Long-term effectiveness and mediators of a need-supportive physical activity coaching among Flemish sedentary employees

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SUMMARY

This study examined the long-term and mediation effects of a need-supportive coaching programme on physical activity. Sedentary employees (n = 92) of the university of Leuven received 4 months of physical activity coaching, based on the self-determination theory, by coaches with a bachelor’s degree in kinesiology who are specializing in health-related physical activity (n = 30). The programme consisted of a limited number of individual contact moments (i.e. an intake session, three follow-up contacts and an out-take session), either face-to-face, by phone or by e-mail. Self-reported physical activity, social support, self-efficacy and autonomous motivation were assessed in the coaching group (n = 92) and a control group (n = 34) at three moments: before the intervention (i.e. pre-test), after the intervention (i.e. post-test) and 1 year after pre-test measurements (i.e. follow-up test).

Results revealed significant 3 (time) × 2 (groups) interaction effects on strenuous and total physical activity. Moreover, whereas the control group remained stable from pre- to post-test, the coaching group increased significantly in moderate, strenuous and total physical activity. Additionally, the coaching group increased significantly in mild, moderate, strenuous and total physical activity from pre- to follow-up tests, whereas the control group did not change. Bootstrapping analyses indicated that self-efficacy and autonomous motivation significantly mediated the intervention effect on physical activity from pre- to post-test, while social support significantly mediated the long-term effect. This study provides evidence for the long-term effectiveness of a need-supportive physical activity programme that might be efficient at the community level.

Key words: physical activity; behaviour change; intervention; longitudinal survey

INTRODUCTION

Regular physical activity is considered to be a major contributor to physical and psychological health and well-being [e.g. (Kohl, 2001; Roglin et al., 2007)]. However, the majority of the population in Western societies does not attain the physical activity health norm prescribed by the American College of Sports Medicine (Varo et al., 2003; Philippaerts et al., 2006; Gisle et al., 2010). Therefore, the promotion of physical activity has been identified as government priority (Pate et al., 1995; Golditz, 1999). Numerous studies have demonstrated increased physical activity levels by implementing lifestyle interventions, in which physical activity is incorporated into one’s daily routines [e.g. (Dunn et al., 1998; Opdenacker et al., 2008)]. Among the overall reported positive results, theory-based lifestyle interventions were found to be most effective
In the past decade, the self-determination theory (SDT) has been postulated as a promising theoretical approach to facilitate behavioural change, and in particular to increase physical activity [e.g. (Chatzisarantis and Hagger, 2009)]. SDT assumes that people possess three basic psychological needs, i.e. autonomy, competence and relatedness. These needs are considered as fundamental to obtain high-quality motivated engagement in any given behaviour (Deci and Ryan, 1985). The need for autonomy reflects the desire to be the origin of one’s own behaviour and can be satisfied by using client-centred strategies, such as exploring options and letting the client make decisions. The need for competence implies the pursuit of success experiences in producing desired outcomes and can be fulfilled by appropriate goal-setting and providing positive feedback. Finally, the need for relatedness refers to the feeling that one belongs to a given social environment and can be supported by expressing empathy and avoiding judgement or criticism (Deci and Ryan, 1985; Hardcastle and Hagger, 2011). A need-supportive environment, i.e. fulfilling the needs for autonomy, competence and relatedness, has been shown to be effective in facilitating autonomous motivation (AM). Because autonomously motivated behaviour is initiated by the individual, and thus self-determined, it is more likely to persist in the long term (Deci and Ryan, 1985; Markland and Vansteenkiste, 2007; Silva et al., 2010a,b).

Within the psychology of health behaviour change, motivational interviewing (MI) is recognized as an appropriate collaborative counselling technique to create such a need-supportive environment (Miller and Rollnick, 2002; Markland et al., 2005; 2007). Furthermore, MI has been shown to increase self-efficacy (SE), which is the belief of one’s capability to perform a task (Ajzen, 1991; Bandura, 1997). The concept of SE is related to perceived competence (Biddle, 1999; Markland et al., 2005) and has been proposed as a crucial mediating factor in enhancing behavioural change, e.g. physical activity [e.g. (Dishman et al., 2004; Markland et al., 2005; Taymoori and Lubans, 2008)]. In addition to SE, social support (SOSU) has been identified as an important psychosocial variable in increasing physical activity in sedentary populations [e.g. (Eyler et al., 1999; De Bourdeaudhuij and Sallis, 2002)]. A need-supportive climate, focusing on increasing SE and advancing a supportive social environment by significant others, is thus assumed to be beneficial to physical activity promotion.

Although numerous studies have linked need-supportive coaching to increased physical activity levels [e.g. (Wilson et al., 2003; Chatzisarantis and Hagger, 2009)], previous research has been less conclusive on the long-term effectiveness of such intervention (National Heart, Lung and Blood Institute, 1998; Fortier et al., 2007; Silva et al., 2010a,b). Furthermore, although knowledge of mediation effects can contribute to the effectiveness of physical activity interventions, relatively few studies have examined the mediating influence of theoretical constructs on the relation between a SDT-based intervention and physical activity, especially in the long term (Edmunds et al., 2006; Haerens et al., 2008; Fortier et al., 2011). Finally, the majority of intervention studies involve intensive counselling procedures, which are rather difficult to implement on a large-scale community level (Haerens et al., 2008; Silva et al., 2010a,b).

Therefore, the present study was designed to examine (i) the (long-term) physical activity effects of a need-supportive coaching programme, consisting of a limited number of contact moments, among sedentary employees; and (ii) the mediation effects of SOSU, SE and AM within this coaching process. It was hypothesized that the intervention group (COACH) would increase their physical activity level, while no changes would emerge in the control group (CONTR). Moreover, because the need-supportive intervention was intended to change the underlying psychosocial constructs, changes in physical activity were expected to be mediated by changes in SOSU, SE and AM.

METHOD

Recruitment and participants
Data were derived from a physical activity coaching project at the University of Leuven. Participants (n = 92) were sedentary employees of the university, who had been offered the opportunity to be guided by a personal physical activity coach (n = 30). Recruitment took place via personal mailing and an announcement in a monthly internal newsletter, and resulted in 382
volunteers. A two-stage procedure was followed to reduce the total number of volunteers to 90 participants of COACH, i.e. three per coach: (i) volunteers were asked to indicate whether they already attained the physical activity health norm prescribed by the American College of Sports Medicine (Haskell et al., 2007) (yes/no-question) and to specify their weekly physical activity pattern. Those who already attained the norm of 30 min of moderate-intensity physical activity on at least 5 days a week or 20 min of strenuous-intensity physical activity on at least 3 days a week were refused (n = 36); (ii) The ‘first come—first served’ principle was applied, meaning that volunteers who replied first on the recruitment message were invited to participate in the intervention. Two participants who dropped-out shortly after the intake session (see section below) were immediately replaced, which resulted in 92 participants in COACH. The CONTR consisted of the 34 subsequent volunteers who met the inclusion criteria. Because the majority of volunteers replied on the recruitment message within 2 days, the selected participants for COACH are not considered to be more motivated than volunteers selected for CONTR. At post-test, drop-out rates were 6.5% in COACH and 0.0% in CONTR ($\chi^2 = 2.261, p = 0.152$), while follow-up drop-out rates were 13.0 and 11.8% respectively ($\chi^2 = 0.019, p = 0.580$). The lack of motivation was the most frequent mentioned reason for dropping-out. There were no significant differences between drop-outs and adherers in COACH and CONTR for demographic variables, self-reported physical activity, SOSU, SE and AM at pre-tests.

**Procedures and intervention**

The 4-month intervention took place from November 2009 to March 2010 and consisted of five contact moments between the coach and participants of COACH (i.e. an intake session, three follow-up contacts and an out-take session). Pre-, post- and follow-up tests were completed, respectively, before, immediately after, and 1 year after the beginning of the intervention in COACH and CONTR. No contact occurred between coach and participants between post- and follow-up tests. Participants of CONTR completed all measurements under the supervision of a coach, but did not receive physical activity instructions or a programme.

Coaches were recently graduated with a bachelor’s degree in kinesiology and now specializing in health-related physical activity, to get their master’s degree. Prior to the coaching, they attended a course in psychology of behavioural motivation and physical activity promotion, to improve their coaching proficiency according to SDT and MI. Additionally, regular feedback from experts during the coaching procedure ensured high-quality coaching.

During a face-to-face intake session of $\sim 1$ h, an individualized physical activity programme was set up in accordance with the participant’s preferences, habits and opportunities. The physical activity goals, specified by physical activity type, location, time frame, company, barriers and solutions were written down in an agreement. The main goal was to attain the physical activity health norm as prescribed by the American College of Sports Medicine (Haskell et al., 2007). The three follow-up contacts and the out-take session took place 3–4 weeks after the previous contact. According to earlier research, face-to-face support is as efficacious as support by phone or computer-based support in targeting behavioural changes, e.g. physical activity (Opdenacker and Boen, 2008; Portnoy et al., 2008). Therefore, the second and third follow-up contact occurred face-to-face, by phone or by e-mail, depending on the participant’s need. Follow-up contacts occurred face-to-face, by phone and by e-mail in, respectively, 98.5, 30.7 and 67.7% of the clients. Face-to-face and follow-up contacts by phone lasted $\sim 30$ and 10 min, respectively, while conversations by e-mail consisted of four e-mails. During follow-up contacts, the student-coaches asked for the degree of adherence to the programme (i.e. did the participant reach his or her physical activity goals), identified possible barriers and if necessary, modified goals. The coaches motivated the clients to persist in their programme by using behaviour change techniques (Abraham and Michie, 2008) and, more specifically, by coaching according to the principles of MI and SDT, i.e. autonomy support (e.g. by facilitating rather than prescribing physical activity), competence support (e.g. by providing positive feedback) and relatedness support (e.g. by expressing empathy through active listening). The out-take session was planned to evaluate behaviour change among the participants, to make sure the participants mastered the required techniques to continue engagement in physical...
activity (e.g. barrier identification, using prompts and cues) and to discuss future challenges.

**Questionnaires**

Self-reported physical activity was assessed with a modified version of the Godin Leisure-Time Exercise Questionnaire (GLTEQ) (Godin and Shephard, 1985). The GLTEQ was preferred because this questionnaire is brief, easy to administer and considered to be clearly comprehensible for university employees. The validity and test–retest reliability have already been demonstrated in Western populations (Godin and Shephard, 1985; Jacobs et al., 1993; Karvinen et al., 2007). Furthermore, the GLTEQ has been successfully employed with different populations in Western societies [e.g. (Karvinen et al., 2007; De Bacquer et al., 2010; Rhodes and Pfaeffli, 2010)]. Participants reported the number of times they engaged for at least 20 min in mild, moderate and strenuous-intensity physical activity in a typical week during the past month. An overall measure of self-reported physical activity was obtained by summing the frequencies weighted by the metabolic equivalents for each intensity category, i.e. three, five and nine, respectively.

SOSU was measured by a validated five-point Likert scale from De Bourdeaudhuij and Sallis (2002). Participants were asked how strongly they believed that family, friends and colleagues wanted them to be physically active (3 items) and how frequently they perceived support (i.e. accompany, propose, remind and encourage) from these significant others with respect to physical activity (12 items). Cronbach’s alpha coefficients for pre-, post- and follow-up tests ranged from 0.82 to 0.86, indicating a high internal consistency.

SE was measured by a multi-dimensional Self-Efficacy Questionnaire (Openacker et al., 2008). Participants indicated their confidence level for being physically active in various situations, on a five-point Likert scale, ranging from ‘not at all confident’ to ‘very confident’. Internal consistency was very high with Cronbach’s alpha coefficients for pre-, post- and follow-up tests ranging from 0.90 to 0.93.

AM was assessed with eight items of the Dutch version of the Behavioural Regulations for Exercise Questionnaire (Markland and Tobin, 2004). This self-determined type of motivation comprises the subscales of identified regulation (four items) and intrinsic motivation (four items) (Fortier and Kowal, 2007) and is positively associated with long-term physical activity behaviour (Pelletier et al., 2001; Chatzisarantis et al., 2003; Vansteenkiste et al., 2004). Cronbach’s alpha coefficients for pre-, post- and follow-up tests ranged from 0.88 to 0.90, indicating a high internal consistency.

**Statistical analysis**

All data were analysed with SPSS 16.0 (SPSS, Inc., Chicago, IL, USA). To assess differences between COACH and CONTR, one-way ANOVA and \( \chi^2 \) analyses were used. One person with a pre-test GLTEQ score more than three standard deviations above the pre-test mean was excluded from all analyses. Effects on physical activity were analysed with repeated measures ANOVAs. Multivariate analyses (Phillai’s trace coefficient) were conducted to test several dependent variables simultaneously. Mediation effects were analysed with the bootstrapping macro provided by Preacher and Hayes (2008). The primary advantage of bootstrapping is that no assumptions are made about the shape of sampling distribution of the indirect effect (Preacher and Hayes, 2008). Change scores of SOSU, SE and AM were included simultaneously in a multiple mediator model, because this (i) ‘purifies’ the indirect effects by controlling for all the other mediators, and (ii) allows the researcher to determine which mediators are more successful than others (Preacher and Hayes, 2008). Mediation analyses were conducted for change scores from pre- to post-test (\( \Delta \text{prepo} \)) and from pre- to follow-up tests (\( \Delta \text{prefu} \)). The significance level was set at \( p < 0.05 \).

**RESULTS**

**Demographic profile**

The mean age was 41.3 years (SD = 13.6). There were 52.0% women and most participants were married or lived together with their life partner (71.2%). Twenty-seven per cent were technical employees, while professors and research assistants represented, respectively, 20.8 and 37.0%. A minority (e.g. emeritus professors, partners of university employees) was
not employed at the university (15.2%). No significant differences in the abovementioned demographic variables emerged between COACH and CONTR.

Effect analyses
Table 1 depicts the physical activity means (SD) at pre-test, pre- to post-test and pre- to follow-up-test change scores for physical activity, \(3 \times 2\) interaction effects and one-way ANOVAs for the physical activity change scores. Significant \(3 \times 2\) interaction effects emerged on strenuous and total physical activity, indicating that the reported strenuous and total physical activity in COACH changed differently over time compared with CONTR. Furthermore, while no changes occurred in CONTR, participants of COACH showed significant increases in moderate, strenuous and total physical activity from pre- to post-test and in all intensity physical activities from pre- to follow-up tests (all \(p = 0.000\)). One-way ANOVA analyses revealed significant differences in \(\Delta_{\text{prepo}}\) for moderate, strenuous and total physical activity (Pillai’s trace: \(F = 9.463, p = 0.000\)) and in \(\Delta_{\text{prefu}}\) for strenuous and total physical activity (Pillai’s trace: \(F = 3.715, p = 0.014\)) between COACH and CONTR. Despite their lower pre-test levels of strenuous and total physical activity (strenuous physical activity: \(F = 7.419, p = 0.007\); total physical activity: \(F = 7.965, p = 0.006\)), participants in COACH reported higher levels of physical activity at post-test (strenuous physical activity: \(F = 5.346, p = 0.023\); total physical activity: \(F = 8.570, p = 0.004\)).

Mediation
Because significant \(3 \times 2\) interaction effects emerged on strenuous and total physical activity, mediation effects of changes in SOSU, SE and AM on changes in strenuous and total physical activity were tested (Table 2). The paths from the intervention to pre- to post-test change scores in SE and AM (\(\alpha\)-paths) were significant, indicating that participants in COACH increased more in SE and AM from pre- to post-test than participants in CONTR (Pillai’s trace: \(F = 3.421, p = 0.020\)). In contrast, the \(\alpha\)-path on SOSU failed to reach significance, indicating no differences in SOSU between COACH and CONTR from pre- to post-test. Furthermore, the \(\beta\)-paths from pre- to post-test changes in the proposed mediators to changes in strenuous and total physical activity were not significant. Finally, the confidence intervals of

Table 1: Means (SD) at pre-test, pre- to post-test and pre- to follow-up-test change scores for physical activity in COACH and CONTR, \(3 \times 2\) interaction effects and one-way ANOVAs for physical activity change scores from pre- to post-test and from pre- to follow-up test

<table>
<thead>
<tr>
<th></th>
<th>COACH Mean (SD)</th>
<th>CONTR Mean (SD)</th>
<th>3 (\times 2) Interaction (F) (\eta^2)</th>
<th>One-way ANOVA (F) (\eta^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild PA (times a week for (\geq 20) min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre</td>
<td>1.01 (1.75)</td>
<td>1.35 (1.74)</td>
<td>1.952</td>
<td>0.018</td>
</tr>
<tr>
<td>(\Delta_{\text{prepo}})</td>
<td>+0.20</td>
<td>+0.10</td>
<td>0.067</td>
<td>0.001</td>
</tr>
<tr>
<td>(\Delta_{\text{prefu}})</td>
<td>+0.82</td>
<td>+0.25</td>
<td>3.228</td>
<td>0.029</td>
</tr>
<tr>
<td>Moderate PA (times a week for (\geq 20) min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre</td>
<td>0.92 (1.64)</td>
<td>1.38 (1.37)</td>
<td>2.122</td>
<td>0.020</td>
</tr>
<tr>
<td>(\Delta_{\text{prepo}})</td>
<td>+1.45</td>
<td>+0.39</td>
<td>5.765*</td>
<td>0.047</td>
</tr>
<tr>
<td>(\Delta_{\text{prefu}})</td>
<td>+1.98</td>
<td>+0.78</td>
<td>2.302</td>
<td>0.021</td>
</tr>
<tr>
<td>Strenuous PA (times a week for (\geq 20) min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre</td>
<td>0.22 (0.56)</td>
<td>0.66 (1.04)</td>
<td>5.882**</td>
<td>0.054</td>
</tr>
<tr>
<td>(\Delta_{\text{prepo}})</td>
<td>+0.96</td>
<td>-0.01</td>
<td>14.291***</td>
<td>0.109</td>
</tr>
<tr>
<td>(\Delta_{\text{prefu}})</td>
<td>+0.85</td>
<td>+0.12</td>
<td>5.852*</td>
<td>0.052</td>
</tr>
<tr>
<td>Total PA (score on GLTEQ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pre</td>
<td>9.61 (9.58)</td>
<td>16.83 (12.72)</td>
<td>8.998***</td>
<td>0.080</td>
</tr>
<tr>
<td>(\Delta_{\text{prepo}})</td>
<td>+16.46</td>
<td>+2.17</td>
<td>23.277***</td>
<td>0.166</td>
</tr>
<tr>
<td>(\Delta_{\text{prefu}})</td>
<td>+19.95</td>
<td>+4.24</td>
<td>9.849***</td>
<td>0.084</td>
</tr>
</tbody>
</table>

Note: PA, physical activity; COACH, intervention group; CONTR, control group; GLTEQ, Godin Leisure-Time Exercise Questionnaire; SD, standard deviation; pre, pre-test value; \(\Delta_{\text{prepo}}\), change score from pre- to post-test; \(\Delta_{\text{prefu}}\), change score from pre- to follow-up test; \(3 \times 2\) Interaction, interaction effect over time (3) and between groups (2) for mild, moderate, strenuous and total physical activity; One-way ANOVA, difference between the intervention and control group for change scores in physical activity; *\(p < 0.05\); **\(p < 0.01\); ***\(p < 0.001\).


Table 2: Mediation effects of changes in social support, self-efficacy and autonomous motivation on changes in strenuous and total physical activity

<table>
<thead>
<tr>
<th></th>
<th>α-Path</th>
<th>β-Path</th>
<th>αβ-Path</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient (SE)</td>
<td>Coefficient (SE)</td>
<td>Coefficient (SE)</td>
</tr>
<tr>
<td>Δprepo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strenuous PA (times a week for ≥ 20 min)</td>
<td>Δprepo SOSU</td>
<td>-0.208 (0.123)</td>
<td>0.274 (0.182)</td>
</tr>
<tr>
<td></td>
<td>Δprepo SE</td>
<td>-0.267 (0.119)*</td>
<td>0.274 (0.206)</td>
</tr>
<tr>
<td></td>
<td>Δprepo AM</td>
<td>-0.257 (0.102)*</td>
<td>0.373 (0.240)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>0.373 (0.240)</td>
</tr>
<tr>
<td>Total PA (score on GLTEQ)</td>
<td>Δprepo SOSU</td>
<td>-0.208 (0.123)</td>
<td>1.698 (2.292)</td>
</tr>
<tr>
<td></td>
<td>Δprepo SE</td>
<td>-0.267 (0.120)*</td>
<td>4.903 (2.596)</td>
</tr>
<tr>
<td></td>
<td>Δprepo AM</td>
<td>-0.257 (0.102)*</td>
<td>2.191 (3.022)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>2.191 (3.022)</td>
</tr>
</tbody>
</table>

Note: PA, physical activity; GLTEQ, Godin Leisure-Time Exercise Questionnaire; SOSU, social support; SE, self-efficacy; AM, autonomous motivation; Δprepo, change score from pre- to post-test; Δprefu, change score from pre- to follow-up test; α, estimate of the intervention effect on changes in the proposed mediators; β, estimate of the direct effect of changes in the proposed mediators on changes in physical activity while controlling for the intervention effect; αβ, estimate of the indirect effect of the intervention on changes in physical activity through the proposed mediators; 95% CI, 95% bias corrected confidence interval with the empirically derived bootstrapped sampling distribution of αβ (result of 2000 bootstrap resamples); *p < 0.05.

Finally, Δprefu in SOSU significantly contributed to the indirect effect of the intervention on Δprefu in total physical activity (αβ-path). The overall models explained 19.0% ($F = 5.968$, $p = 0.000$) and 16.5% ($F = 5.024$, $p = 0.001$) of the variance in Δprefu in strenuous and total physical activity, respectively.

**DISCUSSION**

The results of this study showed that need-supportive coaching with a limited number of contact moments was effective in increasing physical activity. This finding is in line with previous SDT-based intervention studies [e.g. (Edmunds et al., 2008; Chatzisarantis and Hagger, 2009; Silva et al., 2010a,b)], but extends earlier research by demonstrating long-term effectiveness. The increased physical activity level from pre-to post-test in COACH on the one hand and the stable physical activity level in
COACH and CONTR from post-test to 1-year follow-up test on the other hand correspond with research of Opdenacker et al. (2008). It provides evidence for exercise engagement and persistence as a result of a need-supportive coaching environment.

As suggested previously (Edmunds et al., 2006; Silva et al., 2010a,b), different intensities of physical activity were considered as separate outcomes. While mild physical activities are often more regarded as habitual lifestyle activities (e.g. walking for transportation), moderate and strenuous physical activities are considered to be more purposeful and structured. Consequently, higher intensity physical activities might require more cognitive processing (Edmunds et al., 2006; Silva et al., 2010a,b). The increase in higher intensity physical activity from pre- to post-test in participants of COACH reflects the fact that during the intervention, the coaches mainly encouraged the participants to incorporate structured physical activities of moderate to high intensity into their individualized physical activity programme (e.g. following dancing classes or going for a swim once a week). Furthermore, because of the higher level of cognitive processing associated with higher intensity physical activities, moderate and strenuous physical activities were possibly easier to remember compared with mild physical activities, and therefore more likely to be reported in the physical activity questionnaire. The increased engagement in moderate and strenuous-intensity physical activity in COACH is especially important, because earlier studies have demonstrated that a higher intensity of performed physical activity results in greater aerobic and cardioprotective benefits (Williams, 1998; Swain and Franklin, 2006).

The long-term results, i.e. from pre- to follow-up tests, indicate that participants seemed to integrate mild physical activities (e.g. active transportation) in their daily life as well, in addition to the structured higher intensity physical activities. This means that in the long term, mild physical activities that had become a habit were also experienced as self-determined in COACH. Mild physical activities like active transportation can not only be advanced by a physical activity coach, but are also important to consider at the policy level (e.g. ensure safe environment). Moreover, assuming that the post-intervention increases in moderate and strenuous physical activities resulted in higher levels of physical fitness, participants might have incorporated more mild physical activities in their habitual lifestyle because they require less effort the more one is physically fit. Additionally, because CONTR also demonstrated small, albeit non-significant, increases in moderate physical activity from pre- to follow-up tests, seasonal reasons (i.e. spring and summer) can partly explain the increase in moderate physical activities. However, the significant time × group interaction effect from pre- to follow-up tests for strenuous and total physical activity underscores the value of SDT-based coaching for facilitating persistence in structured high intensity physical activities.

The impact of the need-supportive intervention on the proportion of people who attain the physical activity health norm should also be noted (Pate et al., 1995). Although the GLTEQ does not provide a precise measure of minutes that participants engage in physical activity, the overall physical activity score obtained by this questionnaire can be considered as a general guideline to determine whether or not one attains the recommended physical activity level. According to Haskell et al., health benefits can be obtained by performing 20 min of strenuous physical activity on at least 3 days a week (Haskell et al., 2007). This corresponds to an overall score of 27 on the GLTEQ (Scheerder et al., 2011). The results of this study showed that the number of participants in COACH that attained a GLTE score of 27, and thus obtained the physical activity health norm, increased from 8.7% in pre-test to 41.9 and 48.8% in, respectively, post- and follow-up tests. Percentages in CONTR changed from 18.2% over 27.3 and 24.1%, respectively. This resulted in a significant difference in the long term (i.e. at follow-up) between COACH and CONTR ($\chi^2 = 5.286$, $p = 0.017$). Furthermore, One-way analyses revealed that participants who increased their physical activity level were less physically active at pre-test compared with participants who decreased or did not change their physical activity level. This trend emerged for moderate, strenuous and total physical activity from pre- to post-test and for all intensities of physical activity from pre- to follow-up tests. The appearance of this trend corresponds with the identified significant time effects in COACH, suggesting that the significant effects are mainly resulting from the increases in physical activity in the most sedentary participants.
These results highlight the potential of a need-supportive physical activity coaching as a public health initiative, especially when targeting the most sedentary population.

Because understanding the role of underlying psychosocial constructs enlarges the insight in how an intervention works (Hillsdon et al., 2005), mediation effects of changes in SOSU, SE and AM on changes in physical activity were also studied. Mediation analyses were conducted only on strenuous physical activity and on total physical activity because these require a higher level of cognitive processing compared with less intensive physical activity. The results are in line with earlier SDT-based studies, in which (changes in) physical activity could partly be explained by (changes in) SE and competence, which are closely related concepts (Edmunds et al., 2006; Fortier et al., 2007; Haerens et al., 2008). Moreover, previous research found positive relations between AM on the one hand and strenuous and total physical activity on the other hand (Edmunds et al., 2006; Silva et al., 2010a,b; 2011). Although the components of AM (i.e. identified regulation and intrinsic motivation) have been shown to contribute differently to the prediction of physical activity, both are proposed to be beneficial to optimal and continued exercise engagement (Edmunds et al., 2006). While identified regulation appears to be relevant for engagement in physical activity, intrinsic motivation is important for exercise persistence (Pelletier et al., 2001). Physical activity promotion should thus focus on increasing both motivational components in order to be effective. The mediation by SOSU in the long term is consistent with previous research of De Bourdeaudhuij and Sallis (2002). This finding emphasizes the importance of interpersonal relationships as a determinant of physical activity and indicates the high value of the coach’s fulfillment of the need for relatedness during the intervention, e.g. by active listening, conveying empathy and using non-judgmental language. Furthermore, it highlights the importance of continued SOSU from significant others (e.g. family, friends, colleagues) during and after the intervention in order to enhance sustained physical activity.

In conclusion, the results partially supported our hypotheses, suggesting that SDT-based behaviour change techniques (Abraham and Michie, 2008) such as providing options and focusing on task goals (i.e. autonomy support), setting realistic goals and providing positive feedback (i.e. competence support) and showing empathy (i.e. relatedness support), are successful in promoting (long-term) physical activity through various psychosocial constructs.

The present study had its particular strengths and weaknesses. First, although coaches were recently graduated with a bachelor’s degree in kinesiology and thus less experienced, the intervention demonstrated long-term effects on physical activity. This strengthens the effectiveness of a SDT-based intervention in the promotion of physical activity at the community level. Second, the limited number of need-supportive contact moments between coach and client enhances the efficiency and large-scale implementation of physical activity initiatives, especially because previous research (Conn et al., 2002; Fortier et al., 2007) indicated that intense and regular contact with a physical activity coach is more effective than limited contact. Individual need-supportive contact seems to be essential in the beginning of physical activity coaching. This is because need-supportive coaching is considered to increase the client’s feelings of competence and as a result to enhance long-term engagement. However, it should be noted that need-supportive coaching remains time and labour intensive, even with a limited number of contact moments. Therefore, alternative coaching strategies or multi-sectoral and integrated approaches appear inevitable to advance large-scale physical activity promotion. Replacing individual contact moments by group sessions (e.g. in a socio-cultural organization) once the individual’s competence level is sufficient could increase the feasibility of need-supportive coaching at the community level. Furthermore, in addition to this midstream (i.e. lifestyle) approach that aims to directly influence behaviour (e.g. increase physical activity), upstream approaches are needed as well to obtain effective population-based prevention. More specifically, there is vast need for promotion actions within the broader socio-ecological and economic domain (e.g. education, finance, appropriate physical environment). The high level of physical inactivity within the population requires a policy response. Structural environmental changes (e.g. safe bicycle and footpaths) have been found to be promising steps to make healthy choices the easy choices (Ostlin et al., 2006; Sacks et al., 2009).
A third strength of the present study is the inclusion of a control group within a long-term design. This allows us to consider increases in physical activity as an intervention effect rather than as an attention effect.

Although the study included a control group in which participants did not receive any coaching, the lack of strict randomization between the control and the intervention group constitutes a first limitation. Because of ethical, educational and social reasons, the ‘first come—first served’ principle was applied. However, first responders (who were involved in COACH) did not demonstrate higher pre-test levels of AM nor SE compared with slower responders (who were involved in CONTR). Therefore, it seems unlikely that the lack of strict randomization was responsible for the significant differences in strenuous and total physical activity at pre-test between COACH and CONTR. Second, physical activity was based on self-reports, which can lead to social desirability (Motl et al., 2005) and overestimation (Fogelholm et al., 2006). On the other hand, the questionnaire used in this study has been shown to have reasonable construct validity and reliability (Godin and Shephard 1985). Moreover, the GLTE score has been found to be positively correlated with maximum oxygen consumption (Jacobs et al., 1993) and activity monitoring (Kriska and Caspersen, 1997). Third, because more than half of the participants in this study were (emeritus) professors or research employees, the participants were highly educated compared with the Flemish population. Therefore, the results should be generalized with caution to the entire Flemish population. On the other hand, both the gender distribution and age of the participants (48.0% of men; 41.3 years) were representative for the Flemish population.

It can be concluded that the findings provide support for the long-term effectiveness of a need-supportive physical activity coaching with limited contact through various psychosocial constructs. The study can be considered as a preliminary but promising step within the domain of efficient physical activity promotion at the community level.

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REFERENCES


Need-supportive physical activity coaching