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The effects of the iPlayClean education programme on doping attitudes and susceptibility to use banned substances among high-level adolescent athletes from the UK: A cluster-randomised controlled trial

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ABSTRACT

Background This study examined the effects of the iPlayClean anti-doping intervention on attitudes towards doping and susceptibility, and whether delivery mode affected the results.

Methods A total of 1081 high-level UK athletes (14–18 years old, 904 males, 177 females) were cluster-randomised to the control (11 teams/organisations/schools, 314 athletes), face-to-face group presentation (8 teams/organisations/schools, 254 athletes), online (11 teams/organisations/schools, 251 athletes), or face-to-face presentation with online access (5 teams/organisations/schools, 262 athletes).

Results Compared to the control group, all modes of the iPlayClean anti-doping education programme reduced favourable attitudes towards doping immediately after the intervention, which was sustained across all intervention groups 8 weeks later. All delivery modes impacted doping susceptibility immediately after the intervention, in comparison to the control group, but the effects were only sustained for the face-to-face presentation group.

Conclusion Contrary to findings within previous anti-doping interventions, we have shown that doping attitudes can be changed and that the results can be sustained across all modes of delivery, 8 weeks later. Research is required to assess for how long these changes are sustained, and how often anti-doping education should be delivered to high-level athletes to reinforce clean play values.

Organisations such as the World Anti-Doping Agency (WADA) are concerned about the use of banned substances and methods, particularly among young athletes aged between 14 and 18 years. Indeed, Howman (2015), the former WADA director general, recently stated in an interview that "the area of most concern for us is young athletes who have not broken through into the elite, who are trying to get that breakthrough and are susceptible to taking drugs because that's a shortcut." Addressing the psychological factors that influence doping may reduce its prevalence among adolescent athletes (Nicholls et al., 2017).

A model designed to explain the factors that predict doping among adolescent athletes is the Sport Drug Control Model for Adolescent Athletes (SDCM-AA; Nicholls et al., 2015). The SDCM-AA posits that an athlete's attitude towards doping and doping susceptibility are key factors that predict whether an athlete will dope or not, and, hence, are the primary and secondary outcomes of the present study. In regards to doping attitudes, Zelli, Mallia, and Lucidi (2010) assessed a number of constructs such as attitudes and intentions at Time 1 and doping behaviour 4–5 months later, with a sample of adolescent athletes. They found that favourable attitudes towards doping were associated with intentions to dope, which predicted doping behaviour. In a similar study, Lucidi, Zelli, and Mallia (2013) also found that attitudes towards doping were associated with intentions at Time 1, which predicted doping behaviour three months later. Doping susceptibility is "the absence of a firm resolve not to engage in doping activities or to give any consideration at all to an offer to do so" (Gucciardi, Jalleh, & Donovan,

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2010, p. 481). The coaches in the Nicholls et al. (2015) study suggested that doping susceptibility was a key construct that would predict doping behaviour among adolescent athletes. It has been argued that when doping susceptibility is associated with favourable attitudes towards doping among athletes, it is a proxy for doping behaviours (Barkoukis, Lazuras, Lucidi, & Tsorbatzoudis, 2015; Blank, Schobersberger, Leichtfried, & Duschek, 2016). To date, however, researchers have not assessed whether doping susceptibility predicts doping behaviour among adolescent athletes. It should be noted that susceptibility positively predicts substance use among adolescents. Longitudinal studies found that susceptibility predicted alcohol use (Andrews, Hampson, Barckley, Gerrard, & Gibbons, 2008; Cranford, Zucker, Jester, Puttler, & Fitzgerald, 2010) and smoking behaviours (e.g., Jackson, 1998). Further, reducing susceptibility appears to lower alcohol use for up to one and a half years later among adolescents (Jackson et al., 2016). Combined, these studies indicate the importance of susceptibility and attitudes in regards to doping behaviour among adolescent athletes, adding weight to the worthiness of using these constructs as the primary and secondary outcomes of the iPlayClean anti-doping intervention.

Anti-doping interventions for adolescent athletes

A recent systematic review by Bates et al. (2019) identified 14 anti-doping education interventions that were tested with adolescent athletes. The content of the interventions was classified into education about doping, persuasion not to dope, and different forms of training such as skills to resist doping and information about the correct weight training techniques. Eleven of the 14 interventions were designed to reduce the risk factors associated with doping (e.g., doping attitudes, doping intentions and doping knowledge). Information on the social consequences of doping (n = 9), followed by educating athletes about the health consequences of doping (n = 8), and information on how athletes could use the behaviours taught in the interventions such as moral behaviour, goal setting, or general behaviour change (n = 5) were the most frequently used behaviour change strategies. Given the low numbers of athletes who reported doping in these studies interventions, the potential to reduce doping was low. Of interest to the current study, most of the studies reviewed by Bates and colleagues had limited success in reducing favourable attitudes towards doping, with one study even increasing them (e.g., Elbe & Brand, 2016). To address the knowledge gaps in the current literature, an aim of this paper was to assess the effects of the iPlayClean education programme on the attitudes towards doping and doping susceptibility among adolescent athletes from the UK on a talent pathway with a national governing body or professional club.

Another aim of this study was to assess whether different modes of intervention delivery affected the effectiveness of the iPlayClean programme. Over the last 10 years there has been a gradual increase in the utilisation of online learning across many educational sectors, as it enables learners to study at a time and place that suits them, and at a reduced cost, compared to traditional face-to-face learning (O' Shea, Stone, & Delahunty, 2015). Of the 14 interventions reported by Bates et al. (2019), only Elbe and Brand's (2016) intervention was delivered online. This intervention comprised of six 30-minute online sessions in which the adolescent athletes worked through 18 different ethical dilemmas associated with doping. The authors of this study assessed the impact of their intervention on attitudes towards doping. Surprisingly, Elbe and Brand's (2016) online intervention increased favourable attitudes towards doping, and thus may have made doping more likely among the athletes in their study. This finding raises doubts about the potential efficacy of online anti-doping educational programmes. It should be noted, however, that Elbe and Brand assessed doping using six items from the original 17-item Performance Enhancement Attitude Scale (PEAS; Petrózci & Aidman, 2009). Nicholls et al. (2017) found a poor model fit for the PEAS among adolescent athletes and recommended it should not be used with this population. As such, it is unclear at this stage whether it was the online mode of delivery or the scale used that may have contributed to an increase in favourable attitudes towards doping. Other studies, with non-athlete samples, have shown the efficacy of online interventions in reducing relapses in alcohol and substance abuse (e.g., Doumas, Esp, Flay, & Bond, 2017; Trudeau, Black, Kamon, & Sussman, 2017). Therefore, it appears prudent not to dismiss online delivery modes for anti-doping education, given their efficacy in related domains to this study. Testing the effectiveness of online anti-doping interventions in comparison with face-to-face presentations could have ramifications for the way in which anti-doping education is delivered.

It was hypothesised that all iPlayClean education delivery modes would reduce favourable attitudes towards doping, in comparison to the control group, and that the results would be sustained 8 weeks later. We also hypothesised that doping susceptibility would be reduced immediately after all intervention modes, in comparison to the control group, and that the results would be sustained 8 weeks later.

Method

Athletes were eligible for this study if they were on a talent pathway with a national governing body or a professional club, and were aged between 14 and 18-years-old. Consent for participation, including parental consent for athletes aged under 18 years of age, was taken in accordance with The Department of Sport, Health and Exercise Science ethics committee, which approved this study (approval number 1,516,164). Consent and assent were required to participate in this study.

Participants

In total, 1081 high-level adolescent athletes from 33 athlete teams/ organisations/ schools took part in this study. At least one parent and one coach for each athlete attended the coach and parent presentation or received online access to the iPlayClean website. There were 314 participants from 11 athlete teams/organisations in the control group; 254 participants from 8 athlete teams/organisations in the presentation only group; 251 participants from 11 athlete teams/organisations in the online only group; and 262 participants from five teams/organisations were in presentation with online access group (see Fig. 1). It should be noted that because we recruited through national governing bodies, professional clubs, and schools; there were two instances in which athletes who played the same sport from separate schools, but were affiliated to the same organisation were randomised into different groups. For example, there were eight footballers from one school in the online only group and four footballers from another school in the control group, but all of these footballers were associated with the same professional club, across different age groups. There were also 17 rugby union players from one school in the online group and six rugby union players from another school in the control group, but all of these players played for the same county across different age groups. In both cases, the control group participants were recruited first because we knew this was a risk. As such, the data would not have been affected.

Table 1 shows the sample were not well balanced for age and ethnicity at baseline. We did not test for significant differences between groups at baseline, because this is not considered good practice according the CONSORT guidelines (Moher et al., 2010). Altman (1985) stated that assessing for baseline tests only assesses for the correctness of randomisation rather than whether such imbalances may have impacted the results of an RCT. More recently, (De Boer et al., 2015) advocated that researchers follow the 2010 CONSORT guidelines and do no publish significant tests for baseline differences. The baseline participant demographics were included in the primary analysis to adjust for any essential imbalance. Tolerable imbalance was observed in experience in years, ethnicity, and religion. Gender was not balanced

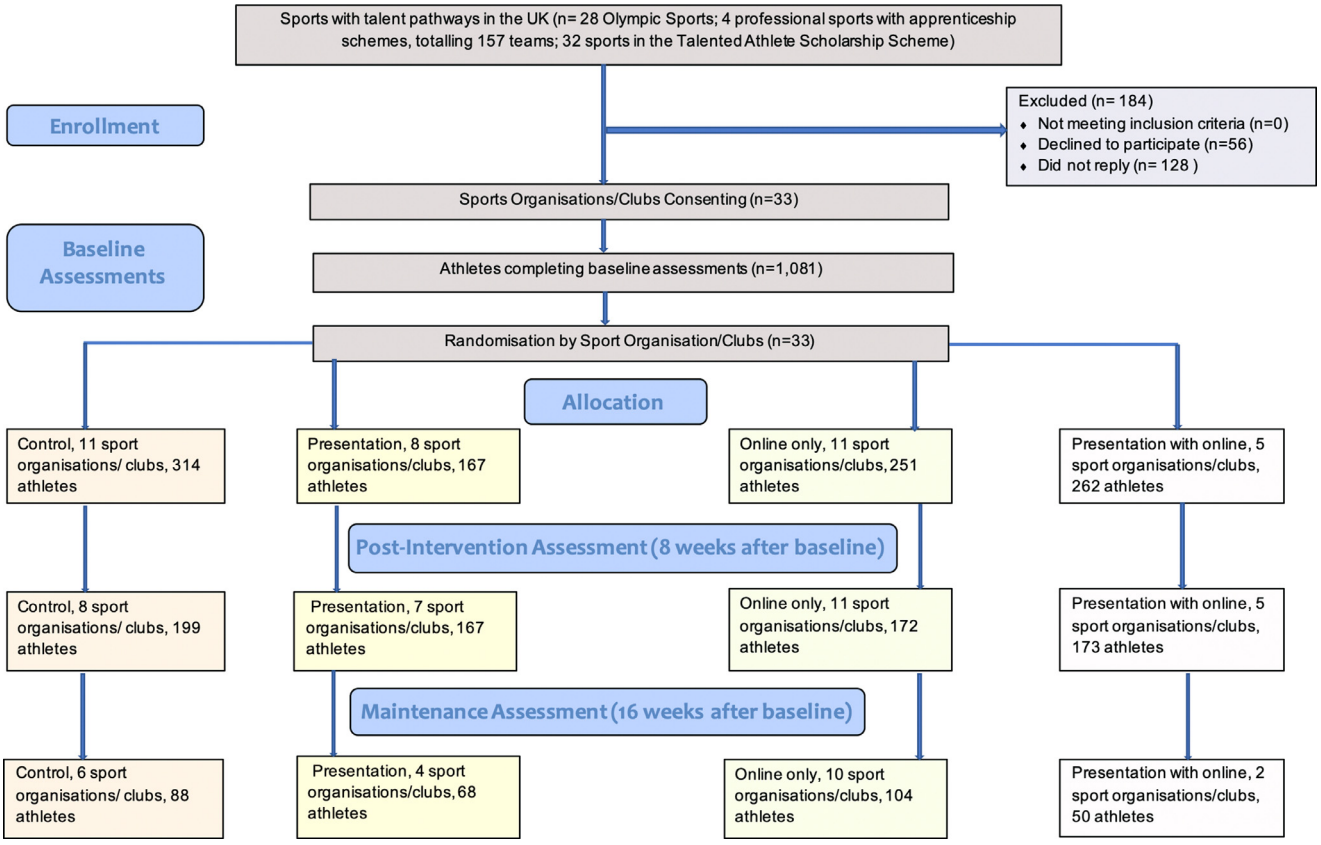

Fig. 1. Participant flow diagram.

within the four intervention groups, so it was included in primary analysis to adjust for any imbalance. See Table 2 for descriptive information for doping attitudes and Table 3 for descriptive information for doping susceptibility.

Intervention

The iPlayClean anti-doping programme is a theory (Nicholls et al., 2015) and evidence- (Nicholls et al., 2017; Ntoumanis, Ng, Barkoukis, & Backhouse, 2014) informed programme that was designed specifically to educate high-level adolescent athletes on talent pathways and their parents and coaches to influence doping attitudes and susceptibility. The athlete programme contains 10 modules on the following topics: introduction to doping, goals, motivation, doping myths, playing fair, resisting temptations, making the right decisions, drug testing and health, nutritional supplements, and coping strategies. In addition, the parent and coach session included a specific introduction module for this group, how to maximise the psychological environment of athletes, and how to provide social support. The iPlayClean intervention was delivered using three delivery modes: (1) face-face presentation; (2) online access, and; (3) blended face-to-face and online access, in order to assess whether the delivery method impacted upon the effectiveness of anti-doping education. The face-face presentation delivery method involved athletes attending two group presentations that lasted 90 min each, scheduled 8 weeks apart. The athlete's coach and at least one parent of the athlete attended a 60-minute presentation designed specifically for them. The online delivery method involved athletes accessing the iPlayClean website (www.iplayclean.co.uk) in front of their

Table 1
Participant demographics.

Group		Control (n = 314)	Presentation (n = 254)	Online (n = 251)	Presentation with online access (n = 262)
Age	Mean (SD)	15.9 (1.6)	16.5 (1.1)	15.9 (1.3)	16.2 (1.3)
	Min, max	14–18	14–18	14–18	14–18
Gender n (%)	Female	109 (34.7%)	16 (6.3%)	52 (20.7%)	0 (0%)
	Male	205 (65.3%)	238 (93.7%)	199 (79.3%)	262 (100%)
Experience in years	Mean (SD)	7.3 (3.3)	7.4 (3.7)	8.3 (3.4)	8.3 (3.5)
	Min, max	0–17	1–18	1–15	1–15
Ethnicity n (%)	European	289 (92.0%)	236 (92.9%)	232 (92.4%)	254 (96.9%)
	Other	20 (6.4%)	15 (5.9%)	14 (5.6%)	6 (2.3%)
	Missing	5 (1.6%)	3 (1.2%)	5 (2.0%)	2 (0.8%)
Religion	Yes	45 (14.3%)	44 (17.3%)	38 (15.1%)	34 (13.0%)
	No	266 (84.7%)	209 (82.3%)	208 (82.9%)	226 (86.3%)
	Missing	3 (1.0%)	1 (0.4%)	5 (2.0%)	2 (0.8%)
Main sports n (%)	Team	234 (74.5%)	252 (99.2%)	235 (93.6%)	262 (100%)
	Individual	79 (25.2%)	2 (0.8%)	16 (6.4%)	0 (0%)
	Missing	1 (0.3%)	0 (0%)	0 (0%)	0 (0%)

Table 2
Descriptive information for attitudes to doping.

		Control	Presentation	Online	Presentation with online access
Pre-education	*n* =	313	254	251	262
	Mean (SD)	9.8 (5.9)	10.5 (7.3)	11.1 (6.7)	9.3 (6.3)
	Min, max	4–28	4–28	4–28	4–28
Immediately after education	*n* =	210	169	172	173
	Mean (SD)	10.7 (6.7)	5.8 (2.7)	6.0 (3.2)	6.4 (3.1)
	Min, max	4–28	3–18	3–21	4–17
8 weeks after finishing education	*n* =	88	68	104	50
	Mean (SD)	9.9 (6.2)	4.9 (1.5)	6.4 (3.1)	6.6 (3.0)
	Min, max	4–28	4–8	4–17	4–16

Table 3
Descriptive information for doping susceptibility.

		Control	Presentation	Online	Presentation with online access
Pre-education	*n* =	313	254	251	262
	Mean (SD)	12.5 (8.2)	9.7 (6.6)	12.3 (8.1)	15.2 (10.4)
	Min, max	5–35	5–35	5–35	5–35
Immediately after education	*n* =	210	166	172	173
	Mean (SD)	12.2 (7.3)	7.5 (3.7)	9.1 (5.4)	8.7 (4.4)
	Min, max	5–35	5–25	5–35	3–23
8 weeks after finishing education	*n* =	88	68	104	49
	Mean (SD)	12.5 (7.9)	6.3 (2.7)	9.8 (6.1)	10.9 (6.3)
	Min, max	5–35	4–20	4–35	5–21

teacher or coach. The presentation with online access group involved athletes attending the same two group presentations that lasted 90-minutes and were eight weeks apart, before receiving access to the iPlayClean website. The control group received no anti-doping education and carried on training and competing in their sport as normal. Athletes were cluster-randomised based on approximate numbers in each organisation/club using a computer-based randomisation procedure into: (1) control group, (2) face-to-face presentation, (3) online, or (4) blended group presentations and online access.

Outcome measures

The Adolescent Sport Doping Inventory (ASDI; Nicholls et al., 2019) was used to assess the primary (i.e., doping attitudes) and secondary outcomes (i.e., doping susceptibility) of this study. The doping attitude subscale of the ASDI contains four questions such as "In order to be successful in my sport, I need to take PEDs" and "Legalising PEDs would benefit my sport." The susceptibility subscale contains five questions such as "I would be tempted to take PEDs, if I knew they would increase my performance" and "I would be tempted to take PEDSs if I had a bad injury." Both subscales were completed on the same 7-point Likert-type scale that was anchored at '1 = *Strongly Disagree*' and '7 = *Strongly Agree*.'

Athletes in the iPlayClean groups completed the ASDI immediately before the intervention, immediately after completing the intervention (eight weeks after the first assessment), and then again eight weeks later. The primary endpoint was immediately after completion of the intervention. Athletes in the control group completed the ASDI at the same time points.

Statistical analysis

Participant characteristics were summarised by descriptive analyses using mean (SD), minimum-maximum, or n (%), as appropriate. Each ASDI subscales was tabulated as mean (SD), minimum-maximum by intervention groups at three time points (pre-education, immediately after education and 8 weeks after finishing education).

The primary analysis was undertaken according to the intention to treat principle (Gupta, 2011). Two-level regressions were performed with each ASDI subscale at follow-up points (immediately after education and 8 weeks after finishing education) as dependant variables, adjusting for its baseline subscale, gender and intervention groups. Intervention effects (compared to control group) were reported with 95% confidence interval (CI). Intraclass correlation (ICC) in each model was also reported. We also carried out a per-protocol analysis as secondary analysis via the same two-level regression model, excluding two athlete teams that potentially contaminated intervention. SPSS (version 24) and R language (version 3.5) were utilised for statistical analysis.

Results

Intervention effects for doping attitudes

Immediately after education, compared to control group, the intervention effect was −4.8 (95% CI −6.6 to −3.0; $p < 0.01$) for presentation only group, −4.4 (95% CI −6.1 to −2.7; $p < 0.01$) for

Table 4
Intervention effect on doping attitudes.

	Presentation Intervention effect (95% CI)	*p* value	Online Intervention effect (95% CI)	*p* value	Presentation with Online Access Intervention effect (95% CI)	*p* value	Overall Number of participants included	ICC
Immediately after education	−4.8 (−6.6, −3.0)	<0.01**	−4.4 (−6.1, −2.7)	<0.01**	−4.0 (−6.0, −2.1)	<0.01**	724	0.14
8 weeks after finishing education	−5.4 (−7.0, −3.9)	<0.01**	−3.7 (−5.1, −2.4)	<0.01**	−3.9 (−5.8, −2.1)	<0.01**	310	0.04

** indicates it is significant at 0.01 significance level.

the online group, and −4.0 (95% CI −6.0 to −2.1; $p < 0.01$) for presentation with online access group (Table 4). The ICC was 0.14, indicating 14% of the total variance is accounted for by variations between athlete teams/organisations. At eight weeks after finishing education, the intervention effect was −5.4 (95% CI −7.0 to −3.9; $p < 0.01$) for presentation only group, −3.7 (95% CI −5.1 to −2.4; $p < 0.01$) for the online group and −3.9 (95% CI −5.8 to −2.1; $p < 0.01$) for presentation with online access group. The ICC was 0.04, indicating 4% of the total variance is accounted for by variations between athlete clusters (see Table 2). The effect sizes for the primary outcome, immediately after the intervention were 0.73 (presentation only), 0.70 (online group), and 0.66 (presentation with online access). Our intention to treat and per protocol analyses also demonstrates consistency in results (see Electronic Supplementary Material Appendix S1).

Intervention effects for doping susceptibility

Immediately following the anti-doping education, after adjustments for baseline susceptibility and gender, compared to control group the intervention effect for the presentation group was −4.3 (95% CI −5.5 to −3.0; $p < 0.01$), whereas the intervention effect for the online group was −3.2 (95% CI −4.3 to −2.0; $p < 0.01$). Finally, the intervention effect immediately after the anti-doping education for the presentation and online access group was −4.6 (95% CI −5.8 to −3.3; $p < 0.01$). The ICC was 0.01, indicating teams/organisations accounted for 1% of the total variance. After 8 weeks following completion the intervention effects were −5.1 (95% CI −7.9 to −2.3; $p < 0.01$) for the presentation group, −2.2 (95% CI −4.7 to 0.2; $p = 0.07$) for the online group, and. −3.2 (95% CI −6.7 to 0.3; $p = 0.07$) for the presentation and online access group. The ICC was 0.09, indicating 9% of the total variance is accounted for by variations between athlete clusters (see Table 5).

Discussion

An aim of this intervention was to assess the effects of the iPlayClean education programme on doping attitudes among high-level adolescent athletes from the UK. A secondary aim of this study was to compare the different delivery modalities of iPlayClean (e.g., face-to-face presentation, online, and face-to-face presentation with online access). Our hypotheses were generally supported, as the iPlayClean intervention reduced favourable attitudes towards doping across all modalities of delivery immediately after the intervention, and these effects were sustained eight weeks later. In regards to doping susceptibility, all delivery modes reduced doping susceptibility immediately after the intervention. These effects, however, were not sustained in the online group or presentation with online access, eight weeks later. In regards to the changes in doping attitudes, the doping attitude and susceptibility subscales of the ASDI (Nicholls et al., 2019) contain four and five 7-point Likert scale questions, respectively, so their effectiveness can be translated into a Likert scale change. For example, the 4.8 reduction in doping attitude for presentation only group indicates an average of a one-point change in the Likert-type scale across this group of athletes.

Attitudes towards doping appears to be an important predictor of doping behaviour among adolescent athletes (Lucidi et al., 2013; Zelli et al., 2010). Unfortunately, existing anti-doping interventions had a limited impact on reducing favourable attitudes towards doping (Bates et al., 2019). A possible reason for the success of the iPlayClean intervention in reducing favourable attitudes towards doping is that it targeted the antecedents of doping attitudes among adolescent athletes. As such, there were modules on each of the key factors that are thought to underpin an adolescent athlete's attitudes towards doping in the SDCM-AA. In particular, the iPlayClean intervention contained modules that attempted to increase the threat of being caught and developing ill health through doping, reducing the perceived benefits of doping using athlete testimonials, reducing the influences that others have on an athlete, the immorality of doping, and legitimacy of anti-doping organisations' testing procedures.

Susceptibility is another key construct linked to young athletes using banned substances, especially when it is associated with favourable doping attitudes (Barkoukis et al., 2015; Blank et al., 2016). In support of our hypotheses, all iPlayClean delivery modes had an immediate effect at reducing perceived doping susceptibility. These effects, however, weakened over time for the online group and presentation with online access group, but not for the presentation only group. Although researchers have failed to assess the impact of anti-doping interventions on susceptibility towards doping longitudinally among adolescent athletes, other scholars have shown that interventions can reduce susceptibility for up to 48 months post-intervention (Jackson et al., 2015). It would be interesting to see how long the effects of the presentation only group would be sustained for, beyond the 8 weeks measured in this study.

Another aim of this paper was to compare the impact of the mode of delivery on the primary and secondary outcomes. Our findings somewhat contrast to the literature that has compared the effectiveness of face-to-face and online interventions. A meta-analysis by Suh, Sohn, Kim, and Lee (2019), which evaluated the effectiveness of randomised controlled trials on reducing perfectionism and symptoms of both anxiety and depression, indicated that there were no differences between face-to-face and online delivery modalities. Wagner, Horn, and Maercker (2014) compared the immediate and 3-month follow up effects of an online and face-to-face intervention on depressive symptoms. Both modalities were effective at reducing depression, but when the participants were assessed three months later, depressive symptoms of those in the online group remained stable but increased for the face-to-face group. Although the contexts in the Wagner et al. (2014) study and the present study are different, the internet modality in the former study appeared to have more sustained effects than the face-to-face modality, which contrasts our findings. We offer two explanations for this discrepancy. Firstly, there were only 62 participants in the Wagner et al. (2014) study and the authors suggested that their findings needed to be re-examined in an adequately powered study. As such, Wagner's findings may not be generalisable to a much larger sample. Secondly, the athletes in the online group in our study might not have completed the whole online section. van Ballegooijen et al. (2014) reported significant differences in completion rates between face-to-face and online delivery modalities for cognitive behavioural therapy; 84.7% of participants in the face-to-face group completing their

Table 5
Intervention effect on doping susceptibility.

	Presentation Intervention effect (95% CI)	*p* value	Online Intervention effect (95% CI)	*p* value	Presentation with Online Access Intervention effect (95% CI)	*p* value	Overall Number of participants included	ICC
Immediately after education	−4.3 (−5.5, −3.0)	<0.01**	−3.2 (−4.3, −2.0)	<0.01**	−4.6 (−5.8, −3.3)	<0.01**	721	0.01
8 weeks after finishing education	−5.1 (−7.9, −2.3)	<0.01**	−2.2 (−4.7, 0.2)	0.07	−3.2 (−6.7, 0.3)	0.07	309	0.09

**indicates it is significant at 0.01 significance level.

intervention, compared to only 65.1% in the online group. As such, participants in the online only iPlayClean group might not have completed all sections of the online programme, which could potentially affect the immediate fidelity and long-term effect of the intervention. We did not assess the completion rate of the online iPlayClean intervention. Further research is required to explore the long-term effects of delivery modality with anti-doping education on key psychological constructs such as attitudes and susceptibility. It is also unclear why susceptibility among those in the face-to-face presentation with online access diminished after 8 weeks. Researchers could explore by conducting interviews, to understand the athletes' experiences of completing the iPlayClean across different modalities.

One of WADA's biggest concerns relates to doping among adolescent athletes on the cusp of becoming elite athletes. Our findings may therefore be important to WADA and other National Anti-Doping Organisations (NADOs). Given the importance of attitudes in influencing doping behaviour (Lucidi et al., 2013; Zelli et al., 2010) and early adolescence being a period of one's life when attitudes are formed and take shape (Kjellström, Sjölander, Almers and Mccall, 2017), the timing in which athletes are exposed to anti-doping education may be important. If athletes are not exposed to anti-doping education until their late teens, they may become susceptible to forming favourable attitudes towards doping. As such, we believe that NADOs could target young adolescents with key messages about fair play and playing clean without drugs, rather than waiting until they become elite athletes.

Limitations

There are several limitations of this research. Firstly, there were high attrition rates from pre-education to immediately after the education, and then eight weeks after the education finished. Immediately after the iPlayClean education programme, the completion rates in the control, presentation only, online only and presentation with online access groups were quite similar, ranging from 66% to 69%. At eight weeks after finishing iPlayClean, completion rates further dropped down to between 27% to 29%, except for online only group, which was 41%. An issue with conducting research among high-level youth athletes is the high rate of attrition within a study, as athletes can be released from clubs at different times throughout the season or change age groups, which is becoming increasingly common in professional academies. To handle missing data at follow-ups, complete case analysis was initially undertaken. Sensitivity analysis with imputed missing values using multiple imputation approach (imputation model set as linear regression adjusting for baseline characteristic factors; with 20 imputations per case) were then carried out at each follow-up for the attitude and susceptibility subscales, which yielded consistent results.

Before this study took place, the magnitude of intervention effect size was uncertain, because both the ASDI (Nicholls et al., 2019) and the iPlayClean intervention are newly developed. We had planned to analyse the data using latent true modelling, which meant recruiting at least five cases per estimated model parameter for latent variable models. As such, our sample size at baseline was more than adequate for these analyses, but the high attrition rate meant these analyses could not be performed. As such, post-hoc analyses were conducted to ensure the study has adequate power for the statistical analyses employed. With a moderate effect size of 0.4, and by accommodating an ICC of 0.1, 32 sites recruiting an average of 15 participants results in a total sample size of 480 at 5% alpha and 80% power. This study successfully recruited 1081 participants from 33 athlete teams, which indicates adequate power. However, the high attrition rates may affect the actual power for primary analysis. Another limitation relates to the short length of time that the effects of the intervention were assessed over. Some studies have assessed the effects of substance related interventions up to 48 months post-baseline (Jackson et al., 2016), but the current study only assessed intervention effects 16 weeks post-baseline.

Conclusions

This study provides evidence to suggest that it is possible to reduce favourable attitudes towards doping and doping susceptibility for at least eight weeks. It would be interesting to see how long these findings could be sustained for and the extent to which manipulating attitudes and susceptibility influence doping prevalence among young high-level athletes. The delivery mode seems to be more important for susceptibility than it does for attitudes in regards to sustaining the effects. Our findings suggest that online anti-doping education is a cost-effective way of exposing many athletes to fair and clean competition values, without using banned substances.

Declaration of Competing Interest

None.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.drugpo.2020.102820.

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