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Effects of a self-management arthritis programme with an added exercise component for osteoarthritic knee: randomized controlled trial

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Abstract

Title. Effects of a self-management arthritis programme with an added exercise component for osteoarthritic knee: randomized controlled trial

Aim. This paper is a report of a study to assess the effect of an adapted arthritis self-management programme with an added focus on exercise practice among osteoarthritic knee sufferers.

Background. Osteoarthritis of the knee is a major source of loss of function in older people. Previous studies have found self-management programmes to be effective in increasing arthritis self-efficacy and in mastery of self-management practice.

Method. A randomized control trial was carried out from December 2002 to May 2003 and 120 participants (65·9%, including 67 in intervention group and 53 in control group) completed the 16-week postintervention assessments. Outcome measures included arthritis self-efficacy, use of self-management techniques, pain intensity and daily activity.

Findings. At 16 weeks, there was a 'statistically' significant improvement in the arthritis self-efficacy level ($P \leq 0{\cdot}001$), in most of the self-management skills, i.e. use of cold and hot compresses, in two of three joint protective practices ($P \leq 0{\cdot}001$; $P = 0{\cdot}01$), an increase in the duration of light exercise practice ($P \leq 0{\cdot}001$), reduction of current arthritis pain ($P \leq 0{\cdot}001$) and in the ability to perform daily activities ($P \leq 0{\cdot}001$) among the intervention group but not for the control group (P-range from 0·04 to 0·95). One joint protective practice showed a statistically significant increase in both groups ($P \leq 0{\cdot}001$).

Conclusion. Our findings add to evidence showing short-term beneficial effects of self-efficacy theory in education programmes. Self-efficacy theory has great potential for empowering sufferers of chronic conditions to live with their illness.

Keywords: healthcare professionals, knee, osteoarthritis, pain, randomized controlled trial, self-efficacy, self-management

Introduction

Osteoarthritis (OA) is the most prevalent form of arthritis and its most common site is the knee joint (Creamer & Hochberg 1998, Berman *et al.* 1999). A local survey (Lau *et al.* 2000) found that among people aged 50 and over, about 13% of women and 7% of men were diagnosed to have OA of the knee. OA of the knee is common in Hong Kong and responsible for most of the disablement of older people within this population (Cheing & Hui-Chan 2001). Also, it is a major source of morbidity and loss of function especially in older people (Fried & Guralni 1997, Denoeud *et al.* 2005). Because of a rapid increase in the number of people older than 65 years in Hong Kong, knee OA is a growing public health problem (Hong Kong Government Census and Statistics Department 2001).

Both the American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR 2000) emphasize the integral roles played by regular patient education and exercise as the first line non-pharmacologic treatment of OA knee (Pendleton *et al.* 2000). To improve patient education in arthritis, Lorig (1995) suggested utilizing cognitive and behavioural modification, in addition to providing information. It was suggested that self-efficacy was an important mediator of arthritis-related outcomes (Bandura 1977, Lorig & Holman 1993). The construct of perceived self-efficacy was introduced by Bandura (1997), who described in his social-cognitive theory how cognitive and social factors contribute to disease. Self-efficacy was influenced by four sources: mastery experience, vicarious experience, social persuasion and interpretations of somatic state. According to Bandura, perception of high self-efficacy increased the likelihood of consideration, adoption and maintenance of self-management skills. Arthritis self-efficacy affects the sufferer's perception of, interpretation of, and ways of coping with the arthritic experience.

Lorig and her team (Lorig *et al.* 1985, Lorig & Holman 1993) developed measures to assess arthritis self-efficacy and arthritis self-management programmes, which focused on the problems experienced by sufferers and their accomplishments in disease-related problem-solving, such as goal-setting, action planning and the effects of feedback. Simeoni *et al.* (1995), Stephenson *et al.* (1997) and Solomon *et al.* (2002) reported no marked effects from self-management programmes in arthritis self-efficacy and pain levels. However, increasing evidence shows that arthritic patients who are confident in their ability to manage arthritis pain and other symptoms are the ones who have the better health outcomes (Taal *et al.* 1993, McGowan & Green 1995, Chui *et al.* 1998, Alderson *et al.* 1999, Barlow *et al.* 1999, Hammond *et al.* 1999, Siu & Chui 2004, Wong *et al.* 2004, Yip *et al.* 2004). Furthermore, recent evidence showed that integrating the principles of self-efficacy enhancement and strategies in a goal-directed exercise component (either exercise goal-setting or homework to practise exercises) within an education programme resulted in increased physical activities (Heesch *et al.* 2003, Talbot *et al.* 2003) and use of pain coping strategies among retirement community residents with chronic pain (Turner *et al.* 2005). Since exercise was one of the most effective treatments in enhancing functional capacity among OA knee sufferers, Stenstrom (1994) suggested that a specifically focused and regular goal-directed exercise programme for OA knee sufferers was necessary rather than freely determined exercise. Unlike the previous arthritis management programmes (Barlow *et al.* 1999, Fu *et al.* 2003), the team not only integrated the principles of self-efficacy enhancement for OA knee sufferers, but also scaled up the focus on goal-directed exercise components relevant to the group's lifestyle. In this paper, we report the outcome effects of this added focus on exercise practice to an arthritis self-management programmes (ASMP) in enhancing perceived arthritis self-efficacy, and the use of self-management techniques in reducing arthritis pain and increasing daily activity.

The study

Aim

The aim of the study was to assess the effect of an adapted arthritis self-management programme with an added focus on exercise practice among osteoarthritic knee sufferers.

Design

A randomized controlled trial study was carried out between December 2002 and May 2003.

Participants

Patients with OA of the knee were recruited from the specialist outpatient clinic of the Orthopaedic Department of a local hospital, the general outpatient clinic of a local hospital and the Wellness Clinic. Patients were included if they were capable of completing the questionnaire orally and either had OA affecting the knee according to self-report or screening of outpatient medical records. Diagnosis of OA of the knee was confirmed by medical history and a physical examination based on the clinical criteria of the American College of Rheumatology criteria 1991 (Altman *et al.* 1986, Altman 1991, Hopkins 2002). The clinical criteria for OA of the knee

consisted of pain in the knee and any three of the following: (1) aged 50 years of age or over; (2) < 30 minutes of morning stiffness; (3) crepitus on active motion; (4) bony tenderness; (5) bony enlargement; or (6) no palpable joint warmth.

The exclusion criteria applied to those who (1) were bed bound, wheelchair bound or who experienced loss of balance while standing; (2) had knee replacement; (3) were currently undergoing active physiotherapy such as hydrotherapy or strengthening exercises; or (4) were currently receiving acupuncture treatments, since they could over-exert efforts for exercise compliance. Moreover, acupuncture, a popular treatment for joint pain among Chinese people, could influence the outcome results masking the results from the intervention itself.

Qualified and consenting participants were randomly assigned to an intervention or control group by reference to a random number table. Details of the sampling criteria have been reported previously (Yip *et al.* 2007). By assuming an effect size of 0·5 with an alpha level of 0·05 and a beta error tolerance of 20%, a minimum of 64 participants would be needed for each group (Portney & Watkins 1993).

The modified ASMP intervention and added goal-directed exercise component

Lorig and colleagues at Stanford University (Lorig & Fries 2000) developed the ASMP, based on Bandura's concept of self-efficacy and behaviour change (Bandura 1991). The modified ASMP intervention consisted of six 2-hour classes held once a week, with 10–15 participants, led by Registered Nurses trained in leading small groups and in self-management basic principles. The classes were conducted using a small group approach. The programme focused on teaching participants how to cope with and manage common knee OA consequences, such as arthritis pain, fatigue, daily activity limitations and stress. It was designed to give participants skills they could use to optimize their ability to manage their condition.

An action plan using three types of exercise was promoted and reinforced weekly during the programme. These were stretching exercises, walking, and Tai Chi types of movement – fluid, gentle, relaxed and slow in tempo movements – aimed at enhancing exercise for the affected joints (Yip *et al.* 2007). A pedometer (OTO model DM-700) was given to intervention group members for 3 days (two weekdays and one weekend) to act as a positive reinforcement in walking. In addition, routine conventional treatment (treatment prescribed by orthopaedic doctor or outpatient clinic) was continued. The control group received routine conventional treatment (same as the intervention group) but no other treatment.

Data collection

Both groups were assessed at baseline, at 1 week postintervention and again at 16-week postintervention. The baseline measurements were taken from 1 to 3 weeks before the programme. The outcome measures included a structured face-to-face interview and physical assessment of the knee joint. A panel of seven experts in the musculo-skeletal field was invited to verify the content validity of the outcome measures by a content validity index. Content validity of the outcome measures was 0·89 (content validity index). Inter-rater reliability was 0·84 (Kappa statistics) for categorical data and 1·00 (correlation coefficient) for continuous data. The 1-week test and re-test reliability results were 0·9 (Pearson coefficient) for continuous data and 0·95 (Spearman correlation) for ordinal data.

Outcome measures

Demographics

Demographics (e.g. age, gender, education and pre-retirement occupation) and arthritis-related information (e.g. type of arthritis, duration of disease and treatment for current arthritis condition) were collected at baseline only.

Arthritis self-efficacy

The Arthritis Self-efficacy Scale (ASE, Lorig *et al.* 1989) was used as a measure of the strength of a person's belief in their ability to control, or manage various aspects of arthritis. The ASE has two subscales: ASE: pain (five items) and ASE: other symptoms (six items). Each item was scored from 0 (very uncertain) to 10 (very certain). Scores were summed across the items for each subscale, producing scores of 5–50 for ASE: pain, and 6–60 for ASE: other symptoms. Participants rated their perceived degree of ability to control arthritis pain and other related symptoms. Higher scores indicate greater perceived ability to control various aspect of arthritis.

Use of self-management techniques

Self-management techniques included non-pharmacological management of the OA, such as hot and cold compresses for pain relief, joint protection methods and practice of exercise. The joint protection practices included 'share the load among varied joint(s)', 'use a large joint to carry a heavy load' and 'avoid maintaining the same joint position for prolonged periods'. The joint protection practices were assessed by using a simple 'yes' or 'no' response. The frequency and duration of leisure-time light exercise (including flexibility and strengthening exercises, walking exercise and Tai Chi movements) were noted on a weekly basis.

Arthritis pain intensity and daily activity

Standard 100 mm horizontal visual analogue scales (VASs) were used to assess current pain. Scores ranged between 0 and 100. Respondents were asked to place a mark on a line representing their level of pain or fatigue. On the pain VAS, the line was anchored by 'no pain' and 'pain as bad as it could be'. The modified Health Assessment Questionnaire (HAQ, Pincus *et al.* 1983) was used as a measure of the restrictions on daily activities imposed by participants' illness. Participants rated their degree of difficulty on a 4-point scale in eight areas of life, including ability to perform a range of daily activities such as dressing and grooming, walking, hygiene, arising, eating and reaching. Scores ranged from 0 to 3 (0, 'without any difficulty'; 3, 'unable to do'), with higher scores indicating greater physical impairment.

Ethical considerations

The study was approved by the human subjects committee of the School of Nursing at The Hong Kong Polytechnic University and by the local hospitals. Participants were given detailed information about study procedures and written consent was obtained.

Data analysis

All analyses were completed using the Statistical Package for Social Sciences, version 9.0 (SPSS Inc., Chicago, IL, USA). Normality of the outcome data was examined by the Kolmogorov–Smirnov test, with $P < 0{\cdot}05$ indicating that the data were not normally distributed and that non-parametric statistics should be performed. We then compared the baseline characteristics of participants from the control and intervention groups using Mann–Whitney *U* or chi-square tests, according to the type of variables. Intervention effects with and without intent-to-treat were compared. These results were similar, and so analyses of intervention effects on an intent-to-treat basis were performed. To determine whether groups of participants improved on outcome measures, we calculated the mean change by the following formula: mean change $= X_2 - X_0$, where X_2 was the mean score at 16 weeks postintervention and X_0 was the mean score at baseline. The effect size of the outcome measures was calculated by nQuery Advisor 4·0 (Statistical solutions, Belfast, UK, 2001). The Friedman test was used to compare the outcome measures over the baseline and the two follow-ups within the groups. Between-group mean changes on the outcome measures were compared using Mann–Whitney *U* tests. The level of statistical significance was 0·025 (one-tailed) for all tests.

Results

Demographics

For the 182 participants enrolled in the study, 1-week postintervention was completed with 149 (81·90%) and 16 week postintervention with 120 (65·9%) (see Figure 1). The mean age of participants was 65 years, and approximately 75% were women. Participants had suffered from OA knee for 8 years on average. No differences between the groups with respect to age, gender, education, pre-retirement occupation, marital status and all outcome measures were noted (*P*-value range from 0·10 to 0·99). Moreover, participants and drop-outs were also comparable across most demographic characteristics and outcome variables, except arthritis pain intensity rating ($P = 0{\cdot}02$). The drop-out group suffered higher arthritis pain (mean = 52·42/100, SD = 2·76) than the participant group (mean = 44·58/100, SD = 2·11).

Change of ASE score

Mean ASE scores in the two groups for pain and other symptoms at baseline, 1 week postintervention and 16 weeks

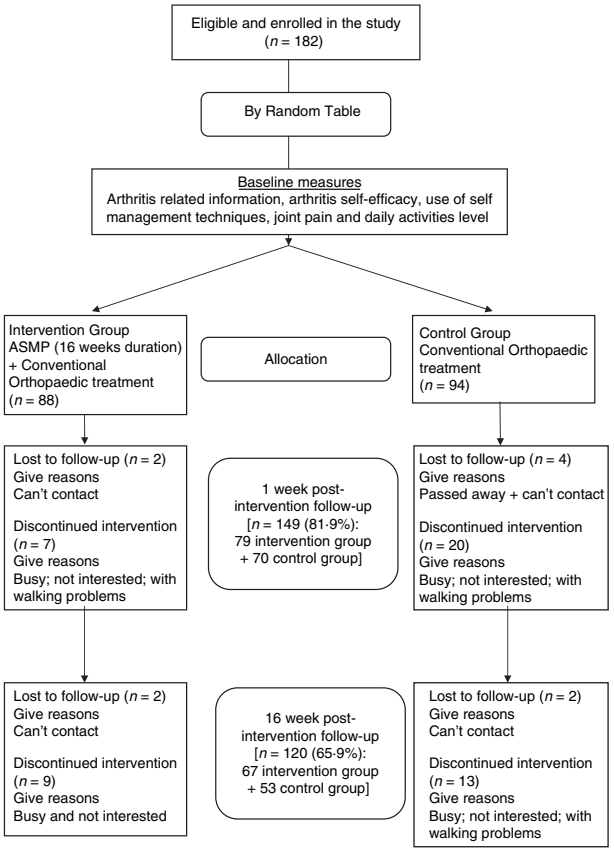

Figure 1 Study flow.

postintervention are presented in Table 1. An improvement in mean pain score (ASE: pain) was found in the intervention group ($P = 0{\cdot}0001$) at 16 weeks postintervention. No statistically significant change in ASE: pain was found for the control group ($P = 0{\cdot}75$) (effect size = 0·53). Similarly, an improvement in other symptoms (ASE: OS) was found in the intervention group ($P = 0{\cdot}0001$) but not for the control group ($P = 0{\cdot}17$) at 16 weeks postintervention (effect size = 0·51). Comparing between-groups on mean changes, participants in the intervention group demonstrated a statistically significant increase in arthritis self-efficacy both for pain and other symptoms ($P = 0{\cdot}0001$) between baseline and 16 weeks postintervention.

Use of self-management skills from baseline to 16 weeks postintervention

Among the intervention group, the use of hot and cold compresses increased from baseline (34·10%) to 16 weeks postintervention (58·0%) ($P = 0{\cdot}0001$). Although their use in the control group slightly increased (26·6% at baseline and 36·2% at 16 weeks postintervention), this was not statistically significant ($P = 0{\cdot}04$) (Table 2). Joint protective practices of sharing the load among varied joints and use of large joints to carry heavy loads were increased from baseline to 16 weeks postintervention ($P = 0{\cdot}0001$ and $P = 0{\cdot}01$, respectively) for the intervention group but not for the control group ($P = 0{\cdot}74$ and $P = 0{\cdot}09$, respectively). The practice of avoiding maintaining the same joint position for prolonged periods increased at 1 week postintervention and 16 weeks postintervention for both the intervention group ($P = 0{\cdot}0001$) and the control group ($P = 0{\cdot}0001$). This was a time trend effect rather than an intervention effect.

There was a statistically significant increase in duration of practising light exercise weekly from baseline (mean = 5·60 hours, SD = 4·48) to 16 weeks postintervention (mean = 7·17 hours, SD = 5·18) for the intervention group but not for the control group (mean = 5·07 hours, SD = 3·96 at baseline and mean = 5·41 hours, SD = 4·20 at 16 weeks postintervention). The *P*-values for the intervention and control groups were 0·0001 and 0·95, respectively, with an effect size of 0·68. For the between-groups comparison of mean change, the *P*-value was 0·0001.

Effects on arthritis pain intensity and daily activity at 16 weeks postintervention

Reduction in current arthritis pain rating was statistically significantly higher for the intervention group (about 12 mm

Table 1 Mean change† in perceived arthritis self-efficacy, joint pain rating, practice of light exercises and functional limitations in intervention ($n = 88$) and control ($n = 94$) groups at 1 week and 16 weeks postintervention

Outcome variables	Baseline, mean (SD)‡	1 week postintervention, mean (SD)‡	16 weeks postintervention, mean (SD)‡	Baseline to 16 weeks postintervention, mean change† (SD)	*P*-value§	Effect size¶
(1) *ASE: pain* (Scale 5–50, higher score = better)				Between groups *P*-value**	0·0001**	
Intervention group	29·20 (3·32)	34·89 (6·27)	36·09 (13·09)	6·89 (12·64)	0·0001§	0·534
Control group	31·73 (8·08)	32·75 (7·80)	33·27 (7·98)	1·54 (6·05)	0·75§	
(2) *ASE: other symptoms* (Scale 5–60, higher score = better)				Between groups *P*-value**	0·0001**	
Intervention group	36·46 (9·00)	43·61 (6·63)	42·92 (8·44)	6·46 (8·21)	0·0001§	0·509
Control group	37·86 (9·57)	40·09 (8·57)	40·12 (9·09)	2·54 (7·11)	0·17§	
(3) *Current pain rating* (VAS, scale 0–100, lower score = better)*				Between groups *P*-value**	0·0001**	
Intervention group	50·45 (20·81)	37·33 (21·06)	38·58 (22·01)	−11·88 (18·91)	0·0001§	0·613
Control group	44·26 (24·42)	44·41 (23·23)	42·50 (23·67)	−1·76 (13·47)	0·17§	
(4) *Health Assessment Questionnaire* (scale 0–100, lower score = better				Between groups *P*-value**	0·14**	
Intervention group	5·56 (3·94)	4·63 (3·80)	4·70 (3·69)	−0·85 (2·17)	0·0001§	0·122
Control group	5·03 (3·51)	4·46 (3·63)	4·44 (3·30)	−0·60 (1·90)	0·12§	
(5) *Practice of light exercise*¶ (hours/week)				Between groups *P*-value**	0·0001**	
Intervention group	5·06 (4·48)	7·39 (4·33)	7·17 (5·18)	2·11 (3·78)	0·0001§	0·566
Control group	5·07 (3·96)	4·83 (3·20)	5·41 (4·20)	0·34 (2·23)	0·58§	

ASE, Arthritis Self-efficacy Scale.
†Mean of score at 16 week postintervention – mean of score at baseline.
‡SD = standard deviation of the mean.
§*P*-value is calculated by Friedman statistics for within-group comparison.
**P-value is calculated by Mann–Whitney *U* statistics for between-group comparison.
*Statistically significant difference between two groups at baseline ($P = 0{\cdot}02$).
¶Effect size is calculated by nQuery 2.1 version.

Table 2 Use of self-management techniques* in intervention ($n = 88$) and control ($n = 94$) groups at 1 week and 16 weeks postintervention

Symptom management variables	Baseline, %	1 week postintervention, %	16 week postintervention, %	*P*-value†
(1) *Use of cold or hot compresses*				
Intervention group	34·1	48·9	58·0	0·0001
Control group	26·6	36·2	36·2	0·04
(2) *Joint protective practice*				
Share the load among various joint(s)				
Intervention group	83·0	94·3	96·6	0·0001
Control group	89·4	87·2	87·2	0·74
Use large joint to carry heavy load				
Intervention group	54·5	70·5	70·5	0·01
Control group	44·7	55·3	53·2	0·09
Avoid maintaining weight on the same joint for prolonged periods				
Control group	72·7	94·3	96·6	0·0001
Control group	75·5	94·7	90·4	0·0001

*Joint protective practice and use of cold or hot compresses.
†*P*-value is calculated by Cochran's Q statistics (for dichotomy variables).

reduction in 100 mm VAS, $P = 0{\cdot}0001$) at 16 weeks postintervention compared with the control group (about 2 mm reduction in 100 mm VAS, $P = 0{\cdot}17$, effect size = 0·61). Comparison of mean changes in the intervention group demonstrated a statistically significant decrease in current pain ($P = 0{\cdot}0001$) between baseline and 16 weeks postintervention. Intervention group participants showed more favourable daily activity outcomes than the control group, as assessed by the HAQ ($P = 0{\cdot}0001$ and $P = 0{\cdot}12$, respectively, effect size = 0·12). However, there was no statistically significant difference in disability health outcomes for the between-group comparison ($P = 0{\cdot}14$).

Discussion

The design of the intervention was grounded in self-efficacy theory (Bandura 1991), i.e. the individual's sense of their ability to perform self-management arthritis tasks. The programme stressed empowerment of the confidence of participants' ability to manage arthritis pain and related symptoms, and to focus on goal-directed exercise components relevant to their lifestyles. We hypothesized that the modified programme with the added goal-directed exercise component would enhance arthritis self-efficacy and the practice of exercise. In addition, the experience of positive arthritis self-efficacy and the practice of exercise might result in less pain and increased daily activity. The results presented support these hypotheses.

Analyses revealed that the intervention group experienced a statistically significant increase in arthritis self-efficacy. Arthritis self-efficacy affects the sufferer's perception of, interpretation of, and ways of coping with the arthritis experience. Bandura (1997) proposed that the perception of high self-efficacy increases the likelihood of consideration and adoption of self-management skills. Our results, which demonstrate increasing perceived self-efficacy throughout the modified self-management programme, are consistent with other findings from arthritis self-efficacy research (Taal *et al.* 1993, McGowan & Green 1995, Bandura 1997, Chui *et al.* 1998, Barlow *et al.* 1999, Siu & Chui 2004). This supports the assumption that level of self-efficacy is related to adoption of self-management behaviour.

On the basis of the central assumption of social-cognitive theory, an increase in the level of perceived arthritis self-efficacy may result in more investment of effort by sufferers in self-management skills, such as joint protection, regular exercise and the use of hot and cold compresses. Previous ASMP studies have shown various effects from increasing self-management behaviours. Some found positive effects on self-management skills such as joint protection (Alderson *et al.* 1999, Hammond *et al.* 1999), and exercise practice (Taal *et al.* 1993, Talbot *et al.* 2003, Siu & Chui 2004). However, there were no statistically significant increases in exercise practice for some arthritis self-management programmes (Simeoni *et al.* 1995, Lindroth *et al.* 1997, Fu *et al.* 2003, Wright *et al.* 2003). One of the joint protection practices, 'avoidance of maintaining the same joint position for prolonged periods', was similar in both groups in our study. This may indicate that joint protection practices were also encouraged in standard care. It is difficult to draw conclusions from the evidence about the increases in joint protection practices as a result of the self-management programme alone since few previous studies have measured this. The outcomes regarding the practice of exercise were

What is already known about this topic

- Osteoarthritis of the knee is the most prevalent form of arthritis and is a major source of morbidity and loss of function, especially in older people.
- Arthritis self-management programmes are effective.
- There is no evidence available on adapted arthritis self-management programmes with an added exercise component in an ethnic Chinese group with osteoarthritis of the knee.

What this paper adds

- An adapted arthritis self-management programme with an added exercise component had a short-term effect in improving self-efficacy, level of self-management practice, pain and ability to perform daily activities for sufferers of osteoarthritis of the knee.
- Further evidence of the benefits of applying self-efficacy theory with additional exercise practices to education programmes for osteoarthritis of the knee sufferers.
- More research is needed to evaluate the effects of the adapted arthritis self-management programme.

inconsistent in previous arthritis self-management experimental studies. One possible difference might relate to slight variations in focus between programmes. One observation of the characteristics of past studies with positive effects on exercise practice is those of arthritis self-management programmes in combination with an exercise component., e.g. kinaesthetic instruction assimilated to the sufferer's home environment (Hammond *et al.* 1999); stress on an endurance exercise programme (Taal *et al.* 1993); home-based walking exercise (Talbot *et al.* 2003) or fitness and exercise (Alderson *et al.* 1999). Review of arthritis self-management studies showed that interventions with added exercise component were more likely to produce positive behavioural change in maintaining exercise habits. Examples include kinaesthetic instruction adapted to the sufferer's home environment (Hammond *et al.* 1999); endurance exercise (Taal *et al.* 1993); home-based walking exercise (Talbot *et al.* 2003) or fitness and exercise (Alderson *et al.* 1999). Although it was too early to draw a definite conclusion, Stenstrom (1994) pointed out that a specifically focused and regular goal-directed exercise increase programme for OA knee sufferers was crucial. Talbot *et al.* (2003) also found that the ASMP with an added walking programme increased walking and improved muscle strength among OA participants at 24 weeks follow-up. Both the ACR and the EULAR 2000 emphasized the role of participation in exercise as the first line of non-pharmacologic treatment for OA knee (Pendleton *et al.* 2000). Similarly, Allegrant and Marks (2003) found that functional self-efficacy was an important factor affecting the functional performance outcome for people with OA knee.

Our adapted ASMP intervention with added goal-directed exercise protocol improved arthritis pain level and daily activity for the intervention group at 16 weeks postintervention. Our results are in line with some previous findings suggesting benefits from an ASMP course in pain reduction (Lorig *et al.* 1985, Lindroth *et al.* 1997, Alderson *et al.* 1999, Barlow *et al.* 1999, Talbot *et al.* 2003, Siu & Chui 2004) and increased daily activity (Mazzuca 1994, Fransen *et al.* 1997, Dias *et al.* 2003, Talbot *et al.* 2003). However, our results are in contrast to previous findings about pain rating (Simeoni *et al.* 1995, Barlow *et al.* 2000, Solomon *et al.* 2002) and activity (Simeoni *et al.* 1995, Barlow *et al.* 1999, Solomon *et al.* 2002). In the present study, the reductions in arthritis pain and increase in daily activity may have been mediated by improvement in participants' perceptions of control of their knee arthritis and related symptoms (Creamer & Hochberg 1998). In addition, the pain reduction may have been related to the focus on an exercise protocol (Berman *et al.* 1999) which was related to joint protective practices and regular light exercise. Perhaps the next step is to explore ways to increase participants' enjoyment and sustainability of self-management practice.

Study limitations

A limitation of this study was the high drop-out rate, especially in the control group. For instance, there were slight differences in the characteristics of drops-out and participants in the number of unplanned medical consultations for arthritis-related problems. Another important limitation in the outcome measures was the potential for response bias by participants in reporting the number of weekly hours of practice of light exercise. In addition, the Hawthorne effect cannot be discounted: it is possible that the outcome improvement was not related to the content of the programme but was simply a result of participants behaving according to their expectations of what the researchers were looking for.

Conclusion

In conclusion, our findings suggest that the combined self-management programme with an exercise protocol had a

positive effect in enhancing arthritis self-efficacy, use of self-management skills, reducing pain and improving daily activities for OA knee sufferers in 16 weeks. Our findings add to the evidence of the benefits of applying self-efficacy theory with additional exercise practices in designing education programmes for OA knee sufferers. Self-efficacy theory has great potential for empowering sufferers to live with chronic illness and enriching arthritis educational management programmes. Future studies are needed to explore how to apply and test the theory for sufferers with OA knee in various local contexts. If our findings are confirmed in future studies, they have clear implications for knee OA education in arthritis care.

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Author contributions

YY, JS, KF, DW and TN were responsible for the study conception and design and YY and JS were responsible for the drafting of the manuscript. YY, KF, DW and LC performed the data collection and YY, JS and KF performed the data analysis. YY, JS, DW, SC and LC obtained funding and YY, JS, SC, LC and TN provided administrative support. YY, JS and TN made critical revisions to the paper. YY and JS provided statistical expertise. YY supervised the study.

References

Alderson M., Starr L., Gow S. & Moreland J. (1999) The program for rheumatic independent self-management: a pilot evaluation. *Clinical Rheumatology* **18**, 283–292.

Allegrant J.P. & Marks R. (2003) Self-efficacy in management of OA. *Rheumatic Diseases Clinics of North America* **29**, 747–768.

Altman R.D. (1991) Classification of disease: OA. *Seminars in Arthritis and Rheumatism* **20**, 40–47.

Altman R.D., Asch E., Bloch D., Bole G., Borenstein D., Brandt K., Christy W., Cooke T.D., Greenwald R., Hochberg M., Howell D., Kaplan D., Koopman W., Longley S. III, Mankin H., McShane D.J., Medsger T. Jr, Meenan R., Mikkelsen W., Moskowitz R., Murphy W., Rothschild B., Segal M., Sokoloff L. & Wolfe F. (1986) Development criteria for the classification and reporting of osteoarthritis – classification of osteoarthritis of the knee. *Arthritis and Rheumatism* **29**, 1039–1049.

Bandura A. (1977) *Social Learning Theory*. Prentice Hall, Englewood Cliffs, NJ.

Bandura A. (1991) Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes* **50**, 248–287.

Bandura A. (1997) *Self-Efficacy: The Exercise of Control*. W.H. Freeman and Co., New York.

Barlow J.H., Williams B. & Wright C. (1999) 'Instilling the strength to fight pain and get on with life': learning to become an arthritis self-manager through an adult education programme. *Health Education Research: Theory and Practice* **14**, 533–544.

Barlow J.H., Turner A.P. & Wright C.C. (2000) A randomized controlled study of the arthritis self-management programme in the UK. *Health Education Research* **15**, 665–680.

Berman B.M., Singh B.B., Lao L., Langenberg P., Li H., Hadhazy V., Bareta J. & Hochberg M. (1999) A randomized trial of acupuncture as an adjunctive therapy in osteoarthritis of the knee. *Rheumatology* **38**, 346–354.

Cheing G.L. & Hui-Chan C.W. (2001) The motor dysfunction of patients with knee osteoarthritis in a Chinese population. *Arthritis and Rheumatism* **45**, 62–68.

Chui Y.Y.D., Poon K.K., Lee S.H. & Lau S.K. (1998) Self-management programme for rheumatoid arthritis in Hong Kong. *British Journal of Therapy and Rehabilitation* **5**, 477–481.

Creamer P. & Hochberg M.C. (1998) The relationship between psychosocial variables and pain reporting in osteoarthritis of the knee. *Arthritis Care and Research* **11**, 60–65.

Denoeud L., Mazieres C. & Payen-Champenosis P.R. (2005) First line treatment of knee osteoarthritis in outpatients in France: adherence to the EULAR 2000 recommendations and factors influencing adherence. *Annals of Rheumatic Diseases* **64**, 70–74.

Dias R.C., Dias J.M. & Ramos L.R. (2003) Impact of an exercise and walking protocol on quality of life for elderly people with osteoarthritis of the knee. *Physiotherapy Research International* **8**, 121–130.

Fransen M., Margiotta E., Crosbie J. & Edmonds J. (1997) A revised group exercise programme for osteoarthritis of the knee. *Physiotherapy Research International* **2**, 30–41.

Fried L.P. & Guralni J.M. (1997) Disability in older adults: evidence regarding significance, etiology, and risk. *Journal of the American Geriatrics Society* **45**, 92–100.

Fu D., Fu H., McGowan P., Shen Y.E., Zhu L., Yang H., Mao J., Zhu S., Ding Y. & Wei Z. (2003) Implementation and quantitative evaluation of chronic disease self-management programme in Shanghai, China: randomized controlled trial. *Bulletin of the World Health Organization* **81**, 174–182.

Hammond A., Lincoln N. & Sutcliffe L. (1999) A crossover trial evaluating an educational-behavioral joint protection programme for people with rheumatoid arthritis. *Patient Education and Counseling* **37**, 19–32.

Heesch K.C., Masse L.C., Dunn A.L., Frankowski R.F. & Mullen P.D. (2003) Does adherence to a lifestyle physical activity intervention predict changes in physical activity? *Journal of Behavioral Medicine* **26**, 333–348.

Hong Kong Government Census and Statistics Department (2001) *Population Report by Age Group, 1991, 1996 and 2001*. Hong Kong Government Census and Statistics Department, Hong Kong. Retrieved from http://www.censtatd.gov.hk/major_projects/2001_population_census/summary_results_of_2001_population_census/index.jsp on 17 August 2001.

Hopkins J. (2002) *Arthritis provides clinical classification criteria and management guidelines 2002*. Retrieved from http://www.hopkins-arthritis.som.jhmi.edu on May 21 2002.

Lau E.C., Cooper C., Lam D., Chan V.N.H., Tsang K.K. & Sham A. (2000) Factors associated with osteoarthritis of the hip and knee in

Hong Kong Chinese: obesity, joint injury, and occupational activities. *American Journal of Epidemiology* **152**, 855–862.

Lindroth Y., Brattstrom M., Bellman I., Ekestaf G., Olofsson Y., Strombeck B., Stenshed B., Wikstrom I., Nilsson J.A. & Wollheim F.A. (1997) A problem-based education program for patients with rheumatoid arthritis: evaluation after three and twelve months. *Arthritis Care Research* **10**, 325–332.

Lorig K. (1995) Patient education: treatment or nice extra. *British Journal of Rheumatology* **34**, 703–706.

Lorig K. & Fries J.F. (2000) *The Arthritis Helpbook: A Test Self-Management Program for Coping with Arthritis and Fibromyalgia*, 5th edn. Perseus Books, Cambridge.

Lorig K. & Holman H. (1993) Arthritis self-management studies: a twelve year review. *Health Education Quarterly* **20**, 17–28.

Lorig K., Lubeck D., Kraines R.G., Seleznick M. & Holman H.R. (1985) Outcomes of self-help education for patients with arthritis. *Arthritis and Rheumatism* **28**, 680–685.

Lorig K., Seleznick M., Lubeck D., Ung E., Chastain R. & Holman H. (1989) The beneficial outcomes of the arthritis self-management course are inadequately explained by behaviour change. *Arthritis and Rheumatism* **32**, 91–95.

Mazzuca S. (1994) Economic evaluation of arthritis patient education. *Bulletin of Rheumatic Diseases* **43**, 6–8.

McGowan P. & Green L. (1995) Arthritis self management in native populations of British Columbia: an application of health promotion and participatory research principles in chronic disease control. *Canadian Journal of Aging* **14**, 201–212.

Pendleton A., Aarden N., Dougados M., Doherty M., Bannwarth B., Bijlsma J.W., Cluzeau F., Cooper C., Dieppe P.A., Gunther K.P., Hauselmann H.J., Herrero-Beaumont G., Kaklamanis P.M., Leeb B., Lequesne M., Lohmander S., Mazieres B., Mola E.M., Pavelka K., Serni U., Swoboda B., Verbruggen A.A., Weseloh G. & Zimmermann-Gorska I. (2000) EULAR recommendations for the management of knee osteoarthritis: report of a task force of the Standing Committee for International Clinical Studies Including Therapetuic Trials (ESCISIT). *Annals of Rheumatic Diseases* **59**, 936–944.

Pincus T., Summey J.A., Sooraci S.A. Jr, Wallston K.A. & Hummon N.P. (1983) Assessment of patient satisfaction in activities of daily living using a modified Stanford Health Assessment Questionnaire. *Arthritis and Rheumatism* **26**, 346–1353.

Portney L.G. & Watkins M.P. (1993) Foundations of Clinical Research Applications to Practice. Appleton & Lange, Norwalk.

Simeoni E., Bauman A., Stenmark J. & O'brien J. (1995) Evaluation of a community arthritis program in Australia: dissemination of a development program. *Arthritis Care and Research* **8**, 102–107.

Siu A.M.H. & Chui D.Y.Y. (2004) Evaluation of a community rehabilitation service for people with rheumatoid arthritis. *Patient Education and Counseling* **55**, 62–69.

Solomon D.H., Warsi A., Brown-Stevenson T., Farrell M., Gauthier S., Mikels D. & Lee T.H. (2002) Does self-management education benefit all populations with arthritis? A randomized controlled trial in a primary care physician network. *Journal of Rheumatology* **29**, 362–368.

Stenstrom C.H. (1994) Home exercise in rheumatoid arthritis functional class II: goal setting versus pain attention. *Journal of Rheumatology* **21**, 627–634.

Stephenson K.S., Yee B.W.K. & Lisse J.R. (1997) Adaptive coping skills for older African Americans with arthritis. *Topics in Geriatric Rehabilitation* **12**, 75–87.

Taal E., Riemsma R.P., Brus H.L.M., Seydel E.R., Rasker J.J. & Wiegman O. (1993) Group education for patients with rheumatoid arthritis. *Patient Education and Counseling* **20**, 177–187.

Talbot L.A., Gaines J.M., Huynh T.N. & Metter E.J. (2003) A home-based pedometer-driven walking program to increase physical activity in older adults with osteoarthritis of the knee: a preliminary study. *Journal of American Geriatrics Society* **51**, 387–392.

Turner J.A., Ersek M. & Kemp C. (2005) Self-Efficacy for managing pain is associated with disability, depression, and pain coping among retirement community residents with chronic pain. *The Journal of Pain* **6**, 471–479.

Wong A.L., Harker J.O., Lau V.P., Shatzel S. & Port L.H. (2004) Spanish arthritis empowerment program: a dissemination and effectiveness study. *Arthritis and Rheumatism (Arthritis Care and Research)* **51**, 332–336.

Wright C.C., Barlow J.H., Turner A.P. & Bancroft G.V. (2003) Self-management training for people with chronic disease: an exploratory study. *British Journal of Health Psychology* **8**, 465–476.

Yip Y.B., Sit J.W.H. & Wong D.Y.S. (2004) A quasi-experimental study on improving arthritis self-management for residents of an aged people's home in Hong Kong. *Psychology, Health and Medicine* **9**, 249–260.

Yip Y.B., Sit W.H.J., Fung K.K.Y., Wong D.Y.S., Chong S., Chung L.H. & Ng T.P. (2007) Impact of a self-management arthritis programme with an added exercise component for osteoarthritic knee sufferers on improving pain, functional outcomes, and use of health care services: an experimental study. *Patient Education and Counseling* **65**, 113–121.