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A statistical synthesis of the literature on personal and situational variables that predict doping in physical activity settings

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Executive summary

Doping behaviors are not uncommon in sport or certain types of exercise settings. Over the last two decades, there has been a growing interest in understanding the psychological mechanisms associated with doping behavior. As such, there is a need to summarize the evidence in the literature and identify demographic (e.g., sex, age) and psycho-social (e.g., attitudes, perceived norms) variables that are most strongly related to doping behaviors or intentions to engage in such behaviors. To this end, this report represents the first meta-analytical (Hunter & Schmidt, 2004) review of available studies in the extant literature. The review aimed to collectively determine (i) the predictive factors of doping intentions and doping behavior, and (ii) identify moderator variables. A total of 63 studies, spanning 1990-2013, containing 63 independent published and unpublished datasets from 18 countries were examined and included in an analysis using odds ratios, Pearson correlations, and Cohen's *d* for combining study estimates. We found that factors such as the use of legal supplements, perceived social norms, and positive attitudes towards doping were the strongest positive correlates of doping intentions and behaviors. In contrast, factors such as morality and self-efficacy to refrain from doping had the strongest negative association with both intentions and doping behaviors.

The effects of potential moderators such as sex, publication status, and study design were also tested. Although different sizes of effect were found across distinct levels of moderators, all such effects were in the expected directions. Given that that the Theory of Planned Behavior (Ajzen, 1991; Fishbein & Cappella, 2006) has been the dominant framework in doping behavior research (e.g., Zelli et al. 2010; Lazuras et al. 2010; Goulet et al. 2010; Lucidi et al. 2008;), we used path analysis to test a TPB-based model of doping using the meta-analyzed correlations as input matrix. Our results suggested that attitudes and perceived norms (positively), and self-efficacy to refrain from doping (negatively) predicted intentions to dope, and in turn predicted doping behaviors. A direct path from perceived norms to doping behaviors was also found, suggesting that perceptions of others' behaviors may play a salient role in individuals' doping behaviors. The findings of this meta-analysis provide an objective and concise synthesis of prior research on the psycho-social variables associated with doping behavior and indicate the stronger predictors of doping use. Overall, they highlight the need for a broader approach to anti-doping education. An approach which moves beyond curricula heavily skewed towards compliance and testing towards one that emphasize the social context of doping behavior via strength- and norm-based activities.

Introduction

Doping behaviors refer to the use of illegal performance enhancing drugs (PEDs) and methods to improve sporting performance (WADA, 2009). Anti-doping rules and regulations are founded upon the premise that doping use violates the rules of competition, the spirit of sport, and can lead to health risks in users (WADA, 2009). Nonetheless, doping behaviors are not uncommon across various levels of sport and exercise participation (Baron, Martin, & Magd, 2007; Pitsch & Emrich, 2011). For instance, in a study conducted in a gym setting, researchers showed that more than 10% of participants have engaged in doping behaviors (Dunn, Mazanov, & Sitharthan, 2009). Amongst competitive bodybuilders, the figures are as high as 77.8% (Blouin and Goldfield, 1995). Children, as young as 10 years old, have also reported engaging in doping behaviors (Faigenbaum, Zaichkowsky, Gardner, & Micheli, 1998). In high performance sport, the prevalence statistics are wide ranging. In a study of German athletes only 0.2% self-reported doping, but this figure increased to 6.6% when the randomized response technique (RRT) was employed (Striegel, et al., 2010). Also employing the RRT, Pitsch and Emrich (2011) suggest the upper limit of the rate of dopers among squad athletes in Germany to be 35%. Critically, prevalence estimates appear higher than WADA's annual positive test statistic of ~2% (WADA, 2009).

Despite the resource-limited efforts of the World-Anti-Doping Agency (WADA), the International Olympic Committee (IOC) and global sports federations, doping in sport prevails. High profile cases including the exposure of the Bay Area Laboratory Co-operative scandal (BALCO; Fainaru-Wada & Williams, 2006), the Lance Armstrong affair (United States Anti-Doping Agency, 2012) and the damning Australian Crime Commission report (Australian Crime Commission, 2013), underscore the harsh reality that detection techniques are not keeping pace with developments in the pharmaceutical industry. Moreover, in a report to the WADA Executive Committee, former WADA president Dick Pound claims that anti-doping programs are failing (Working Group on the (in)effectiveness of testing, 2013). Thus, it seems that dopers remain a giant leap ahead of the testers. Therefore, in light of this situation - and the reach of doping beyond elite sport - preventive and educational action must be taken.

Empirical evidence on psycho-social predictors of doping intentions and behavior has significantly increased over the last decade. As such, a number of facilitating and inhibiting doping-related factors at the personal and socio-contextual level (e.g., gender, achievement goal orientations, moral values, influence of others) have been identified to predict doping behavior. However, the vast majority of these studies have been correlational in design. For the very small number of interventions that have been developed to tackle doping use in sport and leisure the weighted average magnitude of the obtained differences between the intervention and control arms is not known. Petróczi and Aidman (2008) argued that doping use can be explained by the interplay between a person's motivations, cognitions, beliefs, moral code, and moral influences.

Many studies have adopted aspects of the Theory of Planned Behavior (TPB; Ajzen, 1991; Fishbein & Cappella, 2006) to examine the psycho-social mechanisms that may lead to doping behaviors. The TPB, an extension of the theory of reasoned action (Ajzen & Fishbein, 1980), incorporates personality factors and social influences in order to predict behavior and behavioral intentions. A limited number of psychosocial variables are specified in the model, namely 1) intention, 2) attitude, 3) subjective norm (SN), and 4) perceived behavioral control (PBC). Attitudes represent an individual's positive or negative evaluations of performing the behavior in question, and, therefore reflect a personal disposition towards engaging in the behavior. SN are conceptualized as the pressure that individuals perceive from significant others to engage in the target behavior and, in turn, the individual's motivation to comply with these perceived pressures. PBC represent one's evaluation about their capabilities to adopt the behavior. As such, it may reflect obstacles encountered in past behavioral performances. Attitudes, SN and PBC are proposed to influence behavior through their influence on intentions. In this case, intentions would represent an individual's immediate behavioral orientation to engaging in doping behavior and therefore reflect the individual's motivation towards doping. Evidence from narrative and meta-analytic reviews indicate that the TPB is a useful model for predicting a range of behaviors and behavioral intentions (Armitage & Conner, 2001).

Authors utilizing the TPB have reported the ability of doping attitudes and subjective norms to predict doping behavior (e.g., Goulet, Valois, Buist, & Cote, 2010; Lazuras, Barkoukis, Rodafinos, & Tzorbatzoudis, 2010; Lucidi et al., 2008; Wiefferink, Detmar, Coumans, Vogels, & Paulussen, 2008). Importantly, these studies have involved a variety of populations including elite athletes (Lazuras et al., 2010), gym users (Wiefferink et al., 2008), and adolescents (Lucidi et al., 2008; Zelli, Mallia, & Lucidi, 2010) suggesting that attitudes and subjective norms influence doping intentions and in turn doping behavior regardless of the type of athlete an individual represents.

Researchers have also used constructs outside the TPB framework to explain doping behaviors. For example, Lucidi et al. (2008) measured participants' moral disengagement (i.e., disassociating oneself from the moral implications of one's unethical actions) and showed that it predicted doping intentions and behaviors. Barkoukis, Lazuras, Tsorbatzoudis, and Rodafinos (2011) found that athletes with high sportspersonship (e.g., prosocial attitudes and behaviors), autonomous motivation (i.e., motivation resulting from enjoyment or personal value) and mastery-oriented profiles (i.e., emphasis on personal improvement and effort) demonstrated lower doping intentions compared to those with low sportspersonship, controlled motivation and performance oriented ones. This reinforced an earlier finding by Donahue et al. (2006) which showed that different types of motivation may affect PED use through sportspersonship. Similarly, Barkoukis et al. (2011) indicated that in both dopers and non-dopers proximal predictors, such as attitudes, norms and self-efficacy (belief in one's skills and ability), mediated the effect of more distal predictors, such as achievement goals (i.e., one's emphasis on individual or normative criteria to infer personal competence in achievement settings) and sportspersonship on performance enhancing substance use. Further, Goulet et al. (2010) and Zelli et al. (2010) found that justifications for using performance enhancing substances and moral obligations significantly predicted doping intentions among junior athletes. The aforementioned findings highlight that doping use is a complex issue that is affected by a variety of situational and personal variables. Researchers have also designed interventions to reduce doping behaviors in adolescents. For example, Elliot et al. (2008) designed an intervention consisting of eight 45-minute meetings held during sport team training in US high schools. Using a randomized control trial, they showed that the program significantly reduced drug use in participants one to three years after the students graduated from high school. However, the size of effect found was very small.

To date, only one systematic literature review has been performed to synopsize the research findings in this area (Backhouse, McKenna, Robinson, & Atkin, 2007). Focusing on attitudes, values and beliefs towards doping, predictors and precipitating factors in doping and anti-doping education and prevention programs, the authors reviewed 103 articles. Studies examining attitudes towards doping were most common, with college, university and high school athletes dominating the sample. Only twenty-one studies examined correlates, determinants or risk factors associated with the use of PEDs in sport and most of those examined risk factors for anabolic steroid use amongst weight lifters or body builders. As such, this research bias limited the degree to which the findings from the Backhouse et al. review may be generalized to contribute to our understanding of PED use amongst athletes.

Hence, there is a need to accumulate and quantify, controlling for sampling and measurement error, existing evidence across empirical studies to identify the key predictors of doping, so that resources are designed to specifically target these risk factors. There is also a need to examine whether these predictors have the same effect on intentions and doping behaviors for participants of different sex, age, or other demographic/personal characteristics. Hence, a quantitative synthesis of available research findings in the literature is warranted.

The Current Study

In order to provide a quantitative/statistical synthesis of research findings in the literature, we conducted a meta-analysis of existing studies, with the aim to identify the strongest facilitators and inhibitors (admittedly in a correlational sense as most of the meta-analyzed studies used a correlational design) of doping intentions and behaviors. In addition to personal psychological (e.g., attitudes) and social-contextual factors (e.g., social norms), we examined the effects of demographic variables (e.g., sex and age) on doping intentions and behaviors. Although these factors may not have been specifically tested as predictors of doping in some of the meta-analyzed studies, there might be important implications for practice if the effect sizes associated with these variables are notable. We also meta-analyzed results from intervention studies in order to examine the effectiveness of anti-doping interventions by comparing the results in the experimental and control arms.

By conducting a meta-analysis, one can examine whether real effects (i.e., effects that are unlikely to be due to chance) exist between two variables. Moreover, the magnitudes of such effects could be calculated using a standardized metric, which is useful for comparison purposes. Another goal when conducting meta-analyses is to test whether an effect size is moderated by certain variables (i.e., whether the effect size associated with the relationship between two variables varies at the different levels of the moderator variable). Testing for moderators is important because researchers can identify whether certain effects, such as the influence of social norms on doping intentions, need to be dealt with differently in various groups (e.g., males versus females) or in certain contexts (e.g., competitive athletes versus gym users). Similarly, such moderator analysis could allow researchers to explore whether doping interventions are effective across populations and settings.

Method

Literature Search

We conducted a literature search to identify studies that could be included in our analyses. We searched PsycINFO, PsycARTICLES, PubMed, Google Scholar, and Medline. Combinations of keywords specifying the subject (e.g., doping, performance enhancing drugs) and the context of interest (e.g., sport, exercise, and training) were used when performing the database searches (the list of variables used for the database search is shown in Appendix A). We also searched the WADA website for reports of previous studies funded by the agency. The reference lists of included articles were scanned for relevant documents that were not retrieved from the database searches. To locate and retrieve information from any unpublished datasets, we posted messages on electronic mailing lists (e.g., SPORTPSY) reaching out to social science researchers. Authors with a background in doping research were also invited via email requests to contact us if they had any unpublished information that was relevant to our study.

Inclusion and Exclusion Criteria

Studies that measured doping behaviors and doping intentions were included. Studies that measured one of these constructs and at least one other demographic (e.g., age, sex), personal psychological (e.g., attitudes, morality), or social-contextual (e.g., participation in team sport, motivational climate) variable were also included. When only the relation between scores reported by different individuals (e.g., association between coach and athlete ratings) was reported, the corresponding study was excluded.

Included Studies

Using the above criteria, we identified 104 independent datasets. We contacted authors of the publications when information required for our meta-analysis was not available in their manuscripts. Forty one datasets were excluded because the corresponding authors either did not reply or were unable to provide any information that could be included in our analyses. Consequently, our final analyses included 63 independent datasets (see Appendix B). The majority of included studies were published journal articles (number of studies, k = 46). Other sources included online datasets (k = 11), theses/dissertations (k = 3), unpublished manuscripts/datasets (k = 2), and reports retrieved from the WADA website (k = 1). Most of the included studies were cross-sectional (k = 55). Far fewer studies used longitudinal/prospective (k = 4) or experimental designs (k = 4).

Recording of Study Information

Properties of the included studies or their participants were coded to allow moderator analyses to be conducted. We coded for the type of publication (e.g., published journal article, student thesis, manuscript under review), study design (e.g., cross-sectional, longitudinal/prospective, experimental), background of participants (e.g., competitive athletes, gym users, students), type of sport participants engaged in (e.g., team, individual), and age group of participants (e.g., adolescent, adults). The effect sizes between measured variables and self-reported doping behaviors/intentions were recorded. Effect sizes recorded were odds ratios (between dichotomous variables and doping behaviors), zero-order Pearson correlations (when one or both variables were ordinal or continuous), and Cohen's d (for intervention versus control group comparisons). Cronbach's alphas of the measured constructs were also recorded to correct for measurement error in the meta-analyzed effect sizes (Hunter & Schmidt, 2004).

Assessment of Quality of Potential Biases of Included Studies

To ensure study quality would not lead to biases in results, the quality of included studies was assessed (Higgins, Altman, & Sterne, 2011). The assessment tool developed by Higgins et al. (2011) was adopted in this study. However, as this tool was designed for studies using an experimental design only, we created other criteria (see Appendix C) for cross-sectional (e.g., whether valid measures were used) and longitudinal/prospective studies (e.g., whether dropout from the study was random). For each criterion, included studies were rated as having "low risk" or "high risk" of bias. A study would be deemed to have low risk of bias if it was rated as having "low risk" for all assessed criteria. The remaining studies (i.e., those with one or more criteria being considered as indicating "high risk") were deemed as having potential risk of biases.

To determine whether the assessment criteria were appropriate, two researchers rated the study quality of three studies (one cross-sectional, one longitudinal/prospective, and one experimental) individually. The assessment ratings were compared; out of all the ratings given for each of the three studies, only one was different, and this disagreement was resolved after a discussion. The rationales for giving the ratings for each subcategory were also discussed between the two raters to ensure that ratings were given based on similar evidence or reasons. The assessments of all other studies included in the meta-analyses were then conducted by one of the two researchers.

Meta-Analytical Procedures

The random effect methods proposed by Shadish and Haddock (1994) were used to meta-analyze odds ratios (*OR*). The procedures suggested by Hunter and Schmidt (2004), which also adopt a random effect model, were used for Pearson correlations and Cohen's *d*. The population effect size (*OR*, correlation [ρ], or standardized difference [δ], respectively) was calculated for each meta-analyzed relation, adjusting for sampling error (by taking into account the sample size). When computing effect sizes, attenuation due to measurement error was corrected using Cronbach's alphas. As Cronbach's alphas were not available for all recorded effect sizes, the artifact distribution meta-analytical procedures (Hunter & Schmidt, 2004) were employed. Further, 95% confidence intervals (95% CI) were generated for all meta-analyzed effect sizes. If the 95% CI of an effect size did not encompass the point estimate representing a null effect (i.e., 1 for *OR*, 0 for ρ and δ), the effect was considered to be real. When a real effect was found, the magnitude of the meta-analyzed effect sizes was labeled using the criteria suggested by previous researchers (Chen, Cohen, & Chen, 2010; Cohen, 1977). Essentially, an *OR* with a value between 1.68 to 3.47 was considered small, 3.47 to 6.71 medium, and above 6.71 large (the reciprocals of these cut-off values were used when $OR < 1$). The cut-off values used to label small, medium, and large correlations were .1, .3, and, .5, respectively, and for standardized differences, we used values of 0.2, 0.5, and 0.8, respectively.

To address the issue of possible publication bias in the literature (Rosenthal, 1979), we calculated the "fail-safe numbers" (FSNs) when small to medium, medium, or large effects were found. Essentially, a FSN represents the number of studies with null findings which, if included in the meta-analysis, would reduce the effect to a small size (i.e., 1.68 for *OR*, .1 for correlation, and 0.2 for standardized differences). The formula provided by Hunter and Schmidt (2004) was used to derive the FSNs for the meta-analyzed effect sizes. If the FSN corresponding to an effect size was large, it is considered unlikely that the effects found are due publication bias.

To test for heterogeneity in the obtained effect sizes from odd ratios, the *Q* statistic (Shadish & Haddock, 1994) was used. A significant *Q* suggests that the included effect sizes are heterogeneous. For meta-analyses involving Pearson correlations or Cohen's *d*, the 75% rule, proposed by Hunter and Schmidt (2004), was also used. Hunter and Schmidt suggested that when more than 75% of the variance is attributed to sampling and measurement errors, it is likely that the included effect sizes are homogeneous. When either or both tests suggested a particular effect size to be heterogeneous (e.g., moral disengagement predicting doping intention), moderator analysis was conducted. In essence, separate sub-group effect sizes were calculated for each level of the potential moderator (e.g., separate effect sizes for the moral disengagement-doping intention relationship were calculated for different types of study design). A variable was considered to be moderating the size of an effect if the 95% CIs of any two sub-group effect sizes did not overlap (Hwang & Schmidt, 2011). The potential moderators we tested in this study were: sex of participants (males versus females), publication status (published [k = 46] versus unpublished [k = 17]), study design (cross-sectional [k = 55] versus longitudinal/prospective [k = 4] versus experimental [k =4]), background of participants (competitive athletes [k = 16] versus gym users [k = 12] versus students [k = 35]), type of sport they participated (team sports [k = 4] versus individual sports [k = 11] versus a mixture of both [k = 21]), age group of participants (adults [k = 22] versus adolescents [k = 29] versus a mixture of both [k = 10]), and study quality (studies with low risk of bias [k = 55] versus studies with potential risk of bias [k = 8]).

Path Analysis

Using our meta-analyzed effect sizes, we conducted a path analysis of a model based on the Theory of Planned Behavior (Ajzen, 1991). Path analysis and meta-analysis can complement each other (Viswesvaran & Ones, 1995). Path analysis can capture simultaneous interdependencies between several variables after the meta-analysis has removed sampling and measurement errors.

Results

The results of all meta-analyzed effect sizes are presented in Table 1. As a meta-analysis could not be conducted with information from one study only, effect sizes from a single study are shown in the tables but will not be interpreted further. When moderator effects were found (i.e., sub-group effect sizes had non-overlapping 95% CIs), the sub-group effect sizes are presented in Table 2.

Meta-Analyzed Effect Sizes Comparing Intervention and Control Groups

With respect to doping behaviors, we compared the differences in numbers of new reported cases of doping between the intervention and control groups over a season/one school year. We found that the interventions did not show a real effect in terms of reducing doping behaviors (OR = 0.76, 95% CI [0.27, 2.17]; $OR < 1$ indicates there were fewer reports of new doping behaviors in intervention groups). In terms of doping intentions, standardized difference scores between intervention and control groups were meta-analyzed. Over the same period of time, the interventions showed a very small reduction in doping intentions (δ = -0.12, 95% CI [-0.13, -0.11]). Nonetheless, few studies (k = 3 and 2 for behaviors and intention, respectively) were included in these analyses, and therefore the results should be interpreted with caution.

Effect Sizes of Demographic and Social-Contextual Variables Predicting Doping Behaviors or Doping Intentions

A variety of demographic and social-contextual variables were examined in conjunction with doping behaviors or intentions in the included pool of studies. In terms of demographic variables, we found that males reported more doping behaviors than females (OR = 2.72, 95% CI [2.16, 3.42]). We also found that doping behaviors were more prevalent in people who had friends that doped, compared to those who did not (OR = 6.40, 95% CI [3.46, 11.84]). The use of legal supplements was related to more doping behaviors (OR = 8.24, 95% CI [5.07, 13.39]) and higher levels of doping intentions (ρ = .36, 95% CI [.20, .52]). Age was also found to be related to doping intentions (ρ = .05, 95% CI [.02, .09]). However, the size of this effect is very small.

In terms of moderator analyses, we found that the background of participants moderated the effect between sex and doping behaviors. Specifically, we found that this effect was stronger for gym users (*OR* = 7.77, 95% CI [5.31, 11.37]) than competitive athletes (*OR* = 2.17, 95% CI [1.16, 4.08]) and students (*OR* = 2.48, 95% CI [2.04, 3.00]). For the relation between age and doping behaviors, a very small negative effect was found in female (ρ = -.03, 95% CI [-.05, -.02]), but not in male participants (ρ = .00, 95% CI [-.01, .02]). Another moderator of the association between age and doping behaviors was the background of participants. Specifically, we found a very small effect between these variables in gym users (ρ = .09, 95% CI [.01, .17]), but not in students (ρ = -.01, 95% CI [-.02, .003]) as the 95% CIs did not overlap. Further, studies with low risks of bias found a very small negative effect of age on doping behaviors (ρ = -.01, 95% CI [-.02, -.001]), but those with potential risk of bias reported a small positive effect (ρ = .14, 95% CI [.07, .21]). We also found that study design was a moderator of the age – doping intentions relation. Although a very small effect was found in both cross-sectional studies (ρ = .07, 95% CI [.04, .11]) and longitudinal/prospective studies (ρ = .00, 95% CI [.002, .004]), their corresponding 95% CIs did not overlap indicating that these effect sizes were not equivalent.

Effect Sizes of Personal Psychological Variables Predicting Doping Behaviors/Intentions

Some of the effect sizes of personal psychological variables predicting doping behaviors and intentions were based on a very small number of studies. Consequently, moderator analyses could not be conducted because when these effect sizes were broken down to moderator subgroups, there was insufficient number of studies for all subgroups to allow meaningful comparisons. To allow more meaningful comparisons across different levels of moderators, two more stages of analyses were conducted, after the initial stage that calculated an effect size for each psychological variable. In stage two, we collapsed the effect sizes of variables that are conceptually similar (e.g., self-efficacy to refrain from doping and perceived behavioral control; see Table 1 for details regarding how variables were combined) with appropriate reversing (e.g., moral disengagement was reversed when combining effect sizes of morality variables). If conceptually similar constructs were measured in the same study, the weighted averages of the coefficients of interest were used to form a single effect size from this study for the meta-analysis. For brevity reasons, we report below the findings from Stage 2 and 3 only, but the results from all stages are shown in Table 1.

With respect to doping behaviors, we found real positive effects from intentions (ρ = .38, 95% CI [.21, .55]), attitudes (ρ = .17, 95% CI [.04, .29]), norms (ρ = .36, 95% CI [.27, .45]), and amotivation (ρ = .17, 95% CI [.07, .26]). The sizes of these effects were small to medium. Real negative effects to doping behaviors were also found from self-efficacy to refrain from doping (ρ = -.12, 95% CI [-.21, -.02]), morality (ρ = -.21, 95% CI [-.32, -.10]), autonomous motivation (ρ = -.06, 95% CI [-.09, -.03]), and task achievement goal orientation (ρ = -.09, 95% CI [-.17, -.01]). The effects of the latter two variables though were very small. The FSN for the effect between self-efficacy to refrain from doping and doping behaviors was 1 (*k* = 5), suggesting that only one study with null findings was need to reduce this effect to what is considered a small effect (i.e., reduce it from ρ = -.12 to ρ = -.10).

In terms of predicting doping intentions, large positive effects were found for attitudes (ρ = .52, 95% CI [.44, .60]) and norms (ρ = .53, 95% CI [.43, .63]). Small effects were found from dissatisfaction with appearance/body image (ρ = .20, 95% CI [.12, .29]), amotivation (ρ = .24, 95% CI [.20, .27]), and ego achievement goal orientation (ρ = .14, 95% CI [.09, .20]). However, the effect size between doping intentions and ego achievement goal orientation has a FSN of 2 (*k* = 4). Small to moderate negative effects were also found from self-efficacy to refrain from doping (ρ = -.27, 95% CI [-.41, -.14]) and morality (ρ = -.31, 95% CI [-.47, -.16]). A real effect was also found from task achievement goal orientation (ρ = -.08, 95% CI [-.14, -.02]). Nonetheless, the size of this latter effect is very small.

For the third stage of our analyses, variables were categorized as either a facilitator or inhibitor of doping intention or behaviors. A variable was categorized as a facilitator if a real positive effect with doping intention/behaviors was found in the previous stages. In contrast, variables with real negative effects were considered as inhibitors. Based on this categorization, we collapsed the effect sizes associated with all facilitators and inhibitors and conducted meta-analyses and moderator analyses using the combined effect sizes. The variables included in these analyses are shown in Table 1. Forrest plots representing the third stage of meta-analyses are presented in Appendix D.

We found that the sizes of effects for the facilitators (ρ = .20, 95% CI [.08, .32]) and inhibitors (ρ = -.13, 95% CI [-.19, -.07]) variables were small. The FSN for the effect between doping behaviors and inhibitors was also small (FSN = 4, *k* = 11), suggesting that a relatively small number of studies (i.e., 4) with null findings would bring the meta-analyzed effect to a very small value. With respect to doping intentions, we found a medium effect from facilitators (ρ = .44, 95% CI [.36, .51]) and inhibitors (ρ = -.28, 95% CI [-.39, -.17]).

In this third stage of analysis we also found some moderation effects. For the facilitators – doping behaviors relation, a medium effect size was found when only studies with low risk of bias were included (ρ = .31, 95% CI [.21, .41]). However, a small negative effect was found in studies that were rated to have potential risks of bias (ρ = -.10, 95% CI [-.13, -.06]). We also found that the relation between facilitators and doping intentions was moderated by publication status and study design. Specifically, we found that the effects in published datasets (ρ = .49, 95% CI [.40, .59]) were stronger than those found in unpublished datasets (ρ = .31, 95% CI [.24, .39]). Nonetheless, the size of both effects was medium. In terms of study design, we found a medium effect for cross-sectional studies (ρ = .40, 95% CI [.31, .48]), but a large effect for longitudinal/perspective studies (ρ = .56, 95% CI [.52, .61]). Study design also moderated the inhibitors-doping intentions relation. A small effect was found in cross-sectional studies (ρ = -.21, 95% CI [-.33, -.10]), but the magnitude of the effect was stronger in longitudinal/prospective studies (ρ = -.44, 95% CI [-.45, -.43]). Finally, we found that the effect size between inhibitors and doping intentions was small in competitive athletes (ρ = -.16, 95% CI [-.29, -.02]), but large in gym users (ρ = -.62, 95% CI [-.85, -.40]).

Path Analyses of a Theory of Planned Behavior Model

The Theory of Planned Behavior (TPB; Ajzen, 1991; Fishbein & Cappella, 2006) was the most utilized theoretical framework within the pool of included studies. Thus, in order to examine the inter-relation between all TPB constructs and doping behaviors and intentions, we conducted path analyses using meta-analyzed effect sizes from the second stage of our analyses. Path analyses were conducted using Mplus (Muthén & Muthén, 2008). Following recommendations by Viswesvaran and Ones (1995), the harmonic mean of the sample sizes underpinning the corresponding effect sizes of the correlation matrix was used as the total sample size (n = 5,046) for the tested models. Based on the model proposed by Fishbein and Cappella (2006), we tested an initial model with attitudes, norms, and self-efficacy to refrain from doping predicting intentions to dope, which in turn predicted doping behaviors. This model did not fit well (Hu & Bentler, 1999): $\chi^2(3) = 288.98$, $p < .001$, Comparative Fit Index (CFI) = .92, Root Mean Square Error of Estimation (RMSEA) = .14, Standardized Root Mean Square Residual (SRMR) = .04.

We tested three other plausible alternative models by freeing direct paths from attitudes, norms, and self-efficacy to refrain from doping (only one of these paths was freed in each alternative model) to doping behaviors. A plausible model was accepted if the improvement in CFI was larger than .01 compared to the initial model (Cheung & Rensvold, 2002). The alternative models with direct paths from attitudes or self-efficacy to refrain from doping to behaviors did not meet this criterion and were rejected. However, the model with a direct path from norms to doping behaviors (see Figure 1) was accepted (change in CFI = .060). This final model had a significant χ^2, but other fit indices suggested a good model fit: χ^2 (2) = 78.35, $p < .001$, CFI = .98, RMSEA = .09, SRMR = .02. In this model, the direction of paths from attitudes (β = .31), norms (β = .34), and self-efficacy to refrain from doping (β = -.14) to doping intentions were in the expected direction (all path $p < .001$). Paths from norms (β = .22, $p < .001$) and intention (β = .26, $p < .001$) to doping behaviors were also positive. Indirect effects from attitudes (β = .12) and self-efficacy to refrain from doping (β = -.06) were also significant at $p < .001$.

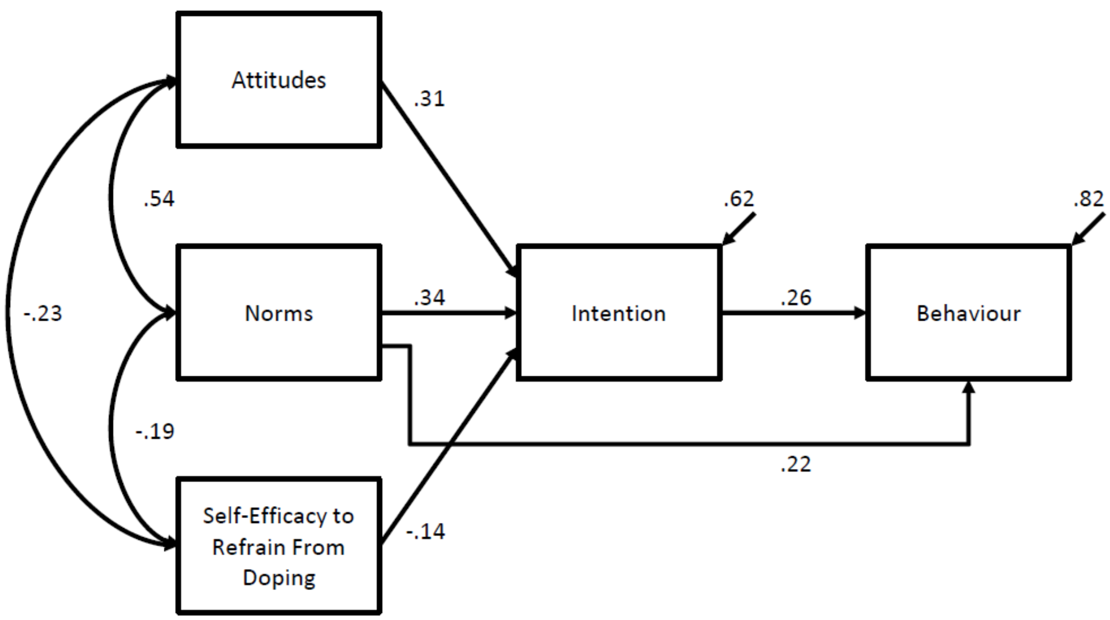

Figure 1. Path diagram of a theory of planned behavior model using meta-analyzed correlations (n = 5,046). All paths significant at $p < .001$.

Discussion

The primary aim of the current study was to quantitatively combine research findings in the extant literature in an effort to identify key factors that are related to doping intentions and doping behaviors. This study provides the first meta-analytic accumulation of psychological studies examining predictors of doping intentions and behaviors.

The strongest effects of psychological variables on doping behaviors, including intentions to dope and perceived norms, were only medium in size. These findings corroborate Petróczi and Aidman's (2008) argument that doping behaviors represent a complex interplay of multiple factors, and hence may not be explained by a few variables alone. Given that intentions to dope were found to be one of the strongest predictors of doping behaviors, we deemed important to also explore the factors predicting this variable. In general, our results indicated that the predictor variables used in the literature predicted stronger doping intentions compared to actual doping use.

We first evaluated the effectiveness of existing randomized control trials and we were only able to include four experimental studies in our analyses. This is because the required effect sizes were not available in some of the published papers (nor were made available to us despite our requests), and therefore some such studies had to be excluded. Consequently, our results with respect to trial effectiveness should be interpreted with caution. Still, the four studies presented data from the evaluations of two long standing North American prevention programs, namely the: Adolescents Training and Learning to Avoid Steroids (ATLAS; Goldberg & Elliot, 2005; Goldberg et al., 1996; Goldberg et al., 2000) and Athletes Targeting Healthy Exercise and Nutrition Alternatives (ATHENA; Elliot et al., 2008; Goldberg & Elliot, 2005) programs. Targeted at adolescents and commercially sold to schools in the US for use with sports teams, these programs are gender-specific and student-led. We found that the trials included in our analyses showed a very small reduction in doping intentions but no changes in doping behavior. This might be attributed to the content of the ATLAS and ATHENA interventions. Both tackle doping alongside other behaviours, including healthy eating and training regimes. Perhaps the lack of a clear focus on doping explains the small effect on intentions and behaviour. For instance, ATHENA is largely focused on information and activities about healthy and disordered eating, drug use (i.e., alcohol, tobacco, marijuana and anabolic steroids), monitoring nutritional intake, and improving psychological factors, such as depression and mood (Elliot et al., 2004, 2008; Ranby et al., 2009). Hence, both these interventions aim to influence athletes'/students' overall health-related behaviors and are not focused specifically on doping use behaviors. Further, it is possible that the small effects found in these interventions reflect floor effects, in that participants had low initial intentions to dope, and therefore, there was not much room for a reduction in their doping-related intentions and behaviors. For example, in Goldberg et al. (1996) study, intention to use steroids at pretest was 5.7 and 6.3 in the experimental and control group, respectively (1-7 scale with 7 being no intent to use).

Thus far, the programs have not been adopted by national and international anti-doping agencies. One possible reason for this is the time commitment involved in delivering their curriculum in order to ensure program fidelity. The sheer cost of rigorous evaluation could explain the relatively small number of intervention studies. Consequently the ATLAS and ATHENA programs remain the only programs where prolonged monitoring and evaluation has been undertaken and findings widely disseminated.

We also included in our meta-analysis effect sizes from non-experimental studies. We found that factors such as being male, using legal supplements, knowing friend(s) who dope, having a positive attitude towards doping, perceiving doping to be normal, having a lower body image, lacking autonomous motivation in exercise or sport, and having an ego goal orientation may facilitate doping intentions and behaviors. In contract, having higher self-efficacy to refrain from doping, having higher moral standards, having a task goal orientation, and anticipating feelings of regret were found to be inhibitors of doping. However, most of the effects were small to medium in size.

Use of legal supplements was the only variable which had a large effect on doping behaviors (*k* = 6). This suggests that users of legal supplements are at a much higher risk of using illegal drugs. This finding is notable when one consider the widespread use of legal supplements across all levels of sport (Burns, Schiller, Merrick, & Wolf, 2004; Hoffman et al., 2008; Maughan, Depiesse, & Geyer, 2007; Tscholl, Alonso, Dollé, Junge, & Dvorak, 2010).

Backhouse and colleagues (2011) suggested that a gradual increase in the use of nutritional supplements can serve as a gateway to doping use mainly because it familiarizes athletes with chemically-assisted performance enhancement. In a sample of competitive athletes, they found that doping use was three-and-a-half times more prevalent in nutritional supplement (NS) users compared with nonusers. This finding was accompanied by significant differences in doping attitudes and beliefs between NS users and nonusers. In a similar vein, Tsorbatzoudis, Barkoukis, and Lazuras (2013) indicated that NS users are two to three times more likely to report doping use and they also displayed biased normative beliefs related to doping use (i.e., they perceived doping as more prevalent in fellow athletes and socially approved). Nevertheless, causality remains to be determined as the gateway hypothesis is based largely on cross-sectional data. NS use is seen as an alternative to doping in the context of chemically-assisted performance enhancement. However, athletes should operate with caution when using NS because a number of risks are present. The supplement industry is largely unregulated and contamination with substances that could lead to a positive dope test has been repeatedly reported (e.g., Geyer et al., 2008). Therefore, targeted education is necessary to ensure athletes are able to make an informed choice when assessing the need and the risk of using a NS.

Notably, several of the psychological variables that may be related to doping behaviors were only measured in one study, and hence the results pertaining to these variables should be viewed with caution. Some of these constructs (e.g., religiousness, willingness to dope) showed a large effect with doping behaviors in their corresponding study. For example, Whitaker (2013) applied the Prototype Willingness Model (Gibbons, Gerrard, Blanton, & Russell, 1998) to doping behaviors in an attempt to overcome the issue of the weak intention-behavior relationship. This model accounts for the fact that social settings, such as those found on a sports team, can afford opportunities to engage in risky behaviors that might overwhelm athletes' good intentions. The results of Whitaker (2013) show that willingness to dope was significantly predicted by athletes' attitudes towards doping, PED user prototype perceptions and subjective norms (perceptions of significant others' approval of doping). Descriptive norms (perceived PES use by other in their sport) were also a significant predictor of county, national and international level athletes' willingness to dope. Further research exploring the utility of this model in the context of doping in sport is needed.

In this study we also examined whether other factors, such as participants' demographic variables or study quality, may moderate the effect sizes found. Although some of the effects varied in size across different levels of moderators, in general, the direction of the effects remained unchanged. However, we found that the effect sizes from some studies deemed as having potential biases may alter the directions of the effect in an unexpected way (e.g., a negative effect between facilitators and doping behaviors). These findings, therefore, emphasize the importance of eliminating all possible sources of biases when conducting primary research in this field as potential biases may lead to dubious results.

Path Analysis

By using the meta-analyzed effect sizes in path analysis, we also tested a path model based on the TPB. We found that the prediction paths from attitudes, perceived norms, and self-efficacy to refrain from doping to doping intentions were in the expected directions. Further, a positive path from doping intentions to doping behaviors was found. By comparing alternative nested models, we found that perceived norms may have a direct effect on doping behaviors. These results are slightly unexpected because in Ajzen’s (1991) conceptualization of the TPB model, perceived behavioral control (later combined with self-efficacy; see Fishbein & Cappella, 2006) had a direct effect on behaviors, but not perceived norms. This finding demonstrates the important role social environment can play in an athlete’s decision to use prohibited substances. Normative influences to engage in doping can range from mere peer pressure and perceived social acceptability of doping by teammates, to pressures associated with results and enhanced performance. Hence, the influence of the athlete’s ‘sportsnet’ (e.g., coach and teammates) and perceptions on the prevalence of doping use among other athletes seem to be important factors determining the decision making process related to doping use. The findings of this meta-analysis underline the importance of addressing the context of the social environment through a multifaceted education program. In essence, interventions which target athletes’ social norm perceptions, images of a doper and reduce the vulnerability to doping through the development of self-regulation skills (i.e., resilience, self-control and problem solving) should be designed and evaluated. Moreover, influential others such as coaches, teachers and parents need to become part of this multifaceted approach to doping prevention. To facilitate this engagement the intervention content should reflect the needs and possible influence of these groups (Backhouse, Patterson, & McKenna, 2012).

Limitations

A meta-analysis can be only as good as the studies included in it. The most important limitation of this work is that many meta-analyzed effect sizes were based on a small number of studies. This is because the studies conducted in this area have been very broad, perhaps too broad, in terms of identifying demographic, personal, and situational predictors of doping intentions and behavior. Nevertheless, this review represents an initial effort to quantify the psychosocial variables that are most strongly related to doping behaviors or intentions to engage in such behaviors. Also, the current conclusions assume that self-reported behaviors are accurate reflections of people's actions (all included studies used self-reports to measure doping behavior). Further, most of the meta-analyzed effect sizes between predictors of doping with doping intentions and behaviors were derived from correlational studies; more intervention studies in this area are needed. As a consequence, our results cannot establish causal relations. For example, a large effect size between perceived norms and intentions may also suggest people having stronger intentions to dope would perceive more people to be doping (Petroczi, Mazanov, Nepusz, Backhouse, & Naughton, 2008). Similarly, people may report having more positive attitudes towards doping because they intend to use illegal substances. Experimental studies are required to examine the causal relations between these variables. Another limitation was that we were unable to test some potentially important moderator effects. For example, in studies that reported the numbers or percentages of participants using legal substance, these were reported for the total sample and not by subgroups. Therefore, comparing effect sizes different levels of moderators was not possible, unless authors were willing to provide us with access to their raw data.

Practical Conclusions

To conclude, we discuss some practical implications of our results. From the individual viewpoint, athletes should be cautious in that estimates of doping use among their fellow athletes and elite athletes are often exaggerated. This is very important as descriptive norms emerged as an important predictor of intentions and actual doping use. Future research and preventive guidelines regarding the social environment should focus on a) the role of coaches and their coaching style, and b) peers and the pressure they can exert on the athlete to decide to use doping substances. Importantly, future prevention interventions should improve athletes' self-efficacy in resisting pressures imposed by coaches or peers, and also their ability to resist temptations (i.e., outcomes of success such as money, fame etc.) which might resort in doping use. In addition, we showed that high moral standards are an important protective factor, especially in young athletes. Thus, aspects of ethical decision making should be incorporated in interventions designed to tackle doping use. Finally, doping-related interventions should inform athletes on the risks and appropriate use of nutritional supplements. It is important that athletes perceive nutritional supplements as an alternative to doping use and not as a getaway. Moreover, given the number of claims of inadvertent doping through the use of nutritional supplements at a global level, regulation of the industry and efficacy trials (assessing the performance benefits and health risks associated with use), is required in order to enable athletes to make an informed choice.

In sum, we found that doping behaviors may be explained by a combination of demographic, social-contextual, and psychological variables. Therefore, the punitive detection-deterrence approach may not be effective in reducing the prevalence of doping behaviors. If a shift towards primary prevention is to take place, researchers, policy makers, and practitioners need to discover, apply, and evaluate educational curricula that focus on the social-contextual and psychological determinants of these behaviors. From our results we recommend placing greater emphasis on modifying norm-based doping perceptions and creating optimal motivational coaching and peer environments. Further, effective prevention interventions to tackle doping use should target athletes' perceptions, cognitions and moral stance, empowering them to resist temptations and choose appropriate ways to enhance performance.

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Table 1

Results of Meta-Analyses and Homogeneity Tests Predicting Doping Behavior and Doping Intentions

	k	*n*	Effect Size	95% CI	FSN	*Q*	% error variance
<u>Stage one analyses</u>							
Comparisons of intervention and control groups (Scores of intervention groups minus those of control groups)							
Behavior (pre- to post-season/school year)	3	3,718	0.76[a]	[0.27, 2.17]	—	3.38	—
Behavior (1 year post-intervention)	1	1,291	0.36[a]	[0.12, 1.10]	—	—	—
Intention (pre- to post-season/school year)	2	3,333	-0.12[b]	[-0.13, -0.11]	—	0.03	100.0%
Intention (1 year post-intervention)	1	1,291	-0.13[b]	[-0.24, -0.02]	—	—	—
Association with doping behaviors							
Demographic variables							
Sex (males vs. females)	43	247,590	2.72[a]	[2.16, 3.42]	40	266.37*	—
Age	34	182,435	-.01[c]	[-.02, .003]	—	185.72*	19.2%
Legal supplement use	6	4,568	8.24[a]	[5.07, 13.39]	19	12.57*	—
Know friend who is doping	5	2,224	6.40[a]	[3.46, 11.84]	13	7.94	—
Social-contextual environment							
Team sports participation (versus other types)	5	3,309	0.96[a]	[0.67, 1.38]	—	2.04	—
Task-involving motivational climate	1	374	.07[c]	[-.03, .17]	—	—	—
Ego motivational climate	1	374	-.08[c]	[-.18, .02]	—	—	—
Theory of Planned Behavior variables							
Intention[1]	10	5,544	.38[c]	[.21, .55]	29	812.44*	2.5%
Attitudes	13	7,992	.12[c]	[-.06, .30]	—	912.51*	2.1%
Knowledge of doping	1	2,285	.08[c]	[.04, .12]	—	—	—
Perceived benefits of doping	3	1,551	.27[c]	[.16, .37]	5	11.26*	27.0%
Perceived negative outcomes of doping	1	167	-.08[c]	[-.23, .07]	—	—	—

	k	*n*	Effect Size	95% CI	FSN	*Q*	% error variance
Beliefs regarding whether doping should be legalized	1	205	.52[c]	[.42, .62]	5	—	—
Subjective norms	8	4,084	.36[c]	[.23, .48]	21	160.17*	6.4%
Descriptive norms	3	1,233	.49[c]	[.27, .70]	12	43.85*	5.8%
Moral norms	1	640	.40[c]	[.33, .46]	3	—	—
Perceived behavioral control	5	3,073	-.01[c]	[-.07, .05]	—	9.86*	51.3%
Self-efficacy to refrain from doping	1	762	-.22[c]	[-.29, -.16]	2	—	—
Situational temptations	2	949	.47[c]	[.42, .52]	8	1.53	100.0%
Other personal psychological variables							
Sportspersonship	4	3,159	-.15[c]	[-.21, -.09]	2	10.78*	37.2%
Moral disengagement	3	2,358	.30[c]	[.10, .49]	6	67.08*	4.3%
Dissatisfaction with appearance or body image[1]	1	203	.15[c]	[.02, .29]	1	—	—
Autonomous motivation[2]	6	3,779	-.06[c]	[-.09, -.03]	—	4.96	100.0%
Controlled motivation	6	3,777	.02[c]	[-.02, .06]	—	6.96	86.9%
Amotivation[1]	5	2,574	.17[c]	[.07, .26]	4	24.32*	20.9%
Task achievement goal orientation[2]	5	2,543	-.09[c]	[-.17, -.01]	—	17.57*	31.0%
Ego achievement goal orientation	5	2,536	.04[c]	[-.02, .11]	—	10.72*	47.3%
Global self-esteem	3	924	-.03[c]	[-.07, .01]	—	0.83	100.00%
Perfectionism	2	463	-.10[c]	[-.19, .001]	—	2.00	98.8%
Religiousness[2]	1	27	-.58[c]	[-.84, -.32]	5	—	—
Sport confidence	1	374	-.04[c]	[-.15, .06]	—	—	—
Anticipated regret[2]	1	641	-.13[c]	[-.21, -.05]	1	—	—
Threat of being caught	1	644	.04[c]	[-.04, .12]	—	—	—
Willingness to dope[1]	1	726	.54[c]	[.49, .59]	5	—	—
Association with doping intentions							
Demographic variables							
Sex (males versus females)	10	6,029	.07[c]	[-.004, .15]	—	95.39*	12.4%
Age	11	6,350	.05[c]	[.02, .09]	—	16.40	69.5%
Legal supplement use	3	2,110	.36[c]	[.20, .52]	8	47.09*	7.2%

	k	*n*	Effect Size	95% CI	FSN	*Q*	% error variance
Social-contextual environment							
Team sports participation (versus other types)	1	218	.08[c]	[-.05, .21]	—	—	—
Theory of Planned Behavior variables							
Attitudes	14	6,878	.55[c]	[.47, .63]	63	188.38*	17.7%
Knowledge of doping	1	144	.28[c]	[.13, .43]	2	—	—
Perceived benefits of doping	2	909	.17[c]	[-.01, .35]	—	16.01*	15.6%
Perceived negative outcomes of doping	2	421	-.25[c]	[-.33, -.16]	3	1.10	100.0%
Beliefs regarding whether doping should be legalized	1	203	.75[c]	[.69, .81]	7	—	—
Subjective norms	11	5,409	.55[c]	[.44, .65]	49	146.13*	15.5%
Descriptive norms	3	1,166	.21[c]	[.10, .32]	4	8.95*	35.7%
Moral norms	1	646	.65[c]	[.60, .69]	6	—	—
Social support to use illegal substances	1	144	.33[c]	[.18, .48]	3	—	—
Perceived behavioral control	8	4,456	-.08[c]	[-.27, .10]	—	448.79*	4.5%
Self-efficacy to refrain from doping	4	2,102	-.55[c]	[-.60, -.49]	18	6.51	100.0%
Situational temptations	2	955	.68[c]	[.43, .92]	12	45.80*	4.3%
Personal psychological variables							
Sportspersonship	3	1,963	-.10[c]	[-.22, .02]	1	19.42*	16.4%
Moral disengagement	3	2,657	.48[c]	[.40, .57]	12	12.57*	26.2%
Dissatisfaction with appearance or body image	3	529	.19[c]	[.03, .36]	3	9.03*	36.6%
Drive for thinness	1	864	.16[c]	[.10, .23]	1	—	—
Drive for muscularity	1	864	.21[c]	[.15, .28]	2	—	—
Autonomous motivation	5	2,585	-.11[c]	[-.23, .002]	1	40.80*	15.0%
Controlled motivation	5	2,583	.02[c]	[-.04, .07]	—	7.11	71.0%
Amotivation[1]	5	2,581	.24[c]	[.20, .27]	7	3.40	100.0%
Task achievement goal orientation[2]	4	2,179	-.08[c]	[-.14, -.02]	—	5.38	75.8%
Ego achievement goal orientation[1]	4	2,172	.14[c]	[.09, .20]	2	4.88	83.2%
Global self-esteem	1	191	-.03[c]	[-.18, .11]	—	—	—
Anticipated regret[2]	1	644	-.53	[-.59, -.48]	5	—	—
Willingness to dope[1]	1	726	.16	[.06, .24]	1	—	—

	k	*n*	Effect Size	95% CI	FSN	*Q*	% error variance
Stage two analyses							
Association with doping behaviors							
Theory of Planned Behavior variables							
Attitudes[1] (also: knowledge of doping, perceived benefits of doping, perceived negative outcomes of doping [reversed], beliefs regarding whether doping should be legalized)	16	8,227	.17[c]	[.04, .29]	11	473.24*	4.6%
Norms[1] (also: subjective norms, descriptive norms, moral norms)	9	4,160	.36[c]	[.27, .45]	24	82.15*	12.2%
Self-efficacy to refrain from doping[2] (also: perceived behavioral control, situational temptations [reversed])	5	3,073	-.12[c]	[-.21, -.02]	1	31.88*	17.5%
Other personal psychological variables							
Morality[2] (also: sportspersonship, moral disengagement [reversed])	7	5,517	-.21[c]	[-.32, -.10]	8	116.85*	6.7%
Association with doping intentions							
Theory of Planned Behavior variables							
Attitudes[1] (also: knowledge of doping, perceived benefits of doping, perceived negative outcomes of doping [reversed], beliefs regarding whether doping should be legalized)	14	6,829	.52[c]	[.44, .60]	60	163.07*	15.8%
Norms[1] (also: subjective norms, descriptive norms, moral norms, social support to use illegal substances)	11	5,402	.53[c]	[.43, .63]	48	135.51*	15.8%

	k	*n*	Effect Size	95% CI	FSN	*Q*	% error variance
Self-efficacy to refrain from doping[2] (also: perceived behavioral control, situational temptations [reversed])	9	4,601	-.27[c]	[-.41, -.14]	16	182.17*	8.5%
Personal psychological variables							
Morality[2] (also: sportspersonship, moral disengagement [reversed])	6	4,620	-.31[c]	[-.47, -.16]	13	156.88*	4.8%
Dissatisfaction with appearance or body image[1] (also: drive for thinness, drive for muscularity)	4	1,393	.20[c]	[.12, .29]	5	8.98*	48.5%
<u>Stage three analyses</u>							
Association with doping behaviors							
Facilitators	17	9,297	.20[c]	[.08, .32]	17	571.47*	3.9%
Inhibitors	11	6,538	-.13[c]	[-.19, -.07]	4	55.79*	23.4%
Association with doping intentions							
Facilitators	15	7,875	.44[c]	[.36, .51]	51	186.29*	14.3%
Inhibitors	11	5,819	-.28[c]	[-.39, -.17]	20	192.69*	9.6%

Note. *k* = number of meta-analyzed studies; *n* = total number of participants; 95% CI = 95% confidence interval; FSN = fail-safe number, i.e., number of studies with null findings which, if included in the meta-analysis, would reduce the estimated effect to a very small size (if it is not already small); *Q* = *Q* statistic for test of homogeneity (shown when k>1); % error variance = percentage of variance accounted by sampling and measurement errors (shown when k>1). [a]Odds ratios; [b]Cohen's *d*; [c]Correlation coefficient; * $p < .05$. [1]Variable considered as a facilitator in stage three analyses; [2]Variable considered as an inhibitor in stage three analyses.

Table 2

Differences in Effect Size Across Levels of Moderators

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Stage one analyses						
Sex – Doping behaviors[a]						
Competitive athletes	12	4,834	2.17	[1.16, 4.08]	25.07*	—
Gym users	4	2,692	7.77	[5.31, 11.37]	4.73	—
Students	27	240,064	2.48	[2.04, 3.00]	187.24	—
Age – Doping behaviors[b]						
Males	33	89,680	.00	[-.01, .02]	115.42*	30.1%
Females	28	91,488	-.03	[-.05, -.02]	100.25*	28.9%
Cross-sectional studies	33	181,673	-.01	[-.02, .001]	144.11*	23.7%
Longitudinal studies	1	762	.22	[.15, .28]	—	—
Gym users	5	713	.09	[.01, .17]	6.55	78.2%
Students	18	176,377	-.01	[-.02, .003]	148.14*	12.8%
Adolescents	15	168,668	-.01	[-.02, -.001]	77.03*	20.5%
Mixed adults and adolescents	7	6,867	.07	[.02, .13]	40.38*	17.6%
Studies with low risk of bias	31	179,895	-.01	[-.02, -.001]	119.09*	27.3%
Studies with potential risk of bias	3	2,540	.14	[.07, .21]	9.29*	31.7%
Intention – Doping behaviors[b]						
Team sports participants	1	236	-.07	[-.20, .06]	—	—
Mixed team and individual sports participants	7	3,946	.44	[.25, .63]	513.79*	2.7%
Studies with low risk of bias	9	5,308	.40	[.22, .57]	723.22*	2.4%
Studies with potential risk of bias	1	236	-.06	[-.19, .07]	—	—
Attitudes – Doping behaviors[b]						
Studies with low risk of bias	11	5,477	.29	[.16, .42]	289.03*	5.5%
Studies with potential risk of bias	2	2,515	-.36	[-.48, -.23]	9.72*	19.0%

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Perceived positive effects – Doping behaviors[b]						
Adults	2	909	.34	[.16, .37]	0.79	100.0%
Mixed adults and adolescents	1	642	.16	[.09, .24]	—	—
Subjective norms – Doping behaviors[b]						
Team sports participants	1	236	-.06	[-.19, .06]	—	—
Mixed team and individual sports participants	6	2,896	.39	[.25, .54]	111.37*	6.9%
Studies with low risk of bias	7	3,848	.38	[.26, .50]	117.52*	8.0%
Studies with potential risk of bias	1	236	-.06	[-.19, .06]	—	—
Descriptive norms – Doping behaviors[b]						
Males	2	599	.64	[.61, .67]	0.46	100.0%
Females	3	464	.26	[.15, .37]	5.17	72.6%
Adults	2	938	.59	[.59, .60]	0.02	100.0%
Adolescents	1	295	.15	[.04, .26]	—	—
Perceived behavioural control – Doping behaviors[b]						
Cross-sectional studies	4	2,311	-.05	[-.08, -.01]	2.23	100.0%
Longitudinal studies	1	762	.09	[.02, .16]	—	—
Moral disengagement – Doping behaviors[b]						
Competitive athletes	1	644	.01	[-.06, .09]	—	—
Students	2	1,714	.40	[.38, .42]	0.48	100.0%
Amotivation – Doping behaviors[b]						
Adults	1	410	-.07	[-.16, .03]		
Adolescents	1	304	.20	[.10, .31]		
Mixed adults and adolescents	3	1,860	.22	[.17, .26]	2.73	100.0%
Task achievement goal orientation – Doping behaviors[b]						
Competitive athletes	4	2,343	-.07	[-.13, -.004]	7.55	54.3%
Students	1	200	-.32	[-.44, -.19]	—	—

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Age – Doping intentions[b]						
Cross-sectional studies	9	4,645	.07	[.04, .11]	11.11	84.1%
Longitudinal studies	2	1,705	.003	[.002, .004]	0.00	100.0%
Attitudes – Doping intentions[b]						
Team sports participants	1	240	.73	[.67, .79]	—	—
Mixed team and individual sports participants	8	4,015	.54	[.41, .66]	118.03*	14.3%
Adults	4	1,567	.38	[.19, .56]	72.28*	12.0%
Mixed adults and adolescents	5	2,195	.68	[.63, .73]	13.54*	100.0%
Perceived benefits – Doping intentions[b]						
Published datasets / Longitudinal studies	1	183	.43	[.31, .55]	—	—
Unpublished datasets / Cross-sectional studies	1	726	.10	[.03, .17]	—	—
Descriptive norms – Doping intentions[b]						
Adolescents	1	296	.07	[-.04, .19]	—	—
Mixed adults and adolescents	1	144	.40	[.26, .53]	—	—
Perceived behavioural control – Doping intentions[b]						
Competitive athletes	3	1,136	.11	[-.12, 35]	28.98*	11.3%
Gym users	1	253	-.91	[-.93, -.89]	—	—
Students	4	3,067	-.09	[-.22, .04]	31.65*	13.8%
Individual sports participants	1	253	-.91	[-.93, -.89]	—	—
Mixed team and individual sports participants	5	2,841	-.03	[-.19, .12]	54.26*	9.9%
Studies with low risk of bias	7	4,274	-.10	[-.29, .09]	414.67*	4.5%
Studies with potential risk of bias	1	182	.35	[.22, .47]	—	—
Situational temptations – Doping intentions[b]						
Adolescents	1	309	.42	[.33, .51]	—	—
Mixed adults and adolescents	1	646	.80	[.77, .83]	—	—
Sportspersonship – Doping intentions[b]						
Published datasets	1	1,024	-.02	[-.08, .05]	—	—
Unpublished datasets	2	939	-.20	[-.31, -.09]	4.72*	41.9%

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Moral disengagement – Doping intentions[b]						
Cross-sectional studies / Mixed adults and adolescents	1	952	.37	[.31, .42]	—	—
Longitudinal studies / Adolescents	2	1,705	.55	[.54, .56]	0.13	100.0%
Dissatisfaction with appearance – Doping intentions[b]						
Competitive athletes	1	182	.39	[.26, .51]	—	—
Students	1	203	.06	[-.08, .20]	—	—
Adults	1	182	.39	[.26, .51]	—	—
Mixed adults and adolescents	2	347	.09	[.04, .15]	0.38	100.0%
Legal supplement use – Doping intentions[b]						
Adolescents	2	1,158	.23	[.19, .27]	0.84	100.0%
Mixed adults and adolescents	1	952	.51	[.47, .56]	—	—
Autonomous motivation – Doping intentions[b]						
Adults	1	410	-.41	[-.49, -.33]	—	—
Adolescents	1	307	-.04	[-.15, .07]	—	—
Mixed adults and adolescents	3	1,868	-.06	[-.11, -.02]	2.05	100.0%
Controlled motivation – Doping intentions[b]						
Competitive athletes	3	1,976	-.01	[-.06, .05]	3.21	94.4%
Students	2	607	.10	[.09, .11]	0.02	100.0%
Stage two analyses						
Attitudes (composite) – Doping behaviors[b]						
Studies with low risk of bias	14	5,710	.28	[.18, .39]	224.58*	9.0%
Studies with potential risk of bias	2	2,518	-.10	[-.12, -.08]	0.39	100.0%

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Norms (composite) – Doping behaviors[b]						
Published datasets	6	2,493	.29	[.17, .40]	49.21*	14.9%
Unpublished datasets	3	1,667	.47	[.42, .52]	3.88	97.7%
Team sports participants	1	236	.06	[-.07, .19]	—	—
Mixed team and individual sports participants	6	2,890	.39	[.27, .51]	58.69*	11.1%
Adults	4	1,269	.50	[.43, .56]	6.11	67.2%
Adolescents	3	1,299	.20	[.06, .35]	20.71*	17.5%
Studies with low risk of bias	8	3,924	.38	[.29, .47]	62.25*	14.5%
Studies with potential risk of bias	1	236	.06	[-.07, .19]	—	—
Self-efficacy to refrain from doping (composite) – Doping behaviors[b]						
Competitive athletes	2	949	-.28	[-.32, -.24]	0.69	100.0%
Students	3	2,124	-.04	[-.09, -.002]	2.19	100.0%
Morality (composite) – Doping behaviors[b]						
Cross-sectional studies	6	4,755	-.18	[-.29, -.07]	91.34*	7.7%
Longitudinal studies	1	762	-.39	[-.45, -.33]	—	—
Competitive athletes	5	3,803	-.12	[-.19, -.06]	19.19*	26.3%
Students	2	1,714	-.40	[-.42, -.38]	0.48	100.0%
Attitudes (composite) – Doping intentions[b]						
Team sports participants	1	240	.72	[.66, .78]	—	—
Individual sports participants	2	397	.55	[.47, .63]	1.39	100.0%
Mixed team and individual sports participants	8	3,966	.51	[.38, .64]	124.36*	11.4%
Adults	4	1,518	.31	[.16, .45]	27.19*	18.8%
Adolescents	5	3,116	.54	[.46, .63]	33.37*	39.0%
Mixed adults and adolescents	5	2,195	.64	[.59, .69]	7.91	100.0%
Norms (composite) – Doping intentions[b]						
Team sports participants	1	241	.70	[.64, .76]	—	—
Mixed team and individual sports participants	7	3,812	.49	[.36, .62]	106.12*	12.6%

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Self-efficacy to refrain from doping (composite) – Doping intentions[b]						
Competitive athletes	3	1,137	-.32	[-.36, -.29]	0.73	100.0%
Gym users	2	397	-.64	[-.88, -.41]	12.05*	30.0%
Students	4	3,067	-.21	[-.40, -.02]	74.82*	6.5%
Individual sports participants	2	397	-.64	[-.88, -.41]	12.05*	30.0%
Mixed team and individual sports participants	5	2,842	-.34	[-.36, -.31]	1.61	100.0%
Morality (composite) – Doping intentions[b]						
Cross-sectional studies	4	2,915	-.19	[-.33, -.04]	54.70*	8.0%
Longitudinal studies	2	1,705	-.55	[-.56, -.54]	0.13	100.0%
Competitive athletes	3	1,963	-.10	[-.22, .02]	19.42*	16.4%
Students	3	2,657	-.48	[-.57, -.40]	12.57*	26.2%
Stage three analyses						
Facilitators – Doping behaviors[b]						
Studies with low risk of bias	15	6,779	.31	[.21, .41]	268.17*	7.4%
Studies with potential risk of bias	2	2,518	-.10	[-.13, -.06]	1.20	100.0%
Inhibitors – Doping behaviors[b]						
Cross-sectional studies	10	5,776	-.11	[-.17, -.06]	47.45*	25.9%
Longitudinal studies	1	762	-.24	[-.31, -.17]	—	—
Competitive athletes	6	4,186	-.09	[-.14, -.04]	11.77*	52.0%
Gym users	1	27	-.65	[-.87, -.43]	—	—
Students	4	2,325	-.19	[-.29, -.10]	18.09*	22.5%
Individual sports participants	1	27	-.65	[-.87, -.43]	—	—
Mixed team and individual sports participants	8	5,149	-.12	[-.17, -.06]	25.64*	32.6%
Studies with low risk of bias	10	6,511	-.13	[-.18, -.07]	43.10*	24.3%
Studies with potential risk of bias	1	27	-.65	[-.87, -.43]	—	—

Relationship [levels of moderator(s)]	*k*	*n*	Size of effect	Confidence interval	*Q*	% error variance
Facilitators – Doping intentions[b]						
Published datasets	9	5,411	.49	[.40, .59]	107.42*	16.2%
Unpublished datasets	6	2,464	.31	[.24, .39]	16.08*	44.7%
Cross-sectional studies	12	5,946	.40	[.31, .48]	155.31*	14.1%
Longitudinal studies	3	1,930	.56	[.52, .61]	3.15	100.0%
Team sports participants	1	241	.70	[.64, .77]	—	—
Mixed team and individual sports participants	9	5,012	.39	[.29, .49]	108.22*	13.7%
Inhibitors – Doping intentions[b]						
Cross-sectional studies	9	4,114	-.21	[-.33, -.10]	162.25*	10.7%
Longitudinal studies	2	1,705	-.44	[-.45, -.43]	0.07	100.0%
Competitive athletes	4	2,157	-.16	[-.29, -.02]	30.36*	15.0%
Gym users	2	397	-.62	[-.85, -.40]	12.05*	26.7%

Note. k = number of meta-analyzed studies; *n* = total number of participants; *Q* = *Q* statistic for test of homogeneity (shown when k>1).; % error variance = percentage of variance accounted by sampling and measurement errors (shown when k>1).. [a]Odds ratios; [b]Correlation coefficient; * $p < .05$.

Appendix A

Keywords Used for Database Search

Keywords used:

Doping, doping intention, steroid, medication, substance, stimulants, growth hormone, performance enhancement, performance enhancing drugs, amphetamine, blood transfusion, drug test, blood-booster

In conjunction with:

Psychology, psychological, demographic, factors, predictors, personality, motivation, motivational climate, attitudes, intention

Appendix B

Summary and Reference of Included Studies

Study	Publication type	Study design	Context	Sport type	Age group	Sample size	Risk of bias	Variables included in analyses
Chng & Moore, 1990	Journal article	CS	Gym users	Mixed	Adults	222	Low	Beh, Sex.
CDC[1], 1991	Dataset	CS	Students	n/a	Adolescent	6,280	Low	Beh, Sex, Age.
CDC[1], 1993	Dataset	CS	Students	n/a	Adolescent	8,211	Low	Beh, Sex, Age.
Brower et al., 1994	Journal article	CS	Gym users	Individual	Adults	134	Potential	Beh, DopeFrd.
CDC[1], 1995a	Dataset	CS	Students	n/a	Adults	2,896	Low	Beh, Sex, Age.
CDC[1], 1995b	Dataset	CS	Students	n/a	Adolescent	5,483	Low	Beh, Sex, Age.
Nilsson, 1995	Journal article	CS	Students	n/a	Adolescent	1,383	Low	Beh, Sex.
Allemeier, 1996	Thesis	CS	Competitive Athletes	Mixed	Adults	182	Potential	Int, Att, Norm, Self-Eff, Esteem, DisApp.
Goldberg et al., 1996	Journal article	Ex	Students	Team	Adolescent	1,226	Low	Beh, Int.
Melia et al., 1996	Journal article	CS	Students	n/a	Adolescent	16,169	Low	Beh, Sex.
Vogels et al., 1996	Journal article	CS	Gym users	Individual	Mixed	330	Low	Beh, Sex, DopeFrd.
CDC[1], 1998	Dataset	CS	Students	n/a	Adolescent	4,089	Low	Beh, Sex, Age.
Faigenbaum et al., 1998	Journal article	CS	Students	Mixed	Children	965	Low	Beh, Sex, DopeFrd.
CDC[1], 1999	Dataset	CS	Students	n/a	Adolescent	7,808	Low	Beh, Sex, Age.
Kindlundh et al., 1999	Journal article	CS	Students	n/a	Adolescent	2,742	Low	Beh, Sex.
Goldberg et al., 2000	Journal article	Ex	Students	Team	Adolescent	2,516	Low	Beh, Int.
CDC[1], 2001	Dataset	CS	Students	n/a	Adolescent	6,925	Low	Beh, Sex, Age.

Study	Publication type	Study design	Context	Sport type	Age group	Sample size	Risk of bias	Variables included in analyses
Pedersen & Wichstrøm, 2001	Journal article	CS	Students	n/a	Adolescent	10,828	Low	Beh, Sex.
Miller et al., 2002	Journal article	CS	Students	n/a	Adolescent	16,175	Low	Beh, Sex, Age.
Goldberg et al., 2003	Journal article	Ex	Students	n/a	Adolescent	385	Low	Beh.
Laure et al., 2004	Journal article	CS	Students	Mixed	Adolescent	1,459	Low	Beh, Sex, TeamSp.
Lucidi et al., 2004	Journal article	CS	Students	n/a	Mixed	952	Low	Beh, Int, Sex, Age, SupUse, Att, Norm, Self-Eff, Mor.
CDC[1], 2005	Dataset	CS	Students	n/a	Adolescent	7,160	Low	Beh, Sex, Age.
Dodge & Jaccard, 2006	Journal article	CS	Students	Mixed	Adolescent	14,322	Low	Beh, Sex.
Donahue et al., 2006	Journal article	CS	Competitive Athletes	Mixed	Mixed	1,201	Low	Beh, Age, AutMot, ConMot, Mor.
Kanayama et al., 2006	Journal article	CS	Gym users	Individual	Adults	89	Low	Beh, Age, Esteem, Perf.
Papadopoulos et al., 2006	Journal article	CS	Students	Mixed	Adults	2,173	Low	Beh, Sex, SupUse.
Striegel et al., 2006	Journal article	CS	Gym users	Individual	Adults	621	Low	Beh, Sex.
CDC[1], 2007	Dataset	CS	Students	n/a	Adolescent	6,930	Low	Beh, Sex, Age.
Dodge & Jaccard, 2007	Journal article	L	Competitive Athletes	Mixed	Adults	301	Low	Beh, Int, Sex, Att, Norm.
Elliot et al., 2007	Journal article	CS	Students	n/a	Adolescent	14,997	Low	Beh, Sex, Age.
Laure & Bingsinger, 2007	Journal article	CS	Students	n/a	Children	3,594	Low	Beh, Sex.
Petróczi et al., 2007	Journal article	CS	Competitive Athletes	Mixed	Adults	199	Low	Beh, Age.
Wanjek et al., 2007	Journal article	CS	Students	Mixed	Mixed	2,313	Potential	Beh, Sex, Age, Att.
Al-Falasi et al., 2008	Journal article	CS	Gym users	Individual	Adults	153	Low	Beh, Age.

Study	Publication type	Study design	Context	Sport type	Age group	Sample size	Risk of bias	Variables included in analyses
Dodge & Jaccard, 2008	Journal article	CS	Competitive Athletes	Team	Adolescent	241	Potential	Beh, Int, Sex, Age, Att, Norm.
Lucidi et al., 2008	Journal article	Pr	Students	Mixed	Adolescent	1,232	Low	Beh, Int, Sex, Age, SupUse, Att, Norm, Self-Eff, Mor.
Moran et al., 2008	WADA Report	CS	Competitive Athletes	Mixed	Adults	375	Low	Beh, Sex, Age, DopeFrd, TeamSp, TaskCli, EgoCli, Att, TaskOri, EgoOri, Perf, SpConf.
Petróczi et al., 2008	Journal article	CS	Students	n/a	Adults	142	Low	Beh, Age, Att.
Rees et al., 2008	Journal article	CS	Students	n/a	Adolescent	495	Low	Int, Age, SupUse.
Wiefferink et al., 2008	Journal article	CS	Gym users	Individual	Mixed	144	Potential	Int, Att, Norm, Self-Eff, DisApp.
CDC[1], 2009	Dataset	CS	Students	n/a	Adolescent	8,239	Low	Beh, Sex, Age.
Dunn et al., 2009	Journal article	CS	Gym users	Individual	Adults	214	Low	Beh, Int, Age, SupUse.
Lugo, 2009	Thesis	CS	Students	Mixed	Mixed	208	Low	Beh, Int, Sex, Age, Att, AutMot, ConMot, Amo, TaskOri, EgoOri, Esteem, DisApp.
Ranby et al., 2009	Journal article	Ex	Competitive Athletes	Team	Adolescent	1,261	Low	Beh, Int.
Rodek et al., 2009	Journal article	CS	Gym users	Individual	Adults	27	Potential	Beh, Age, Reli.
Ip et al., 2010	Journal article	CS	Gym users	Individual	Adults	1,519	Potential	Beh, Sex.
Thorlindsson & Halldorsson, 2010	Journal article	CS	Students	n/a	Adolescent	10,918	Low	Beh, Sex.
Zelli et al., 2010a	Journal article	Pr	Students	n/a	Adolescent	864	Low	Int, Att, DisApp.
Zelli et al., 2010b	Journal article	L	Students	Mixed	Adolescent	1,022	Low	Int, Sex, Age, Att, Norm, Self-Eff, Mor.
Barkoukis et al., 2011	Journal article	CS	Competitive Athletes	Mixed	Mixed	1,035	Low	Beh, Int, Sex, Age, AutMot, ConMot, Amo, TaskOri, EgoOri, Mor.

Study	Publication type	Study design	Context	Sport type	Age group	Sample size	Risk of bias	Variables included in analyses
CDC[1], 2011	Dataset	CS	Students	n/a	Adolescent	7,379	Low	Beh, Sex, Age.
Gucciardi et al., 2011	Journal article	CS	Competitive Athletes	Mixed	Mixed	670	Low	Beh, Sex, Age, TeamSp, Att, Esteem, Thr, Mor.
Neeraj et al., 2011	Journal article	CS	Competitive Athletes	Mixed	Adults	303	Potential	Beh, Sex, DopeFrd.
Petróczi et al., 2011	Journal article	CS	Competitive Athletes	Not reported	Adults	82	Low	Beh, Sex, Age, Att, Norm.
Uvacsek et al., 2011	Journal article	CS	Competitive Athletes	Not reported	Adults	82	Low	Beh, Sex, Age, Att.
Allahverdipour et al., 2012	Journal article	CS	Gym users	Individual	Mixed	253	Low	Beh, Int, SupUse, DopeFrd, Att, Norm, Self-Eff.
Pope et al., 2012	Journal article	CS	Gym users	Individual	Adults	231	Low	Beh, Age.
Backhouse et al., 2013	Journal article	CS	Competitive Athletes	Mixed	Adults	212	Low	Beh, Sex, SupUse, Att, Norm.
Chan et al., 2013	Unpublished manuscript	CS	Competitive Athletes	Mixed	Adolescent	410	Low	Beh, Int, Sex, Att, Self-Eff, AutMot, ConMot, Amo.
Tsorbatzoudis et al., 2013	Unpublished manuscript/ WADA Report	CS	Competitive Athletes	Mixed	Mixed	650	Low	Beh, Int, Sex, Age, TeamSp, Att, Norm, Self-Eff, AutMot, ConMot, Amo, TaskOri, EgoOri, AntReg, Mor.
Whitaker, 2013	Thesis	CS	Competitive Athletes	Mixed	Adults	726	Low	Beh, Int, Sex, Age, Att, Norm, Will.
Barkoukis et al., in press	Journal article	CS	Competitive Athletes	Mixed	Adolescent	309	Low	Beh, Int, Sex, Age, TeamSp, Att, Norm, Self-Eff, AutMot, ConMot, Amo, TaskOri, EgoOri, Mor.

Note. [1]CDC = Centers for Disease Control and Prevention. CS = Cross-sectional; Pr = Prospective; L = Longitudinal; Ex = Experimental. Beh = Behaviour; Int = Intention; SupUse = Legal supplement use; DopeFrd = Know friend who is doping; TeamSp = Team sports participation;

TaskCli = Task motivational climate; EgoCli = Ego motivational climate; Att = Attitudes; Self-Eff = Self-efficacy to refrain from doping; AutMot = Autonomous motivation; ConMot = Controlled motivation; Amo = Amotivation; TaskOri = Task achievement goal orientation; EgoOri = Ego achievement goal orientation; Esteem = Global self-esteem; Perf = Perfectionism; Reli = Religiousness; SpConf = Sport confidence; AntReg = Anticipated regret; Thr = Threat of being caught; Will = Willingness to dope; Mor = Morality; DisApp = Dissatisfaction with appearance or body image.

Appendix C
Risk of Bias Assessment

The risks of bias of included studies were assessed using the following criteria. For each criterion, the paper will be assessed as having a) no or low risk of bias, or b) potential risk of bias.

For all studies

Sampling:

1. Participants are randomly selected
2. Sample sizes are not inadequate
3. Participants are representative of various demographic groups
4. If some participants were excluded from the analyses, the exclusion is justifiable
5. When group comparisons are made, participants are matched on other meaningful demographics

Measures:

6. Validated measures are used, or the authors have provided sufficient support of psychometric properties of measures they devised
7. Measures used were clearly defined and is appropriate

For studies using longitudinal/prospective designs

8. Authors have examined whether dropouts is random or not (e.g., compared baseline variables of dropouts with those who stayed in the study)
9. Dropout rates were not high, and missing data were treated appropriately

For studies using experimental designs

10. Allocation sequence generated to produce comparable groups
11. Allocation was concealed
12. Whether blinding was done; and if so, whether it was effective
13. Outcome data for all outcomes were reported; incomplete outcomes due to attrition and exclusions were addressed
14. No selective outcome reporting
15. Other sources of bias

Risk of Bias Assessment of Individual Studies

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Chng & Moore, 1990	+	+	+	+	+	+	+								
CDC, 1991	+	+	+	+	+	+	+								
CDC, 1993	+	+	+	+	+	+	+								
Brower et al., 1994	−	+	−	−	+	+	+								
CDC, 1995a	+	+	+	+	+	+	+								
CDC, 1995b	+	+	+	+	+	+	+								
Nilsson, 1995	+	+	+	+	+	+	+								
Allemeier, 1996	+	+	+	+	+	−	+								
Goldberg et al., 1996	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Melia et al., 1996	+	+	+	+	+	+	+								
Vogels et al., 1996	+	+	+	+	+	+	+								
CDC, 1998	+	+	+	+	+	+	+								
Faigenbaum et al., 1998	+	+	+	+	+	+	+								
CDC, 1999	+	+	+	+	+	+	+								
Kindlundh et al., 1999	+	+	+	+	+	+	+								
Goldberg et al., 2000	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
CDC, 2001	+	+	+	+	+	+	+								
Pedersen & Wichstrøm, 2001	+	+	+	+	+	+	+								
Miller et al., 2002	+	+	+	+	+	+	+								
Goldberg et al., 2003	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Laure et al., 2004	+	+	+	+	+	+	+								
Lucidi et al., 2004	+	+	+	+	+	+	+								
CDC, 2005	+	+	+	+	+	+	+								
Dodge & Jaccard, 2006	+	+	+	+	+	+	+								
Donahue et al., 2006	+	+	+	+	+	+	+								
Kanayama et al., 2006	+	+	+	+	+	+	+								
Papadopoulos et al., 2006	+	+	+	+	+	+	+								
Striegel et al., 2006	+	+	+	+	+	+	+								
CDC, 2007	+	+	+	+	+	+	+								
Dodge & Jaccard, 2007	+	+	+	+	+	+	+	+	+						
Elliot et al., 2007	+	+	+	+	+	+	+								
Laure & Bingsinger, 2007	+	+	+	+	+	+	+								

Petróczi et al., 2007	+	+	+	+	+	+	+								
Wanjek et al., 2007	+	+	+	+	+	−	+								
Al-Falasi et al., 2008	+	+	+	+	+	+	+								
Dodge & Jaccard, 2008	+	+	+	+	+	−	+								
Lucidi et al., 2008	+	+	+	+	+	+	+	+	+						
Moran et al., 2008	+	+	+	+	+	+	+								
Petróczi et al., 2008	+	+	+	+	+	+	+								
Rees et al., 2008	+	+	+	+	+	+	+								
Wiefferink et al., 2008	+	+	−	+	+	+	+								
CDC, 2009	+	+	+	+	+	+	+								
Dunn et al., 2009	+	+	+	+	+	+	+								
Lugo, 2009	+	+	+	+	+	+	+								
Ranby et al., 2009	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rodek et al., 2009	+	−	+	+	+	+	+								
Ip et al., 2010	−	+	−	−	−	+	+								
Thorlindsson & Halldorsson, 2010	+	+	+	+	+	+	+								
Zelli et al., 2010a	+	+	+	+	+	+	+	+	+						
Zelli et al., 2010b	+	+	+	+	+	+	+	+	+						
Barkoukis et al., 2011	+	+	+	+	+	+	+								
CDC, 2011	+	+	+	+	+	+	+								
Gucciardi et al., 2011	+	+	+	+	+	+	+								
Neeraj et al., 2011	+	+	+	+	+	+	−								
Petróczi et al., 2011	+	+	+	+	+	+	+								
Uvacsek et al., 2011	+	+	+	+	+	+	+								
Allahverdipour et al., 2012	+	+	+	+	+	+	+								
Pope et al., 2012	+	+	+	+	+	+	+								
Backhouse et al., 2013	+	+	+	+	+	+	+								
Chan et al., 2013	+	+	+	+	+	+	+								
Tsorbatzoudis et al., 2013	+	+	+	+	+	+	+								
Whitaker, 2013	+	+	+	+	+	+	+								
Barkoukis et al., in press	+	+	+	+	+	+	+								

Note. + No or low risk of bias; − Potential risk of bias

Appendix D

Forrest Plots of Facilitators/Inhibitors Versus Doping Intentions and Behaviors

Figure D1. Forrest plot of facilitators of doping predicting doping intentions.

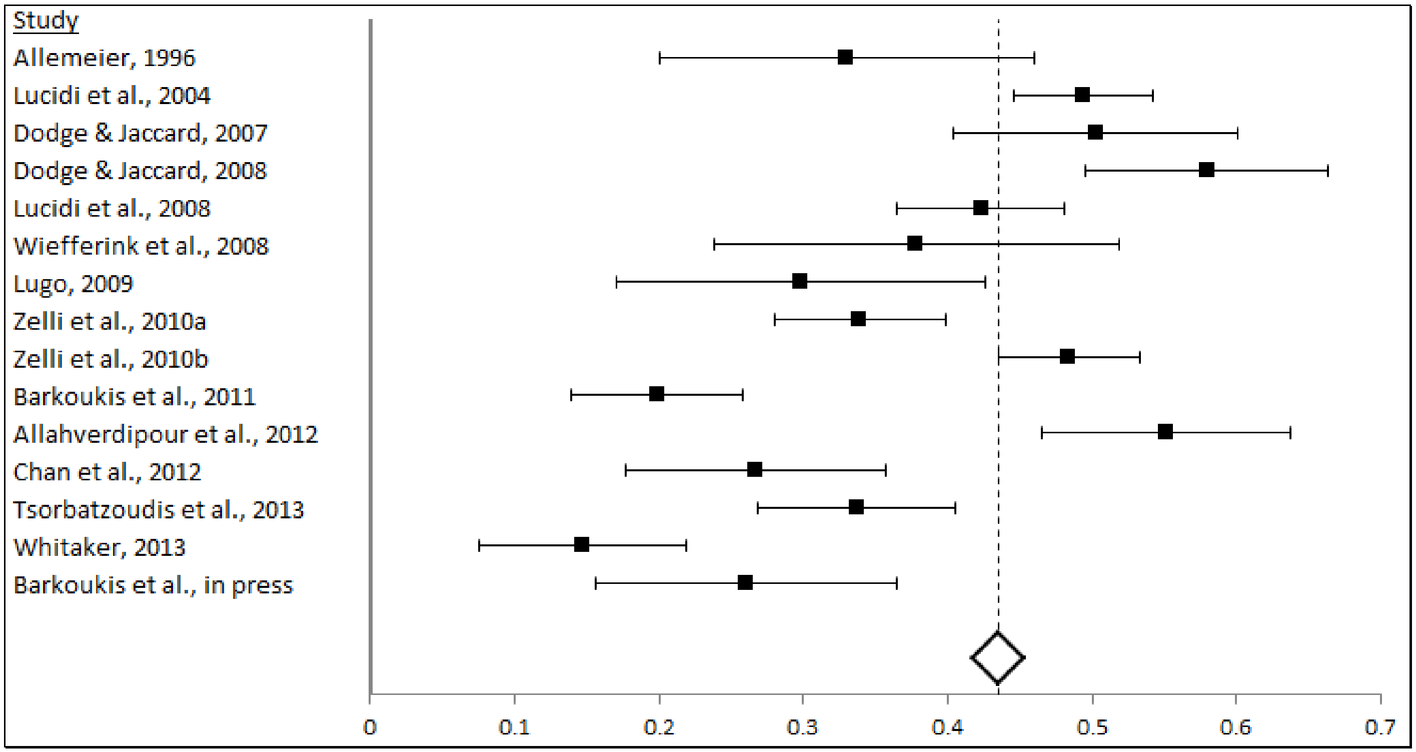

Figure D2. Forrest plot of inhibitors of doping predicting doping intentions.

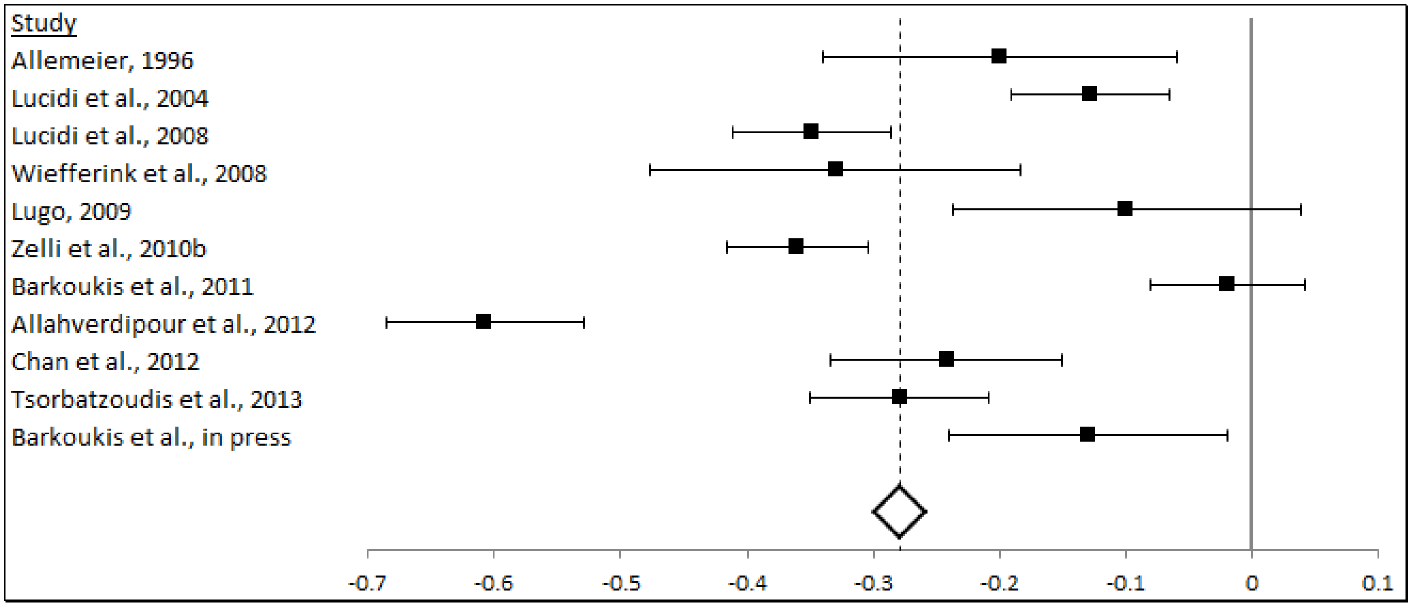

Figure D3. Forrest plot of facilitators of doping predicting doping behaviors.

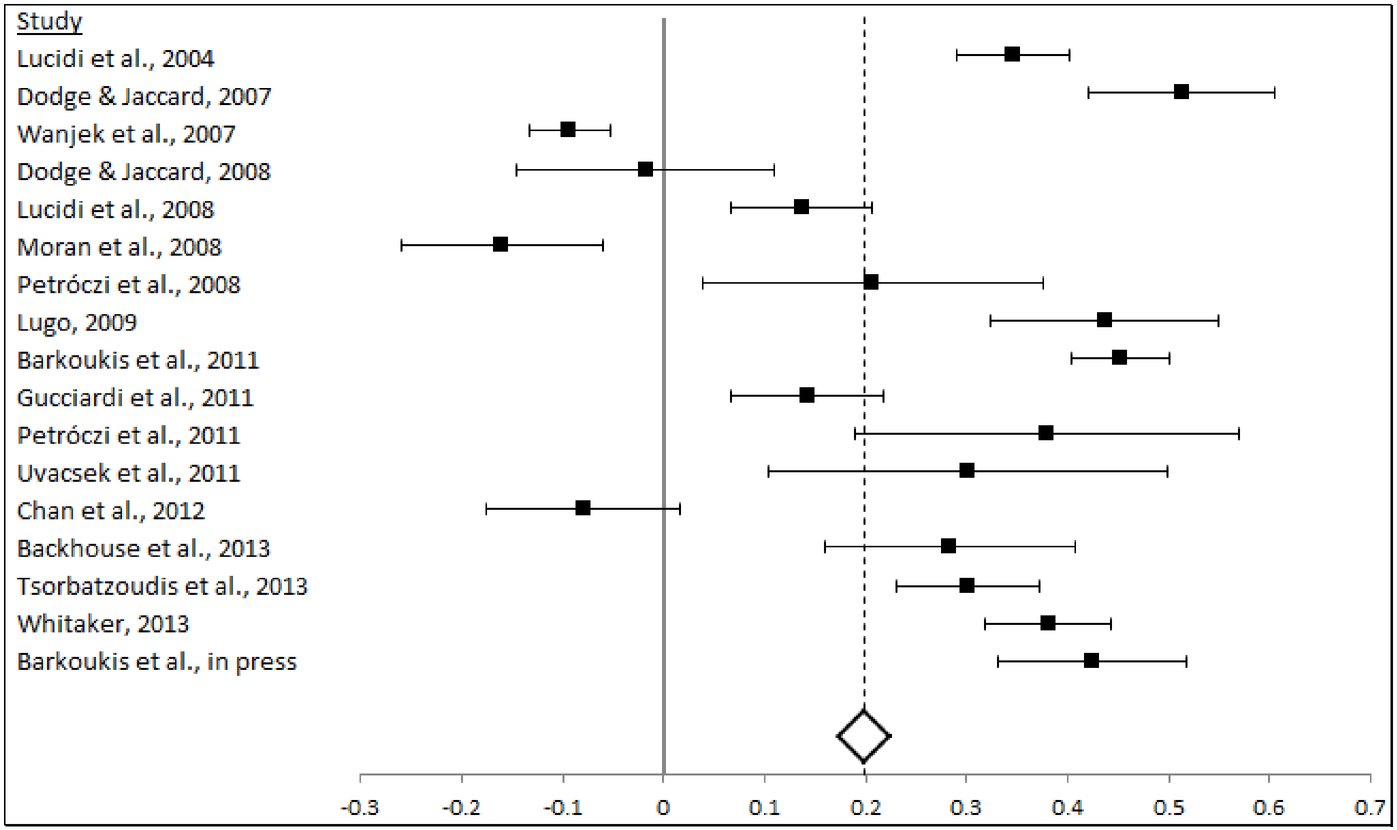

Figure D4. Forrest plot of inhibitors of doping predicting doping behaviors.