

Incidence and consequences of falls among elderly people living in the community



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BACKGROUND AND OBJECTIVES: To evaluate the incidence of falls according to socio-demographic and health factors, and to determine their physical, psychological and social consequences.

SUBJECTS AND METHOD: Population-based prospective study, which included a representative cohort of 448 elderly community-dwellers, aged 65 or more living in the city of Mataró (Spain). We made a baseline evaluation, which was repeated after a one-year follow up, consisting of a standardized questionnaire on socio-demographic characteristics, physical activity, tests of physical and cognitive function, history of falls during the previous year, the Falls Efficacy Scale, and associated chronic conditions. Follow-up interviews at intervals of one month over 12 months, consisting of a standardized questionnaire aimed at detecting and describing any fall occurred during the previous month.

RESULTS: 25.1% (95% CI, 18.8-31.4) of males and 37.0% (95% CI, 31.2-42.8) of females fell. Multiple falls were observed in 3.8% of men and 10.9% of women. 203 falls were reported, providing a crude incidence rate of 30.9 falls per 100 men-years (95% CI, 23.3-41.0) and 56.5 falls per 100 women-years (95% CI, 46.5-68.8). A positive association with falls was found with age, reduced physical and cognitive function, associated chronic conditions and previous falls. 71.1% of falls had physical consequences, with 7.7% of fractures, and 21.7% needed medical aid. 64.4% of fallers feared of falling again.

CONCLUSIONS: Our study shows a pattern of high incidence of falls among the elderly living in the Spanish non-institutionalized community. Our data confirm that adverse consequences derived from the falls are frequent and often severe, which makes falls one of the major problems of elderly people.

Key words: Falls. Elderly. Incidence. Consequences.

Incidencia y consecuencias de las caídas en las personas mayores que viven en la comunidad

FUNDAMENTO Y OBJETIVOS: Valorar la incidencia de caídas en relación con factores sociodemográficos y de salud, así como determinar sus consecuencias físicas, psicológicas y sociales.

SUJETOS Y MÉTODO: Se diseñó un estudio prospectivo de base poblacional.

Participó en él una cohorte representativa de 448 personas de 65 o más años residentes en la ciudad de Mataró (España).

Se realizó una valoración basal, que se repitió después de un año de seguimiento, consistente en un cuestionario estandarizado con datos sociodemográficos, actividad física, test de función física y mental, historia de caídas previas, Falls Efficacy Scale y procesos crónicos asociados. Se realizaron entrevistas de seguimiento mensuales durante 12 meses mediante un cuestionario estandarizado para describir las caídas acaecidas durante el mes previo.

RESULTADOS: Sufrieron una caída el 25,1% (intervalo de confianza [IC] del 95%, 18,8-31,4) de los varones y el 37,0% (IC del 95%, 31,2-42,8) de las mujeres. Se observaron caídas múltiples en el 3,8% de los varones y en el 10,9% de las mujeres. Se produjeron 203 caídas, lo que representa una tasa de incidencia bruta de 30,9 caídas por 100 varones-año (IC del 95%, 23,3-41,0) y 56,5 caídas por 100 mujeres-año (IC del 95%, 46,5-68,8). Se encontró una asociación positiva de las caídas con la edad, actividad física reducida, función física y cognitiva reducidas, procesos crónicos asociados y con la existencia de caídas previas. El 71,1% de las caídas tuvieron consecuencias físicas, con un 7,7% de fracturas y un 21,7% de casos que necesitaron asistencia sanitaria. El 64,4% de las personas que cayeron tuvieron miedo a una nueva caída.

CONCLUSIONES: Este estudio, realizado en España, demuestra un patrón de alta incidencia de caídas entre las personas mayores no institucionalizadas residentes en la comunidad. Los datos confirman que las consecuencias adversas derivadas de las caídas son frecuentes y a menudo graves, lo que las convierten en uno de los principales problemas para las personas mayores.

Palabras clave: Caída. Personas mayores. Incidencia. Consecuencias.

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Falls among the elderly occur frequently and are an important factor in the health limitations of this age group due to a high morbidity caused by physical and psychological consequences, loss of independence and even death. The percentage of elderly people who live in the community and fall is between 29.1% and 42.2%, according to existing prospective studies, and this figure increases with age¹⁻⁵. Some authors have analyzed the incidence rate so that the available data vary between 46.5 and 68.3 falls per 100 person-years¹⁻⁵. At present, in our country, there are retrospective studies displaying important information on the epidemiological problem of falls⁶. However, there is no Spanish study carried out in the community revealing the real incidence of falls because the retrospective analyses underestimate the real incidence of falls.

The consequences of falls are also serious in terms of health and economic costs due to the socio-medical attention they generate. Between 24% and 43% of people that fall need emergency medical attention^{2,4}. Important injuries occur in 24% of people who have fallen⁷, and between 2.5% and 6% have a fracture^{1,5-11}. In the development of the post-fall syndrome, there is a network of physical and psycho-social factors among which the fear of another fall and the loss of self-confidence in performing routine daily tasks stand out^{2,7,12}.

We performed a population-based prospective study of a representative sample of community-dwelling elderly people aged 65 years old or more. We wanted to evaluate the incidence of falls according to the socio-demographic and health characteristics, and to determine the physical, psychological and social consequences of falls on the population studied.

Subjects and method

We conducted a population-based prospective study with a representative cohort of community-dwelling elderly people who were followed up during one year in order to detect all incident cases of falls. The study population was defined by all the 1,341 non-institutionalized persons aged 65 years or more living in the three neighborhoods attended by the primary care center of Cirera-Molins in Mataró (Barcelona, Spain). This

is a mixed residential-industrial city of about 100,000 inhabitants located on the Mediterranean coast.

Study subjects consisted of a representative sample of 450 individuals randomly selected from the municipal census by strata of sex, age and neighborhood. This sample allowed the estimation of an annual cumulative incidence rate of falls of $34\% \pm 3.5\%$ with an error $\alpha = 5\%$. Excluded from the study were people who could not be evaluated because of mental or physical deterioration (2 subjects) or who could not walk (31 subjects), as well as those who were not at home (16 subjects for familial or leisure reasons and 31 subjects for health problems). There were 68 subjects who refused to participate in the study. Non-participants were substituted for others of the same age (± 5 years), sex and neighborhood, who were also randomly selected from the municipal census. For this reason, a total of 598 people were contacted in order to reach the required sample (75.3%). Among the contacted persons who met the criteria for study inclusion, the percentage of participation was 86.9% (450 out of 518). The study was carried out from October 1998 to March 2000.

In accordance with Kellogg International Work Group on the Prevention on Falls by the Elderly a fall was defined as «an event which results in a person's coming to rest inadvertently on the ground or other lower level»¹³. This excluded falls from loss of consciousness (syncope, stroke, epilepsy), sports-related falls, and falls against an object where the subject did not come to rest on the ground.

All participating subjects were seen at the primary health care center or visited at home to perform a baseline evaluation, which was repeated after a one-year follow up. These evaluations were performed by a specifically trained team composed of an administrati-

ve person, a nurse and a medical doctor. Evaluations consisted of a standardized questionnaire on socio-demographic characteristics, physical activity, tests of physical function, basic activities of daily living, ADL (Katz, considering 1 point for each independent activity measured)¹⁴, instrumental activities of daily living or IADL (Lawton, considering 1 point for each independent activity measured)¹⁵ scales, cognitive function evaluated by the Pfeiffer test¹⁶ (we considered a normal Pfeiffer test when there were 2 or less errors, or 3 or less errors in the case of primary education or if the subject belonged to marginal groups), history of falls during the previous year, and the Falls Efficacy Scale (FES) test (a scale measuring self-confidence in performing routine daily tasks¹²). Physical activity and/or exercise at work, at home or in the leisure time, was classified in 3 groups: sedentary if they were sitting most of the day; light if they did an activity with no important effort, including walking, 4 or more times a week; and moderate/vigorous if they did physical or sport activity one or more times a week. According to their physical and cognitive functioning, subjects were classified as vigorous (maximum ADL and IADL and normal Pfeiffer) or fragile. Associated chronic conditions were collected into 38 different pathologies, including joint and bone, genito-urinary, neurologic, cardio-vascular, respiratory, metabolic and sensory problems.

Follow up was conducted by telephone interviews at intervals of one month during 12 months. The interviews consisted of a standardized questionnaire aimed at detecting any fall occurred since the last contact with the interviewer. In affirmative cases, subjects were given a questionnaire on falls published by a working group of the WHO¹⁷, which registered their surrounding or extrinsic circumstances, the

physical consequences, the post-fall syndrome and contact with the health care service. In addition, all patients or their relatives were provided with a diary of falls in order to facilitate their recall and register all the circumstances. If the subject was absent for a month, information was collected from the telephone interview the following month. After the baseline evaluation, 2 subjects refused to continue in the study, and therefore the follow-up information was based on 448 persons. At the end, only 53 subjects did not complete the final evaluation one year after the baseline: 32 refused to continue the study, 13 died and 8 moved. Median follow-up time was 12 months (range 3-12) making up a total of 5,293 person-months.

The statistical analysis of the study data was aimed at calculating the percentage of elderly with any fall, and the annual incidence rate of falls¹⁸. The annual incidence rate of falls expresses the number of falls per 100 person-years of follow-up. It includes those subjects lost to follow-up and, since there were multiple falls within the same subjects, its Poisson distribution was overdispersed. Therefore, the incidence rates and incidence rate ratios (IRR) for the independent variables were obtained from negative binomial models. These models were fitted by maximum likelihood and provide their point estimate and 95% confidence intervals (95%CI) removing the effect of overdispersion¹⁸. Differences, between fallers and non-fallers, of the mean increment of the FES from baseline to the final evaluation were tested with the paired t-test.

Results

Of the 448 subjects studied, 40.8% were men with an average age (sd) of 73.3 (6.1) years; 59.2% were women with an average age of 75.6 (7.3) (table 1). Of the sample, 15.6% lived alone and the majority (53.1%) had a low education. Men presented maximum ADL (Katz) and IADL (Lawton) indexes in 90.2% and 89.6%, respectively, 72.7% had light physical activity and the Pfeiffer test was normal in 80.3%. Women presented maximum ADL (Katz) and IADL (Lawton) indexes in 83.2% and 60.4%, respectively, 64.5% had light physical activity and the Pfeiffer test was normal in 65.8%. Seventy percent of men and 43.8% of women were classified as vigorous, and 26% of the subjects reported having fallen during the year prior to the study (21.4% of men and 29.1% of women).

During the 12 months follow-up, 25.1% (95% CI, 18.8-31.4) of males and 37.0% (95% CI, 31.2-42.8) of females experienced at least one fall (table 2); 108 subjects (24.1%) felt once, and 36 (8.0%) felt 2 or more times. Multiple falls were observed in 10.9% of females and 3.8% of males.

The total number of reported falls was 203 (table 3). The crude incidence rate for falls was 46.0 falls per 100 person-years (95% CI, 39.1-54.2). These results were 30.9 (95% CI, 23.3-41.0) for males and 56.5 (95% CI, 46.5-68.8) for females. The age-adjusted incidence rates were higher in females than in males with an IRR = 1.7 (95% CI, 1.2-2.4). Independently of the gender, incidence rates increased for every year of age (IRR = 1.03; 95% CI, 1.01-1.05). Age-sex interaction was ruled out ($p = 0.99$).

TABLE 1

Baseline characteristics of participants

	Male	Female	Total
N (%)	183 (40.8)	265 (59.2)	448 (100)
Age: mean (sd) in years	73.3 (6.1)	75.6 (7.3)	74.6 (6.9)
Live alone	7.7%	21.1%	15.6%
Low education ^a	45.1%	58.7%	53.1%
Maximum ADL (Katz) index ^b	90.2%	83.2%	86.1%
Maximum IADL (Lawton) index ^c	89.6%	60.4%	72.4%
Physical Activity			
Sedentary	7.1%	24.9%	17.6%
Light	72.7%	64.5%	67.9%
Moderate/vigorous	20.2%	10.6%	14.5%
Intact Pfeiffer test	80.3%	65.8%	71.7%
Vigorous person	70.3%	43.8%	54.8%
Number of diseases: mean (sd)	3.5 (1.9)	4.6 (1.9)	4.2 (2.0)
Fallen during the last year	21.4%	29.1%	26.0%

sd: standard deviation.

^aNo education; difficulties reading or writing or no scholarship; ^bADL maximum index score: 6 (1 point for each independent activity); ^cIADL maximum index score: 4 in males, and 8 in females (1 point for each independent activity).

TABLE 2

Number and percentage of fallers during the 12 months follow-up by groups of age and sex

	AGE GROUP (years)			Total (n = 183)
	65-69 (n = 70)	70-74 (n = 53)	≥ 75 (n = 60)	
Males				
No falls (%)	77.1	73.6	73.3	74.9
Any fall (%)	22.9	26.4	26.7	25.1
1 fall (%)	20.0	24.5	20.0	21.3
> 1 fall (%)	2.9	1.9	6.7	3.8
Females	(n = 77)	(n = 63)	(n = 125)	(n = 265)
No falls (%)	70.1	63.5	58.4	63.0
Any fall (%)	29.9	36.5	41.6	37.0
1 fall (%)	22.1	28.6	27.2	26.0
> 1 fall (%)	7.8	7.9	14.4	10.9
Total	(n = 147)	(n = 116)	(n = 185)	(n = 448)
No falls (%)	73.5	68.1	63.2	67.9
Any fall (%)	26.5	31.9	36.8	32.1
1 fall (%)	21.1	26.7	24.9	24.1
> 1 fall (%)	5.4	5.2	11.9	8.0

TABLE 3

Crude cumulative incidence (per 100 persons per year) and incidence rate (per 100 person-years) of falls by groups of age and sex

	Age group (years)			Total
	65-69	70-74	≥ 75	
Males				
Subjects	70	53	60	183
Falls	18	17	21	56
Incidence rate (95% CI)	25.7	32.1	36.1	30.9 (23.3-41.0)
Females				
Subjects	77	63	125	265
Falls	35	34	78	147
Incidence rate (95% CI)	46.0	54.5	64.0	56.5 (46.5-68.8)
Total				
Subjects	147	116	185	448
Falls	53	51	99	203
Incidence rate (95% CI)	36.3	44.2	55.0	46.0 (39.1-54.2)

CI: confidence interval.

TABLE 4

Variations of the incidence rate of falls according to basic characteristics of non-institutionalized older people. Results expressed as age and sex adjusted incidence rate ratios (IRR) and their 95% confidence intervals (95% CI) of falling during a one year follow-up

	IRR	95% CI
Live		
With someone	1	
Alone	0.99	0.65-1.53
Educational level		
No education ^a	1	
Incomplete primary level	1.31	0.93-1.85
Primary level or more	0.90	0.52-1.56
ADL = 6	1	
ADL < 6	1.63	1.08-2.43
IADL = 4 in males or 8 in females	1	
IADL < 4 in males or 8 in females	1.96	1.35-2.85
Physical Activity		
Sedentary ^b	1	
Light	0.77	0.52-1.16
Moderate/vigorous	1.04	0.59-1.82
Pfeiffer test		
Intact	1	
Non-intact ^c	1.12	0.77-1.63
Subject classification		
Vigorous	1	
Fragile	1.55	1.08-2.22
Number of diseases	1.10	1.05-1.15
Fallen during the previous year		
No	1	
Yes	2.17	1.58-2.98

^aNo education: cannot read or write, or difficulties reading or writing or no scholarship; ^bPhysical activity and/or exercise at work, at home or in the leisure time: Sedentary: sitting most time of the day; light, activity with no important effort, including walking, 4 or more times a week; moderate/vigorous, physical or sport activity one or more times a week; ^cintact Pfeiffer test ≤ 3 errors, or < 4 errors if primary education or if belonging to marginal groups.

The crude rate of falls was higher in winter and fall (56.8 and 57.8/100 person-years; respectively) compared to summer (29.7/100 person-years; p = 0.003) and spring (39.3 person-years; p = 0.066). Significant differences were not found between the proportion of falls in people living alone (34.3%) or accompanied (31.7%), nor in relation to the level of education (30.8% among no education versus 28.3% among primary or higher levels). Regarding physical activity, a U relation appeared to be observed with the percentage of falls, which was higher for sedentary activity (39.2%) and moderate/vigorous activity (36.9%) and lower for light activity (29.3%).

Likewise, a tendency towards a negative association was found with regard to the indexes of physical activity (maximum ADL 30.8% vs. the rest 40.3%; p = 0.14; and maximum IADL 27.2% vs. the rest 45.1%; p < 0.001) and cognitive function (normal Pfeiffer 29.7% vs. abnormal Pfeiffer 38.1%; p = 0.09). The percentage of falls was 27.0% in vigorous subjects and 38.2% in fragile subjects (p = 0.01). Table 4 shows the IRR adjusted for age and sex, calculated using the binomial negative, for the above factors, with very similar results to the univariate analysis of the percentage of falls. The number of pathologies was also associated with the incidence of falls (IRR = 1.10; 95% CI, 1.05-1.15).

Finally, having fallen during the previous year was a clear risk factor for subsequent falls (IRR = 2.17; 95% CI, 1.58-2.98).

The most common pattern for the conditions of the falls was a familiar place (89.2%), which was well-illuminated (90.4%). Falls mainly occurred during the morning (57.9%), although they also happened in the afternoon (29.2%) and at night (12.8%). The climatic conditions were normal (45.4%), very sunny (47.9%) and raining or icy (6.7%). The floor surface was smooth (60.8%) and not slippery (59.8%), and in 82.0% of cases it was sloping. Subjects were wearing slippers in 52.6%, 28.4% wore shoes and 14.4% wore barefoot. Subjects tripped over an object in 78.7% of falls. Most subjects (61.1%) got up immediately, 53.9% could get up with help and only 1.3% could not get up. The falls had physical consequences in 71.1% of cases: 62.9% with a superficial wound or contusion, 7.7% with fractures, and there was one case of cranial traumatism. Of the 15 fractures found, 4 were in lower extremities, 2 of them being femoral fractures (1.4% of all fallen subjects).

As to the psychological consequences, 64.4 % of people who had fallen said they were afraid of falling again (fig. 1) and 9.5 % said that the fall had changed their life style (fig. 2). The decrease found in the FES score between the initial and the final evaluation was greater (p = 0.002) among people that had fallen (a decrease from 81.3 to 60.9 points) than among those that had not (decrease from 87.1 to 71.2 points). Older people had a greater statistically significant decrease in the FES, although the difference in the FES between those who fell and those who did not was not affected by age or sex (data not shown). All the FES items got worse by the end of the year, whether they fell or not, even though the deterioration was particularly greater among those who fell in «prepare simple meals», «go shopping» and «go up or down stairs».

From all of 203 falls, 44 (21.7%) needed medical attention, 19 of them (9.4 % of total falls) by primary care services, and 25 (12.3 % of total falls and 56.8 % of falls that needed medical attention) of them went to the hospital emergency department. Three people were admitted because of the fall in an acute care hospital. At the end of the study period, from those people who needed medical attention, 41 were at home (7 of them with home assistance), 2 were in an intermediate or long term care hospital and one person was in a nursing home (residential home).

Discussion

In this study a monthly follow-up was carried out on a population cohort of 448

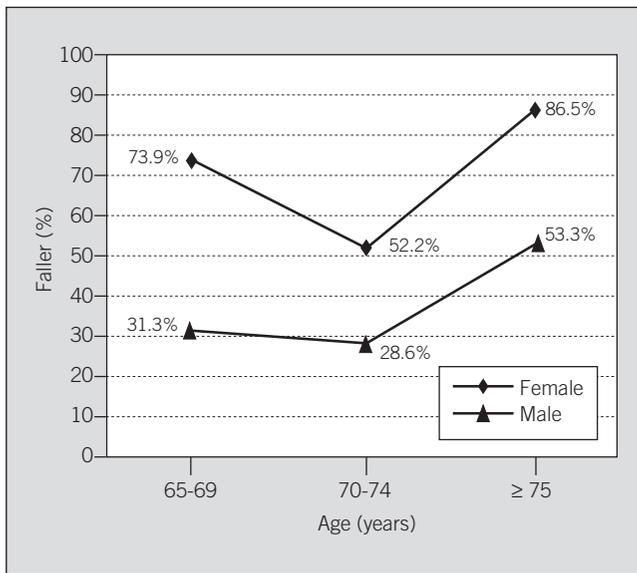


Fig. 1. Fear of falling by age and sex.

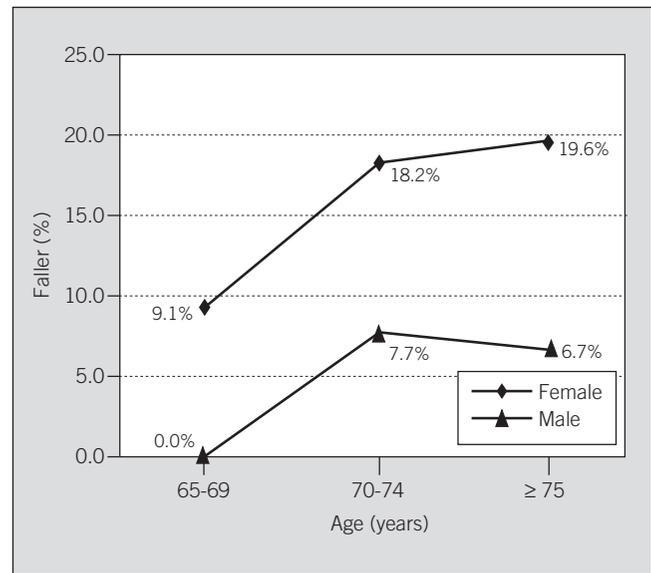


Fig. 2. Live-style changes due to falls by age and sex.

elderly community residents during one year, with a total of 5,293 months of study. The results obtained give a complete description of this health problem from a population-based prospective study in the Spanish urban environment.

The participating subjects may have, in general, a better socio-demographic and health status than expected, indicating the possibility of a selection bias in the estimations obtained. The exclusion criteria of the study (not being able to be evaluated or not being able to walk) may have favored the inclusion of a sample with better life and health conditions. This could imply that the real incidence of falls in the population is higher than that estimated in the present study, yet it must be taken into account that patients who cannot walk do not easily fall and so they are not normally at risk.

Our findings in relation to the incidence of falls agree with those already published. Our percentages of people who had fallen (32.1%) are within the range of published results which vary from 29.1% to 42.2%^{1,2,7,9}. Data obtained from another study in Spain show lower percentages of falls (14%). However, this study was retrospective and probably underestimated the real number of falls in the population⁶. Our findings in relation to the proportion of multiple falls raise some questions when comparing them with those of other authors^{1,9,19,20}. Our figures, either in males or females, are lower than those reported in the literature. Our percentage of 3.8% men with multiple falls is nearly half the 6.4% described by Luukinen et al²⁰ and much lower than the 14.7% described by Campbell et al⁹. Among women, our figure of 10.9% of multiple falls

is closer to the 11.3% described by O'Loughlin et al¹, but far from the 20.8% described by Lord et al¹⁹. Likewise, we find a sizeable proportion of subjects with only one fall (24.1%) in comparison with other published studies: Tinetti et al⁷ found 14.8%, O'Loughlin et al¹ 17.6%, and Luukinen et al²⁰ 19% in people above 70 years. Proportions of multiple and single falls have large variations between studies, and because methodological and sample characteristics differ, our differences could be explained by these factors. Other interpretations may explain these differences. First, our results can closely estimate the true proportion of multiple and single falls in the Spanish elderly population living in the urban environment. This would imply that our population has a specific pattern of falling, with less recurrence of falls. This could be attributable to life-style, socio-cultural, climatological and geographical characteristics. Secondly, it is possible that we underestimated the number of falls; however, the monthly telephone interviews and the use of a diary of falls during the follow-up should have minimized this phenomenon. Thirdly, some authors have studied populations aged over 70 years²⁰ or 75 years⁷, which are populations at greater risk than ours. Further population based studies of our non-institutionalized elderly will clarify this question.

Regarding the rate of incidence, our result of 56.5 falls per 100 person-years in women and 30.9 in men is also similar in range to the results previously published: between 46.5 and 68.3 per 100 person-years^{1,9}. The increase in the rate for women and with age has been widely reported.

The variables analyzed as determinants in the rate of incidence of falls indicate how the incidence of falls varies in the community. A more complete study of these determinants will form a major part of the work directed at identifying and quantifying the risk factors of falls. Physical activity stands out because of its possible non-linear behaviour in determining a higher percentage of falls in those people less and more active. The reasons are opposed, as Vellas et al² found: in the less active population it could be due to physical and functional deterioration, whereas in the active population it could be due to a greater exposure to situations with a risk of falling. Cognitive impairment and poor functional level as well as a greater number of pathologies appear to be important risk factors for falling as other authors have reported⁵. These variables also showed a relationship with multiple falls.

The differences we found between fragile and vigorous people agreed with those of Speechley and Tinetti²¹, although they were not so pronounced (38% vs. 27% and 52% vs. 17%, respectively). The higher frequency of falls among people who have fallen previously is consistent with other community studies^{1,7,11}. Previous falls indicate the existence of earlier risk factors but to these are added the consequences that, as in the case of reduction of mobility, can facilitate a new fall.

The pattern observed in the circumstances described at the moment of the fall agrees with those of other authors^{2,3,11,22}. One aspect that stands out is the footwear worn at the time of the fall, mostly slippers, which are frequently used by elderly people in our country. Another aspect to be emphasized, which has been com-

mented in other studies, is the existence of an object that causes the fall^{6,22-24}. Our results also coincide with the majority of authors in that there are common consequences from the falls that can be important and costly. Although in 62.9% of cases these consequences were light (superficial wounds or contusion), the finding of 7.7% of fractures stands out. In the literature, percentages published are between 2.5% and 6%^{2,7,11}. Our percentage of 1.4% of femoral fractures is also at the top of the range of 1% to 1.4% obtained by Tinetti et al⁷ and Vellas et al² respectively. From the point of view of psychological complications, the change in life-style as a consequence of the fall was observed in fewer people (9.5%) than reported by Tinetti et al⁷ and Vellas et al² (16% and 26%, respectively). This differed from the percentage of people afraid of falling again (64.4%) which agrees with the 43%-73% previously published^{2,11,12}. Our percentage of 21.7% of fallen subjects who needed medical attention was close to the 24%-43% published^{2,10,25}.

Finally, the pattern of distribution observed in the post-fall syndrome in our study, valued by the fear of falling again and the change in life-style after falling items, shows that the syndrome is more frequent among women of any age group; moreover, older the group, the higher the percentage for both sexes. The FES scale showed a bigger drop among those who had fallen. This increase in the post-fall syndrome produces a loss of autonomy in the elderly with all the consequences that this has.

It has been demonstrated that strategies involving multifactorial assessment and intervention effectively reduce the rate of falling²⁶. Therefore, in an older person with a history of falls it is important to ask about the circumstances as well as the potential risk factors of the falls.

In summary, our study shows a pattern of high incidence of falls in the elderly living in the Spanish non-institutionalized community, which in general is similar to other Western studies. Our incidence rate is placed in the lower range of published results and our rate of multiple falls seems rather low. Our data confirm that adverse consequences derived from the falls are frequent and often severe, which poses falls as a major problem of the elderly.

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