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Confirmatory Factor Analysis of the Performance Enhancement Attitude Scale for Adult and Adolescent Athletes

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Abstract

Objectives: The Performance Enhancement Attitude Scale (PEAS; Petróczi & Aidman, 2009) is an extensively used questionnaire to assess doping attitudes among adult and adolescent athletes. To date, however, there is limited evidence to support the structure of the PEAS with either adult or adolescent athletes. The aim of this paper was to assess the factor structure of the PEAS with adult and adolescent athletes.

Design: Cross-sectional.

Methods: One thousand, one-hundred and fifty-four athletes, who were aged between 12 and 68 years (*M* age = 21.76 years, *SD* = 7.68) completed the PEAS in the presence of a research assistant. We subjected the data to Confirmatory Factor Analysis.

Results: The original 17-item PEAS displayed a poor model among the overall sample, and with the sub-samples of adult and adolescent athletes. The 11-item, 8-item, and 6-item versions of the PEAS, which were used in previous studies, provided a better fit than the original 17-item PEAS. The 8-item version of the PEAS demonstrated the best fit for adults, but no model exhibited a good fit with adolescent athletes.

Conclusions: Scholars could consider using the 8-item version of the PEAS with adults. Our data, however, infers that researchers should use the PEAS with caution to assess doping attitudes among adolescent athletes, due to the poor model fit of all versions tested. The accurate assessment of attitudes towards doping among adolescent athletes requires questionnaires specifically designed for this population, and grounded in an appropriate theoretical framework.

Keywords: Doping; Factor Analysis; Performance Enhancing Drugs; Psychometrics

Introduction

Doping represents the occurrence on an anti-doping rule violation, and includes the presence of prohibited substances, its metabolites, or markers within a sample that an athlete provides (WADA, 2015). Scholars usually refer to banned substances that aid performance as performance enhancing drugs (PEDs; Nicholls et al., 2015). According to the White Paper on Sport (2007), the use of PEDs represents a serious threat to European sport. PEDs undermine fair play and open competition. Furthermore, PEDs pose a significant threat to an athlete's physical (e.g., Johnson, 2012) and mental health (e.g., Lindqvist, Moberg, Ehrnborg, Eriksson, Fahlke, & Rosén, 2013), due to supraphysiological intakes of PEDs (Bird, Goebel, Burke, & Greaves, 2016). Although doping may be viewed occurring exclusively within the realms of elite sport, a report containing students from 36 European countries revealed that some athletes within grassroots sport also take performance enhancing drugs (ESPAD, 2011).

In order to generate a greater understanding of doping in sport, there has been a substantial increase in the number of studies reporting the psychosocial predictors of doping intentions and behaviours (Ntoumanis, Ng, Barkoukis, & Backhouse, 2014). Ntoumanis et al. (2014) identified the Theory of Planned Behaviour (TPB; Ajzen, 1991) as the theoretical framework that guided many studies within their meta-analysis. This model infers that doping behaviour is an outcome of intentions, attitudes, subjective norms, and perceived behavioural control. Ntoumanis et al. reported that attitudes and subjective norms were the strongest predictors of doping behaviours. Attitudes are of particular interest to the present article and refer to evaluative judgements or behavioural tendencies to a specific object (Eagly & Chaiken, 1993). Cunningham and Johnson (2007) suggested that whether an individual perceives something as good or bad, pleasant or unpleasant, or to be avoided or approached influences behaviour.

In recent years, adolescent athletes are starting to feature more prominently within the

doping literature. Backhouse, McKenna, Robinson, and Atkin, (2007) reported that adolescents featured sparingly within the doping literature, in comparison to adult athletes. The meta-analysis by Ntoumanis et al. (2014), however, reported 18 journal articles for both adults and adolescents, with nine journal articles containing a mixture of adults and adolescents. Weiss and Bredemeier (1983) suggested a person is an adolescent when they are aged between 12 and 18 years of age. The growing number of studies featuring adolescents is not surprising, because adolescents are at risk of doping (Schirlin et al., 2009). Further, adolescence is widely accepted as a period when a person's attitudes are formed (Harton & Latane, 1997), and when people are susceptible to descriptive norms (Rivis & Sheeran, 2003).

Scholars assessed doping among adolescent athletes via a variety of different questionnaires. Barkoukis, Lazuras, and Tsorbatzoudis (2014) and Barkoukis, Kartali, Lazuras, and Tsorbatzoudis (2016) used a stem proposition in which athletes reported whether performance enhancing drugs were bad/good, useless/useful, harmful/beneficial, or unethical/ethical. Alternatively, Bloodworth, Petróci, Bailey, Pearce, and McNamee (2012) stated that athletes completed a "modified version of a questionnaire used by UK Sport in its 2005 Drug-Free Sport survey" (p. 295), but provided no information on the scale, the modifications made, nor the theoretical framework that underpinned the questionnaire. Other scholars such as Gucciardi, Jalleh, and Donovan (2010) used a shortened 11-item version Performance Enhancement Attitude Scale (PEAS; Petróczi & Aidman, 2009) among their sample of adolescent and adult athletes. Accurately assessing an adolescent's attitude towards doping is important, because it could be the developmental period in which favourable or unfavourable attitudes towards doping are formed (Harton & Latane, 1997). Research is required to assess the validity of questionnaires to assess doping attitudes. It is unknown whether existing doping questionnaires are suitable for athletes of different ages, if

questionnaires need to be modified so they are suitable for athletes of all ages, or indeed whether age specific questionnaires are required.

Recent research by Nicholls et al. (2015) found that there might be subtle differences between adults and adolescents, in regards to the factors that predict attitudes towards doping and doping intentions. Nicholls et al. qualitatively explored the relevance of the Sport Drug Control Model (SDCM; Donovan, Eggar, Kapernick, & Mendoza, 2002) for adolescent athletes, because although two studies had provided evidence to support the SDCM (e.g., Gucciardi, Jalleh, & Donovan, 2011; Jalleh, Donovan, & Jobling, 2014), neither sample contained an adolescent only sample. This resulted in Nicholls et al. developing the Sport Drug Control Model for Adolescent Athletes (SDCM-AA). The key difference between the SDCM-AA and the original SDCM is that age/maturation, sport level, pressure, country of residence, and ethnicity were also factors that might influence an adolescent's attitude towards doping, in addition to perceptions of threat and benefit appraisals, morality, self-esteem, legitimacy, and reference group opinion. The implication from Nicholls et al.'s study is that there might be differences in attitudes towards doping among adult and adolescent athletes. This finding is somewhat echoed from the developmental psychology literature, as Compas, Connor-Smith, Saltzman, Harding Thomsen, and Wadsworth (2001) suggested adolescents should not be treated as *mini* adults and that adolescents require specific theoretical models and questionnaires. A questionnaire that is widely used in the doping literature to assess the doping attitudes of both adult (e.g., Backhouse, Whitaker, & Petróczi, 2013) and adolescent athletes (e.g., Madigan, Stoeber, & Passfield, 2016) is the PEAS (Petróczi & Aidman, 2009).

Performance Enhancement Attitude Scale (PEAS)

The PEAS (Petróczi & Aidman, 2009) is a 17-item unidimensional measure of attitudes towards doping. The authors of this scale did not provide a theoretical or conceptual

framework that underpins the PEAS. Furthermore, there is no published information on how the PEAS was developed other than that the original scale consisted of 97 items, of which 80 items were deleted due to poor fit. Nevertheless, it is widely used in the doping literature to explore the relationship between attitudes to doping and supplement use (Backhouse et al., 2013), perfectionism (Madigan et al., 2016), achievement goals and the motivational climate (Allen, Taylor, Dimeo, Dixon, & Robinson, 2015), willingness to dope (Whitaker, Long, Petróczi, & Backhouse, 2014), and social desirability (Gucciardi, Jalleh, & Donovan, 2010). Some of these samples have included adults (e.g., Backhouse et al., 2013), adolescents (Madigan et al., 2016), or a mixture of adults and adolescents (e.g., Allen et al., 2015).

There is some conflicting evidence regarding the reliability and the validity of the PEAS (Petróczi & Aidman, 2009) and scholars have made several modifications to this scale. For example, Petróczi and Aidman assessed the reliability of the PEAS among nine independent studies over a period of seven years and included a broad range of participants (e.g., elite athletes, student athletes, coaches, and the general public). The internal consistency of the PEAS ranged from .71 to .91 in these samples, which led Petróczi and Aidman to declare that the PEAS is a useful tool to measure attitudes towards doping. Similarly, Zucchettia, Candelaa, and Villosio (2015) reported a Cronbach's alpha of 0.80 for the PEAS among a sample of 109 athletes.

In regards to modifications, Gucciardi et al. (2010), however, found less support for the PEAS. It should be noted that Gucciardi and colleagues used the 11-item short version of the PEAS, which contains 11-items from the original version. In particular, Gucciardi et al. found a poor model fit for the 11-item short versions of the PEAS, which resulted in the deletion of five of the 11-items, culminating in a 6-item scale that displayed an excellent fit. Further, Vargo et al. (2014) used an 8-item version of the PEAS whereas Elbe and Brand (2016) used a 6-item version of the PEAS because the 17-item and 11-item scale did not

provide a good fit. Although Petróczi and Aidman, (2009) and Zucchettia et al. (2015) found evidence to support the PEAS, the results from Gucciardi et al. and Elbe and Brand (2016) imply that further validation of the full 17-item PEAS is required. Given that there also may be subtle differences in factors that contribute towards attitudes towards doping among adults and adolescents athletes (Donovan et al., 2002; Nicholls et al., 2015), it could be argued that the scale should be analysed for both adult and adolescent samples.

In light of these findings, the aim of this study was to examine the factor structure of the PEAS (Petróczi & Aidman, 2009), using Confirmatory Factor Analysis (CFA). Given the potential differences between adults and adolescents in relation to doping (see Donovan et al., 2002; Nicholls et al., 2015) and calls for researchers to not treat adolescents as mini adults (Compas et al., 2001), we wanted to test the appropriateness of the PEAS among both adult and adolescent athletic samples.

Method

Participants

One thousand, one-hundred and fifty-four athletes (male n = 747, female n = 406, unreported gender n = 1), who were aged between 12 and 68 years (M age = 21.76 years, SD = 7.68) participated in this study. The sample included 470 adolescents aged between 12 and 18 years and 684 adults aged between 19 and 68 years. Participants were from team (n = 547) and individual sports (n = 587) or unreported (n = 20). Our sample consisted of 951 Caucasian, 94 Asian, and 34 Chinese, 32 Black-African, 24 Black-Caribbean, 12 Malaysian, 4 Mixed Race, and 3 athletes from other ethnic origins. The athletes in our sample competed at international (n = 147), national (n = 79), county (n = 250), club (n = 642), or beginner (n = 36) levels.

Measure

The 17-item PEAS (Petróczi & Aidman, 2009) assessed the doping attitudes of the

participants in English. Participants responded to the stem "Please answer the following questions about Performance Enhancing Drugs honestly." Questions included "legalising performance enhancements would be beneficial for sports," "Athletes should not feel guilty about breaking the rules and taking performance enhancing drugs," and "Doping is an unavoidable part of the competitive sport." All questions were answered on a 6-point Likert-type scale, with the following anchor points: 1 = *'strongly disagree,'* 2 = *'disagree,'* 3 = *'slightly disagree,'* 4 = *'slightly agree,'* and 5 = *'agree,'* and 6 = *'strongly agree.'*

Procedure

Following ethical approval, by a departmental University Ethics Committee, we distributed information letters to governing bodies, sports clubs, and schools. This information letter contained information about the study, such as the requirements of the participants and the sporting organization. After receiving permission, we sent an information letter to potential participants and their parents if the participants were aged 17 years or younger. We sent assent forms to those aged 18 years or over, whereas assent and consent forms were sent to parents/guardians, in the instance of a participant being 17 years of age and under. We collected all data schools or sports clubs, in the presence of a trained research assistant or schoolteacher. The trained research assistants were able to answer any questions that the participants raised.

Data Analysis

First, we performed confirmatory factor analysis (CFA) to investigate the goodness of fit of the hypothesized 17-item one-factor model of the PEAS (Petróczi & Aidman, 2009), using maximum likelihood estimation in Mplus (Muthén & Muthén, 1998-2012). To evaluate model fit, we examined a range of incremental and absolute fit indices, including the $\chi 2$ statistic, comparative fit index (CFI), Tucker–Lewis Index (TLI [also known as non-normed fit index, NNFI]), root mean square error of approximation (RMSEA), and standardised root

mean square residual (SRMR; Hu & Bentler, 1999; MacCallum & Austin, 2000). The following criteria were indicative of acceptable model fit: CFI > 0.90, TLI > 0.90, RMSEA < 0.08, SRMR < 0.10 (Marsh, Hau, & Wen, 2004).

Next, we sought to investigate measurement invariance across two age groups: Adolescents (18 years and under, $N = 470$) and adults (over 19 years, $N = 684$). In this, we followed the recommendations of van de Schoot, Lugtig, and Hox (2012) and aimed to test configural, metric, and scalar invariance.[1]

Results

The results of the CFA did not support the original model in our overall sample (see Table 1). To determine the data misfit, configural invariance for both adult and adolescent we performed separate CFAs. Again, both models provided a poor fit to the data (see Table 1). Therefore, as the a priori measurement model provided a poor fit, we sought to test alternative models that yielded an adequate fit in previous research. In this regard, we tested the 11-item and 6-item versions from Gucciardi et al. (2010), the 6-item version from Elbe and Brand (2016), and the 8-item version from Vargo et al. (2015). As Table 1 shows, all alternative versions offered significantly better fit than the original 17-item model (e.g., Δ CFI > .01; Cheung & Rensvold, 2002). Both the 11-item version from Gucciardi et al. (2010) and the 8-item version from Vargo et al. (2015) showed good fit for the overall sample. However, when testing the subsamples, only the 8-item version from Vargo et al. (2015) showed adequate fit across all fit indices for the adult subsample. No model showed good fit for the adolescent subsample. As we were not able to provide evidence for configural invariance, we did not proceed with the additional tests of invariance. The results suggest that the 17-item one-factor model does not fit the data well, but the 8-item version from Vargo et

[1]Note, the need to explore a succeeding form of invariance is dependent on the results of the preceding analyses (cf. Meredith, 1993; Widaman & Reise, 1997).

al. (2015) may provide adequate fit for adult athletes. Furthermore, the results did not provide support for measurement invariance across age groups. That is, the modified factor structure of the PEAS did not replicate among adolescents.

Discussion

The purpose of this paper was to examine the factor structure of the PEAS (Petróczi & Aidman, 2009) among adult and adolescent athletes. The 17-item PEAS displayed a poor model fit for the overall sample, in addition to the sub-samples of adult and adolescent athletes. Indeed, the modified versions of the PEAS proposed by Gucciardi et al. (2010), Elbe and Brand (2016), and Vargo et al. (2015) all provided a better fit for the overall sample than the original 17-item PEAS. Gucciardi et al.'s and Vargo et al.'s modified versions showed a good fit for the overall sample. When we separated the data into adult and adolescent athletes, only Vargo et al.'s 8-item version demonstrated adequate fit across all of the indices for adults. Neither the original 17-item PEAS nor the other versions demonstrated a good fit for the adolescent athletes.

The present findings suggest scholars should not use the original 17-item PEAS (Petróczi & Aidman, 2009) to assess attitudes towards doping among adult athletes aged 19 years and older, due to an inadequate model fit. Our findings imply that scholars can still use the PEAS to assess attitudes towards doping among adult athletes, but should use the modified 8-item version adopted by Vargo et al. (2015). Indeed, the 8-item version proposed by Vargo et al. (2015) is also more favourable than in comparison to other modified versions within the doping literature (e.g., Elbe & Brand, 2016; Gucciardi et al., 2010).

In regards to adolescent athletes, our findings imply that scholars should use the PEAS with caution to assess attitudes towards doping among this group of athletes, due to a poor model fit. The model fit for the PEAS did not improve to an acceptable level for adolescent athletes, even after testing the 11-item, 6-item, and 8-item versions of the scale

(Elbe & Brand, 2016; Gucciardi et al., 2010; Vargo et al., 2015). We offer two possible explanations regarding why the original and modified versions of the PEAS demonstrated poor model fit. Firstly, the wording of the questionnaires may not have been suitable for adolescent athletes. Secondly, although limited information is provided on the development of the PEAS and theoretical underpinning, it appears that the PEAS was developed for adults, given that all of the athletes in Petróczi and Aidman's (2009) study were adults. Recent research by Nicholls et al. (2015) identified some subtle differences between adults and adolescents in terms of attitudes towards doping and doping susceptibility. As such, we propose that an adolescent doping inventory is developed. Such a scale needs developing so that adolescents can fully understand all questions and an age specific doping framework underpins the questionnaire. Two frameworks that scholars could use to underpin the development of an adolescent specific doping questionnaire are Lazuras et al.'s (2015) Integrative Model of Doping Use or Nicholls et al.'s SDCM-AA. With researchers indicating that adolescence adolescents are at risk of doping (Schirlin et al., 2009) and this being a period of a person's life for attitude development (Harton & Latane, 1997), it is important that there are tools available for scholars to accurately assess doping attitudes among this population. Adolescent specific measures would enable scholars and governing bodies to identify at risk athletes or help monitor the effectiveness of anti-doping interventions on changing doping attitudes.

The findings of this study also raise a larger question, which goes beyond the doping literature, relating to scholars using invalidated questionnaires with adolescent samples. There are a number of questionnaires that are used with adolescents such as the Mental Toughness Questionnaire 48 (Clough, Earle, & Sewell, 2002), the Stress Appraisal Measure (Peacock & Wong, 1990), and the Dispositional Coping Inventory for Competitive Sports (Hurst, Thompson, Visek, Fisher, & Gaudreau, 2011) that were validated with adult samples.

Based on the findings of the present study, we argue that scholars should validate these questionnaires and others with adolescent athletes, before they are used with this population. We echo Compas et al.'s (2001) sentiment that adolescents are not mini adults and that age appropriate questionnaires and theoretical frameworks for this population are required.

Limitations and Future Research

Caucasian athletes (82.4%) featured prominently in our sample, so it is plausible that our findings may only relate to Caucasian athletes. Future research could explore the model fit of the PEAS (Petróczi & Aidman, 2009) with a more balanced ethnic sample. Given that the PEAS appears an unsuitable questionnaire to assess attitudes towards doping among adolescent athletes, researchers could focus their efforts on developing adolescent specific measures.

Conclusion

The model fit of the 17-item PEAS (Petróczi & Aidman, 2009) provided a poor model fit. The model improved by using 11-item, 8-item, and 6-item versions of the PEAS (Elbe & Brand, 2016; Gucciardi et al., 2010; Vargo et al., 2015). Only Vargo et al.'s (2015) 8-item version of the PEAS demonstrated an adequate fit across all indices for adults. Scholars could use the 8-item version of the PEAS in the future to assess attitudes towards doping among adult athletes. No model, however, demonstrated an acceptable fit for adolescent athletes. As such, our data would imply that scholars should use the PEAS with caution among adolescent athletes, due to the poor model fit of all versions tested. We recommend that scholars devise doping attitudes questionnaires specifically for adolescent athletes and ground the questionnaires in an appropriate theoretical framework.

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Table 1.

Model fit indices for CFAs of different age groups

Model	χ^2	*df*	CFI	TLI	SRMR	RMSEA (± 90% CI)
17-item: Overall	1177.14	119	.86	.84	.05	.088 (.083-.092)
17-item: Adolescents	774.30	119	.80	.77	.07	.108 (.101-.116)
17-item: Adults	701.17	119	.87	.86	.05	.085 (.079-.091)
Gucciardi et al. (2010) 11-item: Overall	344.00	44	.93	.91	.04	.077 (.069-.085)
Gucciardi et al. (2010) 11-item: Adolescents	194.80	44	.92	.90	.05	.085 (.073-.098)
Gucciardi et al. (2010) 11-item: Adults	256.58	44	.92	.90	.05	.084 (.074-.094)
Gucciardi et al. (2010) 6-item: Overall	79.82	9	.96	.93	.03	.083 (.066-.100)
Gucciardi et al. (2010) 6-item: Adolescents	58.61	9	.94	.90	.04	.108 (.083-.135)
Gucciardi et al. (2010) 6-item: Adults	56.45	9	.95	.92	.03	.088 (.067-.110)
Elbe & Brand (2016) 6-item: Overall	81.31	9	.96	.92	.03	.083 (.067-.101)
Elbe & Brand (2016) 6-item: Adolescents	69.55	9	.92	.97	.05	.120 (.094-.147)
Elbe & Brand (2016) 6-item: Adults	65.54	9	.94	.90	.04	.096 (.075-.118)
Vargo et al. (2015) 8-item: Overall	131.24	20	.97	.96	.03	.069 (.058-.081)
Vargo et al. (2015) 8-item: Adolescents	12.133	20	.93	.90	.04	.104 (.086-.122)
Vargo et al. (2015) 8-item: Adult	94.96	20	.97	.95	.03	.074 (.059-.089)

Note. Adolescents (18 years and under), $N = 470$. Adults (over 18 years), $N = 684$. CI = Confidence intervals.