

The efficacy of a specific balance-strategy training programme for preventing falls among older people: a pilot randomised controlled trial

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Abstract

Background: older people participate in exercise programmes to reduce the risk of falls but no study has investigated a specific balance strategy training intervention presented in a workstation format for small groups.

Objective: to determine whether a specific balance strategy training programme delivered in a workstation format was superior to a community based exercise class programme for reducing falls.

Design: a randomised controlled trial model.

Setting: Neurological Disorders, Ageing and Balance Clinic, Department of Physiotherapy, The University of Queensland.

Subjects: 73 males and females over 60 years, living independently in the community and who had fallen in the previous year were recruited.

Methods: all subjects received a falls risk education booklet and completed an incident calendar for the duration of the study. Treatment sessions were once a week for 10 weeks. Subject assessment before and after intervention and at 3 months follow-up included number of falls, co-morbidities, medications, community services and activity level, functional motor ability, clinical and laboratory balance measures and fear of falling.

Results: all participants significantly reduced the number of falls ($P < 0.000$). The specific balance strategy intervention group showed significantly more improvement in functional measures than the control group ($P = 0.034$). Separate group analyses indicated significantly improved performance in functional motor ability and most clinical balance measures for the balance group ($P < 0.04$). The control group only improved in TUG and TUGcog.

Conclusions: the results provide evidence that all participants achieved a significant reduction in falls. Specific balance strategy training using workstations is superior to traditional exercise classes for improving function and balance.

Keywords: randomised controlled trial, falls, balance, functional ability, exercise, workstations, elderly

Introduction

Elderly people fall inside their homes and outside in the community [1]. Elders show a decline in ability to maintain balance when faced with the perturbations imposed by functional requirements such as dividing attention between tasks [2] as is needed to keep balance when walking in a crowd or on a busy road crossing. Declines in sensory (vision, vestibular and proprioception) and motor (strength, coordination,

endurance) function and integration (response time, multi-task ability) have been identified as the major intrinsic factors contributing to falls [3].

Previous research has shown that exercise such as strength, flexibility, balance training [4], Tai Chi [5] and combinations of these activities delivered in a class situation or individually [6, 7] have increased strength, improved balance and improved functional ability in addition to reducing risk of falls. A multi-focus rather than a sole physical intervention approach appears to be

superior in reducing falls. Thus, including fall prevention education, home evaluation and modification, medical review of physical status and medication in conjunction with an exercise programme has been shown to be most beneficial [8, 9].

No previous studies have investigated the efficacy of a specific balance strategy-training programme presented through a workstation or circuit programme as the exercise intervention. In this approach, each workstation is designed to focus on a specific task that addresses aspects required for balance including functional strength, flexibility, balance strategy practice, sensory integration, added attention demands during function and multi-task practice. Each station task is graded to cater to various levels of ability so that participants can have the level of difficulty progressed to increase the challenge. This versatility of degree of difficulty also allows for accommodation to various levels of ability of individual participants. In the class situation under the control of one instructor, safety concerns frequently mean that participants are not challenged to perform at their limit of stability, a requirement for improvement in skilled balance performance. In the workstation situation, the physiotherapist positions his or her self at the most challenging station to ensure safety. Another advantage of the workstation application is the encouragement of self-efficacy in the participants who take control of their programme by remembering what task to practise and how to increase the challenge at each station after consultation with the physiotherapist.

Previous intervention studies utilised various frequencies and time periods over which the interventions were given. Hauer *et al.* [4] showed 12 weeks of intervention three times per week to have a good effect on improving functional ability, as did Gillies *et al.* [10] who provided twice-weekly intervention. Response appears to relate to the number of interventions not necessarily the time span of delivery. However, Gardner *et al.* [11] recommend that exercise programmes for falls prevention should become a lifetime habit. Workstations facilitate this continuance with the tasks easily duplicated in the home environment.

The aim of this study was to determine whether a balance strategy training programme specifically designed for the participants and delivered in a workstation format by physiotherapists was superior to the typical balance exercise class that is delivered in the community to prevent falls and improve balance and function.

Approval for the study was granted by the medical research ethics committee of The University of Queensland and all participants gave written consent before entering the study.

The study received funding support from The University of Queensland Small Grant Scheme.

Methodology

Subjects were recruited through newspaper advertisements and fliers sent to medical practitioners, seniors groups and physiotherapists in the local community. Inclusion criteria required the participants live independently in the community, be over 60 years of age and to have fallen at some time within the previous year. Subjects were excluded if they had not fallen recently, had an unstable cardiac condition or lived

in regions too far from the clinic where the programme was delivered and could not guarantee regular attendance. Ninety-three people volunteered. Seventy-three people met the inclusion criteria, entered the study and underwent initial assessment. The subjects were assessed again on completion of the intervention and 3 months later at follow-up. Twenty volunteers failed to meet inclusion criteria or could not guarantee continued participation.

Measurements

The physiotherapists who undertook all assessments of the participants were blind to the intervention group allocation. Demographic data collected include age, number and severity of falls, co-morbidities, prescribed medications, community services utilised, living arrangements (alone, with a partner or family) and usual activity level [12]. The descriptive grading suggested by Hirvensalo *et al.* [12] was chosen to indicate activity level as it was easily understood by the participants. The grades of activity were: 1=moving only for necessary chores, 2=walking or other outdoor activities one or two times per week, 3=walking or other outdoor activities several times per week, 4=exercising one or two times per week to the point of perspiring and heavy breathing, 5=exercising several times per week to the point of perspiring and heavy breathing, 6=keep fit heavy exercise or sport several times per week.

Participants used a calendar on which each day was marked for a fall, slip, trip or incident free day. Each month the participant returned the calendar sheet for collation of results [8]. Fear of falling was evaluated by each participant self-completing Tinetti's 'falls efficacy scale' (FES) [13].

Functional ability was measured using the Clinical Outcomes Variable Scale (COVS) [14]. This measure was chosen because it had demonstrated reliability and validity in describing the functional ability of the participant when undertaking activities of daily living both in the home and in the community. The 13 items included on the assessment include rolling to right and left, moving from lying supine to sitting, sitting balance, horizontal transfer, vertical transfer from the floor, ambulation ability in the environment, ambulation aids used, ambulation endurance, ambulation velocity and upper limb function on the right and left. Each item is scored from 0 to 7 with the best performance achieving 91 points. One test (wheelchair propulsion) was given a constant score (7) as it was not tested, thereby keeping the maximum attainable score to 91.

Balance ability was tested using clinical and laboratory measures. The clinical measures included functional reach [15] and lateral reach [16] with the right and left hands, the functional step test [17] with the right and left foot, the timed 'up and go' [18], timed 'up and go' manual [19] and the timed 'up and go' cognitive [20]. The protocol described in the original reports of these clinical measurements was followed. The laboratory measures utilised the software programmes of the Neurocom Balance Master™ and included the modified Clinical Test for Sensory Integration of Balance (mCTSIB), unilateral stance with eyes open and the limits of stability test [21].

Intervention

All participants received an education booklet that provided information on reducing the risk of a fall in the home or community and a calendar and reply paid envelopes in which to return each monthly sheet where slips, trips and falls were recorded. The definition of what constituted a 'slip', 'trip' or 'fall' was included on the front of the calendar. A computer generated random numbers programme was used to assign participants to either the balance strategy or control group. Participants attended 10 sessions of 1-hour duration at weekly intervals before reassessment. Table 1 shows examples of workstation activities and Table 2 the control exercise programme. The balance and the control interventions were carried out by a physiotherapist assisted by one or two final year physiotherapy students for small groups of up to six participants so that safety was ensured.

Statistical analyses

Descriptive statistics were used to describe the participant groups and to present the pre and post intervention results. Repeated measures MANOVA was used to determine intervention effect within and between the groups for the data. Since the COVS and the FES supplied ordinal scores,

Wilcoxon signed rank tests were applied to these data for each group to show change due to balance or control exercise interventions. Analyses of clinical and laboratory balance measurement data was undertaken for each group separately using paired *t*-tests to show change resulting from the balance or control interventions.

Results

Random allocation of the 73 subjects (6 males, 67 females) admitted to the study into the balance strategy and control groups led to 37 and 36 subjects entering each group, respectively. Table 3 shows the demographic distribution for the groups. There was no difference between groups for any of these variables.

Forty-five subjects completed the intervention phase of the study (24 balance and 21 control). During the interventions there were no adverse occurrences to report even though participants were very frail. Reasons for non-completion were, death (3), major illness or injury (5), the remaining 20 subjects either gave no reason or mentioned transport difficulties as the major determining factor for withdrawal. Thus 61% of the subjects recruited completed the intervention phase. There was a further loss of 13 subjects during the

Table 1. Workstation examples. Items 1–6 form specific workstations and items 7 and 8 all participants work together and incorporate fun, social interaction and competition

Workstation focus	Response targeted	Progressing the challenge
1. Sit-to-stand-to-sit	Lower limb strength Functional ability Multiple tasks	Lower the height of the chair +/- upper limb assistance Hold an item in the hands, balance a cup +/- water on a saucer/tray Add a cognitive task to the manual task
2. Stepping in all directions (forwards, side and back)	Choice step reaction time Lower limb strength and co-ordination	Use a mirror to provide visual feed back, increase speed of step Perform stepping on a soft surface, close eyes
3. Reaching to limits of stability	Challenging limits of stability Vestibular stimulation and integration Upper & lower limb strengthening	1. Stick objects on a wall in the front by reaching to limits in all directions up and down while keeping feet in one position 2. Lunge forwards to pick up objects that are shifted to a high shelf to the side and behind, progress by reaching further and increasing the weight and size of objects
4. Step up and down	Lower limb strengthening and endurance Step reaction time	Step up forwards, backwards and sideways over blocks of various heights, increase height, repetitions and speed of stepping
5. Ankle, hip and upper limb balance strategy practice	Lower limb strengthening Balance strategy training	Stand in front of a wall with toe touching a line 1/2 metre from the wall. Lean back towards the wall keeping balance and dorsiflexing feet and using arm movement to balance while lowering towards the wall
6. Sideways reach task	Medio-lateral muscle strengthening in lower limbs Vestibular stimulation and integration Challenging limits of stability Multiple tasks and confounded proprioceptive input	Stand between a high and low table positioned on either side, pick up objects from one table and transfer to other table Move the tables further apart and increase weight and size of objects to increase challenge The participant undertakes the task standing on an exercise mat on the floor
7. Ball games	Multiple tasks Hand-eye coordination Vestibular stimulation	Use inflated beach balls and progress to smaller or harder balls or 2 or 3 balls at once Add a cognitive task such as nominating an animal that starts with a 'G', while throwing and catching or kicking the ball
8. Card treasure hunt/sort into suits	Ballistic upper and lower limb activity Coping strategies with visual conflict Vestibular stimulation and challenge of limits of stability	Prior to the session hide playing cards in the room such that to collect the cards the participants have to bend and look under furniture, reach up high or detect the card from a visually confounding background. Red and black teams are possible and the team with the most cards returned to a collecting point inside 5 minutes is the winner. Add the cognitive challenge of finding/sorting cards into order according to suit

Table 2. Control group exercise class content. Progression was attained by increasing the speed and combinations of the movements [8]

Timing	Activities
Initial 5 minutes	Warm-up, walking on the spot Gentle stretches for the upper and lower limb muscles in sitting or standing
12 minutes	Marching forwards, backwards and to the sides Standing still flexing and extending the elbows Lifting the arms alternately above the head then arm circles across the body Marching on the spot and adding in upper limb movements Then stepping forwards adding in arm movements
5 minutes	Rest and water stop
12 minutes	Hip extension and abduction were practised whilst holding on to the back of a chair Stepping sideways with arm swings to abduction or reaching above the head Sitting alternate leg straightening add reciprocal arm bends Alternate hip flexion and reaching above the head Marching forwards and back adding arm circles
5 minutes	Warm-down, gentle stretching and walking on the spot

Table 3. Subject demographics showing frequency of occurrence for group participants

Demographic	Balance group (<i>n</i> = 37)	Control group (<i>n</i> = 36)
Age mean ± standard deviation	75.9 ± 7.7	75.7 ± 7.9
Living situation – alone	29	22
With partner	5	12
With family	3	2
Falls in past year	Total 44 Range 1–9 Median 2	Total 41 Range 1–12 Median 1.5
Severity of fall – no injury	23	19
Minor bruise or cut	7	12
Injury needing doctor’s visit	12	4
Bone fracture	2	6
Number of co-morbidities, mean (range)	5 (2–10)	4 (1–11)
Number of prescribed medications, mean (range)	3 (0–9)	4 (0–9)
Number of community services utilised – 0	23	22
1	10	11
2	2	3
3	2	0
Number of stairs at home – 0	26	24
<5	1	0
5–10	1	0
>10	9	12
Activity level [12] – 1	3	5
2	12	4
3	15	21
4	1	1
5	6	4
6	0	1

follow-up phase. The most common reason for not attending for follow-up assessment was lack of transport and inability to see the usefulness of this assessment. There was no significant difference between subjects lost to those completing the study in baseline measurements.

Analyses were restricted because of the drop-out rate at follow-up to comparing the pre-and post intervention data. The results indicated a main effect for falls reduction ($P = 0.000$) due to the interventions, with no significant difference in fall reduction between the groups. Falls reduced from 44 and 41 in the previous year to 13 and 12 in the 3 months of the study for the control and balance groups, respectively. At the 3-month follow-up the participants remaining in the study showed no change in the number of falls with nine falls being recorded by participants in each group. The two participants who fell and fractured a wrist or hip (both from the control group) are not included as they failed to complete any reassessments. Separate paired *t*-tests applied to the balance strategy training group and the control group showed the balance group attained a better reduction in falls ($P = 0.000$) than the controls ($P = 0.024$).

Repeated measures analysis of functional motor ability as determined by the total COVS scores showed a significant two-way interaction ($P = 0.034$) between groups after intervention. Analyses using the Wilcoxon signed rank test were applied to the pre and post intervention ordinal data from each group. The results showed that there was no significant change on any COVS item for the control exercise group, but the balance group improved significantly in the tasks of rolling to the left ($P = 0.025$), ambulation velocity ($P = 0.023$) and total COVS score ($P = 0.003$). A trend towards improvement was demonstrated for sitting balance ($P = 0.083$), environmental ambulation ($P = 0.075$) and right upper limb function ($P = 0.083$). The FES scores showed no significant change for the control group and a trend for improvement in the balance group ($P = 0.09$).

Repeated measures analyses for all clinical balance measures and all laboratory balance measures showed no significant effect between intervention groups. A significant main effect for time was shown. A paired *t*-test was applied to all clinical balance measures from the balance and control group. The balance group showed a significant improvement for lateral reach ($P = 0.027$, $P = 0.037$) and functional step test ($P = 0.005$, $P = 0.021$) on both right and left sides, respectively, as well as the TUG ($P = 0.01$), TUGman ($P = 0.003$) and TUGcog ($P = 0.021$). The control group showed a significant improvement for the TUG ($P = 0.018$) and TUGcog ($P = 0.048$) only. Neither group showed a significant change for functional reach or laboratory measures. Table 4 shows the means and standard deviations for the COVS items and clinical and laboratory balance measures.

The MANOVA at the 3-month follow-up was completed for the 32 participants (19 balance and 13 control) who were assessed. There was no significant difference in performance between the groups from post-intervention to follow-up assessments for falls, FES, total COVS, clinical balance measures or laboratory balance measures with the exception of left unilateral stance where the balance group swayed less than the control group ($P = 0.007$).

Table 4. Clinical and laboratory balance measurement and COVS item results [mean ± standard deviation]

	Balance group		Control group	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Clinical balance measure				
Timed 'up & go' [seconds]	10.7 ± 0.6	9.4 ± 0.5	10.4 ± 0.7	9.4 ± 0.5
Timed 'up & go' manual	11.9 ± 0.8	10.2 ± 0.6	11.9 ± 0.9	10.6 ± 0.6
Timed 'up & go' cognitive	12.2 ± 0.9	10.2 ± 0.6	12.1 ± 0.9	10.4 ± 0.7
Step test (right) [number completed]	10.5 ± 0.8	12.3 ± 0.8	11.2 ± 0.9	12.1 ± 0.9
Step test (left)	10.9 ± 0.9	12.3 ± 0.8	11.8 ± 0.9	12.1 ± 0.9
Functional reach (right) [cm]	26.5 ± 1.4	28.2 ± 1.5	30.7 ± 1.5	28.9 ± 1.7
Functional reach (left)	27.5 ± 1.5	27.8 ± 1.3	29.4 ± 1.6	28.7 ± 1.5
Lateral reach (right) [cm]	14.9 ± 1.1	16.8 ± 1.1	15.8 ± 1.2	16.1 ± 1.3
Lateral reach (left)	14.1 ± 1.1	16.1 ± 1.2	15.8 ± 1.2	16.2 ± 1.3
Laboratory balance measure				
mCTSIB – firm eyes open [degree/second]	0.28 ± 0.02	0.30 ± 0.02	0.32 ± 0.04	0.33 ± 0.02
Firm eyes closed	0.39 ± 0.04	0.37 ± 0.04	0.44 ± 0.04	0.45 ± 0.04
Foam eyes open	1.20 ± 0.3	1.07 ± 0.26	1.73 ± 0.32	1.71 ± 0.27
Foam eyes closed	3.98 ± 0.3	3.94 ± 0.35	4.79 ± 0.36	4.65 ± 0.37
Unilateral stance (right) [degree/second]	3.85 ± 0.46	3.68 ± 0.43	4.31 ± 0.48	3.64 ± 0.45
Unilateral stance (left)	3.57 ± 0.44	3.93 ± 0.38	4.39 ± 0.46	4.12 ± 0.40
COVS				
Rolling side to side	6.6 ± 0.1	6.7 ± 0.9	6.5 ± 0.1	6.6 ± 0.1
Supine lying to sitting	6.5 ± 0.1	6.8 ± 0.1	6.7 ± 0.1	6.8 ± 0.1
Sitting balance	6.8 ± 0.1	6.9 ± 0.1	6.7 ± 0.1	6.9 ± 0.1
Horizontal transfer	6.8 ± 0.1	6.9 ± 0.1	6.8 ± 0.1	6.8 ± 0.1
Vertical transfer (from floor)	5.5 ± 0.4	5.8 ± 0.4	5.4 ± 0.5	5.2 ± 0.4
Environmental ambulation	6.3 ± 0.2	6.6 ± 0.2	6.6 ± 0.2	6.4 ± 0.2
Ambulatory aid use	6.8 ± 0.1	6.8 ± 0.1	6.7 ± 0.1	6.8 ± 0.1
Ambulation endurance	6.7 ± 0.2	6.9 ± 0.1	6.6 ± 0.2	6.7 ± 0.1
Ambulation velocity (10 m)	6.3 ± 0.2	6.7 ± 0.2	6.6 ± 0.2	6.4 ± 0.2
Arm function	6.9 ± 0.1	7.0 ± 0.1	6.8 ± 0.1	6.8 ± 0.1

Discussion

Both the balance group and the control exercise group benefited from the interventions with a significant reduction in falls. Individual group analyses indicated that those participants receiving the specific balance strategy training did better than the control exercise intervention group. Functional ability as measured by the COVS showed that the balance strategy training group had a significant response to intervention compared to controls who had no demonstrable change in functional ability on any of the COVS items. This improvement in functional ability was mirrored in the more significant change in the clinical balance measures of lateral reach, step test, TUG, TUGman and TUGcog when the data from the balance group was compared for the effect of the intervention separate to the control group. The control group showed they had improved significantly only in the TUG and TUGcog measurements. Neither group showed change in the laboratory balance measurements. The trend towards less fear of falling shown by the balance group appears to support these findings.

One factor that might have contributed to the improvement in the functional ability in the balance group was the composition of the workstation tasks they practised. These tasks contained elements that encouraged participants to bend, turn and reach to limits of stability on various surfaces thereby providing added vestibular stimulation. Such interventions encouraged increased speed and size of movements

which may have increased strength and endurance in addition to improving flexibility and reaction time for the balance group. This could have resulted in more efficient movement reflected in the improved functional ability to balance, ambulate in the environment and at a faster velocity. Support for this view comes from the improved outcomes from a similar multi-dimensional balance-training programme delivered as an individual intervention [6] rather than small groups.

On the other hand, the control exercise class intervention should also have led to an increased strength and walking speed as stepping forward and backward and to the side were incorporated. However, movement to the limits of stability was not an integral component nor were walking on different surfaces, turning and other rotational elements. Thus the differences in programme content might have contributed to the different results.

The ratio of two or three participants to one trainer in each intervention group ensured safe completion of tasks and practise of the activities at the limit of ability for participants while continual monitoring of physiological response and change in level of ability was maintained. Thus the interventions were similar to individualised balance intervention programmes that have been shown to be superior to group interventions in previous studies [8].

All participants received the booklet providing 'tips' to reduce the risk of a fall. This education component could have contributed considerably to the reduction of falls outcome as many reasons falls occur in the environment were discussed and preventive measures suggested. In a recent

study, [22] a home health visitor provided some similar information to that in our education booklet. Their education material included clarification of pain control and other medication use, mobility advice, advice on how to get up after a fall, identification of falls risk factors and diet. No significant difference in health outcome was determined when fallers were compared with those not receiving this intervention [22]. In hindsight, a third intervention group incorporated into our study that only received the education booklet might have identified the contribution this aspect played in falls reduction. Thus a future study evaluating the effect on fall reduction of the education booklet we utilised is indicated as the contribution to the significant fall reduction in the control group might not be fully explained by their improvement in TUG and TUGcog.

Transport was considered a problem that affected recruitment and retention of participants. Only a very few participants lived within 5 km of the clinic. This meant taxi fares were quite high since most participants were unable to use public transport and required taxis or private transport to attend. Many had to travel over 20 km to attend the treatment sessions and this might have added an extra fatigue factor that contributed to withdrawal. The resultant low numbers completing the intervention component accounts for reduced statistical power and the likely reason for lack of conclusive evidence of improved balance measures for participants in the balance programme when compared to the control participants. The number of interventions or the frequency of intervention also might have contributed.

Future interventions that are offered more frequently and utilise additional assessment measurements such as muscle strength, proprioception and vestibular function may provide evidence regarding mode of action for components of the training programmes that contributed to the significant decline in falls and the improvement in function and clinical balance measurements for the balance group. The interventions also would need to be offered nearer to the homes of the participants to encourage attendance.

Key points

- Workstations offer different exercise foci that are multi-dimensional and adaptable for the participant's functional motor ability level and level of task challenge.
 - A reduction in falls and improvement in functional motor ability and on most clinical measurements was achieved using the workstation delivery of specific balance-strategy training interventions.
 - Intervention programmes for frail older people need to be delivered very close to their residence to facilitate retention.
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Consequences of falling in older men and women and risk factors for health service use and functional decline

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Abstract

Objectives: (1) to examine consequences of falls in older men and women and (2) to examine risk factors for health service use and functional decline among older fallers.

Methods: the study was performed within the Longitudinal Aging Study Amsterdam. In 1998/1999, potential risk factors were assessed during the third data collection. In 1999/2000, 204 community-dwelling persons (≥65 years) who reported at least one fall in the year before the interview, were asked about consequences of their last fall, including physical injury, health service use, treatment and functional decline (i.e. decline in functional status, social and physical activities).

Results: as a consequence of falling, respondents reported physical injury (68.1%), major injury (5.9%), health service use (23.5%), treatment (17.2%), and decline in functional status (35.3%), and social (16.7%) and physical activities (15.2%). Using multivariate logistic regression, specific risk factors for health service use after falling could not be identified. Female gender (OR = 2.8, 95% CI = 1.5–5.1), higher medication use (OR = 1.5, 95% CI = 1.0–2.2) and depressive symptoms (OR = 1.9, 95% CI = 1.3–2.8) were independently associated with functional decline after falling. Depressive symptoms (OR = 2.0, 95% CI = 1.2–3.3) and falls inside (OR = 2.6, 95% CI = 1.1–6.5) were risk factors for decline in social activities, while female gender (OR = 2.7, 95% CI = 1.1–7.0) and depressive symptoms (OR = 1.9, 95% CI = 1.2–3.0) were risk factors for decline in physical activities after falling.

Conclusions: almost 70% of the respondents suffered physical injury, almost one-quarter used health services and more than one-third suffered functional decline after falling. No risk factors were found for health service use needed after falling. Female gender, higher medication use, depressive symptoms and falls inside were risk factors for functional decline after falling.

Keywords: *accidental falls, aged, consequences, disabled people, health services, elderly*

Introduction

Falls often occur in older people. Approximately 30% of community-dwelling people aged 65 years and older fall at least once per year, and about 15% fall twice or more per year

[1–4]. Several studies have determined the physical consequences of falls, such as hip fractures (1%), fractures at other sites (3%) or brain injury (2%) [1–3, 5–7]. The overall consequences of falling are still not completely clear and are difficult to determine since physical injuries do not include the