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Predicting Physical Activity in Adolescents: The Role of Compensatory Health Beliefs within the Health Action Process Approach

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Abstract

Objective: Compensatory health beliefs (CHBs), defined as beliefs that healthy behaviours can compensate for unhealthy behaviours, may be one possible factor hindering people in adopting a healthier lifestyle. This study examined the contribution of CHBs to the prediction of adolescents' physical activity within the theoretical framework of the Health Action Process Approach (HAPA).

Design: The study followed a prospective survey design with assessments at baseline (T1) and two weeks later (T2).

Method: Questionnaire data on physical activity, HAPA variables and CHBs were obtained twice from 430 adolescents of four different Swiss schools. Multilevel modelling was applied.

Results: CHBs added significantly to the prediction of intentions and change in intentions, in that higher CHBs were associated with lower intentions to be physically active at T2 and a reduction in intentions from T1 to T2. No effect of CHBs emerged for the prediction of self-reported levels of physical activity at T2 and change in physical activity from T1 to T2.

Conclusion: Findings emphasize the relevance of examining CHBs in the context of an established health behaviour change model and suggest that CHBs are of particular importance in the process of intention formation.

Keywords: Compensatory health beliefs; Health Action Process Approach; physical activity; adolescents; intentions; health behaviour

Globally, physical activity has declined due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization (WHO, 2012). Despite the fact that physical inactivity is the fourth leading cause of death worldwide, 31% of the world's population aged 15 and more is insufficiently active (Kohl et al., 2012). It is furthermore well documented that physical activity decreases throughout adolescence, with the teen years (13-18) as the age of greatest decline (Kahn et al., 2008; Sallis, 2000). The global recommendations on physical activity for 5- to 17-year olds involve an accumulation of at least 60 minutes of moderate to vigorous physical activity daily (WHO, 2011). Engaging in regular physical activity provides essential health benefits for children and adolescents, in contributing to the development of a healthy cardiovascular system, musculoskeletal tissues, neuromuscular awareness and facilitating the maintenance of a healthy body weight (WHO, 2011). However, the adoption and maintenance of a health-enhancing behaviour such as physical activity is a challenging task and even despite the best intentions, many attempts remain unsuccessful (Sheeran, 2002). Recent research proposes that certain types of beliefs – *compensatory health beliefs* – may be an important factor hindering people in adopting a healthier lifestyle (e.g., Kronick & Knäuper, 2010; Rabiau, Knäuper, Nguyen, Sufrategui, & Polychronakos, 2009; Radtke, Scholz, Keller, Knäuper, & Hornung, 2011). This study set out to investigate the role of compensatory health beliefs in the framework of an established health behaviour change model for intention formation and change in physical activity in adolescents.

Compensatory health beliefs

Individuals are faced with temptations and desires throughout daily life: eating delicious but unhealthy food, smoking, taking the car instead of the bike, when at the same time holding goals with regard to their health. One way to resolve the motivational conflict that arises from giving in to temptations and holding on to health goals, is the activation of compensatory health beliefs (Rabiau, Knäuper & Miquelon, 2006).

Compensatory health beliefs (CHBs) are beliefs that the negative consequences of an unhealthy behaviour can be compensated for by engaging in a healthy behaviour (Knäuper et al., 2004). For example, people who have the intention to keep a healthy weight but also desire to eat sweets may activate the following belief "I can eat this piece of cake now, because I will exercise in the evening." The activation of compensatory health beliefs serves as a self-regulatory strategy to reduce the mental conflict at the moment of temptation or subsequently to fulfilling a desire and thus enables individuals to keep the 'best of both worlds': eating the cake, but not feeling guilty about it (Rabiau et al., 2006). Kronick and Knäuper (2010) provided first empirical evidence that the mental conflict of being torn between giving in to food temptation (delicious looking, high caloric cookie) or preserving initial dieting goals elicits the formation of compensatory intentions.

While individuals may intend to engage in the compensatory behaviour, the compensatory behaviour itself is often not carried out. As time passes, the initially felt discomfort weakens and eventually the need to compensate for the unhealthy behaviour fades away. Also, the compensatory behaviour may not effectively compensate for the multiple negative effects an unhealthy behaviour can bring about and may lead to ill health in the long run. It can therefore be assumed that holding CHBs is associated with negative health outcomes over time (Knäuper et al., 2004; Rabiau et al., 2006).

So far, CHBs have been investigated with regard to several health behaviours. These studies provide evidence that higher CHBs are associated with lower diabetes treatment adherence in adolescents with type 1 diabetes (Rabiau et al., 2009), greater caloric intake (Kronick, Auerbach, Stich, & Knäuper, 2011; Kronick & Knäuper, 2010), lower adherence to self-set dieting rules (Miquelon, Knäuper, & Vallerand, 2012), and less readiness to quit smoking in adolescents (Radtke, Scholz, Keller, & Hornung, 2012; Radtke et al., 2011). Moreover, Radtke and colleagues (2012) investigated the role of smoking-specific CHBs for intention formation and smoking behaviour within the theoretical framework of a health behaviour change model, the Health Action Process Approach (HAPA; Schwarzer, 1992). Results showed that smoking-specific CHBs were a significant negative predictor of intention to stop smoking over and above HAPA-specific variables (i.e., risk perception, outcome expectancy, and self-efficacy), but were unable to predict smoking behaviour itself. This finding emphasizes the relevance of examining CHBs in comparison to other well-established constructs of health behaviour change. As Radtke and colleagues (2012) were the first ones to test such effects, further examination is needed. Moreover, CHBs have not yet been investigated in detail in the context of physical activity. In light of the existing evidence that physical activity declines in particular during adolescence, examining CHBs within the context of physical activity could provide more insight into potential mechanisms. Thus, the present study sought to investigate the contribution of CHBs within the HAPA in the context of adolescents' physical activity.

Health Action Process Approach

The Health Action Process Approach (HAPA; Schwarzer, 1992) belongs to the group of dynamic stage models of health behaviour change and suggests a distinction between two phases of health behaviour change: a) a preintentional motivational phase, in which a person forms a behavioural intention, and b) a subsequent postintentional volitional phase, in which a person aims at translating intentions into behaviour. For each phase, the HAPA specifies important social-cognitive processes. Within the motivational phase, risk perception, outcome expectancies, and self-efficacy are assumed as predictors of intention formation. Risk perception as the subjectively perceived vulnerability (e.g., "I am at risk for cardiovascular disease") is in itself insufficient to enable intention formation, but is rather believed to set the stage for a contemplation process for health behaviour change (Schwarzer, 2008). Outcome expectancies are beliefs about positive and negative outcomes of certain behaviours. It is more likely for a person to develop an intention to change the behaviour if the pros prevail over the cons. Self-efficacy refers to beliefs in one's capability of performing a desired action despite difficult demands. It is assumed that self-efficacy is relevant for both phases, and may relate directly to behaviour outcomes (Sniehotta, Scholz, & Schwarzer, 2005).

Once an intention is formed, the motivational phase is completed and the person enters the volitional phase. Crucial factors within the volitional phase besides intentions and self-efficacy are action planning and action control. Action planning refers to forming concrete plans about when, where and how to implement the intended behaviour, and is equivalent to the concept of implementation intentions (Gollwitzer, 1999). Action control is a self-regulatory process that involves three subfacets: awareness of standards, self-monitoring and self-regulatory effort (e.g., Sniehotta, Nagy, Scholz, & Schwarzer, 2006). Both variables are assumed to promote the targeted behaviour (Sniehotta et al., 2005).

The HAPA is a well-established model in the prediction of health behaviour change and has demonstrated applicability across a variety of health behaviours, such as physical activity (e.g., Scholz, Sniehotta, & Schwarzer, 2005), dietary behaviours (Renner & Schwarzer, 2005), smoking cessation (Scholz, Nagy, Göhner, Luszczynska, & Kliegel, 2009), dental hygiene (Schüz, Sniehotta, & Schwarzer, 2007), as well as to diverse samples (e.g., Schwarzer, 2008). Therefore, it is of high applicability to examine the following aim of the study.

Aim of the present study

The aim of the present study was to examine the role of CHBs within the theoretical framework of the HAPA in the context of physical activity in adolescents. Specifically, it was tested whether CHBs contribute a) to the prediction of intentions to be physically active (motivational phase), and b) to the prediction of self-reported level of physical activity (volitional phase) over and above the variables specified in the HAPA. The rationale for this research question was that from a theoretical point of view CHBs might indeed be activated in both phases of behavior change. First, in the motivational phase when a mental conflict results from deciding between keeping up one's health goals (e.g., attending the swimming class on Tuesday night) and giving in to a temptation (e.g., staying at home watching one's favorite sitcom which is on every Tuesday night at the same time as the swimming class). Activating CHBs like "not going to the swimming class is ok as long as I eat a balanced diet" might then negatively influence the formation of an intention to sign up for the swimming class. Second, in the volitional phase, that is after the intention to be physically active has already been set, activating CHBs might reduce the likelihood of indeed acting upon one's intentions. For example, when having decided to attend the swimming class, but a friend suggests going to a nice restaurant at the same night instead, activating CHBs like "not going to the swimming class tonight is ok, because I will go tomorrow instead" might have detrimental effects on translating the good intentions into behavior. In line with this theoretical reasoning, previous research has demonstrated that CHBs may relate directly to health behaviour (e.g., Kronick et al., 2011; Miquelon et al., 2012; Rabiau et al., 2009) and intention formation in the context of smoking cessation (Radtke et al., 2011; 2012). Therefore we hypothesized CHBs to contribute to both phases of behaviour change in showing negative associations between CHBs and intentions to be physically active as well as physical activity itself.

Method

Procedure and participants

Participants were recruited from eighth and ninth grade of four different Swiss schools. Schools were sent detailed information about the study by email and were invited to participate. Participation comprised questionnaire assessment at baseline (T1) and two weeks later (T2)[1]. Questionnaire assessments took place from September to November 2007 during regular school lessons of 45 minutes and were supervised by the respective teacher and one of the authors. Data collection was conducted anonymously by personalized codes. At baseline, questionnaires included one of two planning tasks (intervention vs. control group) and were randomly administered within each class. Participants who were randomly allocated to the intervention group were asked to form action and coping plans concerning physical activity, whereas participants allocated to the control group received an analogue planning task with regard to learning. However, as the intervention[2] was not the main focus of the present study, it only served as control variable in the analyses.

A total of 25 classes (N = 442) participated in the study. Students who provided only data from the follow-up (n = 12) were excluded from the analyses. The final sample consisted of N = 430 adolescents at the age of 12 to 17 years (M = 14.55, SD = 0.98). This is a comparably large age range, but not unusual in Switzerland as the school systems allows for quite some variability in age (e.g. early/late enrollment, repeating or skipping a grade, etc.). 46.3% were female and 77.4% specified (Swiss-)German as their native language. Almost half of the sample (41.2%) were students of the highest school level in Switzerland (subsequently denoted as school level A), 31.2% of secondary school (denoted as school level B), and 27.7% of lower secondary school (denoted as school level C). 51.9% of the participants were allocated to the intervention group, 48.1% to the control group.

Drop-out analyses were conducted to compare those who did not participate at T2 (dropouts, n = 34; 7.9%) from those who completed both questionnaire assessments (completers, n = 396) in terms of socio-demographic variables and main study variables. T-tests showed no significant effect for CHBs, self-efficacy, positive outcome expectancies, risk

[1] The comparably short two-week follow-up period was chosen in order to capture the short-term effects of the intervention described below.
[2] The planning intervention did not reveal any significant effects (cf. Loretini, 2008).

perception, intentions, action planning, action control, physical activity and mean age. However, chi-square tests revealed a significant difference between dropouts and completers in terms of native language, $\chi^2(1, N= 430) = 7.33, p < .01$, in that dropout was lower for adolescents with (Swiss-)German as the native language. No significant effect emerged for intervention, school level and sex.

Measures

All variables were assessed at baseline (T1), whereas outcome measures intentions and physical activity were assessed at both measurement points (T1 and T2). To predict change in outcomes, baseline measures were included as control variables. Risk perception, positive outcome expectancies, self-efficacy, intentions, action planning and action control were all assessed by items adapted from Sniehotta and colleagues (2005) and for all these measures the response format was 1 (not at all true) to 5 (completely true). Item examples given here are examples translated from German. Table 1 gives an overview on means, standard deviations, range and Cronbach's alphas of main variables in the present study.

CHB Scale (Knäuper et al., 2004). CHBs were measured using a German version (Lippke, Hohman, Kalusche, & Knäuper, 2007) of the original Canadian scale (Knäuper et al., 2004), including additional diet-specific items. Seven items concerning substance use (smoking, drinking alcohol) were excluded for the present study as they were found to be inappropriate in a sample of adolescents aged 12 and more. The final scale comprised 21 items assessing various compensatory beliefs in regard to eating, sleeping, stress, exercise and weight regulation, for example "Sleep compensates for stress," or "It's OK to eat junk food sometimes if one is exercising regularly." Response format was 1 (strongly disagree) to 5 (strongly agree).

Risk perception was assessed by six items. All items had the stem "If I keep up my level of activity/inactivity,.." followed by statements concerning perceived vulnerability to probable consequences of physical inactivity such as "…I will become more unattractive for others."

Positive outcome expectancies were measured by three items, introduced by the stem "If I exercise regularly,…" and followed by statements regarding positive consequences such as "…then that's good for my health."

Self-efficacy was assessed by ten items, for example "I am confident that I can exercise regularly, even if I feel sad," or "I am confident that I can exercise regularly, even if I don't see any immediate advantages."

Intentions were measured by five items. Participants were asked to rate five intentional statements regarding physical activity, for example "I intend to do sports regularly," or "I intend to exercise several times a week."

Action planning was assessed by five items. All items had the item stem "I have made a detailed plan for…", followed by statements such as "…when to exercise,", "…where to exercise," or "…how often to exercise."

Action control was assessed by nine items, of which three items each addressed the subcomponents of awareness of standards, self-monitoring, and self-regulatory effort. Items were for example "In the last seven days, I…" a) "…had my intended physical activity always in mind," b) "…constantly monitored whether I exercise frequently enough," c) "…really tried to exercise regularly."

Physical activity. To assess physical activity the short-form of the International Physical Activity Questionnaire (IPAQ; Booth, 2000) was used. Participants were asked to indicate on how many days in the last seven days they engaged in moderate and vigorous activities and how much time they usually spent with those activities per day. Frequency and duration was multiplied to obtain an average total hours of moderate and vigorous physical activity per week.

(over here Table 1)

Data analysis

As the present sample comprised students nested within classes, multilevel linear models were employed in SPSS 20 to account for the hierarchical data structure. Multilevel modelling allows investigating associations between constructs at the student level (Level 1) as well as at the class level (Level 2). To examine the amount of variability on both levels, intraclass correlations (ICC) were calculated for each variable in the study (see Table 1).

For the prediction of intentions at T2, risk perception, positive outcome expectancies, self-efficacy and CHBs served as Level 1 predictors. Sex and intervention (Level 1) as well as school level (Level 2) were included as control variables. To predict change in intentions from T1 to T2, baseline measure of intentions was included as additional Level 1- predictor. For the prediction of physical activity at T2, intentions, self-efficacy, action planning, action control and CHBs served as Level 1 predictors. Sex and intervention (Level 1) as well as school level (Level 2) were controlled for. Again, to predict change in physical activity from T1 to T2, baseline measure of physical activity served as additional Level 1 predictor.

As school level was a categorical variable with three values (school level A, B, and C), we dummy coded it into school level dummy 1 (school level A, but not B, and C) and school level dummy 2 (school level B, but not A, and C). The third category (school level C, but not A, and B) served as the reference group which was compared against all other categories. Further, all Level 1 variables were grand-mean centered by subtracting the mean sample score from each individual score of a given variable. Generally, centering is a useful tool to combat multicollinearity between predictor variables, to give predictors a meaningful zero point and to render models more stable (Field, 2009). Grand-mean centering was chosen here, as the study's primary interests lied in detecting effects on individual students instead of detecting effects on different school classes (e.g., Kreft & DeLeeuw, 1998). To give an example, Level 1 equation for intention formation at the individual level can be written like this:

y_{ij} (intentions) = β_{0j} + β_{1j} (risk perception) + β_{2j} (positive outcome expectancies) + β_{3j} (self-efficacy) + β_{4j} (compensatory health beliefs) + β_{5j} (intervention) + β_{6j} (sex) + r_{ij}

where y_{ij} is defined as individuals' (i) intentions to be physically active (y) across different school classes (j). β_{0j} is the intercept term and represents the mean level of intentions in the school class context j. β_{1j}– β_{6j} are the slopes representing the associations between intentions and the predictors mentioned above for every school class (j), and r_{ij} is the residual variance. Accordingly, the Level 2 equation for intentions at T2 reads as follows :

$\beta_{0j} = \gamma_{00} + \gamma_{01}$(school level, dummy 1) + γ_{02}(school level, dummy 2) + u_{0j};

$\beta_{1j} = \gamma_{10}+u_{1j}$;

$\beta_{2j} = \gamma_{20}+u_{2j}$;

$\beta_{3j} = \gamma_{30}+u_{3j}$;

$\beta_{4j} = \gamma_{40}+u_{4j}$;

$\beta_{5j} = \gamma_{50}+u_{5j}$;

$\beta_{6j} = \gamma_{60}+u_{6j}$

with γ_{00} being the sample mean of intentions, and γ_{01} and γ_{02} the association between intentions and school level (dummy coded). u_{0j} stands for the random error in β_{0j}, that is the variation in mean levels of intentions between school classes. γ_{10}– γ_{60} represent the mean sample slopes of the associations between intentions and different predictor variables. The slopes of the Level 1 variables were specified as random (error terms: u_{1j}–u_{6j}), indicating possible differences between classes in these mean effects.

Additionally, as an indicator of effect size, Pseudo R^2 was computed. The Pseudo R^2 statistic stands for the amount of reduction of error variance at a given level that results from comparing a model with all predictor variables included against a model with all but the predictor of interest included (Kreft & DeLeeuw, 1998). It is important to note that the Pseudo R^2statistic should be interpreted with caution, as it cannot be uniquely defined in models with random slopes and use is therefore limited in multilevel modeling (Kreft & DeLeeuw, 1998).

Treatment of Missing Values

As outcome variables had missing data points up to 11.2% and dropout analyses revealed a systematic pattern of missing data, multiple imputation (MI) was employed (Graham, 2009) using SPSS 20. The MI technique takes the missing data uncertainty into account by generating multiple values for a missing data point in form of generated multiple datasets. This approach is suitable for multilevel data as well (cf. Zhao & Yucel, 2009). For the present study, five datasets were generated. All analyses were conducted using all five imputed data files. However, using MI, for some coefficients pooled statistics could not be obtained. Therefore, in the present work range of F-statistics and standard deviations across the imputed dataset were presented and unstandardized b-coefficients were reported for fixed effects of multilevel models.

Results

Preliminary Analysis

Intra-class correlation (ICC) analyses of all variables revealed rather low ICCs varying from 0.02 to 0.05 (see Table 1). The ICC is a measure of the degree of dependence of individuals and is defined as the amount of variance between second-level units, in this case different school classes, in relation to total variance (Kreft & DeLeeuw, 1998). Small ICC values therefore indicate that the amount of variance between classes was relatively small. However, while in small samples a small ICC hardly affects the alpha level, in larger samples it may inflate the alpha level significantly (Kraft & DeLeeuw, 1998), and thus, it is important to consider a multilevel approach.

For intentions at T2, no ICC could be computed. The unconditional means model that allows the partitioning of the total outcome variation resulted in no variance at the between-level. In order to provide another test for this insufficient variance in intentions between classes, we employed a one-way ANOVA with class as predictor and intentions as the outcome. Results suggested that there were no significant differences between classes in terms of intentions at T2, $F(24, 370\text{-}405) = .79 - .96$, $p = .52 - .76$. Thus, in further analyses including intentions as the outcome variable, the random statement was dropped.

Inter-correlations of main variables

Inter-correlations of main variables are presented in Table 2. CHBs only showed a significant association with positive outcome expectancies, indicating that adolescents holding higher CHBs have more positive outcome expectancies. No correlations with outcome variables at T2 could be found. Overall, bivariate correlations support assumptions of the HAPA. Of the motivational variables, positive outcome expectancies and self-efficacy showed significant positive associations with intentions at both measurement points, whereas for the volitional phase self-efficacy, intentions, planning and action control were positively associated with physical activity at T1 and T2. Risk perception was, contrary to the theoretical assumptions, negatively correlated with all other HAPA variables. Of the socio-demographic variables, sex was significantly associated with both outcome measures in that males reported higher intentions and higher physical activity at T2, and thus, served as control variable in all analyses. In order to rule out possible intervention or school level effects, school level and intervention were additionally included as control variables in all analyses regardless of bivariate associations with outcome measures.

(over here Table 2)

Prediction of Intentions

In a first step, we tested the hypothesis that CHBs significantly contribute to the prediction of intentions over and above the variables specified in the HAPA. No random effects of intercept or slopes were tested in the model, as no differences between classes existed.

The model predicting intentions at T2 (see Figure 1A) resulted in statistically significant fixed effects for self-efficacy (b = .36, p < .01; Pseudo R^2 = .08), positive outcome expectancies (b = .59, p < .01; Pseudo R^2 = .20), risk perception (b = -.11, p < .05; Pseudo R^2 = .01), and CHBs (b = -.30, p < .01; Pseudo R^2 = .03). There were no significant effects for sex (b = .03, p = .75; Pseudo R^2 = .00), intervention (b = -.11, p = .23; Pseudo R^2 = .00), school level dummy 1 (b = -.09, p = .46; Pseudo R^2 = .00), and school level dummy 2 (b = -.23, p = .06; Pseudo R^2 = .01).

The model predicting change in intentions from T1 to T2 (see Figure 1B) resulted in statistically significant fixed effects for intentions at T1 (b = .53, p < .01; Pseudo R^2 = .26), self-efficacy (b = .17, p < .01; Pseudo R^2 = .02), positive outcome expectancies (b = .26, p < .01; Pseudo R^2 = .05), and CHBs (b = -.22, p < .01; Pseudo R^2 = .02). There were no significant effects for risk perception (b = -.07, p = .14; Pseudo R^2 = .01),-sex (b = .06, p = .49; Pseudo R^2 = .00), intervention (b = -.12, p = .14; Pseudo R^2 = .01), school level dummy 1 (b = -.03, p = .78; Pseudo R^2 = .00), but a significant effect for school level dummy 2 (b = -.25, p < .05; Pseudo R^2 = .01).

These results indicate that adolescents with higher self-efficacy, higher positive outcome expectancies, and less risk perception at T1 showed higher intentions to be physically active at T2, and that adolescents with higher self-efficacy and higher positive outcome expectancies also reported an increase in intentions, whereas adolescents in school level B reported a decline in intentions to be physically active from T1 to T2. Moreover, in line with our hypothesis, CHBs emerged as significant negative predictor of intentions at T2 and change in intentions from T1 to T2, indicating that adolescents holding higher CHBs reported less intentions to be physically active.

(over here Figure 1)

Prediction of Physical Activity

In a second step, we tested the hypothesis that CHBs significantly contribute to the prediction of physical activity over and above the variables specified in the HAPA. Random effects of the intercept of physical activity and of the slopes were not significantly different from zero, indicating that there were no differences between classes in initial levels of physical activity and in associations between predictor and outcome variables. Therefore, the random statement was dropped for subsequently reported analyses.

The model predicting physical activity at T2 (see Figure 2A) resulted in a statistically significant fixed effect for action control (b = .44, p < .05; Pseudo R^2 = .01), but no effect for self-efficacy (b = .41, p = .07; Pseudo R^2 = .01), intentions (b = .30, p = .14; Pseudo R^2 = .01), action planning (b = .22, p = .27; Pseudo R^2 = .00), and CHBs (b = -.15, p = .64; Pseudo R^2 = .00). Of control variables, sex (b = 1.01, p < .01; Pseudo R^2 = .02), school level dummy 1 (b = -1.87, p < .01; Pseudo R^2 = .05), school level dummy 2 (b = -1.79, p < .01; Pseudo R^2 = .04), but not intervention (b = -.47, p = .17; Pseudo R^2 = .01) were significant predictors of physical activity at T2. These results suggest that adolescents in school level A and B reported less physical activity at T2, whereas male adolescents and adolescents with higher action control at T1 reported to be more physically active at T2. In contrast to the prediction of intentions, CHBs did not emerge as a significant predictor of physical activity.

The model predicting change in physical activity from T1 to T2 (see Figure 2B) resulted in a statistically significant fixed effect for physical activity at T1 (b = .43, p < .01; Pseudo R^2 = .21), but no effect for action control (b = .30, p = .08; Pseudo R^2 = .01), self-efficacy (*b* = .29, *p* = .15; Pseudo R^2 = .01), intentions (*b* = .11, *p* = .53; Pseudo R^2 = .00), action planning (*b* = .07, *p* = .68; Pseudo R^2 = .00), and CHBs (*b* = .04, *p* = .89; Pseudo R^2 = .00). Of control variables, school level dummy 1 (*b* = -1.34, $p < .01$; Pseudo R^2 = .03), school level dummy 2 (*b* = -1.41, $p < .01$; Pseudo R^2 = .03), but not sex (*b* = .48, *p* = .12; Pseudo R^2 = .01), and intervention (*b* = -.38, *p* = .20; Pseudo R^2 = .00) were significant predictors of physical activity at T2. These results indicate that adolescents in school level A and B reported a decline in physical activity. Again, CHBs did not predict change in physical activity from T1 to T2.

(over here Figure 2)

Discussion

The aim of the present study was to investigate the contribution of CHBs in predicting adolescent's physical activity within an established framework of a health behaviour change model (HAPA). Findings showed that CHBs emerged as a significant negative predictor of adolescent's intentions as well as change in intentions over and above standard motivational HAPA predictors. The negative association indicates that for adolescents holding CHBs is rather counterproductive as higher CHBs go along with lower intentions and a reduction in intentions to be physically active over two weeks. This is in line with the theoretical assumption that the activation of CHBs serves as a justification of unhealthy behaviour choices and may hinder adolescents in acquiring healthier lifestyles such as losing weight or being physically active (cf. Knäuper et al., 2004). Moreover, this finding might serve as a potential explanation for low levels of physical activity in general and also during adolescence (e.g. Kahn et al., 2008; Sallis, 2000), and thus CHBs could potentially provide an approach for such interventions.

CHBs emerged as a significant negative predictor of intentions at T2 and change in intentions from T1 to T2, despite the fact that bivariate associations were not significant. This could possibly be due to a suppressor effect (e.g., Cohen, Cohen, West, & Aiken, 2003) and would suggest that CHBs make a unique contribution to the prediction of intentions once self-efficacy and outcome expectancies were taken into account.

However, contrary to our hypothesis, we could not find evidence that CHBs added significantly to the prediction of adolescent's self-reported level of physical activity over and above standard volitional HAPA predictors. This result was rather unexpected as it stands in contrast with previous studies on CHBs in the context of diabetes and dietary adherence, in which CHBs were directly associated with behavioural outcomes (e.g., Kronick et al., 2011; Miquelon et al., 2012; Rabiau et al., 2009). The present results though corrobate prior work on smoking-specific CHBs that were found to add significantly to the prediction of intentions but not smoking behavior itself within the HAPA (Radtke et al., 2012). Thus, in combination, these findings emphasize that for adolescents CHBs might not be equally important in different phases of health behaviour change. While CHBs, along with other motivational predictors, seem to play a crucial role in the process of intention formation, they are not as relevant for the translation of intentions into behaviour. This suggests that CHBs are rather motivational in nature and should be considered an integral part of a decision-making process. This is also coherent from the perspective of self-licensing processes in the context of hedonic consumption (cf. De Witt Huberts, Evers, & De Ridder, 2012). Self-licensing describes the process of relying on justifications to permit an otherwise forbidden pleasure, and contends that people are more likely to choose hedonic goods when the decision context allows them to justify the consumption (such as dieters who permit themselves a supersized fast food dinner after a difficult exam). Self-licensing has so far been found to lead to more hedonic choices, as seeking and constructing reasons may be part of resolving the decisional conflict, but may not be expected to automatically translate from decision making into hedonic behaviour.

Still, further research is needed to better understand the role of CHBs within the process of behavioural enactment. One possible approach could lie in assessing CHBs more distinctly. In the present study, we used a response format ranging from 1 “strongly disagree” to 5 “strongly agree”, in order to avoid a simple evaluation of accuracy of beliefs (cf. Miquelon et al., 2012). However, whereas higher endorsement in CHBs may not be as relevant for the translation of intentions into behaviour, *how often* the strategy of CHBs as a justification is used, regardless of agreement, could be of importance. Therefore, future studies should try to fill this gap by asking to additionally rate frequency with which CHBs were applied (cf. Radtke & Scholz, 2012). In a similar vein, Kaklamanou, Armitage and Jones (2013) point out that in order to distinguish between beliefs and behaviours it would be of great importance to develop a compensatory health behaviour questionnaire assessing the frequency of employing a CHB strategy.

Furthermore, the present study used an adapted scale of general CHBs. Following the approach from Radtke and colleagues (2011; 2012), an additional advancement could lie in assessing behaviour-specific CHBs with regard to physical activity. This approach was not possible in the present study, as the respective subscale comprising three exercise-specific items (with physical exercise as the behavior to be compensated for) did not yield a satisfactory reliability. For this purpose, future research should consider the need for developing an exercise-specific CHB scale, that specifically targets physical activity not only as the compensatory behaviour (e.g., “The bad effects of stress can be made up for by exercising.“) but also as the behaviour to be compensated for (e.g., “Physical inactivity can be compensated for by eating less.”).

Overall, the HAPA demonstrated good applicability in predicting physical activity in adolescents. Consistent with assumptions of the HAPA, adolescents with higher positive outcome expectancies and self-efficacy reported more intentions to be physically active, while adolescents with higher action control were more physically active. Despite significant positive associations between intentions, self-efficacy and action planning with physical activity on a bivariate level, they did not emerge as significant predictors of physical activity. This finding might be attributed to the fact that action control emerged as the most powerful volitional predictor, which is in line with assumptions that action control plays a central role in the self-regulation of behaviour (e.g., Sniehotta et al., 2006). Contrary to assumptions, risk perception was negatively associated with other HAPA variables. This is similar to the findings of a recent study on the HAPA model predicting sport participation among individuals with acquired physical disabilities (Perrier, Sweet, Strachan, & Latimer-Cheung, 2012) revealing a negative, albeit not statistically significant association between risk perceptions and intentions to participate in sport. One possible explanation might be that the ambigous item phrasing ("If I keep up my level of activity/inactivity…") in the assessment of risk perception produced a converse effect, in that adolescents with high levels of activity at baseline did not perceive themselves as vulnerable to probable social or health consequences which resulted in low reported levels of risk perception and negative associations with the other HAPA constructs. This explanation is in line with results from a study on the use of safe water options in Bangladesh (Inauen, Hossain, Johnston, & Mosler, 2013), showing that users of safe water option felt less vulnerable to developing health problems such as arsenicosis than non-users. 99.1% of users indicated that this was due to the fact that they were already drinking safe water.

Moreover, results indicate that adolescents of higher-level schools (school level A and B) were less physically active than adolescents in school level C. This result stands in contrast with findings on socio-economic discrepancies in physical activity, suggesting that individuals from lower socio-economic status show lower level of activities (e.g., Gidlow, Johnston, Crone, Ellis, & James, 2006).

This study has some limitations that need to be acknowledged. First, our sample consisted of adolescents in 8th and 9th grade of four different Swiss schools and is therefore not representative of the adolescent population in Switzerland. Future studies should examine whether the present results generalize to different samples. Second, all variables were assessed using self-report measures. Especially self-report measures on physical activity are critical as physical activity is a socially desirable behaviour that is likely to be overreported among adolescents and adults (Sallis & Saelens, 2000). Further, reporting on frequency and duration of activities of moderate and vigorous intensity throughout the last seven days might be challenging for adolescents, as they have to accumulate all activities they have engaged in. However, the International Physical Activity Questionnaire (IPAQ; Booth, 2000) is an internationally established measure and as in the present study questionnaires were self-administered and anonymous, we believe that social desirability and recall bias should have been limited. Still, future studies might consider employing additional objective measures of physical activity such as accelerometers (e.g., Hall & Epp, 2013). Third, the present study employed a prospective design with two measurement points to better understand relationships between CHBs and behavioural change. However, results need to be interpreted cautiously as no conclusions about the causal role of CHBs can be drawn. Moreover, the chosen two-week follow-up period is relatively short compared to other studies testing effects of CHBs over a timespan of between two and six months (e.g. Kaklamanou & Armitage, 2012; Miquelon et al., 2012; Radtke et al., 2011; 2012). Future studies might consider employing a longer study timeframe.

An important implication from the present findings is that CHBs could provide a promising approach for health behaviour change interventions. CHBs could be targeted in the class context by clarifying the inaccuracy of such beliefs, the difficulty to engage in the intended compensatory behaviour and the maladaptive effects that may emerge. Adolescents should further be provided with alternative strategies they could use to avoid activation of CHBs (e.g., via planning, avoiding tempting situations, etc.).

In sum, the present paper demonstrated the usefulness of examining the role of CHBs within the theoretical framework of the HAPA and emphasized the particular importance of CHBs as a contradictory motivational process for intention formation in adolescents.

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Table 1. *Means, standard deviations, internal consistency and Intra-class Correlations (ICC) for main variables (N = 430)*

	M	*SD*	Range	α	ICC
CHBs	3.09	0.53	1-5	.77	0.04
Risk perception	1.78	0.94	1-5	.92	0.05
Positive outcome expectancies	3.79	0.86	1-5	.80	0.02
Self-efficacy	2.87	0.84	1-5	.86	0.02
Intentions T1	3.66	1.14	1-5	.91	0.03
Intentions T2	3.64	1.15-1.17	1-5	.93	-[a]
Action planning	3.24	1.22	1-5	.92	0.03
Action control	2.73	1.19	1-5	.95	0.03
Physical Activity T1	3.42	3.78-3.83	0-20.5	-	0.03
Physical Activity T2	3.24	3.60-3.69	0-21.9	-	0.05

Note. CHBs = Compensatory health beliefs; As pooling of standard deviations is not available, ranges of standard deviations (SDs) across the 5 imputed data sets are reported.

[a] ICC could not be computed

Table 2. Inter-correlations between variables of interest, group-mean centered (*N* = 430)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. CHBs (T1)	-													
2. Risk perception (T1)	.05	-												
3. Pos. outcome exp. (T1)	.12*	-.15**	-											
4. Self-efficacy (T1)	.09	-.13**	.39**	-										
5. Intentions (T1)	.03	-.16**	.58**	.45**	-									
6. Intentions (T2)	-.05	-.19**	.55**	.43**	.70**	-								
7. Planning (T1)	-.02	-.13**	.47**	.45**	.67**	.66**	-							
8. Action Control (T1)	.00	-.10*	.46**	.40**	.59**	.62**	.65**	-						
9. Physical activity (T1)	-.04	-.24**	.26**	.23**	.31**	.34**	.31**	.32**	-					
10. Physical activity (T2)	.01	-.11*	.24**	.24**	.29**	.35**	.31**	.35**	.53**	-				
11. Sex (0= female, 1= male)	.01	-.26**	.10*	.13**	.07	.10*	.11*	.14**	.20**	.19**	-			
12. Nat. language (0= German, 1 = other)	-.03	.04	.04	-.03	.04	.04	.09	.05	.11*	.09	.02	-		
13. Intervention (0= no, 1= yes)	-.02	-.10*	.02	.04	.03	-.02	-.07	-.03	-.02	-.06	.04	-.08	-	
14. School level dummy 1 (0= no, 1= yes)	.02	-.08	.01	.18**	.00	.07	.12*	-.01	-.10	-.12*	-.12**	-.30**	-.01	-
15. School level dummy 2 (0= no, 1= yes)	.06	-.08	.02	-.01	.06	-.06	-.04	-.01	-.01	-.08	.05	-.06	-.01	-.56**

Note. Pearson correlations were calculated based on group-mean centered Level 1 variables in order to account for multilevel data structure. Associations with Level 2 variables (school level dummy 1 and 2) were based on normal Pearson correlations (uncentered variables).

CHBs = Compensatory health beliefs; Pos. outcome exp. = Positive outcome expectancies; Nat. language = Native language; School level dummy 1 = School level A, but not B, and C; school level dummy 2 = School level B, but not A, and C;

Time 1 or Time 2 of measurement. *p<.05. ** p<.01.

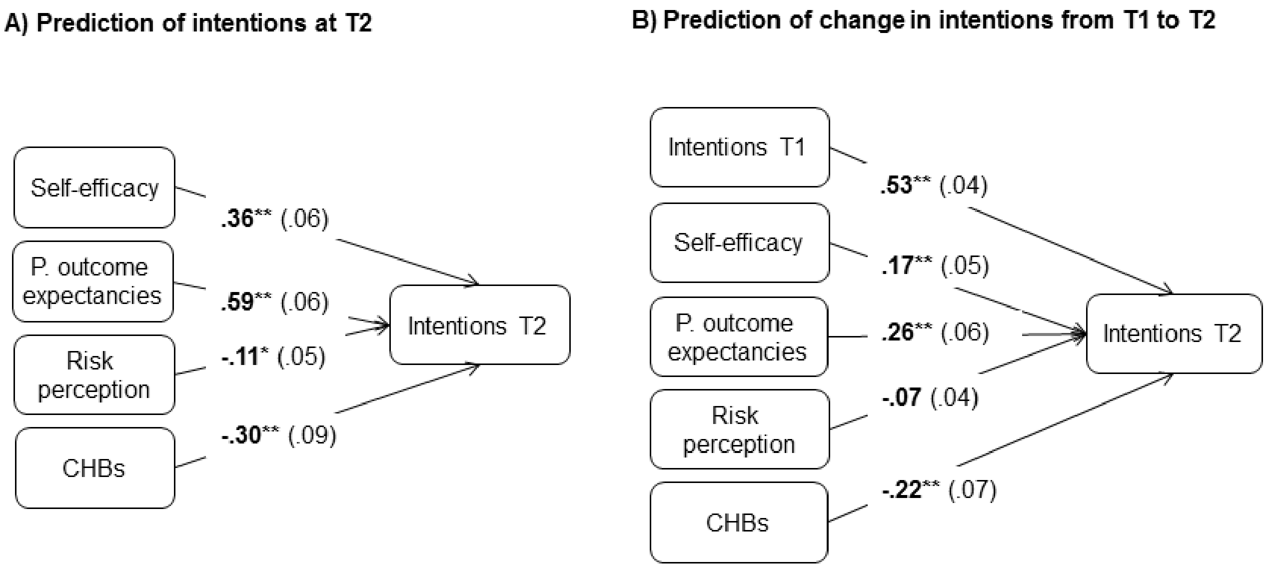

Figure 1. Prediction of intentions: Fixed effects of variables at student level

Note. Unstandardized coefficients in bold, standard errors in parenthesis. Controlled for sex, intervention and school level. **p < .01, *p < .05

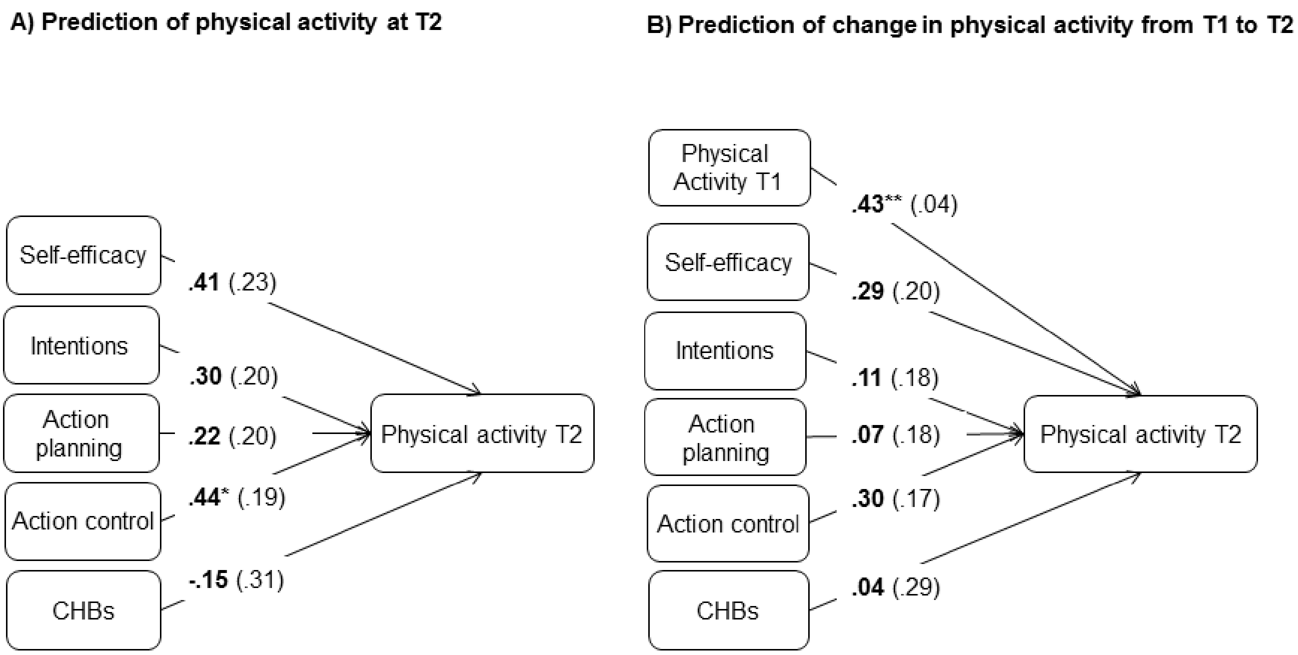

Figure 2. Prediction of physical activity: Fixed effects of variables at student level

Note. Unstandardized coefficients in bold, standard errors in parenthesis. Controlled for sex, intervention and school level. **p < .01, *p < .05