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Original Research

A multifactorial fall prevention programme in home-dwelling elderly people: A randomized-controlled trial

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Falls;
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Summary *Objectives:* To describe the implementation and the effects of a multifactorial fall prevention trial on the specified risk factors of falling, incidence of falls and injurious falls, and on specified secondary outcome measures; to describe the design of the study and to assess the success of randomization.
Study design: Randomized-controlled trial.
Methods: Recruitment started in March 2003 and lasted until the end of January 2005, when a total number of 591 participants was reached. Participants were randomized into two age groups (65–74 years and 75 years and over), then into an intensive multifactorial risk-based prevention programme or into a one-time counselling on fall prevention. The intervention included individual geriatric assessment, guidance and treatment, individual guidance on fall prevention, physical exercise in small groups, psychosocial group activities, lectures, home-exercises and home hazards assessment.
Results: A total of 293 people were randomized into the 1-year prevention programme and 298 into the control condition. The mean age was 73.5 years in both groups; 84% of the participants were women. The groups were well balanced at baseline in relation to risk factors of falls, and the only statistically significant difference was found in the amount of regularly taken medicines, which was significantly lower in the control group: mean 3.7 (SD 3.0) vs. 4.2 (SD 3.1), $P = 0.028$.

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Conclusions: Participants were successfully randomized into a multifactorial fall prevention trial.

Introduction

Falls, especially injurious falls, are a major public health concern among elderly people,[1] and the costs of treating injuries caused by falls are high. Effective prevention programmes are available. According to previous studies, the proportion of people who fall, and the risk of falls and injurious falls, can be significantly reduced among elderly people living in the community.[2]

Prevention programmes may be divided into population-based or those targeted to certain groups at high risk of falling, such as women, frail elderly people or people who have fallen previously. They may be planned to reduce a single internal or external risk factor of falling[3–5] or be broadly focused to reduce multiple risk factors simultaneously.[6–12] In narrowly focused interventions, physical exercise and reduction of psychotropic medications have been especially effective in reducing the total number of falls, injuries and hospital admissions due to falls.[2,13–17]

Prevention may be even more effective when multiple risk factors of falls are taken into account.[10,18] Most multifactorial fall prevention programmes have been successful in reducing the incidence of falls and risk factors of falling, especially when prevention has been individually tailored and targeted to populations at high risk of falling.[6,9,11,18,19] However, some interventions have been unable to reduce the risk of falls requiring medical treatment[20–22] or the benefits have only been short-term.[7] In addition, numbers needed to treat (NNT) to prevent a single falling accident vary between studies (NNT 4–20).[17] These results suggest that an individually tailored prevention programme targeted to reduce multiple risk factors simultaneously among a high-risk population may be an effective strategy to prevent falls, but the exact content of the most effective approach remains unclear.

The materials of some intervention studies have not been large enough to answer these kinds of questions. In addition, the duration of follow-up has been quite short- and the long-term effects of such interventions have not been determined.

We implemented a multifactorial fall prevention programme in the town of Pori, in Western Finland, among elderly people aged 65 years and older living at home who had fallen at least once during the previous 12 months. The prevention programme was individually tailored, targeting various risk factors of falling simultaneously, and the duration of the intervention was rather long (12 months).

The aim of the research project was to describe and analyse the effects of the multifactorial programme on specified risk factors of falling, and on incidence of falls and injurious falls (primary outcome measures). The effects on participants' health habits, physical, psychological and social functional abilities, quality of life, use of health and social services and all-cause mortality (secondary outcome measures) were also analysed.

In this paper, we describe the design of the study and assess the success of randomization.

Methods

General study features

The multifactorial fall prevention programme started in March 2003. It was implemented among people aged 65 years or older who had fallen at least once during the previous 12 months and were living in the town of Pori in the Western coast of Finland. The study was a single-centre, randomized-controlled trial designed to assess the effects of the multifactorial prevention programme compared with one-time counselling on specified risk factors of falling, incidence of falls and injurious falls, and on physical, psychological, social functional abilities, quality of life, use of health and social services and mortality in elderly people living at home and among persons living in sheltered housing. The study was approved by the Ethics Committee of Satakunta Hospital District, and written informed consent was received from each participant. A fall was defined as an unexpected event where a person falls to the ground from an upper level or the same level.[1]

Study population

The sample size was estimated on the basis of the results of previous fall prevention studies showing

that every third fall or injurious fall may be prevented. According to power calculation, a 30% difference (power 0.80, significance level 0.05) may be detected with a minimum of 183 people in both groups and 366 people in the whole study. With an estimated attrition rate of 20%, the whole study sample should thus be at least 458 people, representing about 10% of people aged 65 years or over who had fallen during the previous year in the town of Pori (total population of people aged 65 years or over was 13 547 in the beginning of the intervention).

Information about the study was widely spread by announcements in local newspapers, pharmacies, Pori Health Centre, Satakunta Central Hospital and private clinics, and by written invitations delivered by physicians, home aids and nurses (a total of 3300 invitations and announcements during the 2-year recruitment period). In addition, informative meetings were held in four sheltered housing facilities (total population = 402) to recruit people living in these facilities. Inclusion criteria for recruitment were 65 years of age or older, having fallen at least once during the past 12 months, moderate or high cognitive abilities (MMSE $\geqslant$ 17),[23] moderate or high physical abilities (able to walk 10 m independently with or without walking aids) and living at home or sheltered housing. People willing to participate were first interviewed by a nurse (by phone) and, if fulfilling the preliminary inclusion criteria, interviewed by the geriatrician who verified the suitability of the person. People living in sheltered housing were primarily interviewed by the geriatrician after each informative meeting. Of 612 people interviewed by the geriatrician, 591 (97%) were accepted into the study. Thirty-four people were living in sheltered housing.

Participants were randomly assigned to two age groups (65–74 years and $\geqslant$75 years) into an intensive preventive programme (intervention group) and into a counselling group (controls). Randomization was carried out after the baseline assessment using consecutively numbered sealed 'envelopes'. Recruitment continued until January 2005 when the number of 591 people were reached. The progression of the study is presented in Fig. 1.

Intervention (prevention programme)

The prevention programme was based on an individual risk factor analysis, and it was separately tailored for each participant according to risk factors, functional abilities and health status. The intervention consisted of seven parts, which are presented in Box 1.

Individual geriatric assessment, guidance and treatment

All the participants in the intervention group were thoroughly assessed by an experienced geriatrician. The individual geriatric assessment, guidance and treatment included measurements of specific risk factors of falling, such as polypharmacy, use of psychotropic and other medications affecting central nervous system, diseases and disorders affecting balance and gait, low bone mass, poor eye sight, difficulties in hearing, poor nutritional status and depression.

The individual geriatric assessment, guidance and treatment were followed by instructions to reduce or withdraw psychotropic medications (especially benzodiazepines and related drugs), medicines causing orthostatic hypotension, anticholinergic medications, medications with central nervous system effects and other potentially inappropriate medications for elderly people. All participants were prescribed calcium (500 mg) and vitamin D_3 (400 IU) supplements. Alendronate medication (Fosamax®, 70 mg/week) was prescribed according to the bone density test results measured by Bone Densitometry, DEXA®.

A referral to an ophthalmologist was given if visual acuity was $<$0.5 (Snellen Chart) with or without glasses, or the difference in vision between eyes was $>$0.3 or if the participants had complaints about poor vision. Nutritional guidance or a referral to a public health nurse was given if the participant had diabetes, a body mass index of $>$25 or $<$20, or other diseases or special diets that could lead to nutritional problems. Psychological support was given if the subject's sum score on the Geriatric Depression Scale[24] was over 10 or if the participant was determined to be depressed according to the interviews. These participants were also advised to join the smaller psychosocial group ('support group') in the intervention. A referral to an audiometrician in a local health care centre was given if the participant complained of hearing difficulties or poor hearing for speech at 1 m. In addition, a referral to the participant's own health care centre physician or a specialist was given if the participant had symptoms or diseases needing examination, treatment or rehabilitation.

Individual guidance on fall prevention

All participants in the intervention group were given oral and written information about fall prevention by a trained public health nurse. The oral information consisted of discussion about risk factors of falling, home hazards, safe environment, healthy diet, the importance of calcium and vitamin D supplement and use of hip protectors in

Figure 1 Overall study design

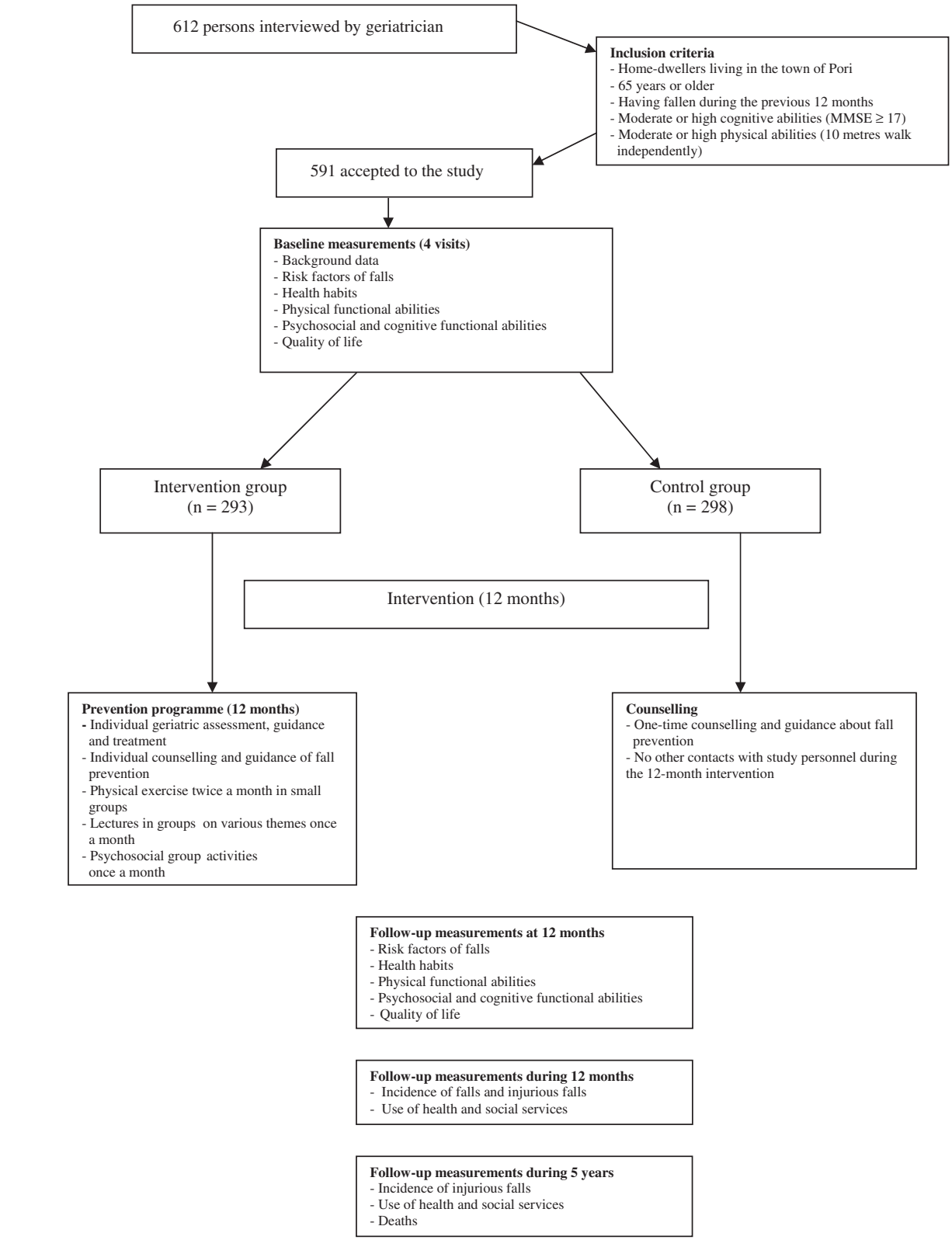

Fig. 1 Overall study design. MMSE, Mini-Mental State Examination.

certain cases. The activities of the individual prevention programme were explained to each participant, and appointments for bone density measurement and laboratory tests were made. The participants were given four brochures about calcium and vitamin D supplements, home hazards and prevention of falls in general.

Physical exercise in groups
For the exercise groups, the participants were divided into three levels according to their physical performance (balance, muscle strength and respiratory function). The 'high intensity group' consisted of those who did not have dyspnoea or any difficulties in breathing, and whose peak expiratory flow (PPF) was over 300 l/min, sum score of Berg' s Balance Scale[25] (BBS) was 50–56 and muscle strength was classified as 'very good'. The 'average intensity group' consisted of participants who suffered from dyspnoea or chest pain during hard exercise, work or walking, and whose PPF was 200–300 l/min, sum score of (BBS) was 40–49 and muscle strength was classified as 'average'. The 'low intensity group' included participants who had dyspnoea, chest pain, or both, after a minimal effort or at rest, and whose PEF was under 200 l/min, sum score of BBS under 40, and muscle strength was classified as 'poor' or the subject was using walking aids.

Each exercise session began with warm-up exercises (5–10 min), followed by exercises designed to improve lower leg muscle strength, balance and co-ordination (30 min) and ended with cool-down exercises (5–10 min). The intensity of the exercises was increased progressively in each group. The intensity of the exercises was measured after each session by the Borg Rating of Perceived Exertion Scale, which is based on the physical sensations a person experiences during physical activity.[26] Exercises could be carried out in a sitting or standing position according to the person's health and functional status.

Lectures
The participants in the intervention group were offered lectures once a month on preventive aspects of falling. Lectures included themes such as causes of falling, walking aids and fall prevention, nutrition in old age, home hazards, physical exercise and overall fall prevention. All lectures were given by health professionals.

Psychosocial groups
Psychosocial group activities were designed to offer recreational activities and psychological support. Participants were divided into two groups according to their psychological health, amount of depressive symptoms, feelings of loneliness and level of social activity. Those having few contacts with other people and feeling themselves lonely, and whose sum score was over 10 on the Geriatric Depressive Scale, were advised to join a smaller 'support' group. All others were advised to join a bigger psychosocial group. The sessions were organized about once a month and held by nursing students. Activities included discussions on different themes and actual events, group singing, quizzes, reading poems and a summer party organized in July.

Home exercises
The participants were advised to carry out physical exercises similar to those in other groups three times a week at home. The participants were given a brochure based on the exercise class content, and encouraged to record the amount of their physical activity in the physical exercise diaries daily.

Home hazards assessment
Home hazards assessment included a thorough assessment of the home environment with a detailed form. The form consisted of questions about lighting, stairs, thresholds, corridors, floors, carpets, furniture and availability of handrails. Written suggestions for modifications were given to each participant, and an additional home visit was carried out about 6 months after the first one to reinforce the modifications. Assessment was carried out by trained student nurses.

Definition of outcome measures
The primary and secondary outcomes measured at baseline and at 1-year follow-up are presented in Box 2. Data were collected by self-administered questionnaires, interviews, clinical tests, laboratory tests, diaries and from registers.

Primary outcome measures

Risk factors for falling
The maximal isometric muscle strength measurements of lower extremities (knee extension and flexion) and dominant hand (hand grip) were carried out with an adjustable dynamometer chair (Good Strength®, Metitur, Finland). The participants were verbally encouraged to perform to their maximum during the measurements. Three trials were conducted on each measurement, and the best performance with highest value was accepted as a result.

Static and dynamic balance were measured with a force platform (Good Balance®, Metitur,

Finland). Static balance tests consisted of two tests; two-legged stance in natural position with eyes open and closed and semi-tandem stance with eyes open. The semi-tandem test was carried out with one foot placed ahead of the other, with feet touching. Dynamic balance was tested by a special measurement where a participant could use a direct visual output of the position of participant's centre of forces. The aim of the test was to move the centre of pressure in a predefined way shown on the computer screen as narrowly as possible. After the tests, participants were shown the reference values of their results. BBS was also carried out. All muscle strength and balance measurements were carried out by a physiotherapist.

Other risk factors of falling included depressive symptoms measured by Geriatric Depressive Scale, visual acuity measured by Snellen Chart and nutritional status measured by Mini-Nutritional Test[27] and laboratory tests (creatinine, albumin, prealbumin and electrolytes). Information on quantity and quality of regularly and irregularly used medications, diseases and disorders affecting balance and gait was requested during the geriatric assessment. This information was verified from health centre databases (Effica®, TietoEnator, Finland). In addition, questionnaires included three questions about fear of falling and one question about feelings of loneliness.

Incidence of falls and injurious falls

During the intervention, fall data were collected by fall diaries, which were returned every month over 12 months. In the case of a fall, participants were advised to report it in detail as soon as possible by a phone call to the nurse or research assistant. Relatives of the participants, visiting nurses and nurses taking care of the participants in sheltered housing were also advised to deliver the information whenever the participant was unable to do so. During the interview a brief informal description of a fall event was requested. In addition, details of time, place, footwear, activities during the fall, possible injuries and medical treatment were collected by a structured questionnaire. Participants were also asked about the perceived causes of the fall event and whether it might have been prevented. Whenever fall diaries were not returned at the end of the month, participants were reminded by a phone call. Occurrences of injurious falls can be verified from medical records in the Pori Health Centre and Satakunta Central Hospital, and all injuries are classified according to the ICD-10-classification.

Secondary outcome measures

Health habits

Health habits were identified by a questionnaire. This included questions about smoking, drinking habits and level of physical activity. Participants were asked about their own perception of the likelihood of a falling accident at home.

Physical functional abilities

Physical functional abilities included tests of walking ability and PEF, and 16 questions about managing activities of daily living. Walking ability was measured by a 10-m walking test, which could be carried out with or without walking aids. Walking time in seconds and the amount of steps were recorded. The questionnaire included questions about walking ability, basic activities of daily living and instrumental activities of daily living.

Psychosocial and cognitive functional abilities

Cognitive function was measured by Mini-Mental State Examination. The questionnaire included questions about self-perceived health, various symptoms, feelings of insecurity and overall life satisfaction.

Social functional abilities

To measure social functional abilities, participants were asked about visits with friends and relatives, and participation in other social activities.

Quality of life was measured with a 15-dimensional health-related quality-of-life instrument (15D).[28]

All-cause mortality data were obtained from national death registers and use of health and social services from health centre, hospital and social service registers.

Statistical analyses

Values were expressed as means (standard deviation) or frequencies (%). Differences in continuous variables between the intervention and control groups were tested by the Student two-sample *t*-test or the Mann–Whitney *U* test, when appropriate. The SAS System for Windows®, version 9.1 (SAS Institute Inc., Cary; NC, USA) was used for all statistical analyses. Associations between group and categorical variables were analysed using ψ^2 test. *P*-values less than 0.05 were considered statistically significant.

Results

A total of 591 people participated; 293 were assigned to the intervention and 298 to the control group. Groups were well balanced at baseline, and no significant differences between the intervention and control group were seen on any of the baseline demographic or clinical characteristics, or in the occurrence of falls during the previous 12 months. The mean age of the participants was 73.5 years in both groups and 84% of participants were women. Most (57%) of the participants in the intervention group and almost a half (49%) of the participants in the control group were living alone. This difference tended to be significant ($P = 0.051$). Half of the participants in both groups had fallen at least twice during the previous 12 months, and 25% of older participants had experienced a fall requiring medical treatment. Most falls (55%) in both groups had occurred outside.

The amount of regularly taken medication was significantly lower in the control group: mean 3.7 (SD 3.0) vs. 4.2 (SD 3.1), $P = 0.028$. The control group had also a better functional ability in basic activities of daily living; mean ADL sum score 29.7 (SD 4.0) vs. 30.2 (SD 3.6), $P = 0.009$. However, these differences were small in absolute terms. No other statistically significant differences were found between the groups in risk factors of falling or in physical and cognitive functional abilities.

For later purposes, the analyses were performed separately for two age groups (65–74 and 75 years) according to the randomization. No statistically significant differences between the groups were found on any of the tested variables in either age group (Tables 1–5).

Table 1 Activities of the prevention programme

Activity
1. Individual geriatric assessment, guidance and treatment
2. Individual guidance of fall prevention
3. Physical exercise in small groups (3 levels)
4. Psychosocial activity groups (2 levels)
5. Lectures
6. Home-exercises
7. Home hazards assessment

Discussion

Elderly people aged 65–94 years living at home, who had fallen at least once during the previous 12 months, were successfully randomized into a multifactorial fall prevention programme. The intervention and control groups were well balanced at baseline in relation to risk factors of falling, and the only statistically significant difference between the groups was found in regularly used prescription medications, which was significantly lower in the control group. However, the difference was small in absolute terms.

Table 2 Primary and secondary outcome measures

Primary outcome measures

- Risk factors of falling; muscle strength (dynamometer chair, Good Strength®), static balance (force platform, Good Balance®) and dynamic balance (Berg's test), vision acuity (Snellen Chart), medication, depressive symptoms (GDS[1]), fear of falling, loneliness, nutritional status (BMI[2], MNA[3], laboratory tests)
- Incidence of falls (fall-diaries, telephone interviews and interviews)
- Incidence of injurious falls (medical records)

Secondary outcome measures

- Health habits; alcohol use, smoking, physical activity, safety behaviour (questionnaire)
- Physical functional abilities; walking abilities (10 m walk, questionnaire), peak expiratory flow (PEF), basic and instrumental activities of daily living (ADL[4], IADL[5])
- Psychosocial and cognitive functional abilities; self perceived health and symptoms, life satisfaction, feelings of insecurity (questionnaire), visits with friends and relatives, other social activities (questionnaire), cognitive function (MMSE[6])
- Quality of life (15D)
- Mortality (Official death register)
- Use of health and social services (health centre, hospital and social service registers)

1 = Geriatric Depression Scale, 2 = Body Mass Index, 3 = Mini Nutritional Test, 4 = Activities of Daily living, 5 = Instrumental activities of daily living, 6 = Mini Mental State Examination.

Table 3 Baseline demographic characteristics of participants and occurrence of falls during previous 12 months, by age group

Variable	65–74 years ($n = 368$)			⩾ 75 years ($n = 224$)		
	Intervention ($n = 179$) Mean (SD)	Control ($n = 188$) Mean (SD)	*P*-value	Intervention ($n = 114$) Mean (SD)	Control ($n = 110$) Mean (SD)	*P*-value
Age, (yrs)	69.6 (2.8)	69.5 (3.0)	0.898	79.5 (4.4)	80.3 (4.6)	0.195
Falls during previous 12 months						
All falls*	2.3 (1.7)	2.3 (2.1)	0.447	2.6 (3.7)	3.1 (5.6)	0.657
Falls needing medical treatment *	0.4 (0.67)	0.3 (0.6)	0.104	0.4 (0.8)	0.7 (1.2)	0.173
	n (%)	*n* (%)		*n* (%)	*n* (%)	
Women	153 (85)	157 (84)	0.606	98 (86)	89 (81)	0.308
Marital status						
Unmarried	9 (5)	12 (6)	0.289	10 (9)	6 (5)	0.363
Married or common- law marriage	91 (51)	108 (57)		29 (25)	36 (33)	
Widowed, divorced or judicial separation	79 (44)	68 (36)		75 (66)	68 (62)	
Living circumstances						
Living alone	86 (48)	80 (43)	0.291	82 (72)	67 (61)	0.081
Living with spouse or some other person	93 (52)	108 (57)		32 (28)	43 (39)	
Circumstances of last fall						
At home (inside or outside)	57 (32)	58 (31)	0.601	60 (53)	55 (50)	0.895
Inside	8 (5)	13 (7)		6 (5)	7 (6)	
Outside	114 (64)	117 (62)		48 (42)	48 (44)	

SD = standard deviation.
Two-sample *t*-test or Mann–Whitney *U*-test (*) was used for continuous variables to compare groups.
χ^2 test was used for categorical variables to compare group.

Table 4 Baseline clinical characteristics of participants, by age group

Variable	65–74 years ($n = 367$)			⩾ 75 years ($n = 224$)		
	Intervention ($n = 179$) Mean (SD)	Control ($n = 188$) Mean (SD)	*P*-value	Intervention ($n = 114$) Mean (SD)	Control ($n = 110$) Mean (SD)	*P*-value
Blood pressure (mmHg)						
Systolic	154.7 (22.7)	154.6 (21.0)	0.969	155.4 (23.9)	154.9 (27.8)	0.900
Diastolic	86.4 (10.1)	86.2 (9.9)	0.844	81.4 (10.2)	81.9 (11.5)	0.723
Pulse	68.5 (10.7)	69.3 (11.9)	0.542	71.8 (13.5)	70.7 (11.8)	0.514
Weight (kg)	77.4 (13.2)	77.9 (13.1)	0.690	69.8 (11.4)	71.6 (12.0)	0.269
Height (cm)	162.8 (7.7)	162.6 (7.3)	0.800	158.6 (7.6)	160.2 (8.2)	0.150

SD = standard deviation.
Two-sample *t*-test was used to compare groups.

Table 5 Risk factors of falling, physical and cognitive functional abilities of participants, by age group

Variable	65–74 years (n = 367)			⩾ 75 years (n = 224)		
	Intervention (n = 179) Mean(SD)	Control (n = 188) Mean(SD)	*P*-value	Intervention (n = 114) Mean(SD)	Control (n = 110) Mean(SD)	*P*-value
Risk factors of falling						
BBS[1] sum score	53.1 (3.5)	52.1 (5.0)	0.071	45.7 (9.8)	47.3 (7.3)	0.166
Prescription medication						
Regularly taken medicines	3.5 (2.9)	3.1 (2.5)	0.154	5.2 (3.2)	4.8 (3.5)	0.173
Irregularly taken medicines	1.7 (1.9)	1.3 (1.5)	0.126	1.6 (1.5)	1.8 (1.7)	0.450
GDS[2] sum score †	5.3 (5.5)	5.1 (5.3)	0.789	6.9 (6.0)	6.1 (5.9)	0.250
Fear of falling n (%)						
Yes	79 (44)	78 (42)	0.640	45 (39)	43 (39)	0.953
No	100 (56)	109 (58)		69 (61)	67 (61)	
Physical functional abilities						
10-m walking test (s)	6.6 (1.7)	6.8 (6.8)	0.629	10.9 (11.5)	9.1 (4.2)	0.166
Walking ability sum score	15.0 (2.0)	14.9 (2.0)	0.873	12.4 (3.9)	13.0 (3.5)	0.299
Functional ability sum score						
ADL[3] ‡	31.0 (2.1)	31.2 (2.1)	0.054	27.6 (5.3)	28.5 (4.9)	0.101*
IADL[4]‡	29.9 (3.0)	29.7 (3.9)	0.744	24.2 (8.0)	25.6 (7.2)	0.184*
Cognitive functional abilities						
MMSE[5] sum score§	27.7 (2.1)	27.5 (2.2)	0.476	26.8 (2.6)	26.7 (2.3)	0.464

SD = standard deviation.
Mann Whitney *U*–test was used to compare groups.
χ^2 test was used for categorical variables to compare groups.
BBS = Berg's Balance Scale[1], GDS = Geriatric Depression Scale[2], ADL = activities of daily living[3], IADL = instrumental activities of daily living[4], MMSE = Mini Mental State Examination[5].
*In scales Higher values indicated more independency in functional abilities.
†n = 360 in younger age group, n = 215 in older age group.
‡n = 223 in older age group.
§n = 217 in older age group.

This study has several strengths. First, it tries to apply the best current evidence of fall prevention. The preventive methods were multifactorial, individually tailored and based on an individual risk factor assessment carried out by the geriatrician, nurse and physiotherapist. The duration of the intervention was long (12 months), and the effects will be followed-up for 5 years. The outcome assessments were wide-ranging, and we believe that the methods are suitable for primary care with some modification. By the end of January 2005, a total of 591 people were recruited, and this is by far the largest risk-based multifactorial fall prevention trial carried out in Finland.

However, this study poses some challenges. The population consists mostly of elderly people living at home with few functional or cognitive disabilities. It is challenging to implement an intervention programme intensive enough to produce changes in outcome variables in this kind in an elderly population. However, we tried to intensify our programme by increasing the length of the intervention and providing frequent physical exercise group meetings.

The individual geriatric assessment, guidance and treatment were carried out only at the beginning of the intervention for financial reasons. The overall intensity of guidance by the geriatrician remained, therefore, low, even if the effect was enforced by information given at lectures and in psychosocial group meetings. This programme represented a new mode of action in relation to fall prevention in the town of Pori. The overall knowledge of fall prevention and adverse drug effects is inadequate among health centre physicians in Finland. This may have decreased their readiness for the new approach, and might have reduced the effect of prevention, especially changes in medication.

Generalizability of the results may also be hampered because of the selection of the population. This intervention was targeted at people who were at high risk of falling, and the results represent the effects of a prevention programme on a risk group, not in the whole population.

Some practical issues should also be considered. When implementing a trial in a small town, the contamination of the control group has to be taken into account. It is possible that some people in the control group have been affected by information aimed only at the intervention group (e.g. family members, friends or newspapers).

Previous multifactorial studies have concentrated mainly on physical and clinical outcomes, such as reduction of certain physical risk factors of falling and incidence of falls or injurious falls and fractures.[6–10,12] Only a few multifactorial trials aiming to affect psychosocial factors linked to falling are available in this age group.[29,30] Our study aimed to increase knowledge of the potential of a risk-based multifactorial prevention trial, and to also affect psychosocial risk factors of falling by targeting actions to those suffering from loneliness or depression. The adherence to different activities in the intervention programme was analysed by functional abilities of the participants to clarify whether the programme had reached people most prone to falls. A large sample size also enabled us to analyse subgroups with best benefits.

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