001	54.3	0.001	27.2	<0.001
Age, in decade						
60	48.5		55.7		29.2	
70	44.4		54.0		26.8	
80	38.4		53.8		25.0	
90	30.6	<0.001	52.7	0.005	22.2	<0.001
Higher education						
Yes	48.7		55.6		29.9	
No	45.2	<0.001	54.9	ns	27.5	<0.001
Co-habiting						
Yes	47.6		55.8		29.2	
No	43.3	<0.001	53.7	<0.001	25.9	<0.001
Place of residence						
Urban	46.1		55.1		28.1	
Rural	44.7	ns	54.6	ns	27.8	ns
Slow walking speed						
Yes	42.6		53.9		26.4	
No	49.9	<0.001	56.2	<0.001	29.8	<0.001
Co-morbidity[a]						
Yes	43.0		53.9		26.6	
No	48.5	<0.001	56.0	<0.001	29.2	<0.001

[a] Prevalence of one or more of the following diagnoses: heart disease, heart failure with symptoms, chronic obstructive pulmonary disease, osteoporosis-related fracture, cancer and cognitive impairment.

Table 3

Mean scores at the baseline and follow-up assessments in non-fallers and fallers in the SF-12, physical component summery (PCS, 0–100), mental component summery (MCS, 0–100) and Life Satisfaction index A (LSI-A, 0–40). Changes over time described as the value of Delta. Statistical differences analyzed with Independent sample T-test, n = 1321.

	Baseline		**Follow-up**		**Value of Delta**	
SF12 PCS						
Non-fallers	48.2		46.6		1.6	
Fallers	41.8	<0.001	39.3	<0.001	2.5	ns
SF12 MCS						
Non-fallers	55.3		55.3		0	
Fallers	52.5	0.001	52.4	0.004	0.1	ns
LSI-A						
Non-fallers	28.4		28.3		0.1	
Fallers	25.4	<0.001	25.3	<0.001	0.1	ns

Table 4

Multivariate linear regression analysis of the predication of falls at baseline on the SF-12, physical component summery (PCS, 0–100), mental component summery (MCS, 0–100) and the Life satisfaction index A (LSI-A, scale 0–40) at the follow-up assessment. Adjusted for age, sex, baseline score of the instrument, social factors[a], low walking speed and co-morbidity[b], n = 1321.

	B-Coefficient	Std. error	95% CI	*p*	R^2
PCS	−1.8	0.826	−3.4 to −0.2	0.031	0.424
MCS	−1.0	0.791	−2.5 to 0.6	0.213	0.180
LSI-A	−0.5	0.581	−1.6 to 0.7	0.426	0.420

[a] Prevalence of higher education, co-habiting and urban/rural living.

[b] Prevalence of one or more of the following diagnoses: heart disease, heart failure with symptoms, chronic obstructive pulmonary disease, osteoporosis-related fracture, cancer and cognitive impairment.