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Eagerness for Physical Activity Scale: Theoretical background and validation

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ABSTRACT

The Eagerness for Physical Activity Scale (EPAS) validated in this study is based on the belief that eagerness for physical activity should be seen as a major outcome of interventions and physical activity contexts. The aim of the study was to introduce the concept of eagerness into physical activity research, to validate EPAS, and to explore its relationship with maximal oxygen uptake (VO_{2max}) and motivation. A multi-study validation approach was used. Convergent and discriminant validity was supported and the scale displayed high internal consistency across all studies. When controlling for self-determined motivation, eagerness for physical activity related positively to VO_{2max}, thus supporting incremental validity above and beyond intrinsic motivation, identified regulation, extrinsic regulation, and a-motivation. Based on our results we recommend not only the application of EPAS in the assessment of how intervention programs and regular types of activity contexts affect people of all ages, but also the introduction of the concept of eagerness into physical activity and health research and policy in general.

Background

Despite decades of public provision of evidence-based knowledge on the association between physical inactivity and mortality (Blair et al., 1995; Ekelund et al., 2015; Paffenbarger, Hyde, Wing, & Hsieh, 1986), supplemented with preventive physical activity recommendations (WHO, 2010), mass media campaigns (Abioye, Hajifathalian, & Danaei, 2013), a growing number of public physical activity programs and an expanding fitness industry, more than 30% of the adult population do not reach recommended levels of physical activity (Hallal et al., 2012). This may indicate that the promotion of physical activity as a prophylactic treatment to prevent obesity and early death is not effective (Haskell, Blair, & Hill, 2009). On the contrary, many have argued that the physical activity discourse has become too aggressive and invasive to be healthy at the grassroots level (Alexander & Coveney, 2013; Frohlich, Alexander, & Fusco, 2013). Some researchers contend that global and national physical activity recommendations have contributed to a rather instrumental, objectified, and rational physical activity discourse that disregards the human body and personal experience (Monaghan, 2008; Pringle & Pringle, 2012). In the field of sports medicine, Myer et al. (2015) recently argued that the estimated minimums of physical activity in terms of frequency, duration and intensity have gained too much attention in physical activity interventions and that the qualitative aspects (e.g., enjoyment of exercise) of program design have been underestimated. As a consequence, the effect of physical activity programs has most often been assessed in terms of changes in physical activity level, while a better understanding of people's subjective experiences of physical activity has been neglected, which precludes such information from being used as a possible determinant for future activity.

In this paper it is argued that there is a lack of research tools that assess personal experience from physical activity interventions in terms of personal significance and relevance, and thus eagerness for further involvement. The Eagerness for Physical Activity Scale (EPAS) validated in the present study is based on the belief that a sustainable physical activity level is more dependent on personal desire than on a set of requirements; that bodily movement is something we have all enjoyed and are still capable of enjoying. Physical activity is more than a means to an end of increased physical health; it is in fact an end in itself, pleasurable and satisfying in its own right. People who are eager to exercise are stimulated by a desire to immerse themselves in meaningful bodily experiences.

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The final version of EPAS (see Appendix A) includes items reflecting subjective experiences from prior physical activity settings as well as predictions regarding future behavior. EPAS was developed to support researchers with an experience-related measurement tool that predicts VO_{2max} (the gold standard for measuring physical work capacity and thus physical health) for use in screenings and intervention studies, yet also to offer an alternative discourse into the applied domain and public health program design in particular. Bodily movement is first of all a relational affair, involving biological, mental, cultural and behavioral systems which cannot be encouraged solely by preventive and dualistic approaches. In other words, human beings possess not only the ability to move, but also to explore, appreciate, value and develop their bodily interactions in terms of "positive movement experiences" (Agans, Säfvenbom, Davis, Bowers, & Lerner, 2013; Næss, Säfvenbom, & Standal, 2013). If eagerness for physical activity predicts VO_{2max} then intervention studies and physical activity promotion work cannot solely be anchored in evidence-based knowledge from physiology. Rather, they must also take the participants' subjective experiences of the activity into consideration, because these experiences will affect their physical work capacity, not to mention their health, in the broadest sense.

The theoretical framework of the Eagerness for Physical Activity Scale (EPAS)

In scientific literature, the concept of eagerness has been explained in both functional and dysfunctional terms (Keltikangas-Järvinen et al., 2007), but generally, eagerness is associated with concepts that denote a positive state, such as passion (Vallerand et al., 2003), value (Higgins, 2000) and desire (Jensen, 2007), and it has proven to affect health in a positive way (Keller, 2006).

Eagerness is conceptually related to desire, which remains a key concept in the understanding of developmental processes (Jensen, 2007). The concept of desire overlaps to some extent with the concept of motivation, but desire includes a behavioral dimension, a deeply emotional wanting or longing mixed with excitement that makes people strive for a sense of completeness (Jensen, 2007). Conceptual contrasts with eagerness include "inertia" (Moeltner & Englin, 2004, p. 216) and caution, or vigilance (Higgins, Idson, Freitas, Spiegel, & Molden, 2003). According to Higgins et al. (2003), eagerness seeks to promote positive behavior while vigilance seeks to prevent negative behavior, meaning that people focused on promotion prefer to pursue goals eagerly, and people focused on prevention pursue their goals vigilantly. People aimed at preventing negative behavior see their goals as responsibilities whose attainment will increase their security. Commitment to these security goals is characterized by doing what is necessary—and nothing more (Shah & Higgins, 1997).

Our conceptualization of EPAS is theoretically anchored in the work of Dewey (Dewey, 1925, 2008; Dewey, Boydston, & Baysinger, 1985) and in more recent theories on human behavior and development such as the Relational Developmental Systems Theories (Lerner, 2015; Overton, 2013, 2014). The main core of Dewey's seventy years of thought and philosophizing can be found in his concepts of relation, continuity and the process of inquiry (Dewey, 2005; Dewey et al., 1985). According to Dewey, every new interactive experience is another relation which cannot be treated in isolation from other simultaneous experiences or prior experience. An experience, he wrote, is a "bi-product of continuous and cumulative interaction of an organic self with the world" (Dewey, 2005, p. 220). When we act upon something, it acts upon us in return. Every new situation, defined and inquired by the individual, will contribute to an extension or a restriction of the individual's self. Within this process, a dynamic interplay between (a) the individual's definition of the situation, (b) the qualitative immediacy of the experience, and (c) the person's judgment (their mental apprehension and individual interpretation) of the experience is of crucial importance for further involvement.

Relational Developmental Systems Theories seek to understand human behavior and development through an approach that integrates biological, psychological, social, and behavioral factors at several integrated and reciprocal levels (Hood, Halpern, Greenberg, & Lerner, 2010; Overton, 2014). Within this perspective, the past and the future are linked together through the interrelated concepts of experience and action. As a consequence, the individual should be viewed as simultaneously an active producer and the product of his or her ontogeny (Brandtstädter, 2006). In other words, action (in the case of this study, physical activity) depends on a process involving personal experience, self-organization, and valid intentions for further action. In this process, the individual is constantly weighing a range of different factors, including a mix of biological, social, mental and behavioral experiences from prior and present exercise contexts, the influence of messages aimed at the prevention of ill effects subsidized by the government and the leisure industry, and the individual's own predictions, anxieties and hopes for the future.

Filling the gap between assessments of physical activity, planned behavior, and motivation

Research on the effects of physical activity programs and interventions has been dominated by more or less objective measurements of physical activity on the one hand and assessment of intentional physical activity and motivation for physical activity on the other.

Assessment of physical activity

The rationale for measuring physical activity is associated with the dose-response curve (Pate, 1995) which estimates levels of activity required to avoid sickness and early mortality. In line with this rationale it has been deemed important to study a person's biological energy expenditure through "accurate, valid and reliable assessments of habitual physical activity" (Hansen, 2013 p. 4). Today, the use of monitoring devices such as accelerometers measuring Metabolic Equivalent of Task (MET), are seen as a valid method for gaining objective data for research (Hansen et al., 2013). However, an accelerometer does not capture individuals' former and present embodied experience of involvement, and should be questioned as a valid predictor for long-term physical activity and health development. In intervention studies, a significant increase in physical activity in terms of MET proves nothing but a more or less temporary change in biological energy expenditure caused by an intervention. In worst case scenarios, mandatory interventions such as in a school setting, may affect children's experiences of and eagerness to engage in physical activity negatively, even if an increase in MET is shown.

Assessment of intention

In the applied domain, health psychology models such as the Health Belief Model/Value-Expectancy Model (Becker, Maiman, Kirscht, Haefner, & Drachman, 1977), Theory of Reasoned Action (Ajzen & Fishbein, 1980) and Theory of Planned Behavior (Ajzen, 1991) have dominated and guided the promotion of exercise at the grassroots level. The basic assumption of these models is that intentional behavior (i.e., exercise) is predicted according to the value one places on the outcome (i.e., avoidance of illness) and on one's expectation that the given behavior will lead to the specified outcome. This model cultivates a prevention and avoidance-oriented physical activity discourse which fails to identify the origins of core constructs central to the development of an individual's intentions (Hagger & Chatzisarantis, 2008). From a planned behavior perspective, a physical activity intention caused by a moral imperative is equally as valuable as an intention caused by eagerness or intrinsic motivation. However, from a public health perspective it is essential to observe the difference between these two types of rationale, and their relative effects on long-term physical activity and health.

Assessment of motivation

Process-related instruments based on the Transtheoretical Model of behavior change (Marshall & Biddle, 2001; Prochaska & Diclemente, 1986) and instruments based on social cognitive motivation theory such as Self-Determination Theory (STD: Deci & Ryan, 1985, 2000) have also gained a foothold in physical activity and health research. Self-determination theory (SDT) maintains that an understanding of human motivation requires a consideration of innate psychological needs for competence, autonomy, and relatedness (Deci & Ryan, 2000). The desire to fulfill these basic psychological needs is what drives motivation, and measurements based on SDT assess why people are involved in certain types of behavior. The assessments distinguish between autonomous and controlled types of motivational regulation and their differential impact on an individual's psychological well-being, behavioral quality, persistence, functionality, and learning (Ryan & Deci, 2000). Autonomous motivation distinguishes between identified regulation, integrated regulation and intrinsic motivation and "involves regulation of behavior with the experiences of volition, psychological freedom and reflective self-endorsement" (Vansteenkiste, Niemiec, & Soenens, 2010, p. 118). Controlled motivation (including external regulation and introjected regulation) is associated with "experiences of pressure and coercion to think, feel, or behave in particular ways" (ibid). According to Deci and Ryan (2008) controlled regulation depletes energy while autonomous regulation may enhance energy available for self-regulation. They claim that persistent exercise behavior is most likely when an individual involves in activity as a result of autonomous motivation.

In this paper we will argue that even if EPAS to some extent may overlap with instruments assessing motivation, EPAS is more capable of assessing the subjective experience from movement contexts and thus the desire for future involvement in such contexts. First, while motivation is primarily associated with achievement or competence within the field of physical activity, eagerness describes excitement about and a deep emotional longing for the bodily and relational experience associated with movement itself (Agans et al., 2013). Attaining athletic skills or weight reduction requires motivation in terms of orientation (e.g., autonomous vs. controlled) and level (power). However, bodily movement is not only a means to an end. Bodily movement is something most people enact every day and is therefore not usually considered an achievement. Some people may have forgotten about the thrill of positive movement experiences (Næss et al., 2013), but the experience is lived and stored and it may be re-discovered through interventions. Second, instruments anchored in motivational theory do not include an explicit behavioral dimension. Unlike the EPAS, measures of autonomous motivation reveal nothing about future behavior, nor do they measure resistance or resilience in autonomously motivated behavior. The EPAS delves deep in order to reveal specific emotional desires (e.g., "I am willing to sacrifice a lot to be physically active"), it emphasizes excitement (e.g., "I am always happy when I have been practicing/been involved in physical activity"), and it includes fundamental concepts such as identity and meaning (e.g., "I think that physical activity is one of the most meaningful things to do").

In this article we will show that there is a gap between the existing methodological approaches mentioned above and that this gap can be filled by an assessment of the individual's relationship with exercise, in terms of an interactive long-lived experience, and of the individual's desire to be involved in this type of interaction over an extended period of time. Therefore, the aim of the present study is to develop and test an Eagerness for Physical Activity Scale (EPAS) in terms of how eagerness compares to motivation in its contribution to the prediction of work capacity and general physical health in everyday life.

Hypotheses

Based on the theoretical background and the conceptualization of eagerness presented above we began our study with the expectation that people who report prior and present meaningful movement activity experiences and eagerly anticipate partaking in this behavior in the future, will actually act on their eagerness. We predicted therefore that eagerness for physical activity would affect activity involvement, and in the long term, VO_{2max} as the major predictor for functioning and health:

H1: There is a positive relationship between eagerness for physical activity and VO_{2max}.

According to SDT and research performed on the relationship between autonomous motivation and physical activity and health, there is a conceptual overlap between motivation (Deci, Connell, & Ryan, 1989; Vallerand, 1997) and eagerness. However, although there are similarities between self-determined motivation and eagerness for physical activity, they are, as explained above, conceptually distinct from a theoretical perspective. According to SDT, while autonomous motivation emerges out of satisfaction of innate psychological needs for competence, autonomy, and relatedness (Deci & Ryan, 2000), eagerness appears from a more dynamic set of interactive factors which include biological, psychological and cultural variables in a retrospective, introspective and prospective manner. Thus, compared to motivation, eagerness represents a more overall, cohesive and behavioral concept, and there is reason to believe that autonomous motivation (defined in this paper as intrinsic motivation and identified regulation) may contribute positively to eagerness. Accordingly, we expect that:

H2: There is a positive relationship between (a) intrinsic motivation and eagerness for physical activity, and between (b) identified regulation and eagerness for physical activity.

As a consequence of this hypothesis we also claim that more controlled motivation and amotivation should be related to lower levels of eagerness for physical activity:

H3: There is a negative relationship between (a) extrinsic motivation and eagerness for physical activity, and between (b) amotivation and eagerness for physical activity.

Study 1

The aim of our first study was threefold. The first goal was to develop a scale for measuring eagerness for physical activity, based on our construct definition. The second goal was to examine the factor structure of the developed eagerness scale through confirmatory factor analysis (CFA), and revise it if necessary. The third goal was to assess the internal consistency of the developed eagerness scale.

Method

Items, participants, and procedure

According to the theoretical framework, EPAS was deliberately developed as an instrument covering affective, cognitive and behavioral aspects of bodily interactions in terms of physical activity and exercise. Based on our construct definition, we generated 12 initial items for measuring eagerness for physical activity for this study (please see Appendix B). After initial item generation, we surveyed 88 students from 4 upper secondary schools in Norway to pilot our measure. The respondents were comprised of 49 (55.7%) female- and 39 (44.3%) male students with an average age of 15.8 years ($SD = 0.52$). The respondents recorded their responses on a Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Analyses

To determine whether the items reflected the construct they were intended to measure, we performed a confirmatory factor analysis (CFA) with the use of the Mplus program. More specifically, following Kuvaas, Buch, Dysvik, and Haerem (2012), we estimated a Multiple Indicator Multiple Cause (MIMIC) model to control for sample heterogeneity when performing the CFA (cf. Bollen, 1989; Muthén, 1989). Because of the non-independent observations in the dataset (the respondents are nested within schools) the MIMIC-CFA was performed using cluster robust standard errors at the school level. Finally, since "ordinal variables are not continuous and should not be treated as if they are" (Jöreskog, 2005, p. 10), we used the weighted least squares (WLSMV) estimator (Muthén, du Toit, & Spisic, 1997), to accommodate the ordered categorical data (e.g., Flora & Curran, 2004).

Results and discussion

In the initial MIMIC-CFA model we tested, we regressed the full EPAS on the control variables; gender (women = 1; men = 2), age, and school affiliation (represented by four dummy variables). The results of this model (see Appendix B) suggested a relatively good fit to the data, but indicated room for improvement (χ^2 [109] = 142.80, $p < .05$; RMSEA = 0.06; CFI = 0.98; TLI = 0.97). Accordingly, to ensure the adequacy of our measurement model, we performed a more exploratory approach where we deleted the items that did not have strong loadings (i.e., below .60; Chin, 1998). This resulted in a nine-item scale (see Appendix A) which provided excellent fit to the data (χ^2 [67] = 86.86, $p > .05$; RMSEA = 0.06; CFI = 0.99; TLI = 0.99) when controlling for sample heterogeneity (i.e., by regressing the EPAS on the control variables). Furthermore, all factor loadings were statistically significant with a mean standardized loading of .81, thereby further supporting convergent validity (Anderson & Gerbing, 1988). Finally, the trimmed scale demonstrated high internal consistency, with a Cronbach's alpha of .93, thus indicating a reliable measurement model. Accordingly, the findings of Study 1 provide initial support for the validity and reliability of the Eagerness for Physical Activity Scale.

Study 2

The purpose of our second study was twofold. First, because the factor analytical techniques we used to develop the measures could have resulted in sample-specific factors (Hinkin, 1998), the main purpose of Study 2 was to cross-validate the findings of Study 1 using a larger sample. Furthermore, eagerness for physical activity and motivation should theoretically be distinct from each other. Accordingly, in line with the recommendations of Brannick and Williams (cf. Hurley et al., 1997) and Farrell (2010), the second purpose of Study 2 was to evaluate and ensure convergent and discriminant validity by performing an exploratory factor analysis (EFA) on the Motivation and Eagerness for Physical Activity Scales.

Method

Participants and procedure

This second study comprised a nationally representative sample of 820 male respondents (soldiers) from the Norwegian Home Guard force. The mean age was 32 years ($SD = 5$). The respondents represented task forces from five different geographical areas in Norway. The Home Guard consist of reservist soldiers who have completed a mandatory 1-year military service. While Home Guard soldiers primarily live a civilian life, they meet for a military training refresher courses a few days per year. The respondents completed the questionnaire in plenary during such refresher courses. The Norwegian Social Science Data Services approved the study, and subjects volunteered by giving their written consent.

Measures

We administered the nine-item Eagerness for Physical Activity Scale, as designed in Study 1. In addition, we administered the Situational Motivation Scale (SIMS; Guay, Vallerand, & Blanchard, 2000). The SIMS assesses four dimensions of self-determined motivation that an individual may display, namely intrinsic motivation ($\alpha = .88$), identified regulation ($\alpha = .75$), external regulation ($\alpha = .70$), and lastly, amotivation ($\alpha = .68$).

Data analysis

To cross-validate the factor structure of the EPAS we followed the same procedure as in Study 1 and estimated a MIMIC-CFA model (cf. Bollen, 1989; Muthén, 1989) with the use of the WLSMV estimator (Muthén et al., 1997). As in Study 1, the MIMIC-CFA was performed using cluster robust standard errors (at the task-force level), because the observations in the dataset are not independent (i.e., personnel clustered within different forces ready to mobilize). Next, to test the distinctiveness of the EPAS in relation to SIMS, we performed an exploratory factor analysis. The use of EFA is recommended for the purposes of ensuring convergent and discriminant validity in the early stages of scale development (e.g., Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010; Hurley et al., 1997) because it shows how well the items load on the nonhypothesized factors (Kelloway, 1995).

Results and discussion

The MIMIC-CFA model we tested demonstrated good fit to the data (χ^2 [115] = 279.68, $p < .05$; RMSEA = 0.047; CFI = 0.99; TLI = 0.99) when controlling for sample heterogeneity (i.e., by regressing the EPAS on the control variables; age, education, and dummy variables representing task-force affiliation and geographic location). As in Study 1, convergent validity was supported as all factor loadings were statistically significant, with a mean standardized loading of .82 (Anderson & Gerbing, 1988). Furthermore, the EFA reported in Table 1 produced a single factor, *a priori* dimension of eagerness for physical activity, and did not reveal any cross-loadings above .35 (Kiffin-Petersen & Cordery, 2003) or differentials above .20 between the included factors (Van Dyne, Graham, & Dienesch, 1994). Accordingly, the EFA provided further support for the convergent and discriminant validity of our measure (cf. Bernerth, Armenakis, Feild, Giles, & Walker, 2007; Hurley et al., 1997; Liden & Maslyn, 1998). Finally, the coefficient alpha of .94 provided additional evidence of a reliable measurement model.

Study 3

The main purpose of Study 3 was to test the hypotheses and evaluate predictive validity by means of a longitudinal study with four periods of data collection.

Participants and procedure

Physical test data and self-reported questionnaire data for this study was collected from cadets in three Norwegian military academies at four points in time between 2007 and 2011. The sample comprised 90% men and 10% women. The mean age upon entry to the academy was 23 years ($SD = 2.92$). The sample is first of all a convenience sample selected for ease of longitudinal follow-up. However, our choice of sample also increased the risk for refutation of the hypothesis. Military cadets are exposed to a relatively hierarchical, authoritative and competitive style of education, and compared to the general public, any change in VO_{2max} is less dependent on eagerness.

Time 1 data was collected at the start of the first year at the Academy. Time 2 data was collected at the end of the participants first year at the Academy. Time 3 data was collected at the end of the second year, whereas Time 4 data was collected at the end of

Table 1. Exploratory factor analysis for Study 2.

	Eagerness	IM	IR	ER	Amotivation
I will always be physical active (9)	.92				
I enjoy keeping fit (6)	.90				
I look at myself as a person who is physically active (1)	.82				
I am willing to sacrifice a lot to be able to do sport or be physically active (7)	.79				
I will be involved in physical activity or sport as long as I am able to move (12)	.76				
I am eager for physical activity (5)	.74				
I think that physical activity is one of the most meaningful things to do (4)	.67				
I am always happy when I have been practicing / been involved in physical activity (8)	.61				
I always look forward to practice / being physically active (2)	.52	.32			
Because this activity is fun		.95			
Because I think that this activity is pleasant		.89			
Because I think that this activity is interesting		.77			
Because I feel good when doing this activity		.38			
Because I am doing it for my own good			.73		
Because I think that this activity is good for me			.72		
Because I believe that this activity is important for me			.60		
By personal decision			.48		
Because I feel that I have to do it				.78	
Because it is something that I have to do				.66	
Because I am supposed to do it				.49	
Because I don't have any choice				.46	
I don't know; I don't see what this activity brings me					.71
There may be good reasons to do this activity, but personally I don't see any					.60
I do this activity but I am not sure if it is worth it					.58
I do this activity, but I am not sure it is a good thing to pursue it					.55
Eigenvalues	8.60	2.71	1.78	1.42	1.16
% of variance	32.80	8.78	5.51	3.90	2.35

Note. $N = 820$. Factor loadings less than .30 are not shown; Eagerness = eagerness for physical activity; IM = Intrinsic motivation; IR = Identified regulation; ER = External regulation.

participant's third and final year at the Academy. For each measurement occasion, participants filled out a personal code, which we used to match the test data and participant responses on questionnaires of time 1, 2, 3, and 4. The participants were informed that the survey had been approved by the Norwegian Social Science Data Services (NSD) and strict confidentiality was assured. The respondents completed the questionnaire in plenary, with the sport teachers and/or the external test leader on-site. In cases where a cadet was not able to meet for the plenary session, he or she was given the opportunity to complete the questionnaire independently at a later time. Whereas participation on each measurement occasion varied from 128 to 295, the sample of individuals who provided data at all four measurement occasions (both questionnaire and physical test data) consisted of 108 cadets. The sample comprised 85.2% men and 14.8% women. The mean age upon entry to the Academy was 23 years ($SD = 2.72$).

Measures

We administered the nine-item EPAS, as designed in Study 1, and used in Study 2. To assess predictive validity above and beyond the four dimensions of self-determined motivation, we administered the SIMS (SIMS; Guay et al., 2000). The respondents recorded their responses on a Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Maximal oxygen uptake (expressed in $mL \cdot kg^{-1} \cdot min^{-1}$) was measured directly in line with the procedures by Dyrstad, Soltvedt, and Hallén (2006) in a mobile test laboratory placed at the Academy. Before running the treadmill test, subjects completed a ∼20 minute warm up procedure consisting of 10–12 minutes low intensity running, 3 minutes of moderate intensity running, 3×30 seconds high intensity running, and stretching in between and after the running. The subject then attached a nose clip and mouthpiece, the latter connected to a 3-way directional valve (model 2700, Hans Rudolf Inc., Kansas City, MO, USA). The test was performed on a treadmill (PPS 55 Sport, Woodway GmbH, Weil am Rhein, Germany) using an automatic predefined stepwise protocol with a constant incline of 5.2%. The treadmill was calibrated on elevation and speed before all four test periods. Initial speed was set individually ($8–13\ km \cdot h^{-1}$) so that fatigue would be expected to occur within 4–7 minutes of running. This test duration should be sufficient to produce true VO_{2max} values (Midgley, Bentley, Luttikholt, McNaughton, & Millet, 2008). Treadmill speed was increased by $1\ km\ h^{-1}$ every minute until volitional exhaustion, and exercise tolerance time (ETT) to the nearest second was registered.

Because women are likely to have lower VO_{2max} than men (e.g., Wilmore & Costill, 2005), and VO_{2max} has been shown to decline with age (e.g., Hawkins & Wiswell, 2003) we controlled for age (measured at time 1) and gender (men = 0; women = 1). Furthermore, since eagerness for physical activity could vary depending on which Academy the cadets belong to, we controlled for academic affiliation by means of four dummy variables. Finally, to rule it out as an alternative explanation for the observed findings, we controlled for prior educational level on an ordinal scale ranging from 1 to 6, where 1 represented "elementary school" and 6 represented "civil university/college education for a period of 7 years or more."

Data analysis

The data was analyzed in several steps. First, inspired by De Cuyper, Mäkikangas, Kinnunen, Mauno, and Witte (2012), we conducted a logistic regression analysis to inspect whether dropout (dropout = 1) versus participation at all four time periods (participation = 0) was predicted by (i) Academy affiliation, age, gender, and education in step 1; and (ii) the four dimensions of self-determined motivation T1, eagerness for physical activity T1, and VO_{2max} T1, in step 2. In step 1, chi-square was not statistically significant, $\chi^2[8] = 3.18$, $p = .92$, and dropout was significantly predicted by education ($B = .52$, $p < .05$, Odds Ratio = 1.68). In step 2, chi-square was not significant ($\chi^2[8] = 13.64$, $p = .09$), and none of the core study variables contributed significantly to the prediction of dropout. This suggests that, while respondents with a higher level of prior education were more likely to drop out, there were no significant differences in the core study variables between those who participated in all four periods of data collection and those who dropped out.

Second, to test whether the scale items would conform to the hypothesized structure of the data, we followed the same procedure as in Study 1 and Study 2 and performed a MIMIC-CFA on a five-factor model representing eagerness for physical activity, intrinsic motivation, identified regulation, external regulation, and amotivation.

Third, to test the hypotheses using our longitudinal data, we followed recommendations in the literature (e.g., Hox, 2010; Singer & Willett, 2003) and conducted hierarchical linear modeling (HLM). In the present study, the data is hierarchical in the sense that the four measurement occasions are nested within participants. While data can typically be analyzed ignoring the hierarchical structure, this comes at the cost of risking erroneous conclusions. Ignoring the nested nature of the data would violate an assumption standard statistical tests rely heavily on, which is the assumption of independence of the observations (e.g., Singer & Willett, 2003). If this assumption is violated it may result in several spuriously "significant" results because the estimates of the standard errors would be biased using conventional tests (Hox, 2010). HLM, on the other hand, does rest upon the assumption of the independence of the data. Multilevel models are therefore appropriate whenever the data are nested in the sense that they have multiple levels. Compared to ordinary regression models, the use of HLM and longitudinal data has several additional advantages. This type of analysis allows us to estimate a trajectory of individual change in the dependent variables, and to differentiate between concurrent levels of the dependent variables, and the change in the dependent variables over time. Furthermore, since cases which only consist of one, two, or three measurements contribute less to the results of the longitudinal regression (Snijders & Bosker, 1999), differences among participants in the number of measurements (i.e., missing data) do not represent a problem (e.g., Hedeker & Gibbons, 1997; Hox, 2010). Finally, because longitudinal data has more degrees of freedom, estimates obtained via HLM analysis are more efficient than those obtained in cross-sectional analysis (Wittekind, Raeder, & Grote, 2010).

Our model contained two levels of analysis where measurements over time represented level 1, and individuals represented level 2. To facilitate the interpretation of the intercept as the expected outcome on the first occasion, we coded time using consecutive numbers starting from zero (Hox, 2010). We also decomposed the time-varying predictors into a two separate components - a mean value for each person to capture variation between individuals, and deviations from those means (i.e., person-mean centering) to capture variation within individuals across time. We did so because within and between-person effects may differ. To illustrate this, Curran and Bauer (2011) explains that "Empirical evidence has shown that an individual is more likely to experience a heart attack while exercising (i.e., the within-person effect), but at the same time people who exercise more tend to have a lower risk of heart attack (i.e., the between-person effect)" (p. 586). Preceding the analysis, we also grand-mean centered the time-invariant predictors (Hofmann & Gavin, 1998), and set the most frequent value in the categorical predictor gender to zero (Wittekind et al., 2010). The HLM analyses were conducted using the SPSS Mixed procedure of SPSS 19.0.

Results and discussion

We performed a MIMIC-CFA model using time-1 data on a five factor model representing eagerness for physical activity, intrinsic motivation, identified regulation, external regulation, and amotivation. The model showed good fit indices ($\chi^2[365] = 561.40$, $p < .05$; RMSEA $= 0.043$; CFI $= 0.99$; TLI $= 0.99$), hence supporting the results of Study 1 and Study 2. To empirically verify that the nested data structure was not inadvertently impacting our factor structure, we have re-fitted the CFA models to subsamples that are not nested. Specifically, we performed three MIMIC-CFA models (one per military academy) using time-1 data. The CFAs showed good fit indices when performed on students within Academy A ($n = 118$; $\chi^2[325] = 546.44$, $p < .05$; RMSEA $= 0.076$; CFI $= 0.96$; TLI $= 0.96$), Academy B ($n = 105$; $\chi^2[325] = 510.67$, $p < .05$; RMSEA $= 0.074$; CFI $= 0.97$; TLI $= 0.97$), and Academy C ($n = 70$; $\chi^2[325] = 425.18$, $p < .05$; RMSEA $= 0.066$; CFI $= 0.95$; TLI $= 0.95$). Furthermore, the factor loadings for the EPAS items ranged from .60 to .91 in Academy A, from .73 to .95 in Academy B, and from .48 to .91 in Academy C. All factor loadings were statistically significant. Accordingly, the subsample-specific CFAs and the full-sample CFA provided essentially the same results. Descriptive statistics, correlations, and reliability estimates are reported in Table 2.

To test Hypothesis 1, which stated that there is a positive relationship between eagerness for physical activity and VO_{2max}, we followed the procedure suggested by Hox (2010) and examined four hierarchically nested models. Model 0, which is the unconditional model (null model) contained only the level 1 intercept. In model 1, we entered the predictor time as the level 1 slope, and allowed this to randomly vary across individuals. This allowed us to assess the change in VO_{2max} over measurement occasions, and assess possible individual differences in rates of change. In Model 2, we entered the between-person predictors (i.e., the grand-mean centered time-invariant level 2 predictors). In model 3, we entered the within-person predictors (i.e., the person-mean centered time-varying level 1 predictors). Finally, in model 4, we entered the product term of eagerness for physical activity (as a grand mean centered level 2 predictor) and time to examine whether eagerness for physical activity could explain individual differences in rates of change. Table 3 reports the results of these models.

The null model for VO_{2max} showed a within-person variance of 5.90 ($p < .01$) in VO_{2max} over time, and a between-person variance in VO_{2max} of 23.03 ($p < .01$).

Table 2. Descriptive statistics, scale reliabilities, and correlations.

	Variables	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1.	Academy A	.40	.49												
2.	Academy B	.36	.48	−.61**											
3.	Academy C	.24	.43	−.46**	−.42**										
4.	Gender[a]	.10	.30	−.16**	.09	.08									
5.	Age upon entry	23.17	2.92	.03	−.04	.01	−.07								
6.	Education[b]	2.50	.90	−.10	.02	.09	−.11	.47**							
7.	Intrinsic motivation T1	5.25	1.08	.10	−.13*	.04	.13*	−.10	−.16**	(.90)					
8.	Intrinsic motivation T2	5.06	1.16	.14*	−.16*	.02	.06	−.11	−.13*	. 52**	(.87)				
9.	Intrinsic motivation T3	4.73	1.39	.29**	−.14	−.19*	−.01	−.02	.02	.47**	.61**	(.91)			
10.	Intrinsic motivation T4	4.67	1.38	.27**	−.15	−.16	.03	.02	−.11	.38**	.54**	.65**	(.91)		
11.	Identified regulation T1	5.90	.78	.20**	−.16**	−.05	.08	−.05	−.10	.67**	.38**	.33**	.19*	(.73)	
12.	Identified regulation T2	5.46	1.02	.32**	−.22**	−.12	−.02	−.01	−.09	.35**	.71**	.61**	.50**	.41**	(.74)
13.	Identified regulation T3	5.18	1.23	.35**	−.14	−.25**	−.00	−.04	.02	.31**	.47**	.79**	.57**	.36**	.61**
14.	Identified regulation T4	5.20	1.11	.34**	−.25**	−.14	−.05	.06	.04	.29**	.36**	.51**	.75**	.21*	.47**
15.	Extrinsic regulation T1	3.98	1.51	−.02	.00	.02	.03	−.08	.01	−.21**	−.09	−.21**	−.06	−.15**	−.07
16.	Extrinsic regulation T2	5.09	1.57	−.07	.04	.04	−.13*	−.06	.04	−.13*	−.29**	−.28**	−.21*	−.03	−.30**
17.	Extrinsic regulation T3	5.08	1.54	.03	.03	−.07	.06	−.12	−.11	−.05	−.20*	−.26**	−.24**	−.05	−.28**
18.	Extrinsic regulation T4	4.88	1.53	.07	.10	−.20*	.04	−.22**	−.07	−.09	−.14	−.16	−.21**	−.00	−.17*
19.	Amotivation T1	1.47	.69	−.08	.09	−.01	−.04	.07	.14*	−.41**	−.20*	−.29**	−.03	−.54**	−.23**
20.	Amotivation T2	1.81	1.02	−.17**	.07	.12	−.12	.07	.14*	−.23**	−.48**	−.39**	−.29**	−.24**	−.51**
21.	Amotivation T3	1.94	1.14	−.27**	.09	.22**	.00	.08	.16*	−.32**	−.40**	−.58**	−.44**	−.25**	−.47**
22.	Amotivation T4	2.04	1.25	−.24**	.27**	−.01	−.02	−.02	.11	−.16	−.24**	−.42**	−.52**	−.12	−.29**
23.	Eagerness T1	5.57	.93	.10	−.13*	.03	.07	−.06	−.07	.61**	.32**	.25**	.25**	.54**	.28**
24.	Eagerness T2	5.57	.96	.12	−.11	−.01	.02	−.13*	−.09	.47**	.40**	.30**	.25**	.40**	.35**
25.	Eagerness T3	5.65	1.00	.17*	−.01	−.20*	−.02	−.13	−.05	.40**	.31**	.39**	.41**	.36**	.34**
26.	Eagerness T4	5.76	.92	.04	.02	−.07	.10	−.09	−.07	.43**	.31**	.39**	.44**	.40**	.29**
27.	VO_{2max} T1	55.74	5.02	.18*	−.11	−.10	−.53**	−.14*	−.05	.10	.10	.26**	.17	.07	.12
28.	VO_{2max} T2	54.24	5.49	.20*	−.07	−.12	−.49**	−.24**	−.03	.03	.19	.25*	.17	.12	.22*
29.	VO_{2max} T3	53.81	5.52	.09	−.02	−.08	−.44**	−.15	−.03	.15	.20*	.21*	.15	.02	.21*
30.	VO_{2max} T4	53.00	5.50	.16	−.05	−.14	−.43**	−.14	−.22*	.28**	.32**	.27**	.27**	.07	.27**

	Variables	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
13.	Identified regulation T3	(.78)																
14.	Identified regulation T4	.56**	(.77)															
15.	Extrinsic regulation T1	−.19**	−.14	(.84)														
16.	Extrinsic regulation T2	−.23**	−.19*	.40**	(.84)													
17.	Extrinsic regulation T3	−.31**	−.26**	.25**	.30**	(.84)												
18.	Extrinsic regulation T4	−.13	−.20*	.28**	.37**	.47**	(.86)											
19.	Amotivation T1	−.37**	−.09	.24**	.03	.09	.03	(.84)										
20.	Amotivation T2	−.32**	−.33**	.16*	.33**	.15	.21*	.34**	(.84)									
21.	Amotivation T3	−.63**	−.45**	.23**	.35**	.38**	.26**	.43**	.51**	(.84)								
22.	Amotivation T4	−.43**	−.62**	.10	.16	.26**	.28**	.22**	.31**	.59**	(.84)							
23.	Eagerness T1	.24**	.18*	−.19**	−.11	.01	−.03	−.37**	−.15*	−.22**	−.14	(.92)						
24.	Eagerness T2	.23**	.08	−.14*	−.11	−.01	.06	−.24**	−.21**	−.27**	−.13	.72**	(.92)					
25.	Eagerness T3	.42**	.30**	−.21**	−.13	−.03	.04	−.18*	−.17*	−.29**	−.22*	.66**	.68**	(.92)				
26.	Eagerness T4	.42**	.35**	−.08	−.09	−.06	.04	−.16	−.16	−.29**	−.23**	.65**	.56**	.79**	(.92)			
27.	VO_{2max} T1	.19*	.09	−.07	.04	−.06	−.09	−.09	.03	−.13	−.09	.28**	.24**	.30**	.22**			
28.	VO_{2max} T2	.14	.14	.06	.04	.10	.20*	−.10	.01	−.05	−.02	.37**	.41**	.39**	.29*	.88**		
29.	VO_{2max} T3	.11	.06	−.01	−.05	−.04	−.05	.03	−.05	−.03	−.02	.26**	.28**	.38**	.25**	.83**	.81**	
30.	VO_{2max} T4	.24*	.21*	−.03	−.08	−.06	−.13	−.04	−.10	−.25*	−.14	.41**	.27**	.45**	.38**	.76**	.80**	.85**

Note. T1 = entry, T2 = end of first year, T3 = end of second year, T4 = end of third year.
[a]Female = 1; male = 0. [b]Education at the time of entry. *$p < .05$; **$p < .01$.

Table 3. Results of multilevel analysis: Predicting maximal oxygen uptake.

	Maximal oxygen uptake (VO_{2max})				
	Model 0	Model 1	Model 2	Model 3	Model 4
Fixed effects	Est.	Est.	Est.	Est.	Est.
Intercept	54.61***	55.34***	56.14***	56.42***	56.45***
Time		−.73***	−.78***	−.83***	−.83***
Between-person predictors					
Affiliation (1 = Academy A)			.93	.78	.72
Affiliation (1 = Academy B)			.13	−.09	−.13
Gender (0 = Men, 1 = Women)			−8.96***	−9.06***	−9.06***
Age upon entry			−.35**	−.28***	−.26**
Education			.23	.08	.06
Intrinsic motivation			.31	.39	.43
Identified regulation			−.84	−.90	−.91
Extrinsic regulation			−.16	−.16	−.14
Amotivation			−.13	−.10	−.10
Eagerness for physical activity			1.97***	1.97***	1.76***
Within-person predictors					
Intrinsic motivation				.03	.04
Identified regulation				−.11	−.10
Extrinsic regulation				.05	.02
Amotivation				−.05	−.04
Eagerness for physical activity				.75**	.68**
Time*Between-person eagerness for physical activity					.31*
Variation within-person	5.90***	4.30***	4.13***	3.96***	4.02***
Variation in initial status	23.03***	22.38***	10.60***	10.61***	10.60***
Covariance initial status and change		.04	.10	.12	.12
Variation in rate of change		.44*	.49*	.42*	.33
Deviance ($\chi 2$)	3602.32	3529.69	3178.38	2966.26	2960.19
Decrease in deviance ($\Delta\chi 2^a$)		72.63***	351.31***	212.12**	6.07*

[a]The full ML estimator was used to calculate this decrease in deviance ($\Delta\chi^2$) which can be considered a way of expressing effect size in multilevel modeling.
*$p < .05$; **$p < .01$; ***$p < .001$.

The significant fixed effect of time ($\gamma = -.73$, $p < .01$) in Model 1 indicated a decline in VO_{2max} over measurement occasions. Specifically, Model 1 predicts a value of 55.34 at the first occasion, which decreases by $-.73$ on each succeeding occasion. In this model, we allowed the linear component (time) to vary randomly across individuals. The results showed that the linear time slope varied significantly across individuals (Wald Z $= 2.06$, $p < .05$). Furthermore, there was significant variability in the random intercept to be explained (Wald Z $= 9.69$, $p < .001$) between individuals, as well as significant variation over time within individuals (Wald Z $= 9.80$, $p < .001$). These results suggested that the population of individuals started at different VO_{2max} levels, that the VO_{2max} levels varied over time, and that that some individuals' VO_{2max} levels varied more than others over time. Adding the between-person predictors in Model 2 improved model fit, as indicated by the significant reduction in model deviance. Recall that we decomposed the time-varying predictors into two parts. In model 2, the statistically significant between-person part of eagerness for physical activity ($\gamma = 1.97$, $p < .01$) represents the degree to which the individual's average eagerness for physical activity is related to his or her average VO_{2max}. That is, individuals with high eagerness for physical activity may have consistently high VO_{2max}. Adding the time-varying within-person predictors in model 3 further improved model fit and showed that the within-person part of eagerness for physical activity was also statistically significant ($\beta = .75$, $p < .01$) when controlled for the between-person part. This indicated that variation in an individual's eagerness to exercise over time was positively related to variation in his or her VO_{2max}. That is, a person's relatively higher eagerness level is related to a higher relative VO_{2max} for that person at a particular point in time. Hence, both the between-person and within-person part of eagerness for physical activity provided support for Hypothesis 1, which states that there is a positive relationship between eagerness for physical activity and VO_{2max}. The revelation that eagerness for physical activity exceeded intrinsic motivation, identified regulation, extrinsic regulation, and amotivation, in explaining VO_{2max}, indicates that eagerness for physical activity has predictive validity above and beyond self-determined motivation. Finally, because the results revealed that the linear time slope varied significantly across individuals (Wald Z $= 2.06$, $p < .05$) we included the product term of (the grand-mean centered between-person component) eagerness for physical activity and time in model 4 to examine whether individual differences in VO_{2max} growth rates could be explained by eagerness for physical activity. The linear interaction was statistically significant ($\beta = .30$, $p < .05$), and can be interpreted as individuals at

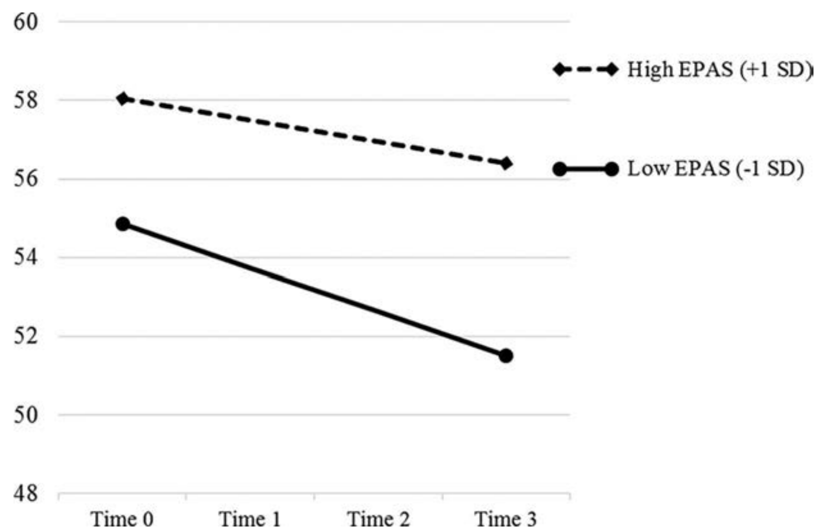

Figure 1. The interaction of time and eagerness for physical activity on maximal oxygen uptake (VO_{2max}).

higher eagerness for physical activity levels demonstrate slightly lower decline in VO_{2max} over time compared to individuals at lower levels for eagerness for physical activity (see Figure 1).

To test the relationships between situational motivation and eagerness for physical activity (Hypotheses 2 and 3), we followed a procedure similar to the one described above and examined hierarchically nested models (reported in Table 4). Model 0 showed a within-person variance of .25 ($p < .01$) in eagerness for physical activity over time, and between-person variance in eagerness for physical activity of .63 ($p < .01$). Introducing time as a linear predictor in Model 1 did not reveal a significant increase in eagerness for physical activity across measurement occasions. This suggested that although eagerness for physical activity fluctuates over time, no clear positive or negative linear trend over time exists with respect to eagerness for physical activity in our data. Adding the between-person predictors in Model 2 improved model fit and revealed a significant effect of the between-person part of intrinsic motivation ($\gamma = .36$, $p < .01$). Hence, individuals with high intrinsic motivation seem to have consistently high eagerness for physical activity. Adding the time-varying within-person predictors in model 3 further improved model fit and showed that the within-person part of intrinsic motivation ($\beta = .11$, $p < .01$) and the within-person part of identified regulation ($\beta = .12$, $p < .01$) were statistically significant when controlled for the between-person parts. This indicated that both variation in an individual's intrinsic motivation and variation in identified regulation was positively related to variation in his or her eagerness for physical activity. Accordingly, we received support for Hypothesis 2a and partial support for Hypothesis 2b. Hypothesis 3, however, was not supported as neither the within-person or between-person effects of (a) extrinsic regulation ($\gamma = .01$, *ns.* and $\beta = -.00$, *ns.*) and (b) amotivation ($\gamma = -.05$, *ns.* and $\beta = .00$, *ns.*) were statistically significant (see Table 3).

Table 4. Results of multilevel analysis: Predicting eagerness for physical activity.

	Eagerness for physical activity			
	Model 0	Model 1	Model 2	Model 3
Fixed effects	Est.	Est.	Est.	Est.
Intercept	5.57***	5.54***	5.54***	5.50***
Time		.03	.03	.09***
Between-person predictors				
Affiliation (1 = Academy A)			−.01	−.03
Affiliation (1 = Academy B)			−.06	−.08
Gender (0 = Men, 1 = Women)			.07	.05
Age upon entry			−.02	−.02
Education			.01	.02
Intrinsic motivation			.36***	.36***
Identified regulation			.11	.12
Extrinsic regulation			.02	.01
Amotivation			−.04	−.05
Within-person predictors				
Intrinsic motivation				.11**
Identified regulation				.12**
Extrinsic regulation				−.00
Amotivation				.00
Variation within-person	.27***	.25***	.25***	.23***
Variation in initial status	.68***	.63***	.45***	.39***
Covariance initial status and change		.02	.00	.03
Variation in rate of change		.02	.01	.01
Deviance (χ^2)	1953.36	1941.51	1799.35	1721.91
Decrease in deviance ($\Delta\chi^{2a}$)		11.85***	142.16***	77.44***

[a]The full ML estimator was used to calculate this decrease in deviance ($\Delta\chi^2$) which can be considered a way of expressing effect size in multilevel modeling.

*$p < .05$; **$p < .01$; ***$p < .001$.

General discussion

The main purpose of the present study was to validate a scale measuring eagerness for physical activity, and to explore its relationship with VO_{2max} and the four dimensions of self-determined motivation. EPAS was developed as an instrument covering affective, cognitive and behavioral aspects of bodily interactions in terms of physical activity and exercise. However, our analyses revealed a one-dimensional factor solution. Specifically, the affective items, the cognitive items and the behavioral items showed a high internal consistency, which has strong implications for the ways that activity involvement interacts with mental, biological, and social systems.

Overall, the results from the three studies are indicative of a valid and reliable measurement model for eagerness for physical activity. Convergent and discriminant validity was supported through both confirmatory and exploratory factor analyses, which demonstrated an invariant factor structure across three separate samples. Predictive validity was supported through longitudinal analyses using objective measures of VO_{2max}. Specifically, in line with our first hypothesis, we found a positive relationship between eagerness for physical activity and VO_{2max}. The fact that both the within-person and between-person components of eagerness for physical activity explained variance in VO_{2max} suggests that eagerness for physical activity predicts both individual differences in VO_{2max} and fluctuations in VO_{2max} over time. In addition, we found that eagerness for physical activity predicted individual differences in rates of change in $VO_{2max.}$ Specifically, although we found that VO_{2max} values are decreasing over time, the magnitude of the decrease seems to be less steep among individuals with relatively higher levels of eagerness for physical activity. One possible reason for this pattern of results may be that individuals who are more eager for physical activity exercise more, thus enabling them to maintain their relatively higher level of aerobic performance and physical fitness over time. These observations should contribute to the extant literature on physical health by suggesting that an individual's relationship with exercise, in terms of an interactive long-lived experience, and the individual's desire to be involved in this type of interaction, may facilitate physical health.

In addition to establishing construct validity and reliability, our aim was to examine motivational determinants of eagerness for physical activity. In testing our second hypothesis, we found that there is a positive relationship between both the within-person and between-person component of intrinsic motivation and eagerness for physical activity, and between the within-person component of identified regulation and eagerness for physical activity. This suggests that eagerness for physical activity occurs as a result of more autonomous motivation where individuals engage in an activity for the pleasure and satisfaction they derive from the activity itself (e.g., Gagné & Deci, 2005). This finding supports the theory that activity eagerness is related to fulfillment of innate psychological needs (Deci & Ryan, 2000) yet that bodily movement is first of all a relational affair, involving biological, mental, cultural and behavioral systems, which cannot be encouraged solely by preventive and dualistic approaches. To understand, create and assess physical activity interventions as relational affairs a multi-systemic and integrative approach (Agans et al., 2013; Lerner, 2015) that include terms such as meaning, happiness, identity and longing is needed in addition to terms such as heart-rate or activity level.

Contrary to what we expected, we did not observe a negative relationship between extrinsic regulation and eagerness for physical activity, or between amotivation and eagerness for physical activity. This may indicate that eagerness is not negatively affected by recommendations, demands or even more controlling factors, but further studies are needed before any conclusions can be drawn.

Limitations and strengths

Some limitations should be acknowledged when interpreting our results. First, even though we utilized a longitudinal design, our data were correlational, thus prohibiting causal inferences. It cannot be ruled out that higher levels of VO_{2max} cause higher levels of eagerness for physical activity, or that higher levels of eagerness for physical activity cause higher levels of autonomous motivation.

Second, our reliance on self-report data may limit the validity of our findings. However, in attempting to lessen potential problems related to the use of self-report data we undertook several procedural remedies recommended by Podsakoff, MacKenzie, Lee, and Podsakoff (2003), such as ensuring the anonymity of the respondents, and psychologically separating the scale items for the predictors and the criterion variables. Furthermore, one of the main strengths of the present study is the fact that we were able to obtain objective test data in addition to self-reported questionnaire data, so as to alleviate potential common method bias stemming from, for example, the *illusory correlations* or *implicit theories* of the respondents (Podsakoff et al., 2003).

Third, the sample used to test the hypotheses consisted of predominantly male cadets from three military academies in Norway, which may limit the generalizability of the results. It may be that in other countries and contexts, a similar study may have produced different results. For instance, in some contexts, eagerness for physical activity might be more important for VO_{2max} than in the context of military training and development.

Implications and consequences

The findings of the present study imply that eagerness for physical activity manifests itself in higher levels of VO_{2max} and that eagerness for physical activity has predictive validity above and beyond self-determined motivation. Based on our results we recommend not only the application of EPAS in the assessment of how intervention programs and regular types of activity contexts affect people of all ages, but also the introduction of the concept of eagerness into physical activity and health research and policy in general.

If physical activity research has contributed to a rather instrumental, objectified, and rational physical activity and health programs (Pringle & Pringle, 2012) it is time to bring the complexity of human bodies and concepts such as personal experience and diversity back into research and physical activity programming. There is reason to believe that applying the concept of eagerness to the physical activity and health literature and adopting the Eagerness for Physical Activity Scale as an instrument for assessing the effects of physical activity interventions will help intervention programs to modify their aims and content in the direction of personal experience. Physical activity programs trying to increase the eagerness of their participants will be encouraged to focus on "promotion and experience" because it is conducive to eagerness, rather that creating a "prevention and avoidance" strategy that may increase caution and vigilance among participants. Such a change corresponds with the point of departure for this study, namely that human beings possess not only the ability to move, but also to explore, appreciate, value and develop their bodily interactions in terms of positive movement experiences (Agans et al., 2013; Næss et al., 2013). Positive movement experiences, and thus development of an eagerness to move require process-oriented, exploratory and experience-oriented approaches rather than prevention-oriented approaches (Næss et al., 2013).

Along with significant literature on positive leisure (Freire, 2013), positive youth development (Benson, Scales, Hamilton, & Sesma, 2006; Dzewaltowski & Rosenkranz, 2014; Fisher & Lerner, 2013), and positive movement experiences (Agans et al., 2013), the concept of eagerness connotes positive, proactive, and interactive process-terms like desire, passion, meaning and recreation rather than negative avoidance and product terms such as obesity, diseases, and early death. We believe that the use of EPAS may contribute to a less instrumental and vigilant "prevention of negative behavior approach" in physical activity and health promotion policy, and that this positive approach can have long term benefits in terms of the health and well-being of the general public.

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Appendix A: MIMIC-CFA on the trimmed scale of the pilot study

	Eagerness for physical activity
Eagerness1: I look at myself as a person who is physically active	.84
Eagerness2: I always look forward to practice/being physically active	.81
Eagerness4: I think that physical activity is one of the most meaningful things to do	.65
Eagerness5: I am eager for physical activity	.83
Eagerness6: I enjoy keeping fit	.83
Eagerness7: I am willing to sacrifice a lot to be able to do sport or be physically active	.86
Eagerness8: I am always happy when I have been practicing / been involved in physical activity	.75
Eagerness9: I will always be physical active	.90
Eagerness12: I will be involved in physical activity or sport as long as I am able to move	.86

Note. $N = 88$. The CFA displayed above is a MIMIC (Multiple Indicator Multiple Cause) model where the full Eagerness for Physical Activity Scale was regressed on the control variables. Standardized factor loadings are shown. All estimates are significant at $p < .01$. The MIMIC-CFA was estimated with the use of the weighted least squares (WLSMV) estimator. $\chi^2[67] = 86{,}86$, $p > .05$; RMSEA = 0.06; CFI = 0.99; TLI = 0.99. Eagerness for physical activity was significantly predicted by age ($\gamma = .04$, $p < .01$), as well as school 1($\gamma = -.32$, $p < .01$), and school 2 ($\gamma = -.16$, $p < .01$). As all items were originally developed in the Norwegian language, they were put through a translation-back translation conversion process to ensure equivalence of item meaning and to avoid the risk of misunderstanding or misconception (Brislin, Lonner, & Thorndike, 1973).

Appendix B: MIMIC-CFA on the full scale of the pilot study

	Eagerness for physical activity
Eagerness1: I look at myself as a person who is physically active	.85
Eagerness2: I always look forward to practice / being physically active	.81
Eagerness3: I find it difficult to be involved in physical activity	.54
Eagerness4: I think that physical activity is one of the most meaningful things to do	.66
Eagerness5: I am eager for physical activity	.83
Eagerness6: I enjoy keeping fit	.81
Eagerness7: I am willing to sacrifice a lot to be able to do sport or be physically active	.86
Eagerness8: I am always happy when I have been practicing/been involved in physical activity	.74
Eagerness9: I will always be physical active	.90
Eagerness10: My experience is that physical activity becomes constantly less fun	.54
Eagerness11: I am not sure if I will involve in physical activity when I grow older	.56
Eagerness12: I will be involved in physical activity or sport as long as I am able to move	.86

Note. $N = 88$. The CFA displayed above is a MIMIC (Multiple Indicator Multiple Cause) model where the full Eagerness for Physical Activity Scale was regressed on the control variables. Standardized factor loadings are shown. All estimates are significant at $p < .01$. The MIMIC-CFA was estimated with the use of the weighted least squares (WLSMV) estimator. $\chi^2[109] = 142.80$, $p < .05$; RMSEA = 0.06; CFI = 0.98; TLI = 0.97. Eagerness for physical activity was significantly predicted by age ($\gamma = .04$, $p < .05$), as well as school 1($\gamma = -.33$, $p < .01$), and school 2 ($\gamma = -.17$, $p < .01$). As all items were originally developed in the Norwegian language, they were put through a translation-back translation conversion process to ensure equivalence of item meaning and to avoid the risk of misunderstanding or misconception (Brislin et al., 1973).