The Development and Validation of the Adolescent Sport Drug Inventory (ASDI) among Athletes from Four Continents

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Abstract

A significant barrier to understanding the psycho-social antecedents of doping use among adolescent athletes is the lack of valid measures. In order to address this issue, the first aim of this paper was to develop and validate the Adolescent Sport Doping Inventory (ASDI) among adolescent athletes from Asia, Europe, North America, and Oceania. The second aim was to assess the construct validity of the ASDI. As such, this paper is divided into two parts. Part 1 relates to the development of the ASDI and contains two studies: Item Development (Study 1) and Factorial Validity (Study 2). Part 2 contains information on how the psycho-social variables measured in the ASDI are associated with situational temptation, and honesty (Study 3), maturation (Study 4), stress and coping (Study 5), and coaching (Study 6). In devising the ASDI, 19 different models were examined, which culminated in a 9-factor, 43-item ASDI. Coping, mastery-approach goals, and cognitive-social maturity were associated with doping attitudes. Caring motivational climates, strong coach-athlete relationships, and positive coach behaviors were associated with athletes being less susceptible towards doping, which provides construct validity for the ASDI. The ASDI is a valid tool to assess the psycho-social factors associated with doping among adolescent athletes. This questionnaire can be used to identify athletes who are the most at risk of doping, assess how the psycho-social factors associated with doping change over time, and to monitor the impact of anti-doping interventions for adolescent athletes.

Public Significance Statement

The Adolescent Sport Doping Inventory accurately assesses the psychological and social factors associated with doping. Furthermore, we also found that maturation, stress, coping, and coaching are also linked to either doping attitudes or susceptibility among adolescent athletes. These findings could help shape anti-doping educational content for both coaches (i.e., information on optimal coaching behavior) and athletes (i.e., appraisal and coping training) to reduce favorable attitudes and doping susceptibility among athletes.

Keywords: Achievement Goals; Adolescence; Attitudes; Coaching; Coping; Maturation; Performance Enhancing Drugs; Stress

The Development and Validation of the Adolescent Sport Drug Inventory (ASDI) among Athletes from Four Continents

The World Anti-Doping Agency (WADA, 2018) defined doping as the occurrence of at least one or more of the 10 anti-doping rule violations, such as the presence of prohibited substances, its metabolites, or markers within an athlete's sample. Doping is not just the preserve of elite or adult athletes. Data indicates that up to 30% of adolescent athletes may use performance enhancing drugs (PEDs; Gradidge, Coopoo, & Constantinou, 2010). Adolescence represents the period of one's life when a person is aged between 12 and 18 years of age (Weiss & Bredemeier, 1983), and is a key developmental period in which attitudes, such as favorable or unfavorable attitudes to doping are be formed (Hartan & Latané, 1997). Given that psycho-social variables (e.g., attitudes, susceptibility, and entourage) are associated with doping behavior among adolescent athletes (see Nicholls, Cope, et al., 2017 for a review), being able to accurately measure and monitor psycho-social variables among adolescent athletes is important for identifying those at risk of doping.

Currently, however, assessing psycho-social variables among adolescents is problematic. This is because scholars have used different measures that may or may not be grounded within a suitable theoretical framework. For example, Bloodworth, Petróczi, Bailey, Pearce, and McNamee (2012) administered a "modified version of a questionnaire used by UK Sport in its 2005 Drug-Free Sport survey" (p. 295) to athletes. Unfortunately, these authors failed to report the modifications they made, information about the guiding theoretical framework underpinning their instrument, nor the scale reliability or validity. Alternatively, Barkoukis, Lazuras, and Tsorbatzoudis (2014) developed a stem proposition, which instructed adolescent athletes to report whether performance enhancing drugs were bad/good, useless/useful, harmful/beneficial,

or unethical/ethical. Barkoukis et al.'s (2014) questionnaire has only been tested among adolescent athletes from Greece. Given that doping is a world-wide problem (WADA, 2018), it is important that questionnaires are valid among athletes from different countries. Further, Barkoukis et al.'s questionnaire only contained questions that measured the psychological predictors of doping intentions. It did not include any questions on social variables. Both psychological and social variables are thought to influence doping behavior among adolescent athletes (Nicholls, Cope, et al., 2017). A questionnaire that includes both psychological and social factors is more likely to encapsulate the antecedents of doping behavior.

The Performance Enhancement Attitudes Scale (PEAS; Petróczi & Aidman, 2009) is another questionnaire that has been used to assess doping attitudes among adolescent athletes (e.g., Madigan, Stoeber, & Passfield, 2016). However, Nicholls, Madigan, and Levy (2017) reported that the PEAS did not exhibit a good model fit for adolescent athletes. At the present time, there is not a valid and reliable questionnaire to assess the psycho-social variables that are associated with doping specifically among adolescent athletes. The lack of theory guided questionnaires to assess the psycho-social doping variables among adolescent athletes, may be due to the lack of theoretical models for adolescent athletes.

Only two theoretical models of doping were specifically designed for young people (e.g., Lazuras, Barkoukis, & Tsorbatzoudis 2015; Nicholls, Perry, et al., 2015). Lazuras et al. (2015) developed an integrated model, which included distal (e.g., sportspersonship, past doping, and achievement goals) and proximal (e.g., outcome expectance beliefs and self-efficacy beliefs) predictors that influenced whether a young person intended to dope or not. Lazuras et al. found that 57.2% of variance in doping intentions was predicted by the model. A limitation of this model, however, is that it focused exclusively on psychological predictors of doping intentions,

despite social variables also influencing doping among adolescent athletes (Nicholls, Cope, et al., 2017).

Another model created for adolescent athletes is the Sport Drug Control Model for Adolescent Athletes (SDCM-AA; Nicholls, Perry, et al., 2015), which was grounded in the Sport Drug Control Model (SDCM; Donovan, Egger, Kapernick, & Mendoza, 2002). The SDCM, according to Donovan et al. (2002) integrates three behavioral science frameworks (e.g., instrumental and normative approaches, threat/fear appeals, and social cognition), with attitudes towards doping being the key factor that influences whether an athlete take PEDs. The SDCM posits that attitudes towards doping are influenced by six constructs (e.g., threat appraisals, benefit appraisals, reference group opinions, morality, legitimacy, and personality). Two studies tested the SDCM (Gucciardi, Jalleh, & Donovan, 2011; Jalleh Donovan, & Jobling, 2014) and found support for the SDCM, although results were inconsistent. These authors, however, did not assess the personality traits of the athletes, despite personality being a key aspect of the SDCM, and both samples comprised exclusively of elite Australian athletes. In order to assess the applicability of the SDCM (Donovan et al., 2002), Nicholls, Perry, et al. (2015) interviewed 11 coaches from four different countries, who worked across seven different sports. On the whole, they found support for the Donovan et al.'s SDCM, in that coaches felt attitudes towards doping were influenced by threat and benefit appraisals, morality, self-esteem, and legitimacy. Nicholls, Perry, et al. (2015) also identified age or maturation, sports participation level, pressure levels, country or residence, and ethnicity as factors that influenced doping attitudes and susceptibility, which were not listed in the SDCM. The revised model was named the SDCM-AA.

Aims of Current Research

The overreaching purpose of this paper was to develop and validate a theoretically underpinned scale to assess the psycho-social variables associated with doping behaviors, and to the measure the construct validity of the questionnaire. This paper is divided into two parts. Part 1 relates to the development of the Adolescent Sport Doping Inventory (ASDI) and contains two studies: item development (Study 1) and factorial validity (Study 2). Part 2 relates to construct validity and contains information on how the psycho-social variables measured in the ASDI were associated with situational temptation, and honesty (Study 3), maturation (Study 4), stress and coping (Study 5), and coaching (Study 6).

PART 1: SCALE DEVELOPMENT

Study 1: Item Development

The purpose of Study 1 was to develop items for the Adolescent Sport Doping Inventory (ASDI) and validate the content of these. Grounded in the SDCM-AA (Nicholls, Perry, et al., 2015), we created a series of questions, based upon the 9 psycho-social factors that coaches thought influenced doping attitudes and susceptibility (i.e., threat, benefit, self-esteem, cheating, legitimacy, reference group, stress, maturation, affordability/availability), in addition to questions for doping attitudes and susceptibility. That is, questions were developed that reflected the essence of each psycho-social factor. For example, Nicholls, Perry, et al. (2015) identified an athlete's reference group opinion, which included coaches, peers, and parents as factors that may influence doping attitudes among adolescent athletes, in either a positive or negative fashion. These three distinct elements of reference group opinion were reflected in the questions we developed, so that coaches, parents, and friends were included in this set of questions (e.g., "What my parents think about PEDs would influence my decision about whether I would take them," "What my team mates think about PEDs would influence my decision about whether I

would take them," and "What my coach thinks about PEDs would influence my decision about whether I would take them"). In regards to stress, Nicholls, Perry, et al. (2015) identified stress associated with negative outcomes of matches or competitions, and expectations placed on athletes. As such, we ensured that this was reflective of the stress questions we created (e.g., "There are lots of expectations on me to perform well" and "I feel nervous I will fail"). This exact process of creating questions that reflected each factor was followed for each psycho-social variable from the SDCM-AA (Nicholls, Perry, et al., 2015). This process culminated in questions about threat ("If I took a PED, how likely is it that I would suffer serious health complications," $n = 10$), benefit ("If I took PEDs, I would get much better at my sport," $n = 10$), self-esteem ("I am worth being in the team/squads that I am currently involved with," $n = 12$), cheating ("I would cheat if I thought it would help me win," $n = 9$), legitimacy ("Samples taken by drug testers are securely looked after," $n = 9$), reference group opinion ("I wouldn't want my team mates to think that I am a cheat," $n = 8$), age/maturation ("I am more physically developed than most athletes my age," $n = 10$), stress ("I usually think that the outcome of matches/competitions will be negative," $n = 12$), affordability/availability ("I know where to get PEDs from," $n = 8$), doping susceptibility ("I would be tempted to take PEDs when I have an important competition," $n = 7$), and "attitudes towards doping (e.g., "Legalising PEDs would benefit sport," $n = 13$).

Though clearly important, item-level analysis is seldom reported in studies. A method that provides appropriate rigor was presented by Waltz and Bausell (1983). Specifically, these authors developed the four-point Content Validity Index (CVI). In this process, a panel of experts judge each item on a scale of one to four for relevance, clarity, simplicity, and ambiguity. A proportion of agreement is then calculated, with scores on the CVI of $< .75$ generally considered strong.

Method

Participants

Three sport psychologists and one coach (four males), who were aged between 24 and 55 years old, took part in Study 1. The sport psychologists' experience ranged between 2 and 19 years and the coach had 18 years' coaching experience from the United Kingdom *n* = 3) or Australia *n* = 1). All participants were independent of the research team.

Procedure

A departmental ethics committee granted ethical approval for this study. Before participating in the research, participants were required to provide written informed consent.

Adolescent Sport Doping Inventory

The preliminary ASDI was drawn up by the research team and contained 108 items pertaining to the psycho-social variables associated with doping. These items related to attitudes towards doping, threat, benefit, self-esteem, cheating, legitimacy, reference group opinion, age/maturation, stress, doping susceptibility, and affordability/availability.

Data Analysis

To examine content validity, each psychologist and coach rated items on the 4-point CVI (Waltz & Bausell, 1983). The criteria can be found in Electronic Supplementary Material (ESM) Appendix S1. Each panel member rated each item according to the criteria. CVI was calculated by summing the amount of responses for each item of three or four. This was divided by the total items to be expressed as a fractional proportion. All items with a CVI over .75 were considered to have sufficient content validity.

Results

Mean CVI scores by item for relevance, clarity, simplicity, and ambiguity are presented in ESM Appendix S2, with item CVI and subscale CVI. In total, seven items presented a CVI below .75. Each of these were reviewed to determine if they could be revised, without replicating an existing item. Four items on the threat scale presented a CVI < .75 and were revised and retained. One item from the attitudes scale and one item from the cheating scale could not be revised without replicating another item and these were therefore removed, yielding a subscale CVI scores of .90 for both of these subscales. One item from the age/maturation scale was revised but to avoid replication, two further items from this scale were removed. CVI scores for all non-revised scales ranged from .89 to .97.

Study 2: Factorial validity

The purpose of Study 2 was to examine the internal structure of the scale generated in Study 1. Specifically, we tested the factor structure of the preliminary ASDI and refined this through an iterative process, to derive a psychometric assessment with factors that demonstrate relative independence and generate internally consistent scores.

Method

Participants

Six-hundred athletes (male n = 362, female n = 238), aged between 12 and 18 years (M_{age} = 16.29, SD = 1.79) participated in Study 2. Our sample resided in the United Kingdom (n = 375), Australia (n = 121), Hong Kong (n = 83), or the United States (n = 21). Athletes competed at beginner (n = 37), amateur (n = 412), semi-professional (n = 35), professional (n = 7), county or state (n = 61), national (n = 34), or international (n = 9). Five athletes failed to report their playing level.

Measure

ASDI. The 104-item ASDI.

Data Analysis

Confirmatory factor analysis (CFA) was performed on the initial model. Factors were anticipated to be relatively independent, hence no cross-loadings were specified, creating an Independent Cluster Model (ICM). Scale refinement was an iterative process, examining model fit, standardized parameter estimates (loadings), and modification indices. At the examination of each model, fit indices were assessed by broadly employing Hu and Bentler's (1999) recommendations, the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and Tucker-Lewis Index (TLI) of close to .95 were considered as demonstrating good incremental model fit (that is, compared to a null model), and the standardized root mean-square residual (SRMR) and root mean square error of approximation close to .08 and .05 respectively indicate good absolute model fit. To examine the adequacy of factor loadings pertaining to each item, we employed Comrey and Lee's (1992) recommendations of .32 (poor), .45 (fair), .55 (good), .63 (very good), and 0.70 (excellent).

Results

The first model subjected to CFA was the 11-factor, 104-item scale developed in Study 1. The results indicated substantive misspecification in this model; χ^2 (5192) = 13897.1, CFI = .736, TLI = .728, SRMR = .075, RMSEA (90% CI) = .053 (.052, .054). The subsequent iterative process to refine the model resulted in constructing and testing 19 different models (Table 1). These analyses culminated in the final 9-Factor, 43-item ASDI (Appendix A for ASDI and scoring key), which presented good CFA model fit; χ^2 (5192) = 1440.4, CFI = .954, TLI = .950, SRMR = .039, RMSEA (90% CI) = .035 (.032, .038). Age/Maturation and Availability/Affordability were removed in the model refinement process. The Age/Maturation

scale had been reduced to just three items after removing items with a weak factor loading. We considered that there are better mechanisms for measuring maturity than including it as a scale within the ASDI and therefore removed it. Although item loadings on the Availability/Affordability scale were acceptable, we believed that this was a practical consideration, whereas all other scales represented psychological or social constructs. All retained items presented good (i.e., > .55) factor loadings (Table 2). The largest correlation between all subscales was .57 (Table 3). Item redundancy was inspected using R-square. All retained items made a satisfactory contribution to the overall variance (R^2 > .30). To measure cross-loadings on the refined model, we examined the exploratory structural equation modelling (ESEM) structure, whereby all factors are indicated by all items. This also presented a good model fit; χ^2 (552) = 964.4, CFI = .969, TLI = .950, SRMR = .017, RMSEA (90% CI) = .035 (.032, .039) with all items loading substantively on their intended factor and no substantive cross-loadings, further supporting the independence of factors (Table 2). Finally, we examined the internal consistency of the responses to each scale using Cronbach's alpha. All scale scores demonstrated suitably reliable estimates (.78 to .95; see Table 3).

PART 2: CONSTRUCT VALIDITY ANALYSIS

We assessed the construct validity of the newly created ASDI in Part 2. Campbell and Fiske (1959) described construct validity by referring to its subordinates; convergent and divergent validity. Convergent validity is evidenced by a construct that is positively associated with theoretically related constructs. Conversely, divergent validity is indicated by theoretically independent variables yielding no association.

Study 3: Psycho-Social Doping Variables, Temptation, and Honesty

We examined the convergent validity of the ASDI by its association with a measure of doping attitudes, situational temptation, and honesty and humility. Firstly, we selected doping attitudes because one of the subscales in the ASDI represents doping attitudes, and the other eight sub-scales have been either theoretically or empirically associated with doping attitudes (e.g., Donovan et al., 2002; Nicholls, Cope, et al., 2017). Situational temptation was included as a related variable because it was linked to doping behaviors among adolescent athletes (Nicholls, Cope, et al., 2017). Finally, the measure of honesty was included because doping represents one of the clearest forms of cheating in sport (Nicholls, Madigan, Backhouse, & Levy, 2017), so being in favor of doping represents an attitude which is the antithesis of sporting values. The extent to which associations between doping attitudes and situational temptation, and doping attitudes and honest and humility differed from the associations between these variables and ASDI scales provided an assessment of divergent validity. We constructed a structural equation model (SEM), whereby situational temptation and honesty and humility were predictor variables of ASDI scales and doping attitudes. We also examined the factor structure of the ASDI on a sample independent of participants used in Study 2.

Methods

Participants

A sample of 423 athletes took part in this study. We included a social desirability scale in the questionnaire pack for this study (Petrides, 2009). Thirty athletes scored above the acceptable threshold and therefore their data was removed. As such, the sample analyzed included 393 athletes (male n = 263, female n = 160), aged between 12 and 18 years of age (M = 16.42, SD = 1.69) from the United Kingdom (n = 113), Australia (n = 137), Hong Kong (n = 69), or the United States (n = 104). Athletes competed at beginner (n = 40), amateur (n = 294), semi-

professional (n = 34), professional (n = 6), county or state (n = 15), national (n = 25), or international (n = 9).

Measures

ASDI. Participants completed the 43-item ASDI.

Performance Enhancement Attitudes Scale (PEAS; Petróczi & Aidman, 2009). The 17-item PEAS assessed doping attitudes. Cronbach's alpha values of the PEAS across 12 samples ranged from .71 to .91.

Situational Temptation. Doping temptation was assessed using the 4-item measure of situational temptation (Lazuras et al., 2010), which yielded a Cronbach's alpha of .86.

Honesty and Humility. Participants completed the honesty-humility questions of the 60-item HEXACO-60 (Ashton & Lee, 2009). Cronbach's alpha values of these questions ranged from .74 to .79.

Social Desirability. Four items, which were taken from the 153-item TEIQue (Petrides, 2009) were used to assess social desirability. Two of the questions were inserted at the end of the PEAS and the Honesty and Humility questions. As these items are not intended to be related to each other, Cronbach's alpha was not calculated. Participants who scored in excess of 20 out of a maximum of 28, were deemed to be supplying socially desirable answers and therefore removed.

Data Analysis

Data were screened for completeness, outliers, univariate normality, and social desirability. We examined internal consistency by estimating omega point estimates and confidence intervals in addition to coefficient alpha, as omega holds fewer assumptions than alpha (Dunn, Baguley, & Brunsden, 2013). As we had large variations in length of scale, we also calculated mean inter-item correlation (MIIC).

We examined the factor structure of the ASDI, using CFA and ESEM (Asparouhov & Muthén, 2009). The main analyses comprised of testing a SEM positing situational temptation, honesty and humility, and exogenous predictor variables of ASDI scales. Doping attitude was co-varied with all ASDI factors.

Results

Preliminary Analyses

There were no missing data or outliers identified (see ESM Appendix S3 for descriptive statistics). Univariate skewness was < 2 in all variables with the exception of the attitudes scale of the ASDI, which was slightly positively skewed, with a large proportion of participants scoring the minimum on this scale.

We calculated Omega point estimates and confidence intervals using the MBESS package (Kelley & Lai, 2012), in R (R Development Core Team, 2015), with 1,000 bootstrap samples. For ASDI subscale scores, internal consistency was excellent on all measures (α = .87 to .94; ω = .87 to .94). PEAS scores reported high alpha and omega levels with lower MIIC. Reponses to situational temptation also demonstrated high levels of internal consistency. The HEXACO-60 (Ashton & Lee, 2009) honesty and humility scales contain very few items, which generates very low alpha and omega estimates. However, it is worth noting that the MIIC were also very low. Even when combining all items, the scale scores present low internal consistency in the sample. Results pertaining to these scales were treated with caution, with the exception of modesty.

ASDI Factor Structure

CFA revealed a good model fit without the need for any modification; χ^2 (824) = 1528.33, p < .001, CFI = .931, TLI = .924, SRMR = .050, RMSEA = .047 (90% CI = .043, .050).

Standardized parameter estimates for all factor loadings are presented in Table 4. The loadings clearly support the factor structure of the ASDI in the ICM. The ESEM model with geomin rotation allowed all items to load on all subscales. Model fit was again good; χ^2 (552) = 1079.89, $p < .001$, CFI = .948, TLI = .915, SRMR = .019, RMSEA = .049 (90% CI = .045, .054). The priority however, was to check that all items loaded onto their intended scale sufficiently and that cross-loadings were not substantive. The factor loadings indicated that all items load substantively onto their own factors and no cross-loadings on any factor were greater than .25. This supports the factor structure and the independence of each scale within the ASDI.

Convergent and Divergent Validity

To examine convergent and divergent validity, we tested a structural model that included the CFA-ICM measurement model of ASDI, regressed on situational temptation and honesty and humility variables, which were included as observed variables. Mean PEAS score was also regressed on these to compare path estimates with those to ASDI. Finally, scores between all ASDI scales were co-varied with mean PEAS score. Model fit was acceptable; χ^2 (1028) = 1838.42, $p < .001$, CFI = .928, TLI = .918, SRMR = .046, RMSEA = .045 (90% CI = .042, .048; see ESM Appendix S4). PEAS score was positively associated with attitude, benefit, cheating, reference group, stress, and susceptibility, but it negatively correlated with legitimacy, providing support for convergent validity.

Situational temptation was a statistically significant predictor of all psycho-social subscales. Notably, there was a large positive path estimate to susceptibility ($\beta = .61$, $p < .001$, 95% CI = .47, .75), cheating ($\beta = .57$, $p < .001$, 95% CI = .42, .71), and reference group ($\beta = .52$, $p < .001$, 95% CI = .38, .65). Significant positive paths from situational temptation were also present to attitude, benefit, and stress. Negative paths to esteem and legitimacy were also

significant. The results support the convergent validity of the ASDI, as does the positive path from situational temptation to PEAS ($\beta = .49$, $p < .001$, 95% CI = .36, .62).

Of the honesty and humility scales, sincerity and greed-avoidance presented only one small ($\beta \leq .15$) standardized coefficient each. This is consistent with their predictive paths to PEAS score however. A similar effect size, but positive, was observed for the estimation of fairness to esteem. Finally, modesty negatively predicted attitude, benefit, cheating, reference group opinion, and susceptibility.

Support for divergent validity was equivocal. Standardized path estimates from PEAS and the attitude scale of the ASDI to situational temptation (PEAS $\beta = .49$, $p < .001$, 95% CI = .36, .62; ASDI Attitude $\beta = .39$, $p < .001$, 95% CI = .18, .59) were similar, as were paths from these variables to sincerity, fairness, greed avoidance, and modesty (ESM Appendix S4). This suggests that the ASDI Attitude scale explains little unique variance above that already explained by PEAS. There was however, varying strengths of paths between PEAS and other ASDI scales, supporting divergent validity. Further, the association between ASDI Attitudes and PEAS was only moderate ($r = .40$, $p < .001$, 95% CI = .25, .55).

Study 4: Psycho-Social Doping Variables and Maturation

Adolescence is associated with dramatic biological and psychological changes (Lazarus, 1999). In other domains, maturation has been found to influence the way adolescent athletes think and manage stress (Nicholls et al., 2013, Nicholls, Levy, et al. 2015). Further, the coaches in Nicholls, Perry et al.'s (2015) study reported maturity may influence attitudes towards doping among adolescent athletes. Coaches suggested that late developers may be tempted to dope, due to their lack of maturity. As such, it is likely that maturation levels be related to attitudes and susceptibility.

The aim of Study 4 was to examine the convergent validity of the ASDI, by exploring the relationship between psycho-social constructs associated with doping and maturity. We predicted a negative relationship between biological maturity, cognitive-social maturity, and emotion maturity with doping attitudes and susceptibility (Nicholls, Levy et al., 2015).

Method

Participants

Three-hundred and twenty-seven athletes (male n = 227, female n = 99, unspecified n = 1), aged between 12 and 18 years of age (M_{age} = 16.27, SD = 1.59) from the United Kingdom (n = 194), Australia (n = 42), Hong Kong (n = 38), or the United States (n = 53) participated in this study. Athletes competed at beginner (n = 26), amateur (n = 244), semi-professional (n = 17), professional (n = 2), county or state (n = 20), national (n = 17), or international (n = 1).

Measures

ASDI. The 43-item ASDI.

Khamis-Roche (KR). The KR method (Khamis & Roche, 1994) assessed biological maturity. Participants reported their age and height, and also the height of their mother and father. The KR method represents biological maturity as a percentage of predicted height, relative to age, and has been validated with skeletal maturity in youth American football athletes (Malina, Dompier, Powell, Barron, & Moore, 2007).

Cognitive Social Maturity Questionnaire (CSMQ). The 8-item CSMQ (Levers-Landis, Neff Greenley, Burant, & Borawski, 2006) assessed cognitive social maturity (e.g., conscientiousness, rule following, and peer influence on behavior). Levers-Landis et al. (2006)

reported Cronbach alpha coefficients of .59 (conscientiousness), .42 (rule following), and .54 (peer influence on behavior).

Emotional Quotient Inventory (USMEQ-i). Eight questions from the USMEQ-i (Yusoff et al., 2011) assessed the emotional maturity level of the participants. Yussoff et al. reported a Cronbach alpha coefficient of .82.

Data Analyses

Data from all measures was screened for outliers, missing data, and univariate normality. We assessed internal consistency using omega point estimates and bootstrapped confidence intervals. We then ran a hierarchical multiple linear regression to determine the statistically predictive capabilities of maturity and ASDI variables on doping susceptibility.

Results

Less than 1% of cells contained missing data and there were no outliers. Descriptive statistics, normality estimates, and omega point estimates are presented in ESM Appendix S5. There were no issues with skewness (all scales < 2). All subscale scores comfortably exceeded the generally acceptable level of $\omega > .70$ for estimates of internal consistency. Indeed, all ASDI exceeded .80.

Assigning *z* scores for biological maturity, we found that of the 204 whom provided sufficient data to calculate this variable, 115 (56.37%) were early in their maturation, 21 (10.29%) were on time, and 68 (33.33%) were late. A one-way ANOVA to determine whether there were differences among the groups, yielded no significant differences.

To gain initial insight of variable associations, we examined the Pearson bivariate correlations with 1,000 bootstrapped samples of ASDI scales with biological, emotional, and social cognitive maturity (see ESM Appendix S6). Correlations were interpreted following the

recommendations of Li, Peng, Zhang, and Zhu (2012) of < .20 = no correlation, .20-.39 = low correlation, .40-.59 = moderate correlation, .60-.79 = moderately high correlation, and > .80 = high correlation. Biological maturity was unrelated to doping constructs, while emotional and social cognitive maturity was negatively associated with doping susceptibility.

Next, we conducted a hierarchical multiple linear regression to determine the extent to which variance in doping susceptibility was account for by maturity and the remaining ASDI variables. First, we entered demographic variables of gender, ethnicity, skill level, and years' experience in Model 1, then maturity variables in Model 2, and finally, the eight remaining ASDI subscales in Model 2. Confidence intervals were obtained from 1,000 bootstrapped samples. The results from this analysis are presented in Table 5. Model one (demographics) was not statistically significant ($\Delta R^2 = .030$, F (4,301) = 2.335, $p = .056$). Model two explained a substantive amount of variance ($\Delta R^2 = .213$, F (7,258) = 13.673, $p < .001$). This was a cumulative effect of the three maturity variables, however, as none of them presented statistically significant coefficients. ASDI variables were then entered in model three. Overall, 66.4% of doping susceptibility variance was accounted for, as Model 3 also substantively increased R^2 ($\Delta R^2 = .421$, F (15,290) = 38.197, $p < .001$). Three ASDI scales significantly contributed to the increased variance in doping susceptibility explained; benefit ($\beta = 14$, $p < .01$), cheating ($\beta = 35$, $p < .01$), and reference group ($\beta = 38$, $p < .01$).

Study 5: Psycho-Social Doping Variables, Psychological Stress, Achievement Goals, Emotions, and Coping

Nicholls, Perry, et al (2015) identified stress as a key factor that may influence attitudes towards doping among adolescent athletes. However, little is known about how stress may be associated with the psycho-social constructs linked to doping. The aim of Study 5 was to further

examine the convergent validity of the ASDI, by exploring the relationship between psycho-social constructs associated with doping and stress appraisals, achievement goals, and coping. Based on Nicholls, Perry, et al (2015), we hypothesized that threat appraisals would correlate positively, whereas as challenge appraisals would correlate negatively with attitudes to doping. We also predicted that there will be positive relationships between performance-approach and performance-avoidance goals with doping attitudes and doping susceptibility, but negative relationships between attitudes to doping with mastery-approach and mastery-avoidance goals. Finally, task-oriented coping strategies would correlate negatively with favorable attitudes towards doping, whereas distraction-oriented and disengagement-oriented coping would correlate positively with doping attitudes. This was because athletes using distraction- and disengagement-oriented coping are less likely to be successful with such strategies (Gaudreau & Blondin, 2002; Nicholls, Taylor, Carroll, & Perry, 2016), so may consider doping as a mechanism of enhancing performance.

Methods

Participants

Three-hundred and sixty-seven athletes (male n = 259, female n = 108), aged between 12 and 18 years of age (M_{age} = 16.27, SD = 1.59) participated in this study. Our sample resided in the United Kingdom (n = 210), Australia (n = 72), Hong Kong (n = 31), or the United States (n = 54). Athletes competed at beginner (n = 41), amateur (n = 209), semi-professional (n = 76), professional (n = 2), county or state (n = 22), national (n = 9), or international (n = 5) levels. Three athletes failed to report their skill level.

Measures

ASDI. The 43-item ASDI.

Stress Appraisal Measure (SAM). Six challenge and six threat questions from the SAM (Peacock & Wong, 1990) assessed challenge and threat. Peacock and Wong reported Cronbach alpha coefficients ranging from .65 to .90.

Achievement Goals Questionnaire for Sport (AGQ). Conroy, Elliot, and Hofer's (2003) 12-item AGQ assessed achievement goals, which has Cronbach alpha coefficients ranging from .70 to .87.

Coping Inventory for Competitive Sport (CICS). The CICS (Gaudreau & Blondin, 2002) measured coping. Cronbach alpha coefficients for individual coping strategies ranged from .67 to .87.

Data Analyses

Data from all measures was screened for outliers, missing data, and normality. Given the complexity of model required to assess the associations between variables, we tried to limit the number of parameters to be estimated in order to achieve Bentler and Chou's (1987) recommendation of a ratio of five cases per free parameter. For the main analyses, we tested a series of path models whereby ASDI subscales were posited as exogenous variables. These were predictors of achievement goal variables, which in turn were predictors of stress appraisal and finally, these were posited as predictors of coping.

Results

There were no concerns regarding missing data (< 1%) or outliers. Descriptive statistics, normality estimates, and omega point estimates are presented in ESM Appendix S7. All subscales presented normal distribution and subscale data comfortably exceeded the generally acceptable level of $\omega > .70$ for internal consistency. Indeed, all scale responses exceeded .80, with the exception of disengagement-oriented coping ($\omega = .70$, 95% CI = .63, 75).

We examined the correlations of ASDI scales with achievement goals, stress appraisal, and coping strategies. Correlations were generally low (see ESM Appendix S8), although esteem and stress appeared to have the strongest relationship with other variables. Next, we conducted a hierarchical multiple linear regression to determine the extent to which doping susceptibility was predicted by the remaining ASDI variables. First, we entered demographic variables of gender, ethnicity, skill level, and years of playing experience in Model 1, before entering the eight remaining ASDI subscales in Model 2. The results from this analysis are presented in ESM Appendix S9. Model 1 (demographics) revealed minimal effect ($\Delta R^2 = .035$, F (4,356) = 3.20, p = .013). Overall, 65.5% of doping susceptibility variance was accounted for, as Model 2 substantively increased R^2 ($\Delta R^2 = .620$, F (12,348) = 55.06, $p < .001$). Four ASDI scales significantly contributed to the increased variance in doping susceptibility (e.g., attitude, benefit, cheating, and reference group opinion).

Path Analyses

The first path model constructed was a mediation model, whereby coping strategies were regressed on stress appraisals, which were regressed on achievement goals, which were regressed on ASDI scales. Mastery-approach was covaried with performance approach and mastery-avoidance was covaried with performance-avoidance to better represent the relationship between these variables. This model required the estimation of 78 parameters, presenting a ratio to participants of 4.71:1. Model fit indicated much room for improvement: χ^2 (57) = 300.81, CFI = .793, TLI = .574, SRMR = .083, RMSEA = .108 (90% CI = .96, .112). Modification indices suggested that chi-square would be significantly reduced, and therefore model fit improved, with the introduction of several direct paths. Paths were estimated only when the predictor variable should appear to the left of the outcome variable. For example, an ASDI subscale could be a

predictor of all endogenous variables, achievement goals could be predictors of stress appraisals and coping strategies, but not of ASDI scales. Stress appraisals could predict coping strategies, but coping strategies, as the final variables in the model, could not act as predictor variables. Specifically, we added paths so that task-oriented coping was predicted by esteem and legitimacy, challenge appraisal was predicted by esteem, legitimacy, and stress, and threat appraisal was predicted by esteem and stress. This resulted in an improved model fit; χ^2 (46) = 138.23, CFI = .922, TLI = .800, SRMR = .043, RMSEA = .074 (90% CI = .060, .088) and the estimation of 89 parameters. RMSEA estimate of .074 indicates significant error in the model. Consequently, we next removed all paths that were not statistically significant. This was judged by meeting two conditions; a) $p > .05$ and b) 95% confidence intervals contained zero. The resultant model, which estimated 53 parameters, indicated good model fit; χ^2 (37) = 79.05, CFI = .962, TLI = .926, SRMR = .041, RMSEA = .056 (90% CI = .039, .073). All paths in this model were statistically significant and are presented in Figure 1.

Four ASDI variables remained in this final path model. Esteem positively predicted mastery-approach ($\beta = .28$, $p < .001$, 95% CI = .11, .45) and performance-approach ($\beta = .23$, $p < .001$, 95% CI = .09, .36) goals. Attitude was negatively predictive of both mastery-approach and mastery-avoidance. Stress presented a positive path to mastery avoidance and performance avoidance. Notably, stress was also a significant predictor of threat appraisals ($\beta = .51$, $p < .001$, 95% CI = .39, .62). Finally, we examined indirect effects throughout the model. The results of this analysis are presented in ESM Appendix S10. The most significant indirect effect was stress via threat appraisals leading to disengagement coping ($\gamma = .28$, $p < .001$, 95% CI = .20, .36).

Study 6: Psycho-Social Doping Variables and Coaching Factors

The sporting environment that a coach creates is associated with attitudes among athletes (Christodoulidis, Papaioannou, & Digelidis, 2001). It is therefore plausible that the motivational climate, the coach-athlete relationship, and coaching behavior may be linked to doping attitudes, because coaches can exert a strong influence on young athletes (Wrobble et al., 2002). Indeed, Terney and McLain (1990) reported that 2% of athletes said a coach had recommended anabolic androgenic steroids (AAS). The aim of Study 6 was to examine the construct validity of the ASDI, by exploring the relationship between psycho-social constructs associated with doping and the motivational climate, coach-athlete relationship, and coach behavior.

We predicted that attitudes to doping would be negatively associated with an empowering motivational climate, but positively associated with a disempowering motivational climate. Further, an athlete's poor perception of his or her coach-athlete relationships would be positively associated with favorable doping attitudes and controlling coaching behaviors would be positively associated with positive doping attitudes. Conversely, autonomy supportive coaching behaviors would be negatively associated with positive attitudes towards doping.

Methods

Participants

Three-hundred and ninety athletes (male n = 275, female n = 115), aged 12 to 18 years (M = 16.06, SD = 1.83) participated in this study. Participants resided in the United Kingdom (n = 255), Australia (n = 45), Hong Kong (n = 34), or the United States (n = 56). Athletes competed at beginner (n = 53), amateur (n = 243), semi-professional (n = 28), professional (n = 23), county or state (n = 25), national (n = 11), or international (n = 7).

Measures

ASDI. The ASDI assessed attitudes and susceptibility to doping and psycho-social factors that predict doping behaviors.

Empowering and Disempowering Motivational Climate Questionnaire-Coach (EDMCQ-C). The EDMCQ-C (Appleton, Ntoumanis, Quested, Viladrich, & Duda 2016) assessed motivational climate, which had Cronbach alpha coefficients of .87 (empowering) and .86 (disempowering) for the two subscales.

Coach Athlete Relationship Questionnaire (CART-Q). The CART-Q (Jowett & Ntoumanis, 2004) assessed perceptions of the coach-athlete relationship. Jowett and Ntoumanis reported Cronbach alpha coefficients of .86 (closeness), 0.83 (commitment), and 0.78 (complementarity).

Coach Behavior. Healy, Ntoumanis, Veldhuijzen van Zanten, and Paine's (2014) 30-item measurement of coach behavior was used. This questionnaire had a Cronbach alpha coefficient of .86

Data Analyses

All data were screened for outliers, missing data, normality, and internal consistency. We ran a hierarchical multiple linear regression to determine the predictive capabilities of environmental and ASDI variables on doping susceptibility.

Results

There were no issues with missing data (< 1%) or outliers. Descriptive statistics, normality estimates, and omega point estimates are presented in ESM Appendix S11. All ASDI, CART-Q, and Coach Behavior internal consistency estimates exceeded $\omega = .80$. Two of the subscales estimates from the EDMCQ-C were below .70. The socially supporting subscale scores ($\omega = .68$, 95% CI = .59, .75) was marginally below, but not enough to cause concern. The

autonomy supportive subscale scores however were substantively below .70 (ω = .55, 95% CI = .48, .61). Item 22 negatively correlated with two items form the same scale. Consequently, we removed this item and re-examined internal consistency. This presented a marginal improvement (ω = .62, 95% CI = .54, .68). This slightly shortened scale was used in subsequent analyses. Correlations between ASDI scales with all environmental variables were largely in the hypothesized direction, but small (ESM Appendix S12).

Next, we conducted a hierarchical multiple linear regression. First, we entered demographic variables of gender, ethnicity, skill level, and years' experience in Model 1, then EDMCQ-C variables in Model 2, CART-Q variables in Model 3, autonomy supportive and controlling coach behaviors in Model 4, and finally, the eight remaining ASDI subscales in Model 5 (see Table 6). Model 1 (demographics) was not statistically significant (ΔR^2 = .026, F (5,371) = 1.977, p = .081). Model 2 explained a statistically significant amount of variance (ΔR^2 = .083, F (10,366) = 4.455, p < .001). Model 3 (ΔR^2 = .007, F (13,363) = 3.657, p < .001). Model 4 (ΔR^2 = .039, F (15,361) = 4.407, p < .001) added negligible explanation of variance. Finally, Model 5 substantively increased R^2 (ΔR^2 = .409, F (23,353) = 19.840, p < .001) the amount of variance. In total, 56.4% of variance in doping susceptibility was explained, largely from ASDI subscales. Autonomy supportive from the EDMCQ-C and autonomy supportive coaching behaviors presented contradictory findings, with a positive coefficient for autonomy supportive but negative for autonomy supportive behaviors. Of the ASDI predictors, cheating, reference group, and stress were all significant and positive contributors to doping susceptibility. Threat, esteem, and legitimacy failed to account for a significant proportion of variance in doping susceptibility, as was the case in Study 4 and Study 5.

General Discussion

The ASDI is a valid tool to assess the psycho-social factors associated with doping among adolescent athletes, which has been tested with independent samples. Indeed, the findings from Study 3 in Part 2, successfully replicated the factor structure of the ASDI created in Part 1. Study 3 utilized an independent sample, and the ASDI demonstrated robust internal consistency in responses for the second time. Second, the findings from Study 3 also provide additional support for the convergent validity of the ASDI, and equivocal support for divergent validity. To further examine convergent validity, we conducted studies identifying relationships with maturation (Study 4), stress, emotions, and coping (Study 5), and coaching factors (Study 6), which make unique contributions to the doping literature by identifying other factors that are associated with doping attitudes and susceptibility.

We found partial support for our hypothesis that maturation was associated with doping attitudes. Although biological maturity was not associated with doping attitudes, attitudes towards doping correlated significantly with emotional maturity and the three subscales of cognitive-social maturity. It should be noted, however, that the correlations were low. Nicholls, Perry, et al (2015) were among the first scholars to reveal that maturation might be associated with doping among young people. Given that doping attitudes accounted for a significant amount of variance in doping prevalence among young people (e.g., Zelli et al., 2010), this represents an important finding. Indeed, our findings suggest that those who are able to successfully manage their emotions are less likely to possess favorable attitudes about PEDs. This could infer that PEDs may be used to help athletes manage negative emotions associated with their own performance or insecurities about their appearance. This contention is supported by the finding that stress levels were negatively associated with emotional maturity. For example, an athlete may be angry or anxious about poor performance, and thus taking PEDs could eradicate such

negative emotions, because the athlete is likely to believe that his or her performance will improve if PEDs are consumed. As such, doping may be a form of coping that allows athletes to regulate their internal responses to stress. In regards to cognitive social maturity, all three subscales correlated negatively with doping attitudes, which was expected. It unsurprising that conscientiousness was negatively associated with doping attitudes. These findings imply young people with high levels of conscientiousness see PEDs as bad and would therefore be less likely to dope. Similarly, those who are less influenced by their peers are also more likely to have an unfavorable view of doping. Peers may be a key factor in influencing whether a young person will dope or not, because Wroble et al. (2002) found that 18% of young people that took AAS did so because of peer pressure.

We found partial support for our hypotheses relating to stress, coping and emotions. Study 5 represents one of the first attempts to examine the relationship between stress appraisals and doping attitudes. The coaches who were interviewed by Nicholls, Perry, et al (2015) suggested that stress may be a key factor in influencing whether athletes will dope. Although we did not examine doping prevalence, doping attitudes predict doping among young people (Zelli et al., 2010). The athletes who used disengagement-oriented coping and had a positive attitude towards doping, may have believed that they could not be successful in their sport without taking PEDs, which is may be why they gave up trying to achieve their goals. Only one form of achievement goal, mastery-approach goals, was associated with doping attitudes. The direction of the correlation was expected, but our finding suggests that goals are less related to doping attitudes than other constructs within the cognitive-motivational-relational theory of emotions (Lazarus, 1999).

Controlling coaching behavior was the only coach factor that was significantly associated

with doping attitudes. Another factor that predicts doping prevalence among young people is susceptibility (Barkoukis et al., 2014). We found that susceptibility was associated with the motivational climate, the coach-athlete relationship, and coach behaviors. That is, athletes who were susceptible towards doping were in a controlling and uncaring environment, had a poor relationship with their coach, and were coached with controlling behaviors. Cheating, stress, and in particular, reference group opinion appeared to be the strongest predictors of doping susceptibility. It could be argued that doping susceptibility may be influenced by a combination of personality and individual differences (i.e., cheating), social factors (i.e., reference group opinion), and states (i.e., stress levels). This is one of the first studies to identify factors that may predict doping susceptibility. Indeed, Part 2 of this research lends support for the notion that maturation, stress variables, and coaching are all related to the psycho-social variables that predict doping. However, it should be noted that the effect sizes were relatively small for some variables. Although this could be viewed as a limitation, it could be argued that doping is predicted by many different variables that all make a small contribution. Another limitation of this research is that we did not measure doping prevalence, and have inferred a relationship based on previous findings with young athletes (Zelli et al., 2010). An additional limitation is that our path analysis implies mediation in a cross-sectional design. Maxwell and Cole (2007) pointed out that true mediation consists of causal processes and therefore such designs typical create biased estimates.

Another potential limitation of this research relates to the use of self-reported questionnaires. Although the ASDI may be affected by social desirability, scholars such as Ntoumanis, Barkoukis, Gucciardi, and King Chun Chan (2017) argued that self-report questionnaires are the most realistic way of capturing the psycho-social variables associated with

doping. Further, they may even provide a more accurate representation of actual doping use, given that WADA (2018) reported 2% of samples contained banned substances, whereas 10% of athletes admitted doping offences in a self-reported study (Lazuras et al., 2010). It should be noted that all questionnaires throughout the six studies were completed anonymously.

In conclusion, the ASDI improves on existing measures by Bloodworth et al. (2012) and Petróczi and Aidman (2009), because it is theory driven with sound psychometric properties. Unlike Barkoukis et al.'s (2014) questionnaire, the ASDI also examines social variables, which are important factors in predicting doping among adolescent athletes (Nicholls, Cope, et al., 2017). The ASDI also examines a broad range of psycho-social factors that are associated with doping attitudes and intentions (e.g., Donovan et al., 2002; Nicholls, Perry, et al., 2015). The ASDI can be used by scholars to assess whether other constructs might be associated with doping attitudes or intentions, in addition to those identified in the present research (e.g. maturation, stress variables, and coaching factors). Further, national anti-doping organizations or coaches could use the ASDI to identify athletes who are the most at risk of doping and then expose such athletes to anti-doping educational programs.

References

Appleton, P. R., Ntoumanis, N., Quested, E., Viladrich, C., & Duda, J. L. (2016). Initial validation of the coach-created Empowering and Disempowering Motivational Climate Questionnaire (EDMCQ-C). *Psychology of Sport and Exercise, 22*, 53-65. doi:10.1016/j.psychsport.2015.05.008

Ashton, M. C., & Lee, K. (2009). The HEXACO-60: A short measure of the major dimensions of personality. *Journal of Personality Assessment, 91*, 340-345. doi:10.1080/00223890902935878

Asparouhov, T. & Muthén, B. (2009). Exploratory structural equation modeling. *Structural Equation Modeling, 16*, 397-438. doi:10.1080/10705510903008204

Barkoukis, V., Lazuras, L., & Tsorbatzoudis, H. (2014). Beliefs about the causes of success in sports and susceptibility for doping use in adolescent athletes. *Journal of Sports Sciences, 32*,212-219. doi:10.1080/02640414.2013.819521

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods and Research, 16,* 78-117. doi:10.1177/0049124187016001004

Bloodworth, A. J., Petróczi, A., Bailey, R., Pearce, G., & McNamee, M. J. (2012). Doping and supplementation: The attitudes of talented young athletes. *Scandinavian Journal of Medicine and Science in Sports,* 22, 293-301. doi:10.1111/j.1600-0838.2010.01239.x

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multifruit-multimethod matrix. *Psychological Bulletin, 56,* 81-105. doi:10.1037/h0046016

Christodoulidis, T., Papaioannou, A., & Digelidis, N. (2001). Motivational climate and attitudes towards exercise in Greek senior high school: A year-long intervention. *European Journal of Sport Science, 1,* 1-12. doi:10.1080/17461390100071405

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis*. Hillsdale, NJ: Erlbaum.

Conroy, D.E., Elliot, A.J., & Hofer, S. (2003). A 2 x 2 achievement goals questionnaire for sport: Evidence for the factorial invariance, temporal stability, and external validity. *Journal of Sport & Exercise Psychology, 25,* 456–476. doi:10.1123/jsep.25.4.456

Donovan, R. J., G. Egger, V. Kapernick, G., & Mendoza, J. (2002). A conceptual framework for achieving performance enhancing drug compliance in sport. *Sports Medicine, 32*, 269-284. doi:10.2165/00007256-200232040-00005

Dunn, T. J., Baguley, T., & Brunsden, V. (2013). From alpha to omega: A practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology, 105,* 399-412. doi:10.1111/bjop.12046

Gaudreau, P., & Blondin, J-P. (2002). Development of a questionnaire for the assessment of coping strategies employed by athletes in competitive sport settings. *Psychology of Sport and Exercise, 3,* 1–34. doi:10.1016/s1469-0292(01)00017-6

Gradidge, P., Coopoo, Y., & Constantinou, D. (2010). Prevalence of performance-enhancing substance use by Johannesburg male adolescents involved in competitive high school sports. *Archives of Exercise in Health and Disease, 2,* 114-119. doi:10.5628/aehd.v2i2.102

Gucciardi, D., Jalleh, G., & Donovan, R.J. (2011). An examination of the sport drug control model with elite Australian athletes. *Journal of Science & Medicine in Sport, 14,* 469-476. doi:10.1016/j.jsams.2011.03.009

Hartan, H. C. & Latané, B. (1997). Social influence and adolescent lifestyle attitudes. *Journal of Research on Adolescence, 7,* 197-220. doi:10.1207/s15327795jra0702_5

Healy, L. C., Ntoumanis, N., Veldhuijzen van Zanten, J. J. C. S., & Paine, N. (2014). Goal striving and well-being in sport: The role of contextual and personal motivation. *Journal of Sport & Exercise Psychology, 36,* 436-449. doi:10.1123/jsep.2013-0261

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal,* 6, 1-55. doi:10.1080/10705519909540118

Jalleh, G., Donovan, R. J., & Jobling, I. (2014). Predicting attitudes towards performance enhancing substance use: A comprehensive test of the Sport Drug Control Model with elite Australian athletes. *Journal of Science and Medicine in Sport, 17,* 574-579. doi:10.1016/j.jsams.2013.10.249

Jowett, S., & Ntoumanis, N. (2004). The coach-athlete relationship questionnaire (CART-Q): development and initial validation. *Scandinavian Journal of Medicine & Science in Sports,* 14, 245-257. doi:10.1111/j.1600-0838.2009.01020.x

Kelley, K., & Lai, K., (2012). *MBESS: MBESS. R package version 3.3.2*. Retrieved from http://CRAN.R-project.org/package=MBESS

Khamis, H. J., & Roche, A. F. (1994). Predicting adult height without using skeletal age: The Khamis-Roche method. *Pediatrics, 94,* 504-507, (*Pediatrics, 95,* 457, 1995 for the corrected version of the tables).

Lazarus, R. S. (1999). *Stress and emotion: A new synthesis.* New York: Springer.

Lazuras, L., Barkoukis, V., Rodafinos, A., & Tzorbatzoudis, H. (2010). Predictors of doping intentions in elite-level athletes: A social cognition approach. *Journal of Sport & Exercise Psychology, 32,* 694-710. doi:10.1123/jsep.32.5.694

Lazuras, L., Barkoukis, V., & Tsorbatzoudis, H. (2015). Toward an integrative model of doping use: An empirical study with adolescent athletes. *Journal of Sport & Exercise Psychology, 37*, 37-50. doi:10.1123/jsep.2013-0232

Levers-Landis, C.E., Neff Greenley, R., Burant, C., & Borawski, E. (2006). Cognitive social maturity, life change events, and health risk behaviors among adolescents: Development of a structural equation model. *Journal of Clinical Psychology in Medical Settings, 13,* 111–120. doi:10.1007/s10880-006-9016-9

Li, G., Peng, H., Zhang, J., & Zhu, L. (2012). Robust rank correlation based screening. *The Annals of Statistics, 40,* 1846–1877. doi:10.1214/12-aos1024

Madigan, D. J., Stoeber, J., & Passfield, L. (2016). Perfectionism and attitudes towards doping in junior athletes. *Journal of Sports Sciences, 34,* 700-706. doi:10.1080/02640414.2015.1068441

Malina, R. M., Dompier, T. P., Powell, J. W., Barron, M. J., & Moore, M. T. (2007). Validation of a non-invasive maturity estimate relative to skeletal age in youth football players. *Clinical Journal of Sports Medicine, 17,* 362–368. doi:10.1097/JSM.0b013e31815400f4

Maxwell, S. E., & Cole, D. A. (2007). Bias in Cross-Sectional Analyses of Longitudinal Mediation. *Psychological Methods, 12,* 23-44. doi:10.1037/1082-989X.12.1.23

Nicholls, A. R., Cope, E., Bailey, R., Koenen, K., Dumon, D., Constantin Theodorou, N., Chanal, B., Saint Laurent, D., Müller, D., Plata Andrés, M., Haahr Kristensen, A., Thompson, M. A., Baumann, W., & Laurent, J-F. (2017). Children's first experience of taking anabolic-androgenic steroids can occur before their 10th birthday: A systematic review identifying 9 factors that predict doping among young people. *Frontiers in Psychology,* 8:1015. doi:10.3389/fpsyg.2017.01015

Nicholls, A. R., Levy, A. R., & Perry, J. L. (2015). Emotional maturity, dispositional coping, and coping effectiveness among adolescent athletes. *Psychology of Sport and Exercise, 17,* 32-39. doi: 10.1016/j.psychsport.2014.11.004

Nicholls. A. R., Madigan, D. J., Backhouse, S. H., & Levy, A. R. (2017). Personality traits and performance enhancing drugs: The Dark Triad and doping attitudes among competitive athletes. *Personality and Individual Differences, 112,* 113-116. doi: 10.1016/j.paid.2017.02.062

Nicholls, A. R., Madigan, D. J., & Levy, A. R. (2017). A confirmatory factor analysis of the Performance Enhancement Attitude Scale for adult and adolescent athletes. *Psychology of Sport and Exercise, 28,* 100-104. doi:10.1016/j.psychsport.2016.10.010

Nicholls, A. R., Perry, J. L., Jones, L., Morley, D., & Carson, F. (2013). Dispositional coping, coping effectiveness, and cognitive social maturity among adolescent athletes. *Journal of Sport and Exercise Psychology, 35,* 229-238. doi:10.1123/jsep.35.3.229

Nicholls, A. R., Perry, J. L., Levy, A. R., Meir, R., Jones, L., Baghurst, T., Sanctuary, C., Thompson, M. A. (2015). Coach perceptions of performance enhancement in adolescence: The Sport Drug Control Model for Adolescent Athletes. *Performance Enhancement & Health, 3,* 93-101. doi:10.1016/j.peh.2015.07.001

Nicholls, A. R., Taylor, N. J., Carroll, S., & Perry, J. L. (2016). The development of a new sport-specific classification of coping and a meta-analysis of the relationship between different coping strategies and moderators on sporting outcomes. Frontiers in Psychology, 7:1674. doi: 10.3389/fpsyg.2016.01674

Ntoumanis, N., Barkoukis, V., Gucciardi, D. F., & King Chung Chan, D. (2017). Linking coach interpersonal style with athlete doping intentions and doping use: A prospective study. *Journal of Sport & Exercise Psychology, 39,* 188-198. doi:10.1123/jsep.2016-0243

Peacock, E. J., & Wong, P. T. (1990). The stress appraisal measure (SAM): A multidimensional approach to cognitive appraisal. *Stress and Health, 6,* 227–236. doi:10.1002/smi.2460060308

Petrides, K. V. (2009). Psychometric properties of the Trait Emotional Intelligence Questionnaire. In C. Stough, D. H. Saklofske, and J. D. Parker, *Advances in the assessment of emotional intelligence*. New York: Springer. doi:10.1007/978-0-387-88370-0_5

Petróczi, A., & Aidman, E. (2009). Measuring explicit attitude toward doping: Review of the psychometric properties of the performance enhancement attitude scale. *Psychology of Sport and Exercise, 10,* 390–396. doi:10.1016/j.psychsport.2008.11.001

R Development Core Team (2015). *R: A language and environment for statistical computing*. Vienna, Austria. Retrieved from http://www.R-project.org/

Terney, R., & McLain, L. G. (1990). The use of anabolic steroids in high school students. *American Journal of Disorders of Children*, 144, 99-103. doi:10.1001/archpedi.1990.02150250111046

Waltz, C. F., & Bausell, R. B. (1983). *Nursing research: Design, statistics and computer analysis. (2nd Ed.)*. Philadelphia: FA Davis Company.

Weiss, M.R., & Bredemeier, B.J. (1983). Developmental sport psychology: A theoretical perspective for studying children in sport. *Journal of Sport Psychology, 5,* 216–230. Retrieved from http://www.journals.humankinetics.com/jsep.

World Anti-Doping Agency (2018). *World Anti-Doping Code*. Quebec, Canada.

Wroble, R. R., Gray, M., & Rodrigo, J. A. (2002). Anabolic steroids and preadolescent athletes: Prevalence, knowledge, and attitudes. *Sport Journal*, *5*, 1-8.

Yusoff, M. S. B., Rahim, A. F. A., Pa, M. N. M., & Mey, S. C. (2011). The validity and reliability of the USM Emotional Quotient Inventory (USMEQ-i). Its use to measure emotional quotient (EQ) of future medical students. *International Medical Journal, 18,* 293-299. doi:10.1016/s0191-8869(99)00139-7

Zelli, A., Mallia, L., & Lucidi, F. (2010). The contribution of interpersonal appraisals to a social-cognitive analysis of adolescents' doping use. *Psychology of Sport and Exercise*, *11*, 304–11. doi: 10.1016/j.psychsport.2010.02.008

Table 1.

Confirmatory factor analyses fit indices from iterative model development (Study 2).

Model	χ^2	*df*	CFI	TLI	SRMR	RMSEA (90% CI)
1. 11-factor, 104 items	13897.048	5197	.736	.728	.075	.053 (.052, .054)
2. 11-factor, 87 items	9331.782	3599	.802	.794	.062	.052 (.050, .053)
3. 11-factor, 71 items	4711.262	2359	.897	.891	.049	.041 (.039, .042)
4. 11-factor, 69 items	4252.479	2222	.908	.903	.048	.039 (.037, .041)
5. 10-factor, 66 items	4053.332	2034	.908	.903	.049	.041 (.039, .043)
6. 10-factor, 63 items	3703.991	1845	.909	.904	.049	.041 (.039, .043)
7. 10-factor, 61 items	3366.375	1724	.914	.909	.049	.040 (.038, .042)
8. 10-factor, 58 items	2910.902	1550	.923	.918	.048	.038 (.036, .040)
9. 9-factor, 50 items	2175.449	1139	.934	.929	.045	.039 (.036, .041)
10. 9-factor, 48 items	1919.848	1044	.941	.937	.043	.037 (.035, .040)
11. 9-factor, 47 items	1841.855	998	.943	.938	.043	.038 (.035, .040)
12. 9-factor, 45 items	1672.906	909	.946	.941	.043	.037 (.035, .040)
13. 9-factor, 44 items	1498.959	866	.954	.950	.042	.035 (.032, .038)
14. 8-factor, 39 items	1161.947	647	.961	.957	.038	.035 (.031, .038)
15. 9-factor, 51 items	2276.615	1188	.929	.924	.046	.039 (.037, .041)
16. 9-factor, 48 items	1937.232	1044	.939	.935	.043	.038 (.035, .040)
17. 9-factor, 47 items	1753.109	998	.948	.943	.042	.036 (.033, .038)
18. 9-factor, 44 items	1521.880	866	.952	.948	.041	.036 (.033, .038)
19. 9-factor, 43 items	1440.403	824	.954	.950	.039	.035 (.032, .038)

Table 2.
Standardized factor loadings for the final 9-factor, 43-item ASDI (Study 2).

Item	Attitude		Threat		Benefit		Esteem		Cheating		Legitimacy		Ref Group		Stress		Suscept	
	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM	CFA	ESEM
A2	.59	**.42**		.00		.04		-.03		.11		-.02		.06		.03		.06
A5	.77	**.74**		.00		-.02		.05		.15		.03		-.07		.04		-.02
A11	.72	**.57**		-.02		.11		-.05		.01		-.09		.07		-.05		.06
A12	.81	**.89**		-.01		-.02		-.01		-.05		-.01		.00		-.01		.01
T2		-.07	.65	**.60**		-.06		-.01		-.04		.01		-.02		.02		-.02
T4		.01	.63	**.64**		-.05		.02		.04		-.09		.00		-.06		-.06
T9		.02	.63	**.65**		.07		.06		.00		.04		.02		.05		.02
T10		-.01	.84	**.82**		.02		-.02		-.03		.04		-.01		-.01		.02
B6		.02		-.03	.85	**.83**		.03		.06		.03		.00		.02		-.02
B7		-.01		-.04	.81	**.80**		.00		.01		.02		.05		.03		.01
B8		.02		.02	.92	**.92**		.02		-.04		.00		-.01		.01		.04
B9		.01		-.02	.89	**.90**		-.03		-.05		-.03		-.02		-.02		.00
B10		-.03		.06	.85	**.85**		-.01		.07		-.01		-.01		-.03		-.01
E1		.02		-.02		.02	.88	**.90**		.00		.03		-.02		.05		-.01
E2		-.03		-.04		-.03	.82	**.84**		.00		-.05		.00		-.01		.04
E3		-.04		.02		.00	.87	**.85**		.02		-.01		.02		-.03		-.03
E7		-.00		.04		.03	.81	**.76**		-.03		.00		-.01		-.11		-.02
E11		.08		.07		-.03	.63	**.61**		-.03		.05		-.01		.01		.03
C1		.05		-.01		.00		.02	.89	**.87**		-.01		.00		-.02		-.01
C2		.11		.02		.01		-.03	.86	**.77**		-.09		.02		-.01		.01
C3		-.03		-.02		-.04		-.01	.88	**.81**		.04		.03		.03		.13
C4		-.03		-.01		.09		.01	.82	**.76**		.01		.00		.01		.06
C7		.01		-.06		.01		-.02	.74	**.67**		-.03		.00		-.02		.04
L2		.01		.00		-.05		.01		.00	.76	**.74**		.03		-.01		-.07
L5		.02		.07		-.05		-.05		-.08	.80	**.78**		.02		-.07		.06
L6		-.00		.02		.06		-.03		-.02	.87	**.88**		.00		.02		.01
L7		-.01		-.01		.03		.03		.04	.90	**.90**		-.02		.01		-.03
L8		-.01		-.04		.00		.06		.01	.82	**.80**		-.01		-.01		-.01

R2	-.01	.01	.02	.01	.07	.01	.67	**.67**		-.02		-.02
R4	-.06	-.01	-.02	.03	-.08	.00	.82	**.84**		.00		.07
R5	.04	-.02	.00	-.02	-.02	.01	.93	**.94**		-.02		-.04
R6	.01	.01	.01	-.02	.05	.00	.95	**.93**		.02		.00
R8	.01	.00	-.01	.00	.03	.00	.72	**.70**		.06		.02
S2	-.05	.01	-.01	.04	-.03	.00		.01	.71	**.73**		.05
S3	.04	.08	.02	-.10	.18	-.01		.00	.68	**.67**		-.14
S4	.01	-.01	.04	-.02	-.03	-.05		.01	.81	**.80**		.00
S6	.00	-.08	-.01	-.03	-.02	.01		-.02	.78	**.76**		.08
S9	-.01	-.01	-.03	.08	.03	.02		.05	.64	**.65**		-.03
SU2	.04	-.01	-.01	-.01	-.02	-.02		-.03		.02	.91	**.91**
SU3	-.02	.01	.01	-.03	.06	.04		-.01		-.01	.91	**.89**
SU4	.08	-.02	.03	.03	.07	.01		.01		.02	.91	**.81**
SU6	.08	-.01	.06	.03	.00	-.05		.05		-.01	.81	**.73**
SU7	-.05	.02	-.03	-.02	.03	-.02		.02		.00	.91	**.92**

Note. Intended factor loadings are in bold.

Table 3.

Factor Correlations of final ASDI model (Study 2).

	1	2	3	4	5	6	7	8	9
1. Attitude	(.81)	-.20	.25	-.16	.47	-.29	.16	.11	.41
2. Threat	-.28	(.78)	-.15	.19	-.28	.33	-.15	-.11	-.26
3. Benefit	.29	-.16	(.94)	.02	.31	-.07	.10	.09	.28
4. Esteem	-.18	.21	.02	(.90)	-.16	.20	-.09	-.19	-.11
5. Cheating	.57	-.34	.34	-.17	(.92)	-.22	.29	.14	.65
6. Legitimacy	-.33	.37	-.07	.22	-.26	(.92)	.01	-.09	-.21
7. Reference Group	.22	-.18	.11	-.11	.33	-.01	(.91)	.18	.36
8. Stress	.15	-.15	.11	-.23	.18	-.12	.22	(.85)	.14
9. Susceptibility	.50	-.30	.30	-.14	.72	-.24	.38	.18	(.95)

Note. CFA below, ESEM above diagonal. Internal consistency estimates (α) are shown in parentheses along the diagonal.

Table 4.

CFA and ESEM standardized parameter estimates for ASDI (Study 3).

Item	CFA	R^2	ESEM	R^2	Item	CFA	R^2	ESEM	R^2
Attitude					*Legitimacy*				
1	.82	.71	.69	.67	24	.85	.73	.84	.74
2	.77	.75	.65	.60	25	.90	.81	.88	.82
3	.88	.81	.77	.77	26	.80	.64	.78	.65
4	.75	.71	.60	.56	27	.86	.74	.86	.75
Threat					28	.71	.50	.69	.52
5	.78	.73	.62	.61	*Reference Group*				
6	.85	.84	.74	.72	29	.77	.59	.71	.60
7	.85	.81	.72	.71	30	.81	.66	.73	.67
8	.89	.89	.80	.79	31	.92	.84	.90	.88
Benefit					32	.97	.93	.90	.93
9	.76	.68	.59	.58	33	.69	.48	.64	.50
10	.81	.69	.66	.66	*Stress*				
11	.91	.94	.85	.83	34	.72	.52	.71	.53
12	.93	.91	.87	.87	35	.64	.41	.52	.49
13	.86	.85	.75	.73	36	.78	.61	.71	.64
Esteem					37	.87	.75	.83	.77
14	.74	.71	.57	.55	38	.75	.57	.79	.63
15	.77	.76	.63	.59	*Susceptibility*				
16	.95	.92	.90	.90	39	.89	.79	.70	.79
17	.94	.89	.88	.88	40	.87	.76	.83	.77
18	.78	.73	.62	.60	41	.89	.79	.73	.78
Cheating					42	.83	.69	.70	.69
19	.70	.61	.52	.50	43	.92	.84	.84	.85
20	.69	.52	.49	.47					
21	.92	.69	.82	.84					
22	.86	.73	.75	.74					
23	.78	.79	.67	.61					

Table 5.

Hierarchical linear regression coefficients for maturation and ASDI as predictors of doping susceptibility (Study 4).

	B (95% CI)	SE β	*β*	*t*	R^2
Model 1					.030
Gender	.357 (-.955, 1.532)	.756	.021	.472	
Ethnicity	-.163 (-.338, .007)	.087	-.072	-1.877	
Skill level	-.007 (-.340, .319)	.221	-.001	-.033	
Years' experience	.049 (-.103, .211)	.080	.022	.610	
Model 2					.243**
Biological maturity	-.029 (-.144, .057)	.051	-.025	-.565	
Social-cognitive maturity	-.085 (-.214, .050)	.055	-.065	-1.540	
Emotional maturity	-.019 (-.119, .070)	.050	-.015	-.378	
Model 3					.664**
Attitude	.071 (-.064, .216)	.066	.049	1.087	
Threat	-.043 (-.151, .060)	.051	-.032	-.836	
Benefit	.133 (.045, .206)	.041	.141	3.230**	
Esteem	.015 (-.079, .122)	.051	.013	.303	
Cheating	.346 (.210, .493)	.052	.346	6.700**	
Legitimacy	.002 (-.107, .106)	.048	.001	.035	
Reference group opinion	.375 (.229, .532)	.046	.382	8.096**	
Stress	.003 (-.087, .094)	.039	.003	.080	

*Statistically significant at $p < .05$, **$p < .01$.

Table 6.

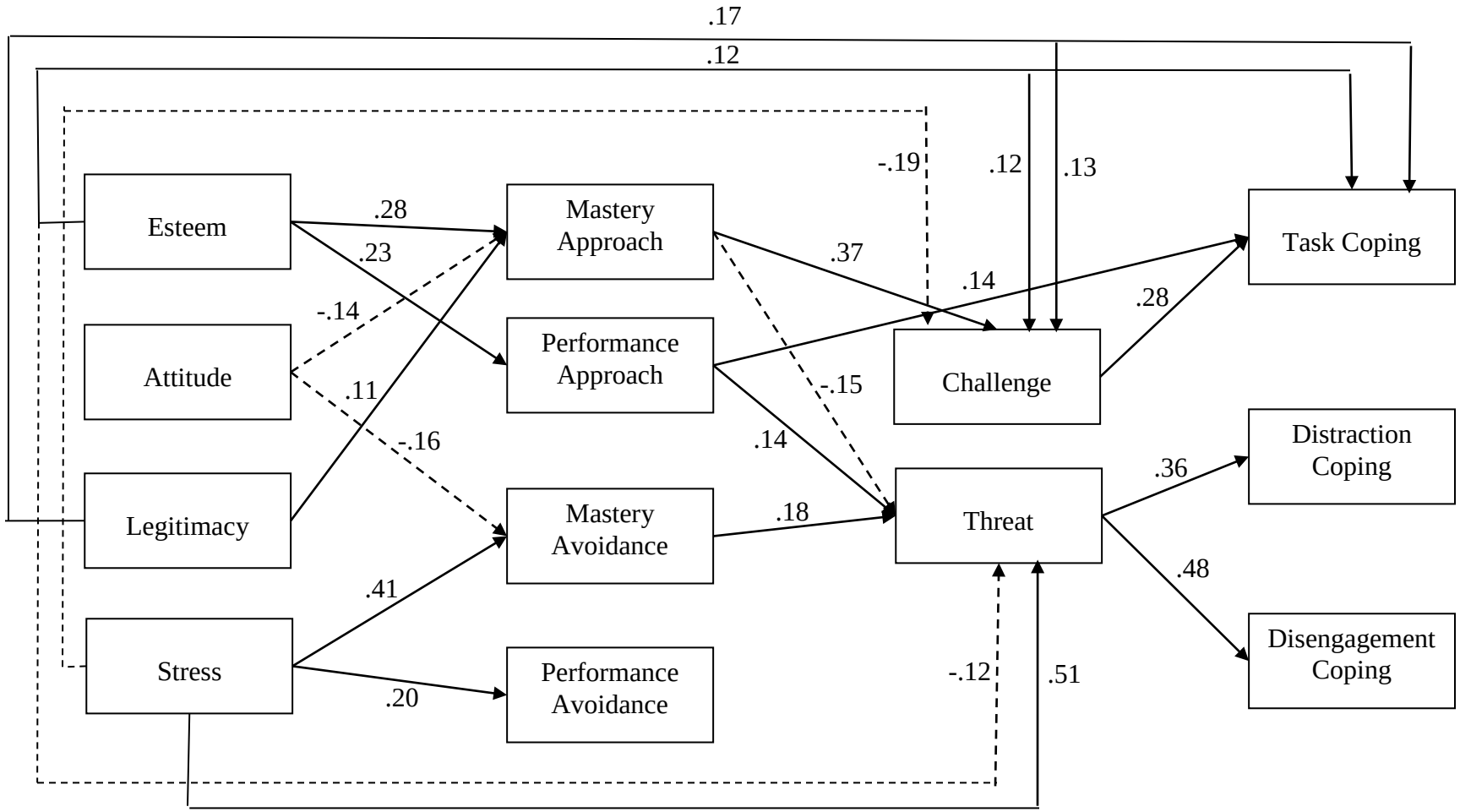
Hierarchical linear regression coefficients for environmental-social factors and ASDI as predictors of doping susceptibility (Study 6).

	B (95% CI)	SE β	*β*	*t*	R^2
Model 1					.026
Gender	.063 (-989, 1.156)	.548	-.017	-.418	
Ethnicity	.062 (-.109, .206)	.077	.014	.349	
Skill level	.050 (-.332, .426)	.192	.010	.259	
Years' experience	.025 (-.115, .154)	.072	.014	.349	
Model 2					.109**
Task Involving	-.075 (-.174, .035)	.059	-.063	-1.271	
Autonomy Supportive	.789 (.352, 1.230)	.228	.370	3.466**	
Socially Supportive	.040 (-.262, .311)	.150	.014	.269	
Ego Involving	.034 (-.104, .155)	.062	.032	.543	
Controlling Coaching	-.024 (-.115, .084)	.047	-.029	-.515	
Model 3					.116
Closeness	.006 (-.289, .273)	.125	.004	.044	
Commitment	.124 (-.125, .382)	.124	.066	1.003	
Complementarity	-.047 (-.334, .271)	.129	-.031	-.364	
Model 4					.155**
Autonomy Support	-.744 (-1.243, -.244)	.273	-.305	-2.722**	
Controlling Coach Behaviors	-.036 (-.087, .011)	.023	-.098	-1.597	
Model 5					.564**
Attitude	.126 (-.034, .282)	.066	.091	1.891	
Threat	-.037 (-.111, .044)	.048	-.030	-.777	
Benefit	.015 (-.066, .092)	.041	.017	.371	
Esteem	-.016 (-.115, .096)	.047	-.014	-.344	
Cheating	.213 (.103, .323)	.050	.214	4.299**	
Legitimacy	.049 (-.043, .140)	.045	.047	1.097	
Reference Group Opinion	.424 (.314, .525)	.044	.460	9.533**	
Stress	.129 (.044, .226)	.041	.132	3.150**	

*Statistically significant at $p < .05$.

Figure 1.

Doping Factors, Achievement Goals, Stress Appraisals, and Coping (Study 5).



Appendix A:

Adolescent Sport Doping Inventory and Scoring Key.

This questionnaire measures factors that are related to attitudes about Performance Enhancing Drugs (PEDs). There are no wrong or right answers, and it is important that you answer all questions as honestly as possible. Please answer each question by circling the appropriate number, which represents how you feel. PEDs = Performance Enhancing Drugs		**Strongly disagree**			**Neither agree nor disagree**			**Strongly Agree**
1)	In order to be successful in my sport, I need to take PEDs	1	2	3	4	5	6	7
2)	Legalizing PEDs would benefit my sport	1	2	3	4	5	6	7
3)	You have to take PEDs to play at the highest level in sport	1	2	3	4	5	6	7
4)	Making PEDs legal would improve sport	1	2	3	4	5	6	7
5)	I would suffer serious health complications if I took PEDs	1	2	3	4	5	6	7
6)	If I took a PED, it could make me very ill many years later	1	2	3	4	5	6	7
7)	PEDs can cause sexual dysfunction problems in males and infertility in females	1	2	3	4	5	6	7
8)	Taking a PED could cause a serious illness	1	2	3	4	5	6	7
9)	Taking PEDs could help me earn more money in the future	1	2	3	4	5	6	7
10)	Taking PEDs could help me keep my place in the team or training squad	1	2	3	4	5	6	7
11)	Taking PEDs could help me become famous by helping me perform at a much higher level	1	2	3	4	5	6	7
12)	Taking PEDs could help me get sponsored by leading sports companies	1	2	3	4	5	6	7
13)	Taking PEDs might help me become a celebrity	1	2	3	4	5	6	7
14)	I am worth being in the team/squads that I am currently play for	1	2	3	4	5	6	7
15)	I am at least as good as others in my team/squad	1	2	3	4	5	6	7
16)	I feel positive about training for my sport	1	2	3	4	5	6	7
17)	I feel positive about competing in my sport	1	2	3	4	5	6	7
18)	I believe I have the talent to be successful in my sport	1	2	3	4	5	6	7
19)	I would cheat if I thought it would help me win	1	2	3	4	5	6	7
20)	If other athletes cheat, I think it is ok for me to cheat too	1	2	3	4	5	6	7
21)	I would cheat if my coach encouraged me to do so	1	2	3	4	5	6	7
22)	I would cheat if I knew I won’t get caught	1	2	3	4	5	6	7
23)	Winning is more important than playing by the rules	1	2	3	4	5	6	7
24)	Drug testing authorities make sure they look after all samples they take	1	2	3	4	5	6	7
25)	Samples taken by drug testers are securely looked after	1	2	3	4	5	6	7
26)	Drug tests are very thorough	1	2	3	4	5	6	7

27)	I think the analyses of samples are accurate	1	2	3	4	5	6	7
28)	Drug testers are likely to catch those who take PEDs	1	2	3	4	5	6	7
29)	What other people think about PEDs influences my decision on whether I would ever take them or not	1	2	3	4	5	6	7
30)	What my coach thinks about PEDs would influence my decision about whether I would take them or not	1	2	3	4	5	6	7
31)	What my friends thinks about PEDs would influence my decision about whether I would take them or not	1	2	3	4	5	6	7
32)	What my teammates thinks about PEDs would influence my decision about whether I would take them	1	2	3	4	5	6	7
33)	What others think about PEDs influences my views on them	1	2	3	4	5	6	7
34)	Competing in sport makes me feel anxious or worried	1	2	3	4	5	6	7
35)	I usually think that the outcome of matches/competitions will be negative	1	2	3	4	5	6	7
36)	Playing in competitions can be threatening or worrying	1	2	3	4	5	6	7
37)	I feel stressed when performing in my sport	1	2	3	4	5	6	7
38)	There is lots of pressure when I play sport	1	2	3	4	5	6	7
39)	I would be tempted to take PEDs if my coach tells me to	1	2	3	4	5	6	7
40)	I would be more likely to take PEDs if my parents or guardians encouraged me to	1	2	3	4	5	6	7
41)	I would be tempted to take PEDs, if I knew they would increase my performance	1	2	3	4	5	6	7
42)	I would be tempted to take PEDSs if I had a bad injury	1	2	3	4	5	6	7
43)	I would be tempted to take PEDs if my coach put pressure on me to do so	1	2	3	4	5	6	7

Scoring Key and Instructions

Sum the scores for each sub-scale to get the total score for each participant. Scholars can use the ASDI in its entirety, or just the sub-scales that are relevant to their research.

Sub-scale	Question Numbers
Attitudes	1, 2, 3, 4
Threat	5, 6, 7, 8
Benefit	9, 10, 11, 12, 13
Esteem	14, 15, 16, 17, 18
Cheating	19, 20, 21, 22, 23
Legitimacy	24, 25, 26, 27, 28
Reference Group Opinion	29, 30, 31, 32, 33
Stress	34, 35, 36, 37, 38
Susceptibility	39, 40, 41, 42, 43