Incidence and seasonality of falls amongst old people receiving home help services in a municipality in northern Sweden

Irene Vikman, Anders Nordlund, Annika Näslund & Lars Nyberg

ORIGINAL ARTICLE

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Irene Vikman [1], Anders Nordlund [2,3], Annika Näslund [1], Lars Nyberg [1]

[1] Division of Health & Rehabilitation, Department of Health Science, Luleå University of Technology, Luleå, Sweden
[2] Department of Social Work, Stockholm University, Stockholm, Sweden
[3] Nestor Research and Development Center, Stockholm, Sweden

ABSTRACT

Objectives. Falls among old people is a well-documented phenomenon; however, falls among people living in the community and receiving home help services have been under-researched. The aim of this study was to investigate the incidence, including possible seasonal variation, circumstances and injuries related to falls among community living home help receivers, and to investigate whether fall incidence is associated with the type and amount of home help services received.

Study design. Prospective cohort study.

Methods. All 614 persons aged 65 and over who were living in a particular northern Swedish community and receiving municipality home help were included. Data on age, sex and home help service use were collected from home help service records, and falls were reported by staff on report forms specifically designed for the study.

Results. A total number of 264 falls were recorded among 122 participants. The overall fall incidence was 626 per 1,000 PY, and incidence rate ratios were significantly correlated to the total amount of services used (p<0.001), as well as to the degree of help for I-ADL needs (p<0.001), P-ADL needs (p<0.001) and escort service (p=0.007). The proportion of falls reported as resulting in injury was 33%. The monthly fall incidence was significantly associated to daylight photoperiod, however it was not associated to temperature.

Conclusions. Fall incidence among home help receivers aged 65 and over seems correlated to the amount of services they receive. This is probably explained by the fact that impairments connected to ADL limitations and home help needs also are connected to an increased risk of falls. This implies that fall prevention should be considered when planning home help care for old people with ADL limitations. Further research on the connection between daylight photoperiod and fall incidence in populations at different latitudes is needed.

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INTRODUCTION

Falls constitute a major age-related public health problem and represent a well-documented phenomenon among old people living in the community (1–4). They have also been studied among old people in various forms of residential care (3,5). However, falls among old people living in the community and receiving home help services have been under-researched. In studies of community-living old people, home help receivers have been included (2,3), but not specifically reported. To our knowledge there are only 2 studies that have focused on similar, though not identical, populations (6,7). Both these studies were retrospective with short timespans.

The fall incidence rate in community-living old people has in different studies been variably estimated at 517 per 1,000 person-years (PY) (3) and 683 per 1,000 PY (2). Amongst old people in residential care, corresponding figures have been estimated at 1,581 per 1,000 PY (3) and 2,236 per 1,000 PY (5). Intrinsic risk factors have been extensively studied and include advanced age; female sex; cognition, vision, sensory function and muscle strength impairments; gait, balance, mobility and ADL limitations; fear of falling and attention deficits; and medical diagnoses such as stroke, Parkinson's disease and a number of chronic diseases (4). Environmental factors such as slippery surfaces, obstacles causing stumbling, low light and so on seem more weakly associated to falls than these intrinsic factors. It is likely that the occurrence of falls will be determined by the interaction between the old person's functional abilities and the environment, rather than the environmental risk factors in and of themselves (4).

A factor of special interest regarding circumpolar populations may be the potential association between seasonal conditions and the occurrence of falls, which has been studied to a limited extent. Seasonal variance in hip fracture incidence, with higher incidence connected to winter conditions, has been reported in several studies (8–11). Regarding fall incidence, no consistent pattern of seasonal variation was found among old people in residential care in Sweden (5), nor regarding injurious falls among community-living old people in Finland (12). On the other hand, among community-living people aged 70 and older, Luukinen et al. (13) demonstrated a higher incidence of outdoor falls during periods of extreme cold, and Campbell et al. (14) showed an association between low temperatures and fall incidence among women.

Falls have a significant impact on health and life quality in old age, as well as on the health care system. They are the leading cause of injury-related hospitalization in persons aged 65 and over (15), and the direct societal costs of falls in Sweden (population 9 million) were estimated at 5 billion SEK in 2003 (16). Besides injurious consequences, falls can also result in a fear of falling, which, in turn, is associated with a restriction in activity and loss of independence (17–19). The ratio of falls resulting in injury is typically reported to be about half of the falls in community populations (2,20) and about one-third in residential care population (5). About 1 fall in 10 results in fractures or other more significant injuries (2,5,20).

In Sweden, 140,300 people aged 65 or older received home help services in their own homes during 2006 (21). This represents 9% of the population of this age group. Home help services are allocated according to individual needs and the amount of services required is strongly correlated to ADL dependency as well as cognitive impairments and advanced age (22). The overall number of old people receiving elderly care has been basically stable since the year 2001. Simultaneously, however, the number of old people living in resi-

dential care has decreased and the number of old people receiving home help has increased (21). This indicates that many old individuals receiving home help services constitute a transitional group between independent, community-living old people and people in residential care, and that there is a trend towards a greater resemblance between home help receivers and the latter group.

Thus, this study is a first attempt to look specifically at the occurrence of falls in an important population of old people which may form a transitional group between community-living old people and institutional care residents. The aim was to investigate incidence (including possible seasonal variation), circumstances and injuries related to falls among elderly community dwellers receiving home help services, and to investigate whether fall incidence is associated to the type and amount of home help services received.

MATERIAL AND METHODS

This 1-year prospective cohort study was conducted in a municipality in the north of Sweden, located at latitude 65.50° N. The number of inhabitants was 28,002 and 19% were aged 65 and older. In Sweden, almost 90% of home help services are provided by municipal authorities and 10% by other caregivers. In the municipality that was the focus of this study, 100% of home help services were provided by the municipal authority.

The criteria for inclusion involved being age 65 or older and having received regular municipality home help services for long or short intervals during 1 particular year. Participants matching the inclusion criteria were identified through monthly reviews of the home help service records, from which data were collected concerning each participant's age, sex and the type and amount of home help service they used.

Types of home help services were categorized as follows: instrumental ADL (support and help with instrumental activities of daily living, e.g., cooking and shopping); personal ADL (support and help with personal activities of daily living, e.g. dressing and using the toilet); security/social support (regular visits by home care staff in order to provide a feeling of security); relief service in the home (home care staff provide a caregiver with an opportunity to pursue activities of his or her own choice or simply to have a rest); escort service (home care staff accompanies the elderly person to an activity outside the elderly person's home).

All 614 individuals matching the inclusion criteria were included and registered in the study using a code number. Their mean age (±SD) was 81.8±6.8 years, and 410 (67%) were women. The distribution of home help services is presented in Table I. Median time in the study (exposure time) was 304 days (Q1, Q3: 132, 365) and 270 participants were followed for 1 full year. The number of participants included at start of the study was 410 and 204 more were added during the study period as they became regular home help receivers. The number of participants that were followed until the end of the study was 395, while 53 died, 65 moved to residential care facilities, and 101 ceased being home help service users before the end date of the study.

Falls occurring among the participants during their involvement in the study were documented following a methodology used previously in residential care (5): falls were defined as events in which the person, unintentionally and regardless of cause, came to rest on the floor or another lower level. The home help service staff were instructed to report every event that came to their attention and met with this definition on a specifically designed fall report form. It included person identification

Table I. Distribution of home help services, n=614.

Type of service	Individual median no. of hours per week	Q1,Q3	Percentage of total home help service amount (%)	Percentage having the services (%)
Total service amount	4.75	2.0, 12.3	100	100
Instrumental ADL	2.25	1.0, 5.0	41	89
Personal ADL	1.0	0.0, 4.8	39	54
Security/social support	0.0	0.0, 1.75	15	31
Relief service in the home	0.0	0.0, 0.0	3	4
Escort service	0.0	0.0, 0.0	2	18

data, date, time and location of the fall, as well as the ongoing activity. Consequences – such as injuries and anxiety – and measures taken after the fall were also registered on the report. As it is expected that most falls will not be witnessed by staff (23), they were instructed to gather as much information as possible from the individual concerned, or other persons, whenever a fall came to their attention. Reports were sent to the researchers on a monthly basis.

The study was approved by the authority of the involved municipality and the Regional Ethical Vetting Board in Umeå (Dnr 05-150M). A project management group of researchers, home help service officials and staff representatives prepared the practical routines and monitored the fall data and participant data collection throughout the study. Staff members were informed of the study's aims and instructed regarding the management of the fall reports during a series of meetings prior to the study's start. At staff meetings throughout the study period, they were reminded and encouraged to keep up with reporting routines.

Descriptive data are presented as means, medians, numbers, percentages and incidence rates. For the calculation of incidence rates, the number of incidents occurring among individuals in the total sample or in subgroups was divided by the individuals' aggregated exposure time during the corresponding time period.

In order to assess seasonal variation in fall incidence, monthly fall incidence rates were described and associated by linear regression with the mean daylight photoperiod (number of daylight hours for the 15th day of each month) or with mean temperatures, collected from the Swedish Meteorological and Hydrological Institute (SMHI).

For comparison of fall incidence rates between subgroups, incidence rate ratios (IRR) with a 95% confidence interval were calculated using a negative binomial regression (nbreg) (Stata software, version 10.0; StataCorp, College Station, Texas). This method was used because it takes into account the dependence of events by the same individual and it is recommended for use in the evaluation of fall prevention (24).

RESULTS

During 1 year, 264 falls occurred among 122 of the participants (20%). Among the fallers, 74 (61%) had 1 fall, and 48 (39%) had more than 1 fall, ranging up to 11. The fall incidence (and 95% confidence interval) rate was 626 (479–773) per 1,000 PY. The fall incidence rate ratio was not related to sex (IRR for women compared to men: 0.92; 95% CI: 0.57–1.51; p=0.752), but the incidence was positively associated with advancing age (IRR: 1.06; 95% CI: 1.02–1.05; p<0.001).

The monthly fall incidence seemed to roughly follow a sinusoidal curve (Fig. 1), however it was inverted to the daylight photoperiod and temperature variation during the year. As can be seen

from Table II, the variation in fall incidence had a significant correlation to the photoperiod (r=-0.78; r²=0.61; p=0.003) but not to the mean temperature (r=-0.51; r²=0.26; p=0.090).

Falls were rather equally distributed during day and night, with the exception of a lower frequency during midday between 10.00 and 14.00 (Table III). The number of falls during night hours (22.00–07.00) corresponded closely to an overall mean frequency.
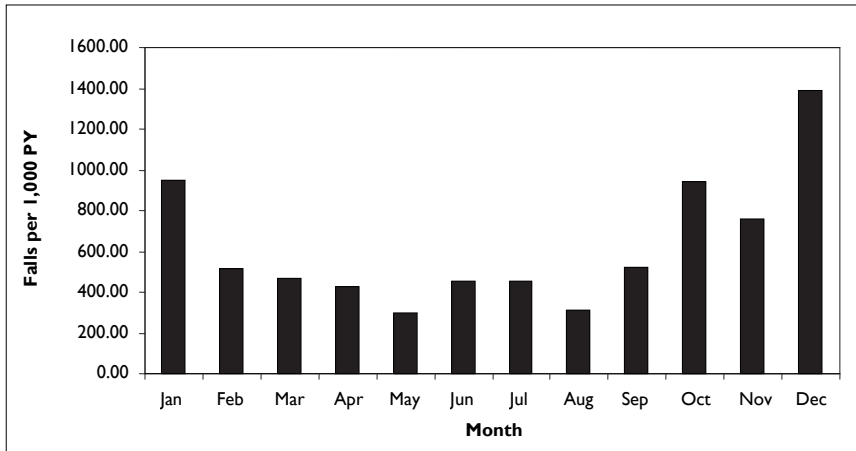

Figure 1. Monthly variation in fall incidence rate.

Table II. Monthly fall incidence rate and its correlation to photoperiod and mean temperature.

Month	Fall incidence rate per 1,000 PY	Mean photoperiod (hours)*	Mean temperature (centigrades)
January	951	04:46	-5.9
February	516	08:22	-9.8
March	468	11:39	-9.1
April	426	15:17	0.8
May	300	18:58	7.9
June	456	22:50	13.1
July	451	20:41	16.2
August	313	16:47	17.6
September	520	13:09	10.9
October	944	09:41	4.8
November	756	06:03	0.4
December	1,388	03:17	-7.8
Correlation to monthly fall incidence:			
r		-0.78	-0.51
r²		0.61	0.26
p		0.003	0.090

* Nunber of daylight hours calculated for the 15th day of each month.

Table III. Time for occurrence of falls, n=264.

Time intervals	Frequency	Percent	Standardized percent*
07.00–10.00	35	14%	23%
10.00–14.00	28	12%	14%
14.00–17.00	29	12%	19%
17.00–22.00	61	25%	24%
22.00–07.00	90	37%	20%

* Standardized percent adjusted for different lengths of the intervals. Data missing for 21 falls.

Of the 259 falls for which location was described, 247 (97%) occurred indoors. The most common locations for indoor falls were the bedroom (34%), the kitchen (24%) and the bathroom (21%). The most common activities connected to these falls were walking indoors and standing up/sitting down (Table IV).

Injuries were reported in 82 of 249 falls (33%, data missing for 15 cases), which corresponds to a fall injury incidence rate of 194 per 1,000 PY. Fractures were reported in 11 of the falls (4%), corresponding to a rate of 26 per 1,000 PY.

In 59 falls (22%), staff reported that the home care user experienced fear or anxiety as a consequence of the fall. Hospital care was the consequence of 29 falls (11%). Other reported consequences were consultations with a general practitioner (8 cases; 3%), consultation with a registered nurse (22 cases; 8%) and increased home care levels (9 cases; 3%). In 170 cases (64%), no specific consequence was reported.

As can be seen in Table V, a higher total amount of home help services, as well as higher specific amounts of instrumental ADL, personal ADL and escort services, was significantly associated with higher incidence of falls. Point IRR estimates indicated a 7% increase in the risk of falls per each increased weekly hour of home help services. For instrumental and personal ADL help, which accounted for 80% of the total amount of service provided, the corresponding figures were 19% and 9%, respectively.

We tried to adjust the incidence rate ratio calculations for age. This showed only marginal effects on IRRs and confidence intervals and no changes regarding significant associations were shown. Thus, results are presented without age adjustments.

Table IV. Activity connected to the falls, n=264.

Activity	Frequency	Percent
Walking indoors	95	36 %
Standing up / sitting down	47	18 %
Lying in bed / sitting in chair	23	9 %
Transfer between chair and bed	11	4 %
Standing still	8	3 %
Walking outdoors	7	3 %
Other	16	6 %
Unknown	47	17 %
Missing data	10	4 %

Table V. Relation of falls incidence rate to types and amounts of different home help services.

Home help service (hours/week)	IRR*	95% confidence interval	p-value
Total service amount	1.07	1.04–1.10	<0.001
Instrumental ADL help	1.19	1.11–1.28	<0.001
Personal ADL help	1.09	1.04–1.15	<0.001
Security/social support	1.08	0.96–1.22	0.213
Relief service in the home	0.75	0.49–1.14	0.178
Escort service	1.97	1.20–3.23	0.007

* Negative binominal regression. The total amount and the amounts of each specific type of service are each independent variables in separate bivariate analyses with falls as the dependent variable.

DISCUSSION

This study presented an overall fall incidence rate among old people receiving home help services which was comparable to that found among community-living old people (2,3). However, the incidence rate was strongly correlated to the amount of services received, and specifically to services related to self-care limitations. This study also presented a consistent pattern of seasonal variation in fall incidence, correlated to the daylight photoperiod.

To our knowledge this is the first study to present fall incidence rate among old people living in their own homes and receiving home help services. Fletcher et al. (6), in a retrospective study of a cohort of home care service receivers, reported that 27% fell over a 90-day period. Lewis et al. (7), in a retrospective case-control study, reported that 6% of individuals receiving home health services during a single year suffered falls. The services in these studies included health care provided in the home by professionals, rather than help with carrying out activates in daily life in the home.

The circumstances surrounding the falls reported in this study resemble those found among old people in residential care (5). This applies to the facts that almost all falls occurred indoors, that the most frequent locations for these falls were the bedroom, kitchen and bathroom, that walking and rising /sitting down were the most common activities connected to falls and that falls occurring during night-time were quite common (considering the fact that people could be expected to be at rest during these hours). Among community-living old people, on the other hand, almost half of the falls seemed to take place outdoors (16) and the percentage of night-time falls has been variably

estimated to count for 2% (25) and 4% (26) of cases.

The overall incidence rates of falls, injuries and fractures among old people receiving home help services did not seem to be much higher than those among community-living old people in general (2,3,20,27), but there was a strong and important correlation between the amount of service provided and the fall incidence. Our findings indicate that people receiving greater amounts of home care services resemble residential care populations more than community populations in regards to both fall incidence and fall circumstances. Further, we interpreted the connection between falls and the amount of services provided to be a consequence of the fact that a greater amount of home care services is associated with greater impairment (22) which in turn is associated with a greater fall risk. Therefore, fall prevention measures should be a serious concern when planning home help services, especially for people with greater needs because of ADL limitations.

The seasonal fall incidence variation presented in this paper might add interesting information to previous findings in the literature (8–14). The fact that almost all falls (97%) took place indoors excludes a direct comparison with the higher fall incidence at low temperatures that was reported by Luukinen et al. (13) and Campell et al. (14). On the other hand, an interesting connection to the daylight photoperiod emerged, explaining 58% of the variance in monthly fall incidence. The photoperiod has rarely been used as a factor to explain seasonal variation in falls and fracture incidence, but as suggested by Douglas et al. (10), doing so might help to explain the observed increase in hip fracture incidence during winter months, possibly through the photoperiod's effects on

circadian rhythms and D-vitamin synthesis. The fact that our study was conducted at very high latitude, with extreme seasonal variance in the daylight photoperiod, might have contributed to our ability to detect such an association. More research is needed, however, regarding both the seasonal variation of falls at different latitudes and the effects of the photoperiod on the risk of falls. In line with the discussion of Luukinen et al. (13) – which suggests that heating and insulation against the cold creates comfortable indoor temperatures regardless of very low outdoor temperatures and thereby possibly reduces the effects of low temperatures on fall incidence – it would be interesting to study how ordinary indoor illumination may or may not reduce the effects of the lack of daylight during the long, dark winter months at high altitudes.

We postulate that the municipality used in this study can be seen as approximately representative for home help services across Sweden, although there is some variance among municipalities regarding home help service provision. Compared to national figures (21), the total number of home help receivers is somewhat lower in the municipality studied here; however, the number of people receiving greater amounts of services (50 hours per month and more) is somewhat higher in this municipality. This may imply a slight risk of overestimation of the fall incidence rate.

Unfortunately, for practical and financial reasons, it was not possible for us to collect data on previous falls, health conditions, cognitive function, medication or gait and mobility activity limitations among the participants. This is an external validity limitation and it also means that we were not able to study the direct connections between participant char-

acteristics and fall incidence. Nor could we compare fall incidence rates between populations of community-living old people who were receiving and not receiving home help services.

In studies depending on fall reports, there is always a risk of under-reporting. Falls might occur without coming to the attention to of the staff, and staff may neglect to report known fall cases. Therefore, we and the district managers of the home help organization were careful to instruct and motivate staff members to fill in the report forms and to remind them about this at regular staff meetings throughout the study. However, there is still a risk of a relative under-reporting of falls among people seldom visited by the home help staff that cannot be ignored. The method of collecting fall report forms that have been filled in by staff implies a loss of detail and precision in injury recording, however, we expect that fractures and other serious injuries were not under-reported to any great degree in this study because of regular contact routines between the home help services, health care centres and hospital clinics. Injury and fracture frequencies in this study may be seen as indicators that under-reporting is not much higher than in similar studies, since in cases of low report rates, injurious falls should be relatively over-reported.

In conclusion, our study shows that the fall incidence rates among home help receivers aged 65 and older are comparable to those reported among community-living old people. However, the fall incidence rate among home help receivers seemed correlated to the amount and type of services they received, especially services related to ADL limitations. The Swedish Social Service Act (28) states that "the social welfare committee shall endeavour to ensure that older

persons are enabled to live independently and securely..." The findings of this study indicate that services provided to people with self-care limitations might not be quite sufficient from a safety and security perspective. This means that falls are an important issue for home help providers to consider.

We suggest that fall prevention measures should be considered when deciding on which services to provide, and that staff should be suitably trained for delivering services from a fall prevention perspective. This is becoming even more important since there is a growing tendency for home help services to be provided to people with greater and greater impairments and limitations (29). From a more general fall research perspective, the seasonal variation of fall incidence and its possible relation to the daylight photoperiod should be further investigated.

Conflict of interest
We have no conflict of interest to give account for.

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Irene Vikman, RPT
Division of Health & Rehabilitation, Department of Health Science,
Luleå University of Technology
SE 971 87 Luleå
SWEDEN
Email: irene.vikman@ltu.se