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Factors Associated with falls in Elderly Living at Home in Sweden

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Abstract

Background: Falls among elderly constitute a major public health issue of increasing magnitude. For the prevention of fall at population level, it is necessary to study risk factors among community-dwelling elderly people in the population. The aim of this explorative study is to show associations between falls and self-rated health, physical exercise, physical functioning and physical disorders in elderly men and women living in their own homes in urban areas in a high-income country.

Methods: The associations between reported falling during the previous year and factors such as physical functioning, physical disorders, exercise, and self-rated health were investigated in a case-control study. The study base included all men and women aged 75 years and older living in their own homes in two municipal districts, one in the Stockholm area and one in the south of Sweden, from October 2008 to March 2009. A questionnaire was developed, but with questions used in earlier studies.

Results: Of the1243 who participated in the study, 434 (35%) reported that they had fallen at least once during the previous year, and 759 (61%) reported no falls at all during the same period. Of the fallers, 158 (36%) were men, and 276 (64%) women. Unsteady gait (log reg 1.38, 95% CI 1.09-1.75) and poor self-rated health (log reg 2.04, 95% CI 1.29-3.20) were associated with falls during the previous year.

Conclusion: The results from this study indicate that the most important factors related to falls are within physical functioning, and that there are differences between men and women regarding the strength in the associations, and regarding marital status and age.

Keywords: Falls; Elderly; Community-dwelling; Gait ability; Musculoskeletal disorders

Introduction

Increasing life expectancy means that people are living longer, which has consequences for the age structure of the population, leading to an escalating growth in the number of elderly people [1]. The proportion of elderly people in the population structure is increasing in Sweden, as in other high-income countries [2]. As a result of this development there will not be enough places available in special accommodation for the elderly, and it is therefore necessary to support and facilitate people to continue living at home, even in old age.

Background

Most elderly people in Sweden live independently in their homes and this situation is likely to remain [3,4]. The overall ambition and policy in Swedish society is to ensure that older people are able to live independently in secure conditions in their own homes [5]. When people get older their physical ability, such as muscle strength, gait speed and balance deteriorates. This process differs between individuals [6,7]. Evidence has been found in studies, that regular physical activity, among other benefits, prevents falls [8]. Lack of regular exercise and physical activities causes decreased muscle strength, and loss of bone mass and flexibility. Together with the ageing process itself, this contributes to falls and also affects health consequences due to falling. The increasing proportion of elderly people means that falling is an increasing problem, as the number of falls will continue to rise. In numerous studies, the following risk factors for falls have been identified: disease, cognitive impairment, neuromuscular impairment, balance and gait disorder, depression, functional decline, higher use of medication, and environmental hazards [9].

The rationale for this explorative study is that falls are frequent among elderly people, and cause suffering for the individual. There is a lack of knowledge concerning risk factors for falling in elderly community-dwelling people, as falling is not reported unless injuries and disability have occurred [10]. As a prerequisite to fall prevention it is necessary to explore associated factors for falls at population level, and include all older people who live in their own homes. The aim of this study is to show associations between self-rated health, physical exercise, physical functioning and physical disorders, and recent falls among elderly men and women living in their own homes in urban areas in a high-income country.

Methods

Study population, setting, and design

The associations between reported falling during the previous year and factors that could be associated regarding physical functioning and disorders, such as pain, regular exercise, weight and self-rated health, were investigated in a case-control study with a cross-sectional design. The study base included all men and women aged 75 years and older living in their own homes in two municipal districts, one in the Stockholm area and one in southern Sweden, from October 2008 to March 2009. There were 1690 persons who fulfilled the criteria to participate in the study, and 1243 of them (74%) agreed to participate.

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The participants ranged from 75 to 106 years of age, and the median age was 81. More than 60% of the study population was under 85 years of age. Most of the men were cohabiting, while most of the women were single. Almost two thirds of both men and women lived in a house, and the rest in an apartment or a condominium (Table 1).

Questionnaire

A questionnaire was developed from two standardized questionnaires. From the SF-36 Standard Swedish Version 1.0 of the International Quality of Life Assessment, there were questions on physical dysfunctions and disorders [11,12]. Questions on physical activity habits were from Sweden's national public health survey: "Health on equal terms" [13]. The validity of the individual questions had been tested at Statistics Sweden [14].

Thus, the questionnaire included questions on falling during the past year, self-reported health, physical functioning, exercise habits, disease symptoms, and general health status. There were questions with three or more response alternatives. For responses to the item on global self-rated health there was a five-level scale: very poor, poor, fair, good, very good. In the analysis, the responses from these five response alternatives were dichotomized to very poor/poor/fair or good/very good. Regarding health complaints there were three response alternatives: no problems, moderate problems or severe problems. These were dichotomized into a yes/no response in the analysis [11,12]. Regarding physical functioning one question, "The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?", with ten items on what was possible to do such as kneeling, climbing stairs, ability to carry, and use of mobility aids, and also two questions on physical impairments and how these affect daily activities (four and three alternatives respectively) [11]. Two questions on exercise habits included weekly frequency (four alternatives) and about strenuous activities (five alternatives) [13] and "If your gait is unsteady, how often does it feel unstable?" (four alternatives) [12]. There were a few questions with just "yes" and "no" responses, such as "Did you fall during the past year?" and "Do you have any long-term illness, problems following an accident, any functional impairment or other long-term health problem?" [13]. Socio-demographics were obtained from the Swedish official statistics, Statistics Sweden [4], and demographic data included age, gender, marital status and standard of living. Marital status was dichotomized into living together/cohabiting or single.

A pilot study among a few selected individuals from the study population was carried out to ensure the function of the questionnaire as a whole. The questionnaire worked well and no changes in the design of the questionnaire were made.

Demographic characteristics	Men n (%) 471 (38)	Women n (%) 772 (62)
Age		
75-84	324(69)	475(62)
≥85	147(31)	297(38)
Marital status*		
Single	152 (32)	478 (62)
Cohabiting	291 (62)	226 (29)
Living situation*		
Apartment/condominium	129 (27)	206 (27)
House	330 (70)	457 (60)

*Data missing for some of the participants

Table 1: Socio-demographic characteristics of the study population (n=1243).

Data collection

Data collection was carried out in 2009. The questionnaire was sent to each study person, together with a covering letter and a stamped addressed envelope. In the covering letter the aim of the study was explained. They were informed that their personal data would appear at group level and that it would not be possible to identify any individual; furthermore, that participation was voluntary and could be interrupted at any time. In the letter it was also stated that by sending back the questionnaire in the stamped addressed envelope they gave their approved consent to participate in the study. In case of missing answers the questionnaire was sent out once again.

The Ethics Committee at Karolinska Institutet in Stockholm, Sweden, approved the study, 2008/1346-31, and the sampling from the population register was also approved.

Data analysis

Self-reported falling during the past year was considered the dependent variable in this study, and those who reported falls were considered cases. Those who did report that they had not fallen during the previous year were controls.

In this study an exposure is a factor that might possibly influence the risk of falling. Odds ratios were used to estimate the strength of the associations between self-reported falling during the previous year and physical functioning, musculoskeletal disorders, and physical activity habits. All information and exposures were based on self-reports, and each variable was dichotomized.

The bivariate odds ratios with variables connected to falling were first calculated, with reported falls during the previous year as an outcome measure and the dependent variable. All significant odds ratios from the bivariate calculations were thereafter entered into a multivariate logistic regression model of analysis with self-reported falls during the previous year as outcome. The confidence intervals for all the odd ratios, in the bivariate analyses and in the multivariate logistic model respectively, were calculated for 95% confidence intervals. The statistical analyses were performed using the statistical package SPSS for Windows, version 13.0.

Results

Of those 1243 who participated in the study, 471 (38%) were males and 772 (62%) females. Of these 434 (35%) reported that they had fallen at least once during the previous year, and 759 (61%) reported no falls at all during the same period. Of those who had fallen, 158 (13%) were men, and 276 (22%) women. The men and women who had fallen during the previous year were distributed evenly with respect to marital status and housing situation, according to the socio-demographic status. But differences were found between men and women regarding age distribution, marital status and falling: there were fewer fallers (12%) among women who were under 85 years of age, while the corresponding figure for men in this age group was 63%. The figure for falling among single men was 14%, while it was 67% in single women.

The unadjusted, bivariate analyses show associations between falling and self-rated health, physical functioning, and musculoskeletal disorders, and differ significantly between those who reported falls and those who did not report falls. The associations are strongest for physical functions such as unsteady gait and walking problems, getting in and out of bed, and not being able to climb stairs. Regarding musculoskeletal disorders and pain, there are significant associations for all parts of the body. Lack of exercise and over- or underweight also

shows associations with reported falling. Generally, the estimates for men are stronger than those for women (Table 2).

In the multivariate logistic regression model there are significant associations with unsteady gait, self-rated health and getting in and out of bed, in the studied population. Unsteady gait is significant both for the whole study population and also when men and women were analyzed separately. Pain in the hands, elbows, legs or knees shows a significant negative association with falls during the past year in men (Table 3).

Variables	Observations (n)	Reported falls (n)	OR	95% CI
Poor self-rated health (all)	724	313	2.44	1.90-3.14
Poor self-rated health (men)	256	115	3.22	2.13-4.87
Poor self-rated health (women)	468	198	2.05	1.49-2.82
Pain in neck and shoulders (all)	495	207	1.62	1.27-2.06
Pain in neck and shoulders (men)	153	68	2.01	1.34-3.03
Pain in neck and shoulders (women)	342	139	1.41	1.04-1.92
Back pain, sciatica or hip pain (all)	616	260	1.92	1.49-2.47
Back pain, sciatica or hip pain (men)	196	85	2.06	1.37-3.09
Back pain, sciatica or hip pain (women)	420	175	1.84	1.32-2.55
Pain in hands, elbows, legs or knees (all)	710	287	1.74	1.36-2.23
Pain in hands, elbows, legs or knees (men)	224	91	1.83	1.23-2.72
Pain in hands, elbows, legs or knees (women)	486	196	1.66	1.20-2-30
Over- or underweight (all)	341	147	1.55	1.19-2.02
Over- or underweight (men)	119	55	1.97	1.27-3.05
Over- or underweight (women)	222	92	1.35	0.97-1.88
Unsteady gait (all)	685	324	4.15	3.16-5.45
Unsteady gait (men)	228	120	6.17	4.01-9.51
Unsteady gait (women)	457	204	3.21	2.25-4.57
No moderate/regular exercise (all)	687	462	2.04	1.58-2.64
No moderate/regular exercise (men)	295	211	3.04	1.98-4.66
No moderate/regular exercise (women)	392	251	1.61	1.16-2.22
Cannot move freely (all)	501	242	3.33	2.56-4.33
Cannot move freely (men)	172	89	5.44	3.50-8.44
Cannot move freely (women)	329	153	2.46	1.77-3.43
Cannot walk without aids (all)	479	227	2.55	1.98-3.29
Cannot walk without aids (men)	146	82	4.64	3.02-7.11
Cannot walk without aids (women)	333	145	1.83	1.33-2.51
Cannot walk up stairs (all)	316	152	2.11	1.62-2.76
Cannot walk up stairs (men)	105	62	4.13	2.63-6.50
Cannot walk up stairs (women)	211	90	1.47	1.05-2.05
Cannot bend down (all)	362	178	2.40	1.85-3.12
Cannot bend down (men)	140	75	3.93	2.56-6.02
Cannot bend down (women)	222	103	1.81	1.30-2.52
Cannot kneel down (all)	687	301	2.72	2.08-3.56
Cannot kneel down(men)	218	104	4.03	2.63-6.17
Cannot kneel down (women)	469	197	2.06	1.45-2.93
Cannot get in and out of bed (all)	75	49	3.96	2.47-6.36
Cannot get in and out of bed (men)	31	23	7.32	3.40-15.76
Cannot get in and out of bed (women)	44	26	2.74	1.49-5.04
Cannot walk about indoors (all)	88	53	3.17	2.05-4.91
Cannot walk about indoors (men)	33	21	4.08	2.00-8.32
Cannot walk about indoors (women)	55	32	2.73	1.57-4.76
Cannot walk outdoors (all)	336	170	2.44	1.88-3.15
Cannot walk outdoors (men)	105	62	4.13	2.65-6.44
Cannot walk outdoors (women)	231	108	1.84	1.34-2.54
Pain in muscles and joints (all)	243	112	1.51	1.08-2.12
Pain in muscles and joints (men)	73	39	2.69	1.48-4.90
Pain in muscles and joints (women)	43	21	1.14	0.76-1.73

Table 2: Unadjusted bivariate associations with self-reported falls during the past year. Men and women ≥ 75 years of age, living in their own homes in the two municipalities.

Discussion

The results indicate that physical functioning is the most important factor related with falling in the elderly in Sweden; furthermore, there are differences between men and women regarding the strength in the associations, and also regarding marital status and age.

The image of a Swedish man or woman who has fallen during the past year could be that he or she experiences poor health, has an unsteady gait, and has difficulties in walking and in the activities of daily living, such as getting in and out of bed, climbing stairs, and getting down on their knees. Women are over 85 years of age and single, while men are cohabiting at any age over 75 years. Both sexes cannot walk without aids and have pain and musculoskeletal problems, especially in the neck and back. In addition, both sexes fail to take part in physical training or exercise.

High age and being female are generally known as strong risk factors for both falls and fractures, thereby causing an age- and gender impact on the total number of falls in a municipality [14]. Urbanization, modernization and cultural change affect both patterns of life and physical environment. Less physical activity in an increasingly technologically advanced society and an environment with hard surfaces outdoors, such as stone and asphalt, contribute to the increasing number of falls [15].

The rate of falling during the past year in our study is on a similar level to that of other studies in the western world, and has been found to vary between 35 and 40% for elderly people living in their own homes [16]. This is well in line with our results.

Variables	OR	95% CI
Poor self-rated health (all)	**1.38**	**1.09-1.75**
Poor self-rated health (men)	1.48	0.97-2.15
Poor self-rated health (women)	**1.36**	**1.00-1.86**
Pain in neck and shoulders (all)	1.38	0.76-1.33
Pain in neck and shoulders (men)	1.33	0.77-2.30
Pain in neck and shoulders (women)	0.92	0.65-1.30
Back pain, sciatica or hip pain (all)	1.07	0.84-1.37
Back pain, sciatica or hip pain (men)	0.93	0.61-1.42
Back pain, sciatica or hip pain (women)	1.12	0.82-1.54
Pain in hands, elbows, legs or knees (all)	0.97	0.74-1.26
Pain in hands, elbows, legs or knees (men)	0.58	0.36-0.93
Pain in hands, elbows, legs or knees (women)	1.26	0.93-1.74
Over- or underweight (all)	1.01	0.74-1.37
Over- or underweight (men)	1.24	0.71-2.18
Over- or underweight (women)	0.89	0.61-1.30
Unsteady gait (all)	**2.04**	**1.29-3.20**
Unsteady gait (men)	**2.22**	**1.01-4.90**
Unsteady gait (women)	**1.95**	**1.11-3.44**
No moderate/regular exercise (all)	0.89	0.70-1.15
No moderate/regular exercise (men)	0.87	0.57-1.32
No moderate/regular exercise (women)	0.92	0.67-1.27
Cannot move freely (all)	1.31	0.95-1.82
Cannot move freely (men)	1.49	0.81-2.73
Cannot move freely (women)	1.27	0.86-1.89
Cannot walk without aids (all)	1.09	0.82-1.45
Cannot walk without aids (men)	1.41	0.82-2.40
Cannot walk without aids (women)	0.97	0.69-1.37
Cannot walk up stairs (all)	0.98	0.71-1.26
Cannot walk up stairs (men)	1.06	0.60-1.70
Cannot walk up stairs (women)	0.90	0.67-1.35
Pain in muscles and joints (all)	1.35	0.90-2.03
Pain in muscles and joints (men)	2.02	0.95-4.32
Pain in muscles and joints (women)	1.12	0.68-1.85

Table 3: Multivariate logistic regression model with associations with no self-reported falling history during the past year. Men and women ≥ 75 years of age, living in their own homes in the two municipalities.

Differences were found between men and women regarding falling, in that there were few fallers among women under 85 years of age, but the opposite was the case for men. Also, there were few fallers among single men, while almost 70% of the female fallers were single. Findings in earlier studies have shown a generally higher frequency of falling among elderly women, but regardless of age group [17]. Elderly people living alone, especially women, have also proved to be more vulnerable to suffering from recurrent falls. Living alone is more often associated with greater morbidity and more frequent contacts with healthcare, which is in line with the increased risk of falling among women in our study. Earlier studies have shown that for elderly people who live alone, regardless of gender, the risk of falling has more than doubled, or at least higher risk ratios [14,18-20].

It has been concluded in earlier research that there is limited knowledge about the impact of gender on perceptions of the risk of falling [17]. We cannot find obvious reasons, in earlier research, for the gendered differences found in our study. A possible explanation is a gendered difference in how elderly people set up their activities and how they live their lives when they live alone or cohabit. The physiological differences between men and women, and how this difference could impact falling, should certainly also be considered. In addition, our study population did not include men and women living in nursing homes, but only community dwellers.

This study shows that gait and general health status was rated lower among the men and women who reported falling during the past year. Physical dysfunctions and falling can certainly impact ratings of health in the individual, and limitations in the activities of daily living and fear of falling due to this might also add to a sense of poor health [21,22].

In addition to the estimations of general health and the association with falling, our study shows associations that can be considered as intrinsic factors, which are attributable to the individual and related to falls. This concerns factors such as pain in muscles and joints, muscle strength, cognition, balance and coordination of movements. It has been found in earlier studies that there is a strong relation between number of impairments in an individual and the level of fall risk [23,24]. Functional activities such as gait, climbing stairs, bending down and getting in and out of bed require good function regarding intrinsic factors. As people get older, their physical ability deteriorates, but the ageing process is individual and the causal background regarding impairment of physical functions is complex and cannot directly be connected to a few individual factors. This is a process that depends on physical and mental illness and disease, inactivity, and general ageing [25,26].

Regular physical activity and exercise can certainly affect and improve mobility and balance performance, and physical fitness is important in preventing falls [27,28]. This is in line with our results, although studies have shown that high levels of physical activity have been related to either high or low fall risk, respectively [29,30]. These contradictory results may be due to different definitions, and may differ for various types of activities, differences in settings and study populations.

Methodological Considerations

The study population was selected from the general Swedish population register, thus including all elderly people living at home in the two selected municipal districts. This means that this study could be considered a population study, and it is possible that the results could be generalized to the elderly population segments in urban areas with similar socio-economic structures, and living and cultural settings.

Recall bias leading to misclassification occurs when the accuracy of information collected from the study participants is not equal between cases and controls. Misclassification of exposure is non-differential if it is similar among cases and controls. The consequence of non-differential misclassification of a dichotomous exposure, such as falling or not during the past year, could lead to a dilution of the measure of association, and an underestimation of the associations [31]. However, we have no reason to believe that there was a differential misclassification in this study, as the focus on falling is important for all elderly people, regardless of whether they have fallen or not; furthermore, the exposure they were required to remember was not so remote, since we were only concerned with the past year. We did not differentiate between the numbers of falls or take into consideration that the respondent had fallen at least once during the past year.

The data were collected on one occasion, implying somewhat unclear causality. As the study is based on self-reported data, the reporting could be dependent on the outcome, which is falling during the past year and a possible negative health outcome due to a falling accident. This is a limitation of the study, due to its design, and some of the reported health outcomes and dysfunctions could have been a result of a former fall. In other cases the reported health dysfunctions and physical activities could have preceded the fall. However, this was what reported at the time of the investigation, and it reflects the circumstances at that time. The explorative and cross-sectional design, based on self-reports, are the prerequisites for this study; and to secure causality, a prospective design would have been necessary. These conditions mean that conclusions should be drawn with caution.

The results from this study can be used in public health initiatives aiming to predict fall risk and prevent falling. There is a need for effective community-based programmes that target the important basic intrinsic risk factors, which in turn can maintain or improve more complex physical functions. Individual factors such as an unsteady gait and walking problems showed the strongest associations with falls in this study; and, as it has been found in previous studies that gait quality can easily be measured [32], this can be considered and improved in elderly people living at home. A possible prevention measure is customized physical exercise, whether individually prescribed or conducted in group-based settings, and focused on functional training, balance and flexibility. Our results also indicate that there are differences between men and women that must be considered in prevention measures.

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