

Original article

An evaluation of prevention initiatives by 53 national anti-doping organizations: Achievements and limitations

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Abstract

Background: One main purpose of the World Anti-Doping Agency was to harmonize anti-doping efforts, including the provision of anti-doping education. A multifaceted approach to doping prevention can play a key role in preventing intentional and unintentional doping. This article aimed to systematically record and evaluate doping prevention approaches in the form of information and education activities of national anti-doping organizations (NADOs) and assess the extent to which a multifaceted doping prevention approach has been realized.

Methods: Data on anti-doping information and education activities of 53 NADOs were collected via a survey and an online search of the NADOs' websites. Prevention activities were classified into knowledge focused, affective focused, social skills, life skills, and ethic- and value-based. The implementation of the prevention activities was assessed by 4 independent raters using a modified visual analogue scale.

Results: In total, 59% of the NADOs ($n = 38$) returned the survey and 70% ($n = 45$) had information available online. The data were combined for the visual analogue scale assessment. Overall, 58% of the NADOs ($n = 37$) reported offering activities including elements of all 5 approaches. Results of the raters' assessments indicated that the knowledge-focused approach was best implemented; the implementation of the other 4 approaches was largely unsatisfactory. The most common barriers to implementing doping prevention programs reported by the NADOs were lack of resources ($n = 26$) and difficulties in collaborating with sports organizations ($n = 8$).

Conclusion: Results show a discrepancy between NADOs' self-report data and the implementation assessment. Even though the NADOs indicated otherwise, most of their education-based approaches did not address aspects of the visual analogue scale (e.g., resisting peer pressure) and only a few programs were ongoing. Possible explanations might be found in the reported barriers (e.g., financial). Concrete guidelines defining multifaceted, values-based education, and best practice examples should be developed to indicate how to include all 5 approaches in prevention. 2095-2546/© 2020 Published by Elsevier B.V. on behalf of Shanghai University of Sport. This is an open access article under the CC BY-NC-ND license. (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Anti-doping program; Doping prevention; Education; Harmonization; NADO

1. Introduction

The main purpose of the World Anti-Doping Agency (WADA) is to protect athletes' right to participate in drug-free sport and "to ensure harmonized, coordinated, and effective anti-doping programs with regard to detection, deterrence, and prevention of doping" (p. 11).¹ The World Anti-Doping Code

(WADC) is the fundamental document upon which this unified fight against doping is based. Since the publication of the 1st Code in 2004, National Anti-Doping Organizations (NADOs) have been provided with rules and guidelines concerning the adoption and implementation of anti-doping legislation, cooperation with other organizations, reciprocal testing between NADOs, and the need to support anti-doping research.² The 3rd Code, published in 2015, provided more detailed information on anti-doping education, including the goal of education programs and the minimum number of issues to be covered (Article 18).³ Even though these rules and responsibilities are

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specified in the WADC, the implementation, which also includes the provision of anti-doping education, is left to the individual code signatories.¹ Studies have shown that this freedom might undermine harmonization because large variations were found in the implementation of anti-doping regulations among NADOs.^{4–6}

Only a few studies have investigated the implementation of information- and education-based doping prevention efforts. A study by Patterson et al.⁷ investigated anti-doping education for coaches among national and international sporting and anti-doping organizations. The study found great variability regarding education programs in place: some federations use face-to-face workshops based on WADA's CoachTrue program, others develop their own workshops or use e-learning specifically for coaches (e.g., Coach Clean by UK Anti-Doping), and some only have generic programs. In general, coaches seem to receive anti-doping education only sporadically, because training elite athletes and the avoidance of a positive doping test are prioritized.⁷ Furthermore, a recent evaluation study in Finland investigated 70 Finnish sport organizations and categorized their anti-doping programs into developing (0–36 points), average or middle level (37–45 points), and top level (46–64 points). According to the results of the study's assessment, only 23 national sport federations are carrying out top-level anti-doping activities.⁸ However, regarding athletes, research assessing prevention activities provided by NADOs in terms of their content, target group and frequency is still scarce. Thus, this article aims to give an overview of doping prevention programs in the form of information and education activities offered by NADOs around the world. The goal was to provide information regarding the extent to which multifaceted doping prevention is being implemented. Additionally, we aimed to evaluate the potential constraints that NADOs face.

1.1. The idea of harmonizing anti-doping activities and the importance of NADOs

In the 1990s, several doping incidents pressured the International Olympic Committee (IOC) and led to a change in the organization of anti-doping activities. During that time, several disparities were evident: international and national sport federations and anti-doping organizations used different rules, research policies lacked coordination, and little was done to advance anti-doping activities at the international level.⁹ Consequently, WADA was established in 1999 with the aim of leading a coordinated movement toward doping-free sport, by harmonizing anti-doping rules worldwide.^{10,11} These rules and responsibilities of all signatories were outlined in the 1st Code.² To date, more than 660 sports organizations have accepted the Code. This includes 144 NADOs (of which one was classified as non-compliant in August 2019) and other sporting bodies such as federations and National Olympic Committees.¹² The rules in the code also included education- and information-based doping prevention. For the harmonized implementation of these rules in every aspect, NADOs are one of several important stakeholders (next to national and international sport federations, sport clubs, etc.). NADOs can be

considered as the 1st point of contact for many athletes with respect to athletes' anti-doping interactions. Most athletes are 1st tested by a NADO Doping Control Officer and receive information (such as the definition of doping, its health-affecting side effects, dangers of nutritional supplements) and anti-doping education.¹³ Research evaluating the global harmonization of anti-doping work among NADOs indicated that, despite various efforts, anti-doping practices differ for athletes from different countries and contexts, especially in terms of testing as a preventive measure.^{4,5} In terms of information- and education-based prevention, there is currently only a limited amount of research focusing on doping information- and education-based prevention activities in different countries. In this regard, the concept of harmonization might also be criticized because some authorities suggest that the exact same practice in each sport and country is not feasible and should be tailored to the target group and context.^{14–16} However, this discussion would benefit from additional detailed evidence about what is actually being done in different countries, with a focus on athletes.

1.2. Importance of the combination of information and education

The key pillars in current doping prevention work are deterrence elements (such as doping testing and banishment from sport) and prevention elements (such as information and education). Despite an increasing focus on deterrence elements in global policy¹⁵ and improved testing programs and techniques, the number of positive test results remains low (around 1%–2% each year),¹⁷ and social science research indicates that the true prevalence numbers are higher than these numbers.¹⁸ The limitations of detection-based deterrence (e.g., unequal implementation of testing^{5,6} and limited deterrence effect of testing^{15,19,20}) have led to an emphasis on the need to assign a higher priority to prevention-orientated strategies.¹⁵ If activities were focused on protective factors, athletes should be able to resist doping even though they are exposed to risk factors that might promote doping behavior. In past years, anti-doping research has focused both on the possible risk and protective factors for and against doping behavior to develop prevention measures that decrease risk and increase protection. In the context of risk factors, empirical research that was derived from different theoretical perspectives has investigated diverse possible risk factors to predict doping attitudes and behavior. This research was mainly informed by models from behavioral, social and health psychology such as the Theory of Planned Behavior,²¹ the Health Action Process Approach,²² or the Self-Determination Theory.²³ Two meta-analyses summarized all potential predictors identified in various studies, and the results showed that factors such as attitudes toward doping, perceived social norms, training/coaching environment, moral disengagement, goal orientation, and situational temptation predict doping intention, susceptibility, and behavior.^{24,25} In the context of protective factors, personal factors such as strong morality, self-control, and resilience against peer pressure seem to be important.^{16,26,27} Similarly, Englar-Carlson

et al.²⁸ proposed that positive psychology, a perspective similar to health promotion, be used as a tool for anti-doping by exploring how athletes could overcome difficult situations without doping. They emphasized the importance of focusing on the strengths of athletes, their motivation to remain clean, and how their social relationships support their cleanliness. This approach should be translated into prevention efforts by creating anti-doping education programs that also include the experiences and characteristics of successful clean athletes, thus, strengthening these protective factors.²⁸

Knowledge (or the lack thereof) about prohibited substances and methods can be considered from both perspectives, and its significance has been demonstrated.^{29–32} Even though the small effect sizes (based on Cohen³³) calculated in 2 meta-analyses^{24,25} indicated that the predictive power and associations were rather low, providing sufficient information and increasing awareness of the topic should be integrated into prevention efforts. Preventing unintentional doping seems to be especially important in view of the high number of athletes using dietary supplements; some studies have shown that these supplements can be contaminated and can contain prohibited substances such as anabolic steroids or stimulants.^{34–36} The absence of knowledge about the possible dangers of nutritional supplements might lead to unintentional doping cases.³⁷ A study on awareness of these risks among adolescent athletes showed that only 40.6% refused to eat a food product that was given to them, and only 16.1% read the ingredients list before eating.³⁸ Based on this research evidence, there was a demand for additional information for athletes and their support personnel^{31,32} to improve knowledge about the risks of doping in an information-based approach.

Research not only from doping prevention, but also from the social and health psychology and health promotion fields highlights the importance of integrating all of these concepts into prevention measures to reduce risk factors and augment protective factors.^{14,28} Such a multifaceted approach has already proven effective in other domains like social exclusion (i.e., bullying)³⁹ and tobacco⁴⁰ and alcohol use.⁴¹ The results of a literature review of empirical research concerning these domains and aimed at providing recommendations for anti-doping indicated that the most important facet for an effective intervention was that it be interactive, that is, that it encourage the interaction of participants via methods such as role-playing, debates, and discussions about knowledge, social skills, life skills, and values.¹⁴ Additionally, prevention programs are most effective when targeted at children and adolescents because attitudes and values are being formed during these stages of life.^{14,42} Thus, it is important that prevention programs be customized for specific target groups, that is, separately for adolescents and adults.

1.3. Classification of doping prevention measures

To support NADOs in developing, implementing, and evaluating education programs in accordance with scientific evidence, WADA published education guidelines based on Donovan's Sport Drug Control Model.⁴³ These guidelines classify different prevention approaches by clearly differentiating

between information (i.e., providing basic knowledge) and education (i.e., focusing on prevention and being value-based).⁴⁴ However, despite the importance attributed to value-based education, the term itself is only vaguely defined.

Backhouse et al.³⁷ further categorized the main approaches used in doping prevention that were found to be effective in tackling unhealthy behavior.¹⁴ The 5 approaches identified were (1) "knowledge-focused (e.g., side effects)", (2) "affective-focused (e.g., targeting feelings of value and self-worth)", (3) "social skills training (e.g., assertiveness, decision-making, and resistance to peer pressure)", (4) "life skills training (e.g., multicomponent: social skills, personal skills, and knowledge)", and (5) "ethic- and value-based (e.g., against the rules, fair play, honesty, and integrity)" (p. 53).³⁷ Aside from this categorization, however, no further guidelines on the implementation of multifaceted prevention approaches at the local level exists. WADA only offers some general guidelines, for example, that value-based education is best delivered at a young age and that face-to-face sessions are most effective.³ The actual mode of implementation is left to the individual NADOs, a situation that can lead to significant differences in anti-doping programs, depending on the country and the individuals responsible for implementing the measures.

1.4. Aims of the current study

There is strong empirical support for the potential success of multifaceted prevention that goes beyond pure sharing of information.^{7,14,45} Despite the pivotal importance of providing information to decrease intentional and unintentional doping, few studies have explored the actual prevention work of NADOs. Especially regarding information- and education-based doping prevention, aside from the studies from Patterson et al.⁷ focusing on coaches and the Finnish Center for Integrity in Sports focusing on sport organizations, there exists no research that has systematically explored how NADOs around the world have implemented information and education programs for athletes. Furthermore, we lack knowledge about the programs' content, specific target group, and frequency.

This 1st goal of the current study is to fill this gap by documenting the extent to which NADOs around the world perceive that they have implemented doping prevention approaches in the form of information and education activities. The 2nd goal is to systematically assess whether NADOs understand that multifaceted education involves more than delivering information and whether that understanding is reflected in the contents of their prevention programs. The study is not intended to evaluate whether these programs are effective in decreasing doping behavior. Additionally, potential barriers that NADOs face with respect to implementing prevention programs are explored. On that basis, we discuss the extent to which the aims of multifaceted doping prevention, including value-based education but also provision of information, affective-based education, life skills training, and social skills training, have been realized and what factors might potentially limit this implementation. This study, therefore, provides insight into the current doping prevention work done by NADOs and whether the key elements that are

demanded by WADA have been implemented. It also provides insight into why specific content is not included in the programs, which might support a future discussion on the challenges of harmonization for information- and education-based prevention. These results are useful for both NADOs and WADA in adapting their prevention programs and can be used to identify possible best practice examples they can learn from.

2. Methods

2.1. Design and procedure

The current observational study is based on a survey and systematic desk research. The data collected included all written information (brochures, pamphlets, or slides, *etc.*) and all lectures/education sessions provided to adolescent (≤ 18 years) and adult (>18 years) athletes by the investigated NADOs. Because a full data collection of all 144 NADOs was not feasible for this study, investigated NADOs included those in all 28 European Union member states and all countries sending 25 or more participants to the 2018 Youth Olympic Games in Buenos Aires. The inclusion of countries sending more than 25 participants to the 2018 Youth Olympic Games is due to the current study being part of a larger study addressing doping prevention for elite adolescent athletes. Hence, we included NADOs from a wide geographical range (all continents) and balanced in size (smaller and larger NADOs). Detailed data collection procedures are outlined in Fig. 1.

2.2. Research instrument and online search strategy

To obtain an overview on prevention activities, we sent a survey (available on request) to the 64 NADOs by email. The

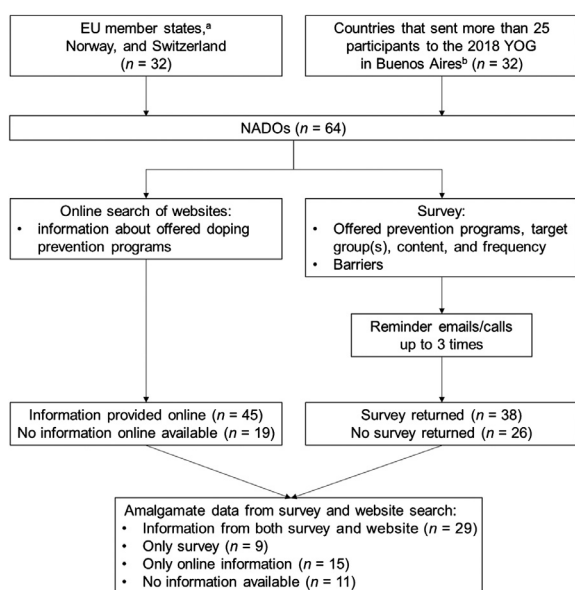


Fig. 1. Flow chart of the data collection process. ^a One country has 3 separate NADOs. ^b The current study is part of a major project, including surveying adolescent athletes at the YOG about how they perceive provided doping prevention. EU = European Union; NADOs = National Anti-Doping Organizations; YOG = Youth Olympic Games.

survey was available in English, German, and Italian. Email addresses were taken from the respective NADO websites, and the email was sent by the study team. The survey required the NADOs to specify the content, target groups, and frequency (i.e., how often the program was delivered) of their prevention programs. Based on the classification of Backhouse et al.³⁷ described in the introduction, NADOs were asked to indicate which type(s) of the 5 approach(es) each activity included (multiple answers were permitted). Activities were identified as being either for adult athletes or for adolescent athletes because, as discussed in the Introduction, education is best delivered at a young age and thus the intended audience should be reflected in the programs. Additionally, the NADOs were asked via an open-ended question about the barriers they face when trying to implement doping prevention activities. To ensure a high response rate, NADOs were reminded about the survey up to 3 times by email or were called directly. The NADOs were contacted from January to December 2018.

To gather information that was as complete as possible, we additionally searched the websites of the NADOs for published information on their doping prevention work. This included printable materials such as pamphlets and brochures as well as written information on the prevention programs they offered (i.e. description of face-to-face sessions, seminars, *etc.*). Websites without an English version were translated using an online translation tool: Google Neural Machine Translation (Google Inc., Mountain View, CA, USA).⁴⁶ The search took place simultaneously to sending out the survey, and the information was combined with the survey results (where applicable) for further analysis.

2.3. Data analysis

2.3.1. Descriptive data analysis of the survey

Data from the survey was analyzed descriptively to determine the frequencies of the types of prevention programs offered, without assessing the content objectively. Responses pertaining to the open-ended question regarding barriers were analyzed based on their content and categorized into the most common themes (e.g., resources) using thematic analysis.⁴⁷ Themes were presented descriptively as relative and absolute frequencies.

2.3.2. Content analysis of prevention programs

Following the guidelines provided by the Consensual Assessment Technique,⁴⁸ 4 researchers from the field of interest independently assessed the combined data (survey and website information) of every activity in each country. To improve objectivity, two of these researchers were not part of the research team and were unfamiliar with the research hypothesis. Both of them rated one-half of the countries each; the allocation of the countries to be rated was random. An adapted online visual analogue scale (VAS, 0–10) was developed based on the prevention classification of Backhouse et al.,^{14,37} Botvin and Griffin,⁴⁹ and the WADC³ (for details, refer to the Table 1). The VAS was used to rate how well the required content for each activity was implemented, based on what is expected to prevent

doping behavior.^{3,14,37,49} Adult and adolescent activities were rated separately for each country.

An intraclass correlation (ICC; 2-way random; single measurement; consistency) was calculated for each approach, separately for adults and adolescents, to ensure homogeneity among the raters in the VAS evaluation. Values of less than 0.5 indicated poor reliability, values between 0.5 and 0.75 indicated moderate reliability, values between 0.75 and 0.9 indicated good reliability, and values of greater than 0.9 indicated excellent reliability.⁵⁰ For approaches with an ICC of greater than 0.75, 1 mean VAS value for adults and for adolescents was generated. All approaches from a country were categorized into 4 categories according to their mean VAS value (<5.0 unsatisfactory implementation, 5.0–7.5 satisfactory implementation, 7.6–9.0 good implementation, and >9.0 excellent implementation). To the best of our knowledge, there are no evaluation studies that provide indications of the categorization of program implementation. Thus, we deliberately divided the categories

Table 1
Anchor points for the visual analogue scale assessment of the various approaches based on Backhouse et al.,¹⁴ Backhouse et al.,³⁷ Botvin and Griffin,⁴⁹ and the World Anti-Doping Code.³

Anchor points
Information
<i>Knowledge-focused approach</i>
<ul style="list-style-type: none"> • Substances and methods on the prohibited list • Anti-doping rule violations • Consequences of doping, including sanctions, health, and social consequences • Doping control procedures • Athletes' and athlete support personnel's rights and responsibilities • Therapeutic use exemptions • Whereabouts system • Managing the risks of nutritional supplements • Harm of doping to the spirit of sport
Education
<i>Affective-focused approach</i>
<ul style="list-style-type: none"> • Interactive activities (e.g., discussions, role plays, and dilemma situations) • Runs over a period of time (a single session will not be effective) or at least includes a follow-up session • Targets feelings of value and self-worth • Examine one's self-image and its effects on behavior • View personal challenges in a positive light
<i>Social skills training</i>
<ul style="list-style-type: none"> • Interactive activities (e.g., discussions, role plays, and dilemma situations) • Runs over a period of time (a single session will not be effective) or at least includes a follow-up session • Encourage assertiveness and utilize verbal/nonverbal assertiveness skills to make or refuse requests • Decision making by means of resisting to peer pressure
<i>Life skills training</i>
<ul style="list-style-type: none"> • Interactive activities (e.g., discussions, role plays, and dilemma situations) • Runs over a period of time (a single session will not be effective) or at least includes a follow-up session • Multi-component: interaction of social skills, personal skills and knowledge • Decision making (considering the consequences of each alternative solution before making decisions)
<i>Ethic- and value-based approach</i>
<ul style="list-style-type: none"> • Interactive activities (e.g., discussions, role plays, and dilemma situations) • Runs over a period of time (a single session will not be effective) or at least includes a follow-up session • Against the rules • Fair play • Honesty and integrity • Values and principles (of sport in general and/or personal)

into 4 unequal units. We argue that a prevention program should achieve at least a score of 5 on the VAS, indicating that 50% of the "required" contents are included. In our opinion, programs with a score of less than 5 cannot be considered satisfactory. Data were analyzed separately with respect to provision of information (i.e., knowledge-focused approach) and education (i.e., affective-focused approach, social skills training, life skills training, and ethic- and value-based approach).

2.4. Ethical considerations

All NADOs invited to participate were informed about the study via email and signed a written informed consent form before taking part in the study. The study was approved by the ethics board of the Private University for Health Sciences, Medical Informatics and Technology.

3. Results

In total, 64 NADOs from 62 countries were investigated. Of these, data for further analysis were available from 53 NADOs, because they either returned the survey, had information provided online or both.

3.1. NADOs' self-reported prevention programs

Of all NADOs contacted, 38 (59%) returned the survey. The self-reported results indicated that more than one-half (58%) of those NADOs offer activities, including content, from each of the 5 approaches. The knowledge-focused approach was offered most commonly (adults 90%; adolescents 97%), followed by the ethic- and value-based approach (adults 82%; adolescents 92%). In addition, 89% of the NADOs ($n = 47$) offer outreach activities at major events. For details, please refer to [Table 2](#).

The responses to the survey indicated that almost all NADOs (87%, $n = 33$) considered lectures delivered by NADO representatives or e-learning programs as knowledge-focused. If these lectures included, for example, discussions about doping or role-plays on the procedures of doping controls, they were also reported as affective-focused and ethic- and value-based. Face-to-face seminars requiring athletes' participation were mostly reported to include all 5 approaches. Education for adolescent athletes supplied by 14 NADOs also included teaching materials and consisted, inter alia, of dilemmas used to develop athletes' decision-making skills or games that illustrated the unfairness of doping (e.g., by playing a match with 1 team having fewer players). European NADOs offered most of these classroom materials, and they mostly classified them as including all 5 approaches.

3.2. Assessing the implementation of prevention programs

Doping prevention activities from 53 NADOs were assessed based on the programs' contents using the modified VAS. On average, NADOs offered 3.0 ± 1.6 (mean \pm SD; min = 1.0, max = 8.0) different prevention activities for their adult and/or adolescent athletes. In general, more programs were offered for adolescents (VAS: 2.9 ± 1.6) than for adults (VAS: 2.0 ± 1.1). Two NADOs also offered a program for children in primary schools.

Table 2
Distribution of self-reported doping prevention programs by continent (%).

Type of activity	Overall (<i>n</i> = 38)	Europe (<i>n</i> = 29)	The Americas ^a (<i>n</i> = 3)	Asia (<i>n</i> = 3)	Africa and Oceania ^b (<i>n</i> = 3)
Adult athletes					
Knowledge-focused	90	86	100	100	100
Affective focused	63	55	67	100	100
Social skills	58	52	100	100	33
Life skills	68	63	100	100	67
Ethic- and value-based	82	79	67	100	100
Adolescent athletes					
Knowledge-focused	97	97	100	100	100
Affective-focused	79	72	100	100	100
Social skills	73	69	100	100	67
Life skills	73	69	100	100	67
Ethic- and value-based	92	90	100	100	100

Note: *n* = 38 NADOs.

^a This refers to NADOs of North, Central, and South America.

^b Africa and Oceania were combined due to data protection reasons to ensure the anonymity of participating countries.

Abbreviation: NADOs = National Anti-Doping Organizations.

ICC values for all but 1 approach was less than 0.7. The ICC for the affective-focused approach for adults was 0.7, with an upper bound of 0.8, and thus was acceptable. Consequently, the mean VAS scores of all raters were calculated and allocated to the respective categories: C1 (unsatisfactory implementation; VAS < 5.0), C2 (satisfactory implementation; VAS: 5.0–7.5), C3 (good implementation; VAS: 7.6–9.0), or C4 (excellent implementation; VAS > 9.0).

Detailed results are presented in Table 3. In general, the assessment indicated that the knowledge-focused approach was best implemented across the NADOs. Among European NADOs, more than one-half (adults 63%; adolescents 64%) offered activities with good to excellent implementation (VAS > 7.5). Regarding the Americas, Asia, and Africa and Oceania (the latter two were combined for data protection reasons), good to excellent implementation was evident in 20%–50% of the surveyed NADOs, with the Americas being an outlier with 75% for adolescent programs. Overall, almost 60% of the investigated NADOs implemented the knowledge-focused approach to a good or excellent level for adults and adolescents. Regarding programs for adults, only 1 NADO received a VAS value of greater than 7.5 for the ethic- and value-based approach. The other 3 approaches were all rated with VAS values of less than 7.5. Regarding adolescents' programs, the ethic- and value-based approach was offered by 17%–60% of European, American, and African and Oceanian NADOs with a good to excellent implementation rating (VAS > 7.5). Asian NADOs lacked satisfactory implementation in all approaches but the knowledge-focused approach. Affective-focused approaches and social and life skills training were generally unsatisfactorily implemented by the surveyed NADOs, for both adolescents and adults.

3.3. Barriers and restraints reported by NADOs

A total of 31 NADOs elaborated on their experiences of barriers and restraints when implementing information and education programs. Their answers were categorized into themes. The most common barrier was limited financial and personnel

resources (84%, *n* = 26), followed by a lack of support from other sporting organizations with respect to the implementation of doping prevention programs (26%, *n* = 8). Other categories were lack of proper evaluation (6%, *n* = 2), economic and political interests (6%, *n* = 2), lacking interest of target groups (26%, *n* = 8), limited access to target groups (16%, *n* = 5), and others (10%, *n* = 3). Please refer to Table 4 for example quotes. All quotes are available in the Supplementary Material.

4. Discussion

The current study aimed to investigate the implementation of prevention programs in the form of information and education offered by NADOs around the world. A key finding was that a majority of the surveyed NADOs reported that they offered athletes most or all of the 5 approaches. However, a discrepancy between the self-reported data and our VAS assessment was evident. Good to excellent implementation was apparent in the knowledge-focused approach, but implementation of education approaches, including affective dimensions, social and life skills, and ethics and values, seemed to be underrepresented. The main self-reported barrier for NADOs was a lack of resources, followed by challenges regarding cooperation from other sporting organizations.

4.1. NADOs' perceptions of their own doping prevention programs

Most NADOs reported offering athletes all 5 approaches, which suggests that NADOs have a positive self-perception with respect to meeting the WADA requirements on information and education programs. In general, NADOs offered more programs for adolescents than for adults. This finding is positive because it is important to start prevention early;^{51–53} adolescence is the time when values and attitudes are formed.^{14,42} This might, however, also present a challenge for NADOs, because anti-doping messages must be tailored specifically to young people and must use appropriate language. Additionally, because young athletes rarely train alone, it

Table 3
Independent raters' assessment of the extent of prevention programs implementation by approach and continent.

	Adults					Adolescents			
	C1	C2	C3	C4		C1	C2	C3	C4
Overall (n = 53)^a									
Knowledge focused	27 (14)	21 (11)	23 (12)	29 (15)	Knowledge focused	25 (12)	17 (8)	19 (9)	40 (19)
Affective focused	100 (52)	0 (0)	0 (0)	0 (0)	Affective focused	100 (52)	0 (0)	0 (0)	0 (0)
Social skills	100 (52)	0 (0)	0 (0)	0 (0)	Social skills	89 (47)	8 (4)	4 (2)	0 (0)
Life skills	98 (51)	2 (1)	0 (0)	0 (0)	Life skills	93 (49)	4 (2)	2 (1)	2 (1)
Ethic- and value-based	94 (49)	4 (2)	2 (1)	0 (0)	Ethic- and value-based	77 (36)	4 (2)	6 (3)	13 (6)
Europe (n = 34)^a									
Knowledge focused	15 (5)	21 (7)	27 (9)	36 (12)	Knowledge focused	16 (5)	19 (6)	16 (5)	48 (15)
Affective focused	100 (34)	0 (0)	0 (0)	0 (0)	Affective focused	100 (34)	0 (0)	0 (0)	0 (0)
Social skills	100 (34)	0 (0)	0 (0)	0 (0)	Social skills	88 (30)	12 (4)	0 (0)	0 (0)
Life skills	100 (34)	0 (0)	0 (0)	0 (0)	Life skills	94 (32)	6 (2)	0 (0)	0 (0)
Ethic- and value-based	97 (33)	3 (1)	0 (0)	0 (0)	Ethic- and value-based	79 (23)	3 (1)	7 (2)	10 (3)
Asia (n = 9)^a									
Knowledge focused	44 (4)	33 (3)	22 (2)	0 (0)	Knowledge focused	44 (4)	22 (2)	33 (3)	0 (0)
Affective focused	100 (9)	0 (0)	0 (0)	0 (0)	Affective focused	100 (9)	0 (0)	0 (0)	0 (0)
Social skills	100 (9)	0 (0)	0 (0)	0 (0)	Social skills	100 (9)	0 (0)	0 (0)	0 (0)
Life skills	100 (9)	0 (0)	0 (0)	0 (0)	Life skills	100 (9)	0 (0)	0 (0)	0 (0)
Ethic- and value-based	100 (9)	0 (0)	0 (0)	0 (0)	Ethic- and value-based	100 (9)	0 (0)	0 (0)	0 (0)
The Americas^b (n = 5)^a									
Knowledge focused	40 (2)	20 (1)	20 (1)	20 (1)	Knowledge focused	25 (1)	0 (0)	25 (1)	50 (2)
Affective focused	100 (5)	0 (0)	0 (0)	0 (0)	Affective focused	100 (5)	0 (0)	0 (0)	0 (0)
Social skills	100 (5)	0 (0)	0 (0)	0 (0)	Social skills	60 (3)	20 (1)	20 (1)	0 (0)
Life skills	100 (5)	0 (0)	0 (0)	0 (0)	Life skills	80 (4)	0 (0)	0 (0)	20 (1)
Ethic- and value-based	100 (5)	0 (0)	0 (0)	0 (0)	Ethic- and value-based	40 (2)	0 (0)	20 (1)	40 (2)
Africa and Oceania^c (n = 5)^a									
Knowledge focused	60 (3)	0 (0)	0 (0)	40 (2)	Knowledge focused	50 (2)	0 (0)	0 (0)	50 (2)
Affective focused	100 (4)	0 (0)	0 (0)	0 (0)	Affective focused	100 (4)	0 (0)	0 (0)	0 (0)
Social skills	100 (5)	0 (0)	0 (0)	0 (0)	Social skills	100 (5)	0 (0)	0 (0)	0 (0)
Life skills	75 (3)	25 (1)	0 (0)	0 (0)	Life skills	100 (4)	0 (0)	13 (1)	0 (0)
Ethic- and value-based	50 (2)	25 (1)	25 (1)	0 (0)	Ethic- and value-based	50 (2)	25 (1)	0 (0)	25 (1)

Notes: Data are presented as % (n). Due to rounding up to whole numbers, the sum does not always equal 100%. C1 : unsatisfactory implementation; C2 : satisfactory implementation; C3 : good implementation; C4: excellent implementation.

^a Might include missing data.

^b This refers to NADOs of North, Central, and South America.

^c Africa and Oceania were combined for data protection reasons to ensure anonymity of participating countries.

Abbreviation: NADOs = National Anti-Doping Organizations.

seems especially important to strengthen their resistance against any pressure in their training environment; studies have shown that peers can have an influence on an athlete's decision to dope.^{54,55} According to our survey results, almost three-quarters of all investigated NADOs self-declared that they had faced these challenges successfully by offering prevention programs especially for adolescent athletes including most of the 5 approaches.

4.2. Assessment of prevention programs

The NADOs' self-reporting regarding the provision of information programs was in line with the findings of our VAS assessment; the majority of the NADOs have largely implemented the content that an information program should be included based on our ratings. Especially in view of the still persistent risk of unintentional doping,^{35,36,56} these programs are essential for athletes of all ages. Our results indicate that NADOs acknowledge their role as information providers since many NADOs ($n \geq 27$) provide implementation of knowledge-focused programs at a good to excellent level.

Research has shown that even though knowledge-focused programs do reduce an athlete's intention to dope, they do not change actual doping behavior and should not constitute the sole approach in doping prevention.^{14,25,45,57} To actually change behavior, other measures must be taken, such as a multifaceted prevention approach outlined in the Introduction. However, our results showed that the 4 education-based approaches, which should help to prevent athletes from engaging in doping, seemed to be implemented at an unsatisfactory level. Most of the components that should be included in each approach (according to the VAS definition) were missing; and, as shown in Table 3, most prevention programs were allocated to category C1 (unsatisfactory implementation). Interestingly, there appears to be a large discrepancy between Asian NADOs' self-perception of their delivered prevention activities and the content they actually deliver (according to the VAS-based implementation assessment).

In general, the discrepancy is particularly apparent for 3 approaches: affective-focused, social skills training, and life skills training. Given the programs currently offered by

Table 4
Typical example quotes from National Anti-Doping Organizations regarding barriers faced when implementing doping prevention programs.

Theme	Quotes
Financial and personnel resources	<p>“Funding—more percentage of overall National Anti-Doping Organizations (NADOs) budgets should be allocated for prevention/education programs.” (Europe)</p> <p>“Resource—if we had more resource to deliver face-to-face education to more groups, in more locations throughout the country, we would see more athletes and Athlete Support Personnel (ASP) educated.” (Africa and Oceania)</p>
Lack of support from other sporting organizations	<p>“Communication with national sport federations — some of them still don't realize that doping is a problem and that prevention programs are an essential part of fight against doping.” (Europe)</p> <p>“Sporting organization support—some sports are harder to organize education opportunities with than others. With increased support from Sporting Organization (SO)'s we may see more education opportunities and increased engagement and enthusiasm around engaging with our subject matter.” (Africa and Oceania)</p>
Lack of proper evaluation	<p>“Lacking proper method of education evaluation would be a setback to justify the effectiveness of doping prevention programs, which could hinder it from getting more attention and funding from the stakeholders.” (Asia)</p> <p>“Lack of ability to demonstrate impact.” (Europe)</p>
Economic and political interests	<p>“Economic interests sometimes ‘stand in the way’ of prevention work regarding sensitization for daily situations of athletes, esp. in regard to sponsoring (e.g., through nutritional supplements) and a strict no-tolerance stance towards nutritional supplements is not effective and we as NADO accept that athletes take supplements (80%–90% of the athletes do), we offer assistance and try to give them alternatives to avoid doping cases. The cooperation with nutrition counsellors is very important in this context.” (Europe)</p> <p>“Sometimes it is difficult to start these programs with different political ideology than the (country)'s government.” (Europe)</p>
Lacking interest of target groups	<p>“We also meet resistance from athletes and coaches who would be reluctant to miss a training session to attend anti-doping education.” (Europe)</p> <p>“Attractiveness of the subject: creating ‘fun’ education sessions with a ‘not so fun’ subject.” (Europe)</p>
Limited access to target groups	<p>“Scheduling (especially for National Registered Testing Pool athletes with busy and very different schedules).” (Europe)</p> <p>“Exposure to athletes and ASP—often we have only 1 opportunity per year (if that) to deliver education with groups. Ideally, we would have multiple opportunities so that 1 session could cover technical information and following sessions could be more values based and focus on affecting change.” (Africa and Oceania)</p>
Others	<p>“Translation of the World Anti-Doping Agency (WADA) Alpha e-learning into (country)'s language.” (Europe)</p> <p>“Lack of knowledge about anti-doping legislation, rules, and ADRV (Anti-Doping Rule Violation).” (Asia)</p>

NADOs, the likelihood of success in preventing athletes from doping is questionable because some relevant content is not included. The programs are interactive and engage the athletes in discussions or role plays; however, only a few such programs are on-going. Regarding affective-focused activities, some NADOs did include affective-related content (e.g., self-worth, body image), but exercises were limited and did not set the focus on affectivity. This lack of relevant content could negatively affect prevention efforts, especially with respect to adolescent athletes at the beginning of their athletic careers. An affective-focused approach should “target feelings of value and self-worth” (p. 54)³⁷ to promote self-esteem. In view of the daily pressures that characterize an athletic career, personal development and self-worth are significant predictors of lower doping susceptibility,²⁴ and are therefore essential. Studies investigating doped athletes have shown that, for many athletes, good results are an important component of their self-esteem,⁵⁸ and low self-esteem has been reported to be a risk factor for drug use,⁵⁹ a finding that has also noted for young doped athletes who reported low self-esteem.²⁹ Adolescent athletes might prove to be an easy target for doping if they do not perform as expected and have low self-esteem. Therefore, it seems to be crucial to include affective components in doping prevention measures for adolescent athletes. However, based on the results of the current study, this seems to have not yet occurred.

Regarding social skills and life skills training, our VAS assessment revealed a similar picture. Overall, a large majority of NADOs implemented these 2 approaches only at an

unsatisfactory or satisfactory level, with programs for adolescents being a minor outlier (4% had either a good or excellent implementation rating for both approaches). This is somewhat concerning, especially insofar as it relates to resistance against peer pressure—an important element of social skills¹⁴—which has previously been shown to act as a protective factor against doping.²⁶ Life skills training should combine the development of social skills, personal skills, and knowledge,¹⁴ as well as promote healthy alternatives to risky behavior.⁴⁹ The life skills approach was already proven to be most effective for reducing social drug use in school settings,⁶⁰ a result that can be applied to doping, and especially to doping education for adolescent athletes. Based on our findings, it seems that NADOs are aware of the importance of developing athletes' self-esteem together with their social and life skills, since they apparently believe that they have implemented these components. However, according to our results, relevant content is missing. For example, no investigated NADO included assertiveness training in their programs. Those NADOs that offer social or life skills activities do so by presenting discussions and dilemma situations by which athletes learn the decision-making process, and most of these activities are targeted at adolescent athletes. Nonetheless, when looking at the VAS values, only a few implemented this at a satisfactory level. These results seem to suggest that NADOs face difficulties translating results from research into practice. More successful results might be achieved if NADOs were provided with best practice examples for each of the categories classified by Backhouse et al.³⁷ and,

thus, be able to recognize what a successful multifaceted prevention program looks like, enabling them to implement it according to their specific country's characteristics.

The ethic- and value-based approach seems to be a small outlier in the implementation of this type of program, since 9 NADOs implemented such programs for adolescent athletes at a good or excellent level. Even though this number for effective implementation is small, the fact that these programs are tailored to adolescent athletes is positive since research has shown that prevention programs are best offered at a young age.¹⁴ However, from the 77% of the programs that were classified as C1 (unsatisfactory implementation), about one-half had a VAS of 0, meaning that the NADOs did not offer this approach at all. This is a surprising finding, especially because WADA places much importance on the term "values-based". Because values are formed during adolescence,^{14,42} more focus should be placed on this approach.

4.3. Challenges to implementing anti-doping information and education

The open-ended question in our survey on the barriers and restraints NADOs face can help us to understand some of the implementation challenges. These challenges include not only the possible lack of financial resources and expertise for the development and delivery of education initiatives and programs, but also dealing with a lack of interest on the part of athletes and sporting networks and difficulties in collaborating with other sport organizations and competing political interests. In regard to the lack of interest from athletes and their coaches mentioned by 6 NADOs, it has been shown previously that not providing athletes with relevant education can have a negative effect on the legitimacy of the anti-doping work done by NADOs.⁶¹ This was underscored by Westmattmann et al.,⁶² who reported that athletes found education programs only moderately effective, and less effective than doping controls. Perceiving doping education as irrelevant and ineffective can lead to even greater difficulty in reaching athletes and their support networks because they might perceive their training routine to be more important than anti-doping education. This is supported by the results from a recent study investigating coaches and their perception of their roles in doping prevention. The study showed that coaches were reluctant to include doping prevention in their athletes' training because the athletes' performance was prioritized.⁷

The results of our study suggest that an increase in financial resources might have potential for facilitating the delivery of the types of education programs that may be effective in preventing athletes from doping. This finding is reinforced by the fact that the majority of NADOs (84%) reported that a lack of resources limited their opportunities for effective prevention work and that with more money, they could provide more activities on a more regular basis and employ more staff and properly educate their staff to deliver the prevention programs appropriately. This point is underscored by a study investigating anti-doping education for coaches,⁷ which showed that the organizations often did not receive the resources they needed

to educate athletes and coaches. This involves not only financial resources but also personnel, since employees responsible for anti-doping education often have additional responsibilities, such as developing and distributing resource materials and managing the Whereabout system.⁷

To counteract this barrier, NADOs that have more financial resources could support those with smaller budgets by sharing their expertise and experiences. Analyses of our data show that some NADOs offer excellent seminars for adolescent athletes, including, for example, interactive games or discussions about fair play and its relevance to daily life. By using such best practice examples and sharing their expertise, these NADOs could support developing NADOs, which might lead to an improvement in anti-doping initiatives worldwide. According to Kamber,¹³ such cooperation could also be supported financially by WADA or other bodies. This mutual help would "clearly be a step further in rising the quality of the worldwide fight against doping" (p. 8).¹³

4.4. Limitations

One limitation of this study is language bias. Some NADO websites were written in a language that the study team did not know, and some websites did not have an English version or provided less content for the English version than for the original. These websites were translated into English using an online translation tool, which had been determined to be accurate.⁴⁶ To test the reliability of the translation tool, we used German and Italian translations with satisfying results. Still, content on some websites may have been less robust owing to language issues.

There might also have been a selection bias due to the NADO inclusion criteria. We did not include all NADOs operating worldwide, but because all continents are represented, our results provide an overall picture of the prevention programs offered. From the 53 NADOs assessed, 64% ($n = 34$) were located in Europe, which might have led to a bias owing to over-representation. This might have positively influenced the results, especially because most school programs for adolescents, including programs with ethic- and value-based content, were offered by European NADOs. Additionally, NADOs from other continents might have experienced additional barriers that were overlooked due to the over-representation of European NADOs. Also, NADOs with limited budgets might not have had the means to provide fully developed websites, and all their activities might not have been included in our analyses if they were not published online or mentioned in the survey responses. Future research should survey NADOs again to ensure that none of their programs were overlooked.

4.5. Implications for policymakers

Valuable implications for anti-doping policy can be deduced from this study. The NADOs self-declared that they were carrying out extensive doping prevention work in the form of information and education activities. However, there may be a discrepancy between what they claim they do and what they actually do. A possible reason for this might be that

NADOs lack experience in implementing multifaceted education measures, and WADA's education guidelines do not provide concrete examples. This is underscored by Patterson et al.,⁷ who showed that national sporting organizations felt that they received only little guidance from WADA "regarding the minimum standards of their education provision" (p. 42) for anti-doping education for coaches.⁷ To help NADOs succeed, there is a need for concrete guidelines that define what values-based education means, what components it should include and how it can be implemented. These guidelines should be based on the 5 approaches addressed in this study because they have been shown to be the most successful preventive approaches in other social domains.¹⁴

Best practice examples could help to clarify WADA's vague definition of values-based education. Such examples can provide NADOs with ideas they need to implement their own programs that are tailored to their respective target groups. In view of the cultural and socioeconomic differences across countries, WADA should not provide a one-size-fits-all best practices program that all NADOs across the world are expected to implement equally. Rather, WADA should provide best-practice examples that make the definition of values-based education more transparent, thus helping NADOs to implement multifaceted prevention strategies based on their countries' characteristics. The International Standard of Education,⁶³ which is currently under review, might help to address this challenge. This could be especially important for the 11 NADOs that neither participated in the survey nor provided any online information. Possible reasons for their nonresponsiveness might be that they lacked the personnel resources to answer the survey or to develop their content for online delivery on a website. Additionally, they might not have fully developed prevention programs or were reluctant to share this information because of mistrust. Future studies should address this issue by highlighting the fact that it is not the aim of research studies to demean NADOs' work, but to help and support them in developing and improving their programs.

Another suggestion is to provide NADOs with larger budgets for doping prevention, a proposal approved of by most of the surveyed NADOs. In some cases, NADOs receive a lot of money each year for doping controls and testing. However, only 1%–2% of doped athletes are caught annually,¹⁷ and studies have shown that limitations exist in the deterrent effects of identifying these athletes.^{16,19} Thus, more money could be allocated to education than to deterrence, a point that has also been raised by Morente-Sanchez and Zabala.⁵³ Another possibility is for additional financial resources to be provided from new sources, such as the IOC, international federations, sponsors, or national governments. This suggestion has been promoted by Houlihan,⁶⁴ who has pointed out that it would be possible for the IOC, as a wealthy organization, to use more of its financial resources for anti-doping education.

Another possibility is for NADOs to consider offering online webinars. In this way, they could decrease costs and bypass scheduling problems but still provide face-to-face meetings. Currently, many educational institutions, such as universities, offer distance learning programs. Research in other domains has shown that distance learning not only decreases geographic

barriers, but also allows participants to learn at their own pace,^{65–67} which can be especially important for athletes with busy schedules. Most of the existing distance learning programs focus on the acquisition of knowledge;⁶⁶ thus, this type of learning may be especially suitable for the knowledge-focused approach used in doping prevention. When integrating the other 4 education approaches into doping prevention activities, alternating between face-to-face meetings achieved through webinars and education delivered through other types of online programs might also be possible.^{65–67}

5. Conclusions

NADOs play a major role in providing anti-doping information and education for competitive athletes. They have succeeded in providing sufficient information through the implementation of valuable knowledge-focused programs. However, regarding education, it seems that despite concerted efforts from NADOs, there is still much room for improvement. Many of the currently offered prevention programs do not seem to provide athletes with all the tools they need to deal with difficult situations during their athletic career (e.g., peer pressure, setbacks in performance). In acknowledging their role and the need to focus more on education, WADA prepared the International Standard of Education with the aim to further support organizations entrusted with anti-doping by establishing mandatory standards. Future research is needed to predict if harmonized education, as intended by WADA, will be likely to be implemented successfully. Future studies should analyze how the programs offered are perceived by athletes who are dealing with difficult situations. In addition, future studies should investigate the effectiveness of programs in preventing athletes from doping, thus justifying budget increases for doping prevention and showing that the additional investment in time and money is worthwhile.

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Authors' contributions

KG was responsible for project administration, contributed to the conceptualization, performed data collection, conducted statistical analysis, and drafted the manuscript; MG performed data collection, helped with the statistical analysis, and revised the manuscript; MO, BS, and WS contributed to the conceptualization and revised the manuscript; CB supervised the project, contributed to the conceptualization, reviewed the statistical analysis, contributed in drafting the first version of the manuscript, and revised the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

The authors declare that they have no competing interests.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsbs.2019.12.002.

References

- World Anti-Doping Agency. *ADO reference guide*. Available at: https://www.wada-ama.org/sites/default/files/resources/files/wada_ado_reference_guide_to_code_final_en_revsept2015.pdf. [accessed 05.06.2019].
- World Anti-Doping Agency. *World Anti-Doping Code 2003*. Available at: https://www.wada-ama.org/sites/default/files/resources/files/wada_code_2003_en.pdf. [accessed 05.06.2019].
- World Anti-Doping Agency. *World Anti-Doping Code 2015*. Available at: <https://www.wada-ama.org/sites/default/files/resources/files/wada-2015-world-anti-doping-code.pdf>. [accessed 05.06.2019].
- Efverström A, Bäckström Å, Ahmadi N, Hoff D. Contexts and conditions for a level playing field: elite athletes' perspectives on anti-doping in practice. *Perform Enhanc Health* 2016;5:77–85.
- Hanstad DV, Skille EÅ, Loland S. Harmonization of anti-doping work: myth or reality? *Sport Soc* 2010;13:418–30.
- Overbye M. Doping control in sport: an investigation of how elite athletes perceive and trust the functioning of the doping testing system in their sport. *Sport Manag Rev* 2015;19:6–22.
- Patterson LB, Backhouse SH, Duffy PJ. Anti-doping education for coaches: qualitative insights from national and international sporting and anti-doping organisations. *Sport Manag Rev* 2016;19:35–47.
- Finnish Center for Integrity of Sports. *Evaluation of the anti-doping activities of Finnish sports organisations*. Available at: https://www.suek.fi/web/en/news/-/asset_publisher/8Dtf/content/evaluation-of-the-anti-doping-activities-of-finnish-sports-organisations?redirect=https%3A%2F%2Fwww.suek.fi%2Fweb%2Fen%2Fnews%3Fp_p_id%3D101_INSTANCE_3gqR_%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-5%26p_p_col_count%3D1. [accessed 04.09.2019].
- Catlin DH, Fitch KD, Ljungqvist A. Medicine and science in the fight against doping in sport. *J Intern Med* 2008;264:99–114.
- Hanstad DV, Smith A, Waddington I. The establishment of the World Anti-Doping Agency. A study of the management of organizational change and unplanned outcomes. *Int Rev Sociol Sport* 2008;43:227–49.
- Mottram D, Chester N. *Drugs in Sport*. London: Routledge; 2018.
- World Anti-Doping Agency. *National Anti-Doping Organizations (NADO)*. Available at: <https://www.wada-ama.org/en/who-we-are/anti-doping-community/national-anti-doping-organizations-nado>. [accessed 14.09.2019].
- Kamber M. Development of the role of national anti-doping organisations in the fight against doping: from past to future. *Forensic Sci Int* 2011;213:3–9.
- Backhouse S, McKenna J, Patterson L. *Prevention through education: a review of current international social science literature*. Available at: https://www.wada-ama.org/sites/default/files/resources/files/backhouse_prevention_through_education_final_2009.pdf. [accessed 05.06.2019].
- Overbye M. Deterrence by risk of detection? An inquiry into how elite athletes perceive the deterrent effect of the doping testing regime in their sport. *Drugs: Educ Prev Policy* 2016;24:206–19.
- Overbye M, Knudsen ML, Pfister G. To dope or not to dope: elite athletes' perceptions of doping deterrents and incentives. *Perform Enhanc Health* 2013;2:119–34.
- World Anti-Doping Agency. *2017 Anti-Doping Testing Figures*. Available at: https://www.wada-ama.org/sites/default/files/resources/files/2017_anti-doping_testing_figures_en_0.pdf. [accessed 05.06.2019].
- Ulrich R, Pope HG Jr, Cleret L, Petroczi A, Nepusz T, Schaffer J, et al. Doping in two elite athletics competitions assessed by randomized-response surveys. *Sports Med* 2018;48:211–9.
- Strelan P, Boeckmann RJ. Why drug testing in elite sport does not work: perceptual deterrence theory and the role of personal moral beliefs. *J Appl Soc Psychol* 2006;23:2909–34.
- Engelberg T, Moston S, Skinner J. The final frontier of anti-doping: a study of athletes who have committed doping violations. *Sport Manag Rev* 2015;18:268–79.
- Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process* 1991;50:179–211.
- Schwarzer R. Self-efficacy in the adoption and maintenance of health behaviors: theoretical approaches and a new model. In: Schwarzer R, editor. *Self-efficacy: thought control of action*. London: Routledge; 1992. p. 217–43.
- Deci EL, Ryan RM. *Handbook of self-determination research*. Rochester, NY: University of Rochester Press; 2002.
- Blank C, Kopp M, Niedermeier M, Schnitzer M, Schobersberger W. Predictors of doping intentions, susceptibility, and behaviour of elite athletes: a meta-analytic review. *Springerplus* 2016;5:1333. doi:10.1186/s40064-016-3000-0.
- Ntoumanis N, Ng JY, Barkoukis V, Backhouse S. Personal and psychosocial predictors of doping use in physical activity settings: a meta-analysis. *Sports Med* 2014;44:1603–24.
- Erickson K, McKenna J, Backhouse S. A qualitative analysis of the factors that protect athletes against doping in sport. *Psychol Sport Exerc* 2015;16:149–55.
- Gatterer K, Niedermeier M, Streicher B, Kopp M, Schobersberger W, Blank C. An alternative approach to understanding doping behavior: a pilot study applying the Q-method to doping research. *Perform Enhanc Health* 2019;6:139–47.
- Englar-Carlson M, Gleaves J, Macedo E, Lee H. What about the clean athletes? The need for positive psychology in anti-doping research. *Perform Enhanc Health* 2016;4:116–22.
- Laure P, Binsinger C. Doping prevalence among preadolescent athletes: a 4-year follow-up. *Br J Sports Med* 2007;41:660–3.
- Laure P, Lecerf T, Friser A, Binsinger C. Drugs, recreational drug use, and attitudes towards doping of high school athletes. *Int J Sports Med* 2004;25:133–8.
- Peters C, Schulz T, Oberhoffer R, Michna H. Doping and doping prevention: knowledge, attitudes, and expectations of athletes and coaches (Doping und dopingprävention: kenntnisse, einstellungen, und erwartungen von athleten und trainern). *Dtsch Z Sportmed* 2009;60:73–8. [in German].
- Wanjek B, Rosendahl J, Strauss B, Gabriel HH. Doping, drugs and drug abuse among adolescents in the State of Thuringia (Germany): prevalence, knowledge and attitudes. *Int J Sports Med* 2007;28:346–53.
- Cohen J. *Statistical power analysis for the behavioral sciences*. Mahwah, NJ: Lawrence Erlbaum Associates; 1988.
- Chan DKC, Tang TCW, Yung PS, Gucciardi DF, Hagger MS. Is unintentional doping real, or just an excuse. *Br J Sports Med* 2019;53:978–9.
- Martinez-Sanz JM, Sospedra I, Ortiz CM, Baladia E, Gil-Izquierdo A, Ortiz-Moncada R. Intended or unintended doping? A review of the presence of doping substances in dietary supplements used in sports. *Nutrients* 2017;9:E1093. doi:10.3390/nu9101093.
- Chan DK, Ntoumanis N, Gucciardi DF, Donovan RJ, Dimmock JA, Hardcastle SJ, et al. What if it really was an accident? The psychology of unintentional doping. *Br J Sports Med* 2015;50:898–9.
- Backhouse SH, Collins C, Defoort Y, McNamee M, Parkinson A, Sauer M, et al. *Study on doping prevention: a map of legal, regulatory, and prevention practice provisions in EU 28*. Luxembourg: European Commission; 2014.
- Chan DK, Donovan RJ, Lentillon-Kaestner V, Hardcastle SJ, Dimmock JA, Keatley DA, et al. Young athletes' awareness and monitoring of anti-doping in daily life: does motivation matter. *Scand J Med Sci Sports* 2015;25:e655–63.
- Smith PK, Ananiadou K, Cowie H. Interventions to reduce school bullying. *Can J Psychiatry* 2003;48:591–9.
- Norfolk and Waveney Clinical Commissioning Groups. *Educational and psychosocial interventions to prevent uptake of smoking by young people*. Available at: <https://pdfs.semanticscholar.org/12a9/e6ab015b734608a587fdc700bc8827c7e293.pdf>. [accessed 10.06.2019].
- Jones L, James M, Jefferson T, Lushey C, Morleo M, Stokes E, et al. *A review of the effectiveness and cost-effectiveness of interventions delivered in primary and secondary schools to prevent and/or reduce alcohol use by young people under 18 years old*. Available at: <https://www.nice.org.uk/guidance/ph7/documents/alcohol-and-schools-executive-summary2>. [accessed 10.06.2019].

42. Kohlberg L, Hersh RH. Moral development: a review of the theory. *Theory Pract* 2009;**16**:53–9.
43. Donovan RJ, Egger G, Kapernick V, Mendoza J. A conceptual framework for achieving performance enhancing drug compliance in sport. *Sports Med* 2002;**32**:269–84.
44. World Anti-Doping Agency. *Information/Education guidelines to prevent doping in sport*. Available at: <https://www.wada-ama.org/en/resources/education-and-prevention/guidelines-education-and-information-to-prevent-doping-in-sport>. [accessed 05.06.2019].
45. Hanson JM. Equipping athletes to make informed decisions about performance-enhancing drug use: a constructivist perspective from educational psychology. *Sport in Society* 2009;**12**:394–410.
46. Wu Y, Schuster M, Chen Z, Le QV, Norouzi M, Macherey W, et al. *Google's neural machine translation system: bridging the gap between human and machine translation*. Available at: <https://arxiv.org/pdf/1609.08144.pdf>. [accessed 21.08.2019].
47. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101.
48. Amabile TM. *Creativity in context: update to the social psychology of creativity*. Boulder, CO: Westview Press; 1996.
49. Botvin GJ, Griffin KW. Life skills training: empirical findings and future directions. *J Prim Prev* 2004;**25**:211–32.
50. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 2016;**15**:155–63.
51. Furhapter C, Blank C, Leichtfried V, Mair-Raggautz M, Muller D, Schobersberger W. Evaluation of West-Austrian junior athletes' knowledge regarding doping in sports. *Wien Klin Wochenschr* 2013;**125**:41–9.
52. Vitzthum K, Mache S, Quarcoo D, Groneberg DA, Schoffel N. Interdisciplinary strategies versus doping. *Wien Klin Wochenschr* 2010;**122**:325–33.
53. Morente-Sanchez J, Zabala M. Doping in sport: a review of elite athletes' attitudes, beliefs, and knowledge. *Sports Med* 2013;**43**:395–411.
54. Ohl F, Fincoeur B, Lentillon-Kaestner V, Defrance J, Brissonneau C. The socialization of young cyclists and the culture of doping. *Int Rev Sociol Sport* 2013;**50**:865–82.
55. Lentillon-Kaestner V, Carstairs C. Doping use among young elite cyclists: a qualitative psychosociological approach. *Scand J Med Sci Sports* 2010;**20**:336–45.
56. Yonamine M, Garcia PR, de Moraes Moreau RL. Non-intentional doping in sports. *Sports Med* 2004;**34**:697–704.
57. Blank C, Leichtfried V, Schaiter R, Müller D, Schobersberger W. *Associations between doping knowledge, susceptibility, and substance use of Austrian junior elite athletes?* Available at: <https://jacobsublishers.com/journals/jacobs-journal-of-sports-medicine/fulltext/associations-between-doping-knowledge-susceptibility-and-substance-use-of-austrian-junior-elite-athletes>. [accessed 21.08.2019].
58. Piffaretti M. *Psychological determinants of doping behaviour through the testimony of sanctioned athletes*. Available at: https://www.wada-ama.org/sites/default/files/resources/files/learning_about_determinants_m.piffaretti_final_report_6.2011def.pdf. [accessed 10.06.2019].
59. Greydanus DE, Patel DR. The adolescent and substance abuse: current concepts. *Curr Probl Pediatr Adolesc Health Care* 2005;**35**:78–98.
60. Faggiano F, Vigna-Taglianti FD, Versino E, Zambon A, Borraccino A, Lemma P. School-based prevention for illicit drugs use: a systematic review. *Prev Med* 2008;**46**:385–96.
61. McDermott V. *The war on drugs in sport: moral panics and organizational legitimacy*. London: Routledge; 2016.
62. Westmattmann D, Dreiskamper D, Strauss B, Schewe G, Plass J. Perception of the current anti-doping regime - a quantitative study among German top-level cyclists and track and field athletes. *Front Psychol* 2018;**9**:1890. doi:10.3389/fpsyg.2018.01890.
63. World Anti-Doping Agency. *International Standard for Education. Draft Version 3.0*. Available at: https://www.wada-ama.org/sites/default/files/resources/files/ise_draft_april2019.pdf. [accessed 05.06.2019].
64. Houlihan B. Policy harmonization: the example of global antidoping policy. *J Sport Manage* 1999;**13**:197–215.
65. Ehlers U-D, Pawlowski JM. *Handbook on quality and standardisation in e-learning*. Berlin: Springer; 2006.
66. Sinclair PM, Kable A, Levett-Jones T, Booth D. The effectiveness of Internet-based e-learning on clinician behaviour and patient outcomes: a systematic review. *Int J Nurs Stud* 2016;**57**:70–81.
67. McCutcheon LRM, Alzghari SK, Lee YR, Long WG, Marquez R. Interprofessional education and distance education: a review and appraisal of the current literature. *Curr Pharm Teach Learn* 2017;**9**:729–36.