Stages of change for physical activity in a community sample of adolescents

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Abstract

The aims of the present study were to investigate (1) the proportion of adolescents in each of the stages of change, (2) the differences in psychosocial factors and in physical activity between the stages, and (3) the classification accuracy using several reference criteria. A random sample of 38 schools from the Flemish community in Belgium resulted in a sample of 5931 adolescents (mean age = 14.8, range 12–18, 61% females). All adolescents completed a computerized questionnaire assessing demographic variables, physical activity, physical activity determinants and stages of change. Distribution across the stages was: precontemplation, \( n = 684 \) (11.5%); contemplation, \( n = 948 \) (16.0%); preparation, \( n = 818 \) (13.8%); action, \( n = 492 \) (8.3%); and maintenance, \( n = 2989 \) (50.4%). Analyses revealed gender and age differences \((P < 0.001)\), with girls and older adolescents being more prevalent in the first three stages. Differences between the stages of change were related to higher levels of physical activity of different intensity and within different contexts \((P < 0.001)\), together with more favorable psychosocial determinants related to physical activity \((P < 0.001)\). No differences between stages were found for sedentary activities. Three subgroups of adolescents were identified based on psychosocial determinants and physical activity levels. About 71% of the adolescents placed themselves in a stage which was in accordance with their self-reported level of physical activity.

Introduction

Health benefits of regular physical activity are well documented in all age groups (Bouchard et al., 1994). Nevertheless, a sedentary lifestyle among adolescents, adults and older persons is prevalent in almost all parts of the Western world (Caspersen et al., 1994; Steptoe et al., 1997). There is a clear age gradient throughout the lifespan. In particular, a steep decline in activity levels occurs in adolescence (Sallis, 2000). Furthermore, tracking studies have revealed that low levels of physical activity remain stable from adolescence into adulthood (Malina, 1996; Lefevre et al., 2000), especially in females (De Bourdeaudhuij et al., 2002). Therefore, adolescents seem to be an important group to promote the maintenance of adequate physical activity levels or to encourage inactive adolescents to become more active.

It is obvious that interventions to promote physical activity have to be based upon its most important processes or determinants in that population. Based on generic theories or models (Ajzen and Madden, 1986; Bandura, 1986), physical activity in adolescence was best predicted by self-efficacy, attitudes or beliefs, family or friend support, and perceived benefits and barriers (De Bourdeaudhuij, 1998; Sallis et al., 2000). The Transtheoretical Model...
(Prochaska and DiClemente, 1983) has also been proposed as a useful framework to understand the adoption and maintenance of exercise behavior [for review, see (Marshall and Biddle, 2001)]. A major contribution of the Transtheoretical Model is that it matches the determinants of the generic psychosocial models with the readiness of the individual to change behavior and that it also provides guidelines for designing interventions. Research has shown that the role of attitudes, social influence, self-efficacy, and perceived benefits and barriers in changing behavior differs depending upon the particular stage (Prochaska et al., 1994; De Vries and Mudde, 1998; Marshall and Biddle, 2001; Ronda et al., 2001).

Until now the Transtheoretical Model has not been extensively investigated in the context of physical activity in adolescence. An application is not straightforward, as some problems may arise. First, the level of physical activity in adolescence is higher than during adulthood. There may be few adolescents in the precontemplation and contemplation stages, resulting in a low statistical power (Nigg and Courneya, 1998; Hausenblas et al., 2002). Second, a core feature in the Transtheoretical Model is its time perspective. It is unknown whether this time perspective also applies in children and adolescents. Finally, it is not known whether adolescents are able to adequately evaluate their own level of physical activity. Awareness of their own (in)activity is necessary not only to categorize themselves in the correct stage (precontemplation, contemplation and preparation, i.e. not meeting the reference criteria, versus action and maintenance, i.e. meeting the reference criteria), but also to perceive a need to change.

The present study is the first to investigate the stages of change of physical activity in a large representative sample of adolescents within a broad age range (12–18 years). Previous studies have used smaller and selective samples (Cardinal et al., 1998; Nigg and Courneya, 1998; Walton et al., 1999; Hausenblas et al., 2002). This often resulted in the merging of stages which hindered a specific and detailed analysis of the stages of change (Marshall and Biddle, 2001). The present study focused upon three issues. First, the proportion of adolescents in each of the stages of change is determined. Second, differences in psychosocial factors and in physical activity across the stages of change are investigated. Third, correct classification, misclassification, sensitivity and specificity of the stages of change for physical activity in adolescents were evaluated against two reference criteria.

### Methods

#### Participants

Adolescents were recruited from secondary schools randomly selected throughout the Flemish community in Belgium. Thirty-eight schools participated with a total of 6117 adolescents. Schools were representative with respect to geographic region, school system (catholic, governmental, provincial and city) and educational system (general, technical and vocational). The study was approved by the different educational authorities and by the Ethical Committee of the University Hospital of Ghent University. Of the 6117 participants, 186 (3%) were excluded because they did not answer the question about the stages of change, resulting in a sample of 5931 adolescents. The mean age was 14.8 (SD = 1.9), ranging from 12 to 18 years old. Sixty-one percent of the participants were girls. Every adolescent present completed a computerized questionnaire in the computer class at school. Data were collected through the intranet of the school. Questionnaire software was loaded from a CD-ROM onto the school computer server.

#### Measures

**Physical activity**

A questionnaire was developed to assess the levels of physical activity in diverse domains, such as school activity, transportation, leisure time activity and sedentary activities. Sport participation was assessed by asking adolescents to select their three most important sports out of a list of 178 sports. For each of these three sports, they reported frequency (from once a year to more than once a day) and duration (from some hours per year to more than
20 hours per week). A *sport participation* index was computed by summing hours per week spent in these three sports. A *sport at school except Physical Education (PE)* index was assessed by asking participants the extent of sport or physically activity during noon break, during and after study hours after school, at Wednesday afternoon (a ‘free’ afternoon in Belgian schools), or at class or school tournaments. Participants reported whether they participated and how much time they spent in these activities. A *sport at school except PE* index was calculated by summation of the time spent in these activities.

*Active transportation* was assessed by asking for walking and cycling to school, and for transportation in leisure time. Two different indices were computed: a *walking or cycling to school index* and a *walking or cycling in leisure time index*. A *voluntary physical activity* index was composed by summing up the four indexes mentioned above. A *total physical activity* index was provided by adding PE to the voluntary physical activity index. The Government Education Policy for PE in Belgian schools is a minimum of 2 hours obligatory PE for all students.

Two questions were included asking for the number of times per week that participants engaged in vigorous activity for at least 20 minutes and for the number of days per week that participants engaged in continuous moderate activity for 60 minutes. Physical inactivity was assessed asking for hours per day that participants watched television or video, or played computer games during a week day and during a weekend day. All activity indexes were expressed in hours per week; the sedentary index in hours per day.

This computer-assisted questionnaire has a good reliability and an acceptable validity (Philippaerts *et al.*, 2003). Intra-class correlation coefficients (reliability) varied between 0.64 and 0.91 (*P* < 0.01), with the lowest coefficient for energy expenditure during leisure time transport. Pearson correlation coefficients with mean counts and the time spent in activities of different intensities (light, moderate, hard and very hard) from CSA accelerometers (validity) were significant for all activity measures (*r* = 0.41–0.79, *P* < 0.05).

### Physical activity determinants

General-affective attitude, social influences, self-efficacy, perceived benefits and barriers were assessed by 21 items with a five-point scale. Questions were selected and adopted from previous studies with adolescents and adults (De Bourdeaudhuij and Sallis, 2002). General-affective attitudes towards physical activity were assessed using bipolar adjectives. Participants were asked whether sports and physical activity are ‘not pleasant – pleasant’, ‘bad – good’, ‘healthy – unhealthy’ and ‘stupid – smart’. Social support was assessed by asking respondents how frequently their family and their friends encouraged them to be physically active. Self-efficacy was measured by asking how easy or difficult it was to continue with sports or physical activity for 30 minutes to 1 hour per day. Perceived benefits and barriers with regard to physical activity were investigated by asking respondents to rate their agreement with possible effects of sports and physical activity (seven items: weight and physical appearance, health and fitness, social interaction, pleasure, competition, stress and depression, and relaxation from work) and the frequency with which barriers prevented them from exercising (seven items: lack of time, lack of discipline, lack of interest, health problems, personal problems, not the sporty type and facilities too far). A *voluntary physical activity* index was composed by summing up the four indexes mentioned above. A *total physical activity* index was provided by adding PE to the voluntary physical activity index. The Government Education Policy for PE in Belgian schools is a minimum of 2 hours obligatory PE for all students.

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### Stages of change

*Stages of change* was assessed with two questions based on the study of Kearney *et al.* (Kearney *et al.*, 1999) investigating stages of change in 15 countries in the European Union. In the first question, participants were asked whether they believed they did sufficient sports or physical activity on a two-point scale (yes/no). Those who answered ‘no’ were asked to select one of the following three options regarding their intention to engage in sports or physical activity in the future: ‘I’m not sufficiently sporting or being physically active, and I have no intention to start with it’ (*precontemplation*), ‘I’m not sufficiently sporting or being physically active, but I intend to start with it in the next 6 months’ (*contemplation*) and ‘I’m not sufficiently sporting or being physically active, but I intend to start with it in the next month’ (*preparation*). Those answering
‘yes’ choose between two options: ‘I’m currently doing enough, and I started in the past month’ (action) and ‘I’m currently doing enough, and I have been for more than 6 months’ (maintenance). This staging algorithm did not include an objective criterion for staging to action. At the time Kearney et al. (Kearney et al., 1999) developed their staging algorithm, almost no countries of the European Union had physical activity standards. The same was true for the present study. A general consensus about the present activity standards for adolescents was only reached in Belgium after this study was executed. Test–re-test reliability of this staging algorithm showed a $\kappa = 0.85$ in a separate study (Philippaerts et al., 2003).

**Data analyses**

Descriptive statistics were used to compute the distribution across the stages of change for the total group, gender groups and three age groups. ANOVAs with Scheffé’s multiple comparison test were used to test for significant differences in psychosocial correlates of physical activity. All physical activity indices were examined across the stages of change using ANOVAs with multiple comparison tests. In all analyses, age and sex were included as covariates. $F$-values, $P$-values and partial $\eta^2$ as a measure of effect size are reported. Because consecutive ANOVAs were performed, a Bonferroni correction was used to protect against Type I error. Adolescents were classified according to their belief to be sufficiently active and according to two different activity standards: 7 and 5 hours per week physical activity. In addition, sensitivity, specificity and related quality indices were calculated based on the recommendations of Kraemer (Kraemer, 1992). Differences were considered to be statistically significant when $P < 0.01$. All analyses were performed using SPSS 11.0.

**Results**

**Descriptive statistics**

The distribution of the participants across the stages (see Table I) was as follows: precontemplation, $n = 684$ (11.5%); contemplation, $n = 948$ (16.0%); preparation, $n = 818$ (13.8%); action, $n = 492$ (8.3%); and maintenance, $n = 2989$ (50.4%). Analyses revealed gender [$\chi^2(4) = 381.18$, $P < 0.001$] and age [$\chi^2(8) = 206.18$, $P < 0.001$] differences across stages: girls and older adolescents were more prevalent in the preadoption stages.

**Psychosocial factors as a function of the stages of change**

The results of ANOVAs and effect sizes (partial $\eta^2$) are presented in Table II. Differences between stages of change were found for all psychosocial factors (all $P < 0.001$). Partial $\eta^2$ ranged between 0.06 and 0.15, showing medium to large effect sizes. Post-hoc tests revealed differences in all psychosocial factors between the precontemplation stage and all other stages, and between the maintenance stage and all other stages. Differences in psychosocial factors between the contemplation, preparation and action stage were less pronounced. Adolescents in the preparation stage reported a more positive attitude towards physical activity and perceived more benefits than those in the contemplation and action stages. Those in the preparation

<table>
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<th><strong>Table I. Prevalence (%) within the stages of change</strong></th>
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<tr>
<td>Precontemplation</td>
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<tr>
<td>Total group ($n = 5931$)</td>
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<tr>
<td>Males ($n = 2300$)</td>
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<tr>
<td>Females ($n = 3631$)</td>
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<tr>
<td>12–13 year olds ($n = 1623$)</td>
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<td>14–16 year olds ($n = 3034$)</td>
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<td>17–18 year olds ($n = 1263$)</td>
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and action stage reported more support from friends, more self-efficacy and perceived less barriers than those in the contemplation stage. The differences in decisional balance between the pros and cons across the stages was significant \((P < 0.001, \eta^2 = 0.15)\). The most negative balance was found in the precontemplation stage, followed by the contemplation stage. No significant differences were found between the preparation and action stage.

Physical activity and inactivity as a function of the stages of change

Table III depicts physical activity and inactivity across the stages of change. Differences between the stages were found for all measures of physical

| Table II. Mean (SD) on psychosocial factors for the five stages of behavioral change |
|---------------------------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                                | Precontemplation | Contemplation | Preparation | Action | Maintenance | \(F\)                  | \(\eta^2\)                  |
| General attitude               | 3.57 (0.67)\(^a\) | 3.87 (0.56)\(^b\) | 4.01 (0.63)\(^c\) | 3.93 (0.65)\(^d\) | 4.25 (0.61)\(^e\) | 174.23**                  | 0.11                  |
| Family support                 | 2.80 (1.25)\(^f\) | 3.19 (1.14)\(^g\) | 3.41 (1.18)\(^h\) | 3.32 (1.17)\(^i\) | 3.78 (1.15)\(^j\) | 112.41**                  | 0.07                  |
| Friends support                | 3.05 (1.13)\(^k\) | 3.45 (1.07)\(^l\) | 3.61 (1.05)\(^m\) | 3.68 (1.05)\(^n\) | 3.84 (1.01)\(^o\) | 88.28**                  | 0.06                  |
| Self-efficacy                  | 2.58 (1.02)\(^p\) | 2.98 (0.93)\(^q\) | 3.13 (0.90)\(^r\) | 3.31 (0.90)\(^s\) | 3.79 (0.92)\(^t\) | 258.93**                  | 0.15                  |
| Perceived benefits (pros)     | 2.98 (0.74)\(^u\) | 3.32 (0.58)\(^v\) | 3.45 (0.62)\(^w\) | 3.32 (0.71)\(^x\) | 3.62 (0.67)\(^y\) | 132.25**                  | 0.08                  |
| Perceived barriers (cons)     | 2.70 (0.67)\(^z\) | 2.59 (0.60)\(^{ab}\) | 2.46 (0.63)\(^{ac}\) | 2.42 (0.77)\(^{ad}\) | 2.05 (0.74)\(^{ae}\) | 160.60**                  | 0.10                  |
| Balance (pros – cons)          | -12.10 (14.28)\(^f\) | -5.57 (12.45)\(^g\) | -2.13 (12.14)\(^h\) | -3.41 (14.53)\(^i\) | 5.72 (14.66)\(^j\) | 256.74**                  | 0.15                  |

**\(P < 0.001\).  
\(^a–d\)Means with different indices are significantly different in post-hoc tests.

| Table III. Mean scores (SD) on self-rated physical activity and inactivity for the five stages of change |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Physical activity/inactivity | Precontemplation | Contemplation | Preparation | Action | Maintenance | \(F\)      | \(\eta^2\)                  |
| Sport participation (hours per week)             | 1.72 (2.93)\(^a\) | 2.47 (3.30)\(^b\) | 3.71 (3.85)\(^c\) | 4.05 (4.13)\(^c\) | 6.54 (4.51)\(^d\) | 279.29**                  | 0.16                  |
| Sport at school except PE (hours per week)       | 0.16 (0.65)\(^a\) | 0.22 (0.77)\(^{ab}\) | 0.39 (1.05)\(^b\) | 0.58 (1.24)\(^b\) | 0.87 (1.55)\(^c\) | 36.20**                  | 0.02                  |
| Walking or cycling to school (hours per week)    | 0.40 (0.89)\(^a\) | 0.38 (0.90) \(^b\) | 0.33 (0.82)\(^c\) | 0.38 (0.90) \(^c\) | 0.54 (1.09)\(^d\) | 4.04*          | 0.00                  |
| Walking or cycling in leisure time (hours per week) | 0.80 (0.82)\(^a\) | 0.87 (0.82) \(^b\) | 1.0 (0.89)\(^c\) | 0.94 (0.88) \(^c\) | 0.99 (0.93)\(^d\) | 4.76**                  | 0.01                  |
| Voluntary physical activity (hours per week)     | 2.86 (3.39)\(^a\) | 3.71 (3.79)\(^b\) | 5.17 (4.45)\(^c\) | 5.67 (4.71)\(^c\) | 8.60 (5.22)\(^d\) | 277.60**                  | 0.16                  |
| Total physical activity (hours per week)         | 4.92 (3.44)\(^a\) | 5.80 (3.92) \(^b\) | 7.31 (4.58)\(^c\) | 7.86 (4.86) \(^c\) | 11.04 (5.66)\(^d\) | 283.70**                  | 0.16                  |
| Vigorous activity 20 minutes (times per week)     | 0.92 (1.23)\(^a\) | 1.35 (1.51)\(^b\) | 1.70 (1.59)\(^c\) | 1.98 (1.85)\(^c\) | 3.01 (2.03)\(^d\) | 240.41**                  | 0.14                  |
| Moderate activity 60 minutes (days per week)      | 1.12 (1.48)\(^a\) | 1.50 (1.64)\(^b\) | 1.81 (1.65)\(^c\) | 1.83 (1.65)\(^c\) | 2.65 (1.86)\(^d\) | 134.63**                  | 0.08                  |
| Sedentary behavior (hours/day)                    | 3.50 (1.60)\(^a\) | 3.36 (1.60)\(^b\) | 3.46 (1.55)\(^c\) | 3.60 (1.56)\(^c\) | 3.46 (1.63)\(^d\) | 1.73          | 0.00                  |

\(^a\)\(^P < 0.01, {^b\)\(^P < 0.001.  
\(^a–d\)Means with different indices are significantly different in post-hoc tests.
activity. The pattern of activity across the stages was also similar. For all physical activity indices except for walking or cycling to school, adolescents in precontemplation had the lowest activity levels, followed by those in the contemplation stage. Adolescents in the maintenance stage had the highest activity levels. Preparation and action were not significantly different. Partial $\eta^2$ ranged between 0.08 and 0.16, showing medium to high effect sizes. Adolescents in precontemplation reported less than 2 hours of sports participation per week, increasing to 2.5 hours in contemplation, about 4 hours in preparation and action, and more than 6.5 hours in maintenance. For total hours of physical activity in leisure time, adolescents in precontemplation reported almost 3 hours per week, those in contemplation almost 4 hours per week, those in preparation and action 5–6 hours per week and those in maintenance about 8.5 hours of physical activity per week. As most schools have 2 hours of obligatory PE per week, mean activity scores increase with about 2 hours in each stage when PE was added to hours spent in leisure time activity. Differences between stages were small for transportation ($\eta^2 = 0.00$ and 0.01). Walking or cycling to school was significantly higher in the maintenance stage compared to the preparation stage. Walking or cycling for transportation in leisure time was higher in the maintenance and the preparation stage compared to the precontemplation stage. No differences were found between the stages of change for sedentary behavior measured by hours watching TV or video and playing computer games or using the Internet. The mean score for adolescents in all stages was about 3.5 hours per day.

**Sensitivity and specificity of the stages of change**

The classification of respondents related to awareness, sensitivity, specificity and related quality indices are presented in Table IV. Total hours physical activity per week including PE was used as the outcome variable. Compared to both norms, about 70% of the adolescents were realistic about their level of physical activity. The kind of misclassification was dependent on the norm. Overestimation was most prominent when the most stringent norm (7 hours per week) was used. Seventeen percent overestimated their activity compared to only 9% with the less stringent criterion (5 hours per week). One-fifth of the adolescents underestimated their activity level using the 5 hours per week norm compared to only 12% for the 7 hours per week norm. The sensitivity and specificity of the staging instrument were good. The related quality indexes were moderate.

**Discussion**

Compared to a meta-analysis including 71 studies using mainly adult participants (Marshall and Biddle, 2001), there were less adolescents in the present study in precontemplation, preparation and action, but more in maintenance. Our distribution for adolescents makes sense because adolescence is
a period of drop-out from sports and not a period of picking up new physical activities (Sallis, 2000). This is further corroborated by our finding that there is a drop from 60% of the 12–13 year olds in the maintenance phase to 40% of the 17–18 year olds. These results replicate and extend previous findings. Only one previous study (Nigg and Courneya, 1998) investigated the stages of change in a Canadian sample covering the whole adolescent period (12–18 year olds). In that study, 819 adolescents with a mean age of 15 years (range 13–19) participated and there was a response rate of 61%. Nigg and Courneya (Nigg and Courneya, 1998) found very low rates in precontemplation (2.1%) and contemplation (4.2%). A large group of adolescents were in maintenance (49.3%), preparation (28.7%) and action (15.7%). They attributed the low percentages of adolescents in the first two stages to the fact that non-exercisers probably did not fill in the questionnaire. Other researchers studied a group of younger children (Cardinal et al., 1998; Walton et al., 1999; Hausenblas et al., 2002) and found 60–88% of the children in the action or maintenance stages.

As all adolescents within the participating classes in the present study responded, the stage distribution may be considered as a good estimate of the population prevalence in each stage. About 59% of the adolescents classified themselves in the adoption stages. This means that they are convinced to do sufficient physical activity. The data showed that for 71% of the adolescents, their classification corresponds with their self-reported physical activity level. The algorithm overstaged only 17% (7 hours per week standard) or 9% (5 hours per week standard) of the adolescents. This means that adolescents do better than Dutch adults from which a substantial proportion of the respondents (35.6%) overestimate their physical activity level in relation to the recommended target of 30 minutes on at least 5 days a week (Ronda et al., 2001). From a health promotion perspective this is important information as unrealistic self-assessment is often a barrier to encourage people to move forward in the behavioral change process because they see no need to change. From the present study it could be argued that adolescents classify themselves reasonably reliably into the stages of change. However, including an objective staging criterion into the algorithm could further improve self-assessment, and possibly show a more clear distinction between the preparation and action stage.

Previous studies on the stages of change often used a general and short physical activity questionnaire (Godin et al., 1986). In the present study, a broad definition of physical activity was used. Differences across stages of change were not only found for sport participation or total physical activity (high effect sizes), but also for sport at school except PE and active transportation (lower effect sizes). This suggests that ‘active’ adolescents are active at different levels and that ‘inactive’ ones combine an inactive lifestyle with little sport participation. The latter group is probably at extra risk as they do not compensate for their lack of sport participation with daily activity.

Two additional issues arise from the stage distribution of physical activity in our sample. First, it is clear that adolescents within the preadoption stages or those within the adoption stages do not only differ in intention, but also in behavior. As the Transtheoretical Model was developed based on smoking research (Prochaska and DiClemente, 1983), the behavior difference between the preadoption and adoption stages in smoking is obvious (smoking versus non-smoking) and persons within those stages only differed in intention. However, for physical activity, a gradual increase across the stages of change is not exceptional. In their review, Marshall and Biddle (Marshall and Biddle, 2001) found that the level of physical activity increased as individuals moved to a higher stage of change. They suggested that transitions within preadoption stages are also associated with changes in physical activity. This shows that people probably need physical activity experiences and some initial changes in physical activity before they decide to adopt adequate levels of physical activity. A second issue that deserves attention is the lack of difference between the preparation and the action stage for all measures of physical activity in the present study. In their review, Marshall and Biddle (Marshall and Biddle, 2001) found the largest effects for physical
activity from preparation to action, which seems evident as individuals move from preadoption to adoption and reach an activity criterion. It is possible that this is a specific phenomenon in adolescents. As the decline in physical activity is typical in adolescence, it is possible that adolescents do not progress through the stages of change from precontemplation to maintenance as is expected in adults, but the other way around. In primary school, a high percentage of children are in maintenance (Cardinal et al., 1998; Walton et al., 1999). Our data reveal that about 20% will drop into the preadoption stages during adolescence.

Surprisingly, no differences were found across stages of change for sedentary activities such as TV viewing or computer use. It is often assumed that a lack of physical activity goes together with a high level of sedentary activities (Robinson, 1999). Our data reveal a mean difference of about 5 hours of physical activity per week between adolescents in maintenance and those in precontemplation, but no difference in sedentary activities. A mean score of about 3.5 hours TV viewing and computer use per day was found for adolescents in all stages. This is in line with the recent research of Marshall et al. (Marshall et al., 2002) who argued that physical activity and sedentary behavior are not two sides of the same coin. Using cluster analyses in a sample of 11- to 15-year-old adolescents from the US and the UK, they showed that sedentary behavior can sometimes compete with and sometimes coexist with physical activity.

At present, concepts from the Transtheoretical Model and from the Theory of Planned Behavior are most often used to understand and guide interventions for physical activity. The combination of both theories makes it possible to provide guidelines to target particular determinants as a function of stage. A stable pattern was found in which determinants positively related to physical activity increase gradually through the stages of change. This general increase in psychosocial determinants as a function of stages of change is in line with previous studies in adults (Marshall and Biddle 2001; Ronda et al., 2001) and in adolescents (Nigg and Courneya, 1998). Adolescents in the precontemplation stage and those in the maintenance stage differed very strongly on psychosocial factors from all other stages. Distinctions between the contemplation, preparation and action stages were less pronounced for psychosocial factors. It could be argued that not five, but three types of adolescents could be distinguished: adolescents in the extreme stages show, respectively, an unfavorable (precontemplation) and a very favorable (maintenance) pattern of determinants; adolescents in the contemplation, preparation and action stages can be considered as one group; with a psychosocial pattern in between both extremes. This has implications for tailoring intervention strategies promoting physical activity in adolescents to the stages of change.

Although the score for the pros still outnumbered the cons in adolescents in the precontemplation stage, they clearly perceived most barriers and least benefits. In addition, adolescents in the precontemplation stage reported the least social support from family and friends, but especially a very low self-efficacy. In a previous study, tracking from adolescence into young adulthood was investigated for physical activity and psychosocial determinants (De Bourdeaudhuij et al., 2002). This study revealed that over a 7-year period, high tracking scores were found for determinants of physical activity such as perceived benefits, perceived barriers and self-efficacy. This relative stability of psychosocial determinants together with the rather low participation in physical activity argues for early interventions, especially in this first group of youngsters in the precontemplation stage, to make cognitions and emotions related to physical activity more positive. In addition, higher levels of modeling and social support in the home/school/social environment of the adolescent in the precontemplation stage are needed. For a second group of adolescents, those in the contemplation, preparation and action stages, physical activity interventions need to focus on the maintenance of adequate levels of activity. Most adolescents in those stages are still relatively active meeting the activity standards, but it is very likely that their activity levels will considerably drop when they reach young adulthood. For this subgroup, interventions should be tailored towards increasing
self-efficacy; more specifically, in overcoming perceived barriers related to physical activity. The third subgroup of adolescents in the maintenance stage does not need further encouragement of physical activity, as they have very favorable psychosocial determinants, together with high sport participation and high lifestyle physical activity scores. However, context changes such as leaving home and the transition into higher education or the labor market could cause a considerable drop in physical activity in this yet highly motivated subgroup (Caspersen et al., 2000; De Bourdeaudhuij et al., 2002). Information is needed on how activity patterns can be converted from structured sports participation into lifestyle physical activity within changing contexts for this subgroup.

There were several limitations of the present study. First, the data relied on self-reports of physical activity and psychosocial variables. Despite the use of validated questionnaires, some over-reporting of physical activity may be present. Second, only the stages of change concept in relation to psychosocial variables was tested in the present study, not the Transtheoretical Model as a whole. Third, the algorithm used to classify respondents into stages of change was based upon previous work with adults in Europe and did not include definitional criteria such as information about frequency, duration or intensity of physical activity needed. This makes it harder for respondents to categorize themselves into the ‘right’ stage. Although we believe that the staging algorithm worked with few misclassifications, we agree with Marshall and Biddle (Marshall and Biddle, 2001) that it is better to include an activity criterion to define action when categorizing stages of change in the future. Finally, as this study was cross-sectional in nature, no information is available on progression or regression through stages during adolescence. As we expect a regression in adolescents, in line with the decline in physical activity during this period, longitudinal studies are needed to further our understanding on these processes.

We can conclude that our data partly support the validity of the stages of change model for physical activity in adolescents. Higher levels of physical activity of different intensity and within different contexts, and more favorable psychosocial determinants were found in the later stages. A large percentage of the adolescents placed themselves in a stage which was in accordance with their self-reported level of physical activity. Intervention strategies to adolescents can be tailored based on their stage of change. However, some differences were also revealed. Adolescents within the pre-adoption stages or those within the adoption stages did not only differ in intention, but also in behavior. No differences in physical activity were found between the preparation and the action stage. With regard to psychosocial factors, adolescents in the contemplation, preparation and action stages can be considered as one group, which has implications for interventions. Further research is warranted in this age group on the progression and regression through the stages of change for physical activity, and the implications for tailoring interventions.

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References


