

## Research Article

### Osteoporosis School in Primary Health Care-A Pilot Study

Ann-Charlotte Grahn Kronhed<sup>1,2\*</sup>

<sup>1</sup>Rehab Väst Vadstena, Local Health Care Services in the West of Östergötland, Sweden

<sup>2</sup>Division of Physiotherapy, Department of Medical and Health Sciences, Linköping University, Linköping, Sweden

#### Abstract

An Osteoporosis school was introduced as a pilot study in a Swedish primary health care center. Women aged 50 years and over with healed fragility fractures were asked to participate. The aim was to increase awareness amongst the participants and to advise them about life-style and fall prevention strategies to prevent a secondary fragility fracture. The Osteoporosis school was scheduled to once a week for eight weeks and included theory and exercise training sessions. Eleven women with mean age 74 years participated. Clinical tests such as back straightening test and balance tests were performed, pain was estimated by the visual analogue scale, and health-related quality of life was measured by the SF-36 questionnaire. Straightening of the back improved 0.6 cm ( $p < 0.05$ ), worst estimated pain decreased from 5.8 to 4.0 ( $p < 0.05$ ), and the SF-36 bodily pain domain improved ( $p < 0.05$ ). The participants completed an average of 7 out of 8 sessions. The exercise training sessions were the most appreciated part of the program.

**Keywords:** Education; Fragility fracture; Older adults; Osteoporosis; Women

#### Background

Osteoporosis is a major growing public health problem and affects more than 200 million people worldwide [1]. Osteoporosis is defined as “a disease characterised by low bone mass and microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk” [2,3]. Sweden has one of the highest incidences of osteoporotic fractures in the world with about 107,000 osteoporosis-related fractures each year [4,5]. The lifetime risk for a hip, spine or forearm fracture at the age of 50 is estimated at 46% for women, and 22% for men, in Sweden [6]. Hip fracture is the most serious fragility fracture and means deteriorated health related quality of life and great suffering to the individual

\*Corresponding author: Ann-Charlotte Grahn Kronhed, RehabVäst Vadstena, Local Health Care Services in the West of Östergötland; Division of Physiotherapy, Department of Medical and Health Sciences, Linköping University, Linköping, Sweden, Tel: +46 101048158; E-mail: lotta.grahn-kronhed@telia.com

**Citation:** Grahn Kronhed AC (2017) Osteoporosis School in Primary Health Care-A Pilot Study. J Orthop Res Physiother 3: 033

**Received:** March 31, 2017; **Accepted:** October 02, 2017; **Published:** October 16, 2017

and high costs to the society. The costs of a hip fracture have been estimated at approximately US \$21000 for the first year [7]. Accelerated bone loss due to estrogen deficiency occurs immediately after the menopause and lasts for about 10 years. About half of the loss in trabecular bone results from the menopause and about a half from the aging process [8]. Low Bone Mineral Density (BMD) is a strong risk factor for fracture. The T-score, defined by the WHO, is used for the diagnosis of low BMD measured by Dual energy X-ray Absorptiometry (DXA) equipment at the spine, hip or mid radius sites and uses a reference group of “young adult women.” A T-score value of not more than 1 Standard Deviation (SD) below the mean value of peak bone mass in young adult women is defined as normal. A T-score greater than 1 SD below the young adult mean, but less than 2.5 SDs below this value, is defined as osteopenia, and a T-score of 2.5 SDs or more below the young adult mean is defined as osteoporosis. Established (severe) osteoporosis means a T-score of 2.5 SDs or more below the young adult mean and the presence of at least one fragility fracture [3]. Some people with a fragility fracture might not be adequately treated by bone-specific drugs and might not either get any information on appropriate physical activity or fall preventive advice in the prevention of a secondary fracture. Primary health care has the main responsibility for the prevention of osteoporosis and fragility fractures, as stated by the WHO [8]. The FRAX® tool ([www.shef.ac.uk/FRAX](http://www.shef.ac.uk/FRAX)) integrates the weight of clinical risk factors for a ten-year probability of hip fracture and major osteoporotic fracture, in persons aged 40-90 years using patient-derived clinical risk factors, with or without the inclusion of femoral neck BMD (Figure 1). A fragility fracture is usually caused by a mild to moderate trauma such as a fall from standing height or less and an osteoporotic vertebral fracture may occur after lifting an object or bending forward [9]. Considerable height loss may indicate osteoporotic vertebral fractures [10]. An increase in vertebral fracture prevalence in relation to historical height loss was previously found and the cutoff was suggested to be 6 cm (2.4 inches) in postmenopausal women [11].

A recent review indicated that it is unclear whether patient education is beneficial and whether it has a significant and clinically relevant impact on osteoporosis management results, and therefore requires further investigation [12].

A pilot study with an Osteoporosis school was introduced at Vadstena Primary Health Care Centre (PHCC), Sweden, focusing middle-aged and elderly women with a healed fragility fracture. The aim of the Osteoporosis school was to deliver disease-specific information to persons at risk of having a secondary fracture and to advise them about the importance of a healthy life-style and adequate physical activity, and also about ergonomic principles and fall prevention measures to prevent a secondary fracture.

#### Materials and Methods

##### Participants

Women aged 50 years and over with a healed low-energy fracture such as vertebral, hip, upper arm (humerus) or distal forearm fracture attending primary health care in the west of Östergötland, Sweden were offered to participate in an Osteoporosis school. Information on

the start of the Osteoporosis school for the recruitment of patients was given to physicians working at primary health care centres (n=9) and at Proxima orthopaedic clinic, and also to rehabilitation personnel in the West of Östergötland. A total of eighteen women were asked about participating in group activities and received information about the Osteoporosis school.

**Questionnaire:**

1. Age (between 40 and 90 years) or Date of Birth  
 Age:  Date of Birth: Y:  M:  D:

2. Sex Male  Female

3. Weight (kg)

4. Height (cm)

5. Previous fracture No  Yes

6. Parent fractured hip No  Yes

7. Current smoking No  Yes

8. Glucocorticoids No  Yes

9. Rheumatoid arthritis No  Yes

10. Secondary osteoporosis No  Yes

11. Alcohol 3 or more units/day No  Yes

12. BMD femoral neck (g/cm<sup>3</sup>)

Select BMD

**Figure 1:** FRAX-Fracture Risk Assessment Tool (<http://www.shef.ac.uk/FRAX/>). (For the clinical risk factors, a no or yes response is asked for. If the field is blank, then a "no" response is assumed. In patients without a BMD test, the field for BMD femoral neck should be left blank).

## Methods

A questionnaire was completed at baseline concerning the presence of diseases and medications, body height and fracture occasion at adulthood, and fall events for the last year. The FRAX® tool was used for the calculation of a ten-year probability of a hip fracture and major osteoporotic fracture. Body height (cm) was measured by a stadiometer and body weight (kg) by a digital scale. Body Mass Index (BMI) was calculated as body weight in kg/ (height in metres squared). The distance (cm) between the seventh cervical vertebra (C7) and the wall was measured by a folding ruler to estimate the back-straightening ability and grade of thoracic kyphosis [13]. Measurements by clinical tests and Health-Related Quality of Life (HRQL) were performed before and after the intervention period. Jamar dynamometer was used to measure hand grip strength (kg) of the dominant and the non-dominant hand. For standardization, the adjustable handle was set at the second position. Each test was performed three times and the best trial was counted [14]. Static balance tests were performed by tandem standing with eyes open and then closed (Sharp-eyed Romberg), one-leg standing (right and left) with the eyes open and then closed. The one-leg standing tests were performed with the opposite foot lifted halfway up the calf of the supporting leg and arms at sides. The static balance tests were limited to a maximum of 30 seconds. Timing was stopped if the supporting foot was moved from its initial position. The dynamic balance tests included tandem walking forwards heel to toe and backwards toe to heel on a line. The number of steps were counted and maximized to 15 correct steps. The static and dynamic balance tests were performed three times and the best

trial was used as the final score [15]. There was also a chair rising test five times without support of the arms. This test was assessed as being successful or not successful [16]. An experienced physiotherapist performed the clinical tests.

The participants completed the generic Short Form 36 (SF-36, version I) for assessment of their HRQL. The questionnaire has good reliability and validity [17-20]. The SF-36 version 1 comprises 36 items with two to six response options according to an ordinal scale. Eight health domains were assessed: Physical Function (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Function (SF), Role Emotional (RE), and Mental Health (MH) [17,21]. Two summary scores were calculated from these eight domains: Physical Component Summary (PCS) and Mental Component Summary (MCS) indexes using previously established methods [21]. The SF-36 items were coded, scored and summarized to derive the eight domains. The scores were transformed into a 0-100 scale. Zero indicated the worst possible HRQL and 100 the best [18]. Present pain and the worst pain were estimated by a Visual Analogue Scale (VAS) from 0-10, where 0 indicated no pain and 10 the worst possible pain [22,23].

## Intervention program

The Osteoporosis school was scheduled to once a week for eight weeks. Each session lasted 90 minutes and included theory and exercise training sessions. The training started with a 10-minute warm-up phase and the exercises were individually adjusted to the participant's physical capacity. The importance of a good body posture was emphasized through the training program. The training program consisted of back extension exercises positioned on hands and knees while raising the leg and the opposite arm in a diagonal plane, isometric back extensor muscle training in a prone position (with a pillow under the stomach), facing a wall in standing position and straightening the back by simultaneously raising the arms with support against the wall, push-ups at wall bars, elastic band and dumbbells exercises, chair rising, careful knee-bending, toe-rising when standing, and also different coordination steps [24-29]. Balance exercises were tailored to the participants and were performed by different steps with different velocity and directions and also by rising exercises and by training equipment and balls [15,30]. The program was completed by qi-gong and relaxation exercises [31,32]. In addition, the participants were educated about adequate home-based exercises for strengthening the back and lower extremity [24,25,33]. The women received information that exercises such as sit-ups, bending forward and rotation of the trunk should be avoided, as these exercises may increase the risk of a vertebral compression [24,34]. After each training session, there was a coffee break followed by the educational part. Physiotherapists, occupational therapist and a nurse were responsible for the different part of the sessions. The educational themes were as follows:

1. The disease osteoporosis and its consequences – a public health problem
2. Clinical risk factors for the probability of an osteoporotic fracture (FRAX), diagnosis and treatment
3. Anatomy of the skeleton and bone structure, and also the balance system
4. Ergonomic aspects of performing daily living activities, and also adequate aid and support (orthoses)

5. Self-management with nutritional, physical activity and fall prevention behaviour
6. Mindfulness

At the end of the intervention period the participants were offered physical activity on prescription (in Swedish FaR®) to improve their physical activity habits [35], and they were also introduced to individual or group training program with sequence training equipment at the PHCC gymnasium [36,37].

### Statistical methods

Group results are presented as Mean (M) and Standard Deviation (SD) and Median (Md) and range are also reported. Wilcoxon sign rank test was used for the analysis of change in the group, as the material was small. Significant level  $\alpha$  less than 5% was considered as statistically significant. Statistica version 13 was used for the calculations.

## Results

### Participants and drop-outs, attendance

Eighteen women were asked about participating in the Osteoporosis school. Some preliminary participants declined the school, as they had not quite understood the information that the school meant group activities and some had also problems with transportations to and from the Osteoporosis school. Eleven women consented to the study and participated in the program. Only two of the participants were referred from primary health care centres other than the Vadsstena PHCC. The participants completed an average of 7 sessions (Md=7, range 4-8).

### Group characteristic

The women were born 1921-1953 and their mean age was 74 years (SD=9.5, Md=76 years, range 58-90), mean body height was 158 cm (SD=9, Md=160 cm, range 141-169), mean body weight was 65.6 kg (SD=14.2, Md=60 kg, range 48-90), and mean BMI was 26 (SD=4.2, Md=26, range 20-32). Mean body height loss since young adult age was 5 cm (SD=3.4, Md=5 cm, range 1-12) ( $p<0.01$ ).

### Drugs, fractures and FRAX-values

Eight women used bone-specific drugs such as bisphosphonates, and calcium combined with vitamin D. Three women had rheumatic diseases and had used corticosteroids and three women used levaxin. Vertebral fracture was reported by six women, humerus fracture by four women, and forearm fracture by one woman. Six women reported at least one fall for the last year. FRAX mean value for the probability of a ten-year hip fracture was 21% (SD=16, Md=16%, range 2-54), and FRAX mean value for the probability of a major osteoporotic fracture was 38% (SD=16, Md=39%, range 13-64).

### Back straightening, chair rising, balance performance, handgrip, pain, and health-related quality of life

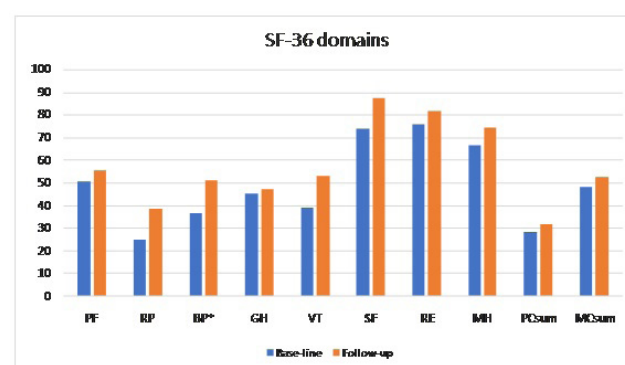
The back-straightening test (C7-wall distance) was improved with about 0.6 centimetre ( $p<0.05$ ). Ten women were successful in the chair rising test. One woman withdrew from the rising test and another woman from the one leg balance stance tests because of worsened back pain. There was a tendency towards more correct steps in the tandem walking forwards on a line from 10.4 to 11.5 steps ( $p=0.068$ ). The women managed to stand on one leg with eyes open for about

13 seconds. Handgrip strength did not change. Estimated worst pain decreased from 5.8 to 4.0 ( $p<0.05$ ) and there was also a tendency towards decreased present pain from 4.7 till 2.8 ( $p=0.069$ ) (Table 1). The SF-36 bodily pain domain improved from 36.7 to 51.3 ( $p<0.05$ ) (Figure 2).

Clinical tests	Base-line	Follow-up	n	p
	Mean (SD)	Mean (SD)		
Back straightening (C7-wall) (cm)	6.7 (1.5)	6.1 (1.8)	11	<b>0.018</b>
Handgrip dominant (kg)	19.4 (7.5)	19.8 (7.0)	11	0.307
Handgrip non-dominant (kg)	17.6 (7.8)	17.6 (6.7)	11	0.859
Sharpened Romberg, eyes open (s)	23.2 (11.2)	25.2 (9.0)	11	0.225
Sharpened Romberg, eyes closed (s)	12.4 (13)	11.7 (12.6)	11	0.917
Right leg, eyes open (s)	12.3 (11.9)	13.3 (12.3)	10	0.401
Left leg, eyes open (s)	14.4 (14.3)	12.2 (10.6)	10	0.646
Right leg, closed eyes (s)	2.5 (4.5)	2.6 (5.6)	10	0.654
Left leg, closed eyes (s)	1.4 (2.3)	1.4 (2.3)	10	1
Walking forwards (steps)	10.4 (6.9)	11.5 (5.9)	11	0.068
Walking backwards (steps)	8.5 (6.9)	9.5 (6.2)	11	0.106
Present pain (VAS)	4.7 (2.4)	2.8 (2.7)	11	0.069
Worst pain (VAS)	5.8 (3.5)	4.0 (3.4)	10	<b>0.043</b>

**Table 1:** Change in the group with Mean and Standard Deviation (SD) at base-line and after the intervention period.

Significance level  $p<0.05$  is presented in bold.



**Figure 2:** Comparison between base-line and follow-up concerning the SF-36 domains in participants (n=11) in the study group.

PF=Physical Function; RP=Role Physical; BP=Bodily Pain; GH=General Health; VT=Vitality; SF=Social Function; RE=Role Emotional; MH=Mental Health; PC sum=Physical Component Summary; MC sum=Mental Component summary.

Score 0 indicated the worst and score 100 the best condition for SF-36 domains.

Significance level  $p<0.05$  is presented as \*

After the intervention period three women joined a strength training group and one woman joined a balance training group at the PHCC. Other participants continued their physical activity by regular walks and home training exercises.

## Discussion

The lack of a “fracture coordinator” was obvious in the present study, as it was hard to recruit participants with a fragility fracture to the Osteoporosis school activities from other PHCCs than the one in



Vadstena. The use of coordinated, multi-disciplinary models of care for secondary fracture prevention is recommended by the International Osteoporosis Foundation ([www.iofbonehealth.org/capture-fracture](http://www.iofbonehealth.org/capture-fracture)) [38]. The power of the present pilot study was weak, as the number of appropriate participants was small and there was not either any control group. Other concepts of structuring an Osteoporosis school may be better than the present school. A larger randomized controlled intervention study with an Osteoporosis school is planned to start in 2018 and will be issued from the regional Osteoporosis unit with restricted inclusion criteria such as diagnosed osteoporosis and vertebral fracture in persons aged over 60 years. Several Swedish health care regions have implemented the FRAX® tool to find out high-risk patients in order to give adequate medical treatment and rehabilitation for the prevention of a secondary fracture. The use of FRAX® into physical therapist practice is a rather new activity. Educating about patients' absolute fracture risk may lead to improved exercise motivation and adherence. However, questions on risk factors such as physical inactivity, propensity to fall, and height loss are not included in the FRAX algorithm model and should be added, when meeting patients in the clinic [39].

The Osteoporosis school was appreciated amongst the women in specific the exercise training sessions, which they told us were the best part of the school. A qualitative study previously confirmed that professionally supervised specific back exercise training may bring benefits to everyday life, increase well-being and quality of life in elderly women with vertebral fractures [40]. Supervised exercise training sessions for bone health and balance performance could be recommended to persons suffering from osteoporosis [23,27,30,41-43]. The back-straightening ability was improved in the present study, which may mean better back muscle function [27]. Estimated pain decreased amongst the participants, which is in accordance with training studies designed for elderly women with osteoporosis and fractures with exercise sessions 45-60 minutes 2-3 times per week for 2.5-6 months [23,41-43]. The improvement in the SF-36 bodily pain domain agrees with a training study for four months [41]. A tendency towards improved balance performance was found in tandem walking forwards in spite of the few scheduled training sessions. In a training study for women with osteoporotic vertebral compression balance performance was improved after exercising two times a week for three months [42]. Five women in the present Osteoporosis school did not manage to stand on one leg with the eyes open for 10 seconds or more, which may mean about 2.6 times increased hip fracture risk according to a study with Swedish elderly women [44]. Mean values for hand grip strength (19.6 kg in the dominant and 17.6 kg in the non-dominant hand) amongst the participants in the present study corresponded to normative mean values in American women aged 75 years and over [14].

Personal guidance, encouragement, and advice on adequate physical activity are very important to improve bone health, muscle function and balance in elderly women with osteoporosis and fragility fractures [45-46]. The international physical activity guidelines for public health recommend at least 150 min of moderate intensity distributed amongst 5-7 days a week, such as brisk walks for all adults [47,48]. However, elderly women with osteoporotic related fractures should not be forced to walk too fast due to an increased risk of falls [49]. There is a lack of well-designed studies evaluating the effect of education and physical exercise training in women with established osteoporosis [50,51]. Osteoporosis and fracture may have a profound

impact on physical function and everyday activity. Thus, healthcare professionals and persons with osteoporosis would benefit from more information on how treatments impact patients' physical function and everyday activity, to optimise treatment decisions and to improve compliance and persistence with treatment to prevent future fractures [52].

## Conclusion

This pilot study with an Osteoporosis school showed good compliance with decreased pain and improved back-straightening ability in older women with fragility fractures in their intention to become healthier by increased physical activity.

## Acknowledgement

The study received financial support from Östergötland County Council.

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