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Does a physical activity referral scheme improve the physical activity among routine primary health care patients?

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KEYWORDS

Exercise, prescription, lifestyle, primary prevention, health promotion, health education, interpersonal relations, health service research

ABSTRACT

Physical activity referral (PAR) schemes or concepts occur in varying forms. Because few physical activity intervention studies have been carried out in routine health care settings, it is difficult to translate research findings into daily practice. The aim of this study was to analyze the effectiveness of a PAR scheme implemented in routine primary health care. The study did not include a control group and was based on the ordinary staff's work efforts and follow-up measures. During a 2-year period, 6300 PARs were issued. Effectiveness was measured by an increase in self-reported physical activity. Half of the patients reached reported increased physical activity both at 3 months (49%) and at 12 months (52%). The proportion of inactive patients decreased from 33% at baseline to 17% at 3 months and 20% at 12 months. The proportion of patients who were physically active on a regular basis increased from 22% at baseline to 33% at 3 months and 32% at 12 months. Neither the patient's age nor the profession of the prescriber was associated with differences in effectiveness. The patient's activity level at baseline, the type of physical activity as well as the reason for the prescription were associated with increased physical activity.

A physically active life promotes both physical and mental health and increases quality of life, well-being, and functional independence (U.S. Department of Health and Human Services, 1996; Department of Health and Ageing, 1999; The Swedish National Institute of Public Health & Yrkesföreningar för fysisk aktivitet, 2003; Department of Health, 2004; Pedersen & Saltin, 2006). Today's guidelines for physical activity state that adults should accumulate at least 30 min of moderate-intensity physical activity on at least 5 days a week (The Swedish National Institute of Public Health & Yrkesföreningar för fysisk aktivitet, 2003; Haskell et al., 2007). However, approximately 60% of the adult populations in the world today do not reach this recommended level (World Health Organisation, 2002). The health care system, particularly primary health care (PHC), is in a strategic position for promoting population health (The National Public Health Committe, 2000; Whitlock et al., 2002), as approximately 70% of the Swedish population consults PHC each year (The National Board of Health and Welfare, 2004). By broadening its base to encompass behavioral risk factors and behaviors, including physical inactivity, PHC could potentially prevent a considerable amount of mortality, morbidity, and disability before serious health problems develop (Babor et al., 2004).

PHC-based interventions aimed at increased physical activity of individuals, groups, and populations have gained interest during the last decade (Elley et al., 2003; Harrison et al., 2005a; Morgan, 2005; Sorensen et al., 2006). However, the literature shows mixed results on the effectiveness of different types of health care-based interventions to increase patients' levels of physical activity (Hillsdon et al., 2005; Morgan, 2005; National Institute for Health and Clinical Excellence, 2006; Sorensen et al., 2006; SBU, 2007). A Cochrane review (Hillsdon et al., 2005) found that professional advice and guidance with continued support can encourage people aged 16 years and older to become physically active. However, there was insufficient evidence to determine whether any particular type of physical activity was more likely to be adopted (e.g. walking, jogging, or running). The literature thus far is sparse concerning the effects of advice about different types of activity (i.e. everyday activities vs exercise and self-supervised programs vs organized exercise) (Hillsdon et al., 2005; Morgan, 2005; SBU, 2007). In addition, little is known about the long-term (12 months or more) effects of physical activity interventions in health care settings (Morgan, 2005; Sorensen et al., 2006).

One strategy that seems both acceptable and feasible in a PHC setting is written physical activity and/or exercise prescriptions, which have been launched in several countries (van Sluijs et al., 2004; Sorensen et al., 2006). Physical activity/exercise referral schemes have been shown to be effective in increasing patients' level of physical activity (Morgan, 2005; National Institute for Health and Clinical Excellence, 2006; Sorensen et al., 2006; SBU, 2007), particularly among individuals who are not sedentary but already slightly active and among older adults and those who are overweight but not obese (Morgan, 2005).

Despite promising findings on the effectiveness of physical activity and exercise interventions in PHC, there are a number of obstacles when translating research findings into routine practice. Few studies have been conducted in routine PHC settings (Eakin et al., 2004; Harrison et al., 2005a). Many studies are characterized by a great deal of heterogeneity in patient populations, interventions, and outcome measures (Morgan, 2005; Sorensen et al., 2006; Isaacs et al., 2007). Moreover, many studies are based on patients recruited from only one or two health care practices, which makes it difficult to generalize the findings to other contexts (Elley et al., 2003). Some findings are difficult to reproduce in a routine service setting, such as studies where the method of recruiting patients was via media advertising or telephone surveys (Morgan, 2005). The majority of studies describing the effect of physical activity promotion in health care settings have been undertaken in English-speaking countries, yielding results that are not necessarily applicable in other countries and health care systems (Isaacs et al., 2007). The interchangeable use of the terms "exercise" and "physical activity" also complicates the translation of findings (Dugdill et al., 2005). Today's recommendations of moderate-intensity physical activity constitute a shift from an exercise–fitness paradigm to a physical activity–health paradigm and it has recently been suggested in the United Kingdom that exercise referral schemes should be renamed physical activity referral (PAR) schemes to reflect this emphasis on promoting physical activity rather than just exercise (Dugdill et al., 2005).

A PAR scheme-styled model was introduced in Sweden in 2001 by the National Institute of Public Health as part of a national campaign called "Sweden on the move" (Kallings et al., 2007). The model was based on moderate-intensity physical activity, consisting of activities that were self-monitored and activities organized by community physical activity organizations. Few of these initiatives have been evaluated. The aim of this study was to assess the effectiveness of a PAR scheme implemented in routine practice at 42 PHC units in a Swedish county. Effectiveness was evaluated in terms of the changes in physical activity in relation to patient gender, age, and physical activity level at baseline, type of physical activity, reasons for PARs (i.e. diagnosis), and the profession of the practitioner.

Materials and methods

Study setting

The study was conducted during 2004 and 2005 in the county of Östergötland, Sweden. This county of 416 000 inhabitants is the fourth largest region in Sweden and includes two large cities (>120 000 inhabitants) and 11 smaller, more rural municipalities. The County Council encompasses three hospitals and 42 PHC units, of which four were privately owned and 38 were managed by the County Council, during the study period.

All PHC units in Östergötland have a specified catchment area and/or a listed population (ranging from 3700 to 20 700 patients/unit). The PHC units usually include different health care professionals, i.e. physicians, nurses, physiotherapists, occupational therapist, dieticians, and behavioral scientists. The number of staff in the PHC units ranged from 10 to 80, with the number of physicians ranging from 2 to 12 and nurses from 8 to 35 (as of January 2005). At the end of 2003, 80% of the PHC units in the region worked with PARs to some extent and had established a supportive community-based structure to assist patients to gain access to various local activities.

The Östergötland PAR scheme

The PAR scheme in Östergötland was built on structures developed over a number of years, including a widely used prescription form, local networks, and collaboration with physical activity organizations in the local community. The single-paged prescription form included patient background characteristics (including current activity level), prescriber characteristics, and information about the reason for the prescription and the selected activity. Each local

PAR network or PHC unit in the region established collaborations with eligible physical activity organizations (i.e. local public health and sports organizations). As a result of this collaboration, PAR coordinators/contact persons were appointed both at the PHC units and at the physical activity organizations. Patients paid the normal fee to the organization for the activities they attended (e.g. €5 for one aerobic session, €50 for aerobic in one semester, or €300–500 a year for weight and circuit training in a private gym). In addition to structured facility-based activities, PARs included lifestyle activities such as walking.

Persons eligible to receive PARs were all ordinary PHC patients whom the regular staff believed would benefit from increased physical activity. The patients either had a sedentary lifestyle or a diagnosis, that indicated that increased physical activity could be beneficial, e.g. high blood pressure, diabetes, and musculo-skeletal disorders. The patient was provided with a written PAR and a copy was kept in the patient's medical record. If the activity prescribed was facility based, a copy was also sent to the PAR coordinator in the selected physical activity organization, who then contacted the patient by telephone or letter. The physical activity organization also made a phone call after 5 weeks to check whether the patient had attended the suggested group activity. The purpose of the phone call was threefold: (1) to guide and motivate potential drop-out patients to participate in other activities; (2) to give other patients/participants the opportunity to attend instead of drop-out patients; (3) and to gather information about drop-outs for feedback to the PHC units. Patients prescribed lifestyle activities did not receive this phone call.

Data collection

The PAR coordinators in each PHC unit collected data for patients during 2004 and 2005. All prescription forms were registered in a Microsoft Excel-based spreadsheet, which was sent to the first author three times a year.

Follow-up measures were performed by PHC personnel after 3 and 12 months. To make the follow-up procedure easier for the PHC units' PAR coordinator, three optional methods were used to collect the data: telephone interview, postal questionnaire, and/or during the patient's normal return visit. At the 3-month follow-up, 73% of the patients were contacted by telephone, 17% by postal questionnaire, and 10% answered the follow-up questions during a return visit. The 12-month follow-up showed a similar pattern, with 68% contacted by telephone, 21% by postal questionnaire, and 11% during a return visit.

As shown in Fig. 1, 37 (in 2004) and 38 (in 2005) of the 42 PHCs in the region participated. Of the five units that did not participate in 2004, two public PHC did not work with PARs and three private PHC units declined to participate due to lack of time. In 2005, one further public PHC unit initiated its PAR work and was included in the study. A 3-month follow-up was conducted by 36 units in 2004 and by 37 in 2005, and a 12-month follow-up was conducted among patients issued physical activity on prescription in 2004 by 27 of the 37 units that included patients in 2004. The main reasons for non-participation in follow-ups were lack of time and shortage of staff.

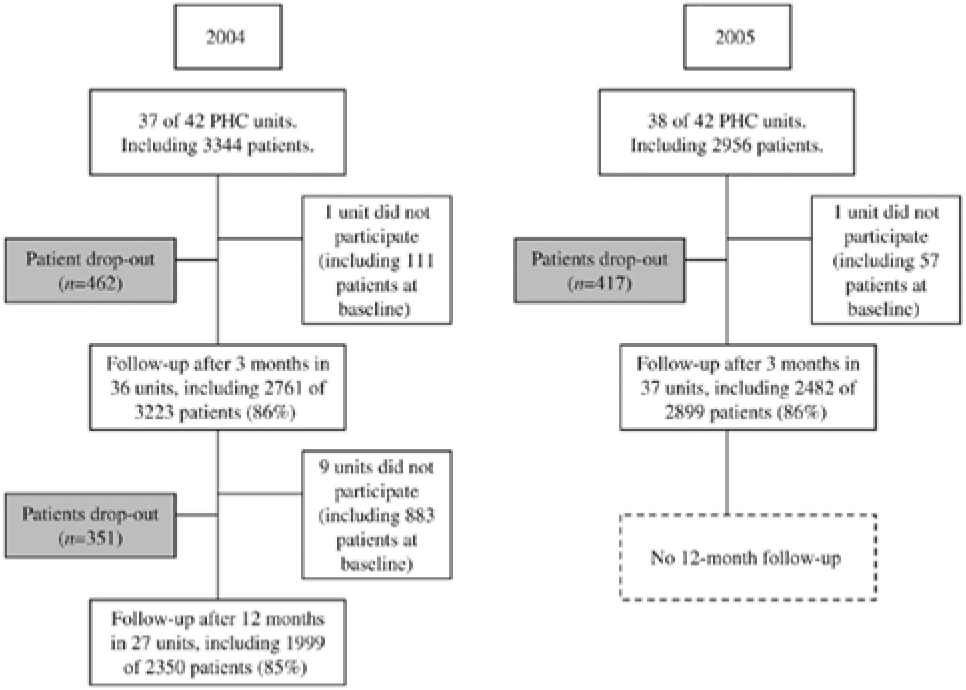

Fig. 1. Data collection flow chart including PHC units and patient dropout.

Measurements

Baseline data for each patient, including self-reported physical activity level, age, sex, and prescriber's profession, were collected from the prescription form. Effectiveness was measured as a change in self-reported physical activity between baseline and follow-up. Instead of using a longer and validated physical activity instrument, the patients were asked to state the number of days with "at least a total of 30 min of physical activity that made you warm, e.g. brisk walking, gardening, heavy housework, bicycling and/or swimming." This question was based on the current Swedish physical activity recommendation (The Swedish National Institute of Public Health & Yrkesföreningar för fysisk aktivitet, 2003). Physical activity in the previous week ("7-day recall") and physical activity in a normal week ("normal week") were assessed. The 7-day recall question was used as the primary outcome measure. It is complemented by the normal week question when comparing baseline characteristics (Table 1) and describing changes in patients' activity level from baseline (Table 2). Patients' self-reported physical activity was classified into four groups: (1) regularly active (those who reported 5–7 days of 30 min of moderately intense physical activity); (2) moderately active (3–4 days); (3) somewhat active (1–2 days); and (4) inactive (0 days).

Reasons for receiving physical activity on prescription were registered on the form by selecting one or more of seven pre-defined options including a sedentary lifestyle. The disease-specific options were musculo-skeletal disorders, overweight (body mass index >25), diabetes, high blood pressure, high blood cholesterol, and mental ill-health. "Other PAR reasons" covers any other reason for receiving PARs. Patients issued PARs for more than one reason were categorized as a "combination of reasons/diagnosis." The form also included data on the recommended type of activity. The activities could either be a lifestyle activity (free-living or home-based activities such as walking) or a structured facility-based activity provided by a local physical activity organization. Some patients were issued both lifestyle activities and structured activities; these cases were classified as a combination category.

Table 1. Patient characteristics at baseline, for all patients and the 3 and 12 months follow-up groups

	All patients at baseline (*n*=6300)	**3-month follow-up group at baseline (*n*=5243)**	***P*-value***	**12-month follow-up group at baseline (*n*=1999)**	***P*-value****
Mean age, years (%)	54 (14.6)	55 (14.5)	0.408	54 (14.3)	0.836
Sex, percent females	67	67	0.836	66	0.767
Activity level at baseline (7-day recall)			0.959		<0.001
0 days	33	33		37	
1–2 days	29	29		30	
3–4 days	16	16		14	
5–7 days	22	22		19	
Activity level at baseline (normal week)			0.959		<0.001
0 days	27	27		31	
1–2 days	30	29		30	
3–4 days	19	19		18	
5–7 days	24	25		21	
Referred activity type			0.636		<0.001
Lifestyle activity	40	39		38	
Facility-based activity	41	41		45	
Combination of lifestyle and facility-based activity	19	20		17	
Referral practitioner			0.893		<0.001
Physician	35	36		41	
Nurse	30	30		31	
Physiotherapist	18	18		14	
Other	17	17		14	
PARs reason			0.891		<0.001
Sedentary	3	3		6	
Musculoskeletal	22	22		19	
Overweight	9	8		10	
Diabetes	10	9		11	
High blood pressure	7	7		8	
Cholesterol	1	1		1	
Mental health	3	3		3	
Other *PARs* reasons	3	3		2	
Combination of reasons/diagnosis	42	44		40	

* Test of the distribution between the total group at baseline and the 3-month follow-up group at baseline for each of the characteristics.
** Test of the distribution between the total group at baseline and the 12-month follow-up group at baseline for each of the characteristics.

Statistical analyses

Continuous variables are presented as the mean value and standard deviation; categorical variables are presented as percentages. Differences between proportions were analyzed by the chi-square test. Fisher's exact test was used when appropriate.

Univariate and multiple logistic regression analyses were applied to identify possible associations between an individual's self-reported increase in physical activity (not including patients already categorized as regularly active) from baseline to follow-up, and his/her sex, age, activity level at baseline, referred activity type, referral practitioner, and reason for being issued physical activity. Separate analyses were performed for the 3- and 12-month follow-ups. In the two final multiple models, all possible two- and three-way interaction terms were tested.

Statistical significance was set at $P<0.05$ and the confidence intervals were 95%. SPSS (release 15.0) software was used for all analyses.

Table 2. Change in patient-reported physical activity level from baseline to 3 and 12 months follow-up

	Activity level at 3-month follow-up					**Activity level at 12-month follow-up**				
	n	**0 days (%)**	**1–2 days (%)**	**3–4 days (%)**	**5–7 days (%)**	***n***	**0 days (%)**	**1–2 days (%)**	**3–4 days (%)**	**5–7 days (%)**
Activity level at baseline (7-day recall)	4282					1652				
0 days	1393	29	30	19	22	598	29	28	22	21
1–2 days	1220	14	37	27	22	497	16	29	29	26
3–4 days	717	9	21	36	34	240	14	25	28	33
5–7 days	952	8	11	19	62	317	10	15	16	59
Activity level at baseline (normal week)	4322					1652				
0 days	1398	22	29	23	26	500	25	29	24	22
1–2 days	1231	6	34	35	25	490	11	29	34	26
3–4 days	719	3	14	43	40	312	8	22	37	33
5–7 days	974	4	9	15	71	352	7	9	17	67

Results

Patient characteristics

The study population consisted of 6300 patients. One PHC unit did not participate, leaving 6122 patients available for the 3-month follow-up. The 12-month follow-up involved only patients included in 2004; 2350 patients were available at follow-up. The response rate was 86% (5243/6122) at the 3-month follow-up and 85% (1999/2350) at the 12-month follow-up. There were no statistically significant differences between patients at baseline and the patients in the 3-month follow-up regarding any of the characteristics presented in Table 1. However, patients at the 12-month follow-up differed from baseline by being less active at baseline ($P<0.001$), more commonly issued to facility-based activities ($P<0.001$), more frequently issued prescriptions by physicians ($P<0.001$), more often had a sedentary lifestyle as a PAR reason, and less often received PARs due to musculo-skeletal problems ($P<0.001$).

Change in activity level at 3 and 12 months

One-third of all patients were categorized as inactive at baseline (Table 1). Approximately one in five (22%) met the recommendation of being regularly physically active. In the 3-month follow-up, the proportion of inactive patients had declined from 33% to 17% and at the 12-month follow-up to 20% (Fig. 2). The number of regularly active patients had increased at 3 months from 22% to 33% and to 32% at 12 months. Differences in the distribution of activity level between baseline and follow-up were statistically significant (*P*>0.001).

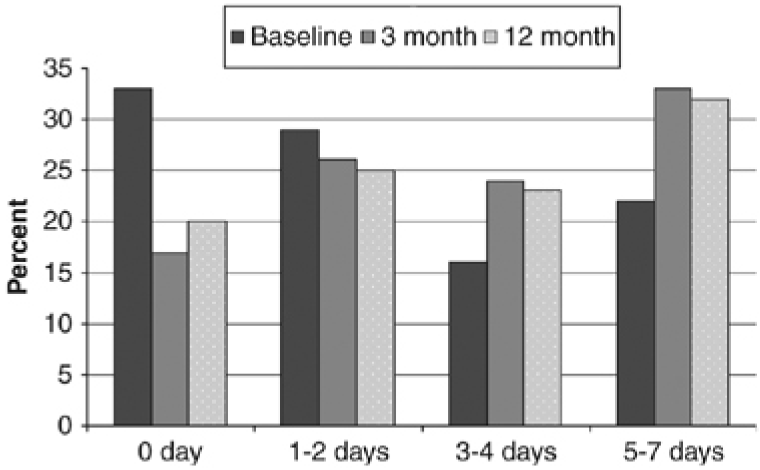

Fig. 2. Physical activity level as percent at baseline (*n*=5477), 3 months (*n*=4705), and 12 months (*n*=1808).

Table 2 shows the patients' change in activity level after 3 and 12 months in relation to their activity level at baseline. Nearly one-third (29%) of the patients reporting 0 days of 30 min activity a week (7-day recall) were still inactive at the 3-month follow-up. However, 30% increased their physical activity to the 1–2 days a week level and 19% increased to the 3–4 days a week level; almost one in four (22%) reached the level of regular physical activity. A similar pattern was found for the same question for a normal week at the 12-month follow-up. Fewer patients reported inactivity and more were regularly active when referring to physical activity in a normal week compared with their report of physical activity in the last 7 days.

There were no differences in the change in self-reported physical activity between baseline and follow-up between sexes or between age groups (Table 3). Fewer of the patients issued facility-based activities reported an increase in activity rates than patients issued lifestyle activities or a combination of the two. Patients issued a prescription by a physician or a nurse increased their physical activity to a greater extent than patients issued by a physiotherapist.

The univariate logistic regression analyses (Table 4) showed that an increase in physical activity was statistically significant in relation to a low activity level at baseline, being issued by a nurse or a physician (compared with a physiotherapist), and being diagnosed with diabetes or high blood pressure (compared with musculo-skeletal diagnoses). Patients who were issued facility-based activity showed a lower increase in physical activity than those issued lifestyle activities at the 3-month follow-up. At the 12-month follow-up, only low activity level at baseline showed a significant association with increased physical activity. An increase in physical activity in the least active group was three times more common than in those who were active three to four times a week. However, a tendency toward increased activity was seen among persons issued PARs by a physician and, again, a decrease in activity was observed for persons who were issued facility-based activities.

Table 3. Percentage of patients who changed self-reported physical activity after 3 and 12 months

	3-month follow-up					**12-month follow-up**				
	n	**Increase (%)**	**No change (%)**	**Decrease (%)**	***P*-value**	***n***	**Increase (%)**	**No change (%)**	**Decrease (%)**	***P*-value**
Total	4282	49	29	22		1652	52	25	23	
Sex					0.121					0.265
Female	2862	49	29	23		1097	51	25	24	
Male	1419	49	31	20		554	54	26	21	
Age (groups)	4281				0.764	1652				0.494
0–17	16	63	13	25		7	14	29	57	
18–29	210	50	28	22		70	57	24	19	
30–44	828	49	30	21		349	52	26	22	
45–64	2143	49	30	21		837	51	25	24	
>65	1084	48	29	23		389	53	24	23	
Activity type	4242				<0.001	1646				<0.033
Lifestyle activity	1736	53	26	21		631	55	23	22	
Facility-based activity	1665	44	34	22		740	49	28	23	
Combination of lifestyle and facility-based activity	841	49	29	22		275	53	20	27	
Referral practitioner	4204				<0.001	1651				<0.006
Physician	1479	50	29	20		669	55	25	20	
Nurse	1264	52	30	18		488	52	26	22	
Physiotherapist	713	42	29	29		245	47	20	33	
Other	748	48	28	24		249	51	27	22	
PARs reason	4282				<0.040	1652				<0.0488
Sedentary	141	48	35	17		89	57	25	18	
Musculoskeletal	870	45	30	25		327	53	25	22	
Overweight	361	45	34	21		163	50	32	18	
Diabetes	370	55	26	19		139	55	18	27	
High blood pressure	305	54	29	17		133	55	20	25	
Cholesterol	29	48	31	21		18	56	17	28	
Mental health	136	52	29	19		49	51	25	24	
Other *PARs* reasons	142	45	28	27		36	58	17	25	
Combination of reasons/diagnosis	1928	49	29	22		698	50	26	24	

The final multiple logistic regression model (Table 5) for the 3-month follow-up, apart from all the variables of the univariate model, included an interaction term between activity level at baseline and referral practitioner. Age and sex were both included, although they had a *P*-value <0.05. At the 12-month follow-up, an increase in physical activity was associated with a low level of physical activity at baseline and with activity type.

Table 4. Odds ratio for univariate logistic regression analyses of increase in physical activity at 3-months (n=3679) and 12-months (n=1468)

	3-months			**12-months**		
	***P*-value**	**Odds ratio**	**95% CI**	***P*-value**	**Odds ratio**	**95% CI**
Sex	0.862			0.589		
Female		1.01	0.88–1.17		0.94	0.74–1.18
Male		1.00			1.00	
Age (groups)	0.010			0.182		
0–17		2.93	0.64–13.46		0.17	0.02–1.62
18–29		0.76	0.55–1.05		0.87	0.49–1.53
30–44		0.72	0.59–0.89		0.71	0.51–0.99
45–64		0.91	0.76–1.08		0.79	0.60–1.06
>65		1.00			1.00	
Activity level at baseline (7-day recall)	<0.001			<0.001		
0 days		3.10	2.57–3.74		3.85	2.81–5.27
1–2 days		1.77	1.47–2.13		2.51	1.83–3.44
3–4 days		1.00			1.00	
Activity type	<0.001			0.071		
Lifestyle activity		1.18	0.97–1.43		1.02	0.73–1.42
Facility-based activity		0.74	0.61–0.89		0.78	0.56–1.08
Combination of lifestyle and facility-based activity		1.00			1.00	
Referral practitioner	<0.001			0.060		
Physician		1.49	1.21–1.83		1.55	1.11–2.15
Nurse		1.59	1.25–1.91		1.27	0.90–1.78
Other		1.34	1.05–1.70		1.45	0.97–2.18
Physiotherapist		1.00			1.00	
PARs reason	<0.001			0.252		
Sedentary		0.90	0.60–1.33		1.02	0.60–1.75
Overweight		0.87	0.66–1.15		0.76	0.50–1.17
Diabetes		1.87	1.37–2.55		1.22	0.75–1.99
High blood pressure		1.49	1.09–2.04		1.07	0.66–1.73
Cholesterol		1.08	0.43–2.67		1.35	0.41–4.44
Mental health		1.22	0.80–1.86		0.73	0.37–1.44
Other *PARs* reasons		1.06	0.69–1.61		1.47	0.60–3.63
Combination of reasons/diagnosis		1.01	0.84–1.22		0.76	0.56–1.04
Musculoskeletal		1.00			1.00	

Discussion

This study was conducted in order to analyze the effectiveness of a routine PHC-based PAR scheme. The actual scheme was built on structures developed over a number of years, including a standardized prescription form, local networks with PAR coordinators, and collaboration with physical activity organizations. The findings show that the PARs were effective in increasing the self-reported physical activity level both in the short term (3 months) and in the long term (12 months). Half of the patients increased their physical activity, with the largest increase found among those who were least active at baseline, which indicates that the intervention was effective in increasing physical activity in those who gained the most.

Table 5. Odds ratio for the multiple logistic regression model of increase in physical activity at 3 months (n=3679) and 12 months (n=1468)

	3-months			**12-months**		
	***P*-value**	**Odds ratio**	**95% CI**	***P*-value**	**Odds ratio**	**95% CI**
Sex	0.054					
Female		1.17	1.00–1.37			
Male		1.00				
Age (groups)	0.076					
0–17		3.29	0.68–15.96			
18–29		0.83	0.58–1.18			
30–44		0.78	0.62–0.97			
45–64		0.95	0.79–1.15			
>65		1.00				
Activity level at baseline (7-day recall)	<0.001			<0.001		
0 days		4.58	2.86–7.35		3.97	2.89–5.46
1–2 days		1.49	0.96–2.31		2.52	1.83–3.46
3–4 days		1.00			1.00	
Activity type	<0.001			0.015		
Lifestyle activity		1.07	0.87–1.32		0.97	0.69–1.38
Facility-based activity		0.66	0.54–0.82		0.70	0.50–0.98
Combination of lifestyle and facility-based activity		1.00			1.00	
Referral practitioner	<0.312					
Physician		1.48	0.94–2.33			
Nurse		1.31	0.82–2.08			
Other		1.52	0.92–2.51			
Physiotherapist		1.00				
PARs reason	<0.001					
Sedentary		0.63	0.41–0.96			
Overweight		0.75	0.54–1.04			
Diabetes		1.36	0.94–1.98			
High blood pressure		1.03	0.72–1.49			
Cholesterol		0.76	0.28–2.01			
Mental health		1.00	0.63–1.58			
Other *PARs* reasons		0.78	0.48–1.25			
Combination of reasons/diagnosis		0.71	0.56–0.89			
Musculoskeletal		1.00				
Interaction between referral practitioner and activity level at baseline	0.021					
Physician × active 0 days		0.63	0.35–1.21			
Physician × active 1–2 days		1.35	0.77–2.37			
Nurse × active 0 days		0.72	0.39–1.30			
Nurse × active 1–2 days		1.49	0.85–2.61			
Other × active 0 days		0.81	0.42–1.56			
Other × active 1–2 days		0.91	0.49–1.71			
Physiotherapist × 3–4 days		1.00				

This was an observational study in a real-life setting, which is essential for analyzing the effectiveness of methods shown to perform well in randomized control trials (Black, 1996). However, because this was an observational study, the lack of a control group makes it difficult to determine the exact effect of the intervention. Some of the changes observed in the patients' physical activity levels could be due to natural causes, as many people move between being sedentary and being active at different times in their lives (Sherwood &

Jeffery, 2000). Other possible reasons for increased physical activity could be the Hawthorne effect, regression to the mean effect, or measurement effects (van Sluijs et al., 2006). However, the effectiveness levels attained in our observational study are largely comparable to the results achieved in intervention groups in randomized-controlled trials (RCT) based on similar concepts. Improvements in the proportion of patients reaching a certain level of physical activity seen in such studies vary between 15% and 25%, and approximately 5–15% in the control group (Elley et al., 2003; Harrison et al., 2005b).

A Swedish observational study, including 13 PHC from the north to the south of Sweden, showed that physical activity on prescription (including both facility- and home-based activity) significantly changed the patient's (*n*=298) physical activity level at 6 months (Kallings et al., 2007). Those results, gathered from a comparable context, are similar to ours. However, the present study included a much larger proportion of patients, had a lower drop-out rate and a longer follow-up period, and therefore to an even greater extent confirms that PAR is effective in increasing the physical activity levels of patients.

The large number of patients included in our study made it possible to conduct subgroup analyses in order to gain an improved understanding of the variables crucial to achieving increased physical activity. We found small differences in adherence/effectiveness between practitioners in our study and these differences disappeared in the multiple analyses. Significant differences were maintained for "PAR reason," in favor of diagnosis like diabetes and high blood pressure having the highest number of patients increasing their physical activity. These diagnoses typically require the patients to have regular contact with their health care provider and perhaps the interpersonal communication between the patients and the health care provider is advantageous for adherence to a physical activity prescription. The largest increase in physical activity was found among those participating in lifestyle activities. A possible explanation may be that these activities are easier to carry out and thereby better suited for PARs than structured facility-based activities. On the other hand, different activities suit different people, and an increase in 44% of the patients prescribed structured activities is still a satisfying result. It seems that PARs work well in different subgroups, as patients of both sexes and in different age groups increased their physical activity.

Few studies until now have performed sub-group analyses like this (Elley et al., 2003; National Institute for Health and Clinical Excellence, 2006). One of these was a qualitative and quantitative combined study, including 980 patients, mainly referred by general practitioners (GPs) (76%), nurses (19%), and cardiac rehabilitation nurses (5%). The highest adherence rates were found among patients referred by cardiac rehabilitation nurses (57%), followed by practice nurses (45%) and GPs (32%). Other findings were higher adherence among males, increased age, and twice the level of adherence among patients with certain referral conditions (e.g. myocardial infarction) than other conditions (e.g. mental illness). The reasons for these differences were not fully explored, but some practice nurses felt that interpersonal communication between them and the participants was often better than between the participant and the GP (Dugdill et al., 2005).

These and our results underline the complexity of our understanding of PARs and interpreting the results. More research, both qualitative and quantitative, is therefore needed to establish how different background characteristics influence the effectiveness of PARs.

Methodological problems often appear when measuring physical activity and there seems to be a consensus on this; the design features vary considerably between studies. This is seen as the greatest weakness of studies in the field (Morgan, 2005). However, self-reported levels of physical activity collected from simple patient questionnaires have been found to be both practical and valid for epidemiological studies compared with more objective measures such as motion sensors, heart rate monitoring, and doubly labelled water (Elley et al., 2003). The main reasons for using a simple question in our study, where patients were asked to state the number of days/week with at least 30 min of physical activity, were solely practical. Meeting a certain physical activity target has been used by others as a follow-up measure (Harrison et al., 2005b; Kallings et al., 2007) instead of using more advanced and sophisticated methods. Aside from the limitation of not having been validity and reliability tested, the question used in this trial might also have been too general and simple. The most obvious limitation is the lack of possibility to see changes in intensity of the activity. If a person was walking three times a week at baseline, and then changed activity to a more intensive activity like running three times a week, they will still be categorized in the "no change group." It might have been possible to gather this information with a more sophisticated questionnaire. Another limitation is that follow-up was measured in three different ways. The differences between postal questionnaire, telephone follow-up, and follow-up during the return visit could have influenced the results.

Other methodological problems in our study could be the risk of recall or social desirability bias, which often occurs when using self-reported physical activity as an outcome measure (Elley et al., 2003). Furthermore, there were no data available on how many patients were asked initially about their willingness to be issued PARs and how many did not give consent. This voluntary aspect, as a result of the interaction between the patients and their practitioner, might have resulted in recruitment of patients more willing to change their activity level. On the other hand, according to the patients' activity levels, this intervention targeted a population less active (33% inactive patients at baseline) than the general population, as approximately 14% of the adult population in Sweden are categorized as sedentary/inactive (The Swedish National Institute of Public Health, 2005).

Apart from the large sample size and low internal dropout, the major strength of our study is the real-world approach. The patients were ordinary PHC patients, recruited by ordinary staff in regular meetings in their local PHC unit. There were no extra PHC personnel or research personnel involved. The only differences from ordinary routine care were the 3- and 12-month follow-ups, made by the PHC coordinator, and an economic compensation given to the PHC units to cover the follow-up effort. However, questions must be raised about the generalizability of these results, when implemented in another context (settings, country, health-care systems, etc.).

Perspectives

Patients often cite health care providers as a primary source for information and advice on preventive health issues (Johansson et al., 2005). Health care providers and their staff play a unique and important role in motivating and assisting patients to achieve healthy behavioral change. The health care system is a natural setting for interventions to improve health behaviors for many individuals as repeated contacts typically occur over a number of years (Whitlock et al., 2002). As health care systems differ both within and between countries, the results are not necessarily applicable and easy to translate between different settings; it is therefore important to develop and evaluate interventions in real contexts. The findings from the present study show that this PAR was successful in increasing self-reported physical activity among ordinary patients in routine PHC. The concept reached 6300 patients (approximately 1.5%) of the population in the region over a 2-year period. One-third of the patients were inactive at baseline. As every increase in physical activity is important for health, a health gain is possible for all those who really increase their physical activity at 12 months, regardless of whether they reach the present, recommended level of physical activity.

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