ORIGINAL ARTICLE

Physical activity on prescription (PAP): Costs and consequences of a randomized, controlled trial in primary healthcare

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Abstract

Objectives. To analyse costs and consequences of changing physical activity behaviour due to the “Physical Activity on Prescription” (PAP) programme. **Design.** A randomized controlled trial with a four-month intervention, with comparison between intervention and control group. **Intervention.** The PAP programme, with exercise twice a week, education, and motivational counselling. **Subjects.** 525 sedentary individuals, 20–80 years (intervention group $n = 268$, control group $n = 257$), with lifestyle-related health problems. A total of 245 returned for the four-month assessment. **Main outcome measure.** Programme costs based on intention-to-treat estimations, direct and indirect costs of inactivity, and physical activity behaviour analysed with IPAQ (International Physical Activity Questionnaire), self-reported physical activity, and measures of functional capacity. **Results.** The intention-to-treat programme costs for the four-month programme period was SEK (Swedish Kronor) 6475 (€ [Euro] 684) for the intervention group and SEK 3038 (€ 321) for the control group. Of this, healthcare providers’ costs were 24% in the intervention group, and 31% in the control group. The physical activity behaviour was significantly improved in both groups, but no differences were found between the groups. **Implications.** The largest share of the PAP programme costs was the participants’ costs. Significant improvements were shown in physical activity behaviour in both groups, but no differences were found between the intervention and control groups. Due to many non-completers, the potential for improvements of the motivating assignment with sedentary individuals in primary healthcare is obvious. Long-term follow-up can determine the sustainability of the results, and can be used in a future cost-effectiveness analysis.

Key Words: Costs, primary healthcare, Physical Activity on Prescription, RCT study

Almost 40% of the Swedish population was in 2006 insufficiently physically active, implying a substantial individual and societal health burden [1–7]. The estimated costs of inactivity were SEK 6000 million in 2002 in Sweden, including costs for production loss and healthcare [8]. Scientific evidence supports physical activity as a preventive and therapeutic measure of inactivity-related chronic conditions [1,2,9–12]. The “Physical Activity on Prescription” (PAP) programme aims to increase the physical activity level among sedentary adults, and has not been evaluated from a health-economic perspective looking at costs and consequences [11,13–16]. Several studies have estimated the cost-effectiveness of physical activity interventions, but the evidence for this is limited [17–20].

The aim of this paper was to analyse the costs and consequences of changing physical activity behaviour through the four-month PAP programme by comparing a high-intensity group (intervention) and low-intensity group (control).

Material and methods

The study was a randomized controlled trial with a four-month intervention with comparison between an intervention and a control group. Participant outcomes were evaluated before intervention and after four months. Written consent was obtained from all participants. The study protocol was approved by the Ethical Committee of Research at the University of Lund.

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(Received 15 July 2008; accepted 4 March 2009)

Costs and consequences of changing physical activity through the “Physical activity on Prescription” programme were studied in this RCT.

- Healthcare providers were responsible for 28% of the costs. Participants’ contribution – leisure time and travelling – was the largest share.
- The cost offset due to decreased inactivity is for both groups SEK 241 200 (€ 25 497) every year.
- Both intervention and control group showed significantly improved physical activity behaviour, but no differences were found between the groups.

Sample

Participants were recruited in primary healthcare from five municipalities in the South-East Healthcare District of Skåne Region, Sweden. Starting in February 2006 participants were recruited continuously until December 2007 as all those who received a prescription for physical activity from a physician, nurse, physiotherapist, occupational therapist, welfare officer, or nutritionist. Criteria for having a prescription were: being at least 18 years old, having a sedentary lifestyle and one or more of the following diseases: cardiovascular disease, type 2 diabetes, obesity, musculoskeletal pain and disorders, mental illness, or respiratory problems.

Intervention

The randomization process, using closed envelopes, was performed by the physiotherapists before the functional testing of the participants. Of the 525 participants randomised to either intervention or control group, 245 returned for the four-month assessment (Figure 1). The share of dropouts was for both groups 53%. Participants randomized to the intervention group had two supervised exercise sessions (45 to 60 minutes) in local sport clubs twice a week, two hours’ education in physical activity and individual motivational counselling performed by physiotherapists [21]. They were also instructed to exercise additionally once a week on their own with an activity lasting at least 30 minutes and at least on a moderate level. The control group obtained written information about the possibility to participate in supervised exercise once a week on a moderately intense level. Results were reported from a societal perspective [22].

Direct and indirect costs of physical inactivity

The estimated total costs of inactivity in Sweden on at the 2002 price level were between SEK 5820 and 6902 million [23]. In 2002 the Swedish population comprised 8 940 788 persons, and 6 999 878 were aged 18 years and older [24]. A prevalence of inactivity of 40% is equal to 2 799 951 persons, and means a cost of ~SEK 2265 per inactive person in the year of 2002. Transferred to the 2007 price level with the Swedish consumer price index, the cost is SEK 2412 per inactive person, and is a cost to society which a sufficient physically active person does not carry. Based on this calculation, we can estimate the indirect and direct costs of the inactive and active individuals respectively before and after participation in the PAP programme.

Main outcome measures

Three different methods were used to classify inactive vs active physical activity behaviour: *self-rated physical activity* with the IPAQ (International Physical Activity Questionnaire) short form, *self-reported physical activity level*, and a *functional test* with the Six-Minute Walk Test [25–27]. The IPAQ short form protocol assesses MET values of walking, moderate-intensity activities, and vigorous activities, and the average MET minutes was used in the analysis [28,29]. The second method, a single question of present extent of physical activity level, is based on the Transtheoretical Model, and the five levels were

Figure 1. Flow chart showing the prescription, randomization, and participation rates of the participants.

dichotomized into “active” and “inactive” for the further analysis [30]. The third method was the Six-Minute Walk Test; the participant walked as fast as possible during six minutes, and the distance (metres) covered was measured [31]. The outcomes also included an exercise diary to measure compliance.

Self-reported costs of the individual associated with the programme included exercise equipment purchased, travelling and travel time costs to and from exercise, and injuries due to the programme. Participants’ exercise and travel time cost is a mean value, calculated on the basis of the self-reported monthly gross salary and working hours. The exercise was performed in participants’ leisure time. The costs of the exercise in the different sport clubs in the area include staff time for exercise instructors and rent of facilities. Each participant visited the physiotherapist twice (for the intervention group an additional 20 minutes’ time for the motivational counselling), at baseline and at four months. For the non-completers the costs were based on the assumption that the majority of them dropped out within the first month, implying that the first month’s costs were same for both completers and non-completers.

Statistical analyses

Means and standard deviations as well as relative frequencies (%) were used to describe the sample. Differences at baseline between intervention and control groups were tested with t-tests with regard to age, BMI, and income, and with chi-squared tests with regard to sex, education, and health. Due to skew distributions the Mann–Whitney U-test was used for comparisons between intervention and control groups with regard to MET minutes and the Six-Minute Walk Test, while Wilcoxon’s signed rank test was used for comparisons between baseline and the four-month follow-up. Chi-squared tests were used for comparisons between intervention and control groups with regard to physical inactivity. McNemar’s test was used to test change in inactivity between baseline and four-month follow up. Statistical significance was set at $p < 0.05$.

Resource utilization and costs

In the following estimation of the costs within the PAP programme, we designated the value of resources

Table I. Baseline characteristics of the completers and non-completers (baseline only): Differences between intervention and control groups are tested.

	Completers (n = 245)			Non-completers (n = 280)		
	Intervention n = 125 ¹	Control n = 120 ²	p-value	Intervention n = 143 ³	Control n = 137 ⁴	p-value
Sex (%)			0.394 ⁵			0.123 ⁵
Women	70.4	66.7		63.6	72.3	
Men	29.6	33.3		36.4	27.7	
Age (years)			0.591 ⁶			0.679 ⁶
Mean (SD)	55.2 (12.5)	54.4 (13.2)		49.7 (13.9)	49.0 (13.5)	
Range	20–80	22–79		19–81	18–84	
BMI (kg/m ²)			0.635 ⁶			0.273 ⁶
Mean (SD)	31.5 (5.8)	31.8 (6.7)		32.4 (6.2)	33.3 (7.0)	
Range	18.0–50.0	19.8–55.0		19.4–60.7	19.7–55.6	
Income (SKr)			0.538 ⁶			
Mean (SD)	15 440 (7 027) ¹	14 805 (6 811) ²		n.a. ⁷	n.a. ⁷	
Range	0–40 300	0–37 500				
Education level (%)			0.852 ⁵			0.720 ⁵
Nine-year compulsory school	36.8	33.3		30.5	34.1	
2 years upper secondary school	20.0	25.0		21.3	18.5	
3 years upper secondary school	24.8	22.5		27.0	26.7	
University or college	18.4	19.2		21.3	20.7	
Health (%)			0.858 ⁵			0.299 ⁵
Poor	8.9	9.2		18.3	19.7	
Somewhat poor	50.0	50.8		51.4	51.8	
Good	31.5	30.0		21.8	25.5	
Very good	8.1	9.2		7.0	2.9	
Excellent	1.6	0.8		1.4	0	

Notes: ¹Due to missing values n varies between 90 and 125; ²due to missing values n varies between 91 and 120; ³due to missing values n varies between 139 and 143; ⁴due to missing values n varies between 134 and 137; ⁵chi-squared test, linear-by-linear association; ⁶t-test 1: n = 84, 2: n = 86; ⁷not available.

Table II. Intention-to-treat programme average costs (SEK) per patient for the four-month programme period for intervention group and control group.

Type of cost		Intervention n = 268	Control n = 257
Medical staff time		SEK	SEK
	Physiotherapist	586	506
	Health educator	73	0
Exercise			
	Activity instructor	560	288
	Rent	80	41
	Introduction	8	0
	Group leader	168	86
Participants' costs			
	Exercise time	1722	652
	Travel time costs	1310	449
	Exercise equipment	483	426
	Travel costs	1420	571
Costs of programme due to participants' injuries			
	Visits to hospital	0	0
	Visits to primary healthcare	7	7
	Costs of absence from work due to injury	58	12
Total costs		6475	3038

Note: The table shows the value of each cost component.

used rather than expenses. All costs are reported in Swedish Kronor (SEK).

Programme costs and quantities

Baseline analyses showed no significant differences between the groups in age, BMI, income, education level, or self-perceived health (Table I). The programme costs for the four-month intervention period were based on intention-to-treat estimations and are presented in Table II.

Among the participants, 82% used a car to travel to the exercise class, 18% walked or cycled, and 0 % used public transport. The average travel time of the participants was 22 minutes.

Three minor injuries due to participation in the programme were reported in the intervention group and four in the control group, respectively, and comprised knee or ankle sprains. They resulted in one visit to primary healthcare and absence from work for 10 and two days respectively. Due to the exercise diary, the mean number of exercise sessions for individuals who completed the four-month intervention was 31 (SD = 14, range = 2–48) for the intervention group (n = 91), and 12 (SD = 4, range = 2–23) for the control group (n = 79).

Costs of the PAP programme

The results show intention-to-treat programme costs for the four-month programme period of SEK 6475 for the intervention group and SEK 3038 for

the control group (see Table II). The largest share of the costs was the participant's cost, which included time spent on exercise, travel, and travel time to and from exercise. An on-treatment analysis shows programme costs for the intervention group of SEK 10 721 per patient and for the control group SEK 4822, which is an expected result considering the adherence rate and time of participation of the non-completers.

Table III shows the average change in physical activity of completers in intervention and control group. All three measures of physical activity were significantly improved in both groups at the four-month follow-up. After four months, 65% of the intervention group reported an active level of self-perceived physical activity, among the controls this was 53%. For both groups together, 12% of the already active individuals became inactive. The self-rated estimation of MET minutes per week showed more than twice as many MET minutes at the four-month follow-up compared with baseline in both groups. The Six-Minute Walk Test showed significant improvements for both groups. The improvements from baseline to four-month follow-up showed no significant differences between the two groups.

Table IV shows the costs for the share of inactive individuals, and as a consequence of the programme the cost offset every year due to reduced inactivity.

Discussion

The cost offset due to decreased inactivity as a consequence of participation in the PAP programme was for

Table III. Physical activity behaviour for intervention and control group at baseline and at four-month follow-up for participants who have completed the four-month programme: Differences between intervention and control group.

	Baseline	Four-month follow-up	p-values ¹
Intervention n = 125			
MET minutes per week ² median (q1–q3)	480 (6–1737)	1020 (264–2493)	0.003 ³
Inactivity (%)	76	28.8	< 0.001 ⁴
Six-Minute Walk Test ² (metres) median (q1–q3)	510 (457–550)	525 (489–580)	< 0.001 ³
Control n = 120			
MET minutes per week ² median (q1–q3)	524 (7–1382)	1200 (268–2940)	0.001 ³
Inactivity (%)	71.8	37.4	< 0.001 ⁴
Six-Minute Walk Test ² (metres) median (q1–q3)	500 (442–552)	521 (468–573)	< 0.001 ³
p-values ⁵			Differences between the groups regarding changes from baseline to four-month follow up (p-values ⁶)
MET minutes	0.733 ⁶	0.936 ⁶	0.681
Inactivity	0.231 ⁷	0.249 ⁷	0.053
Six-Minute Walk Test	0.444 ⁶	0.344 ⁶	0.180

Notes: ¹Comparisons between baseline and four-month follow-up; ²due to missing values n varies between 183 and 225; ³Wilcoxon's test; ⁴McNemar's test; ⁵comparisons between intervention and control group; ⁶Mann–Whitney U-test; ⁷chi-squared test.

both groups SEK 241 200 (€ 25 497) every year, and is a cost offset of SEK 984 (€ 104) for healthcare costs and value of lost production per individual and year based on the assumption that the individual maintains the physical activity level during a period of one year.

The healthcare provider was responsible for only a minor part of the total programme costs: 24% (intervention group) and 31% (control group), respectively. The main part of the programme costs was the participants' own costs – leisure time and travelling, together 76% for the intervention group and 69% for the control group. However, the programme costs do not cover the intangible benefits, i.e. consequences that are difficult to value such as the value of improved health.

The individuals' own cost should be considered when planning physical activity interventions for sedentary individuals with lifestyle-related diseases and the question of a subsidy from society must be raised. The individual's own contribution may also influence the motivation for participation, and be a reason for the number of non-completers.

The main strength of the present study is that it is a randomized controlled trial. We chose three different ways of measuring physical activity. The IPAQ short form has relevant questions and acceptable criterion validity and specificity to correctly classify people achieving current physical activity guidelines, and has measurement properties as good as other self-reports [25,26]. A low physical activity

Table IV. Costs of inactivity for intervention and control group at baseline and at four-month follow-up.

	Intervention n = 125 ¹		Control n = 120 ²		Total n = 245 ³	
	Baseline	Four-month Follow-up	Baseline	Four-month follow-up	Baseline	Four-month follow-up
Inactivity, n (%)	95 (76)	36 (28.8)	84 (71.8)	43 (37.4)	179 (80.5)	79 (33.8)
Costs of inactivity every year (SEK)	229 140	86 832	202 608	103 716	431 748	190 548
Estimated cost offset every year (SEK)		142 308		98 892		241 200

Notes: Inactivity was assessed using the self-reported question about present extent of physical activity. Estimated cost offset every year with a retained activity level. ¹Due to missing values n varies between 119 and 125; ² due to missing values n varies between 115 and 120; ³due to missing values n varies between 234 and 245.

level is defined as less than 600 MET minutes, a moderate level at least 600 MET minutes, and a high level at least 1500 MET minutes [29]. The participants in the present study show baseline values of around 500 MET minutes and at four months 1000–1200 MET minutes. Research shows different suggestions for significant improvements in the Six-Minute Walk Test: depending on intervention, gender, and patient category, reported mean changes of improvements in different studies have been between 33 and 170 metres [27,32]. In our results, the median increase was 15 and 21 metres respectively (both p -values < 0.001). The changes in physical activity are in agreement with earlier studies, showing improvements but no differences between intervention group and controls [33–35]. Our study showed that exercise twice a week, motivational counselling, and education compared with exercise only once a week does not make any difference in improving physical activity, and may be of note when designing programmes in primary healthcare. The completers may have stronger motivation for physical activity and exercise, and could have influenced the results of physical activity. The number of non-completers shows substantial potential for improvements in the implementation of the PAP programme with special regard to recruitment, motivational tasks, and environmental background.

A follow-up study should analyse the net resource utilization and costs vs net benefits of quality of life per se and cost per QALY respectively. Long-term follow-up of the results can be transformed into cost-effectiveness analyses, and should contain analyses of the cost offset in a long-term perspective and the sustainability of the improved physical activity level, and should consider quality of life.

The cost offset due to decreased inactivity is SEK 984 (€ 104) per individual and year, assuming a maintained physical activity level during one year. Both intervention and control group showed significantly improved physical activity behaviour, but no differences between the groups, a result that is of interest when planning health-promotion interventions in primary healthcare and for a future cost-effectiveness study.

Acknowledgements

This work was supported by Region Skåne, Sweden and the Skåne District Sport Federation. The authors would also like to thank the physiotherapists in primary healthcare in the South East Health Care District for their helpful participation. Opinions expressed in the article are the responsibility of the authors and do not reflect the views of the funding bodies.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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