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"Is Intensity Decisive?" Changes in Levels of Self-efficacy, Stages of Change and Physical Activity for Two Different Forms of Prescribed Exercise

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This study explores the long-term treatment effect on levels of self efficacy, stages of change and physical activity of prescribed exercise (EoP) for two different groups: a treatment group (TG) which includes patients with hypertension and a prevention group (PG). This study is an evaluation of best practice. Analyses were conducted at baseline and after 4, 10 and 16 months. The TG received group-based training and motivational counseling. The PG received motivational counseling only. No significant change in self-efficacy across time and no differences between groups were found. A significantly greater probability of reporting high level of stages of change was observed for the TG. No differences were observed between the groups across time. A significant increase in physical activity level across time was found, but no differences between the groups were found. EoP improves participants' level of physical activity and stages of change, regardless of the intensity of the intervention.

Keywords: exercise prescription, adherence, transtheoretical model, motivation, exercise, motivational interviewing

Introduction

Prescribed exercise in many countries is used to facilitate physical activity in sedentary populations with or at risk of developing lifestyle diseases (Elley et al., 2003; Harrison, Roberts & Elton, 2005; Sorensen et al., 2007). Physical

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activity is known to positively affect individuals with lifestyle diseases, such as hypertension, type 2 diabetes, metabolic syndrome and cardiovascular diseases. However, few studies have examined the long-term effect of prescribed exercise and findings concerning the long-term effect (more than six months) of prescribed exercise are sparse (Lawton et al., 2008). Results from the few studies that have investigated the long-term effects of prescribed exercise are inconsistent, (Fleming & Godwin, 2008; Hillsdon et al., 2005; Sorensen, Skovgaard & Puggaard, 2006) with some researchers reporting a moderately positive effect (Elley et al., 2003; Sorensen et al., 2007; Roessler & Ibsen, 2009) and others reporting no effect on physical activity level at all (Fleming & Godwin, 2008; Sorensen et al., 2008). Since long-term behaviour change is the aim of prescribed exercise interventions, it is necessary to determine if factors other than the intervention itself could influence adherence. A study of prescribed exercise in Denmark emphasises the necessity of behaviour change and adherence (Sorensen et al., 2008).

In health and sport science, researchers have adopted different theories and models from general, social, educational and health psychology, and tested and applied them in the context of physical activity behaviour, primarily with an individual focus (Sutton, 2004). In essence, theories of exercise behaviour can be divided into five categories: beliefs and attitudes (e.g., Theory of Planned Behaviour (Ajzen, 1991), perceptions of competence (e.g., the Self-efficacy theory (Bandura, 1986), perceptions of control (e.g., the Self-determination theory (Deci & Ryan, 1991), stage-based theories (e.g., the Transtheoretical model (Prochaska & Diclemente, 1983) and hybrid approaches (e.g., the Health Action Process Approach (Schwarzer, 1992). These five categories can be understood as heuristic and overlapping (Biddle & Nigg, 2000). From these five categories, numerous theoretical and primarily individual models have been developed to guide planning and implementation of interventions. Models from all categories have been used often in research on exercise behaviour, but especially the Self-efficacy theory and the Transtheoretical model have been used extensively (Biddle & Nigg, 2000; Biddle et al., 2007). These empirically supported models have shown to be applicable when creating interventions that help people move from one stage to the next. They have offered practitioners the possibility of designing programmes and treatments that are more efficient and effective than interventions in which all individuals are offered identical treatment (Biddle et al., 2007).

The Self-efficacy theory (Bandura, 1986) has been extensively used in research studying individual motivation in exercise psychology (Biddle & Nigg, 2000). The construct of self-efficacy has been documented as one of the most consistent predictors of physical activity behaviour. Self-efficacy is defined by Bandura as:

> People's judgements of their capabilities to organise and execute courses of action required to attain designated types of performances. It is concerned not with the skills one possesses, but rather with judgements of what one can do with whatever skills one possesses (Bandura, 1986, p. 391).

The Self-efficacy theory states that confidence in one's ability to conduct a given task or behaviour is strongly related to one's ability to perform that behaviour (Bandura, 1986). Self-efficacy beliefs are closely bound to the accomplishment of behaviour such as physical activity and exercise (Sallis et al., 1986). The Transtheoretical Model was developed by Prochaska and Diclemente (Prochaska & Diclemente, 1983) to describe different stages involved in changing and maintaining behaviour. The model encompasses stages of change and self-efficacy as well as processes of change and decisional balance, but only stages of change and self-efficacy are addressed in this paper. The model suggests individuals change behaviour through the stages of Precontemplation (no intention to change behaviour), Contemplation (intention to change behaviour), Preparation (preparing to change behaviour), Action (currently changing behaviour) and Maintenance (sustaining behaviour change). The progression through stages is thought to be dynamic, with individuals progressing through stages at various rates, with some individuals getting stuck at certain stages and others relapsing to previous stages (Prochaska & Diclemente, 1983; Markus & Simkin, 1994). The amount of progress individuals make as a result of an intervention is a result of the stage they were in when the intervention was initiated (Jones et al., 2005).

Research indicates that positive development in relation to these individual psychological parameters (self-efficacy and stages of change) from interventions could be a predictor of long-term adherence to physical activity (Jones et al., 2005; Biddle & Mutrie, 2007). Interestingly, knowledge concerning the long-term influence of prescribed exercise interventions on these parameters is sparse (Jones et al., 2005), thereby not showing the possible influence of changes in levels of self-efficacy and stages of change on physical activity. Drawing on extensive measures of levels of self-efficacy, stages of change and physical activity obtained at four time points over a period of 16 months (at baseline (0 months), at the end of the intervention (4 months), 6 months after intervention (10 months) and 12 months after intervention (16 months), this study aims to extend previous research conducted on the long-term success of prescribed exercise by doing an evaluation of best practice. Specifically, it is hypothesised that: 1) participation in prescribed exercise intervention leads to changes in levels of self-efficacy, stages of change and physical activity, and 2) participants' changes in levels of self-efficacy, stages of change and physical activity vary as a function of intensity of the intervention offered.

Materials and methods

Exercise on Prescription in Funen County and Frederiksberg Municipality. A prescribed exercise intervention, called Exercise on Prescription (EoP), was used in Denmark, to initiate physical activity among sedentary individuals with or at risk of developing lifestyle diseases (Bredahl, Puggaard & Roessler, 2008). The EoP intervention was organised and implemented by and in Funen County and Frederiksberg Municipality as a practical municipal treatment and prevention effort. The EoP intervention was composed of two central parts which apart from a high-intense general EoP treatment scheme (TG) also included a lower-intense prevention scheme called "Motivational counselling" (PG).

Inclusion criteria. The TG was directed towards individuals with specific medically controlled lifestyle diseases. The General practitioners (GP) could refer sedentary individuals with medically controlled and diagnosed lifestyle diseases known to be affected by physical activity (hypertension, type 2 diabetes, metabolic syndrome, and cardiovascular diseases) (Pedersen, 2005; Pedersen, 2003; Sundhedsstyrelsen, 2004; Sundhedsstyrelsen, 2006). Physical inactivity was defined as being active less than 30 minutes a day (Sundhedsstyrelsen, 2006). Duration of the individual lifestyle disease was not decisive for inclusion to the intervention and therefore not assessed. The individuals should be motivated to change lifestyle and should believe to be able to improve health from an increased level of physical activity. Motivation for physical activity was estimated by the GP through personal conversation during the consultation and through the principles of motivational counselling (Miller & Rollnick, 2002). Motivation for physical activity was used as an inclusion criterion to better assure compliance to the intervention. The individuals should also be willing to pay DKK 750 (€ 100) for the intervention (Sorensen et al., 2007). If the patient met the inclusion criteria, the GP prescribed TG. After consultation with the GP and after referral to the TG, about half of the patients who received a prescription from their GP to join TG contacted the physiotherapist or the exercise specialist to make an initial appointment to join the TG.

The PG was directed towards citizens at risk of developing lifestyle diseases (hypertension, type 2 diabetes, metabolic syndrome and cardiovascular diseases) due to physical inactivity. At the GP the participant could be advised to join PG by their general practitioner if they were physically inactive and at risk of developing a lifestyle disease susceptible to physical activity. Furthermore, the participants could be enrolled by their own initiative by directly contacting the physiotherapist or exercise specialist. The physiotherapist or exercise specialist decided if the participant met the inclusion criteria (e.g. the criteria of physical inactivity were assessed by personal conversation) Information about the PG

was available at pharmacies, local media and health organisations (e.g. Diabetes Society, Heart Society, and The Danish Cancer Society). The participants in the PG contacted and entered the intervention by their own initiative. Due to the participants own effort and initiative to participate their level of motivation were expected to be high and therefore not assessed systematically. Since the PG participants did not receive any expensive organised training as a part of PG they were not charged with an enrolment fee.

Training and motivational counselling. The participants in the TG followed a supervised group-based training (with 8-12 other TG participants) which was carried out by physiotherapists or exercise specialists. During the first two months, two weekly 1-hour training sessions were completed. During the final two months, one weekly training session was completed, supplemented by one weekly unassisted training session. In all, this included 24 assisted- and mandatory training sessions and 8 unassisted training sessions. The group-based training sessions involved elements of aerobic exercise (e.g. Nordic Walking, Aerobic), strength training, stretching and games. The training sessions focused primarily on improving aerobic capacity (more than 50% of heart rate reserve for a minimum of 20 minutes). In general, the training complied with the guidelines for minimal intensity for improving aerobic capacity in a physically inactive population (Sorensen et al., 2007; ACSM, 1998). In a parallel study of EoP in Vejle and Ribe counties, a sub-sample was analysed concerning heart rate during a training session (Sorensen et al., 2007). For the sample of participants, the results indicated that the intensity was on average 76% of maximal heart rate, which is above the minimum training intensity for improving aerobic capacity in a physically inactive population (ACSM, 1998). A more precise description of the training sessions is not possible, since the planning, organisation and execution were controlled by the physiotherapist or exercise specialist and could vary between training sessions. An objective of the intervention was to introduce the participants to different forms of physical activity instead of just one specific training programme to incite and inspire to physical activity after intervention. Participants were introduced to activities in the local area during the 4 months intervention period (figure 1) (Sorensen et al., 2007).

In addition, the participants received motivational counselling by the physiotherapist or exercise specialist (Miller & Rollnick, 2002) at baseline and after four months. Subsequently they received voluntary phone based and/or personal motivational counselling after ten and sixteen months. The motivational counselling was based upon the principles of motivational interviewing (Miller & Rollnick, 2002), incorporating the Transtheoretical Model as well (Prochaska & Diclemente, 1983). The aim of the motivational counselling was to increase daily physical activity by influencing central elements described by the Transtheoretical

Model (stages of change, self-efficacy, decisional balance and processes of change) in cooperation with the participants (Miller & Rollnick, 2002). Furthermore, the counselling concerned the discussion of possible strategies for overcoming barriers towards being physically active. The physiotherapists and exercise specialists had no prior experience conducting motivational interviews, but they were all trained in authorised educational courses selected by the county and municipality. The motivational counselling sessions had duration of approximately 45 to 60 minutes. In general, the counselling was used for making a plan of action and a physical activity schedule. The participants were responsible for carrying out the schedule.

In the PG, participants received only motivational counselling and not structured training. The counselling was carried out in the same way as in the TG, following the same guidelines. Likewise, for the TG, the motivational counselling was carried out by physiotherapists or exercise specialists educated along the same guidelines. After initial motivational counselling, the participants in the PG were expected to carry out unassisted training or participate in training in existing local sports clubs. Information of the intensity of the training done unassisted or at local sports clubs was not collected. Information on general level of physical activity was gathered, as in the TG, at the above-mentioned four time points. Participants in the PG received personal motivational counselling at baseline and after four months. Subsequently they received voluntary phone based and/or personal motivational counselling after ten and sixteen months. The participant was responsible for carrying out the schedule (figure 1).

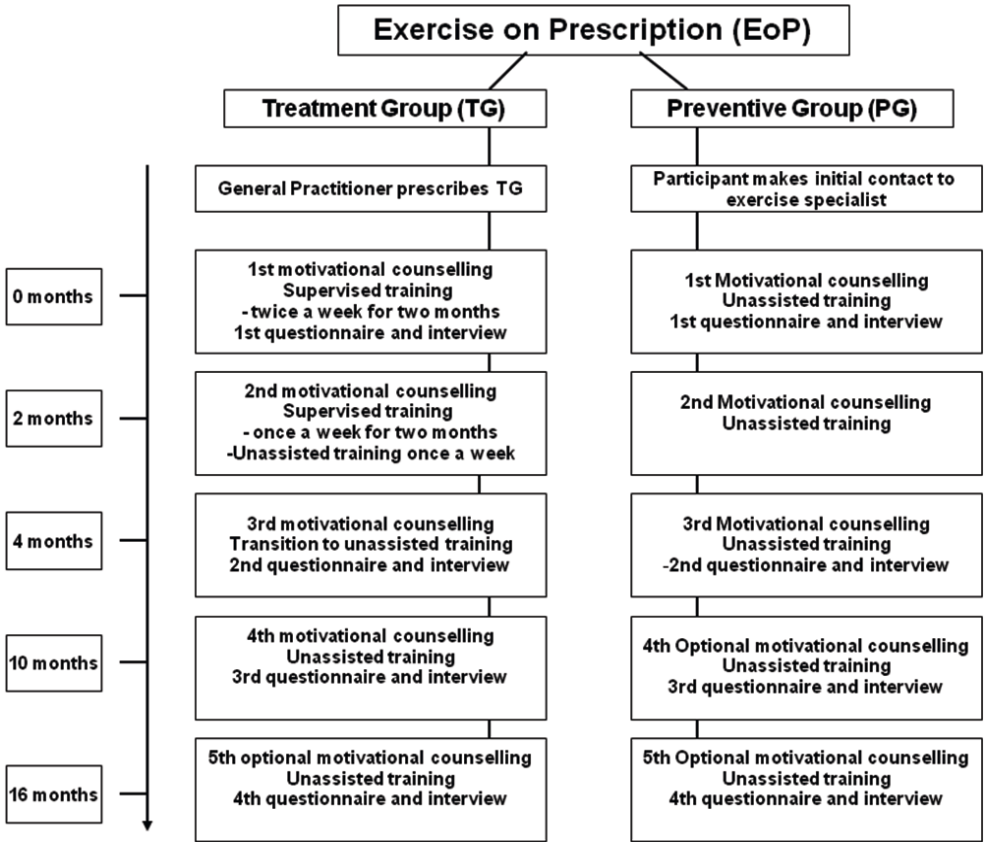

Figure 1. Schematic overview of Exercise on Prescription in the County of Funen and Municipality of Frederiksberg. Schematic overview of the two groups: The Treatment Group (TG) and the Preventive Group (PG) in Exercise on Prescription. In TG the general practitioner (GP) prescribes Exercise on Prescription for sedentary individuals with medically controlled conditions. The individual takes the prescription to a physiotherapist or an Exercise Specialist working with Exercise on Prescription. The participants complete four months of supervised training and motivational counselling. Questionnaires and interviewing are completed after 0, 4, 10 and 16 months. In PG the participant contacts the physiotherapist or Exercise Specialist working with Exercise on Prescription. The participants are included to PG if they are sedentary and in risk of developing lifestyle diseases that can be positively influenced by physical activity. The participants carry out unassisted exercise and receive motivational counselling at 0, 4, 10 and 16 month. Questionnaires and interviewing are completed after 0, 4, 10 and 16 months.

Study design

The EoP intervention were organised, controlled and conducted by the county and the municipality as a practical municipal treatment and prevention effort. Inclusion criteria, inclusion procedures, the organisation of the intervention, the training of the participants, the motivational counselling and contact with the participants were planned, controlled and initiated by the county and the municipality.

This study was conducted as an evaluation of best practice and not as a randomised controlled trial. Best practice can be understood as the process of planning and organising the most appropriate intervention for the setting and population rather than as a gold standard or a packaged intervention (Driever, 2002; Green, 2001). The purpose of the study was to provide information to improve the interventions and provide feedback to professionals concerning the strengths and weaknesses of the intervention (Modeste, 1996). The analyses might also provide valuable information regarding the ongoing development of EoP schemes in general. The study design offers the possibility to inspire to new randomised controlled studies and moreover supplement already existing knowledge.

As a consequence of the study design, data on the incidence of different lifestyle diseases were not collected. Furthermore, none of the employed health professionals working with the TG or the PG could be blinded to which group the participants belonged and what training and counselling they had been a participated in. Moreover, none of the participants could be blinded to which intervention they were a part of.

Outcome measures. All measures were assessed by self-administrated questionnaires distributed by the physiotherapist and/or the exercise specialist at baseline and after four months. At ten and sixteen months, questionnaires were administered by the first author. All questionnaires were returned by mail in postage-paid envelopes. Data on level of self-efficacy, stages of change, and physical activity are presented in the current study.

Participants provided information on socio-demographic characteristics including gender, age, and income. Participants indicated their annual income on a 10-point scale where 0 indicated zero to 13.300 €, and 10 indicated 99.900 € and above.

Analyses were conducted with 213 participants with lifestyle diseases (TG), 63% female participation and mean age 56±12 and 124 participants at risk of developing lifestyle diseases (PG), 78% female participation and mean age 51±14.

Self-efficacy in relation to barriers towards physical activity was assessed using a questionnaire developed by Marcus and colleagues (Benisovich et al., 1998; Marcus et al., 1992) to measure self-efficacy in relation to physical activity. Stages of change in relation to physical activity was assessed using a questionnaire by Benisovich and colleagues (Benisovich et al., 1998; Nigg et al., 1999; Norman et al., 1998) which provides a summarised score for each of the six ranked categories of stages of change. Measures of stages of changed were categorised into a low and high measure. The four lowest ranking stages (precontemplation non-believers, precontemplation believers, contemplation or preparation) were classified as low stages of change, and the highest ranking stages of change (action or maintenance) were classified as high stages of change (Nigg, 2002).

Level of physical activity was assessed by using a questionnaire (Norman et al., 2001), allowing estimation of energy expenditure measured as metabolic equivalents (MET) (kcal/kg×h) (Ainsworth et al., 2000).

Statistical analyses. The primary objective was to evaluate change in individual level of self-efficacy, stages of change, and physical activity. Thus, we used linear growth curve analyses (LGC) – a special case of multilevel linear regression (Rabe-Hesketh & Skrondahl, 2008). The advantage of LGC analysis is that it allows the estimation of individual change as a function of time. Using standard notation (Rabe-Hesketh & Skrondahl, 2008), the partial variability terms are named intercept-variance (σ2a1), slope variance (σ2a2) and residual variance (σ2a3), respectively. For analyses including stages of change as the outcome measure, we used random-effect logistic regression, though restricted to models that included a random intercept only.

In the present analyses, we used the measurement of time as a simple linear measurement with measurement points equally spaced. Thus, time was coded 0 for 'baseline', 1 for '4 months', 2 for '10 months' and 3 for '16 months', and time was entered as a categorical variable in all LGC models.

Taxonomy of four growth curve models was fitted to facilitate systematic evaluation of the fixed effects and the variance components (Singer & Willet, 2003). In model 1, the overall rate of change of the outcome of interest (physical activity, self-efficacy and stages of change) was estimated by fitting a model that included time and a random term for the intercept and slope. In model 2, the measure that classified participants as TG or PG was added. In model 3, an interaction-term of group by time was included to facilitate estimation of a possible difference in rate of change in, e.g., level of physical activity (or self-efficacy) for participants classified as TG versus participants classified as PG. A logistic individual growth curve model was fitted for the analysis of individual stages of change

(a dichotomous outcome). The possible influence of gender (female), age at baseline and, income at baseline on individual rate of change was evaluated in model 4.

Comparisons of socio-demographic and basic physiological factors between the TG and the PG at baseline were assessed by independent t-tests and Chi-Square tests (McKnight et al., 2007). After analyses of hypotheses by LGC analysis, baseline differences in socio-demographic factors between the TG and the PG were introduced into the LGC analyses as covariates at each time point.

Missing data due to drop-out or insufficient completion of questionnaires were imputed by "last observation carried forward" (mcKnight et al., 2007; Shao & Zhong, 2003; Verbeke & Molenberghs, 2000). Outcome values from participants who completed the study were compared to outcome values from both participants and drop-outs at the long-term assessment (16 months) to determine if inclusion of drop-out data statistically significantly influenced the outcome.

All analyses were performed using STATA, version 10.0. A p-value less than 0.05 were considered statistically significant.

Trial registration. The Danish Data Protection Agency registration number is: 2005-41-5248. ClinicalTrials.gov ID is: NCT00594360. Due to the non-biological and non-treatment perspective of the study, no registration to the local ethics committee was needed.

Results

Some attrition was observed. The number of individuals who had been a part of the TG fell from 213 at baseline to 117 at 16 months and the number of individuals in the PG fell from 124 at baseline to 64 at 16 months, indicating drop-out rates of 45% and 49%, respectively.

Details of the sample characteristics and number of observations at different time points are provided in table 1. Participants in the PG group was statistically significantly younger ($M = 50.8$, $s = 14.1$) than participants in the TG group ($M = 55.8$, $s = 11.9$), $t(335) = -3.45$, $p < .05$. At baseline, the proportion of females in the TG group (63.4%) was statistically significantly lower, compared to the proportion of females in the PG group (78.0%). $\chi 2(1, n = 336) = 7.8$, $p < .05$. No statistical significant difference was observed in BMI between participants in the TG group ($M = 31.7$, $s = 5.7$) and the PG group ($M = 31.7$, $s = 6.7$), $t(329) = -0.19$, $p > .05$. Participants in the TG group reported a higher annual income compared to participants in the PG group $\chi 2(10, n = 217) = 23.2$, $p < .05$. Measures of gender (female), age and income were included as covariates in the multivariate analysis.

Table 1. Number of observations and attrition from baseline to 16 month

Variables	n	Percent
Female	231	68.7
Mean age (SD)	337	54.5 (12.9)
Median income at baseline (IQR)[a]	217	6 (5)
Baseline		
TG	213	63.2
PG	124	36.8
Level of physical activity	267	100
Self-efficacy	314	100
High level of stages of change	302	31.1
4 month		
TG	154	62.9
PG	91	37.1
Level of physical activity	179	67.0[b]
Self-efficacy	228	72.6[c]
High level of stages of change	223	56.9
10 month		
TG	129	64.2
PG	72	35.8
Level of physical activity	160	59.9
Self-efficacy	183	56.9
High level of stages of change	181	56.9
16 month		
TG	117	64.6
PG	64	35.3
Level of physical activity	122	45.7
Sel-efficacy	162	51.6
High level of stages of change	159	45.3

Note: Standard deviation in parentheses.
a IQR = interquartile range
b Percentage relative to number of observations of level of physical activity at baseline
c Percentage relative to number of observations of self-efficacy at baseline

Self-efficacy. In the analyses including self-efficacy as the outcome measure, model 1 revealed a mean level of self-efficacy at baseline of 56.12 (SE = 0.99), p = 0.00, but no statistically significantly change in self-efficacy across the subsequent measurement points in time was observed (table 2). The initial level of self-efficacy varied considerably between participants across the measured points in time (p = 0.00). Although, we failed to observe a change in level of self-efficacy across the measurement points in time, we introduced the measure identifying the two groups of participants in model 2 to investigate possible differences. Results of the estimates for the grouping variable were observed to be statistically significant (p = 0.02), suggesting that the initial level of self-efficacy at baseline was higher for the TG compared to the PG. In model 3, we investigated possible differences concerning changes in level of self-efficacy for the two groups at each measurement point in time. When introducing time to the analyses no statistically significant differences were observed between the groups at any point in time. Baseline covariates were introduced into the analysis (model 4), but no statistically significant differences between model 3 and model 4 were noted. The marginal change (12.6%) in the variance component estimates between model 4 and 1 suggests, that neither the grouping variable nor the covariates serve as important predictors of initial level or change in level of self-efficacy over time. Hence, we conclude that results in model 4 were not affected by baseline differences between the TG and the PG. Analysis including imputed values of missing cases revealed similar results.

Table 2. Fixed Effects and Variance – Covariance Estimates of Change in Self-Efficacy among the TG and the PG.

	Model 1	Model 2	Model 3[c]	Model 4
Variables	B (SE)	B (SE)	B (SE)	B (SE)
		Fixed effects		
Baseline	56.12* (0.99)	53.48* (1.50)	54.19* (1.62)	57.61* (5.39)
4 month	-0.15 (1.16)	-0.16 (1.18)	-1.54 (1.90)	-1.92 (2.24)
10 month	-1.50 (1.32)	-1.51 (1.32)	-3.72 (2.16)	-5.12* (2.54)
16 month	-1.84 (1.48)	-1.85 (1.48)	-2.51 (2.43)	-3.92 (2.87)
TG at baseline		4.15* (1.79)	3.01 (2.04)	1.62 (2.38)
TG at 4 month			2.21 (2.41)	3.66 (2.87)
TG at 10 month			3.53 (2.73)	3.66 (2.87)
TG at 16 month			1.05 (3.06)	3.05 (3.65)
Covariates				

Female				-2.64 (2.09)
Age at baseline				-0.07 (0.08)
Income at baseline				0.75* (0.32)
Random parameters				
Intercept variance σ^2_{a1}	152.92* (23.04)	49.03* (22.84)	149.05* (22.80)	116.33* (24.68)
Slope variance σ^2_{a2}	0.33 (0.17)	0.33 (1.17)	0.33 (1.17)	0.31 (0.21)
Residual variance σ^2_{a3}	160.01* (11.58)	160.24* (11.61)	159.65* (11.57)	157.07* (13.88)

Note: Standard errors are in parentheses.

σ^2_{a1} Intercept variance represents random deviation from the population mean in initial level of self-efficacy

σ^2_{a2} Slope variance represents random deviation from the population mean of change in self-efficacy

σ^2_{a3} Residual variance represents a summary of individual random deviation between the estimated individual trajectory and the true individual score

* $p < .05$.

Stages of change. In model 1, the odds ratio of high level of stages of change was statistically significantly higher across all measurement points in time, compared to baseline (table 3). The initial individual level of stages of change varied significantly between participants 95% CI [1.10 - 1.83], as did the dependency of the responses for the same individual 95% CI [0.20 - 1.21]. Thus, the statistically significant estimate of intra-individual variance suggests that measures of stages of change across time are rather unstable and that other time-varying factors may explain this variability. In model 2, the grouping variable was added. A significant higher probability of reporting high levels of stages of change at baseline was observed among members of the TG, compared to members of the PG, 95% CI [1.09 - 2.89]. Differences in the probability of reporting high levels of stages of change between the two groups of participants across all measurements point in time were investigated in model 3 and no statistically significant differences were observed. Estimates of the variance components also remained unchanged. Income at baseline was observed as a significant predictor of stages of change in model 4, but inclusion of this covariate essentially did not affect estimates of individual change in the outcome. Inclusion of income however, attenuated the variance component and probably accounted for the significant variation of initial level of stages of change and residual variation observed in the previous models.

Table 3. Odds ratio and 95% Confidence Interval of Change in Stages of Change among TG and PG Participants.

	Model 1	Model 2	Model 3	Model 4
Variables		Odds Ratio [95% CI]		
		Fixed effects		
Baseline	ref	ref	ref	ref
	4.31*	4.31*	4.81*	3.46*
4 month	[2.72 – 6.82]	[2.72 – 6.82]	[2.31– 9.97]	[1.49 – 8.06]
	4.26*	4.26*	3.77*	2.96*
10 month	[2.62 – 6.92]	[2.62 – 6.92]	[1.75 - 8.15]	[1.21 - 7.25]
	2.15*	2.15*	2.07	2.77*
16 month	[1.32 - 3.50]	[1.32 - 3.50]	[0.92 - 4.66]	[1.10 – 6.97]
		1.78*	1.77	1.49
TG at baseline		[1.09 - 2.89]	[0.89 - 3.72]	[0.66 – 3.33]
			0.84	0.97
TG at 4 month			[0.34 - 2.07]	0.33 - 2.83]
			1.22	1.62
TG at 10 month			[0.44 – 3.21]	[0.51 - 5.11]
			1.05	0.56
TG at 16 month			[0.38 - 2.89]	[0.17 - 1.82]
Covariates				
				1.20
Female				[0.67 – 2.15]
				1.01
Age at baseline				[0.99 – 1.04]
				1.10*
Income at baseline				[1.00 – 1.20]
		Random parameters		
	1.42*	1.39*	1.40*	1.25
Intercept variance σ^2_{a1}	[1.10 - 1.83]	[1.08 - 1.80]	[1.08 - 1.81]	[0.92 - 1.70]
	0.70*	0.67*	0.67*	0.45
Residual variance σ^2_{a3}	[0.20 - 1.21]	[0.15 – 1.18]	[0.16 - 1.19]	[-0.15 - 1.07]

Note: σ^2_{a1} Intercept variance represents random deviation from the population mean in initial level of self-efficacy; σ^2_{a3} Residual variance represents a summary of individual random deviation between the estimated individual trajectory and the true individual score
* $p < .05$.

Level of physical activity. In analysis of individual rate of change in physical activity, a significant mean level of physical activity at baseline of ($p = 0.00$) was observed, as were a steady increase across the subsequent measurement points in time (table 4). The initial level of physical activity varied considerably between participants across the measured points in time ($p = 0.00$). Residual variance was statistically significant ($p = 0.00$). The observed variability in rate of change showed a trend towards significance but was statistical non-significant. However, because the grouping variable was our focal predictor, we decided to include the term in subsequent models to explore the full spectrum of its effect. Model 2 included the same predictors as model 1, and the measure identifying the two groups of participants. Results of model 2 were essentially the same as model 1, with estimates of the grouping variable being non-significant ($p = 0.41$), suggesting that the initial level of physical activity at baseline was not different for the two groups of participants. The estimates of the intercept and slope variance, respectively, remained unchanged. In model 3, we investigated possible differences in changes in level of physical activity for the two groups, specifically for each measurement point in time. Results suggested no statistically significant differences in changes in level of physical activity between the groups at any point in time. The intercept and slope variance remained unchanged. Thus, the statistically significant variance of initial level of physical activity and marginally significant change in level of physical activity suggest that there must be other unknown characteristics of the participants that could explain the observed variability. Baseline covariates were introduced into the analysis (model 4), but no statistically significant differences between model 3 and model 4 in comparisons of the TG and the PG were found. Analysis including imputed values of missing cases revealed similar results.

Table 4. Fixed Effects and Variance – Covariance Estimates of Change in Level of Physical Activity among TG and the PG

	Model 1	Model 2	Model 3	Model 4
Variables	B (SE)	B (SE)	B (SE)	B (SE)
		Fixed effects		
Baseline	38.70* (0.28)	38.44* (0.43)	38.53* (0.48)	37.12* (1.63)
4 month	0.99* (0.26)	0.99* (0.26)	0.81 (0.43)	0.79 (0.48)
10 month	1.33* (0.29)	1.33* (0.29)	1.25* (0.46)	1.17* (0.53)
16 month	1.27* (0.34)	1.26* (0.34)	0.78 (0.57)	1.22 (0.67)
TG at baseline		0.43 (0.52)	0.27 (0.57)	0.45 (0.68)
TG at 4 month			0.28 (0.55)	0.51 (0.62)
TG at 10 month			0.11 (0.59)	0.31 (0.68)
TG at 16 month			0.73 (0.70)	-0.02 (0.83)
Covariates				
Female				0.69 (0.61)
Age at baseline				0.00 (0.02)
Income at baseline				0.03 (0.09)
		Random parameters		
Intercept variance σ^2_{a1}	16.05* (1.86)	16.05* (1.86)	15.97* (1.83)	15.10* (2.06)
Slope variance σ^2_{a2}	0.46 (0.24)	0.46 (0.24)	0.43 (0.23)	0.50 (0.27)
Residual variance σ^2_{a3}	5.87* (0.51)	5.87* (0.51)	5.88* (0.51)	5.12* (0.54)

Note: Standard errors are in parentheses. σ^2_{a1} Intercept variance represents random deviation from the population mean in initial level of self-efficacy; σ^2_{a2} Slope variance represents random deviation from the population mean of change in self-efficacy; σ^2_{a3} Residual variance represents a summary of individual random deviation between the estimated individual trajectory and the true individual score

* $p < .05$.

Discussion

The results of the present analyses indicate an increase in stages of change and level of physical activity. Changes in self-efficacy were not observed. Changes in these features were however, indistinguishable between participants in the TG and PG.

The results of the analyses also suggest that the variability of the measures of initial level and rate of change across time remained the same. The baseline differences regarding gender, age, and income were found not to be influential, suggesting that other factors that characterise the participants may be better predictors of the changes in the outcome. An important difference between the participants is the manifest diagnosis among the members of the TG. Obviously, chronic diseases may limit participants physically and mentally and hamper their efforts to fully benefit from the intervention. Future research should investigate this issue in more detail.

Self-efficacy. The level of self-efficacy did not change in either group throughout the study period. This is in contradiction with research showing a positive development in level of self-efficacy with participation in an intervention (Jones et al., 2005) and an association between an increased level of physical activity (physical activity results) and increased level of self-efficacy (Marcus et al., 1992; Cardinal & Kosma, 2004; Edmunds, Ntoumanis & Duda, 2008; McAuley, 1993). Consistent with the arguments offered by Jones et al. (2005), participation throughout the programme reflects individual motivation regardless of group characteristics (TG or PG). Thus, due to the design of the intervention and the different inclusion criteria between groups, it is possible that these factors resulted in a sample that was homogeneous with regard to level of self-efficacy.

Since the current results show a significant development in level of physical activity over time, the impact of the intervention on self-efficacy level could be debated. One explanation for the lack of development in levels of self-efficacy in the TG could possibly be the transition from the structured intervention programme to unassisted training after 4 months. This transition from one organisational form to another could be described as a key element of the TG intervention. The TG informants cross from a structured programme, where others are responsible, to unassisted physical activity of their own responsibility. This change of responsibility could affect the TG members' level of self-efficacy to such a degree that development in self-efficacy level fails to happen. This indicates that the motivational counselling and the intervention are not effective enough to process this fundamental issue. This is not relevant for the PG since no organisational change happens. This also indicates that the TG intervention in spite of a more intense intervention is not more effective in influencing levels of self-efficacy and thereby levels of physical activity. This is supported by literature showing no difference in level of self-efficacy between control group members and intervention group members (van Sluijs et al., 2005).

It could be hypothesised that deciding to be a part of an intervention illustrates interest and motivation and therefore possibly a high level of self-efficacy towards barriers. This is consistent with literature showing motivation or interest as an important incentive for being physically active (Biddle & Mutrie, 2007) and literature indicating that level of self-efficacy is a significant predictor of exercise behaviour in the early and middle stages of an exercise program (McAuley et al., 1994). Therefore, it was initially hypothesised that the PG would score higher in level of self-efficacy at baseline than the TG because they volunteered to be a part of the intervention, instead of being referred by their GPs. The results do not support this; the initial level of self-efficacy concerning barriers was the same for both groups. Major barriers (e.g., motivation or having an illness and injury) are described in the literature as important in the initial change towards physical activity (Sallis & Hovell, 1990). Acknowledging this, the participants in the TG could possibly have greater barriers towards being physically active due to their lifestyle diseases and as a consequence of this a lower level of self-efficacy. Unfortunately, specific information about the participants' lifestyle diseases was not available. A thorough analysis including this information could possibly provide knowledge indicating whether certain lifestyle diseases are more hampering for the development of lifestyle diseases than others. This information could possibly have improved the effort of practitioners and organisers to influence levels of self-efficacy. Another explanation for self-efficacy at baseline not being different between the groups could be that the TG participants enter a structured intervention where others are responsible for their physical activity. This could possibly explain a higher baseline self-efficacy than initially expected.

One could question whether the results of the analyses can be trusted due to the comparison of two different groups receiving two different interventions. Since baseline differences between the groups, introduced as covariates in analyses, did not statistically significantly influence the results, the results could be trusted to the extent the strengths of the design permit. Possible bias could be found in areas other than gender, age, BMI, education and income. Future analyses, for example, could include information on health status and lifestyle diseases at baseline as potential factors biasing results. Another issue that should be addressed is the high degree of drop-outs in both groups, and how this might bias the finding concerning levels of self-efficacy; however, since drop-out analyses did not influence the results significantly, factors other than drop-outs may be more important in explaining the lack of development in levels of self-efficacy.

Stages of change. As hypothesised, the probability of a high level of stage of change increased in both the TG and the PG over time. Thus, the findings are consistent with observations reported by Kallings (2008) (Kallings et al.,

2008) and with literature indicating progression in level of stages of change to be related to progression in intervention and physical activity (Biddle & Mutrie, 2007). Moreover, these results are supported by literature indicating no differences in stage of change between volunteers and recruited participants to health promotion programs (Prochaska & Velicer, 1997). However, a study debates the applicability when measuring mild exercise, which in most cases is current in the TG and PG (Schumann et al., 2003).

The PG group participants were expected to have progressed further in their initial stages of change than were the TG members since participation was voluntary. In contrast to the hypothesis, the participants in both groups exhibited about the same initial level of stages of change. The lack of differences in initial level of stages of change between the TG and PG may be explained by the dichotomisation of the measure of stages of change into high and low levels. Due to the high drop-out rate, finely graded differences between the groups, with regard to variations in distinct stages, are possibly blurred by the reduction of six stages into two [38]. Nonetheless, the results still suggest that the participants in both groups moved progressively through stages. However, the lack of a statistically significantly difference in probability of high stages of change between the groups suggests that the distinction between counselling with accompanying training (TG) and counselling only (PG) did not contribute to the observed overall increase in probability of a high level of stages of change.

One might question whether the results of the analyses of levels of stages of change can be trusted due to comparing two different groups receiving two different interventions. But since baseline differences did not significantly influence the results of the LGC analyses when introduced as covariates, the results are reliable and relevant in the discussion of the effect of the TG and the PG. Possible bias blurring differences between the groups should be found in areas other than gender, age, BMI, education and income. Furthermore, the high drop-out rate did not influence the results significantly, thereby indicating that factors other than drop-outs may be more important in explaining the lack of development in levels of self-efficacy.

Level of physical activity. A small positive and statistically significant increase in level of physical activity across the subsequent measurement points in time for both groups was seen. This small yet significant effect on physical activity level in both groups is supported by other studies of prescribed exercise showing only moderately positive or no effect on physical activity level (Hillsdon et al., 2005; Sorensen, Skovgaard & Puggaard, 2006; Roessler & Ibsen, 2009; Dugdill, Graham & McNair, 2005).

It was expected that the level of physical activity reported by the TG (receiving training as well as counselling) would be higher compared to the PG (receiving counselling only) e.g. due to the systematised intensity of the training done by the TG. Surprisingly, no statistically significant differences were observed between participants in the TG and the PG throughout the study period. These results are contradicted by studies showing greater effects of prescribed exercise interventions for treatment groups than controls (Aittasalo et al., 2006, but also at least partly in accord with at least one other study reporting a lack of difference in maximal oxygen uptake (VO2max) between EoP-participants in Denmark (Sorensen et al., 2008). The effect of counselling on physical activity level is supported by an earlier study [1]. The moderate yet significant increase in level of physical activity in both groups is in line with observations from other studies of prescribed exercise (Hillsdon et al., 2005; Sorensen, Skovgaard & Puggaard, 2006; Roessler & Ibsen, 2009).

Intra-individual variance remained statistically significantly different from zero throughout the entire study period which suggests that the measures of the outcome were unstable. We did not investigate the source of this instability and acknowledge that it may be difficult to disentangle the various sources due to a trial that was non-randomised. We do not know if the instability is caused by measurement techniques or true variability in response patterns among the participants or a combination of both. Additional analysis including imputed values for missing cases revealed similar results suggesting that the instability of measures of physical activity was not associated with missing cases. Baseline differences between the TG and the PG group introduced as covariates did not alter the results and neither did drop-out analyses. This indicates that factors other than group belonging and the selected socio-demographic factors are determining progress in levels of physical activity

The general results of the present study indicate that estimates of the intercept and slope variance, respectively, generally remained unchanged. This underlines that factors other than baseline differences and group characteristics differentiating participants in the TG and PG may explain the variability in initial levels and change over time in self-efficacy, and physical activity. Income measured at baseline though did account for the initially observed variability in initial level and change over time of stages of change. Nevertheless, the present study suggests that both time-varying and time-invariant factors should be invoked in future research to disentangle the web of factors that influence the efficiency of prescribed exercise interventions in a community-based setting.

Limitations of this study. An evident limitation of this study was its design. The study is not a randomised controlled trial, which may hamper the possibility of

controlling e.g., inclusion to the intervention, organisation, training and counselling. Furthermore, this lack of control prevents the possibility of forming comparable intervention and control groups. The design also prevents the possibility of gathering specific information on lifestyle diseases among the participants in the TG. This introduces potential biases in the comparison of the TG and the PG, although analyses of baseline covariates showed no statistically significant effects on the results except for income on stages of change. To better analyse the effect of training and counselling versus counselling alone on self-efficacy, stages of change, and level of physical activity a randomised controlled trial comparing a TG group receiving both training and counselling with a TG group receiving counselling alone would provide more precise data. The same issue is present for the PG group. This would also address the possible bias of the participants in the TG paying for participation whereas the participants in the PG do not.

Another obvious limitation of the present study is the high drop-out rate of 45% and 49% at 16 months, even though analysis suggests that missing values did not influence the results when included although they could possibly differ in other areas, as suggested by other studies (Jones et al., 2005). A further limitation is the use of self-report measures. Self-report information concerning physical activity, for example, may be less accurate than administered methods such as accelerometers, pedometers or gold standard measurements as doubly labelled water (Norman et al., 2001; Conway et al., 2002). However, self-report questionnaires are documented useful and easy to administer, and are especially useful in larger studies. The utility and efficiency of self-report measures may outweigh the decreased measurement accuracy (Rennie & Wareham, 1998)[59].

Strengths. The analytical strategy of the present study is a strength, and extends existing knowledge of what is known regarding EoP in Denmark (Sorensen, Skovgaard & Puggaard, 2006; Bredahl, Puggaard & Roessler, 2008; Bredahl et al., 2010). In addition to information concerning the possible effect of various predictors, linear growth curve analysis provides information on the variability of three variance components of the individual measures obtained over an extended period of time. The richness of information increases the precision and reliability of the results and enables inference about possible factors such as e.g. group belonging and scoring instruments that separately or in concert could explain the change in the outcome of interest. Knowledge of these factors introduces additional knowledge by explaining significance of individual and group variability of the development of self-efficacy, stages of change and level of physical activity. Furthermore, the intervention period of 16 months provides valuable long-term knowledge of individual psychological variables shown to influence adherence to a physically active lifestyle. The data adds knowledge to other studies of prescribed exercise done only with follow-up

of 6 months (Roessler & Ibsen, 2009; Sorensen et al., 2008). Despite the caveats mentioned above, the analyses conducted in this study reflect the complexity of the reality in which the EoP intervention happens (Zachariae, 2007) and provides valuable information about the challenge of the ongoing development of Exercise on Prescription (Modeste, 1996).

Conclusion

EoP improves participants' levels of physical activity and stages of change, regardless of the intensity of the intervention (counselling versus counselling and exercise). Self-efficacy is not influenced. By longitudinally comparing two interventions an overall estimate of best practice as the process of planning and organising the most appropriate intervention for the setting and population can be given. The results of the present study support findings from other studies showing no additional effect of the more intense prescribed exercise intervention compared to other and less intense interventions. The analyses of development within the groups can provide valuable knowledge to researchers and practitioners of the appropriateness of the intervention as a whole, as well as specific components of the intervention (e.g., the structured intervention in the TG). It is valuable to observe longitudinal development to understand which mechanisms in the intervention are important for behaviour change. This knowledge can be used to plan and organise more effective interventions facilitating behaviour change. The results from comparisons between the groups (the TG and the PG) can provide researchers and practitioners important insight into which intervention forms possibly affect individuals in need of behaviour change towards a more physically active lifestyle.

Overall, the results of the present study indicate that factors other than the intervention intensity and group characteristics differentiating participants in the TG and PG may explain the variability in initial levels and changes in self-efficacy, stages of change and physical activity. Further, the present study suggests that both time-varying (e.g., lifestyle diseases, life-events, occupations and barriers) and time-invariant (e.g., family, social relations and social class) factors should be invoked in future research to disentangle the web of factors that influence the efficiency of prescribed exercise interventions in a community-based setting.

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